

→ ESA'S WATER MISSION

smos newsletter

Issue 15 | July 2018



SMOS satellite launched on 2 November 2009

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Highlights

Highlights of Using Low Frequency Passive Microwave Measurements in Research and Operational Applications workshop

"Using Low Frequency Passive Microwave Measurements in Research and Operational Applications" workshop took place for 4-6

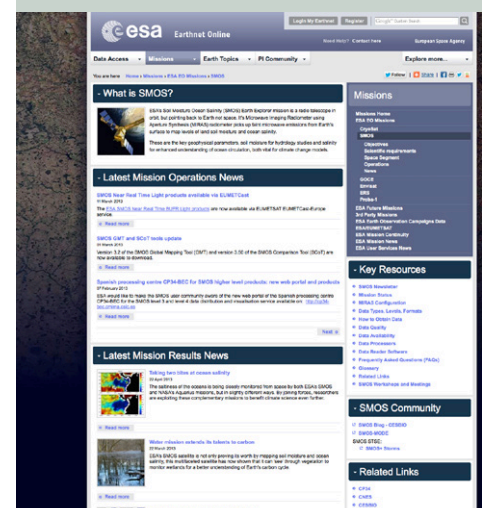
December 2017 at ECWMF, Reading, UK. The workshop was jointly organised by ESA and ECMWF with approximately 60 participants from the carbon, ocean, land, and polar research communities. A number of operational agencies and services were represented, including the UK MetOffice, Météo France, the Finnish Meteorological Institute, the Danish

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>.



Figure-1: Using Low Frequency Passive Microwave Measurements in Research and Operational Applications" workshop's participants. Credit: ECMWF.



Meteorological Institute, EUMETSAT, the Copernicus Marine Environment Monitoring Service and Mercator.

In four dedicated sessions key applications and scientific achievements based on low frequency passive microwave remote sensing were discussed. A wide range of operational applications have been presented: sea ice monitoring and ship routing, fire risk estimates and food security, Numerical Weather Prediction, and ocean monitoring and a number of pre-operational services are being developed (e.g. in the field of hydrology, agricultural monitoring and severe storm forecasting).

All service providers require continued observations especially in L- and C-band to guarantee high-quality, synergistic products. Participants recommended that missions with at least similar or better performance than SMOS, SMAP and AMSR shall be implemented as soon as possible minimizing the risk of a data gap for operational applications already being based on such measurements. The key outcomes of the workshop discussions across the different domains and applications is available on <https://www.ecmwf.int/en/learning/workshops/workshop-using-low-frequency-passive-microwave-measurements-research-and-operational-applications>.

Joint Workshop of the International Surface Working Group (ISWG) and Land Surface Analysis Satellite Application Facility (LSA-SAF)

On 26-28 June, 2018 at the Instituto Português do Mar e da Atmosfera (IPMA) in Lisbon, Portugal the Joint Workshop of the 2nd International Surface Working Group (ISWG) and 8th Land Surface Analysis Satellite Application Facility (LSA-SAF) meetings was convened. This workshop saw over 15 countries represented by a dynamic, diverse and engaging group with lively discussions.

The aim of the International Surface Working Group (ISWG) is to gather requirements specific to surface observations to enhance both our understanding and ability to monitor the components of the Earth system including land, vegetation, snow, ice, and coastal and open waters. The presentations and final plenary actions and recommendations will be available on the workshop web page at: <http://cimss.ssec.wisc.edu/iswg/meetings/2018>. Contributions in this area



Figure-2: International Surface Working Group (ISWG) and Land Surface Analysis Satellite Application Facility (LSA-SAF) joint workshop's participants
Credit: ESA/ISGW/LSA-SAF

and related areas of research will be collected in a special issue "Advancing Earth Surface Representation via Enhanced Use of Earth Observations in Monitoring and Forecasting Applications" in the journal Remote Sensing. Finally, the tentative schedule for the following ISWG-3, is early July in 2019 in Montreal, Canada.

