

# → ESA'S WATER MISSION

## smos newsletter

Issue 12 | February 2017



SMOS satellite  
launched on 2 November 2009

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## Highlights

### ESA Council at Ministerial Level

European ministers and representatives in charge of space activities from the 22 ESA Member States, plus Slovenia, and Canada met to decide future space activities for Europe, on December, 1-2 2016, in Lucerne, Switzerland. The sums allocated by Ministers to ESA was about €10.3 billion for its space activities and programmes, with the Earth Observation programme being funded by about €1.3 billion,

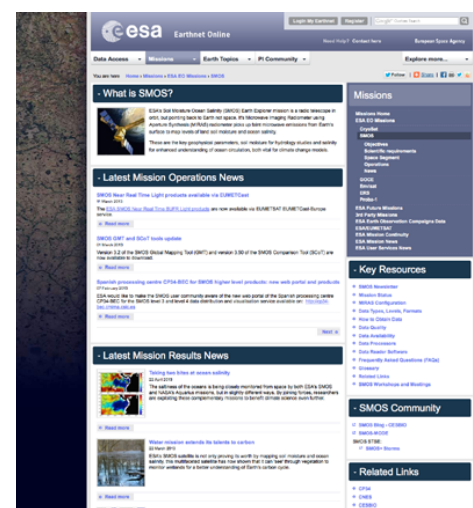
allowing the continuation of the SMOS mission operations to at least 2019, pending CNES' decision to continue to support the platform operation. Further information about the ESA Council at Ministerial Level and the final resolution document are available here: [http://www.esa.int/About\\_Us/Ministerial\\_Council\\_2016/European\\_ministers\\_ready\\_ESA\\_for\\_a\\_United\\_Space\\_in\\_Europe\\_in\\_the\\_era\\_of\\_Space\\_4.0](http://www.esa.int/About_Us/Ministerial_Council_2016/European_ministers_ready_ESA_for_a_United_Space_in_Europe_in_the_era_of_Space_4.0)

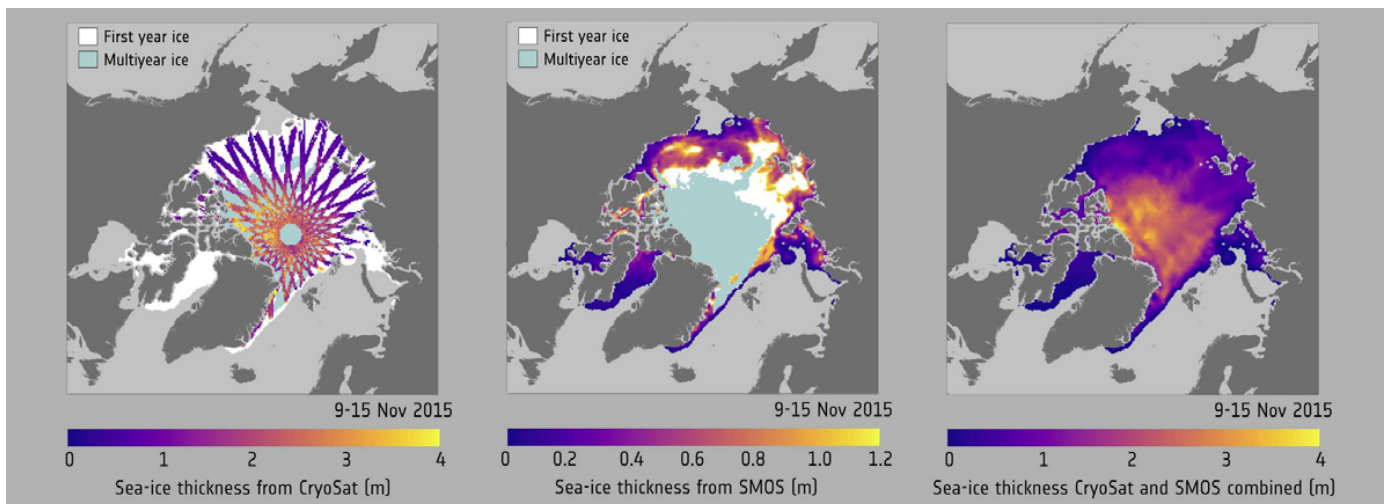
Stay up-to-date with the ESA SMOS web portal <http://earth.esa.int/SMOS>

