

→ ESA'S WATER MISSION

smos newsletter

Issue 14 | December 2017



SMOS satellite launched on 2 November 2009

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Highlights

SMOS mission extension

CNES has confirmed the extension of SMOS mission operations for 2018/2019 and potentially beyond until pending a successful mid-term extension review in 2018. This decision is also in line with ESA's plans for continuation of the SMOS mission.

Improved SMOS level 2 soil moisture products are now available

An improved level 2 soil moisture dataset (v650) has been released to the user community on 15th November 2017 (see Figure-1). Operational and reprocessed level 2 soil moisture products v650 are accessible

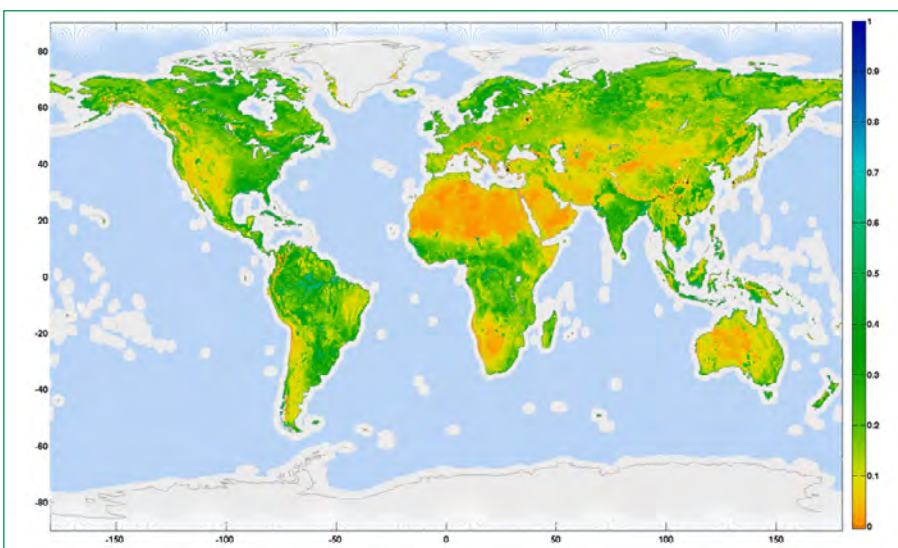
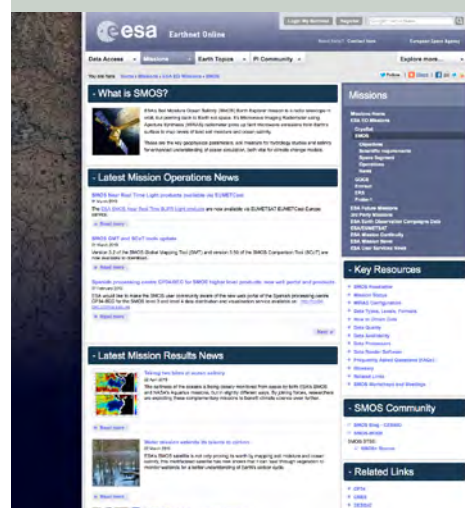


Figure-1: Averaged soil moisture (4 months per year January, April, July and October) during 7 years derived from level 2 reprocessed dataset v650. Soil moisture scale is m^3 / m^3 . Credit: CESBIO.

Stay up-to-date with the ESA SMOS web portal <http://earth.esa.int/SMOS>

The ESA SMOS web portal provides a comprehensive access point for all SMOS related information. Users are encouraged to visit the SMOS portal for announcements, updates on ground segment operations and scientific mission achievements. Recent SMOS newsletters are available on the ESA web portal: <https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/newsletter>.



from the ESA SMOS Online Dissemination Service: <https://smos-diss.eo.esa.int>. The main improvements in this dataset compared to the previous version v620 are related to processing algorithm updates, parameters configuration and auxiliary data. A detailed summary of all improvements can be found in the [read-me-first note](#) and in the [reprocessing reports](#). Data users are invited to use this new operational and reprocessed dataset for their research and applications.

Highlights of the Agriculture and Earth Observation Workshop

The workshop took place on 4th–5th July 2017 at the Dutch Ministry of Economic Affairs, The Hague. The Netherlands Space Office (NSO) led the organisation of the workshop in cooperation with ESA and AeroVision B.V. The workshop focussed on:

- **What is needed**, with presentations from commercial, public and scientific users
- **What is available**, providing an overview of the variety of satellite and in-situ data sources currently available and information services and applications being developed from them.
- **Future opportunities**, summarising current and future evolutions in satellite and in-situ data provision versus user needs.