SMOS reveal recent climate-induced carbon losses in African drylands

SMOS L-band vegetation optical depth products have been used in a recent research published in the journal Nature Ecology & Evolution (<http://www.nature.com/natecolevol/>). The study has demonstrated, the applicability of L-band vegetation optical depth to quantify and to monitor the evolution of the aboveground biomass-carbon changes in sub-Saharan Africa region between 2010 and 2016 (see Figure-3). Scientist, from different international university, on

the basis of calibrated relationships between SMOS L-band vegetation optical depth and an existing benchmark map, have analysed temporal patterns of carbon gains and losses in different humidity zones of sub-Saharan Africa due to weather variations. Results have shown the importance of the highly dynamic and vulnerable carbon pool of dryland savannahs for the global carbon balance, despite the relatively low carbon stock per unit area. In next future, SMOS L-band vegetation optical depth product might become a complementary data source for the quantification and monitoring of carbon stocks for national reports and largescale efforts, such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC), especially for semi-arid regions with little inventory data. To access the study: <http://www.nature.com/articles/s41559-018-0530-6>

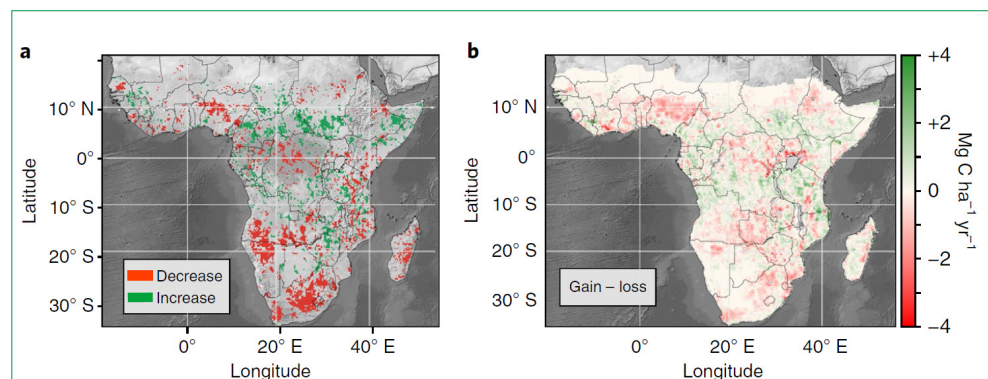


Figure-3: Changes in carbon stocks for 2010–2016. Left panel: pixels with significant positive (green) and negative (red) changes in SMOS L-band vegetation optical depth as a proxy for aboveground carbon density for the 2010–2016 period. Right panel: net changes in carbon density between 2010 and 2016.

Credit: M. Brandt et al, "Satellite passive microwaves reveal recent climate-induced carbon losses in African drylands", Nature Ecology & Evolution volume 2, pages 827–835 (2018).



Six years of new SMOS sea surface salinity maps in the Mediterranean Sea now available

The new L4 product has been developed by the Barcelona Expert Center and the GHER group at University of Liège (Belgium), under the ESA STSE project "SMOS sea surface salinity data in the Mediterranean Sea (SMOS+Med)". A new methodology has been used combining several processing technique in order to reduce the system errors produced by the contamination of the land over the sea, to mitigate the seasonal time dependent biases and to increase the SMOS data resolution (see Figure-4). To download the new L4 product see: <http://bec.icm.csic.es/six-years-of-the-new-smos-sss-maps-in-the-mediterranean-sea-now-available>

SMOS-wind product update

ESA in collaboration with OceanDataLab (ODL) and IFREMER has started in January 2018 the implementation of a SMOS wind data service. The service will provide, in near real time, surface wind speeds over oceans derived from SMOS data, initially for a period of two years of operations, with an optional one year extension to follow. The service implementation has well advanced with the design of the near real time processor. The project is now approaching its major milestones: the critical design review which will be held in ESRIN on 1 August. Data will become available after the operational readiness review foreseen by end 2018.