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>



ESA's Ministerial Council in Lucerne, Switzerland, 1 and 2 December 2016. Credits: ESA





### Continuity of L-Band measurements from space

The SMOS scientific and operational user community continues to express their need for continuous L-Band measurement in the context of the current discussion for the future evolution of the Copernicus programme (on-line survey is available here: <http://copernicus.eu/copernicus-call-for-interest-survey>) at relevant meetings. During the 3<sup>rd</sup> Satellite Soil Moisture Validation and Application Workshop (2016, 21-22 September, New York City, NY) participants recommended: "The continuity of passive microwave L-band measurements as a part of a constellation of satellites, i.e. complementing the ASCAT and AMSR series and the Sentinel-1s" (see page 31 Gewex News, Vol. 26 No. 4, November 2016 on [http://www.gewex.org/gewex-content/files\\_mf/1480533350Nov2016\\_final\\_opt.pdf](http://www.gewex.org/gewex-content/files_mf/1480533350Nov2016_final_opt.pdf)). A position paper prepared by representatives of the Copernicus Marine Environment Monitoring Service (CMEMS) during the Polar and Snow Cover Applications – User Requirements Workshop (2016, 23 June, Brussels) reports: "Sea ice thickness is a very important indicator of climate change in the Arctic. In view of the uncertainty in the freeboard to sea ice thickness inversion, a Cryosat-3 type mission is an attractive option, preferably in combination with a laser altimeter. ... However, for operational sea ice monitoring, input to sea ice models and sea ice charting, satellite measurements of the thin sea ice below 0.5 m (SMOS- like) is indeed also required."

### Sea-ice thickness Cryosat and SMOS combined

The new SMOS and CryoSat sea ice product (see Figure-1) combines the skill of SMOS

for measuring thinner sea ice with CryoSat's ability to better detect thicker sea-ice, having complementary measurement principles. Further information about this new combined product: [http://www.esa.int/Our\\_Activities/Observing\\_the\\_Earth/SMOS/Satellite\\_cousins\\_have\\_ice\\_covered](http://www.esa.int/Our_Activities/Observing_the_Earth/SMOS/Satellite_cousins_have_ice_covered).

### SMOS level 4 experimental products for the Cryosphere in Antarctica available

New SMOS based cryospheric products, are now available for Antarctica from Centre Aval de Traitement des Données SMOS (CATDS): <https://www.catds.fr/Products/Available-products-from-CEC-SM/CryoSMOS-project>.

The new products provide: i) estimation of internal ice-sheet temperature, ii) estimation of ice thickness, iii) indicator of the origin of ice-shelves variability and iv) surface melting occurrence. The experimental products have been developed by the ESA STSE CryoSMOS project, led by IFAC (IT) supported by IGE (FR); CESBIO (FR); DTU(DK); UHAM (DE).

### Towards a SMOS-wind product

A three-day workshop about the science and applications of ocean surface winds, with a focus on measuring high or extreme wind speeds was held on 15-17 November 2016 at the UK Met Office. The workshop was organized in the framework of the ESA SMOS+STORM STSE project. (Workshop presentations are available here: <http://www.smosstorm.org/News-Outreach/High-Wind-Workshop-presentations-now-available>). During the workshop, results about surface ocean wind speed estimation from passive (radiometers) and active (scatterometer, SAR, GNSSR) sensors operated at different