During the workshop observations were presented from different sources, relevant for agricultural applications. A number of recommendations were made which can be found at www.spaceoffice.nl/agrieo/en/output. One of the recommendations was directly relevant for the currently discussed L-Band continuity, with workshop attendees asking to “maintain passive L-band continuity, as it has demonstrated impact in a variety of applications (complementary to active SAR systems)” [Recommendation # 13].

Highlights of the 4th Satellite Soil Moisture Validation and Application Workshop

The 4th Satellite Soil Moisture Validation and Application workshop took place on 19th–20th September 2017, at Vienna University of Technology. The workshop was jointly organised by TU Wien, USDA, VanderSat BV, George Mason University, and the Earth Observation Data Centre for Water Resources Monitoring (EODC) and was supported by ESA. Participants emphasised that

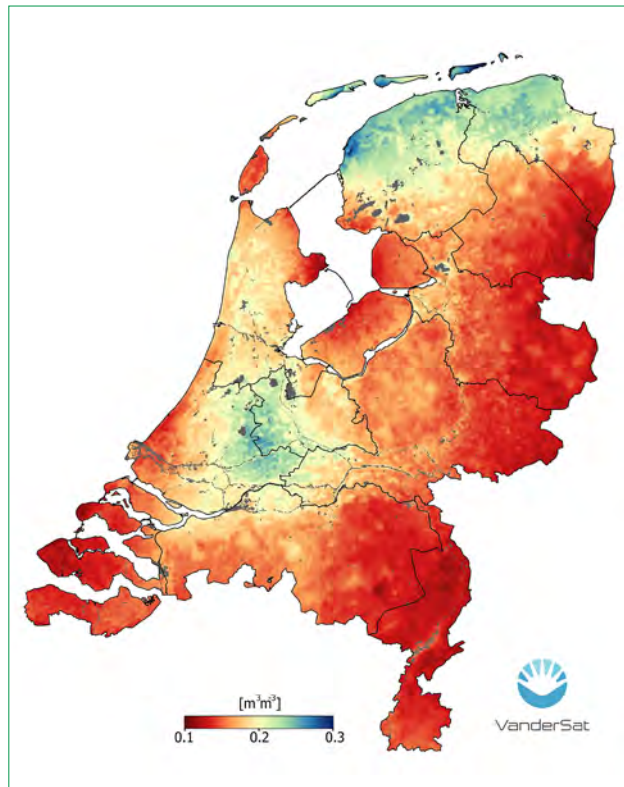


Figure-2: Soil moisture map of the Netherlands for June 2017. Soil moisture measurements provided by ESA's Soil Moisture and Ocean Salinity mission are vital for assessing the availability of water. Companies can use these measurements to give farmers value-added advice on irrigation, warn them of droughts or water stress, and help to improve their crop yield predictions.

Credit: VanderSat BV

“The performance of the different soil moisture data products is variable in space and time, and that the best results can be achieved by combining observations from different satellites and by assimilating the satellite observations into land surface modelling systems. Satellite soil moisture data have been taken up by a wide variety of users (e.g. meteorologists, hydrologists, agricultural users) and multiple real-world applications are benefiting from using and integrating such observations. The assimilation of satellite soil moisture observations improves flood prediction, even in medium-sized basins (<500 km²). Further evidence of the added value of satellite soil moisture data includes, the improvement of energy flux estimation through land surface modelling, the advancement in the estimation of satellite precipitation and, recently, the detection and quantification of irrigation”. The participants were highly concerned regarding the long-term continuity of passive microwave L-band observations and they “Strongly recommended to start activities defining a future L-band observation system based on the lessons learned from SMOS and SMAP”. The workshop summary report will be published by GEWEX. The workshop presentations are available at: <http://smw.ge.tuwien.ac.at/presentations>.

SMOS data included in long-term global dataset of soil moisture measurements

The ESA's Soil Moisture CCI project has delivered a new, long-term global dataset of soil moisture measurements from space including data from SMOS. The dataset stretches back to 1978 and will be updated in near real time every ten days with soil moisture retrievals from current satellite missions that are thoroughly tested, and have short data latency (SMOS, AMSR2 & ASCAT A/B). The near real time dataset will be available through the Copernicus Climate Change Service. More information can be found at: www.esa.int/Our_Activities/Observing_the_Earth/Space_for_our_climate/Nearly_four_decades_of_soil_moisture_data_now_available.