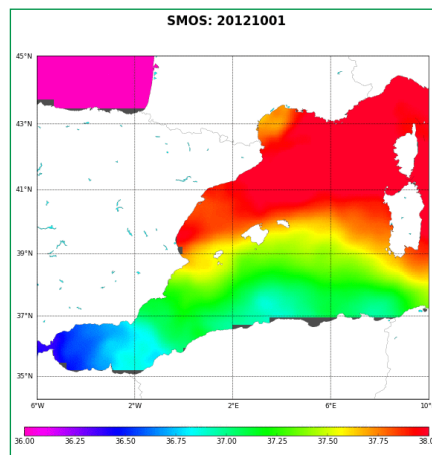


Figure-4: Sea surface salinity derived from SMOS data for October 2012 over Western Mediterranean Sea. Sea surface salinity dynamics described by the new L4 SMOS product agrees quite well with available in situ measurements.

Credit: BEC

Pi-MEP - SMOS Pilot Mission Exploitation Platform for Salinity

The SMOS Pilot Mission Exploitation Platform (Pi-MEP) for Salinity project, launched in 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-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 constantly liaising with a dedicated Scientific Advisory Group (SAG), which provided feedback for scientific requirements and implementation in two consultation meetings held in May 2017 and May 2018.

A test-platform was made available for early adopters in May 2018. Following interest from NASA, options to enlarge the scope of the platform under joint ESA-NASA activities have been discussed.

A parallel dedicated effort for a Pilot SMOS Mission Exploitation Platform (SMOS Pi-MEP) for Soil Moisture is under preparation and due to start 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 0.60% (see Figure-5). 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.

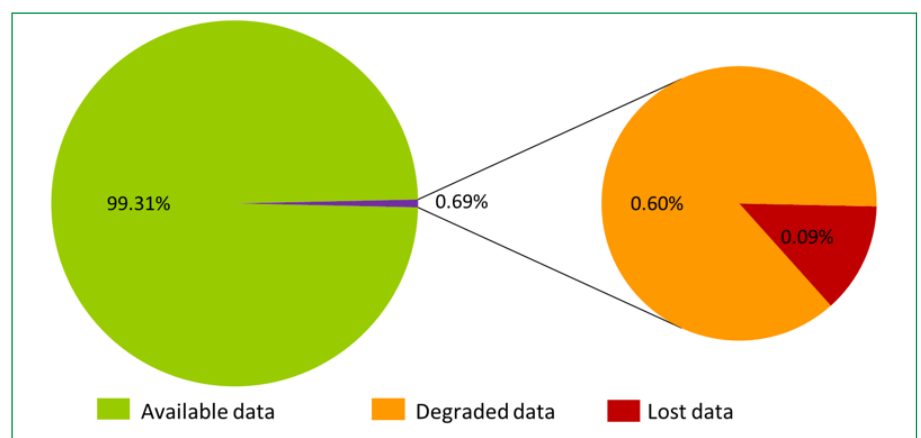


Figure-5: SMOS mission data availability percentage since May 2010. Instrument data availability is extremely high, about 99%. Only 0.09% of data is lost due to MIRAS anomalies.

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

The current versions of the operational processors installed in the SMOS ground segment are listed on the table 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>.

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.

