Objectives for the Round Table

1. Review the “seed” questions and identify actions and recommendations for IVOS
2. Establish a “distilled” set of Recommendations for WGCV to possibly be forwarded to CEOS Plenary
3. Establish a Workplan for the coming (3?) years for IVOS
4. Decide if we should repeat a Workshop of this kind (possibly with a wider framework) in the future

Round Table Issues - 1

Target requirements for cross calibration

- What is the current performance of satellites in orbit in terms of radiance / reflectance cross calibration.
- What is the required level of radiance / reflectance cross calibration performance for level 2 data products merging:
  - Ocean parameters: SST, Chlorophyll concentration
  - Land paramaters: LAI, FAPAR, …
  - Atmosphere parameters…

Round Table Issues - 2

Documentation Server (Hyper-links)

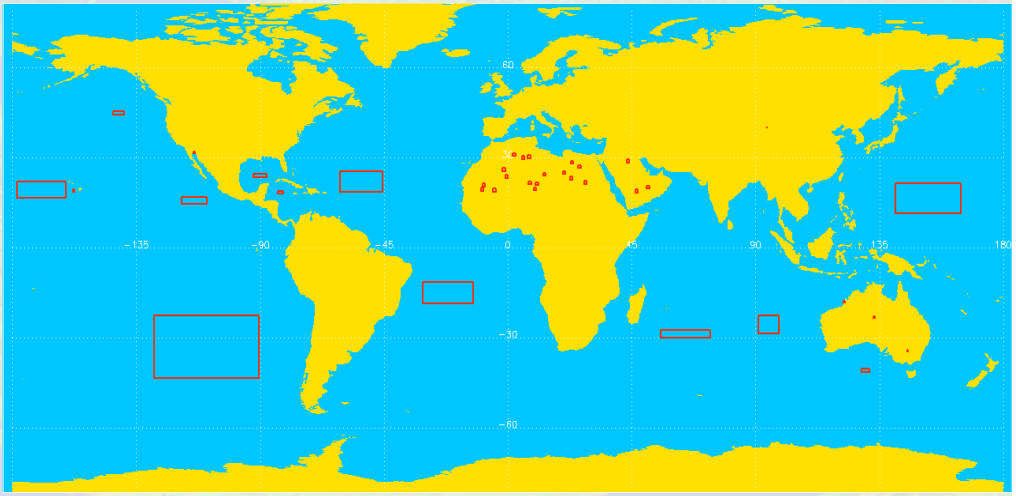
Is there the need for a web site containing links to:

- **Instrument description (including performance documentation)**
- **Calibration methods**
  - **Radiometric (corrected offsets / non linearity / scales)**
  - **Spectral (spectral responses, solar irradiance spectrum, inband irrandiace, inband atmospheric absorption…)**
  - **Geometric (pixel size and shape, resampling methods…)**
- **L0 and L1 processing document (algorithms)**
- **Library / links to software tools (radiative transfer tools, data reading routines…)**
- **Library of publications on vicarious calibration and intercomparisons.**

Diagnostic Data Sites

Is there a need for a centralised access to data over a set of diagnostic data sites:

- **Which space borne instruments data would be available?**



Which sites?

- **Desert (e.g. AVHRR/Libyan desert)**
- **Ocean (e.g. SIMBIOS)**
- **Snow-Ice (Dome-C)**
- **Ocean Buoys (Moby-Boussole)**
- **Instrumented Land Targets (VALERI, MODLAND, FLUXNET)**