Pi-MEP - SMOS Pilot Mission Exploitation Platform for Salinity

The SMOS Pilot Mission Exploitation Platform (Pi-MEP) for Salinity project, which started in January 2017 aims to: i) serve as an enhanced sea surface salinity validation platform, complementing the efforts of the SMOS Expert Support Laboratories (e.g. exploring satellite performances at different spatial/temporal scales or against various ground-



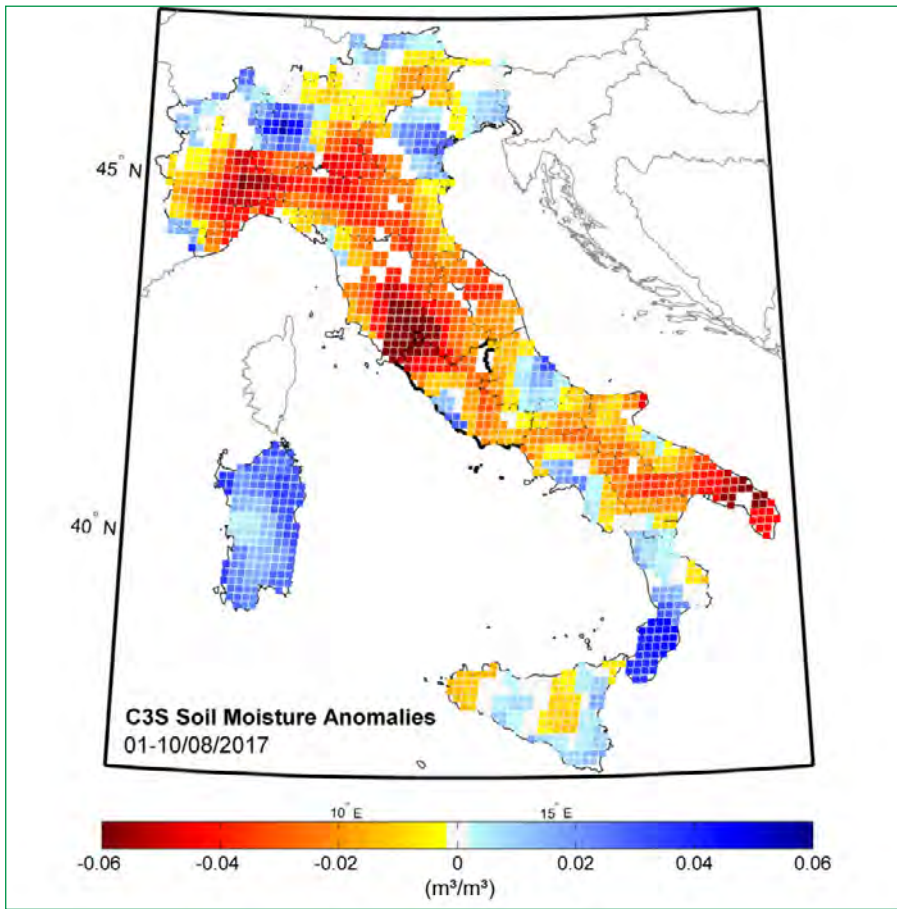


Figure-3: Soil moisture anomaly in Italy during early August 2017. The long-term global dataset were compiled by ESA's Soil Moisture CCI project, and includes information from active and passive microwave sensors (such as those on the ERS, MetOp, SMOS, Aqua and GCOM-W1 satellite missions).

Credit: C3S/ECMWF/TU Wien/VanderSat/EODC/AWST/Soil Moisture CCI

truth data) and ii) offer a testbed to enable and monitor oceanographic process studies, capitalising on SMOS salinity data in synergy with additional satellite products (e.g. SST, WS, currents, rain rates). The Pi-MEP Salinity is a one-stop shop for scientific validation, monitoring, assessment and exploitation of SMOS salinity data. The consortium is liaising with a dedicated Scientific Advisory Group (SAG), which provided feedback for scientific requirements and implementation in a first consultation meeting held in May 2017. The consortium is currently working towards the design and implementation of the project platform, which will open to the wider user community towards the end of 2018.