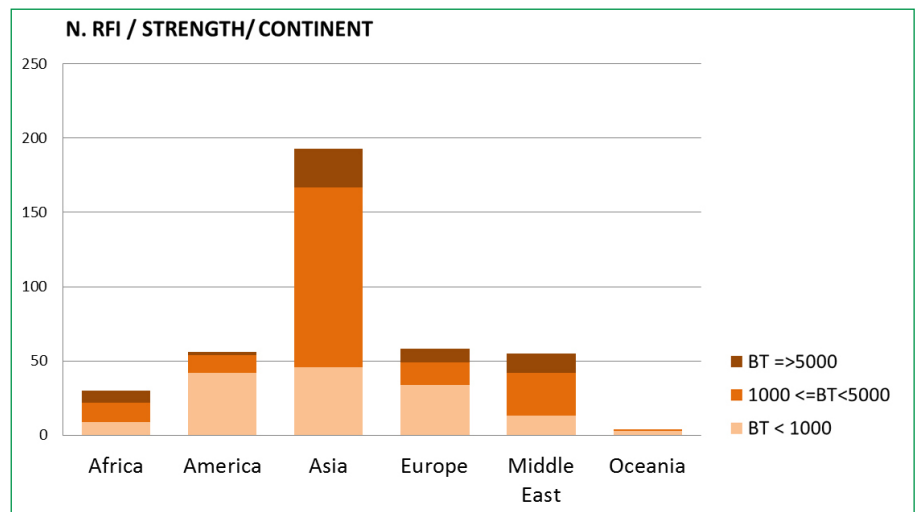


Figure-6: Worldwide number of active RFI sources per continent and intensity in May 2018.

Credit: SMOS RFI team at ESA ESAC

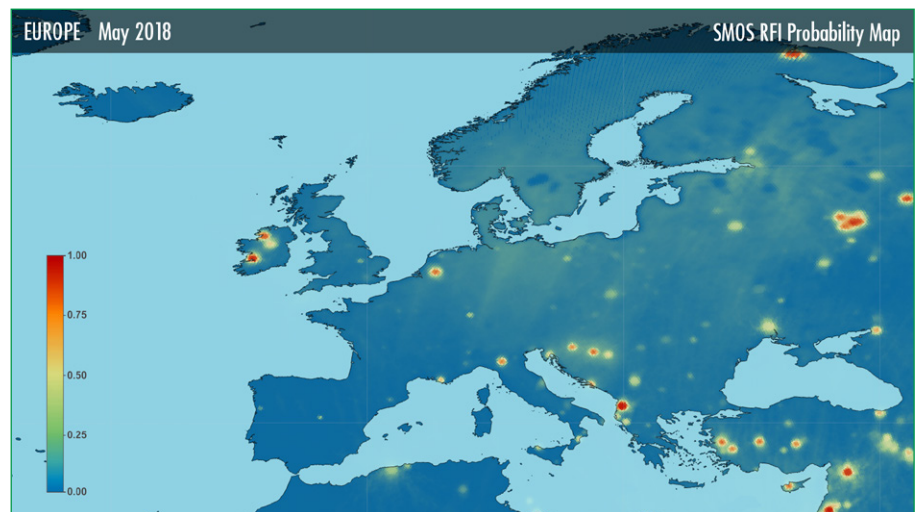


Figure-7: Map of Europe showing the probability of SMOS persistent RFI occurrences during the period 17 - 31 May 2018

Credit: SMOS RFI team at ESA ESAC

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)

Active RFI sources are continuously monitored in term of intensity and geographical distribution as illustrated in Figure-6 and Figure-7

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



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 (http://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 and over the oceans (areas with 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)

Upcoming Meetings & Announcements

IGARSS 2018

The International Geoscience and Remote Sensing Symposium will take place in Valencia, Spain on **23–27 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 are present including tutorials for land and ocean. A dedicated SMOS event “**SMOS – an ESA Earth Explorer satellite: From technology demonstrator to operational applications**” is scheduled for Tuesday 24 July (programme on https://igarss2018.org/SMOS_Program.pdf) For further details please visit the IGARSS 2018 web page: <https://igarss2018.org>.