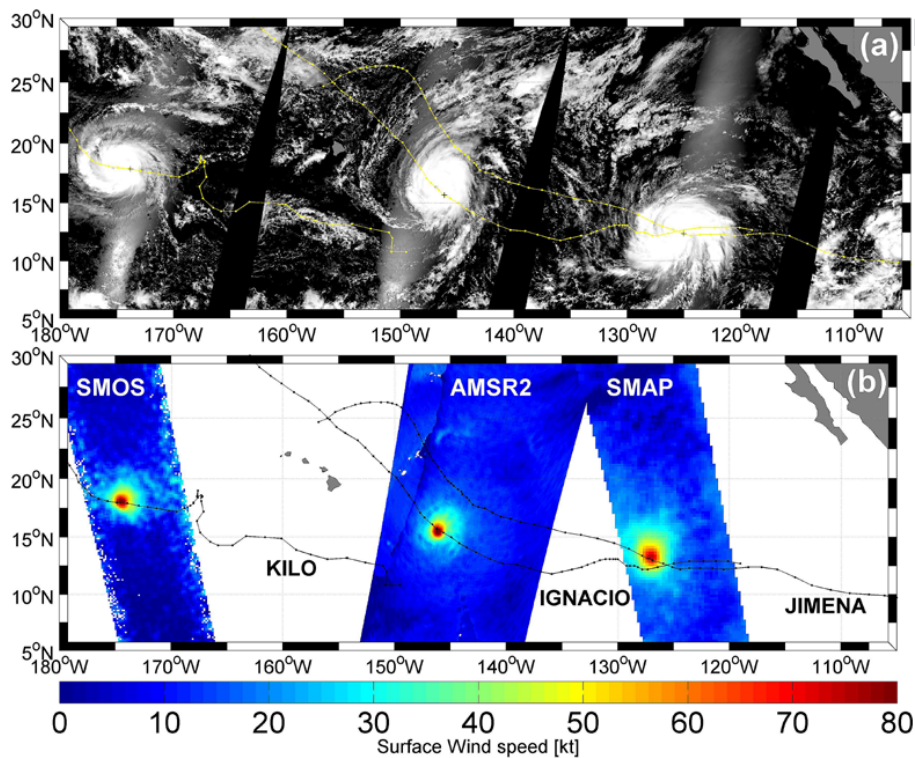
frequency were presented and discussed highlighting the useful complementarities between available datasets. L-Band measurements (SMOS and SMAP) have shown good sensitivity to high surface ocean wind speed (see Figure-2), as confirmed by validation results presented during the workshop for extreme tropical cyclones events. The user community has expressed its interest in a systematically provided wind speed data product based on SMOS data, which is planned to be implemented in 2017. An extensive SMOS winds database, including information about data quality is available on: <http://www.smosstorm.org/Data>.

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### Pi-MEP - Pilot SMOS Mission Exploitation Platform for Salinity

The Pilot SMOS Mission Exploitation Platform (Pi-MEP) project, led by IFREMER in collaboration with ODL, has started with the major objectives: i) to serve as enhanced sea surface salinity validation platform, complementing the efforts of the SMOS Expert Support Laboratories (e.g., exploring satellite performances at different spatio/temporal scales, with different filtering criteria, or against various ground-truth data) and ii) to offer a testbed to enable oceanographic process studies in different domains, capitalizing on SMOS salinity data in synergy with additional satellite products





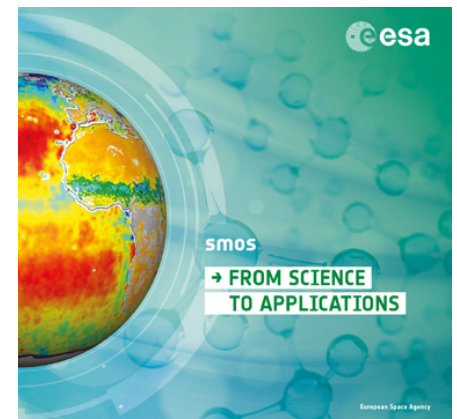
**Figure-2:** (a) NASA's Terra satellite visible imaging of Hurricanes Kilo (left), Ignacio (center), and Jimena (right) lined up across the Central and Eastern Pacific Ocean on August 29 at 22:25 UTC (b) Surface wind speed (in knots) retrieved from SMOS (29 August 2015 at 17:18 UTC), AMSR2 (29 August 2015 at 11:17 UTC) and SMAP (30 August 2015 at 2:15 UTC) radiometer data as their swaths intercepted hurricanes Kilo (left), Ignacio (middle) and Jimena (right), respectively. The three tropical cyclones were intercepted as they were developing into categories 3-4 on the Saffir-Simpson scale. Hurricane best tracks are indicated by yellow and black dotted curves in (a) and (b), respectively.