13th CEOS WGCV IVOS Meeting

Cal/Val survey for the inter-comparison of optical, imaging spaceborne sensors

Satellite sensors in flight	Agency	Resolution	Coverage
SeaWIFS	NASA		
MODIS-TERRA	NASA		
MODIS-AQUA	NASA		
ASTER-TERRA	NASA	Mid-Hi-Res	
MISR-TERRA	NASA		
Hyperion-EO_1	NASA		
ALI-EO_1	NASA	Mid-Hi-Res	
TM-Landsat(L5)	NASA	Mid-Hi-Res	
ETM+-Landsat(L7)	NASA	Mid-Hi-Res	
Imager-GOES-N,11,12	NOAA	GEO	
AVHRR-NOAA_16,17	NOAA		
MERIS-ENVISAT	ESA		
AATSR-ENVISAT	ESA		
ATRS_2-ERS_2	ESA		
Chris/PROBA	ESA	Mid-Hi-Res	
SEVIRI-MSG_1	EUMETSAT	GEO	
MOS	DLR		Local
HSRS-BIRD	DLR	Hi-Res	
HRV-SPOT_V	CNES	Hi-Res	
VEGETATION-SPOT_V	CNES		
POLDER--ADEOS_2	CNES		
POLDER_P-Parasol	CNES		
GLI-ADEOS_2	NASDA(JAXA)		
OSMI-Kompsat_1	KARI		
EOC-Kompsat_1	KARI		
CMRISR-FY_3	NRCC		
MSSR-FY-1D/2C	NRCC	GEO	
COCTS-HY_1	NSOAS		Local
CCD_imager-HY_1	NSOAS		
IR_MSSS-CBERS_2	China/Brazil	Mid-Hi-Res	
Topasat-TOPSAT	BNSC	Hi-Res	
DMC_imager-BNSCSAT	BNSC	Mid-Hi-Res	
VHRR-INSAT 3D,3A	ISRO	GEO	
Imager-INSAT 3D,3A	ISRO	GEO	
CCD_camera-INSAT 3D,3A	ISRO	GEO	
LISS_IV-Resourcesat-1	ISRO		
ANIFS-Resourcesat-2	ISRO	Mid-Hi-Res	
OCM-IRS_P 4	ISRO		
MSU+SU##-SICH-2	NSAU		
MSU-MONITOR-E	Rosaviakosmos		

Survey of vicarious calibration targets							
Testsites							**In-situ Measu**
Deserts							
Algeria1	23.8	0	0	-0.4	0	0	N/A
Algeria2	26.09	0	0	-1.38	0	0	N/A
Algeria3	30.32	0	0	7.66	0	0	N/A
Algeria4	30.04	0	0	5.59	0	0	N/A
Algeria5	31.02	0	0	2.23	0	0	N/A
Arabia1	18.88	0	0	46.76	0	0	N/A
Arabia2	20.13	0	0	50.96	0	0	N/A
Arabia3	28.92	0	0	43.73	0	0	N/A
Sudan1	21.74	0	0	28.22	0	0	N/A
Niger1	19.67	0	0	9.81	0	0	N/A
Niger2	21.37	0	0	10.59	0	0	N/A
Niger3	21.57	0	0	7.96	0	0	N/A
Egypt1	27.12	0	0	26.1	0	0	N/A
Libya1	24.42	0	0	13.35	0	0	N/A
Libya2	25.05	0	0	20.48	0	0	N/A
Libya3	23.15	0	0	23.1	0	0	N/A
Libya4	28.55	0	0	23.39	0	0	N/A
Mali1	19.12	0	0	-4.85	0	0	N/A
Mauritania1	19.4	0	0	-9.3	0	0	N/A
Mauritania2	20.85	0	0	-8.78	0	0	N/A
Dunhuang	40.095	0	0	94.155	0	0	N/A
Sonora	31.8	0	0	-113.86	0	0	N/A
Libyan_Desert	22	0	0	28.5	0	0	N/A
Instr. Bouys							
Moby	20.816	0	0	-157.192	0	0	
Boussole	43.367	0	0	7.9	0	0	
Instr. Land							
Railroad_valley_playa	38	32	31.2	-115	43	47.4	
Ivanpah_Playa							
La_Crau							
Munich	48.08	0	0	11.3	0	0	
Pirrene	43.384	0	0	1.291	0	0	
White_sands	32.93	0	0	-106.35	0	0	
Hay	-34.382	0	0	145.292	0	0	N/A
Amburla	-23.285	0	0	133.119	0	0	N/A
Thangoo	-18.1	0	0	122.26	0	0	N/A
Snow/Ice							
Greenland	73.75	0	0	-40	0	0	N/A
Barrow	71.266	0	0	-156.833	0	0	
Syowa	-69	0	0	39.583	0	0	
DomeC	-75	6	0	123	23	43	
Saroma							
Ocean Campaigns							
ACE-ASIA	35.78	0	0	132.58	0	0	
Bermuda_Atlantic	32	0	0	-64	0	0	
CALCOFI	32	0	0	-121	0	0	
Chesapeake_Bay	38	0	0	-76	0	0	
Gulf_of_Maine	43	0	0	-67	0	0	
Gulf_of_Mexico	28	0	0	-90	0	0	
Ocean							
ClimSPac1	4			-43.5	0	0	N/A
				-128.5	0	0	N/A
				-43.5	0	0	N/A
				-90.5	0	0	N/A
				-22.5	0	0	N/A

Radiative Transfer Codes and their inter-comparison for TOA signal prediction

Because there are today many different existing radiative transfer codes (RTC), is there the need for:

- **Links to RTC source and documentation?**
- **A RTC intercomparison exercise?**
  - **Which codes?**
  - **Which test cases and conditions for inter-comparison?**
- **A reference code against which fast codes can be assessed? (e.g. Montecarlo code)**

Dedicated IVOS campaign to intercomparison of vicarious calibration methods

Is there a need for a campaign dedicated to large scale vicarious calibration where:

- **Vicarious calibration methods could be intercompared?**
- **Best practises could be identified? (e.g. ideal site, list of equipment, DEM?)**
- **Results + field data synthesis are documented in a TN**
- **Do field sensors and lab equipment need to be submitted to a Round Robin inter-comparison (via e.g. transfer radiometer)**
- **Should campaign results be available for a wider Community**
- **Should a campaign calendar be maintained (regular experiments)**

Previous Recommendations - ongoing

R1: Since satellite operators and data providers globally use varying solar irradiance profiles for the derivation of radiances and reflectances, IVOS recommends for consistency, to converge to the recently refined solar reference spectrum by G. Thuillier and encourages its use at the highest possible spectral resolution. The source spectrum should be provided also through the WGCV web-site with pointers to different instrument (resampled) spectra. (**The Solar Spectral I** **DONE** **to 2400 nm as Measured by the SOLSPEC Spectrometer from the Atlas** **s, Solar Physics** 214(1): 1-22; May 2003, by: G. Thuillier; M. Hersé; D. Labs; T. Foujols; W. Peetermans; D. Gillotay; P.C. Simon; H. Mandel)

IVOS further recommends that Instrument teams should post the exo-atmospheric solar irradiances they use with processing/resampling information, in a band-integrated form on www (single spectrum recommended).

R2: For post-launch calibration of visible and near-infrared sensors it is recommended to implement a global instrumented and automated network of testsites:

- Capture radiometric, spectral, spatial, geometric, and temporal characteristics of each test site.
- Use standard in-situ measurement protocols for data acquisition by common traceably calibrated instruments and central/identical data processing (transfer radiometers, e.g. 2nd Internat. IR intercomp…..).
- Emphasize autonomous in situ sensors and wireless telecommunication. (On hold)

Previous Recommendations ctd.

R3: Define key factors for Calibration and Validation to be documented in Protocols => A coordinating Group/office in view of up-coming (2002) sensors is needed, (See proposed Intercomparison experiment and possibility for cooperation with WTF). Important work already carried out has to be recognised, e.g. SIMBIOS/SeaWIFS protocols. Interface to ISPRS/WGCV needs to be defined. (Information to plenary)

R4: IVOS requests through WGCV that CEOS members support the in-depth study of the behaviour of onboard diffuse [illegible]ds and their stability in the space environment (hard radiation) [illegible]activity is demonstrated by experience with current satellite sensors and the preliminary study carried out by NPL.

DONE

Under discussion for future recommendation:

- Similarly to the 2nd International Infrared Radiometer Calibration and intercomparison (Miami Campaign) 2001 IVOS proposes e a similar experiment with in-situ spectrometers.
- In view of the forthcoming workshop on the Intercomparison of large scale optical sensors an underflight of MERIS, AATSR, SPOT-5, MODIS/Aqua, Landsat-7ETM+ by CHRIS recommended over desert site such as Railroad valley and Sudan desert site for cross-calibration/ inter-comparison and characterisation campaign.(Superseded /solved by planned intercomparison experiment)

Large-scale Optical Sensor Inter-comparison (LOSI)

Objective:
With a view to the Earth's changing climate large scale satellite sensors are a critical component for reliable and continuous observations. It is imperative that observations made by the different sensors are stable over time and consistent across sensor systems, enabling synergistic combination of space-borne data from different sources

Goal:
Inter-compare satellite sensor ouputs and instruments used for in-situ data characterisation of the targets at different (product level-) stages on their measurements and inter-changeability.

Experiment:
Inter-compare at sensor radiances between currently deployed optical imaging space-borne sensors over a single, uniform target area. Simultaneous deployment of all in-situ based instruments to characterise target areas.

In a parallel activity normalised products (radiances) as routinely released by the related instrument teams could be made available for inter-comparison and analysis of possible differences.

Subsequently further experiments may be carried out over several sites and could be extended to a number of geophysical variables (level-2 products).

