NIES GOSAT

Product Format Descriptions

Version 1.50

National Institute for Environmental Studies
GOSAT Project Office

Change history

Version	Revised on	Page			Description
Ver.1.0	19 Jan. 2009				
Ver.1.01	29 Jan. 2009	6.3-9, 6.4-9, 7.1-9			1) cirrusTopPressure unit: none -> hPa 2) cirrusTopPressure is tailored to the Japanese version of validRange.
Ver.1.02	23 Apr. 2009	4-1, 6.2-11, 6.2-13	6.2-12,		1) List of File Names TIR L2 [0/J] -> [0] 2) Added "mapScaleX", "mapScaleY". (Table 6.2-2) 3) Added "Minimum and maximum pixel values in the frame". (Table 6.2-2) 4) Added "Minimum and maximum altitude values in the frame". (Table 6.2-2) 5) Changed the number of example from band1 Image to band4 Image of "radianceScale", "radianceOffset". (Table 6.2-2)
Ver.1.03	3 Aug. 2009	4-2, 6.1-3, 6.1-4, 6.1-6, 6.1-11, 6.2-3, 6.2-4, 6.2-6, 6.3-3, 6.3-4, 6.3-6, 6.3-7, 6.3-10, 6.3-11, 6.3-12, 6.4-3, 6.4-4, 6.4-6, 6.4-7, 6.4-10, 6.4-11, 6.4-12, 6.5-3, 6.5-4, 6.5-5, 6.5-6, 6.5-7, 6.5-10, 6.5-11, 6.6-3, 6.6-4, 6.6-8, 7.1-3, 7.1-4,			1) Modified comments in "Chapter 4 List of File Names". 2) "useLimitation" size: 64 -> 65 (add period) (Table 6.1-2, 6.2-2, 6.3-2, 6.4-2, 6.5-2, 6.6-2, 7.1-2, 7.2-2, 7.3-2, 7.4-2) 3) Changed the order of the "keywords". (Table 6.1-2, 6.2-2, 6.3-2, 6.4-2, 6.5-2, 6.6-2, 7.1-2, 7.2-2, 7.3-2, 7.4-2) 4) "electronicMailAddress" size: 21->24 (Table 6.1-2, 6.2-2, 6.3-2, 6.4-2, 6.5-2, 6.6-2, 7.1-2, 7.2-2, 7.3- 2, 7.4-2) 5) "band4IntegrationTime" size: numLine4 -> numLine (Table 6.1-2) 6) "satelliteAttitude" size: numLine,3 -> numLine,4 (Table 6.1-2) 7) "title": TANSO-CAI/GOSAT -> TANSO-FTS/GOSAT (Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2) 8) Changed the description, invalidValue datatype and example of "crossTrackObservationPoint". (Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2)

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		7.1-6,	7.1-7,	9) Changed the long name of "surfaceWindSpeed".
		7.1-10,	7.1-11,	(Table 6.3-2, 6.4-2, 7.1-2)
		7.1-12,		10) Changed the datatype of "SNRBand1",
		7.2-3,	7.2-4,	"SNRBand2", "SNRBand3". (Table 6.3-2, 6.4-2, 7.1-2)
		7.2-6,	7.2-7,	11) Changed the description of "qualityInformation".
		7.2-10,		(Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2)
		7.3-3,	7.3-4,	12) Changed the attribute datatype of
		7.3-6,		"aerosolAprioriWeight". (Table 6.3-2, 6.4-2, 7.1-2)
		7.4-3,	7.4-4,	13) "linkage" size: 28 -> 27 (onLine) (Table 6.5-2)
		7.4-6		14) Changed the datatype of "scanDirection".
				(Table 6.5-2)
				15) Changed the example of "time". (Table 6.5-2)
				16) "L1BQA" size: 1*numScan -> numScan
				(Table 6.5-2, 7.2-2)
				17) Changed the size of "pressure", "CO2Profile",
				"CO2ProfileError", "CO2ProfileQualtyFlag" (original
				Profile). (Table 6.5-2)
				18) "missingPixelRate" size: numBand -> 1
				(Table 6.6-2)
Ver.1.05	16 Dec. 2009	6.1-10,	6.1-11,	1) Added "saturationFlag". (Table 6.1-2)
		6.1-12,		2) Added "frameLineRange".
		6.2-15,		(Table 6.1-2, 6.2-2, 6.6-2, 7.3-2, 7.4-2)
		6.3-9,	6.3-17,	3) Added the attribute of "CAIL1ADataInformation".
		6.4-9,	6.4-17,	(Table 6.1-2)
		6.5-13,		4) Modified the unit number of "solarZenith",
		6.6-7,	6.6-9,	"solarAzimuth", "satelliteZenith", "satelliteAzimuth",
		7.1-9,	7.1-13,	"relativeAzimuth".
		7.2-7,	7.2-13,	(Table 6.1-2, 7.3-2, 7.4-2)
		7.3-7,	7.3-10,	5) Added "scanSequenceNumber".
		7.3-11,		(Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2)
		7.4-7,	7.4-10,	6) Modified the unit number of "cirrusTopPressure".
		7.4-11		(Table 6.3-2, 6.4-2, 7.1-2)
				7) Modified the size of "productName". (Table 6.6-2)
				8) Modified the size of "productCode".
				(Table 7.2-2, 7.4-2)

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				9) Modified the size of "fileIdentifier". (Table 7.3-2)
Ver.1.06	18 Feb. 2010	5-9,		1) Added "5.3.2 CAI L2CloudFlagBit Field".
		6.2-12,	6.2-15,	2) Changed the description of "sun/zenith",
		6.3-7,	6.3-9,	"sun/azimuth", "satellite/zenith", "satellite/azimuth".
		6.3-13,	6.3-16,	(Table 6.2-2)
		6.3-17,		3) Changed the datatype of "frameLineRange".
		6.4-7,	6.4-9,	(Table 6.2-2)
		6.4-13,	6.4-16,	4) Changed the description of
		6.4-17,		"crossTrackObservationPoint".
		6.5-8,		(Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2)
		7.1-7,	7.1-9,	5) Added "temperatureProfile",
		7.1-13,	7.1-16,	"waterVaporTotalColumn", "dryAirTotalColumn",
		7.1-17,		"CAIRadianceScreening",
		7.2-8		"differenceOfAOT_CO2_CH4", "iterations".
				(Table 6.3-2, 6.4-2, 7.1-2)
				6) Modified the rank of "footPrintLatitude",
				"footPrintLongitude".
				(Table 6.3-2, 6.4-2, 7.1-2)
Ver.1.06a	22 Feb. 2010	6.3-9,		1) Changed the description of "surfacePressure",
		6.4-9,		"waterVaporProfile", "temperatureProfile".
		7.1-9		(Table 6.3-2, 6.4-2, 7.1-2)
Ver.1.07	8 Apr. 2010	6.1-8		1) Deleted "band4LineIndex", "band4PixelIndex".
				(Table 6.1-2)
Ver.1.10	4 Aug. 2010	3-1,	3-2,	1) Changed a format of L4A and comments in "Chapter
		4-2,		3 Product List".
		6.3-1,	6.3-3,	2) Changed an extension of L4A in "Chapter 4 List of
		6.3-5,	6.3-6,	File Names".
		6.3-7,	6.3-9,	3) Changed descriptions in "6.3.1 Outline",
		6.3-10,	6.3-12,	"6.4.1 Outline", "7.1.1 Outline".
		6.3-13,	6.3-16,	4) Changed the description of "date", "dateStamp".
		6.4-1,	6.4-3,	(Table 6.3-2, 6.4-2, 7.1-2)
		6.4-5,	6.4-6,	5) Changed the description and size of
		6.4-7,	6.4-9,	"MD_Format/name", "MD_Format/version",
		6.4-10,	6.4-12,	"organisationName".
		6.4-13,	6.4-16,	(Table 6.3-2, 6.4-2, 7.1-2)

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		6.5-7,		6) Modified the description of "scanDirection".
		7.1-1,	7.1-3,	(Table 6.3-2, 6.4-2, 6.5-2, 7.1-2, 7.2-2)
		7.1-5,	7.1-6,	7) Deleted "referenceData/waterVaporTotalColumn",
		7.1-7,	7.1-9,	"referenceData/dryAirTotalColumn,"
		7.1-10,	7.1-12,	"surfaceAlbedoBand1", "surfaceAlbedoBand2",
		7.1-13,	7.1-16,	"surfaceAlbedoBand3,"
		7.2-7		"SNRBand1", "SNRBand2", "SNRBand3",
				"step1Chi2", "differenceOfAOT_CO2_CH4".
				(Table 6.3-2, 6.4-2, 7.1-2)
				8) Deleted "step2CO2Chi2". (Table 6.3-2)
				9) Deleted "step2CH4Chi2". (Table 6.4-2)
				10) Deleted "step2H2OChi2". (Table 7.1-2)
				11) Added "surfaceAlbedo", "SNR",
				"chi2", "residualMeanSquare",
				"auxiliaryParameter/surfacePressure",
				"auxiliaryParameter/aerosolOpticalThickness",
				"auxiliaryParameter/dryAirTotalColumn".
				(Table 6.3-2, 6.4-2, 7.1-2)
				12) Changed from "aerosolOpticalDepth",
				"cirrusOpticalDepth" to "aerosolOpticalThickness",
				"cirrusOpticalThickness", respectively. Changed the
				long name and the long name number.
				(Table 6.3-2, 6.4-2, 7.1-2)
				13) Changed from "highAltitudeAersolScreening" to
				"highAltitudeAerosolScreening".
				(Table 6.3-2, 6.4-2, 7.1-2)
				14) Changed from "step2CO2DFS" to "CO2DFS", and
				added attribute. (Table 6.3-2)
				15) Changed from "step2CH4DFS" to "CH4DFS", and
				added attribute. (Table 6.4-2)
				16) Changed from "step2H2ODFS" to "H2ODFS", and
				added attribute. (Table 7.1-2)

Version	Revised on	Page	Description
			17) Changed the description of "referenceData/surfacePressure", "waterVaporProfile", "temperatureProfile", "surfaceWindSpeed". (Table 6.3-2, 6.4-2, 7.1-2)
			18) Changed the description of "waterSaturationBandScreening". (Table 6.3-2, 6.4-2, 7.1-2)
Ver.1.20	30 Sep. 2010	3-1, 6.1-6, 6.3-6, 6.4-6, 6.5-6, 6.6-6, 6.7-1~6.7-11, 6.8-1~6.8-11, 6.9-1~6.9-13, 6.10-1~6.10-10, 7.1-6, 7.2-6, 7.3-6, 7.4-6	1) Changed the range of shade in "Section 3.1 Standard Products". 2) Added the following sections. "Section 6.7 L3 global CO_2 distribution (SWIR)" "Section 6.8 L3 global CH_4 distribution (SWIR)" "Section 6.9 L3 global CO_2 distribution (TIR)" "Section 6.10 L3 global radiance distribution (all pixels)" 3) Modified the dataset structure of "onlineResource". (Table 6.1-2, 6.3-2, 6.4-2, 6.5-2, 6.6-2, 7.1-2, 7.2-2, 7.3-2, 7.4-2)
Ver.1.30	27 Oct. 2010	6.3-10, 6.3-12, 6.3-13, 6.3-15, 6.3-16, 6.3-17, 6.4-10, 6.4-12, 6.4-13, 6.4-15, 6.4-16, 6.4-17, 7.1-10, 7.1-12, 7.1-13, 7.1-15, 7.1-16, 7.1-17	1) Added the following dataset. "/scanAttribute/referenceData/dryAirPartialColumn" "/scanAttribute/referenceData/ varianceCovarianceMatrix" "/scanAttribute/qualityInformation/CAIRadiance" "/Data/retrievalQuality/errorCovarianceMatrix" "/Data/retrievalQuality/averagingKernelMatrix" "/Data/auxiliaryParameter/temperatureShift" "/Data/auxiliaryParameter/surfaceAlbedo" "/Data/auxiliaryParameter/dryAirPartialColumn" (Table 6.3-2, 6.4-2, 7.1-2) 2) Added "/scanAttribute/referenceData/CO2Profile", "/Data/mixingRatio/CO2Profile". (Table 6.3-2)

Version	Revised on	Page	Description
			3) Added "/scanAttribute/referenceData/CH4Profile", "/Data/mixingRatio/CH4Profile". (Table 6.4-2)
			4) Added "/scanAttribute/referenceData/H2OProfile", "/Data/mixingRatio/H2OProfile". (Table 7.1-2)
			5) Modified the description of "/scanAttribute/qualityInformation/SNR". (Table 6.3-2, 6.4-2, 7.1-2)
Ver.1.40	14 Feb. 2011	3-1, 6.11-1~6.11-9	1) Changed the range of shade in "Section 3.1 Standard Products".
			2) Added "Section 6.11 L3 global reflectance distribution (clear sky)".
Ver.1.50	12 May 2011	3-1, 5-11, 6.5-7, 6.5-9, 6.5-10, 6.5-11, 6.5-12, 6.5-14, 6.6-1~6.6-14, 6.7-1~6.7-9, 6.8-1~6.8-11, 6.9-1~6.9-11, 6.10-1~6.10-13, 6.11-1~6.11-10, 6.12-1~6.12-9, 6.13-1~6.13-8	1) Changed the range of shade in "Section 3.1 Standard Products".
			2) Changed the file size of "L2 CO2 profile (TIR)" and "L2 CH4 profile (TIR)" in "Section 3.1 Standard Products".
			3) Changed the file size and file unit of "L3 global NDVI" in "Section 3.1 Standard Products".
			4) Deleted "Section 5.1.2 TIR".
			5) Added "Section 5.2.4 The rectangle of the CAI L3 NDVI product".
			6) Added the following dataset. "/scanAttribute/referenceData/surfacePressure" "/scanAttribute/referenceData/waterVaporProfile" "/scanAttribute/referenceData/temperatureProfile" "/scanAttribute/cloudInformation/cloudPixelInnerSunwardSide" "/scanAttribute/cloudInformation/cloudPixelOuterSunwardSide" (Table 6.5-2)
			7) Deleted the following dataset. "/scanAttribute/qualityInformation/roughTerrainSurfaceScreening" "/Data/originalProfile/CO2ErrorCovarianceMatrix" (Table 6.5-2)

Version	Revised on	Page	Description
			8) Deleted the invalidValue of the following dataset.
			"/Data/originalProfile/level"
			"/Data/interpolatedProfile/level" (Table 6.5-2)
			9) Changed the size (the order of the array) and
			description of the following dataset.
			"/Data/originalProfile/pressure"
			"/Data/originalProfile/CO2Profile"
			"/Data/originalProfile/CO2ProfileError"
			"/Data/originalProfile/CO2ProfileQualityFlag"
			"/Data/interpolatedProfile/CO2Profile" (Table 6.5-2)
			10) Changed the description of the following dataset.
			"/scanAttribute/crossTrackObservationPoint"
			"/Data/interpolatedProfile/pressure" (Table 6.5-2)
			11) Modified the invalidValue of
			"/Data/geolocation/landSeaMask". (Table 6.5-2)
			12) Added "Section 6.6 L2 CH4 profile (TIR)".
			13) Changed the section number into Section 6.7~6.12
			(from Section 6.6~6.11).
			14) Added "Section 6.13 L3 global NDVI".

Table of Contents

1 Summary

1.1 Introduction

The purpose of this document is to define the formats of higher-level products of the GOSAT TANSO sensor, including CAI L1B and CAI L1B+ products, to be generated by the National Institute for Environmental Studies (hereinafter referred to as "NIES").

1.2 Scope

(1) NEB-070015 GOSAT Mission Operation Interface Specifications (MOIS)

1.3 References

(1) NIES-GOSAT-PO-001 NIES GOSAT Product Definition Document

(2) (No number) JAXA TANSO Level 1 Product Format Description

(3) Geographical Survey Institute, Technical Document E-1 No.281 JMP2.0 Specifications

(4) Geographical Survey Institute, Technical Document E-1 No.282 JMP2.0 Guide

(5) HDF5 Reference Manual (http://hdfgroup.org/)

2　Characteristic features of the GOSAT products provided by NIES

The GOSAT products provided by NIES have the following characteristic features:

(1) On-demand distribution

TANSO-FTS Level 2 products are generated at the time of distribution and provided on demand according to the conditions specified by the user, such as the acquisition time, position, observation mode, etc.　Thus, the number of data to be contained in one product is arbitrary.

(2) Distribution of JAXA products

For the convenience of users, TANSO-FTS L1B products, which are JAXA's products by definition, are also distributed by NIES, in the data unit defined by JAXA.　FTS L1B observation data are stored in the scene unit defined by JAXA. The product format of JAXA products are contained in JAXA's document.

3 Product List

3.1 Standard Products

Processing level	Sensor/ band	Product code	Product name	Major product	File unit	Format	File size *1
L1B	FTS	—	FTS L1B data	FTS radiance spectra	FTS scene	HDF5	12 MB (day side) 2.5 MB (night side)
	CAI	TRB0	CAI L1B data	CAI radiance	CAI frame	HDF5	122 MB
L1B+	CAI	TRBP	CAI L1B+ data	CAI radiance	CAI frame	HDF5	39 MB
L2	FTS	C01S	L2 CO_2 column amount (SWIR)	CO_2 column abundance	Arbitrary (on-demand)	HDF5	9 MB
	SWIR	C02S	L2 CH_4 column amount (SWIR)	CH_4 column abundance	Arbitrary (on-demand)	HDF5	9 MB
	FTS	P01T	L2 CO_2 profile (TIR)	Vertical profile of CO_2 concentration	Arbitrary (on-demand)	HDF5	24 MB
	TIR	P02T	L2 CH_4 profile (TIR)	Vertical profile of CH_4 concentration	Arbitrary (on-demand)	HDF5	24 MB
	CAI	CLDM	L2 cloud flag	Overall clear-sky confidence	CAI frame	HDF5	40 MB
L3	FTS	C01S	L3 global CO_2 distribution (SWIR)	Ave. CO_2 column abundance	Global (monthly average)	HDF5	16 MB
	SWIR	C02S	L3 global CH_4 distribution (SWIR)	Ave. CH_4 column abundance	Global (monthly average)	HDF5	16 MB
	FTS	P01T	L3 global CO_2 distribution (TIR)	Ave. CO_2 concentration by altitude	Global (monthly average)	HDF5	310 MB
	TIR	P02T	L3 global CH_4 distribution (TIR)	Ave. CH_4 concentration by altitude	Global (monthly average)	HDF5	310 MB
	CAI	TRCL	L3 global radiance distribution (all pixels)	CAI radiance	Global (every 3 days)	HDF5	71 MB
		TRCF	L3 global reflectance distribution (clear sky)	CAI ground surface reflectance	Global (every 3 days)	HDF5	71 MB
		NDVI	L3 global NDVI	Vegetation index	Rectangle(Lat. 30°× Lon. 60° (every 15 days))	HDF5	300 MB
L4A	FTS	F01M	L4A global CO_2 flux	CO_2 flux by region	Global 64 locations (annually)	text	270 KB
L4B	FTS	P01M	L4B global CO_2 distribution	CO_2 concentration	Global 2.5-degree mesh (monthly)	NetCDF	170 MB

*1 The file sizes of FTS L2 products are provided above based on an assumed number of scans per day. (SWIR: 3,000; TIR: 8,000)

*2 The products shown in shade are not included in "Chapter 6 Standard Products" hereof.

3.2 Research products

Processing level	Sensor/ band	Product code	Product name	Major product	File unit	Format	File size *1
L2	FTS SWIR	C03S	L2 H_2O column amount (SWIR)	H_2O column abundance	Arbitrary (on-demand)	HDF5	9 MB
	FTS	C01T	L2 CO_2 column amount (TIR)	CO_2 column abundance	Arbitrary (on-demand)	HDF5	24 MB
	TIR	C02T	L2 CH_4 column amount (TIR)	CH_4 column abundance	Arbitrary (on-demand)	HDF5	24 MB
		TMPT	L2 Temperature profile (TIR)	Temperature profile	Arbitrary (on-demand)	HDF5	80 MB
		P03T	L2 H_2O profile (TIR)	Vertical profile of H_2O concentration	Arbitrary (on-demand)	HDF5	80 MB
		C03T	L2 H_2O column amount (TIR)	H_2O column abundance	Arbitrary (on-demand)	HDF5	24 MB
	CAI	CLDP	L2 cloud property	Optical thickness of clouds	CAI frame	HDF5	11 MB
		AERP	L2 aerosol property	Optical thickness of aerosols	CAI frame	HDF5	13 MB
L3	CAI	CLDP	L3 global cloud property	Ave. optical thickness of clouds	Global (monthly average)	HDF5	213 MB
		AERP	L3 global aerosol property	Ave. optical thickness of aerosols	Global (monthly average)	HDF5	71 MB
L4A	FTS	F02M	L4A global CH_4 flux	CH_4 flux by region	Global 64 locations (annually)	text	270 KB
L4B	FTS	P02M	L4B global CH_4 distribution	CH_4 concentration	Global 2.5-degree mesh (monthly)	NetCDF	170 MB

*1 The file sizes of FTS L2 products are provided above based on an assumed number of scans per day. (SWIR: 3,000; TIR: 8,000)

*2 The products shown in shade are not included in "Chapter 7 Research Products" hereof.

4   List of File Names

The following defines the file names of TANSO-CAI L1B, TANSO-FTS L2, and any higher products.

Position: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

CAI L1B

`G O S A T` `T C A I` `Y Y Y Y M M D D H H m m` `P P P` `F F F` `0` _ `1 B` `① ② ③ ④` `V A A A A 0` . h 5

Acquisition date | Pass No. | Frame No. | Processing level | Product code*1 | Version

CAI L1B+

`G O S A T` `T C A I` `Y Y Y Y M M D D H H m M` `P P P` `F F F` `0` _ `1 B` `① ② ③ ④` `V A A A A 0` . h 5

Acquisition date | Pass No. | Frame No. | Processing level | Product code*1 | Version

CAI L2

`G O S A T` `T C A I` `Y Y Y Y M M D D H H m M` `P P P` `F F F` `0` _ `0 2` `① ② ③ ④` `V A A A A 0` . h 5

Acquisition date | Pass No. | Frame No. | Processing level | Product code*1 | Version

SWIR L2

`G O S A T` `T F T S` `Y Y Y Y M M D D` _ `0 2` `① ② ③ ④` `V A A A A R` `y y m m d d n n n n 0` . h 5

Start of the search window | Processing level | Product code*1 | Version | Product order No. (Product ordering date + Serial No.)

TIR L2

`G O S A T` `T F T S` `Y Y Y Y M M D D` _ `0 2` `① ② ③ ④` `V A A A A R` `y y m m d d n n n n 0` . h 5

Start of the search window | Processing level | Product code*1 | Version | Product order No. (Product ordering date + Serial No.)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |

SWIR L3 `G O S A T T F T S Y Y Y Y M M D D y y y y m m d d _ 0 3 ① ② ③ ④ V A A A A . h 5`

Acquisition date　　　　　　Processing level　Product code[*1]　Version

TIR L3 `G O S A T T F T S Y Y Y Y M M D D y y y y m m d d _ 0 3 ① ② ③ ④ V A A A A . h 5`

Acquisition date　　　　　　Processing level　Product code[*1]　Version

CAI L3 `G O S A T T C A I Y Y Y Y M M D D y y y y m m d d _ 0 3 ① ② ③ ④ V A A A A . h 5`

Acquisition date　　　　　　Processing level　Product code[*1]　Version

CAI L3 NDVI `G O S A T T C A I Y Y Y Y M M D D y y y y m m d d _ 0 3 ① ② ③ ④ V A A A A Z Z Z . h 5`

Acquisition date　　　　　　Processing level　Product code[*1]　Version ID (if one dataset is divided)

L4A `G O S A T T F T S Y Y Y Y M M D D y y y y m m d d _ 4 A ① ② ③ ④ V A A A A . t x t`

Time window for flux estimation　　　　Processing level　Product code[*1]　Version

L4B `G O S A T T F T S Y Y Y Y M M D D y y y y m m d d _ 4 B ① ② ③ ④ V A A A A . n c`

Time window for forward calculation　　　Processing level　Product code[*1]　Version

*1 Corresponds to the product codes provided in 3.1 and 3.2.