Using G-POD for processing SMOS data: reminder for call for proposals

ESA would like to remind the SMOS user community of the availability of the Grid Processing-on-Demand (G-POD) service (<http://gpod.eo.esa.int>) for conducting Earth Science research activities. G-POD is offered by ESA's Research and Service Support (http://wiki.services.eoportal.org/tiki-custom_home.php). This is an open call, and therefore G-POD SMOS proposals can be submitted at any time, directly through the following website: <http://eopi.esa.int/G-POD>.

Data and Processors

Data availability

The SMOS instrument MIRAS is operating nominally with the exception of some known on-board anomalies described in the [MIRAS anomaly document](#). The cumulative data loss due to MIRAS instrument unavailability since the beginning of the routine operational phase (May 2010) amounts to 0.09% and the degraded data amounts to 0.64% (see Figure-4). No data loss has occurred during the acquisition of MIRAS raw data at the ground stations since the beginning of the routine operational phase (May 2010). This result has been achieved by implementing an on-board data recording overlap strategy. SMOS Flight Operations Segment (FOS) reports and the detailed list of instrument anomalies compiled on a weekly basis are available at https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/content/-/asset_publisher/t5Py/content/mission-status-7060.

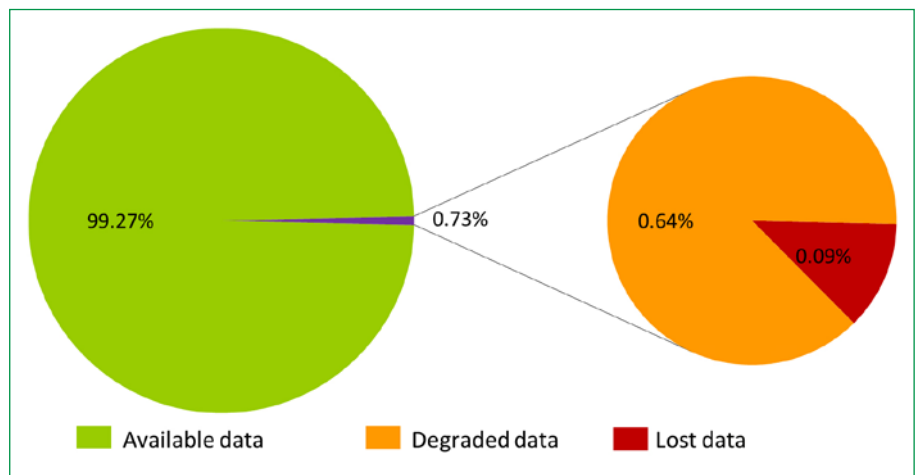


Figure-4: SMOS mission data availability percentage since May 2010. Instrument data availability is extremely high, about 99%. Only 0.09% of data is lost due to MIRAS anomalies.

Credit: SMOS FOS/ESA



Instrument calibration and data quality

Several on-board calibration activities are performed regularly and an overview of the calibration strategy implemented for the MIRAS instrument can be found in the SMOS calibration [summary document](#). During calibration activities science data are not generated, therefore data users should consult the [calibration plan](#) for expected data unavailability.

Monthly reports summarising significant events in the SMOS flight and ground segments, evolution of calibration parameters and SMOS data quality can be found at <https://earth.esa.int/web/guest/-/data-quality-7059>.

Further information on SMOS data performance can be found in the level 1 and level 2 products read-me-first notes available at <https://earth.esa.int/web/guest/-/data-processors-7632>. SMOS data users are invited to consult the read-me-first notes before using SMOS data for their research activities.

Status of the SMOS operational processors

A new processor version v650 was deployed in the SMOS ground segment on 15th November 2017. The current versions of the operational processors installed in the SMOS ground segment are listed below.

A detailed description of the current baseline algorithms used to process the SMOS data are presented in the Algorithm Theoretical Basis Documents (ATBDs) available here: <https://earth.esa.int/web/guest/-/data-processors-7632>.

Processor	Current version In operations since	Previous version In operations since
Level 1A	V6.20 - 5 May 2015	V5.04 - 14 November 2011
Level 1B	V6.21 - 5 May 2015	V5.04 - 14 November 2011
Level 1C	V6.20 - 5 May 2015	V5.05 - 21 March 2012
Near Real Time processor (NRTP)	V6.20 - 5 May 2015	V5.05 - 7 March 2012
Level 2 soil moisture	V6.50 - 15 November 2017	V6.20 - 5 May 2015
Level 2 ocean salinity	V6.62 - 10 May 2017	V6.22 - 5 May 2015

Future evolutions planned for the operational processors include:

Level 1/NRTP: The next upgrade of the level 1 processor (version 7) will include improvements for the data calibration stability, image reconstruction, direct Sun estimation and Radio Frequency Interference (RFI) flagging.