Credits: IFREMER

in the current ESA-CCI-Soil Moisture and to use SMOS soil moisture data as the reference for scaling purposes, thus replacing model estimates currently used in the CCI-Soil Moisture as reference.

#### SMOS: from science to application

A new ESA brochure: SMOS from science to application is available on-line: [http://www.esa.int/About\\_Us/ESA\\_Publications/ESA\\_Publications\\_Brochures/ESA\\_BR-332\\_SMOS](http://www.esa.int/About_Us/ESA_Publications/ESA_Publications_Brochures/ESA_BR-332_SMOS).



#### 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](http://wiki.services.eoportal.org/tiki-custom_home.php)). G-POD SMOS proposals need to be submitted directly through the following website: <http://eopi.esa.int/G-POD>. This is an open call, i.e. proposals can be submitted at any time.

(e.g., SST, WS, currents, rain rates). In a first step the consortium will work with a dedicated Scientific Advisory Group (SAG) to define the user requirements for such a platform. The platform will open to the wider user community in Mid-2018.

#### Level 2 sea surface salinity product update

An improved version of the level 2 sea surface salinity product will be available to the user community in spring 2017. The sea surface salinity will be retrieved by using a single sea surface roughness model, it will be corrected for the land-sea contamination effect and contain an anomaly field.

#### Virtual Sea Ice Mission ISSI Working Group

The first meeting of the ISSI "Sea Ice Virtual Mission" Working Group has taken place in September 2016. The working group combines international experts in the area of sea ice from research and operational agencies. The first meeting focused on the existing models and their individual characteristics and limitations, leading to the definition of a unified emissivity model, focussing on sea ice parameter retrievals and the use as observational operator for predictive models. A follow-on meeting is planned for May 2017. For further information see the Virtual Sea

Ice Mission ISSI Working Group's web-page: <http://www.issibern.ch/workinggroups/seaicemission/>.

#### Dedicated special issue on SMOS in Remote Sensing of Environment (RSE)

The dedicated special issue on SMOS: 'ESA's Soil Moisture and Ocean Salinity Mission - Achievements and Applications' in the Remote Sensing of Environment (RSE) journal volume 180 (2016) is available on the Science Direct website: <http://www.sciencedirect.com/science/journal/00344257/180>.

The main focus of the special issue is on the evolution of novel SMOS data products and applications including the synergistic use of SMOS data with other remote sensing and in-situ data. The special issue also provides an update on the current performance of the mission, the improvements in the algorithm used for both level 1 and level 2 products and their validation.

#### SMOS soil moisture and ESA-CCI-Soil Moisture project

The Passive Microwave Soil Moisture Data Fusion Study, a preparatory activity for the usage of SMOS soil moisture dataset into the ESA-CCI-Soil Moisture project, has been completed. The final report of the study, recommends to integrate the SMOS Land Parameter Retrieval Model (LPRM) approach



## Data and Processors

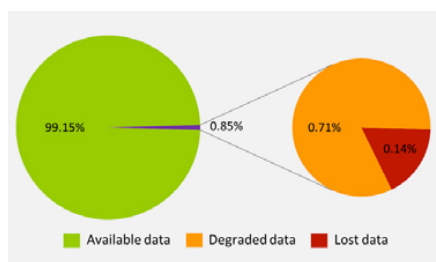
### Data availability

The SMOS instrument MIRAS is operating nominally with the exception of some known on-board anomalies (see the anomaly description [here](#)). The cumulative data loss due to MIRAS instrument unavailability since the beginning of the routine operational phase (May 2010) amounts to 0.14% and the degraded data amounts to 0.71% (see Figure-3). 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 [here](#).