5 Product Definitions

5.1 TANSO-FTS

5.1.1 Scan

One scan of the TANSO FTS is defined as an interferogram (spectrum) observed in one exposure of the FTS. It is the minimal unit of the FTS's observation.

(1) Scan ID

FYYMMDDhhmmssPPSSYX 19 digits

F	: Fixed. Indicates that it is an FTS scan ID.
YYMMDDhhmmss	: Date and time (UTC) of the beginning of the FTS scanning. Date and time of the start of acquiring the interferogram. Note that the digit after the decimal point of the second is half-adjusted.
PP	: Satellite pass number (01 - 44)
SS	: Scene number (serial 01 - 60)
Y	: Sub-scene number (0 - 9)
X	: Observation mode ID

The numbers ('X') to identify the observation mode are defined as:

1 : OBservation mode 1 Day side (observation mode 1 in the sunshine)(OB1D)

2 : OBservation mode 1 Night side (observation mode1 in the shade)(OB1N)

3 : OBservation mode 2 Day side (observation mode 2 in the sunshine)(OB2D)

4 : SPecial Observation mode Day side (specific-point observation mode in the sunshine)(SPOD)

5 : SPecial Observation mode Night side (specific-point observation mode in the shade)(SPON)

Refer to Reference (2) for more details on the definitions of the satellite pass number, scene number, and sub-scene number.

5.2 TANSO-CAI

5.2.1 Frame

One frame of TANSO-CAI is defined as follows:

1) The ground length of the satellite path between an ascending node to the next ascending node is calculated and the derived length is evenly divided into 60. This length is defined as "interval between adjacent frame centers."

2) At first, the descending node is defined as the center of the frame 31. Then, each frame center is defined with the interval between adjacent frame centers, by adding the numbered 01 through 60.

3) A frame is formed by assigning lines with a certain length back and forth of the frame center. Note that the length of line must be determined so that a frame overlaps with its neighboring frames.
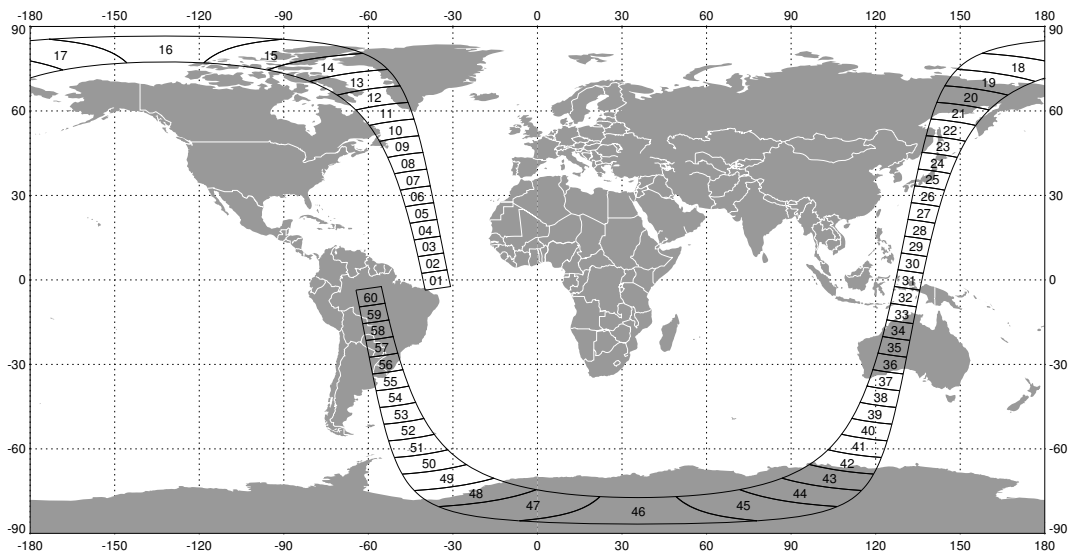
Figure 5.2-1　Image of TANSO-CAI frames (pass number: 5)
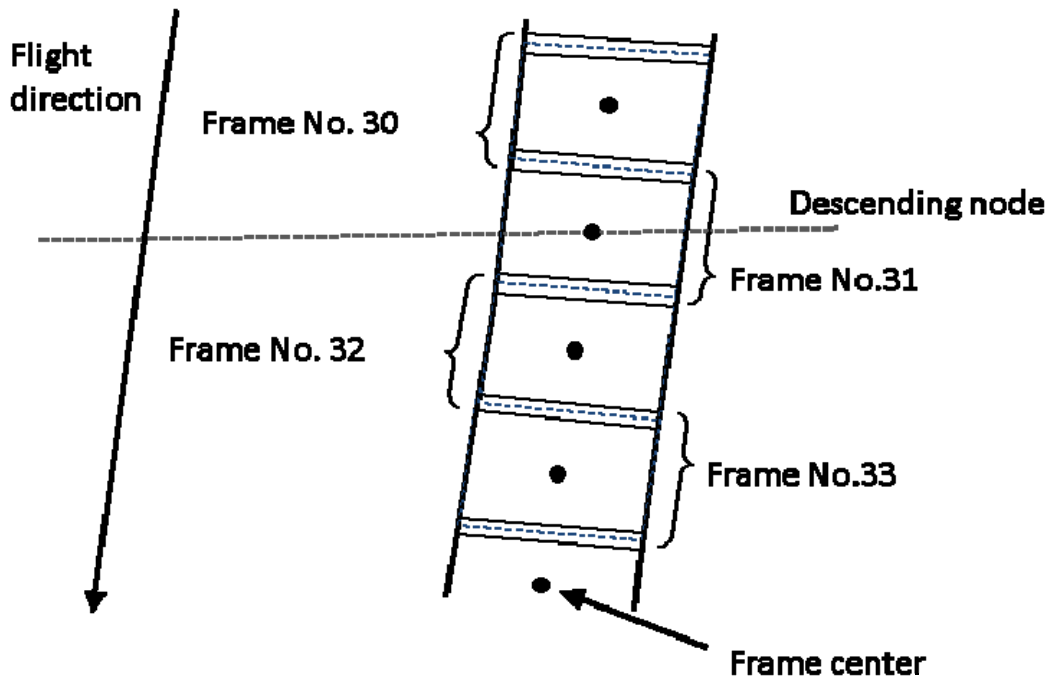
Figure 5.2-2　Frame No. 31 (descending node of the satellite) and its neighboring frames
(Enlarged image)
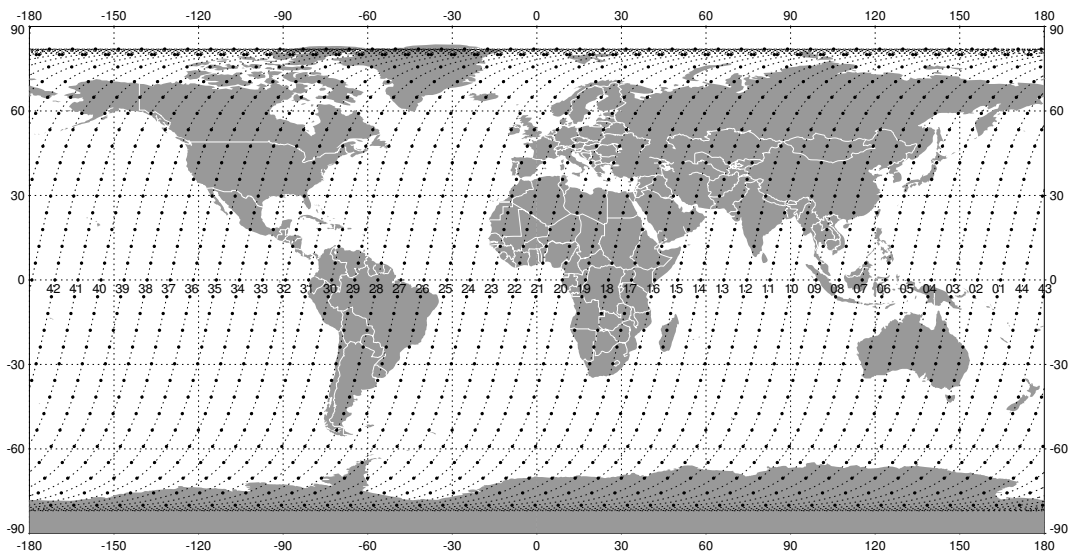
Figure 5.2-3　Positions of the defined frame centers (descending only)

Table 5.2-1 lists up the positions of frame centers of pass number 5.

Table 5.2-1   Positions of frame centers (pass number: 5)

Frame	Lat.	Lon.	Frame	Lat.	Lon.	Frame	Lat.	Lon.
1	-0.02	324.04	21	59.14	149.48	41	-59.12	114.07
2	5.95	322.79	22	53.35	146.35	42	-64.84	109.84
3	11.91	321.52	23	47.50	143.88	43	-70.40	103.59
4	17.87	320.21	24	41.61	141.82	44	-75.63	93.14
5	23.82	318.84	25	35.71	140.03	45	-80.01	73.03
6	29.76	317.38	26	29.78	138.44	46	-81.99	35.73
7	35.68	315.79	27	23.84	136.98	47	-80.02	358.36
8	41.59	314.00	28	17.89	135.61	48	-75.65	338.19
9	47.47	311.94	29	11.94	134.30	49	-70.42	327.71
10	53.32	309.47	30	5.97	133.03	50	-64.86	321.44
11	59.12	306.34	31	0.00	131.78	51	-59.15	317.21
12	64.84	302.11	32	-5.96	130.53	52	-53.35	314.07
13	70.40	295.86	33	-11.92	129.26	53	-47.50	311.59
14	75.63	285.41	34	-17.87	127.95	54	-41.62	309.53
15	80.01	265.30	35	-23.82	126.58	55	-35.71	307.75
16	81.99	227.99	36	-29.76	125.12	56	-29.79	306.15
17	80.02	190.63	37	-35.69	123.52	57	-23.85	304.69
18	75.65	170.46	38	-41.59	121.74	58	-17.90	303.32
19	70.42	159.99	39	-47.48	119.68	59	-11.94	302.01
20	64.86	153.72	40	-53.32	117.20	60	-5.98	300.74

*The third decimal place is half-adjusted.

(1) Frame ID

CYYMMDDhhmmssPPFFX   18 digits

C	: Fixed. Indicates that it is a CAI frame ID.
YYMMDDhhmmss	: Date and time (UTC) of observing the center line of the CAI frame. The start time of line acquisition is used. Note that the digit after the decimal point of the second is half-adjusted.
PP	: Satellite pass number (01 - 44)
FF	: Frame number (serial nos. 01 - 60)
X	: Observation mode ID (Fixed at '1', representing an observation mode)

Note 1) TANSO-CAI observes the day side only; frame IDs for frame numbers between 15 and 45 are usually set.

Note 2) If a CAI frame near the start or end of a CAI scene lacks the centerline (not observed yet), the CAI frame ID is set based on an estimated date and time for observing the frame centerline.

Refer to Reference (2) for more details on definitions of the satellite pass number and scene number.

5.2.2 How to set data into products

Although the number of observed pixels, resolution and swath of the CAI sensor are not identical for all bands, CAI L1B data, L2 cloud flag, and L2 cloud property and aerosol products are generated with the same number of pixels through "band-to-band registration" using Band 3 as the reference. In this process, no interpolation is applied and band-to-band registration is conducted by nearest neighbor method.

CAI L1B and L2 cloud flag data are generated for every pixel after band-to-band registered using Band 3 as the reference.

					··CAI L1B data in the 1st line of the scene···				
					··CAI L1B data in the 2nd line of the scene··				
					··CAI L1B data in the 3rd line of the scene··				
					··CAI L1B data in the 4th line of the scene··				
					··CAI L1B data in the 5th line of the scene··				
					··CAI L1B data in the 6th line of the scene··				
					··CAI L1B data in the 7th line of the scene··				

2,048 pixels
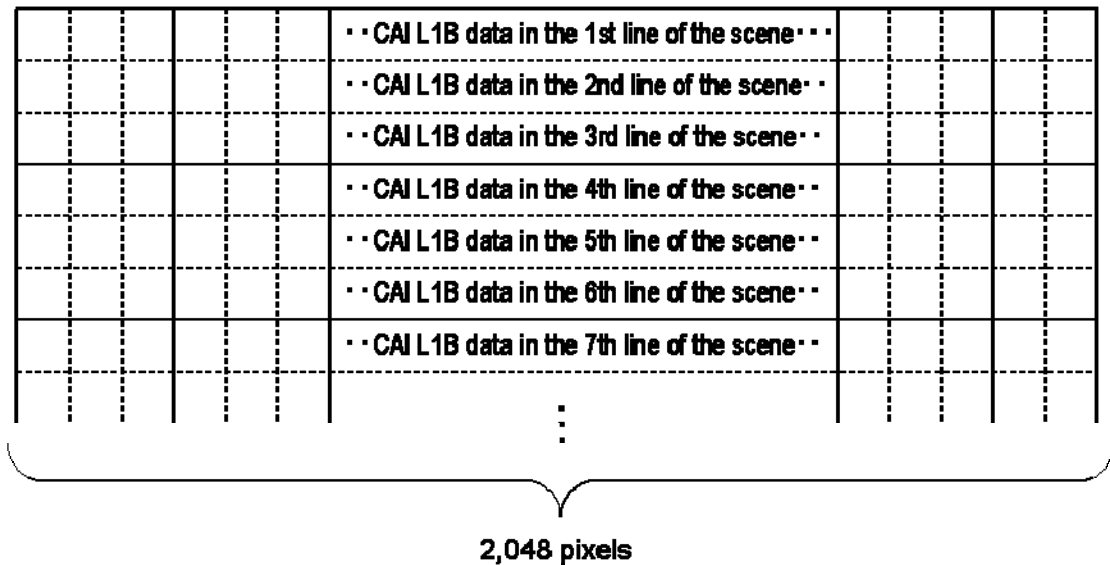
Figure 5.2-4   Image of CAI L1B data and L2 cloud flag pixels

L2 cloud and aerosol property products are derived with respect to those pixels that are extracted every 3 lines x 3 pixels from the aforementioned CAI L1B data.   (The black cells in Figure 5.2-5.)

				··CAI L1B data in the 1st line of the scene···				
				··CAI L1B data in the 2nd line of the scene··				
				··CAI L1B data in the 3rd line of the scene··				
				··CAI L1B data in the 4th line of the scene··				
				··CAI L1B data in the 5th line of the scene··				
				··CAI L1B data in the 6th line of the scene··				
				··CAI L1B data in the 7th line of the scene··				

2,048 pixels (including 683 black pixels)
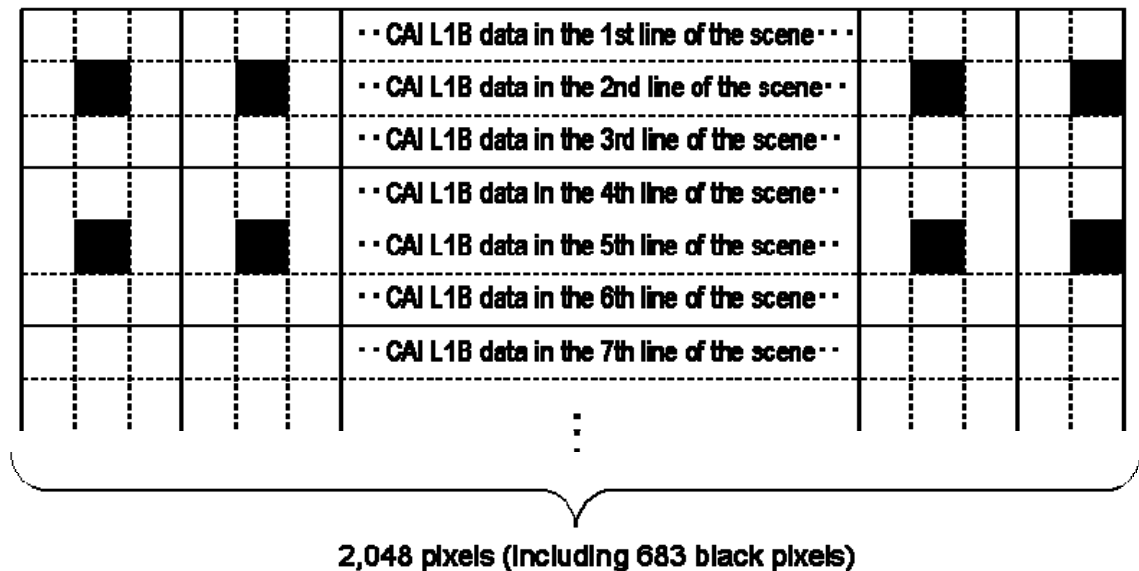
Figure 5.2-5   Image of pixels of L2 cloud and aerosol property products

The lines containing the derived pixels within the frame are contained in the product.
In addition to the CAI level 1B product, the CAI level 1B+ is available. In this product, the interpolation is applied for band-to-band registration and map projection.

5.2.3 CAI L2CloudFlagBit Field

Table 5.2-2 lists the CAI L2CloudFlag Bit Field (/Data/cloudFlag/cloudFlag).

Table 5.2-2　CAI L2CloudFlagBit Field

Bit Field	Description
0	cloud screening execution Flag 0: Not determined 1: Determined

1～4	Clear confidence levels
	Clear confidence (0.0-1.0) is divided into 16 levels with 15 thresholds(0.94, 0.88, 0.82, 0.76, 0.7, 0.64, 0.58, 0.52, 0.46, 0.4, 0.34, 0.28, 0.22, 0.16, 0.1)
	
	  0(0000):　Clear confidence is　less than 0.1 (Cloudy)
	  1(0001):　Clear confidence is　not less than 0.1 and less than 0.16
	  2(0010):　Clear confidence is　not less than 0.16 and less than 0.22
	  3(0011):　Clear confidence is　not less than 0.22 and less than 0.28
	  4(0100):　Clear confidence is　not less than 0.28 and less than 0.34
	  5(0101):　Clear confidence is　not less than 0.34 and less than 0.4
	  6(0110):　Clear confidence is　not less than 0.4 and less than 0.46
	  7(0111):　Clear confidence is not less than 0.46 and less than 0.52
	  8(1000):　Clear confidence is　not less than 0.52 and less than 0.58
	  9(1001):　Clear confidence is　not less than 0.58 and less than 0.64
	10(1010):　Clear confidence is　not less than 0.64 and less than 0.7
	11(1011):　Clear confidence is　not less than 0.7 and less than 0.76
	12(1100):　Clear confidence is　not less than 0.76 and less than 0.82
	13(1101):　Clear confidence is　not less than 0.82 and less than 0.88
	14(1110):　Clear confidence is　not less than 0.88 and less than 0.94
	15(1111):　Clear confidence is　not less than 0.94(Clear)

5	Day/Night Flag (Threshold Solar Zenith Angle of 85 deg) 0: Night 1: Day
6～8	Cone angle for sunglint Cosine of cone angle is divided into 8 levels with 7 thresholds(0.7660444, 0.81915204, 0.8660254, 0.90630778, 0.93969262, 0.965925826, 0.984807753). Cone angle is

	0(000): Cosine of cone angle is not less than 0.984807753
	1(001): Cosine of cone angle is not less than 0.965925826 and less than 0.984807753
	2(010): Cosine of cone angle is not less than 0.93969262 and less than 0.965925826
	3(011): Cosine of cone angle is not less than 0.90630778 and less than 0.93969262
	4(100): Cosine of cone angle is not less than 0.8660254 and less than 0.90630778
	5(101): Cosine of cone angle is not less than 0.81915204 and less than 0.8660254
	6(110): Cosine of cone angle is not less than 0.7660444 and less than 0.81915204
	7(111): Cosine of cone angle is not less than 0.7660444
9	Snow possibility (from NDSI) 0: Probable snow 1: No snow
10～11	Land/Water Flag 0(00): Water 1(01): Spare 2(10): Spare 3(11): Land
12	Spare
13	Thin cirrus Detected (Band3, 4) 0: Probable cirrus 1: No cirrus
14	L1B Band1 saturation flag 0: Saturation 1: No saturation
15	L1B Band2 saturation flag 0: Saturation 1: No saturation
16	L1B Band3 saturation flag 0: Saturation 1: No saturation
17	L1B Band4 saturation flag

	0: Saturation
	1: No saturation
18	Spare
19	Narrow swath
	0: Out of Band4 swath
	1: In Band4 swath
20	Individual test 1 Reflectance test (Band2 (land) or 3 (water))
	0: Cloudy
	1: Clear
21	Individual test 2 Reflectance Ratio (Band2&Band3)
	0: Cloudy
	1: Clear
22	Individual test 3 NDVI (Band2&Band3)
	0: Cloudy
	1: Clear
23	Individual test 4 Reflectance Ratio (Band3&Band4)
	0: Cloudy
	1: Clear
24～31	Spare

5.2.4 The rectangle of the CAI L3 NDVI product

Since the data volume of the global NDVI is very large, the global data is divided into 36"rectangles". Each rectangle is separated, in longitudinal direction, by 60 deg. starting 25deg. W, and, in latitudinal direction, by 30 deg. starting from the 90 deg. N.
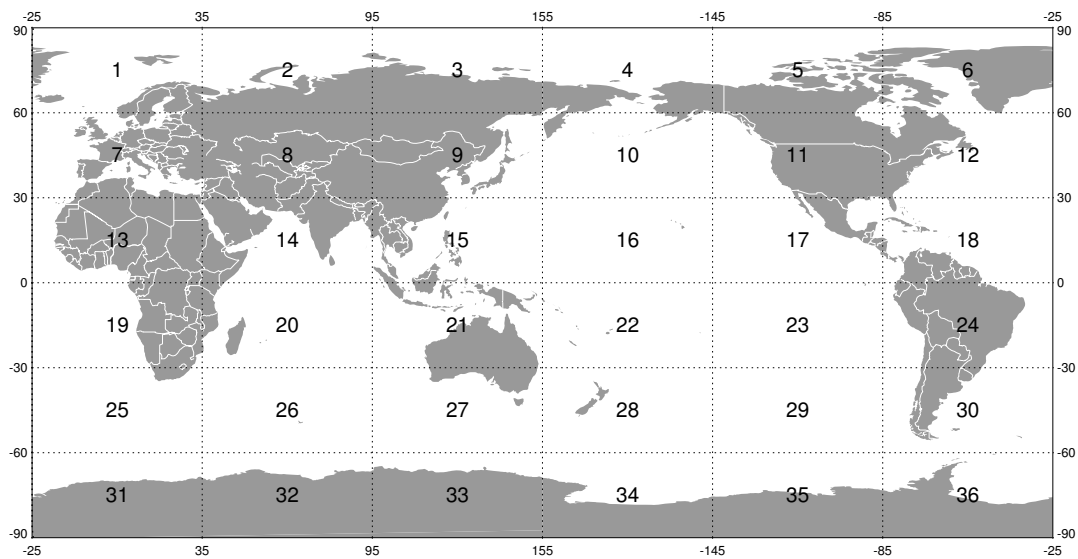
Figure 5.2-6   Definition of the number of each rectangle

6   Standard products

(1) Data type

The data types contained in the standard products are defined as follows:

Type	Definition
H5T_STRING	String with a length of 1 byte or more
H5T_STD_I8LE	Signed 1-byte integer
H5T_STD_I16LE	Signed 2-byte integer
H5T_STD_U16LE	Unsigned 2-byte integer
H5T_STD_I32LE	Signed 4-byte integer
H5T_IEEE_F32LE	Signed 4-byte real number
H5T_IEEE_F64LE	Signed 8-byte real number

(2) Array size

The size of each element of an array is described in the C language, in accordance with the HDF5 standard.   In case of a two-dimensional array, therefore, it is defined as (row, line).