Level 2 Soil Moisture: The next upgrade of the level 2 soil moisture processor (version 7) will include improvements for characterisation of retrieval parameters uncertainties (DQX), refinement parameterisation (omega, roughness) for specific land classes, possible usage of simplified retrieval algorithms, and implementation of a better dielectric constant model for organic soil.

Level 2 Ocean Salinity: The next upgrade of the level 2 sea surface salinity processor (version 7) will include improvements for the estimation of an unbiased sea surface salinity anomaly based on SMOS measurements, Sun and galaxy correction, wind speed

characterisation (source and uncertainties) and upgrade of the dielectric constant model for cold waters.

Radio Frequency Interference (RFI)

Currently more than 75% of the RFI sources detected by the SMOS RFI team have been switched-off, mostly as a consequence of reporting the RFI case to the Spectrum Management Authorities. Currently, there are approximately 400 active RFI sources worldwide, with intensity varying from moderate Brightness Temperature (BT < 1000 K) to very strong Brightness Temperature (BT > 5000 K), the latter being mainly located in Asia and the Middle East as illustrated in Figure-5.

Information about the evolution of the RFI contamination can be found on the frequently updated RFI probability maps for land surfaces, generated fortnightly by CESBIO and available on the SMOS blog (www.cesbio.ups-tlse.fr/SMOS_blog/smos_rfi). Weekly maps of the 3rd and 4th Stokes parameter over ocean surfaces can be found on the SMOS data quality web page (<https://earth.esa.int/web/guest/-/data-quality-7059>). The user can visually inspect the maps to identify RFI contamination over land (with high RFI probability) and over the oceans (weekly averaged 3rd and 4th Stokes parameters above the natural variability of $\pm 10K$). The level 1C product contains several RFI flags that can be used to remove contaminated measurements. Details about the level 1C RFI flags can be found in the level 1 product specification document (<https://earth.esa.int/web/guest/-/data-types-levels-formats-7631>) and in the SMOS level 1 v620 read-me-first note (https://earth.esa.int/documents/10174/1854503/SMOS_L10Pv620_release_note)

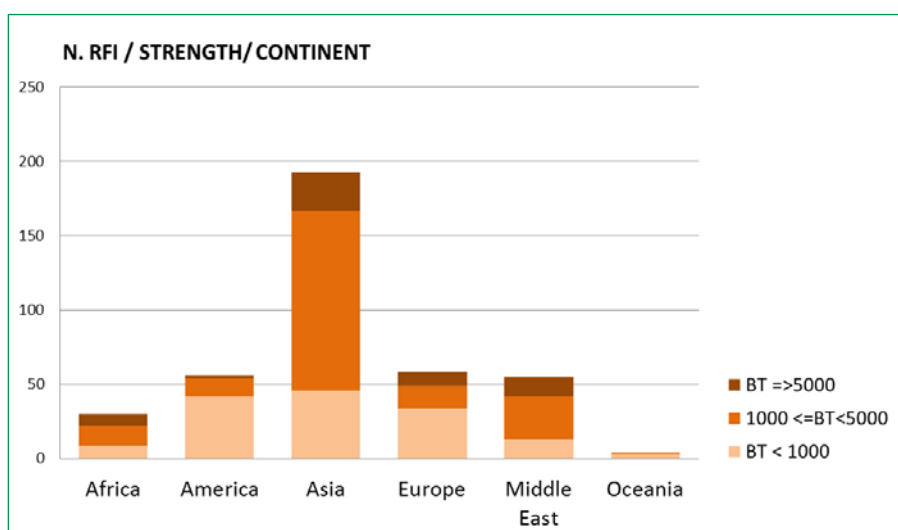


Figure-5: Worldwide RFI for September 2017: number of active sources per continent and intensity.

Credit: SMOS RFI team at ESA ESAC



Upcoming Meetings & Announcements

ECMWF/ ESA Workshop on Using Low Frequency Passive Microwave Measurements in Research and Operational Applications

The workshop will take place at ECMWF (Reading, UK) on 4th–6th December 2017.