### Instrument Calibration and data quality

Several calibration activities are regularly performed on board and an overview of the calibration strategy implemented for the MIRAS instrument can be found in the SMOS calibration summary document available [here](#). During calibration activities science data are not available, therefore data users should consult the calibration plan for data availability. This can be found at <https://earth.esa.int/web/guest/missions/esa-operational-eo-missions/smos/available-data-processing>.

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 performances can be found in the level 1 and level 2 products read-me-first notes available here: <https://earth.esa.int/web/guest/-/data-processors-7632>. SMOS data users are invited to consult the read-me-first note 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:

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 (N RTP)	V6.20 5 May 2015	V5.05 7 March 2012
Level 2 soil moisture	V6.20 5 May 2015	V5.51 24 April 2012
Level 2 ocean salinity	V6.22 5 May 2015	V5.50 15 December 2011

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>.

Since 19th December 2016 auxiliary dataset from the NOAA Interactive Multisensor Snow and Ice Mapping System (IMS) is used by the SMOS soil moisture level 2 processor to represent the snow cover extent. The NOAA IMS, based on data acquired by various sensors, provides a better representation of the snow cover compared to previously snow density information from ECMWF forecast. Globally the impact in terms of soil moisture is not significant.

Future evolution of the operational processors are:

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

**Level 2 Soil Moisture:** The next upgrade of

*Figure-3:* SMOS mission data availability percentage since May 2010. Instrument data availability is extremely high, about 99%. Only 0.14% of data is lost due to MIRAS anomalies.

Credits: SMOS FOS/ESA

the level 2 soil moisture processor (v6.50) is under finalization, with improvements focusing on refinement in the auxiliary files and parameterization of forward radiative transfer models.

**Level 2 Ocean Salinity:** The next upgrade of the level 2 sea surface salinity processor (version 6.62) is planned for spring 2017. The main foreseen improvements are the mitigation of the land-sea contamination in the sea surface salinity estimation the usage of a single roughness model for the sea surface salinity retrieval and anomaly field.

### Radio Frequency Interference (RFI)

The SMOS RFI team continues to monitor the RFI distribution and evolution worldwide; regularly reporting and following-up contacts with the different administrations. So far ESA has reported the RFI cases to the Spectrum Management authorities of 41 countries. There is an important variability in the RFI localisation worldwide: 1700 RFIs have been detected from 2010 to 2016, and currently more than 75% of the total number of RFI sources identified are not operating any more in the protected band. Currently there are approximately 400 RFI sources worldwide active, with strengths from moderate (BT < 1000 K) to very strong (BT > 5000 K), the latter being mainly located in Asia and the Middle East (see Figure-4). In China, 76 RFI cases were reported previously and immediate action was requested in particular for the 20 very strong RFIs. Actions have been taken by the Chinese



authorities and a decrease in the number of very strong RFIs in 2016 can be seen over China (see Figure-5). For Japan, extensive RFIs are detected over the country and there are clear indications that the source is linked to two new satellite TV-broadcast channels. ESA is in contact with the Japanese authorities so that actions are taken to mitigate this RFI case.

ESA has participated in the preparation of new ITU-R recommendation which will be approved in April 2017, to address the "Detection and resolution of radio frequency interference to Earth exploration-satellite service (passive) sensors". This recommendation includes a

template to be used by operators of passive remote sensors for RFI reporting, which is based on the experience gained by ESA with the SMOS mission.

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 newsletter #9 (May 2015) which contains a summary of the RFI flagging approach used for the V6.20 data. Information regarding the evolution of the RFI contamination can be found on the frequently updated RFI probability maps over land surface, generated

fortnightly by CESBIO and available on the SMOS blog ([http://www.cesbio.ups-tlse.fr/SMOS\\_blog/smos\\_rfi/](http://www.cesbio.ups-tlse.fr/SMOS_blog/smos_rfi/)) and on the weekly maps of 3rd and 4th Stokes parameter over ocean surface on the SMOS data quality web page (<https://earth.esa.int/web/guest/-/data-quality-7059>).