6.1 CAI L1B product

6.1.1 Outline

The CAI L1B product is a radiance product obtained by dividing the CAI L1A product into frames, basing on band 3 of TANSO-CAI sensor applying band-to-band registration without interpolation. Map projection is not applied.

6.1.2 File unit

The CAI L1B data is provided in an HDF5-formatted file. Each file corresponds to a CAI frame with a few neighboring lines added.

6.1.3 Dataset structure

The following table summarizes the dataset structure of the CAI L1B product.

Table 6.1-1　Dataset structure of the CAI L1B product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Frame attributes	frameAttribute	The following items are included to provide information related to the observation. ・Number of observed lines ・Number of pixels per line ・Frame ID ・Observation time ・Time at the frame center ・Percentage of missing pixels
3	Data	Data	The following items are included to provide data on the product.

			・Radiance in each CAI band
			・Observed position
			・Solar zenith/azimuth angle
			・Satellite zenith/azimuth angle
			・Ocean/land flag
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing.
			・The granule ID of the CAI L1A product
			・The integral time of all CAI L1A bands
			・The satellite position in the CAI L1A product
			・The satellite attitude in the CAI L1A product
			・Information on the data processing results

6.1.4 Specifications for the file format

Table 6.1-2 presents the specifications for the file format.

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	Global											
G	MD_Metadata											
G	identificationInfo											
G	MD_DataIdentification											
G	citation											
	title	1	27	-	0	-	-	-		H5T_STRING	Title	[TANSO-CAI/GOSAT L1B product] Fixed
G	date											
	date	1	10	-	0	-	-	-		H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC) at the scene center
	dateType	1	3	-	0	-	-	-		H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-		H5T_STRING	Abstract	[CAI level 1B product generated from CAI level 1A and divided into frame. Converted to radiance but no geometrical interpolation and no geographic mapping applied.] Description of the data
	purpose	1	256	-	0	-	-	-		H5T_STRING	Purpose	[To provide a radiometrically and geometrically corrected CAI data set without geometric interpolation.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-		H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints											
G	MD_Constraints											
	useLimitation	1	65	-	0	-	-	-		H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords											
G	MD_Keywords_01											
	keyword	1	5	-	0	-	-	-		H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[Radiance] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
	northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo										
G	MD_Distribution										
G	distributionFormat										
G	MD_Format										
	name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
	version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G	transferOptions										
G	MD_DigitalTransferOptions										
G	onLine										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier	1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel	1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	3	-	0	-	-	-	H5T_STRING	Processing level	[L1B] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[TRB0] Fixed
	productName	1	12	-	0	-	-	-	H5T_STRING	Product name	[CAI L1B data] Fixed
	numBand	1	1	-	0	-	-	-	H5T_STRING	Number of bands	[4] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed
	observationMode	1	4	-	0	-	-	-	H5T_STRING	Observation mode	[OBSM] Fixed

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	frameAttribute (Observation information)										
	numLine	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of lines	Number of Band 3 lines
	numPixel	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of pixels per line	[2048] Fixed.
	numLine4	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of band 4 lines	Number of band 4 line index elements
	numPixel4	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of pixels per line of band 4.	[512] Number of band 4 pixel index elements Fixed.
	frameID	1	18	-	0	-	-	-	H5T_STRING	Frame ID	[CYYMMDDhhmmssPPFFX] Frame ID
	time	1	23*numLine	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time at Band 3 line
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	frameCenterTime	1	23	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time at the frame center (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time of the line which is the nearest to the nominal center of the frame. If the frame center is not covered in the acquisition, the time is estimated.
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	missingPixelRate	1	numBand	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Ratio of missing pixels	Ratio of missing pixels to all pixels in one frame
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	frameCorner										
	startLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the start line	Latitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the start line	Longitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	startLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the start line	Latitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the start line	Longitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the end line	Latitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the end line	Longitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the end line	Latitude (orthorectified) of the end pixel of the end line is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the end line	Longitude (orthorectified) of the end pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	radiance										
	band1Radiance	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_IEEE_F32LE	Band 1 radiance data	Radiance data of Band 1 are contained. Band-to-band registration is performed with reference to band 3 by the nearest neighbor method.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1500.0			
				longName	14	H5T_STRING	long name	band1 radiance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band2Radiance	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_IEEE_F32LE	Band 2 radiance data	Radiance data of Band 2 are contained. Band-to-band registration is performed with reference to band 3 by the nearest neighbor method.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1500.0			
				longName	14	H5T_STRING	long name	band2 radiance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band3Radiance	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_IEEE_F32LE	Band 3 radiance data	Radiance data of Band 3 are contained.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1500.0			
				longName	14	H5T_STRING	long name	band3 radiance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band4Radiance	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_IEEE_F32LE	Band 4 radiance data	Radiance data of Band 4 are contained. Band-to-band registration is performed with reference to band 3 by the nearest neighbor method.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 500.0			
				longName	14	H5T_STRING	long name	band4 radiance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	saturationFlag	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Saturation flag	[0] : Saturated, [1] : Not saturated Saturation flags are set from bit 0 to bit 3 in the order of Band 1, Band 2, Band 3, and Band 4.
				longName	15	H5T_STRING	long name	saturation flag			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Latitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	2	numLine, numPixel	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Height	Heights (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	21	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angles in Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	22	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	landSeaMask	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface USGS land/sea mask in Band 3 lines and pixels are stored.
				validRange	2	H5T_STD_I8LE	valid range	0,1			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			

Table 6.1-2 TANSO-CAI L1B data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information on data processing status	[N/A] Fixed, in general
	frameLineRange	1	2	-	0	-	-	-	H5T_STD_I32LE	Extent of frame lines	Line numbers in CAI L1A data corresponding to the start and end lines of the frame
G	CAIL1ADataInformation										
	CAIL1AGranuleID	1	41	-	0	-	-	-	H5T_STRING	CAI L1A granule ID	Granule ID of the CAI L1A data
	band1IntegrationTime	1	numLine	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Integration time of Band 1 in CAI L1A data	Integration time of Band 1 in the CAI L1A data
				invalidValue	1	H5T_STD_I8LE	invalid value	-1			
	band2IntegrationTime	1	numLine	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Integration time of Band 2 in CAI L1A data	Integration time of Band 2 in the CAI L1A data
				invalidValue	1	H5T_STD_I8LE	invalid value	-1			
	band3IntegrationTime	1	numLine	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Integration time of Band 3 in CAI L1A data	Integration time of Band 3 in the CAI L1A data
				invalidValue	1	H5T_STD_I8LE	invalid value	-1			
	band4IntegrationTime	1	numLine	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Integration time of Band 4 in CAI L1A data	Integration time of Band 4 in the CAI L1A data
				invalidValue	1	H5T_STD_I8LE	invalid value	-1			
	satellitePosition	2	numLine, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position in CAI L1A data	Satellite position in the CAI L1A data
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satelliteAttitude	2	numLine, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude in CAI L1A data	Satellite attitude in the CAI L1A data
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			

6.2 CAI L1B+ product

6.2.1 Outline

The CAI L1B+ product is a map-projected radiance product obtained by dividing the CAI L1A product into frames and applying data interpolation and band-to-band registration.

6.2.2 File unit

The CAI L1B+ data is provided in an HDF5-formatted file.   Each file corresponds to a CAI frame with a few neighboring lines added.

6.2.3 Dataset structure

The following table summarizes the dataset structure of the CAI L1B+ product.

Table 6.2-1　　Dataset structure of the CAI L1B+ product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Frame attributes	frameAttribute	The following items are included to provide information related to the observation. ・Observation time ・Time at the frame center ・Percentage of missing pixels ・Position of the map base point ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle ・Ocean/land flag
3	Data	data	The following items are included to provide data on the product.

			・Radiance of Band 1
			・Radiance of Band 2
			・Radiance of Band 3
			・Radiance of Band 4
			・DEM elevation data
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The file name of the input CAI L1A product ・Information on the data processing results

6.2.4 Specifications for the file format

Table 6.2-2 presents the specifications for the file format.

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	28	-	0	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L1B+ product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[CAI Level 1B+ product generated from CAI Level 1A and divided into frame. Converted to radiance in integer and band to band registration and mapping applied.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[Geolocation can be geolocated from line/pixel location.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	MD_Keywords_02											
	keyword	1	9	-	0	-	-	-		H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03											
	keyword	1	9	-	0	-	-	-		H5T_STRING	Keyword	[Radiance] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed
G	language											
	isoCode	1	3	-	0	-	-	-		H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-		H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-		H5T_STRING	Topic category	[007]: Environment Fixed
G	extent											
G	temporalElement											
G	EX_TemporalExtent											
G	extent											
G	beginEnd											
	begin	1	19	-	0	-	-	-		H5T_STRING	Start date and time of the frame	[YYYY-MM-DD-HH-mm-ss] Start date and time of the frame (UTC)
	end	1	19	-	0	-	-	-		H5T_STRING	End date and time of the frame	[YYYY-MM-DD-HH-mm-ss] End date and time of the frame (UTC)
G	geographicElement											
G	EX_GeographicBoundingBox											
	extentTypeCode	1	1	-	0	-	-	-		H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem											
	code	1	5	-	0	-	-	-		H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-		H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
					eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
					southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude of observation point is stored. s: Plus (+) for north and minus (-) for south of the equator, n: Numerical value
					northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude of observation point is stored. s: Plus (+) for north and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
					version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	4	-	0	-	-	-	H5T_STRING	Processing level	[L1B+] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[TRBP] Fixed
	productName	1	13	-	0	-	-	-	H5T_STRING	Product name	[CAI L1B+ data] Fixed
	numBand	1	1	-	0	-	-	-	H5T_STRING	Number of bands	[4] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed
	observationMode	1	4	-	0	-	-	-	H5T_STRING	Observation mode	[OBSM] Fixed

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	frameAttribute (Observation information)										
	numLine	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of lines per frame	Bands 1 - 4 and DEM images after map projection have the same number of lines per frame.
	numPixel	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of pixels per frame	Bands 1 - 4 and DEM images after map projection have the same number of pixels per frame.
	frameID	1	18	-	0	-	-	-	H5T_STRING	Frame ID	[CYYMMDDhhmmssPPFFX] Frame ID
	frameCenterTime	1	23	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time at the frame center (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time of the line which is the nearest to the nominal center of the frame. If the frame center is not covered in the acquisition, the time is estimated.
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	missingPixelRate	1	numBand	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Ratio of missing pixels	Ratio of dummy pixels interpolated for compensating missing data and processing errors to all pixels in one frame
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	frameCorner										
	upperLeftLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the upper left corner	Latitude of the upper left corner, or the northwesternmost pixel, of L1B+ product including invalid value pixels. The latitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	upperLeftLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the upper left corner	Longitude of the upper left corner, or the northwesternmost pixel, of L1B+ product including invalid value pixels. The longitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	upperRightLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the upper right corner	Latitude of the upper right corner, or the northeasternmost pixel, of L1B+ product including invalid value pixels. The latitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	upperRightLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the upper right corner	Longitude of the upper right corner, or the northeasternmost pixel, of L1B+ product including invalid value pixels. The longitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	lowerLeftLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lower left corner	Latitude of the lower left corner, or the southwesternmost pixel, of L1B+ product including invalid value pixels. The latitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	lowerLeftLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lower left corner	Longitude of the lower left corner, or the southwesternmost pixel, of L1B+ product including invalid value pixels. The longitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	lowerRightLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lower right corner	Latitude of the lower right corner, or the southeasternmost pixel, of L1B+ product including invalid value pixels. The latitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	lowerRightLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lower right corner	Longitude of the lower right corner, or the southeasternmost pixel, of L1B+ product including invalid value pixels. The longitude value points the center of the corner pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	imageCorner										
	upperLeftLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the upper left corner	Latitude of the start line and start pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	upperLeftLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the upper left corner	Longitude of the start line and start pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	upperRightLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the upper right corner	Latitude of the start line and end pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	upperRightLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the upper right corner	Longitude of the start line and end pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	lowerLeftLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lower left corner	Latitude of the end line and start pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	lowerLeftLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lower left corner	Longitude of the end line and start pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	lowerRightLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lower right corner	Latitude of the end line and the pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	lowerRightLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lower right corner	Longitude of the end line and the pixel.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	thinningAttribute										
G	sun										
	sampleNumPixels_sun	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of sampled pixels	Number of sampled pixels containing solar position information after thinning.
	sampleNumLines_sun	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of sampled lines	Number of sampled lines containing solar position information after thinning.
	thinningOffsetPointPixelNum	1	1	-	0	-	-	-	H5T_STD_I16LE	Pixel number for calculating the solar position (Pixel offset	N (integer) shows the first pixel number used for calculating the solar position.
	thinningIntervalPixel	1	1	-	0	-	-	-	H5T_STD_I16LE	Interval of pixels for calculating the solar position (pixel interval)	M (integer) shows the interval of pixels used for calculating the solar position.
	thinningOffsetPointLineNum	1	1	-	0	-	-	-	H5T_STD_I16LE	Line number for calculating the solar position (Line offset	N (integer) shows the first line number used for calculating the solar position.
	thinningIntervalLine	1	1	-	0	-	-	-	H5T_STD_I16LE	Interval of lines for calculating the solar position (pixel interval)	M (integer) shows the interval of lines used for calculating the solar position.
G	satellite										
	sampleNumPixels_satellite	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of sampled pixels	Number of sampled pixels containing satellite position information after thinning.
	sampleNumLines_satellite	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of sampled lines	Number of sampled lines containing satellite position information after thinning.
	thinningOffsetPointPixelNum	1	1	-	0	-	-	-	H5T_STD_I16LE	Pixel number for calculating the satellite position (Pixel offset	N (integer) shows the first pixel number used for calculating the satellite position.
	thinningIntervalPixel	1	1	-	0	-	-	-	H5T_STD_I16LE	Interval of pixels for calculating the satellite position (pixel interval)	M (integer) shows the interval of pixels used for calculating the satellite position.
	thinningOffsetPointLineNum	1	1	-	0	-	-	-	H5T_STD_I16LE	Line number for calculating the satellite position (Line offset	N (integer) shows the first line number used for calculating the satellite position.
	thinningIntervalLine	1	1	-	0	-	-	-	H5T_STD_I16LE	Interval of lines for calculating the satellite position (pixel interval)	M (integer) shows the interval of lines used for calculating the satellite position.

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	mapProjection										
	projectionMethod	1	3	-	0	-	-	-	H5T_STRING	Map projection method	「MER」: Mercator projection 「PS」: Polar stereo projection When 0<=phi<60 (phi = latitude), the Mercator projection formula is used. When 60<=phi<=90, the polar stereo projection formula is used.
	projectionFormula	1	2	-	0	-	-	-	H5T_STRING	Map projection formula	The first element includes the x coordinate of the map projection formula, and the second element includes the y coordinate of the formula.
G	projectionPoint										
	projectionCenterLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the projection center	Reference latitude of the map projection. Not the L1B+ image center latitude.
	projectionCenterLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the projection center	Reference longitude of the map projection. Not the L1B+ image center longitude.
G	mapScale										
	mapScaleX	1	1	-	0	-	-	-	H5T_IEEE_F32LE	X axis scaling factor	The X axis scaling factor used in the map projection. The factor is 500 m per pixel at the center of the projected image.
	mapScaleY	1	1	-	0	-	-	-	H5T_IEEE_F32LE	Y axis scaling factor	The Y axis scaling factor used in the map projection. The factor is 501 m per pixel at the center of the projected image.
G	sun										
	azimuth	2	sampleNumPixels_sun, sampleNumLines_sun	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,360.0	H5T_IEEE_F32LE	Solar azimuth angle	Sun azimuth angle at the pixel measured clockwise from north, which is stored with the thinning ratio set by an external parameter. -9999.0 when values were invalid.
	zenith	2	sampleNumPixels_sun, sampleNumLines_sun	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,180.0	H5T_IEEE_F32LE	Solar zenith angle	Sun zenith angle at the pixel measured clockwise from north, which is stored with the thinning ratio set by an external parameter. -9999.0 when values were invalid.
G	satellite										
	azimuth	2	sampleNumPixels_satellite, sampleNumLines_satellite	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,360.0	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at the pixel measured clockwise from north, which is stored with the thinning ratio set by an external parameter. -9999.0 when values were invalid.
	zenith	2	sampleNumPixels_satellite, sampleNumLines_satellite	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,180.0	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at the pixel measured clockwise from north, which is stored with the thinning ratio set by an external parameter. -9999.0 when values were invalid.

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
	band1Image	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_STD_U16LE	L1B+ Band 1 image	Pixel values at the line and the pixel of Band 1 data.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_STD_U16LE	Minimum and maximum pixel values in the frame (except dummy)	12,680			
				dummy	0	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0059036			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-3.48549			
	band2Image	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_STD_U16LE	L1b+ Band 2 image	Pixel values at the line and the pixel of Band 2 data.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_STD_U16LE	Minimum and maximum pixel values in the frame (except dummy)	12,680			
				dummy	0	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0079738			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-4.7078			

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	band3Image	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_STD_U16LE	L1B+ Band 3 image	Pixel values at the line and the pixel of Band 3 data.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_STD_U16LE	Minimum and maximum pixel values in the frame (except dummy)	12,680			
				dummy	0	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0051595			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-3.04623			
	band4Image	2	numLine, numPixel	unit	16	H5T_STRING	unit	W/m^2/sr/micro m	H5T_STD_U16LE	L1B+ Band 4 image	Pixel values at the line and the pixel of Band 4 data.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_STD_U16LE	Minimum and maximum pixel values in the frame (except dummy)	12,680			
				dummy	0	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0012562			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-0.74166			

Table 6.2-2 TANSO-CAI L1B+ data Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	dem	2	numLine, numPixel	unit	5	H5T_STRING	unit	meter	H5T_STD_I16LE	DEM data	Elevation values at the line and the pixel.
				validRange	2	H5T_STD_I16LE	valid range	-407,8752			
				range	2	H5T_STD_I16LE	Minimum and maximum altitudes in the frame (except dummy)	-10,23			
				dummy	0	H5T_STD_I16LE	invalid value	-32767			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information on data processing status	[N/A] Fixed, in general
	frameLineRange	1	2	-	0	-	-	-	H5T_STD_I32LE	Extent of frame lines	Line numbers in CAI L1A data corresponding to the start and end lines of the frame
G	CAIL1ADataInformation										
	CAIL1AGranuleID	1	41	-	0	-	-	-	H5T_STRING	CAI L1A granule ID	Granule ID of the CAI L1A data

6.3 L2 CO$_2$ column abundance (SWIR)

6.3.1 Outline

The L2 CO$_2$ column abundance product provides information on CO$_2$ column abundances obtained by the TANSO-FTS in the shortwave infrared (SWIR) bands. The part of this product includes the data that is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The relevant data is described on the Table 6.3-2.

6.3.2 File unit

The L2 CO$_2$ column abundance data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

6.3.3 Dataset structure

The following table summarizes the dataset structure of the L2 CO$_2$ column abundance product.

Table 6.3-1　Dataset structure of the L2 CO$_2$ column abundance product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time

			・Sensor information
			(observation mode, gain, AT angle, CT angle)
			・Information on the reference data
			・Cloud information
			・Quality information
3	Data	Data	The following items are included to provide data on the product.
			・CO_2 column abundance
			・CO_2 column abundance error
			・CO_2 volume mixing ratio
			・Observed position (at the center of the FTS's FOV, and FOV)
			・Observation altitude
			・Solar zenith/azimuth angle
			・Satellite zenith/azimuth angle
			・Satellite attitude
			・Satellite position
			・Ocean/land flag
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing.
			・The granule ID of the FTS L1B product
			・Information on the data processing results

6.3.4 Specifications for the file format

Table 6.3-2 presents the specifications for the file format.