Passive microwave radiometry covering frequencies from 1 to 10 GHz provides measurements of the Earth's surface that are largely independent of varying atmospheric conditions. Since the late 1970's satellite measurements have been used to infer geophysical variables ranging from sea surface temperature, sea ice coverage to soil moisture. With the arrival of L-band sensors, new capabilities have been added and substantial progress has been made in retrieving additional parameters, combining the measurements to generate thematic data records, and assimilating the measurements in forecasting systems. The workshop will look at applications that can benefit from the synergistic exploitation of low frequency passive microwave measurements but also on the combined usage of active and passive observations. Four topical areas will be addressed: sea ice and predictability in Polar Regions; sea surface salinity and ocean circulation; soil moisture and flood forecasting; and weather forecasting and climate monitoring.

For further details please visit the workshop's web page: <https://www.ecmwf.int/en/learning/workshops/workshop-using-low-frequency-passive-microwave-measurements-research-and-operational-applications>

ECMWF/ESA Workshop on Using Low Frequency Passive Microwave Measurements in Research and Operational Applications

ECMWF | Reading | 4-6 December 2017



POLAR2018 "Where the Poles come together"

POLAR2018 will take place in Davos, Switzerland on 15th–26th June 2018.

POLAR2018 is a joint event from the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC). The event is organized by WSL-Institute for Snow and Avalanche Research and aims to bring together researchers working on polar regions from twelve scientific domains. For further details please visit the POLAR2018 web page: www.polar2018.org



MicroRad 2018

The 15th Specialist Meeting on Microwave Radiometry and Remote Sensing of the Environment will take place on the Massachusetts Institute of Technology campus in Cambridge, Massachusetts on 27th–30th March 2018.

For further details visit the IGARS 2018 web page: www.microrad2018.org



IGARSS 2018

The International Geoscience and Remote Sensing Symposium will take place in Valencia, Spain on 23rd–27th July 2018. The theme for IGARSS 2018 highlights the pressing demands for "observing, understanding and forecasting the dynamics of our planet". Dedicated SMOS/ L-Band (with Aquarius/SMAP) sessions for land and ocean have been proposed including tutorials for land and ocean.

For further details please visit the IGARSS 2018 web page: <https://igarss2018.org>



2018 Ocean Salinity Science workshop

The workshop will take place in Paris, in November 2018. The workshop aims to review progress and ongoing work and to identify the next frontiers in the fields of ocean salinity and freshwater cycle science. Tentative thematic sessions will address the following topics:

- Observing ocean salinity
- Process-based insights from field observations
- Role of salinity in ocean dynamics
- Role of salinity in the global freshwater cycle and climate variability
- Role of salinity in biogeochemistry
- Aspects of surface freshwater fluxes, runoff, and sea ice
- Challenges of future salinity observing, remote sensing and in situ.

The workshop's website will be available soon.



Data Access

ESA SMOS Online Dissemination service

Since March 2016, the SMOS online dissemination portal has been providing a single point entry for all SMOS level 1 and level 2 data products, including both Near Real Time (NRT) level 1c and soil moisture neural network products. The online service facilitates data access with enhanced catalogue functionality for data navigation and selection by data type, acquisition time, geographical area and data format (i.e. ESA Earth Explorer Format (EEF) or NetCDF format for level 2). Once selected the data can be downloaded immediately using different protocols. Level 1c and level 2 quick-look images are also available for reference. The ESA SMOS Online Dissemination service is accessible here: <https://smos-diss.eo.esa.int>. Further information on accessing SMOS data is available here: <https://earth.esa.int/web/guest/-/how-to-obtain-data-7329>.

SMOS Near Real Time Data through EUMETCast

SMOS Near Real Time (NRT) "Light" (BUFR) and soil moisture neural network products can be accessed via EUMETSAT's EUMETCast service based on standard Digital Video Broadcast (DVB)-S2 technology. For service



details and a coverage map please visit: www.eumetsat.int/website/home/Data/DataDelivery/EUMETCast/index.html. SMOS registered users will be granted access to the service after registration on the EUMETSAT Earth Observation Portal (<https://eoportal.eumetsat.int/userMgmt>).

If you wish to access SMOS NRT "Full" (BUFR) products by network, please send an email to SMOS mission manager: Susanne.Mecklenburg@esa.int.