The user can visually inspect the map to identify areas with RFI contamination over land (with high RFI probability) and over the ocean (weekly averaged 3rd and 4th Stokes parameters above the natural variability of 10K in absolute value).

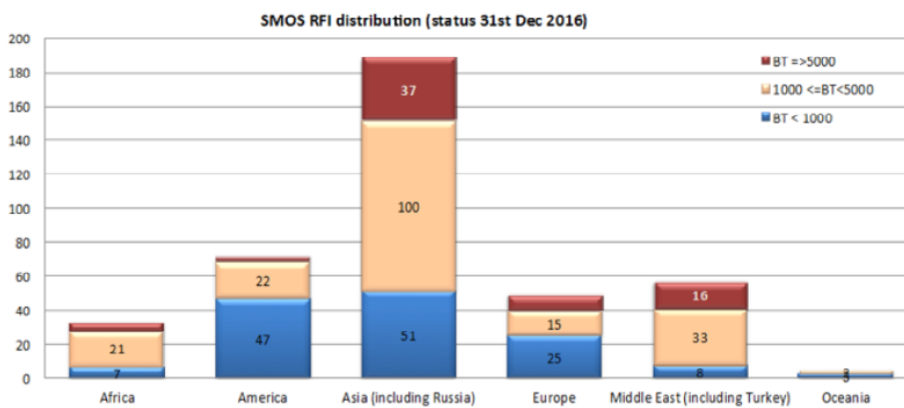
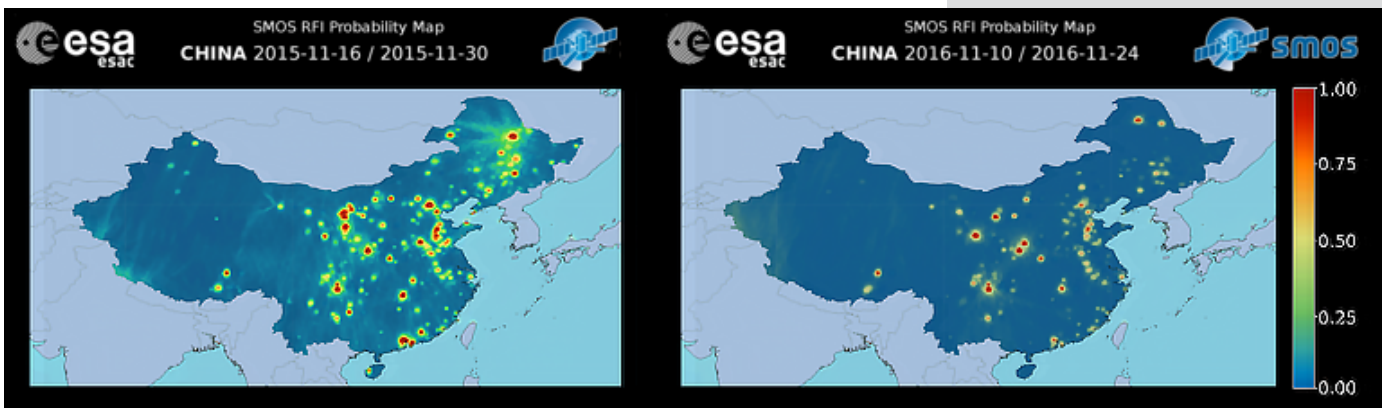


Figure-4: Updated SMOS RFI status distribution worldwide. Credits: ESA/ESAC

Figure-5: Reduction of very strong RFI sources over China in 2016 as compared to 2015. Credits: ESA/ESAC



## Upcoming Meetings & Announcements

### Global Ocean Salinity and the Water Cycle Workshop

The workshop will be held from May 22-26, 2017 at Woods Hole Oceanographic Institution, Woods Hole, Mass., USA focussing on the usage of salinity observations (Remote/in-situ ) and on understanding of how salinity variability originates and its role in the physics of the upper ocean. Registration and abstract submissions are open and will close on April 24, 2017. For further information see the workshop's web-

page: <http://web.whoi.edu/salinity-workshop/>.