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset				dataspace		attribute					Datatype	Dataset name	Description
					rank	size	name	num	datatype	Description	Example			
G	Global													
G		MD_Metadata												
G			identificationInfo											
G				MD_DataIdentification										
G					citation									
					title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L2 CO2 column amount (SWIR) product] Fixed
G					date									
					date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
					dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
				abstract		1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 CO2 column amount (SWIR) generated from FTS (SWIR) level 1B data and other reference dataset.] Description of the data
				purpose		1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CO2 column amount distribution derived from FTS (SWIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
				status		1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G			resourceConstraints											
G				MD_Constraints										
					useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G			descriptiveKeywords											
G				MD_Keywords_01										
					keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
					type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G				MD_Keywords_02										
					keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
					type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
G				MD_Keywords_03											
				keyword		1	3	-	0	-	-	-	H5T_STRING	Keyword	[CO2] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G				MD_Keywords_04											
				keyword		1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G			language												
				isoCode		1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
			characterSet			1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
			topicCategory			1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G			extent												
G			temporalElement												
G				EX_TemporalExtent											
G				extent											
G					beginEnd										
					begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
					end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G			geographicElement												
G				EX_GeographicBoundingBox											
				extentTypeCode		1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G				extentReferenceSystem											
					code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
					westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
					eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
					southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
					northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
					version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C01S] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L2 CO2 column amount (SWIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[-1][1][3][5][7][9][10] [-1]: Specified observation (V00.50) [10]: Specified observation (V00.20, V00.30, V00.80 and later) The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point).
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB2D][SPOD] Observation mode
	gain	2	1*numScan, 2	-	0	-	-	-	H5T_STRING	Gain	[H][M][L] Gain of FTS
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	referenceData										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface pressure	Surface pressure, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	300.0,1100.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	waterVaporProfile	2	numScan, 21	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Water vapor profile	Water vapor profile, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 50000.0			
				longName	19	H5T_STRING	long name	water vapor profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureProfile	2	numScan, 21	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Temperature profile	Temperature profile referred to in the L2 processing is stored. The values are determined by performing temporal and space interpolation onto GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	150.0, 350.0			
				longName	19	H5T_STRING	long name	temperature profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedo	Surface albedo, which is used in the L2 processing, is stored. The first element represents the surface albedo in the O2A band (MODIS 0.858 micro m band), the second the CO2 band (MODIS 1.64 micro m band), and the third the CH4 band (MODIS 1.64 micro m band). Climatological values are used.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

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Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	aerosolOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness (1.6 micrometer)	Aerosol optical thickness, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,100.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Optical thickness of cirrus cloud (0.76 micrometer)	Optical thickness of cirrus clouds, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	24	H5T_STRING	long name	cirrus optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusTopPressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Cloud-top pressure for cirrus	Cloud-top pressure for cirrus, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	115.0, 375.0			
				longName	15	H5T_STRING	long name	cirrus pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceWindSpeed	1	numScan	unit	5	H5T_STRING	unit	m/sec	H5T_IEEE_F32LE	Surface wind speed	Surface wind speed, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	18	H5T_STRING	long name	surface wind speed			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	A priori dry air profile	A priori dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	31	H5T_STRING	long name	a priori dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2Profile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	A priori CO2 profile	A priori profile in CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	20	H5T_STRING	long name	a priori CO2 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	varianceCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	A priori variance-covariance matrix	A priori variance-covariance matrix is stored.
				longName	35	H5T_STRING	long name	a priori variance covariance matrix			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on inner sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on outer sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			

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Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
			dataspace			attribute					
	sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside).
G	qualityInformation (Quality information)										
	SNR	3	numScan, 3, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	SN ratio	The SN ratio of each scan is stored per sub-band per polarization. SNR[numScan][a][b] a=0: O2A band (12950 to 13200 cm-1) a=1: CO2 band (6180 to 6380 cm-1) a=2: CH4 band (5900 to 6150 cm-1) b=0: Polarization P b=1: Polarization S b=2: Synthesized polarization
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	21	H5T_STRING	long name	signal to noise ratio			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
	roughTerrainSurfaceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Terrain roughness screening	[0]: OK, [1]: NG Concerning the average height difference between the scope of FOV and surrounding equivalent FOV, it is OK where Maximum value ≦ Threshold value X and Standard deviation ≦ Threshold value Y. Threshold values: X, Y (TBD)
	highSolarZenithScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Solar zenith angle screening	[0]: OK, [1]: NG It is OK where Solar zenith angle ≦ Threshold value X. Threshold value X: 70deg
	highAltitudeAerosolScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	High altitude aerosol screening	[0]: OK, [1]: NG It is OK where Percentage of high altitude aerosol optical thickness in all layers < Threshold value X or High altitude aerosol optical thickness < Threshold value Y. Threshold values: X, Y (TBD)
	TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2 micro m band	[0]: OK, [1]: NG It is OK where, when normalized based on noise level, Average brightness of P-polarization ≦ Threshold value X and Average brightness of S-polarization ≦ Threshold value X, with regard to certain wavenumber points where the level of absorption by water vapor is very high in the 2 micro m band. Threshold values: 1.0
	CAIRadianceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	CAI radiance screening	[0]: OK, [1]: NG
	totalScreeningResult	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Synthetic screening	[0]: OK, [1]: NG
	CAIRadiance	3	numScan, 4, 2	unit	16	H5T_STRING	unit	W/m^2/sr /micro m	H5T_IEEE_F32LE	Average and standard deviation of CAI radiances observed within the FTS field of view	Average and standard deviation of CAI radiances observed within the FTS field of view (CAI Band 1, 2, 3, and 4) which are utilized for the CAI coherent test. CAIRadiance[numScan][a][b] a=0 : CAI band 1 a=1 : CAI band 2 a=2 : CAI band 3 a=3 : CAI band 4 b=0 : Average of CAI radiances observed within the FTS field of view b=1 : Standard deviation of CAI radiances observed within the FTS field of view
				validRange	2	H5T_IEEE_F32LE	valid range	-10.0, 1000.0			
				longName	37	H5T_STRING	long name	CAI radiance within FTS field of view			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology
	aerosolAprioriWeight	2	numScan, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol a priori weight	Weights of the aerosol properties by CAI and those by SPRINTARS necessary for FTS L2 processing. The 1st element for CAI and the 2nd for SPRINTARS are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1.0			
				longName	22	H5T_STRING	long name	aerosol apriori weight			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	totalColumn										
	CO2TotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	CO2 column	CO2 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^23			
				longName	16	H5T_STRING	long name	CO2 total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2TotalColumnSmoothingError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Smoothing error in CO2 column	Smoothing error in CO2 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^22			
				longName	32	H5T_STRING	long name	CO2 total column smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2TotalColumnRetrievalNoise	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Retrieval noise in CO2 column	CO2 column error attributable to instrumental noise is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^22			
				longName	32	H5T_STRING	long name	CO2 total column retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2TotalColumnInterferenceError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Interference error in CO2 column	Interference error in CO2 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^22			
				longName	35	H5T_STRING	long name	CO2 total column interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2TotalColumnExternalError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	External error in CO2 column	External error in CO2 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3*10^22, 3*10^22			
				longName	31	H5T_STRING	long name	CO2 total column external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	mixingRatio										
	XCO2	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 dry air mixing ratio	CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	4	H5T_STRING	long name	XCO2			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2SmoothingError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Smoothing error in CO2 dry air mixing ratio	Smoothing error in CO2 dry mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 300.0			
				longName	20	H5T_STRING	long name	XCO2 smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2RetrievalNoise	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieval noise in CO2 dry air mixing ratio	Retrieval noise in CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 300.0			
				longName	20	H5T_STRING	long name	XCO2 retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2InterferenceError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Interference error in CO2 dry air mixing ratio	Interference error in CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 300.0			
				longName	23	H5T_STRING	long name	XCO2 interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2ExternalError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	External error in CO2 dry air mixing ratio	External error in CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-300.0, 300.0			
				longName	19	H5T_STRING	long name	XCO2 external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2Profile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Vertical profile in CO2 dry air mixing ratio	Vertical profile in CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	11	H5T_STRING	long name	CO2 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	retrievalQuality										
	chi2	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Chi squared of the total	Chi squared is stored: Chi squared is determined by dividing the sum of squares of residual spectra normalized based on observation noise with the degree of freedom for noise.
				longName	10	H5T_STRING	long name	chi square			
	residualMeanSquare	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Residual mean square	Mean square of spectral residual errors normalized based on observation noise is stored. The first element represents the residual mean square of the O2A band, the second the CO2 band, and the third the CH4 band.
				longName	20	H5T_STRING	long name	residual mean square			
	CO2DFS	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Degree of freedom for CO2 signal in the L2 processing	The degree of freedom for CO2 signal in the L2 processing is stored.
				longName	28	H5T_STRING	long name	degree of freedom for signal			
	iterations	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of iterations	The number of iterations in L2 retrieval is stored.
				validRange	2	H5T_STD_I8LE	valid range	1, 20			
				longName	20	H5T_STRING	long name	number of iterations			
	errorCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	Variance-covariance marix	Variance-covariance matrix in L2 processing is stored.
				longName	23	H5T_STRING	long name	error covariance matrix			
	averagingKernelMatrix	3	numScan, 15, 15	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Averaging kernel matrix	Averaging kernel in L2 processing is stored.
				longName	23	H5T_STRING	long name	averaging kernel matrix			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
G	auxiliaryParameter										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface air pressure simultaneously retrieved	Surface air pressure simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1200.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	aerosolOpticalThickness	1	numScan	unit	3	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness simultaneously retrieved	Aerosol optical thickness in the 1.6 micro m band simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,5.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureShift	1	numScan	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Simultaneously retrieved temperature shift	Simultaneously retrieved temperature shift is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-120.0, 120.0			
				longName	17	H5T_STRING	long name	temperature shift			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	3	numScan, 22, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedos retrieved simultaneously with the column concentrations	Land area observation: Surface albedos (for each calculated wavenumber grid point) retrieved simultaneously with the column concentrations is stored. surfaceAlbedo[numScan][a][b] a= 0~10 : CH4 band (5900~6150 cm-1) a=11~19 : CO2 band (6180~6380 cm-1) a=20~21 : O2A band (12950~13200 cm-1) b=0 : Albedo b=1 : Wavenumber
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirTotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air column	Dry air column, which value is determined by using the surface air pressure simultaneously retrieved and the water vapor column, is stored. This value is used for converting "total column" to "mixing ratio".
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^25			
				longName	20	H5T_STRING	long name	dry air total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air profile	Dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	22	H5T_STRING	long name	dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLatitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	19	H5T_STRING	long name	foot print latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLongitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	20	H5T_STRING	long name	foot print longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.3-2 TANSO-FTS L2 CO2 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type (land or water) of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

6.4   L2 CH$_4$ column abundance (SWIR)

6.4.1 Outline

The L2 CH$_4$ column abundance product provides information on CH$_4$ column abundances obtained by the TANSO-FTS in the shortwave infrared (SWIR) bands. The part of this product includes the data that is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The relevant data is described on the Table 6.4-2.

6.4.2 File unit

The L2 CH$_4$ column abundance data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

6.4.3 Dataset structure

The following table summarizes the dataset structure of the L2 CH$_4$ column abundance (SWIR) product.

Table 6.4-1   Dataset structure of the L2 CH$_4$ column abundance (SWIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time

			・Sensor information (observation mode, gain, AT angle, CT angle) ・Information on the reference data ・Cloud information ・Quality information
3	Data	Data	The following items are included to provide data on the product. ・CH_4 column abundance ・CH_4 column abundance error ・CH_4 volume mixing ratio ・Observed position (at the center of the FTS's FOV, and FOV) ・Observation altitude ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle ・Satellite attitude ・Satellite position ・Ocean/land flag
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the FTS L1B product ・Information on the data processing results

6.4.4 Specifications for the file format

Table 6.4-2 presents the specifications for the file format.

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L2 CH4 column amount (SWIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 CH4 column amount (SWIR) generated from FTS (SWIR) level 1B data and other reference dataset.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CH4 column amount distribution derived from FTS (SWIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_03										
	keyword	1	3	-	0	-	-	-	H5T_STRING	Keyword	[CH4] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04										
	keyword	1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
	eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
	northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo										
G	MD_Distribution										
G	distributionFormat										
G	MD_Format										
	name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
	version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G	transferOptions										
G	MD_DigitalTransferOptions										
G	onLine										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier	1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel	1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C02S] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L2 CH4 column amount (SWIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[-1][1][3][5][7][9][10] [-1]: Specified observation (V00.50) [10]: Specified observation (V00.20, V00.30, V00.80 and later) The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point).
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB2D][SPOD] Observation mode
	gain	2	1*numScan, 2	-	0	-	-	-	H5T_STRING	Gain	[H][M][L] Gain of FTS
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	referenceData										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface pressure	Surface pressure, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	300.0,1100.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	waterVaporProfile	2	numScan, 21	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Water vapor profile	Water vapor profile, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 50000.0			
				longName	19	H5T_STRING	long name	water vapor profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureProfile	2	numScan, 21	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Temperature profile	Temperature profile referred to in the L2 processing is stored. The values are determined by performing temporal and space interpolation onto GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	150.0, 350.0			
				longName	19	H5T_STRING	long name	temperature profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedo	Surface albedo, which is used in the L2 processing, is stored. The first element represents the surface albedo in the O2A band (MODIS 0.858 micro m band), the second the CO2 band (MODIS 1.64 micro m band), and the third the CH4 band (MODIS 1.64 micro m band). Climatological values are used.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	num	datatype	Description	Example	Datatype	Dataset name	Description
	aerosolOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness (1.6 micrometer)	Aerosol optical thickness, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,100.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Optical thickness of cirrus cloud (0.76 micrometer)	Optical thickness of cirrus clouds, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	24	H5T_STRING	long name	cirrus optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusTopPressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Cloud-top pressure for cirrus	Cloud-top pressure for cirrus, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	115.0, 375.0			
				longName	15	H5T_STRING	long name	cirrus pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceWindSpeed	1	numScan	unit	5	H5T_STRING	unit	m/sec	H5T_IEEE_F32LE	Surface wind speed	Surface wind speed, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	18	H5T_STRING	long name	surface wind speed			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	A priori dry air profile	A priori dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	31	H5T_STRING	long name	a priori dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CH4Profile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	A priori CH4 profile	A priori profile in CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 5.0			
				longName	20	H5T_STRING	long name	a priori CH4 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	varianceCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	A priori variance-covariance matrix	A priori variance-covariance matrix is stored.
				longName	35	H5T_STRING	long name	a priori variance covariance matrix			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
		dataspace		attribute							
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on inner sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on outer sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside).
G	qualityInformation (Quality information)										
	SNR	3	numScan, 3, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	SN ratio	The SN ratio of each scan is stored per band per polarization. SNR[numScan][a][b] a=0: O2A band (12950 to 13200 cm-1) a=1: CO2 band (6180 to 6380 cm-1) a=2: CH4 band (5900 to 6150 cm-1) b=0: Polarization P b=1: Polarization S b=2: Synthesized polarization
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	21	H5T_STRING	long name	signal to noise ratio			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
	roughTerrainSurfaceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Terrain roughness screening	[0]: OK, [1]: NG Concerning the average height difference between the scope of FOV and surrounding equivalent FOV, it is OK where Maximum value ≦ Threshold value X and Standard deviation ≦ Threshold value Y. Threshold values: X, Y (TBD)
	highSolarZenithScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Solar zenith angle screening	[0]: OK, [1]: NG It is OK where Solar zenith angle ≦ Threshold value X. Threshold value X: 70deg
	highAltitudeAerosolScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	High altitude aerosol screening	[0]: OK, [1]: NG It is OK where Percentage of high altitude aerosol optical thickness in all layers < Threshold value X or High altitude aerosol optical thickness < Threshold value Y. Threshold values: X, Y (TBD)
	TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
				dataspace		attribute					
	waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2 micro m band	[0]: OK, [1]: NG It is OK where, when normalized based on noise level, Average brightness of P-polarization ≦ Threshold value X and Average brightness of S-polarization ≦ Threshold value X, with regard to certain wavenumber points where the level of absorption by water vapor is very high in the 2 micro m band. Threshold values: 1.0
	CAIRadianceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	CAI radiance screening	[0]: OK, [1]: NG
	totalScreeningResult	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Synthetic screening	[0]: OK, [1]: NG
	CAIRadiance	3	numScan, 4, 2	unit	16	H5T_STRING	unit	W/m^2/sr /micro m	H5T_IEEE_F32LE	Average and standard deviation of CAI radiances observed within the FTS field of view	Average and standard deviation of CAI radiances observed within the FTS field of view (CAI Band 1, 2, 3, and 4) which are utilized for the CAI coherent test. CAIRadiance[numScan][a][b] a=0 : CAI band 1 a=1 : CAI band 2 a=2 : CAI band 3 a=3 : CAI band 4 b=0 : Average of CAI radiances observed within the FTS field of view b=1 : Standard deviation of CAI radiances observed within the FTS field of view
				validRange	2	H5T_IEEE_F32LE	valid range	-10.0, 1000.0			
				longName	37	H5T_STRING	long name	CAI radiance within FTS field of view			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology
	aerosolAprioriWeight	2	numScan, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol a priori weight	Weights of the aerosol properties by CAI and those by SPRINTARS necessary for FTS L2 processing. The 1st element for CAI and the 2nd for SPRINTARS are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1.0			
				longName	22	H5T_STRING	long name	aerosol apriori weight			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	totalColumn										
	CH4TotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	CH4 column	CH4 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^21			
				longName	16	H5T_STRING	long name	CH4 total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CH4TotalColumnSmoothingError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Smoothing error in CH4 column	Smoothing error in CH4 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^20			
				longName	32	H5T_STRING	long name	CH4 total column smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CH4TotalColumnRetrievalNoise	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Retrieval noise in CH4 column	CH4 column error attributable to instrumental noise is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^20			
				longName	32	H5T_STRING	long name	CH4 total column retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CH4TotalColumnInterferenceError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Interference error in CH4 column	Interference error in CH4 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^20			
				longName	35	H5T_STRING	long name	CH4 total column interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CH4TotalColumnExternalError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	External error in CH4 column	External error in CH4 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3*10^20, 3*10^20			
				longName	31	H5T_STRING	long name	CH4 total column external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	mixingRatio										
	XCH4	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CH4 dry air mixing ratio	CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10.0			
				longName	4	H5T_STRING	long name	XCH4			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4SmoothingError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Smoothing error in CH4 dry air mixing ratio	Smoothing error in CH4 dry mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3.0			
				longName	20	H5T_STRING	long name	XCH4 smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4RetrievalNoise	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieval noise in CH4 dry air mixing ratio	Retrieval noise in CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3.0			
				longName	20	H5T_STRING	long name	XCH4 retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4InterferenceError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Interference error in CH4 dry air mixing ratio	Interference error in CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3.0			
				longName	23	H5T_STRING	long name	XCH4 interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4ExternalError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	External error in CH4 dry air mixing ratio	External error in CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3.0, 3.0			
				longName	19	H5T_STRING	long name	XCH4 external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CH4Profile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Vertical profile in CH4 dry air mixing ratio	Vertical profile in CH4 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 5.0			
				longName	11	H5T_STRING	long name	CH4 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	retrievalQuality										
	chi2	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Chi squared of the total	Chi squared is stored: Chi squared is determined by dividing the sum of squares of residual spectra normalized based on observation noise with the degree of freedom for noise.
				longName	10	H5T_STRING	long name	chi square			
	residualMeanSquare	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Residual mean square	Mean square of spectral residual errors normalized based on observation noise is stored. The first element represents the residual mean square of the O2A band, the second the CO2 band, and the third the CH4 band.
				longName	20	H5T_STRING	long name	residual mean square			
	CH4DFS	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Degree of freedom for CH4 signal in the L2 processing	The degree of freedom for CH4 signal in the L2 processing is stored.
				longName	28	H5T_STRING	long name	degree of freedom for signal			
	iterations	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of iterations	The number of iterations in L2 retrieval is stored.
				validRange	2	H5T_STD_I8LE	valid range	1, 20			
				longName	20	H5T_STRING	long name	number of iterations			
	errorCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	Variance-covariance marix	Variance-covariance matrix in L2 processing is stored.
				longName	23	H5T_STRING	long name	error covariance matrix			
	averagingKernelMatrix	3	numScan, 15, 15	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Averaging kernel matrix	Averaging kernel in L2 processing is stored.
				longName	23	H5T_STRING	long name	averaging kernel matrix			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
			dataspace			attribute					
G	auxiliaryParameter										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface air pressure simultaneously retrieved	Surface air pressure simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1200.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	aerosolOpticalThickness	1	numScan	unit	3	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness simultaneously retrieved	Aerosol optical thickness in the 1.6 micro m band simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,5.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureShift	1	numScan	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Simultaneously retrieved temperature shift	Simultaneously retrieved temperature shift is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-120.0, 120.0			
				longName	17	H5T_STRING	long name	temperature shift			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	3	numScan, 22, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedos retrieved simultaneously with the column concentrations	Land area observation: Surface albedos (for each calculated wavenumber grid point) retrieved simultaneously with the column concentrations is stored. surfaceAlbedo[numScan][a][b] a= 0~10 : CH4 band (5900~6150 cm-1) a=11~19 : CO2 band (6180~6380 cm-1) a=20~21 : O2A band (12950~13200 cm-1) b=0 : Albedo b=1 : Wavenumber
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirTotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air column	Dry air column, which value is determined by using the surface air pressure simultaneously retrieved and the water vapor column, is stored. This value is used for converting "total column" to "mixing ratio".
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^25			
				longName	20	H5T_STRING	long name	dry air total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air profile	Dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	22	H5T_STRING	long name	dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLatitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	19	H5T_STRING	long name	foot print latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLongitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	20	H5T_STRING	long name	foot print longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.4-2 TANSO-FTS L2 CH4 column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type (land or water) of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

6.5 L2 CO$_2$ concentration profile (TIR)

6.5.1 Outline

The L2 CO$_2$ concentration profile product provides information on the vertical profile of CO$_2$ concentrations obtained by the TANSO-FTS in the thermal infrared (TIR) band.

6.5.2 File unit

The L2 CO$_2$ concentration profile data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

6.5.3 Dataset structure

The following table summarizes the dataset structure of the L2 CO$_2$ concentration profile (TIR) product.

Table 6.5-1　Dataset structure of the L2 CO$_2$ concentration profile (TIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time ・Sensor information (observation mode, AT angle, CT angle) ・Cloud information

			・Quality information
3	Data	Data	The following items are included to provide data on the product. ・Vertical profile of CO_2 concentrations ・Errors in the vertical profile of CO_2 concentrations ・Covariance matrix of CO_2 concentration errors ・Observed position (at the center of the FTS's FOV) ・Observation altitude ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle ・Satellite attitude ・Satellite position ・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the FTS L1B product ・Information on the data processing results

6.5.4 Specifications for the file format

Table 6.5-2 presents the specifications for the file format.

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	Global											
G	MD_Metadata											
G	identificationInfo											
G	MD_DataIdentification											
G	citation											
	title	1	44	-	0	-	-	-		H5T_STRING	Title	[TANSO-FTS/GOSAT L2 CO2 profile (TIR) product] Fixed
G	date											
	date	1	10	-	0	-	-	-		H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-		H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-		H5T_STRING	Abstract	[Level 2 CO2 profile (TIR) generated from FTS (TIR) level 1B data and other reference dataset.] Description of the data
	purpose	1	256	-	0	-	-	-		H5T_STRING	Purpose	[To provide global CO2 profile distribution above 2 km derived from FTS (TIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-		H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints											
G	MD_Constraints											
	useLimitation	1	65	-	0	-	-	-		H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords											
G	MD_Keywords_01											
	keyword	1	5	-	0	-	-	-		H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02											
	keyword	1	9	-	0	-	-	-		H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
G	MD_Keywords_03										
	keyword	1	3	-	0	-	-	-	H5T_STRING	Keyword	[CO2] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04										
	keyword	1	7	-	0	-	-	-	H5T_STRING	Keyword	[Profile] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset		dataspace		attribute					Datatype	Dataset name	Description
			rank	size	name	num	datatype	Description	Example			
	eastBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
	northBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo											
G	MD_Distribution											
G	distributionFormat											
G	MD_Format											
	name		1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
	version		1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G	transferOptions											
G	MD_DigitalTransferOptions											
G	onLine											
	linkage		1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description		1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier		1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language											
	isoCode		1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
	characterSet		1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel		1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[P01T] Fixed
	productName	1	20	-	0	-	-	-	H5T_STRING	Product name	[L2 CO2 profile (TIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[1][3][5][7][9][10] [10]: Specified observation The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point).
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB1N][SPOD][SPON] Observation mode
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	referenceData										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface pressure	Surface pressure, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	300.0,1100.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	waterVaporProfile	2	numScan, 21	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Water vapor profile	Water vapor profile, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 50000.0			
				longName	19	H5T_STRING	long name	water vapor profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureProfile	2	numScan, 21	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Temperature profile	Temperature profile referred to in the L2 processing is stored. The values are determined by performing temporal and space interpolation onto GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	150.0, 350.0			
				longName	19	H5T_STRING	long name	temperature profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on inner sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on outer sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside)
G	qualityInformation (Quality information)										
	L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
	TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)
	waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2μm band	[0]: OK, [1]: NG It is OK where Average brightness of 2μm band ≦ Threshold value X and Brightness standard deviation of 2μm band ≦ Threshold value Y. Threshold values: X, Y (TBD)
	gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
G	Data										
G	originalProfile										
	level	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Number of CO2 output levels	The number of CO2 output levels is stored.
				longName	5	H5T_STRING	long name	level			
	pressure	2	numScan, 110	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Pressure	Pressure at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1100.0			
				longName	8	H5T_STRING	long name	pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2Profile	2	numScan, 110	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile	CO2 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	11	H5T_STRING	long name	CO2 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileError	2	numScan, 110	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile error	CO2 retrieval error at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-300.0, 300.0			
				longName	17	H5T_STRING	long name	CO2 profile error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileQualityFlag	2	numScan, 110	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Quality flag for CO2 profile	Quality flag for CO2 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				longName	24	H5T_STRING	long name	CO2 profile quality flag			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
G	interpolatedProfile										
	level	1	1	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Number of CO2 output levels	The number of vertical levels, which are interpolated, is stored.
				longName	5	H5T_STRING	long name	level			
	pressure	1	level	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Pressure	Pressure at each vertical level, which is interpolated, is stored. The pressure comprises seven vertical levels: 1000hPa for ground surface; 700hPa, 500hPa, and 300hPa for the free troposphere; and 100hPa, 50hPa, and 10hPa for the stratosphere.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1100.0			
				longName	8	H5T_STRING	long name	pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2Profile	2	numScan, level	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 concentration	CO2 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	11	H5T_STRING	long name	CO2 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.5-2 TANSO-FTS L2 CO2 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

6.6   L2 CH$_4$ concentration profile (TIR)

6.6.1 Outline

The L2 CH$_4$ concentration profile product provides information on the vertical profile of CH$_4$ concentrations obtained by the TANSO-FTS in the thermal infrared (TIR) band.