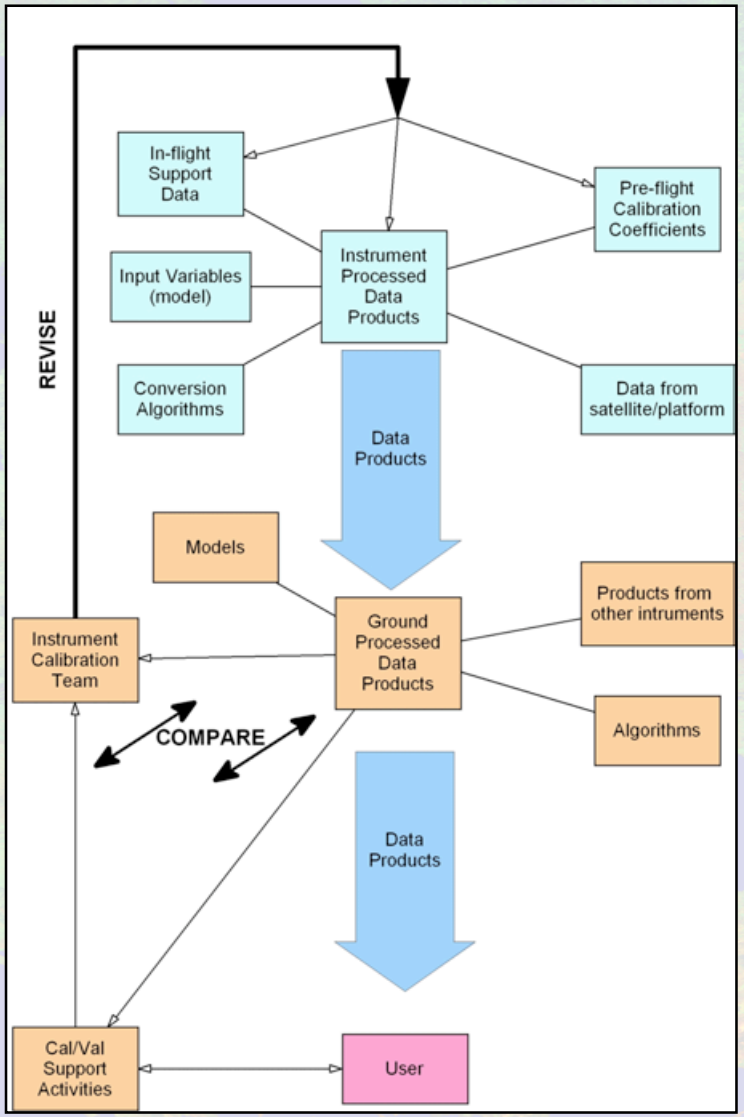
Large-scale Optical Sensor Inter-comparison (LOSI) ctd.

Procedure:
Raw counts->calibrated at sensor radiances (level 1) -> Geobiophysical variables (level 2) - > global space- and time sampled products (level 3) -> Multi-sensor Level 3 products - > Global Process Models (NWP, DGVM, GCM).

Expected outcomes/Impacts and benefits:
Ensure validity and consistency of measurements and resulting data products and thus reduce uncertainties in continuous monitoring of the biosphere and the assessment of global climate change. This will enable the community to supply reliable information to government policy makers.

Next steps:
One or two lead institutes as initiator of this activity to define scope and participants of the experiment.

Deliverable:
Product database maintained by the lead institute(s), containing all space- and in-situ measurements of the experiment, together with the methodology used to derive results from the different sensors.



13th IVOS - Observations

- IVOS will also keep to encourage a common language/format of calibration and validation protocols. In this context the update and maintenance of the CEOS Cal/Val database on Sites, Instruments and laboratories will be instrumental **(this should be discussed with the WGCV/ISPRS standards task force).**
- IVOS further encourages cal/val teams to make available all on-ground characterisation data and in-flight calibration measurements including viewing geometries through the www. The calibration data of vicarious test-sites ought to be also published.
- A 3rd thermal infra-red radiometer inter-comparison activity in the framework of CEOS is encouraged, given the big success of the 2nd experiment, the Walton Smith campaign.

12th IVOS observation to be discussed at 14th IVOS ctd.

It therefore recommends: that CEOS develops a collaborative inter-agency programme/mission to establish a set of SI traceable standard radiometric reference targets viewable by space based EO sensors to unequivocally quantify and remove biases between optical sensors. Such targets would probably include the Moon, Sun and a number of ground sites used by existing missions. Traceability to SI and the assignment and maintenance of a high accuracy radiometric value could be obtained through the support of a dedicated mission (such as TRUTHS).