### IGARSS 2017 Symposium

Hosted by the IEEE Geoscience and Remote Sensing Society, the International Geoscience and Remote Sensing Symposium 2017 (IGARSS 2017) will be held from July 23-28, 2017, at the Fort Worth Convention Center in Fort Worth, Texas, USA. The conference theme, International Cooperation for Global Awareness, underscores the need to work together to find global solutions to our most-pressing problems. For further information see the symposium's web-page: <http://www.igarss2017.org/>.



#### 4<sup>th</sup> Satellite Soil Moisture Validation and Application Workshop

This workshop is a continuation of the first three soil moisture validation and application workshops held at ESA, Italy, in 2013, in Amsterdam, the Netherlands, in 2014 and in New York, NY, USA in 2016. The 4<sup>th</sup> workshop will be held from September, 19-20 2017, at Vienna, Austria. The objective of this workshop series is to discuss and reconcile methodological advances in the validation and application of global satellite soil moisture data. The workshop is unique in that it brings together satellite soil moisture users and developers to focus on both the derivation and exploration of soil moisture data from both passive and active microwave satellite missions (SMAP, SMOS, ASCAT, AMSR-2, Sentinel-1, and other legacy missions).

#### Copernicus Marine Week

The Copernicus Marine Week will be held from September, 25-29 2017 at Brussels, Belgium.

The Copernicus Marine Week is a forum, for players engaged in creating sustainable value for our Oceans. The forum will foster an open dialogue with Policy makers, Industrials & Entrepreneurs, Regional Authorities & Stakeholders, Public Services and Scientists involved in Marine Environment and Blue Growth. For further information see the Copernicus Marine Week's announcement on: <http://marine.copernicus.eu/save-date-copernicus-marine-week-september-25-29-2017/>.

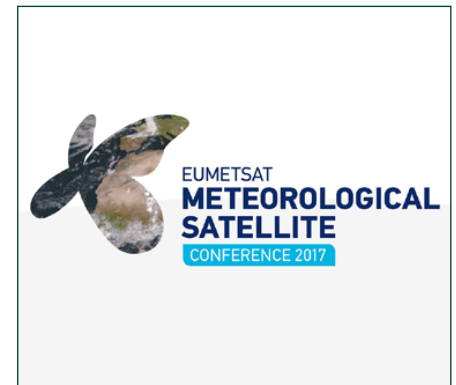


#### EUMETSAT Meteorological Satellite Conference 2017

The 2017 EUMETSAT Meteorological Satellite Conference will take place in Rome, Italy,

from October, 2-6 2017. The EUMETSAT Meteorological Satellite Conference is a forum that brings together meteorologists, scientists and researchers from around the world to share their experience and knowledge during plenary, poster and workshop sessions.

For further information see: [https://www.eumetsat.int/website/home/News/ConferencesandEvents/DAT\\_3212307.html](https://www.eumetsat.int/website/home/News/ConferencesandEvents/DAT_3212307.html).



## Data Access

#### ESA SMOS Online Dissemination service

The SMOS online dissemination portal is providing, since March 2016, a single point entry for all SMOS level 1 and level 2 data products, including Near Real Time (NRT) both level 1c and soil moisture neural network products. The online service facilitates the 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 (EEF) or NetCDF format). 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-ds-02.eo.esa.int/oads/access/> (see Figure-6). For further information on accessing SMOS data see <https://earth.esa.int/web/guest/-/how-to-obtain-data-7329>.

#### SMOS Near Real Time Data through EUMETCast

If you wish to access SMOS Near Real Time (NRT) "Light" (BUFR) and Soil Moisture Neural Network products via EUMETSAT's EUMETCast service based on standard Digital Video Broadcast DVB-S2 technology please



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

If you wish to access SMOS Near Real Time

Figure-6: ESA SMOS Online Dissemination service home page. Credits: ESA

(NRT) "Full" (BUFR) product by network, please send an email to [Susanne.Mecklenburg@esa.int](mailto:Susanne.Mecklenburg@esa.int).