6.6.2 File unit

The L2 CH$_4$ concentration profile data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

6.6.3 Dataset structure

The following table summarizes the dataset structure of the L2 CH$_4$ concentration profile (TIR) product.

Table 6.6-1   Dataset structure of the L2 CH$_4$ concentration profile (TIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time ・Sensor information (observation mode, AT angle, CT angle) ・Cloud information

			・Quality information
3	Data	Data	The following items are included to provide data on the product. ・Vertical profile of CH_4 concentrations ・Errors in the vertical profile of CH_4 concentrations ・Covariance matrix of CO_2 concentration errors ・Observed position (at the center of the FTS's FOV) ・Observation altitude ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle ・Satellite attitude ・Satellite position ・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the FTS L1B product ・Information on the data processing results

6.6.4 Specifications for the file format

Table 6.6-2 presents the specifications for the file format.

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	44	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L2 CH4 profile (TIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 CH4 profile (TIR) generated from FTS (TIR) level 1B data and other reference dataset.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CH4 profile distribution above 2 km derived from FTS (TIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
G	MD_Keywords_03										
	keyword	1	3	-	0	-	-	-	H5T_STRING	Keyword	[CH4] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04										
	keyword	1	7	-	0	-	-	-	H5T_STRING	Keyword	[Profile] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
				eastBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
				southBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
				northBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
					version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
				dataspace		attribute					
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[P02T] Fixed
	productName	1	20	-	0	-	-	-	H5T_STRING	Product name	[L2 CH4 profile (TIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[1][3][5][7][9][10] [10]: Specified observation The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point).
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB1N][SPOD][SPON] Observation mode
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	referenceData										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface pressure	Surface pressure, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	300.0,1100.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	waterVaporProfile	2	numScan, 21	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Water vapor profile	Water vapor profile, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 50000.0			
				longName	19	H5T_STRING	long name	water vapor profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureProfile	2	numScan, 21	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Temperature profile	Temperature profile referred to in the L2 processing is stored. The values are determined by performing temporal and space interpolation onto GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	150.0, 350.0			
				longName	19	H5T_STRING	long name	temperature profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on inner sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on outer sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group		Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
			rank	size	name	num	datatype	Description	Example			
		cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
					validRange	2	H5T_STD_I32LE	valid range	0, 10000			
					longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
					invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
		cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
					validRange	2	H5T_STD_I32LE	valid range	0, 10000			
					longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
					invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
		sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside)
G		qualityInformation (Quality information)										
		L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
		TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)
		waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2μm band	[0]: OK, [1]: NG It is OK where Average brightness of 2μm band ≦ Threshold value X and Brightness standard deviation of 2μm band ≦ Threshold value Y. Threshold values: X, Y (TBD)
		gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
				dataspace		attribute					
G	Data										
G	originalProfile										
	level	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Number of CH4 output levels	The number of CH4 output levels is stored.
				longName	5	H5T_STRING	long name	level			
	pressure	2	numScan, 110	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Pressure	Pressure at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1100.0			
				longName	8	H5T_STRING	long name	pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CH4Profile	2	numScan, 110	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CH4 profile	CH4 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	11	H5T_STRING	long name	CH4 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CH4ProfileError	2	numScan, 110	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CH4 profile error	CH4 retrieval error at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3.0, 3.0			
				longName	17	H5T_STRING	long name	CH4 profile error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CH4ProfileQualityFlag	2	numScan, 110	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Quality flag for CH4 profile	Quality flag for CH4 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				longName	24	H5T_STRING	long name	CH4 profile quality flag			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
G	interpolatedProfile										
	level	1	1	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Number of CH4 output levels	The number of vertical levels, which are interpolated, is stored.
				longName	5	H5T_STRING	long name	level			
	pressure	1	level	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Pressure	Pressure at each vertical level, which is interpolated, is stored. The pressure comprises seven vertical levels: 1000hPa for ground surface; 700hPa, 500hPa, and 300hPa for the free troposphere; and 100hPa, 50hPa, and 10hPa for the stratosphere.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1100.0			
				longName	8	H5T_STRING	long name	pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CH4Profile	2	numScan, level	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CH4 concentration	CH4 concentration at each point-level, which is indexed in the order of the point-level, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	11	H5T_STRING	long name	CH4 profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.6-2 TANSO-FTS L2 CH4 profile (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

6.7 L2 cloud flag

6.7.1 Outline

The L2 cloud flag product contains cloud flag information derived from the TANSO-CAI L1B data.　A cloud flag is derived with respect to each pixel in the CAI reference band (Band 3).

6.7.2 File unit

The L2 cloud flag data is provided in an HDF5-formatted file.　Each file corresponds to a CAI frame.

6.7.3 Dataset structure

The following table summarizes the dataset structure of the L2 cloud flag product.

Table 6.7-1　Dataset structure of the L2 cloud flag product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Frame attributes	frameAttribute	The following items are included to provide information related to the observation. ・Number of observed lines ・Number of pixels per line ・Frame ID ・Observation time ・Time at the frame center ・Percentage of missing pixels
3	Data	Data	The following items are included to provide data on the product.

			・ Overall clear-sky confidence
			・ Cloud state bit
			・ Observed position
			・ Observation altitude
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・ The granule ID of the CAI L1B product ・ Information on the data processing results

6.7.4 Specifications for the file format

Table 6.7-2 presents the specifications for the file format.

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	37	-	0	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L2 cloud flag product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC) at the scene center
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 cloud flag product generated from CAI level 1B data for each pixel.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To judge whether cloud exists in the frame, especially inside FTS field of view.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[Cloud] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
	eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
	northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo										
G	MD_Distribution										
G	distributionFormat										
G	MD_Format										
	name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
	version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G	transferOptions										
G	MD_DigitalTransferOptions										
G	onLine										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier	1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel	1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group		Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
			rank	size	name	num	datatype	Description	Example			
		dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
		metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
		metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G		metadata (except for JMP2.0)										
		operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
		productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[CLDM] Fixed
		productName	1	13	-	0	-	-	-	H5T_STRING	Product name	[L2 cloud flag] Fixed
		productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
		satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
		sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
			dataspace			attribute					
G	frameAttribute (Observation information)										
	numLine	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lines	Number of Band 3 lines
	numPixel	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of pixels per line	[2048] Fixed
	frameID	1	18	-	0	-	-	-	H5T_STRING	Frame ID	[CYYMMDDhhmmssPPFFX] Frame ID
	time	1	23*numLine	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time at Band 3 line
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	frameCenterTime	1	23	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time at the frame center (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time of the line which is the nearest to the nominal center of the frame. If the frame center is not covered in the acquisition, the time is estimated.
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	missingPixelRate	1	1	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Ratio of missing pixels	Ratio of missing pixels to all pixels in one frame
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
G	frameCorner										
	startLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the start line	Latitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the start line	Longitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	startLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the start line	Latitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the start line	Longitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the end line	Latitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the end line	Longitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the end line	Latitude (orthorectified) of the end pixel of the end line is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the end line	Longitude (orthorectified) of the end pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 6.7-2 TANSO-CAI L2 cloud flag Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
				dataspace		attribute					
G	Data										
G	cloudFlag										
	cloudFlag	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Cloud flag	Cloud status bit data on Band 3 lines and pixels are stored.
				longName	14	H5T_STRING	long name	cloud flag bit			
				invalidValue	1	H5T_STD_I32LE	invalid value	-2147483648			
	confidenceLevel	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Clear sky confidence level	Clear sky confidence level data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1.0			
				longName	27	H5T_STRING	long name	integrated confidence level			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	geolocation										
	latitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Latitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	2	numLine, numPixel	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Height	Heights (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
	frameLineRange	1	2	-	0	-	-	-	H5T_STD_I32LE	Extent of frame lines	Line numbers in CAI L1A data corresponding to the start and end lines of the frame
G	CAIL1BDataInformation										
	CAIL1BGranuleID	1	41	-	0	-	-	-	H5T_STRING	CAI L1B granule ID	Granule ID of the CAI L1B data

6.8 L3 global CO_2 distribution (SWIR)

6.8.1 Outline

The L3 global CO_2 distribution (SWIR) product provides information on the monthly average of CO_2 column abundances of every 2.5-degree lattice across the globe, which is retrieved by interpolating with the monthly total of L2 CO_2 column abundances (SWIR).

6.8.2 File unit

The L3 global CO_2 distribution (SWIR) data is provided in an HDF5-formatted file.　Each file contains data for one month.

6.8.3 Dataset structure

The following table summarizes the dataset structure of the L3 global CO_2 distribution (SWIR) product.

Table 6.8-1 Dataset structure of the L3 global CO_2 distribution (SWIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	Attribute	The following items are included to provide calculation results and related information. ・Year and month of observation ・Lattice spacing ・Parameters used in interpolation ・Version of the L2 product used in interpolation ・Observation period of L2 observation points adopted in interpolation

3	Data	Data	The following items are included to provide data on the product.
			・Latitude and longitude of each lattice center
			・Retrieved CO_2 column abundances
			・Standard deviation of errors in the retrieved CO_2 column abundances
			・Simple mean value of L2 observed points in each lattice
			・Number of L2 observation points in each lattice
			・Statistics of L2 observed values in each lattice

6.8.4 Specifications for the file format

Table 6.8-2 presents the specifications for the file format.

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset	rank	size	name	num	datatype	description	example	datatype	Dataset name	Description
		dataspace		attribute							
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L3 CO2 distribution (SWIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Start date of observation (1st day of the month)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001] : Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 3 CO2 distribution (SWIR) generated from CO2 dry air mixing ratio data stored in L2 CO2 column amount (SWIR) product.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CO2 column concentration distribution derived from FTS (SWIR) L2 CO2 column amount.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001] : Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset		dataspace		attribute					datatype	Dataset name	Description
			rank	size	name	num	datatype	description	example			
G	MD_Keywords_02											
	keyword		1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_03											
	keyword		1	3	-	0	-	-	-	H5T_STRING	Keyword	[CO2] Fixed
	type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_04											
	keyword		1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
	type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_05											
	keyword		1	6	-	0	-	-	-	H5T_STRING	Keyword	[Distribution] Fixed
	type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	language											
	isoCode		1	3	-	0	-	-	-	H5T_STRING	File name	[eng] : English Fixed
	characterSet		1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
	topicCategory		1	3	-	0	-	-	-	H5T_STRING	Topic category	[007] : Environment Fixed

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset				dataspace		attribute					datatype	Dataset name	Description
					rank	size	name	num	datatype	description	example			
G	extent													
G		temporalElement												
G			EX_TemporalExtent											
G				extent										
G					beginEnd									
					begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
					end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G		geographicElement												
G			EX_GeographicBoundingBox											
				extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1] : Inside Fixed
G				extentReferenceSystem										
					code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
					westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[-180.00] : Fixed West bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
					eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[180.00] : Fixed East bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
					southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[-90.00] : Fixed South bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value
					northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[90.00] : Fixed North bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset					rank	dataspace size	name	num	attribute datatype	description	example	datatype	Dataset name	Description
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
					version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng] : English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005] : Header of the dataset Fixed
G		contact													
			organisationName			1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
			role			1	3	-	0	-	-	-	H5T_STRING	Role	[005] : Distributor Fixed

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group				Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
					rank	size	name	num	datatype	description	example			
G				contactInfo										
G				phone										
				voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
				facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G				address										
				deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
				city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
				administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
				postalCode	1	8	-	0	-	-	-	H5T_STRING	Zip code	[305-8506] Fixed
				country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
				electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G				onlineResource										
				linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
				description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
				hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
				contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C01S] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L3 global CO2 distribution (SWIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	Attribute										
G	metadeta										
	year	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation year	YYYY
	month	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation month	MM
	intervalLengthOfLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. direction	
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lat. direction	
	intevalLengthOfLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. direction	
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lon. direction	

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	modelParameter										
	predictionType	1	1	-	0	-	-	-	H5T_STD_I32LE	Automated estimation of interpolation model parameters	0 : Automatic 1 : To be specified
	numModelParameterType	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model parameter types	2, Land and Sea
	numParameter	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model parameters	
	maximumDataDistance	2	1, numModelParameterType	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Maximum data distance	Maximum distance to the farthest data used in the retrieval of the lattice. The maximum distance information is stored in the first suffix if the lattice corresponds to sea area or in the second suffix if it is in land area.
				validRange	2	H5T_IEEE_F32LE	valid range	0,40000.0			
	parameters	2	numParameter, numModelParameterType	-	0	-	-	-	H5T_IEEE_F32LE	Interpolation model parameter	
G	ovalParameter										
	longRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-major axis of oval parameter	
	shortRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-minor axis of oval parameter	
G	usedLevel2Info										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Data										
G	mixingRatio										
	XCO2	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieved value of XCO2	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	4	H5T_STRING	long name	XCO2			
				algorithm	7	H5T_STRING	algorithm	Kriging			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2StandardError	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Standard error of XCO2	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	19	H5T_STRING	long name	XCO2 standard error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	minimumDistance	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Distance between the lattice point and the	
	numObservationPoints	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of data used for creating XCO2 data	
	calculationMethod	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Method of interpolation	1：Interpolation by the Kriging method 2：Interpolation by the Kriging method 3：Weighted averaging of four peripheral points, by having the second result as input data. * Refer to the Algorithm Description for details
G	latticeInformation										
	numObservationPoints	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of observation data in the lattice point	
	XCO2Average	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Average value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	13	H5T_STRING	long name	XCO2 average			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2StandardDeviation	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Standard deviation in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	23	H5T_STRING	long name	XCO2 standard deviation			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2Median	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Median value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	11	H5T_STRING	long name	XCO2 median			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.8-2 TANSO-FTS L3 global CO2 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	XCO2Maximum	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Maximum value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	12	H5T_STRING	long name	XCO2 maximum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2Minimum	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Minimum value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	12	H5T_STRING	long name	XCO2 minimum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2Mode	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCO2 (Mode value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	9	H5T_STRING	long name	XCO2 mode			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	geolocation										
	latitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lattice point	Coordinate of each lattice center (latitude)
				validRange	2	H5T_IEEE_F32LE	validRange	-90.0,90.0			
				longName	17	H5T_STRING	long name	latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lattice point	Coordinate of each lattice center (longitude)
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
				longName	9	H5T_STRING	full name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	maskInformation										
	threshold	1	1	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Threshold for distance mask	
	XCO2Mask	2	numLatitude, numLongitude	-	-	-	-	-	H5T_STD_I32LE	XCO2 (distance mask)	0: unmasked 1: masked

6.9 L3 global CH$_4$ distribution (SWIR)

6.9.1 Outline

The L3 global CH$_4$ distribution (SWIR) product provides information on the monthly average of CH$_4$ column abundances of every 2.5-degree lattice across the globe, which is retrieved by interpolating with the monthly total of L2 CH$_4$ column abundances (SWIR).

6.9.2 File unit

The L3 global CH$_4$ distribution (SWIR) data is provided in an HDF5-formatted file.　Each file contains data for one month.

6.9.3 Dataset structure

The following table summarizes the dataset structure of the L3 global CH$_4$ distribution (SWIR) product.

Table 6.9-1 Dataset structure of the L3 global CH$_4$ distribution (SWIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	Attribute	The following items are included to provide calculation results and related information. ・Year and month of observation ・Lattice spacing ・Parameters used in interpolation ・Version of the L2 product used in interpolation ・Observation period of L2 observation points adopted in interpolation

3	Data	Data	The following items are included to provide data on the product.
			・Latitude and longitude of each lattice center
			・Retrieved CH_4 column abundance
			・Standard deviation of errors in the retrieved CH_4 column abundances
			・Simple mean value of L2 observed points in each lattice
			・Number of L2 observation points in each lattice
			・Statistics of L2 observed values in each lattice

6.9.4 Specifications for the file format

Table 6.9-2 presents the specifications for the file format.

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L3 CH4 distribution (SWIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Start date of observation (1st day of the month)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001] : Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 3 CH4 distribution (SWIR) generated from CH4 dry air mixing ratio data stored in L2 CH4 column amount (SWIR) product.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CH4 column concentration distribution derived from FTS (SWIR) L2 CH4 column amount.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001] : Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_03										
	keyword	1	3	-	0	-	-	-	H5T_STRING	Keyword	[CH4] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_04										
	keyword	1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	MD_Keywords_05										
	keyword	1	6	-	0	-	-	-	H5T_STRING	Keyword	[Distribution] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng] : English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007] : Environment Fixed

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10 -		0 -	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10 -		0 -	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1 -		0 -	-	-	-	H5T_STRING	Extent type code	[1] : Inside Fixed
G	extentReferenceSystem										
	code	1	5 -		0 -	-	-	-	H5T_STRING	Code (Identifier for the	[WGS84] Fixed
	westBoundLongitude	1	8 -		0 -	-	-	-	H5T_STRING	West bounding longitude	[-180.00] : Fixed West bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
	eastBoundLongitude	1	8 -		0 -	-	-	-	H5T_STRING	East bounding longitude	[180.00] : Fixed East bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude	1	7 -		0 -	-	-	-	H5T_STRING	South bounding latitude	[-90.00] : Fixed South bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value
	northBoundLatitude	1	7 -		0 -	-	-	-	H5T_STRING	North bounding latitude	[90.00] : Fixed North bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset				dataspace		attribute					datatype	Dataset name	Description
					rank	size	name	num	datatype	description	example			
G	distributionInfo													
G		MD_Distribution												
G			distributionFormat											
G				MD_Format										
				name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
				version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions											
G				MD_DigitalTransferOptions										
G				onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier			1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language												
			isoCode		1	3	-	0	-	-	-	H5T_STRING	Language code	[eng] : English Fixed
		characterSet			1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
		hierarchyLevel			1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005] : Header of the dataset Fixed
G		contact												
			organisationName		1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
			role		1	3	-	0	-	-	-	H5T_STRING	Role	[005] : Distributor Fixed

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group			Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
				rank	size	name	num	datatype	description	example			
G			contactInfo										
G			phone										
			voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
			facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G			address										
			deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
			city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
			administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
			postalCode	1	8	-	0	-	-	-	H5T_STRING	Zip code	[305-8506] Fixed
			country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
			electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G			onlineResource										
			linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
			description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
			hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
			contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C02S] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L3 global CH4 distribution (SWIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	Attribute										
G	metadeta										
	year	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation year	YYYY
	month	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation month	MM
	intervalLengthOfLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. direction	
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lat. direction	
	intevalLengthOfLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. direction	
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lon. direction	

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	modelParameter										
	predictionType	1	1	-	0	-	-	-	H5T_STD_I32LE	Automated estimation of interpolation model	0 : Automatic 1 : To be specified
	numModelParameterType	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model	2, Land and sea
	numParameter	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model	
	maximumDataDistance	2	1, numModelPara meterType	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Maximum data distance	Maximum distance to the farthest data used in the retrieval of the lattice. The maximum distance information is stored in the first suffix if the lattice corresponds to sea area or in the second suffix if it is in land area.
				validRange	2	H5T_IEEE_F32LE	valid range	0,40000.0			
	parameters	2	numParameter, numModelPara meterType	-	0	-	-	-	H5T_IEEE_F32LE	Interpolation model parameter	
G	ovalParameter										
	longRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-major axis of oval parameter	
	shortRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-minor axis of oval parameter	
G	usedLevel2Info										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVer sion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVer sion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVer sion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVer sion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Data										
G	mixingRatio										
	XCH4	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieved value of XCH4	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	4	H5T_STRING	long name	XCH4			
				algorithm	7	H5T_STRING	algorithm	Kriging			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4StandardError	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Standard error of XCH4	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	19	H5T_STRING	long name	XCH4 standard error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	minimumDistance	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Distance between the lattice point and the	
	numObservationPoints	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of data used for creating XCH4 data	
	calculationMethod	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Method of interpolation	1：Interpolation by the Kriging method 2：Interpolation by the Kriging method 3：Weighted averaging of four peripheral points, by having the second result as input data. * Refer to the Algorithm Description for details
G	latticeInformation										
	numObservationPoints	2	numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of observation data in the lattice point	
	XCH4Average	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4 (Average value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	13	H5T_STRING	long name	XCH4 average			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4StandardDeviation	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4 (Standard deviation in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	23	H5T_STRING	long name	XCH4 standard deviation			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4Median	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4 (Median value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	11	H5T_STRING	long name	XCH4 median			
				invalidValue	1	H5T_IEEE_F32LE	invalid nalue	-9999.0			

Table 6.9-2 TANSO-FTS L3 global CH4 distribution (SWIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	XCH4Maximum	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4(Maximum in lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	12	H5T_STRING	long name	XCH4 maximum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4Minimum	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4 (Minimum value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	12	H5T_STRING	long name	XCH4 minimum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCH4Mode	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	XCH4 (Mode value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,10.0			
				longName	9	H5T_STRING	long name	XCH4 mode			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	geolocation										
	latitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lattice point	Coordinate of each lattice center (latitude)
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lattice point	Coordinate of each lattice center (longitude)
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	maskInformation										
	threshold	1	1	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Threshold for distance	
	XCH4Mask	2	numLatitude, numLongitude	-	-	-	-	-	H5T_STD_I32LE	XCH4 (distance mask)	0: unmasked 1: masked

6.10 L3 global CO_2 distribution (TIR)

6.10.1 Outline

The L3 global CO_2 distribution (TIR) product provides information on the monthly average of CO_2 concentration profiles of every 2.5-degree lattice across the globe, which is retrieved by interpolating with the monthly total of L2 CO_2 concentration profiles (TIR).

6.10.2 File unit

The L3 global CO_2 distribution (TIR) data is provided in an HDF5-formatted file. Each file contains data for one month.

6.10.3 Dataset structure

The following table summarizes the dataset structure of the L3 global CO_2 distribution (TIR) product.

Table 6.10-1 Dataset structure of the L3 global CO_2 distribution (TIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	Attribute	The following items are included to provide calculation results and related information. ・Year and month of observation ・Lattice spacing ・Number of profile levels The following information is provided per level. ・Parameters used in interpolation ・Version of the L2 product used in interpolation ・Observation period of L2 observation points

			adopted in interpolation
3	Data	Data	The following items are included to provide data on the product. ・Latitude and longitude of each lattice center ・Retrieved CO_2 concentration at each level ・Standard deviation of errors in the retrieved CO_2 concentration at each level ・Simple mean value of L2 observation points in each lattice at each level ・Number of L2 observation points in each lattice at each level ・Statistics of L2 observed values in each lattice at each level

6.10.4 Specifications for the file format

Table 6.10-2 presents the specifications for the file format.