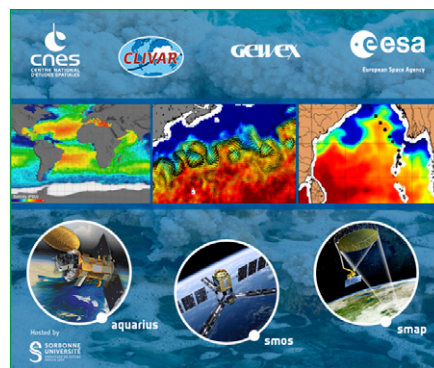


2018 Ocean Salinity Science workshop

The workshop will take place in Paris, France on **6–9 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. For further details please visit the 2018 Ocean Salinity Science workshop web page: <https://nikal.eventsair.com/QuickEventWebsitePortal/2018-ocean-salinity-science-conference/esa-2018>

AGU 2018 Fall Meeting

The AGU 2018 Fall Meeting will take place in Washington DC, USA on **14–15 December 2018**. A session on “The global water cycle:



linkages of ocean salinity with the atmosphere and terrestrial hydrology” has been organized. The session highlights water cycle research that describes linkages between the ocean, atmosphere, and land hydrology. Contributions are invited on all aspects of water cycle research including analyses undertaken using in situ and satellite missions observations, estimates based on numerical models, data assimilation systems, and climate model projections. The early abstract submission deadline is 25 July 2018, and final deadline is 1 August 2018. For further details and abstract submissions please visit: <https://fallmeeting.agu.org/2018/abstract-submissions>

Remote Sensing special issue: “Soil Moisture Remote Sensing Across Scales”

This Special Issue, is mainly focused on remote sensing of soil moisture across different spatial and temporal scales and on studies addressing new missions, such as the

Water Cycle Observation Mission (carrying a one-dimensional synthetic-aperture microwave radiometer), possible SMOS and SMAP follow-up missions, and any other missions deploying L-Band instruments. The studies can deal with the retrieval of soil moisture, the validation of remote sensing measurements and their use for scientific research or operational applications. Deadline for manuscript submissions is 31 August 2018. For further details please visit http://www.mdpi.com/journal/remotesensing/special_issues/Soil_Moisture

Remote Sensing special issue: “Ten Years of Remote Sensing at Barcelona Expert Center”

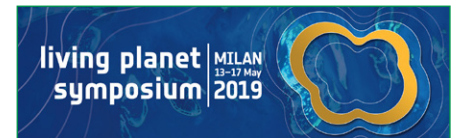
BEC recently celebrated its 10th Anniversary. This year, the Remote Sensing journal is celebrating its 10th Anniversary. To celebrate both events, the Remote Sensing Journal and BEC have organized a Special Issue entitled “Ten Years of Remote Sensing at Barcelona Expert Center”. This Special Issue is mainly devoted to papers on new scientific results covering topics, such as: Microwave radiometry, scatterometry, SAR, GNSS-R, Sensor calibration, Image reconstruction, Ocean Remote Sensing: salinity, winds, sea ice, currents, temperature, Soil Moisture and retrieval algorithms. Deadline for manuscript submissions is **30 June 2019**. For further details please visit http://www.mdpi.com/journal/remotesensing/special_issues/BEC_rs



2019 Living Planet Symposium

The Living Planet Symposium will take place in Milan, Italy on **13–17 May 2019**. The Symposium will focus on latest scientific findings on Earth's environment and climate

derived from satellite data, and on Earth observation's role in building a sustainable future and a resilient society. The deadline for abstract submission is **11 November 2018**. For further details please visit: <https://lps19.esa.int>



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.

The screenshot shows the ESA SMOS Online Dissemination Service website. The header includes the ESA logo and the text "ESA SMOS Online Dissemination" and "European Space Agency". Below the header, there is a navigation bar with "Help | SMOS Mission" and "Not signed in". The main content area features a "Welcome to the ESA SMOS Online Dissemination Service" message. It includes a search bar and a "Login" button. The text describes the service, providing access to SMOS Level 1, Level 2 science nominal and NRT data, and some auxiliary products. It also mentions that the system currently includes the complete SMOS Level 1b/1c and Level 2 dataset v6. The page provides information on how to access the data via Web Access and FTP Access.