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L3 CO2 distribution (TIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Start date of observation (1st day of the month)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001] : Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 3 global CO2 distribution (TIR) generated from L2 CO2 profile (TIR) product.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CO2 concentration distribution for each layer derived from FTS (TIR) L2 CO2 profile.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001] : Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset					dataspace		attribute					datatype	Dataset name	Description
						rank	size	name	num	datatype	description	example			
G				MD_Keywords_02											
				keyword		1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G				MD_Keywords_03											
				keyword		1	3	-	0	-	-	-	H5T_STRING	Keyword	[CO2] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G				MD_Keywords_04											
				keyword		1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G				MD_Keywords_05											
				keyword		1	6	-	0	-	-	-	H5T_STRING	Keyword	[Distribution] Fixed
				type		1	3	-	0	-	-	-	H5T_STRING	Type	[005] : Theme Fixed
G			language												
				isoCode		1	3	-	0	-	-	-	H5T_STRING	File name	[eng] : English Fixed
			characterSet			1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
			topicCategory			1	3	-	0	-	-	-	H5T_STRING	Topic category	[007] : Environment Fixed

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset				dataspace		attribute					datatype	Dataset name	Description
					rank	size	name	num	datatype	description	example			
G	extent													
G		temporalElement												
G			EX_TemporalExtent											
G				extent										
G					beginEnd									
					begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
					end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G		geographicElement												
G			EX_GeographicBoundingBox											
				extentTypeCode		1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1] : Inside Fixed
G				extentReferenceSystem										
					code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the	[WGS84] Fixed
				westBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[-180.00] : Fixed West bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
				eastBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[180.00] : Fixed East bounding longitude of observation point is stored. s: Minus (-) for west of Greenwich, n: Numerical value
				southBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[-90.00] : Fixed South bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value
				northBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[90.00] : Fixed North bounding latitude of observation point is stored. s: Minus (-) for south of the equator, n: Numerical value

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset				dataspace		attribute					datatype	Dataset name	Description
					rank	size	name	num	datatype	description	example			
G	distributionInfo													
G		MD_Distribution												
G			distributionFormat											
G				MD_Format										
					name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
					version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions											
G				MD_DigitalTransferOptions										
G					onLine									
						linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
						description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier			1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language												
			isoCode		1	3	-	0	-	-	-	H5T_STRING	Language code	[eng] : English Fixed
		characterSet			1	3	-	0	-	-	-	H5T_STRING	Character set	[004] : UTF-8 Fixed
		hierarchyLevel			1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005] : Header of the dataset Fixed
G		contact												
			organisationName		1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
			role		1	3	-	0	-	-	-	H5T_STRING	Role	[005]:Distributor Fixed

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group			Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
				rank	size	name	num	datatype	description	example			
G			contactInfo										
G			phone										
			voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
			facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G			address										
			deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
			city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
			administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
			postalCode	1	8	-	0	-	-	-	H5T_STRING	Zip code	[305-8506] Fixed
			country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
			electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G			onlineResource										
			linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
			description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
			hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
			contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	rank	size	name	num	datatype	description	example	datatype	Dataset name	Description
				dataspace		attribute					
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C01T] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L3 global CO2 distribution (TIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	Attribute										
G	metadeta										
	year	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation year	YYYY
	month	1	1	-	0	-	-	-	H5T_STD_I32LE	Observation month	MM
	level	1	1	-	3	-	-	-	H5T_STD_I32LE	No. of profile levels	[7] Fixed
	intervalLengthOfLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. direction	
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lat. direction	
	intevalLengthOfLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. direction	
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lon. direction	

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	modelParameter										
	predictionType	1	1	-	0	-	-	-	H5T_STD_I32LE	Automated estimation of interpolation model	0 : Automatic 1 : To be specified
	numModelParameterType	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model	2, Land and Sea
	numParameter	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of model	
	maximumDataDistance	3	level, 1, numModelParameterType	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Maximum data distance	Maximum distance to the farthest data used in the retrieval of the lattice. The maximum distance information is stored in the first suffix if the lattice corresponds to sea area or in the second suffix if it is in land area.
				validRange	2	H5T_IEEE_F32LE	valid range	0,40000.0			
	parameters	3	level, numParameter, numModelParameterType	-	0	-	-	-	H5T_IEEE_F32LE	Interpolation model parameter	
G	ovalParameter										
	longRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-major axis of oval parameter	
	shortRadius	2	numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Semi-minor axis of oval parameter	
G	usedLevel2Info										
G	layer1										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of used version	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of used version	Name of version used for calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of used scan	Number of scans in data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Used data oldest observation day	The oldest observation date in data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Used data latest observation day	The latest observation date in data of each version

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute description	attribute example	datatype	Dataset name	Description
G	layer2										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version
G	layer3										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version
G	layer4										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version
G	layer5										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	layer6										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version
G	layer7										
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version
	numTypeOfVersion	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of versions used	
	version	1	numTypeOfVersion * 7	-	0	-	-	-	H5T_STRING	Name of the version used	Name of the version used in calculation
	numScan	1	numTypeOfVersion	-	0	-	-	-	H5T_STD_I32LE	Number of scans used	Number of scans in the data of each version
	startDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation start date in the data used	The observation start date in the data of each version
	endDateTime	1	numTypeOfVersion * 23	-	0	-	-	-	H5T_STRING	Observation end date in the data used	The observation end date in the data of each version

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	rank	size	name	num	datatype	description	example	datatype	Dataset name	Description
			dataspace	attribute							
G	Data										
G	mixingRatio										
	CO2Profile	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieved value of CO2 profile	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	10	H5T_STRING	long name	CO2 profile			
				algorithm	7	H5T_STRING	algorithm	Kriging			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileStandardError	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Standard error of CO2 profile	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	19	H5T_STRING	long name	CO2 profile standard error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	minimumDistance	3	level, numLatitude, numLongitude	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Distance between the lattice point and the nearest observation point.	
	numObservationPoints	3	level, numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of data used for creating CO2 profile data	
	calculationMethod	3	level, numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Method of interpolation	1 : Interpolation by the Kriging method 2 : Interpolation by the Kriging method 3 : Weighted averaging of four peripheral points, by having the second result as input data. * Refer to the Algorithm Description for details
G	latticeInformation										
	numObservationPoints	3	level, numLatitude, numLongitude	-	0	-	-	-	H5T_STD_I32LE	Number of observation data in the lattice point	
	CO2ProfileAverage	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Average value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	19	H5T_STRING	long name	CO2 profile average			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileStandardDeviation	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Standard deviation the in lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	29	H5T_STRING	long name	CO2 profile standard deviation			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 6.10-2 TANSO-FTS L3 global CO2 distribution (TIR) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	CO2ProfileMedian	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Median value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	17	H5T_STRING	long name	CO2 profile median			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileMaximum	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Maximum value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	18	H5T_STRING	long name	CO2 profile maximum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileMinimum	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Minimum value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	18	H5T_STRING	long name	CO2 profile minimum			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	CO2ProfileMode	3	level, numLatitude, numLongitude	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 profile (Mode value in the lattice point)	
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1000.0			
				longName	15	H5T_STRING	long name	CO2 profile mode			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	geolocation										
	latitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the lattice point	Coordinate of each lattice center (latitude)
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLatitude, numLongitude	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the lattice point	Coordinate of each lattice center (longitude)
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	maskInformation										
	threshold	1	1	unit	2	H5T_STRING	unit	km	H5T_IEEE_F32LE	Threshold for distance	
	CO2ProfileMask	3	level, numLatitude, numLongitude	-	-	-	-	-	H5T_STD_I32LE	CO2 profile (distance mask)	0: unmasked 1: masked

6.11 L3 global radiance distribution (all pixels)

6.11.1 Outline

CAI L3 global radiance distribution (all pixels) product is the product using CAI L1B+ product as input data.

6.11.2 File unit

The CAI L3 global radiance distribution (all pixels) data is provided in HDF5-formatted file. Each file contains data for three days.

6.11.3 Dataset structure

The following table summarizes the dataset structure of the L3 global radiance distribution (all pixels) product.

Table 6.11-1 Dataset structure of the L3 global radiance distribution (all pixels) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	attribute	The following items are included to provide information related to the observation. ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle
3	Data	Data	The following items are included to provide data on the product. ・ The image of CAI L3 global radiance distribution (all pixels)
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data

			processing.
			・The granule ID of the FTS L1B+ product
			・Information on the data processing results

6.11.4 Specifications for the file format

Table 6.11-2 presents the specifications for the file format.

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	68	-	0	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L3 global radiance distribution (all pixels) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 3 global radiance distribution (all pixels) generated from CAI level 1B+ data.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global image of the Earth.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	64	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	MD_Keywords_03										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[Radiance] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	19	-	0	-	-	-	H5T_STRING	Start date and time	[YYYY-MM-DD-HH-mm-ss] Start date and time (UTC)
	end	1	19	-	0	-	-	-	H5T_STRING	End date and time	[YYYY-MM-DD-HH-mm-ss] End date and time (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: The data indicated in the following dataset of the "geographicElement" Group are inside the Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[-180.000] Fixed
	eastBoundLongitude	1	7	-	0	-	-	-	H5T_STRING	East bounding longitude	[180.000] Fixed
	southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding longitude	[-90.000] Fixed
	northBoundLatitude	1	6	-	0	-	-	-	H5T_STRING	North bounding longitude	[90.000] Fixed

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	distributionInfo										
G	MD_Distribution										
G	distributionFormat										
G	MD_Format										
	name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
	version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G	transferOptions										
G	MD_DigitalTransferOptions										
G	onLine										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier	1	37	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	Language Code	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel	1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery Point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Process level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[TRCL] Fixed
	productName	1	44	-	0	-	-	-	H5T_STRING	Product name	[L3 global radiance distribution (all pixels)] Fixed
	numBand	1	1	-	0	-	-	-	H5T_STRING	Number of bands	[4]: Number of band stored Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed
	observationMode	1	4	-	0	-	-	-	H5T_STRING	Observation mode	[OBSM] Fixed

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace							datatype	Dataset name	Description
		rank	size	attribute							
				name	num	datatype	description	example			
G	attribute										
	intervalLengthOfLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. direction	[0.125] Fixed
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of lattices in the lat. direction	[1440] Fixed
	intevalLengthOfLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. direction	[0.125] Fixed
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I16LE	Number of lattices in the lon. direction	[2880] Fixed
	startTime	1	23	-	0	-	-	-	H5T_STRING	Start date and time of the observarion	[YYYY-MM-DD hh:mm:ss.sss] Frame center time at the observation start frame
	endTime	1	23	-	0	-	-	-	H5T_STRING	End date and time of the observarion	[YYYY-MM-DD hh:mm:ss.sss] Frame center time at the observation end frame
G	mapProjection										
	projectionMethod	1	3	-	0	-	-	-	H5T_STRING	Map projection method	[EQR] : Equirectangular Projection
G	sun										
	azimuth	2	numLatitude, numLongitude	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,360.0	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle of each lattice point, measured clockwise from north, is stored.
	zenith	2	numLatitude, numLongitude	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,180.0	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle of each lattice points is stored.
G	satellite										
	azimuth	2	numLatitude, numLongitude	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,360.0	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle of each lattice point is stored.
	zenith	2	numLatitude, numLongitude	unit validRange	3 2	H5T_STRING H5T_IEEE_F32LE	unit valid range	deg 0.0,180.0	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle of each lattice point is stored.

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
G	Data										
	band1Image	2	numLatitude, numLongitude	unit	16	H5T_STRING	unit	W/m^2/sr /micro-m	H5T_STD_U16LE	Band 1 radiance data	The suffix number is defined as latitude, longitude, in that order. DN value of Band 1 lattice point is stored.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_IEEE_F32LE	radiance range (Minumum and Maximum value when converted into the radiance)	12,680			
				dummy	1	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0059036			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-3.48549			
	band2Image	2	numLatitude, numLongitude	unit	16	H5T_STRING	unit	W/m^2/sr /micro-m	H5T_STD_U16LE	Band 2 radiance data	The suffix number is defined as latitude, longitude, in that order. DN value of Band 2 lattice point is stored.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_IEEE_F32LE	radiance range (Minumum and Maximum value when converted into the radiance)	12,680			
				dummy	1	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0079738			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-4.7078			

Table 6.11-2 TANSO-CAI L3 global radiance distribution (all pixels) Product Format

Group	Group/Dataset	dataspace		attribute					datatype	Dataset name	Description
		rank	size	name	num	datatype	description	example			
	band3Image	2	numLatitude, numLongitude	unit	16	H5T_STRING	unit	W/m^2/sr /micro-m	H5T_STD_U16LE	Band 3 radiance data	The suffix number is defined as latitude, longitude, in that order. DN value of Band 3 lattice point is stored.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_IEEE_F32LE	radiance range (Minumum and Maximum value when converted into the radiance)	12,680			
				dummy	1	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0051595			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-3.04623			
	band4Image	2	numLatitude, numLongitude	unit	16	H5T_STRING	unit	W/m^2/sr /micro-m	H5T_STD_U16LE	Band 4 radiance data	The suffix number is defined as latitude, longitude, in that order. DN value of Band 4 lattice point is stored.
				validRange	2	H5T_STD_U16LE	valid range	1,65535			
				range	2	H5T_IEEE_F32LE	radiance range (Minumum and Maximum value when converted into the radiance)	12,680			
				dummy	1	H5T_STD_U16LE	invalid value	0			
				radianceScale	1	H5T_IEEE_F32LE	scale	0.0012562			
				radianceOffset	1	H5T_IEEE_F32LE	offset	-0.74166			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information on data processing status	[N/A] Fixed
G	CAIL1BP DataInformation										
	CAIL1BPGranuleID	1	arbitrary	-	0	-	-	-	H5T_STRING	Granule ID	Granule ID corresponding to the source CAI L1B+ data

6.12 L3 global reflectance distribution (clear sky)

6.12.1 Outline

CAI L3 global reflectance distribution (clear sky) product is processed by collecting the image data with minimum reflectance data from the CAI L1B product for 30 days.

6.12.2 File unit

The CAI L3 global reflectance distribution (clear sky) is provided in HDF5-formatted file.

6.12.3 Dataset structure

The following table summarizes the dataset structure of the L3 global reflectance distribution (clear sky) product.

Table 6.12-1 Dataset structure of the L3 global reflectance distribution (clear sky) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	attribute	The following items are included to provide information related to the observation. ・Lattice spacing ・Start date of this data ・End date of this data
3	Data	Data	The following items are included to provide data on the product. ・CAI L3 global reflectance distribution (clear sky)
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data

| | | | processing. |
| | | | ・Information on the data processing results |

6.12.4　Specifications for the file format

Table 6.12-2 presents the specifications for the file format.

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

Group	Group / Dataset				dataspace		attribute					Datatype	Dataset name	Description
					rank	size	name	num	datatype	Description	Example			
G	Global													
G		MD_Metadata												
G			identificationInfo											
G				MD_DataIdentification										
G					citation									
					title	1	70	-	0	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L3 global reflectance distribution (clear sky) product] Fixed
G					date									
					date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
					dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
				abstract		1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 3 global reflectance distribution (clear sky) generated from CAI level 1B data.] Description of the data
				purpose		1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global cloud free image of the earth.] Explanation of the purpose of data creation
				status		1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G			resourceConstraints											
G				MD_Constraints										
					useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G			descriptiveKeywords											
G				MD_Keywords_01										
					keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
					type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

Group	Group / Dataset				dataspace		attribute					Datatype	Dataset name	Description
					rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_02													
		keyword			1	9 -		0 -	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
		type			1	3 -		0 -	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03													
		keyword			1	11 -		0 -	-	-	-	H5T_STRING	Keyword	[Reflectance] Fixed
		type			1	3 -		0 -	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04													
		keyword			1	10 -		0 -	-	-	-	H5T_STRING	Keyword	[Cloud Free] Fixed
		type			1	3 -		0 -	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language													
		isoCode			1	3 -		0 -	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet				1	3 -		0 -	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory				1	3 -		0 -	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent													
G	temporalElement													
G	EX_TemporalExtent													
G	extent													
G	beginEnd													
		begin			1	10 -		0 -	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
		end			1	10 -		0 -	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement													
G	EX_GeographicBoundingBox													
		extentTypeCode			1	1 -		0 -	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem													
		code			1	5 -		0 -	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
					westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[-180.000] Western edge latitude of the westernmost mesh is stored. Fixed
					eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[180.000] Eastern edge latitude of the easternmost mesh is stored. Fixed
					southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[-90.000] Southern edge latitude of the southernmost mesh is stored. Fixed
					northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[90.000] Northern edge latitude of the northernmost mesh is stored. Fixed
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
					version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	37	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[TRCF] Fixed
	productName	1	46	-	0	-	-	-	H5T_STRING	Product name	[L3 global reflectance distribution (clear sky)] Fixed
	numBand	1	1	-	0	-	-	-	H5T_STRING	Band number	[4] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed
	observationMode	1	4	-	0	-	-	-	H5T_STRING	Observation mode	[OBSM] Fixed

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	attribute										
	intervalLengthOfLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. direction	[0.125] Fixed
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lat. direction	[1440] Fixed
	intevalLengthOfLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. direction	[0.125] Fixed
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lon. direction	[2880] Fixed
	centralLatitudeOfStartingGrid	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Center latitude of the starting lattices	Center latitude of lattices y=0 in the 2D-array[y][x] of the reflectance data is stored.
	centralLongitudeOfStartingGrid	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Center longitude of the starting lattices	Center longitude of lattices x=0 in the 2D-array[y][x] of the reflectance data is stored.
	startDate	1	10	-	0	-	-	-	H5T_STRING	Start date of this data	[YYYY-MM-DD]
	endDate	1	10	-	0	-	-	-	H5T_STRING	End date of this data	[YYYY-MM-DD]
G	Data										
G	reflectance										
G	land										
	band1Reflectance	2	numLatitude, numLongitude	unit longName invalidValue	4 17 1	H5T_STRING H5T_STRING H5T_IEEE_F32LE	unit long name invalid value	none band1 reflectance -9999.0	H5T_IEEE_F32LE	Band1 ground reflectance data	Band1 ground reflectance data of the each lattice is stored.
	band2Reflectance	2	numLatitude, numLongitude	unit longName invalidValue	4 17 1	H5T_STRING H5T_STRING H5T_IEEE_F32LE	unit long name invalid value	none band2 reflectance -9999.0	H5T_IEEE_F32LE	Band2 ground reflectance data	Band2 ground reflectance data of the each lattice is stored.
	band3Reflectance	2	numLatitude, numLongitude	unit longName invalidValue	4 17 1	H5T_STRING H5T_STRING H5T_IEEE_F32LE	unit long name invalid value	none band3 reflectance -9999.0	H5T_IEEE_F32LE	Band3 ground reflectance data	Band3 ground reflectance data of the each lattice is stored.
	band4Reflectance	2	numLatitude, numLongitude	unit longName invalidValue	4 17 1	H5T_STRING H5T_STRING H5T_IEEE_F32LE	unit long name invalid value	none band4 reflectance -9999.0	H5T_IEEE_F32LE	Band4 ground reflectance data	Band4 ground reflectance data of the each lattice is stored.

Table 6.12-2 TANSO-CAI L3 global reflectance distribution (clear sky) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	sea										
	band1Reflectance	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Band1 water reflectance data	Band1 water reflectance data of the each lattice is stored.
				longName	17	H5T_STRING	long name	band1 reflectance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band2Reflectance	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Band2 water reflectance data	Band2 water reflectance data of the each lattice is stored.
				longName	17	H5T_STRING	long name	band2 reflectance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band3Reflectance	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Band3 water reflectance data	Band3 water reflectance data of the each lattice is stored.
				longName	17	H5T_STRING	long name	band3 reflectance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	band4Reflectance	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Band4 water reflectance data	Band4 water reflectance data of the each lattice is stored.
				longName	17	H5T_STRING	long name	band4 reflectance			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed

6.13 L3 global NDVI

6.13.1 Outline

The CAI L3 NDVI is processed by calculating the NDVI for each mesh with minimum reflectance data from the CAI L1B product for 15 days.

6.13.2 File unit

The CAI L3 NDVI is provided in an HDF5-formatted file. Each file corresponds to a unit defined as rectangle covering the 1/36 of surface of the whole globe.

6.13.3 Dataset structure

The following table summarizes the dataset structure of the L3 global NDVI product.

Table 6.13-1 Dataset structure of the L3 global NDVI product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Attributes	attribute	The following items are included to provide information related to the observation. ・Lattice spacing ・Start date of this data ・End date of this data
3	Data	Data	The following items are included to provide data on the product. ・CAI L3 NDVI
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing.

			・Information on the data processing results

6.13.4 Specifications for the file format

Table 6.13-2 presents the specifications for the file format.

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	Global											
G	MD_Metadata											
G	identificationInfo											
G	MD_DataIdentification											
G	citation											
	title	1	38	-	0	-	-	-		H5T_STRING	Title	[TANSO-CAI/GOSAT L3 global NDVI product] Fixed
G	date											
	date	1	10	-	0	-	-	-		H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-		H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-		H5T_STRING	Abstract	[Level 3 global Normalized Difference Vegetation Index (NDVI) generated from CAI level 1B data.] Description of the data
	purpose	1	256	-	0	-	-	-		H5T_STRING	Purpose	[To identify vegetated area and their condition.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-		H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints											
G	MD_Constraints											
	useLimitation	1	65	-	0	-	-	-		H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords											
G	MD_Keywords_01											
	keyword	1	5	-	0	-	-	-		H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	MD_Keywords_02											
	keyword	1	9	-	0	-	-	-		H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03											
	keyword	1	38	-	0	-	-	-		H5T_STRING	Keyword	[Normalized Difference Vegetation Index] Fixed
	type	1	3	-	0	-	-	-		H5T_STRING	Type	[005]: Theme Fixed
G	language											
	isoCode	1	3	-	0	-	-	-		H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-		H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-		H5T_STRING	Topic category	[007]: Environment Fixed
G	extent											
G	temporalElement											
G	EX_TemporalExtent											
G	extent											
G	beginEnd											
	begin	1	10	-	0	-	-	-		H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-		H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement											
G	EX_GeographicBoundingBox											
	extentTypeCode	1	1	-	0	-	-	-		H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem											
	code	1	5	-	0	-	-	-		H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] Western edge latitude of the westernmost mesh is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] Eastern edge latitude of the easternmost mesh is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
	southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] Southern edge latitude of the southernmost mesh is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
	northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] Northern edge latitude of the northernmost mesh is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo										
G	MD_Distribution										
G	distributionFormat										
G	MD_Format										
	name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
	version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G	transferOptions										
G	MD_DigitalTransferOptions										
G	onLine										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
	fileIdentifier	1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel	1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed
G	contact										
	organisationName	1	108	-	0	-	-	-	H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L3] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[NDVI] Fixed
	productName	1	19	-	0	-	-	-	H5T_STRING	Product name	[L3 global NDVI] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed

Table 6.13-2 TANSO-CAI L3 global NDVI Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	attribute										
	area	1	3	-	0	-	-	-	H5T_STRING	Rectangle number	[001] ~ [036]
	startDate	1	10	-	0	-	-	-	H5T_STRING	Start date of the observation	[YYYY-MM-DD]
	endDate	1	10	-	0	-	-	-	H5T_STRING	End date of the observation	[YYYY-MM-DD]
	intervalLengthOfLatitude	1	3	unit	0	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lat. Direction	[0.004166667] Fixed
	numLatitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lat. direction	[7200] Fixed
	intevalLengthOfLongitude	1	3	unit	0	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Lattice spacing in the lon. Direction	[0.004166667] Fixed
	numLongitude	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lattices in the lon. Direction	[14400] Fixed
G	Data										
G	NDVI										
	NDVI	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	NDVI (Normalized-difference vegetation index)	NDVI value of each mesh is stored.
				validRange	2	H5T_STD_I16LE	valid range	-2000, 10000			
				longName	38	H5T_STRING	long name	Normalized Difference Vegetation Index			
				invalidValue	1	H5T_STD_I16LE	invalid value	-3000			
				scaleFactor	1	H5T_IEEE_F32LE	scale factor	0.0001			
	pathNumber	2	numLatitude, numLongitude	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Satellite path number	The satellite path number of the CAI L1B data where NDVI is calculated.
				validRange	2	H5T_STD_I8LE	valid range	1, 44			
				longName	11	H5T_STRING	long name	path number			
				invalidValue	1	H5T_STD_I8LE	invalid value	-1			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed

7 Research products

(1) Data type

The data types contained in the research products are defined as follows:

Type	Definition
H5T_STRING	String with a length of 1 byte or more
H5T_STD_I8LE	Signed 1-byte integer
H5T_STD_I16LE	Signed 2-byte integer
H5T_STD_I32LE	Signed 4-byte integer
H5T_IEEE_F32LE	Signed 4-byte real number
H5T_IEEE_F64LE	Signed 8-byte real number

(2) Array size

The size of each element of an array is described in the C language expression, in accordance with the HDF5 standard.   In case of a two-dimensional array, therefore, it is defined as (row, line).

7.1 L2 H_2O column abundance (SWIR)

7.1.1 Outline

The L2 H_2O column abundance product provides information on H_2O column abundances obtained by the TANSO-FTS in the shortwave infrared (SWIR) bands. The part of this product includes the data that is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The relevant data is described on the Table 7.1-2.

7.1.2 File unit

The L2 H_2O column abundance data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

7.1.3 Dataset structure

The following table summarizes the dataset structure of the L2 H_2O column abundance (SWIR) product.

Table 7.1-1　Dataset structure of the L2 H_2O column abundance (SWIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time

			・Sensor information
			(observation mode, gain, AT angle, CT angle)
			・Information on the reference data
			・Cloud information
			・Quality information
3	Data	Data	The following items are included to provide data on the product.
			・H_2O column abundance
			・H_2O column abundance error
			・H_2O volume mixing ratio
			・Observed position (at the center of the FTS's FOV, and FOV)
			・Observation altitude
			・Solar zenith/azimuth angle
			・Satellite zenith/azimuth angle
			・Satellite attitude
			・Satellite position
			・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing.
			・The granule ID of the FTS L1B product
			・Information on the data processing results

7.1.4 Specifications for the file format

Table 7.1-2 presents the specifications for the file format.

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
---	---	rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	51	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L2 H2O column amount (SWIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Creation date of this product (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 H2O column amount (SWIR) generated from FTS (SWIR) level 1B data and other reference dataset.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global H2O column amount distribution derived from FTS (SWIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
			dataspace		attribute						
G	MD_Keywords_03										
	keyword	1	3 -	0 -	-	-	H5T_STRING	Keyword	[H2O] Fixed
	type	1	3 -	0 -	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04										
	keyword	1	6 -	0 -	-	-	H5T_STRING	Keyword	[Column] Fixed
	type	1	3 -	0 -	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3 -	0 -	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3 -	0 -	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3 -	0 -	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10 -	0 -	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10 -	0 -	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1 -	0 -	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5 -	0 -	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8 -	0 -	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset					rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
					eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
					southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
					northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	4	-	0	-	-	-	H5T_STRING	Format name	[HDF5] Fixed
					version	1	5	-	0	-	-	-	H5T_STRING	Format version	[1.6.5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G	language														
		isoCode				1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
	characterSet					1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	hierarchyLevel					1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group			Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
				rank	size	name	num	datatype	Description	Example				
G			contact											
			organisationName	1	108	-	0	-	-	-		H5T_STRING	Organisation name	[GOSAT Project Office, Center for Global Environmental Research, National Institute for Environmental Studies] Fixed
			role	1	3	-	0	-	-	-		H5T_STRING	Role	[005]: Distributor Fixed
G			contactInfo											
G			phone											
			voice	1	15	-	0	-	-	-		H5T_STRING	Phone	[+81-29-850-2035] Fixed
			facsimile	1	15	-	0	-	-	-		H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G			address											
			deliveryPoint	1	12	-	0	-	-	-		H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
			city	1	12	-	0	-	-	-		H5T_STRING	City	[Tsukuba-city] Fixed
			administrativeArea	1	7	-	0	-	-	-		H5T_STRING	Administrative area	[Ibaraki] Fixed
			postalCode	1	8	-	0	-	-	-		H5T_STRING	ZIP code	[305-8506] Fixed
			country	1	3	-	0	-	-	-		H5T_STRING	Country	[jpn] Fixed
			electronicMailAddress	1	24	-	0	-	-	-		H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G			onlineResource											
			linkage	1	28	-	0	-	-	-		H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
			description	1	27	-	0	-	-	-		H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
			hoursOfService	1	256	-	0	-	-	-		H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
			contactInstructions	1	256	-	0	-	-	-		H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
				dataspace		attribute					
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of metadata (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C03S] Fixed
	productName	1	27	-	0	-	-	-	H5T_STRING	Product name	[L2 H2O column amount (SWIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[-1][1][3][5][7][9][10] [-1]: Specified observation (V00.50) [10]: Specified observation (V00.20, V00.30, V00.80 and later) The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point).
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB2D][SPOD] Observation mode
	gain	2	1*numScan, 2	-	0	-	-	-	H5T_STRING	Gain	[H][M][L] Gain of FTS
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	referenceData										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface pressure	Surface pressure, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	300.0,1100.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	waterVaporProfile	2	numScan, 21	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Water vapor profile	Water vapor profile, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 50000.0			
				longName	19	H5T_STRING	long name	water vapor profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureProfile	2	numScan, 21	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Temperature profile	Temperature profile referred to in the L2 processing is stored. The values are determined by performing temporal and space interpolation onto GPV data provided by the Meteorological Agency. The pressure comprises twenty one (21) vertical levels: 1000, 975, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 hPa.
				validRange	2	H5T_IEEE_F32LE	valid range	150.0, 350.0			
				longName	19	H5T_STRING	long name	temperature profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedo	Surface albedo, which is used in the L2 processing, is stored. The first element represents the surface albedo in the O2A band (MODIS 0.858 micro m band), the second the CO2 band (MODIS 1.64 micro m band), and the third the CH4 band (MODIS 1.64 micro m band). Climatological values are used.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	aerosolOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness (1.6 micrometer)	Aerosol optical thickness, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,100.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusOpticalThickness	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Optical thickness of cirrus cloud (0.76 micrometer)	Optical thickness of cirrus clouds, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	24	H5T_STRING	long name	cirrus optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cirrusTopPressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Cloud-top pressure for cirrus	Cloud-top pressure for cirrus, which is a priori information for L2 retrieval, is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	115.0, 375.0			
				longName	15	H5T_STRING	long name	cirrus pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceWindSpeed	1	numScan	unit	5	H5T_STRING	unit	m/sec	H5T_IEEE_F32LE	Surface wind speed	Surface wind speed, which is used in the L2 processing, is stored. The value is determined by performing temporal and space interpolation on GPV data provided by the Meteorological Agency.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100.0			
				longName	18	H5T_STRING	long name	surface wind speed			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	A priori dry air profile	A priori dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	31	H5T_STRING	long name	a priori dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	H2OProfile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	A priori H2O profile	A priori profile in H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^5			
				longName	20	H5T_STRING	long name	a priori H2O profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	varianceCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	A priori variance-covariance matrix	A priori variance-covariance matrix is stored.
				longName	35	H5T_STRING	long name	a priori variance covariance matrix			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on inner sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSunwardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer sunward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer sunward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 50000			
				longName	32	H5T_STRING	long name	cloud pixel on outer sunward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside).
G	qualityInformation (Quality information)										
	SNR	3	numScan, 3, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	SN ratio	The SN ratio of each scan is stored per band per polarization. SNR[numScan][a][b] a=0: O2A band (12950 to 13200 cm-1) a=1: CO2 band (6180 to 6380 cm-1) a=2: CH4 band (5900 to 6150 cm-1) b=0: Polarization P b=1: Polarization S b=2: Synthesized polarization
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	21	H5T_STRING	long name	signal to noise ratio			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
	roughTerrainSurfaceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Terrain roughness screening	[0]: OK, [1]: NG Concerning the average height difference between the scope of FOV and surrounding equivalent FOV, it is OK where Maximum value ≦ Threshold value X and Standard deviation ≦ Threshold value Y. Threshold values: X, Y (TBD)
	highSolarZenithScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Solar zenith angle screening	[0]: OK, [1]: NG It is OK where Solar zenith angle ≦ Threshold value X. Threshold value X: 70deg
	highAltitudeAerosolScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	High altitude aerosol screening	[0]: OK, [1]: NG It is OK where Percentage of high altitude aerosol optical thickness in all layers < Threshold value X or High altitude aerosol optical thickness < Threshold value Y. Threshold values: X, Y (TBD)
	TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2 micro m band	[0]: OK, [1]: NG It is OK where, when normalized based on noise level, Average brightness of P-polarization ≦ Threshold value X and Average brightness of S-polarization ≦ Threshold value X, with regard to certain wavenumber points where the level of absorption by water vapor is very high in the 2 micro m band. Threshold values: 1.0
	CAIRadianceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	CAI radiance screening	[0]: OK, [1]: NG
	totalScreeningResult	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Synthetic screening	[0]: OK, [1]: NG
	CAIRadiance	3	numScan, 4, 2	unit	16	H5T_STRING	unit	W/m^2/sr /micro m	H5T_IEEE_F32LE	Average and standard deviation of CAI radiances observed within the FTS field of view	Average and standard deviation of CAI radiances observed within the FTS field of view (CAI Band 1, 2, 3, and 4) which are utilized for the CAI coherent test. CAIRadiance[numScan][a][b] a=0 : CAI band 1 a=1 : CAI band 2 a=2 : CAI band 3 a=3 : CAI band 4 b=0 : Average of CAI radiances observed within the FTS field of view b=1 : Standard deviation of CAI radiances observed within the FTS field of view
				validRange	2	H5T_IEEE_F32LE	valid range	-10.0, 1000.0			
				longName	37	H5T_STRING	long name	CAI radiance within FTS field of view			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology
	aerosolAprioriWeight	2	numScan, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol a priori weight	Weights of the aerosol properties by CAI and those by SPRINTARS necessary for FTS L2 processing. The 1st element for CAI and the 2nd for SPRINTARS are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1.0			
				longName	22	H5T_STRING	long name	aerosol apriori weight			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	totalColumn										
	H2OTotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	H2O column	H2O column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^25			
				longName	16	H5T_STRING	long name	H2O total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	H2OTotalColumnSmoothingError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Smoothing error in H2O column	Smoothing error in H2O column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	32	H5T_STRING	long name	H2O total column smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	H2OTotalColumnRetrievalNoise	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Retrieval noise in H2O column	H2O column error attributable to instrumental noise is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	32	H5T_STRING	long name	H2O total column retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	H2OTotalColumnInterferenceError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Interference error in H2O column	Interference error in H2O column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	35	H5T_STRING	long name	H2O total column interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	H2OTotalColumnExternalError	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	External error in H2O column	External error in H2O column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3*10^24, 3*10^24			
				longName	31	H5T_STRING	long name	H2O total column external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	mixingRatio										
	XH2O	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	H2O dry air mixing ratio	H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 100000.0			
				longName	4	H5T_STRING	long name	XH2O			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XH2OSmoothingError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Smoothing error in H2O dry air mixing ratio	Smoothing error in H2O dry mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 30000.0			
				longName	20	H5T_STRING	long name	XH2O smoothing error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XH2ORetrievalNoise	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Retrieval noise in H2O dry air mixing ratio	Retrieval noise in H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 30000.0			
				longName	20	H5T_STRING	long name	XH2O retrieval noise			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XH2OInterferenceError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Interference error in H2O dry air mixing ratio	Interference error in H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 30000.0			
				longName	23	H5T_STRING	long name	XH2O interference error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XH2OExternalError	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	External error in H2O dry air mixing ratio	External error in H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-30000.0, 30000.0			
				longName	19	H5T_STRING	long name	XH2O external error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	H2OProfile	2	numScan, 15	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Vertical profile in H2O dry air mixing ratio	Vertical profile in H2O dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^5			
				longName	11	H5T_STRING	long name	H2O profile			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	retrievalQuality										
	chi2	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Chi squared of the total	Chi squared is stored: Chi squared is determined by dividing the sum of squares of residual spectra normalized based on observation noise with the degree of freedom for noise.
				longName	10	H5T_STRING	long name	chi square			
	residualMeanSquare	2	numScan, 3	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Residual mean square	Mean square of spectral residual errors normalized based on observation noise is stored. The first element represents the residual mean square of the O2A band, the second the CO2 band, and the third the CH4 band.
				longName	20	H5T_STRING	long name	residual mean square			
	H2ODFS	1	numScan	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Degree of freedom for H2O signal in the L2 processing	The degree of freedom for H2O signal in the L2 processing is stored.
				longName	28	H5T_STRING	long name	degree of freedom for signal			
	iterations	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of iterations	The number of iterations in L2 retrieval is stored.
				validRange	2	H5T_STD_I8LE	valid range	1, 20			
				longName	20	H5T_STRING	long name	number of iterations			
	errorCovarianceMatrix	3	numScan, 15, 15	unit	6	H5T_STRING	unit	ppmv^2	H5T_IEEE_F32LE	Variance-covariance marix	Variance-covariance matrix in L2 processing is stored.
				longName	23	H5T_STRING	long name	error covariance matrix			
	averagingKernelMatrix	3	numScan, 15, 15	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Averaging kernel matrix	Averaging kernel in L2 processing is stored.
				longName	23	H5T_STRING	long name	averaging kernel matrix			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	auxiliaryParameter										
	surfacePressure	1	numScan	unit	3	H5T_STRING	unit	hPa	H5T_IEEE_F32LE	Surface air pressure simultaneously retrieved	Surface air pressure simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1200.0			
				longName	16	H5T_STRING	long name	surface pressure			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	aerosolOpticalThickness	1	numScan	unit	3	H5T_STRING	unit	none	H5T_IEEE_F32LE	Aerosol optical thickness simultaneously retrieved	Aerosol optical thickness in the 1.6 micro m band simultaneously retrieved is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,5.0			
				longName	25	H5T_STRING	long name	aerosol optical thickness			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	temperatureShift	1	numScan	unit	1	H5T_STRING	unit	K	H5T_IEEE_F32LE	Simultaneously retrieved temperature shift	Simultaneously retrieved temperature shift is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-120.0, 120.0			
				longName	17	H5T_STRING	long name	temperature shift			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	surfaceAlbedo	3	numScan, 22, 2	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Surface albedos retrieved simultaneously with the column concentrations	Land area observation: Surface albedos (for each calculated wavenumber grid point) retrieved simultaneously with the column concentrations is stored. surfaceAlbedo[numScan][a][b] a= 0~10 : CH4 band (5900~6150 cm-1) a=11~19 : CO2 band (6180~6380 cm-1) a=20~21 : O2A band (12950~13200 cm-1) b=0 : Albedo b=1 : Wavenumber
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	14	H5T_STRING	long name	surface albedo			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dryAirTotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air column	Dry air column, which value is determined by using the surface air pressure simultaneously retrieved and the water vapor column, is stored. This value is used for converting "total column" to "mixing ratio".
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^25			
				longName	20	H5T_STRING	long name	dry air total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	dryAirPartialColumn	2	numScan, 15	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	Dry air profile	Dry air profile is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 3*10^24			
				longName	22	H5T_STRING	long name	dry air partial column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
		dataspace		attribute							
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLatitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	19	H5T_STRING	long name	foot print latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	footPrintLongitude	2	numScan, 36	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (36 points in FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	20	H5T_STRING	long name	foot print longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.1-2 TANSO-FTS L2 H2O column amount (SWIR) Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

7.2　L2 CO_2 column abundance (TIR)

7.2.1 Outline

The L2 CO_2 column abundance product provides information on CO_2 column abundances obtained by the TANSO-FTS in the thermal infrared (TIR) band.

7.2.2 File unit

The L2 CO_2 column abundance data is provided in an HDF5-formatted file, which contains a product meeting the user-specified conditions, including the acquisition window, area of interest, etc.

7.2.3 Dataset structure

The following table summarizes the dataset structure of the L2 CO_2 column abundance (TIR) product.

Table 7.2-1　Dataset structure of the L2 CO_2 column abundance (TIR) product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Scan attributes	scanAttribute	The following items are included to provide information related to the observation. ・Number of scans contained ・Scan ID ・Scanning direction ・Observation time ・Sensor information (observation mode, AT angle, CT angle)

3	Data	Data	The following items are included to provide data on the product. ・CO_2 column abundance ・CO_2 column abundance error ・Observed position (at the center of the FTS's FOV) ・Observation altitude ・Solar zenith/azimuth angle ・Satellite zenith/azimuth angle ・Satellite attitude ・Satellite position ・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the FTS L1B product ・Information on the data processing results

7.2.4 Specifications for the file format

Table 7.2-2 presents the specifications for the file format.

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	50	-	0	-	-	-	H5T_STRING	Title	[TANSO-FTS/GOSAT L2 CO2 column amount (TIR) product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC)
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 CO2 column amount (TIR) generated from FTS (TIR) level 1B data and other reference dataset.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide global CO2 column amount distribution derived from FTS (TIR) level 1B data for further application to level 3, level 4.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-FTS] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset				dataspace		attribute					Datatype	Dataset name	Description
					rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_03													
		keyword			1	3	-	0	-	-	-	H5T_STRING	Keyword	[CO2] Fixed
		type			1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_04													
		keyword			1	6	-	0	-	-	-	H5T_STRING	Keyword	[Column] Fixed
		type			1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language													
		isoCode			1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
		characterSet			1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		topicCategory			1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent													
G	temporalElement													
G	EX_TemporalExtent													
G	extent													
G	beginEnd													
		begin			1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
		end			1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement													
G	EX_GeographicBoundingBox													
		extentTypeCode			1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem													
		code			1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
		westBoundLongitude			1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset			dataspace		attribute					Datatype	Dataset name	Description
				rank	size	name	num	datatype	Description	Example			
			eastBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
			southBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
			northBoundLatitude	1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo												
G		MD_Distribution											
G			distributionFormat										
G				MD_Format									
				name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
				version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions										
G				MD_DigitalTransferOptions									
G					onLine								
					linkage	1	28	-	0	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier		1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language											
			isoCode	1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet		1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel		1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace rank	dataspace size	attribute name	attribute num	attribute datatype	attribute Description	attribute Example	Datatype	Dataset name	Description
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[C01T] Fixed
	productName	1	26	-	0	-	-	-	H5T_STRING	Product name	[L2 CO2 column amount (TIR)] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-FTS] Fixed
G	scanAttribute (Observation information)										
	numScan	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of scans	Number of scans
	scanID	1	19*numScan	-	0	-	-	-	H5T_STRING	Scan ID	[FYYMMDDhhmmssPPSSYX] Scan ID
	scanDirection	1	numScan	-	0	-	-	-	H5T_STD_I8LE	FTS scan direction	[0][1] Scan direction: [0] for Backward, [1] for Forward
	scanDuration	1	numScan	unit	3	H5T_STRING	unit	sec	H5T_IEEE_F32LE	Measurement duration (Scan duration)	Measurement duration (Scan duration)
				longName	20	H5T_STRING	long name	duration of the scan			
	crossTrackObservationPoint	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Number of cross-track observation points	[-1][1][3][5][7][9][10] [-1]: Specified observation (V00.50) [10]: Specified observation 　　(V00.20, V00.30, V00.80 and later) The number of cross-track observation points is stored in the case of grid point observation mode.
				longName	29	H5T_STRING	long name	cross track observation point			
				invalidValue	1	H5T_STD_I8LE	invalid value	0			
	time	1	23*numScan	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time (Time of measuring the ZPD point)
				longName	29	H5T_STRING	long name	time of the observation (UTC)			

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	sensor										
	observationMode	1	4*numScan	-	0	-	-	-	H5T_STRING	Observation mode	[OB1D][OB1N][SPOD][SPON] Observation mode
	alongTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Along-track angle	Along-track (AT) angle at the time of beginning exposure is stored. "+X (roll)" is for satellite traveling direction. "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The AT angle is defined as the angle between FTS measurement direction and YZ plane. Clockwise direction when looking in the direction of Y axis denotes the positive AT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-20.0,20.0			
				longName	20	H5T_STRING	long name	angle of along track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	crossTrackAngle	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Cross-track angle	Cross-track (CT) angle at the time of beginning exposure is stored. "+X (roll)"is for satellite traveling direction, "-Y (pitch)" always orients for deep space. "+Z (Yaw)" directs for Earth center. The CT angle is defined as the angle between FTS measurement direction and XZ plane. Clockwise direction when looking in the direction of X axis denotes the positive CT angle. (The telemetry output multiplied by -1 is stored.)
				validRange	2	H5T_IEEE_F32LE	valid range	-35.0,35.0			
				longName	20	H5T_STRING	long name	angle of cross track			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	cloudInformation (Cloud information)										
	cloudPixelInnerFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels inside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels inside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in inner FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterFOV	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels outside FOV	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels outside FOV are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 2000			
				longName	23	H5T_STRING	long name	cloud pixel in outer FOV			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelInnerSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an inner satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an inner satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on inner satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	cloudPixelOuterSatellitewardSide	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_STD_I32LE	Number of cloud pixels in an outer satelliteward area	The 1st element for the number of confident cloudy pixels, the 2nd for the number of probably cloudy pixels, the 3rd for the number of valid CAI cloud pixels, and the 4th for the number of CAI pixels in an outer satelliteward area are stored.
				validRange	2	H5T_STD_I32LE	valid range	0, 10000			
				longName	38	H5T_STRING	long name	cloud pixel on outer satelliteward side			
				invalidValue	1	H5T_STD_I32LE	invalid value	-9999			
	sunglintFlag	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Sun glint flag	[0][1] Sun glint flag (0: Inside of glitter area, 1: Outside).

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	qualityInformation (Quality information)										
	L1BQA	1	numScan	-	0	-	-	-	H5T_STD_I8LE	L1BQA	[0]: OK, [1]: NG
	roughTerrainSurfaceScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Terrain roughness screening	[0]: OK, [1]: NG Concerning the average height difference between the scope of FOV and surrounding equivalent FOV, it is OK where Maximum value ≦ Threshold value X and Standard deviation ≦ Threshold value Y. Threshold values: X, Y (TBD)
	TIRCloudScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	TIR cloud screening	[0]: OK, [1]: NG It is OK where (TIR brightness temperature – ground surface temperature) ≧ Threshold value X. Threshold value : X (TBD)
	waterSaturationBandScreening	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Scatterer screening by 2μm band	[0]: OK, [1]: NG It is OK where Average brightness of 2μm band ≦ Threshold value X and Brightness standard deviation of 2μm band ≦ Threshold value Y. Threshold values: X, Y (TBD)
	gasProfileAprioriType	1	numScan	-	0	-	-	-	H5T_STD_I8LE	Type of a priori gas information	[0]: Atmospheric tracer transport model [1]: Climatology

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	totalColumn										
	CO2TotalColumn	1	numScan	unit	14	H5T_STRING	unit	molecules/cm^2	H5T_IEEE_F32LE	CO2 column	CO2 column is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 10^23			
				longName	16	H5T_STRING	long name	CO2 total column			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
	CO2TotalColumnError	1	numScan	unit	13	H5T_STRING	unit	molecules/cm2	H5T_IEEE_F32LE	CO2 column error	CO2 column error is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-3*10^22, 3*10^22			
				longName	22	H5T_STRING	long name	CO2 Total Column Error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-10^30			
G	mixingRatio										
	XCO2	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	CO2 dry air mixing ratio	CO2 dry air mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1000.0			
				longName	4	H5T_STRING	long name	XCO2			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	XCO2Error	1	numScan	unit	4	H5T_STRING	unit	ppmv	H5T_IEEE_F32LE	Error in CO2 dry air mixing ratio	Error in CO2 dry mixing ratio is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-300.0, 300.0			
				longName	20	H5T_STRING	long name	XCO2 error			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Geodetic latitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitude (orthorectified) of observation point (center of FTS's FOV) is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	1	numScan	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Altitude	Altitude of observation point, which is an average of GTOPO30 data in FTS's FOV, is stored.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	solarAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	19	H5T_STRING	long name	solar azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			

Table 7.2-2 TANSO-FTS L2 CO2 column amount (TIR) Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	satelliteZenith	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	22	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAzimuth	1	numScan	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite azimuth angle	Satellite azimuth angle at observation point is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 360.0			
				longName	23	H5T_STRING	long name	satellite azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteAttitude	2	numScan, 4	unit	4	H5T_STRING	unit	none	H5T_IEEE_F64LE	Satellite attitude	Satellite attitude at the time of beginning exposure is expressed by quaternion. (satellite axis to ECR) q0, q1, q2, q3, in that order, are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-1.0, 1.0			
				longName	18	H5T_STRING	long name	satellite attitude			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	satellitePosition	2	numScan, 3	unit	2	H5T_STRING	unit	km	H5T_IEEE_F64LE	Satellite position	Satellite position at the time of beginning exposure is expressed by ECR. X, Y, and Z (ECR) in that order are stored from the 1st element.
				validRange	2	H5T_IEEE_F64LE	valid range	-8*10^3, 8*10^3			
				longName	18	H5T_STRING	long name	satellite position			
				invalidValue	1	H5T_IEEE_F64LE	invalid value	-9999.0			
	landSeaMask	1	numScan	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/Sea mask	[0]: Land, [1]: Water surface, [2]: Mixed. An area type of observation point (inside FTS's FOV) is stored.
				validRange	2	H5T_STD_I8LE	valid range	0,2			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-9999			
G	ancillary										
	procStatusInformation	1	3*numScan	-	0	-	-	-	H5T_STRING	Information of data processing status	[N/A] Fixed, in general
G	FTSL1BDataInformation										
	FTSL1BGranuleID	1	41*numScan	-	0	-	-	-	H5T_STRING	FTS L1B granule ID	Granule ID of the FTS L1B data
	scanSequenceNumber	1	numScan	-	0	-	-	-	H5T_STD_I32LE	Serial scan number	The scan number given serially in the FTS L1B

7.3 L2 cloud property

7.3.1 Outline

The L2 cloud property product provides information on the cloud properties derived from the CAI L1B data. The information is extracted every 3 lines x 3 pixels from the CAI reference band (Band 3) data.

7.3.2 Product unit

The L2 cloud property data is provided in an HDF5-formatted file. Each file corresponds to a CAI frame.

7.3.3 Dataset structure

The following table summarizes the dataset structure of the L2 cloud property product.

Table 7.3-1　Dataset structure of the L2 cloud property product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Frame attributes	frameAttribute	The following items are included to provide information related to the observation. ・Number of observed lines ・Number of pixels per line ・Frame ID ・Observation time ・Time at the frame center ・Percentage of missing pixels
3	Data	Data	The following items are included to provide data on the product.

			・Optical thickness of cloud
			・Effective radius of particle
			・Cloud liquid water path
			・Cloud state bit
			・Quality flag
			・Observed position
			・Observation altitude
			・Solar zenith angle
			・Satellite zenith angle
			・Relative azimuth angle
			・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the CAI L1B product ・Information on the data processing results

7.3.4 Specifications for the file format

Table 7.3-2 presents the specifications for the file format.

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Global										
G	MD_Metadata										
G	identificationInfo										
G	MD_DataIdentification										
G	citation										
	title	1	41	-	0	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L2 cloud property product] Fixed
G	date										
	date	1	10	-	0	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC) at the scene center
	dateType	1	3	-	0	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	H5T_STRING	Abstract	[Level 2 cloud property product generated from CAI level 1B data for each 3*3 pixels. This product contains cloud optical thickness, effective cloud particle radius, cloud liquid water path and cloud flag.] Description of the data
	purpose	1	256	-	0	-	-	-	H5T_STRING	Purpose	[To provide cloud property global distribution.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints										
G	MD_Constraints										
	useLimitation	1	65	-	0	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords										
G	MD_Keywords_01										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03										
	keyword	1	5	-	0	-	-	-	H5T_STRING	Keyword	[Cloud] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
				eastBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
				southBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
				northBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
					version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G					onLine										
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group		Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
			rank	size	name	num	datatype	Description	Example			
		dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
		metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
		metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)											
		operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
		productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[CLDP] Fixed
		productName	1	17	-	0	-	-	-	H5T_STRING	Product name	[L2 cloud property] Fixed
		productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
		satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
		sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	rank	size	name	num	datatype	Description	Example	Datatype	Dataset name	Description
			dataspace			attribute					
G	frameAttribute (Observation information)										
	numLine	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lines	Number of Band 3 lines
	numPixel	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of pixels per line	[683] Fixed
	frameID	1	18	-	0	-	-	-	H5T_STRING	Frame ID	[CYYMMDDhhmmssPPFFX] Frame ID
	time	1	23*numLine	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time at the Band 3 line
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	frameCenterTime	1	23	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time at the frame center (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time of the line which is the nearest to the nominal center of the frame. If the frame center is not covered in the acquisition, the time is estimated.
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	missingPixelRate	1	1	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Ratio of missing pixels	Ratio of missing pixels to all pixels in one frame
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
G	frameCorner										
	startLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the start line	Latitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the start line	Longitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	startLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the start line	Latitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the start line	Longitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the end line	Latitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the end line	Longitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the end line	Latitude (orthorectified) of the end pixel of the end line is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the end line	Longitude (orthorectified) of the end pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	cloudProperty										
	cloudOpticalThickness	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Cloud optical thickness	Cloud optical thickness data on Band 3 lines and pixels are stored.
				validRange	2	H5T_STD_I16LE	valid range	0, 20000			
				longName	23	H5T_STRING	long name	cloud optical thickness			
				offset	1	H5T_IEEE_F32LE	オフセット	0.0			
				scaleFactor	1	H5T_IEEE_F32LE	ファクター	0.01			
				invalidValue	3	H5T_STD_I16LE	invalid value	-32768, 29900, 30000			
	effectiveCloudParticleRadius	2	numLine, numPixel	unit	7	H5T_STRING	unit	micro m	H5T_STD_I16LE	Effective cloud particle radius	Effective cloud particle radius data on Band 3 lines and pixels are stored.
				validRange	2	H5T_STD_I16LE	valid range	0, 20000			
				longName	31	H5T_STRING	long name	effective cloud particle radius			
				offset	1	H5T_IEEE_F32LE	オフセット	0.0			
				scaleFactor	1	H5T_IEEE_F32LE	ファクター	0.01			
				invalidValue	3	H5T_STD_I16LE	invalid value	-32768, 29900, 30000			
	cloudLiquidWaterPath	2	numLine, numPixel	unit	5	H5T_STRING	unit	g/m^2	H5T_IEEE_F32LE	Cloud liquid water path	Cloud liquid water path data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 26666.7			
				longName	23	H5T_STRING	long name	cloud liquid water path			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cloudFlag	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Cloud flag	Cloud status bit data on Band 3 lines and pixels are stored.
				longName	14	H5T_STRING	long name	cloud flag bit			
				invalidValue	1	H5T_STD_I16LE	invalid value	-32768			
	qualityFlag	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Quality flag	Quality flag data on Band 3 lines and pixels are stored.
				validRange	2	H5T_STD_I16LE	valid range	0,10000			
				longName	12	H5T_STRING	long name	quality flag			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Latitude (orthorectified) data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	2	numLine, numPixel	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Height	Heights (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar azimuth angle	Solar azimuth angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	21	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	relativeAzimuth	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Relative azimuth angle	Relative azimuth angles in Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,180.0			
				longName	22	H5T_STRING	long name	relative azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	landSeaMask	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Sea USGS land/sea mask in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I8LE	valid range	0,1			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			

Table 7.3-2 TANSO-CAI L2 cloud property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information on data processing status	[N/A] Fixed, in general
	frameLineRange	1	2	-	0	-	-	-	H5T_STD_I32LE	Extent of frame lines	The line numbers in CAI L1A data corresponding to the start and end lines of the frame.
G	CAIL1BDataInformation										
	CAIL1BGranuleID	1	41	-	0	-	-	-	H5T_STRING	CAI L1B granule ID	Granule ID of the CAI L1B data

7.4   L2 aerosol property

7.4.1 Outline

The L2 aerosol property product provides information on the aerosol properties derived from the CAI L1B data.   The information is extracted every 3 lines x 3 pixels from the CAI reference band (Band 3) data.

7.4.2 File unit

The L2 aerosol property data is provided in an HDF5-formatted file.   Each file corresponds to a CAI frame.

7.4.3 Dataset structure

The following table summarizes the dataset structure of the L2 aerosol property product.

Table 7.4-1   Dataset structure of the L2 aerosol property product

No.	Group	Name	Brief description
1	Global	Global	The following items are included to describe the type, contents, etc. of the product. ・Metadata items compliant with JMP 2.0 ・Product file name ・Sensor name ・Processing level ・Version
2	Frame attributes	frameAttribute	The following items are included to provide information related to the observation. ・Number of observed lines ・Number of pixels per line ・Frame ID ・Observation time ・Time at the frame center ・Percentage of missing pixels
3	Data	Data	The following items are included to provide data on the product.

			・Optical thickness of aerosol
			・Volumetric ratio of black carbons
			・Cloud state bit
			・Observed position
			・Observation altitude
			・Solar zenith angle
			・Satellite zenith angle
			・Relative azimuth angle
			・Land sea mask
4	Ancillary	ancillary	The following items are included to provide ancillary information related to the data processing. ・The granule ID of the CAI L1B product ・Information on the data processing results

7.4.4 Specifications for the file format

Table 7.4-2 presents the specifications for the file format.

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute						Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example				
G	Global											
G	MD_Metadata											
G	identificationInfo											
G	MD_DataIdentification											
G	citation											
	title	1	43	-	0	-	-	-	-	H5T_STRING	Title	[TANSO-CAI/GOSAT L2 aerosol property product] Fixed
G	date											
	date	1	10	-	0	-	-	-	-	H5T_STRING	Date	[YYYY-MM-DD] Observation date (UTC) at the scene center
	dateType	1	3	-	0	-	-	-	-	H5T_STRING	Date type	[001]: Creation Fixed
	abstract	1	256	-	0	-	-	-	-	H5T_STRING	Abstract	[Level 2 aerosol property product generated from CAI level 1B data for each 3*3 pixels. This product contains three types (accumulation mode, dust, sea salt) aerosol optical thickness, soot volume ratio, cloud flag.] Description of the data
	purpose	1	256	-	0	-	-	-	-	H5T_STRING	Purpose	[To correct FTS L1B data affected by aerosol.] Explanation of the purpose of data creation
	status	1	3	-	0	-	-	-	-	H5T_STRING	Status	[001]: Completed Fixed
G	resourceConstraints											
G	MD_Constraints											
	useLimitation	1	65	-	0	-	-	-	-	H5T_STRING	Limitation of users	[Available to any users Only. / Available to any registered users.] Conditions related to limitation of users
G	descriptiveKeywords											
G	MD_Keywords_01											
	keyword	1	5	-	0	-	-	-	-	H5T_STRING	Keyword	[GOSAT] Fixed
	type	1	3	-	0	-	-	-	-	H5T_STRING	Type	[005]: Theme Fixed

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	MD_Keywords_02										
	keyword	1	9	-	0	-	-	-	H5T_STRING	Keyword	[TANSO-CAI] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	MD_Keywords_03										
	keyword	1	7	-	0	-	-	-	H5T_STRING	Keyword	[Aerosol] Fixed
	type	1	3	-	0	-	-	-	H5T_STRING	Type	[005]: Theme Fixed
G	language										
	isoCode	1	3	-	0	-	-	-	H5T_STRING	File name	[eng]: English Fixed
	characterSet	1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
	topicCategory	1	3	-	0	-	-	-	H5T_STRING	Topic category	[007]: Environment Fixed
G	extent										
G	temporalElement										
G	EX_TemporalExtent										
G	extent										
G	beginEnd										
	begin	1	10	-	0	-	-	-	H5T_STRING	Start date	[YYYY-MM-DD] Start date of observation data (UTC)
	end	1	10	-	0	-	-	-	H5T_STRING	End date	[YYYY-MM-DD] End date of observation data (UTC)
G	geographicElement										
G	EX_GeographicBoundingBox										
	extentTypeCode	1	1	-	0	-	-	-	H5T_STRING	Extent type code	[1]: Inside Fixed
G	extentReferenceSystem										
	code	1	5	-	0	-	-	-	H5T_STRING	Code (Identifier for the geographical reference system used.)	[WGS84] Fixed
	westBoundLongitude	1	8	-	0	-	-	-	H5T_STRING	West bounding longitude	[snnn.nnn] West bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset					dataspace		attribute					Datatype	Dataset name	Description
						rank	size	name	num	datatype	Description	Example			
				eastBoundLongitude		1	8	-	0	-	-	-	H5T_STRING	East bounding longitude	[snnn.nnn] East bounding longitude (orthorectified) of observation point is stored. s: Plus (+) for east and minus (-) for west of Greenwich, n: Numerical value
				southBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	South bounding latitude	[snn.nnn] South bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
				northBoundLatitude		1	7	-	0	-	-	-	H5T_STRING	North bounding latitude	[snn.nnn] North bounding latitude (orthorectified) of observation point is stored. s: Plus (+) for north, and minus (-) for south of the equator, n: Numerical value
G	distributionInfo														
G		MD_Distribution													
G			distributionFormat												
G				MD_Format											
					name	1	3	-	0	-	-	-	H5T_STRING	Format name	[HDF] Fixed
					version	1	1	-	0	-	-	-	H5T_STRING	Format version	[5] Fixed
G			transferOptions												
G				MD_DigitalTransferOptions											
G				onLine											
					linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
					description	1	15	-	0	-	-	-	H5T_STRING	Description	[see "abstract".] Fixed
		fileIdentifier				1	41	-	0	-	-	-	H5T_STRING	File identifier (Granule ID)	Granule ID Granule ID of the product
G		language													
			isoCode			1	3	-	0	-	-	-	H5T_STRING	Language code	[eng]: English Fixed
		characterSet				1	3	-	0	-	-	-	H5T_STRING	Character set	[004]: UTF-8 Fixed
		hierarchyLevel				1	3	-	0	-	-	-	H5T_STRING	Hierarchy level	[005]: Header of the dataset Fixed

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	contact										
	organisationName	1	72	-	0	-	-	-	H5T_STRING	Organisation name	[National Institute for Environmental Studies (NIES) GOSAT Project Office] Fixed
	role	1	3	-	0	-	-	-	H5T_STRING	Role	[005]: Distributor Fixed
G	contactInfo										
G	phone										
	voice	1	15	-	0	-	-	-	H5T_STRING	Phone	[+81-29-850-2035] Fixed
	facsimile	1	15	-	0	-	-	-	H5T_STRING	Facsimile	[+81-29-850-2219] Fixed
G	address										
	deliveryPoint	1	12	-	0	-	-	-	H5T_STRING	Delivery point	[16-2 Onogawa] Fixed
	city	1	12	-	0	-	-	-	H5T_STRING	City	[Tsukuba-city] Fixed
	administrativeArea	1	7	-	0	-	-	-	H5T_STRING	Administrative area	[Ibaraki] Fixed
	postalCode	1	8	-	0	-	-	-	H5T_STRING	ZIP code	[305-8506] Fixed
	country	1	3	-	0	-	-	-	H5T_STRING	Country	[jpn] Fixed
	electronicMailAddress	1	24	-	0	-	-	-	H5T_STRING	Electronic mail address	[gosat-support@nies.go.jp] Fixed
G	onlineResource										
	linkage	1	28	-	0	-	-	-	H5T_STRING	Link	[http://www.gosat.nies.go.jp/] Fixed
	description	1	27	-	0	-	-	-	H5T_STRING	Description	[NIES GOSAT Project web site] Fixed
	hoursOfService	1	256	-	0	-	-	-	H5T_STRING	Hours of service	[Automatic data distribution is available any time, for manual inquiries, 9:00 to 17:00 (Japan Standard Time) Monday through Friday except Japanese holidays.] Fixed
	contactInstructions	1	256	-	0	-	-	-	H5T_STRING	Contact instructions	[Contact Instruction: Contact by e-mail: gosat-support@nies.go.jp / If there are any questions, please contact us by e-mail.] Fixed

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
	dateStamp	1	10	-	0	-	-	-	H5T_STRING	Date stamp	[YYYY-MM-DD] Creation date of this product (UTC)
	metadataStandardName	1	3	-	0	-	-	-	H5T_STRING	Name of metadata standards	[JMP] Fixed
	metadataStandardVersion	1	3	-	0	-	-	-	H5T_STRING	Version of metadata standards	[2.0] Fixed
G	metadata (except for JMP2.0)										
	operationLevel	1	2	-	0	-	-	-	H5T_STRING	Processing level	[L2] Fixed
	productCode	1	4	-	0	-	-	-	H5T_STRING	Product code	[AERP] Fixed
	productName	1	19	-	0	-	-	-	H5T_STRING	Product name	[L2 aerosol property] Fixed
	productVersion	1	6	-	0	-	-	-	H5T_STRING	Product version	[VXX.XX] Product version
	satelliteName	1	5	-	0	-	-	-	H5T_STRING	Satellite name	[GOSAT] Fixed
	sensorName	1	9	-	0	-	-	-	H5T_STRING	Sensor name	[TANSO-CAI] Fixed

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	frameAttribute (Observation information)										
	numLine	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of lines	Number of Band 3 lines
	numPixel	1	1	-	0	-	-	-	H5T_STD_I32LE	Number of pixels per line	[683] Fixed
	frameID	1	18	-	0	-	-	-	H5T_STRING	Frame ID	[CYYMMDDhhmmssPPFFX] Frame ID
	time	1	23*numLine	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time at the Band 3 line
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	frameCenterTime	1	23	unit	4	H5T_STRING	unit	none	H5T_STRING	Observation time at the frame center (UTC)	[YYYY-MM-DD hh:mm:ss.sss] Observation time of the line which is the nearest to the nominal center of the frame. If the frame center is not covered in the acquisition, the time is estimated.
				longName	29	H5T_STRING	long name	time of the observation (UTC)			
	missingPixelRate	1	1	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Ratio of missing pixels	Ratio of missing pixels to all pixels in one frame
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,1.0			
G	frameCorner										
	startLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the start line	Latitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the start line	Longitude (orthorectified) of the start pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	startLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the start line	Latitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	startLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the start line	Longitude (orthorectified) of the end pixel of the start line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineStartPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the start pixel of the end line	Latitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineStartPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the start pixel of the end line	Longitude (orthorectified) of the start pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			
	endLineEndPixelLatitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude of the end pixel of the end line	Latitude (orthorectified) of the end pixel of the end line is stored.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
	endLineEndPixelLongitude	1	1	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude of the end pixel of the end line	Longitude (orthorectified) of the end pixel of the end line is provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0,180.0			

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	Data										
G	aerosolProperty										
	accumulationModeAerosolOpticalThickness	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Anthropogenic aerosol optical thickness	Anthropogenic aerosol optical thickness data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	46	H5T_STRING	long name	optical thickness of accumulation mode aerosol			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	dustAerosolOpticalThickness	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Dust aerosol optical thickness	Dust aerosol data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	33	H5T_STRING	long name	optical thickness of dust aerosol			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	seaSaltAerosolOpticalThickness	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Sea salt aerosol optical thickness	Sea salt aerosol data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 2.0			
				longName	37	H5T_STRING	long name	optical thickness of sea salt aerosol			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	sootVolumeRatio	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_IEEE_F32LE	Anthropogenic aerosol soot volume ratio	Anthropogenic aerosol soot volume ratio data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 1.0			
				longName	17	H5T_STRING	long name	soot volume ratio			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	cloudFlag	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I16LE	Cloud flag	Cloud status bit data on Band 3 lines and pixels are stored.
				longName	14	H5T_STRING	long name	cloud flag bit			
				invalidValue	1	H5T_STD_I16LE	invalid value	-32768			

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

Group	Group / Dataset	dataspace		attribute					Datatype	Dataset name	Description
		rank	size	name	num	datatype	Description	Example			
G	geolocation										
	latitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Latitude (geodetic latitude)	Latitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-90.0,90.0			
				longName	17	H5T_STRING	long name	geodetic latitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	longitude	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Longitude	Longitudes (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	-180.0, 180.0			
				longName	9	H5T_STRING	long name	longitude			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	height	2	numLine, numPixel	unit	1	H5T_STRING	unit	m	H5T_STD_I16LE	Height	Heights (orthorectified) in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I16LE	valid range	-407, 8752			
				longName	6	H5T_STRING	long name	height			
				invalidValue	1	H5T_STD_I16LE	invalid value	-9999			
	solarZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Solar zenith angle	Solar zenith angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	18	H5T_STRING	long name	solar zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	satelliteZenith	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Satellite zenith angle	Satellite zenith angles in Band 3 lines and pixels are provided.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0, 180.0			
				longName	21	H5T_STRING	long name	satellite zenith angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	relativeAzimuth	2	numLine, numPixel	unit	3	H5T_STRING	unit	deg	H5T_IEEE_F32LE	Relative azimuth angle	Relative azimuth angle data on Band 3 lines and pixels are stored.
				validRange	2	H5T_IEEE_F32LE	valid range	0.0,180.0			
				longName	22	H5T_STRING	long name	relative azimuth angle			
				invalidValue	1	H5T_IEEE_F32LE	invalid value	-9999.0			
	landSeaMask	2	numLine, numPixel	unit	4	H5T_STRING	unit	none	H5T_STD_I8LE	Land/sea mask	[0]: Land, [1]: Sea USGS land/sea mask in Band 3 lines and pixels are provided.
				validRange	2	H5T_STD_I8LE	valid range	0,1			
				longName	13	H5T_STRING	long name	land sea mask			
				invalidValue	1	H5T_STD_I8LE	invalid value	-128			

Table 7.4-2 TANSO-CAI L2 aerosol property Product Format

| Group | Group / Dataset | dataspace | | attribute | | | | | Datatype | Dataset name | Description |
		rank	size	name	num	datatype	Description	Example			
G	ancillary										
	procStatusInformation	1	3	-	0	-	-	-	H5T_STRING	Information on data processing status	[N/A] Fixed, in general
	frameLineRange	1	2	-	0	-	-	-	H5T_STD_I32LE	Extent of frame lines	The line numbers in CAI L1A data corresponding to the start and end lines of the frame.
G	CAIL1BDataInformation										
	CAIL1BGranuleID	1	41	-	0	-	-	-	H5T_STRING	CAI L1B granule ID	Granule ID of the CAI L1B data