



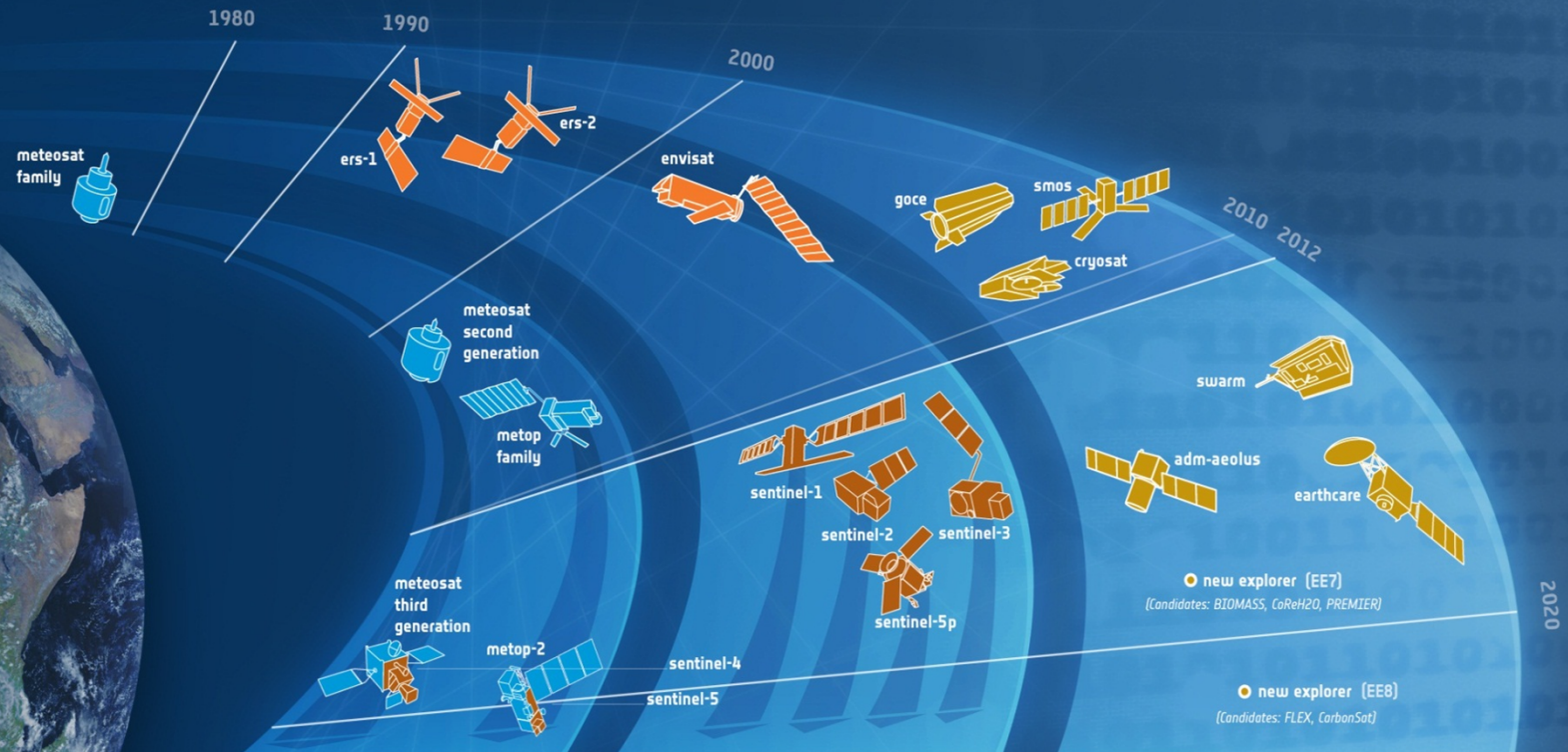
→ SMOS & AQUARIUS SCIENCE WORKSHOP

15 -17 April 2013 | IFREMER | Brest, France

SUSANNE MECKLENBURG – SMOS MISSION MANAGER, ESA

→ OBSERVING EARTH FROM SPACE

Expanding European Earth Observation capability



Meteorological Missions

driven mainly by Weather forecasting and Climate monitoring needs. These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT's Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & MTG satellites).

GMES Sentinel Missions

driven by Users needs to contribute to the European **Global Monitoring of Environment & Security** (GMES) initiative. These satellite missions developed in partnership with the EC include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MTG and EPS-5G respectively).

Earth Explorer Missions

driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth's interior operate and interact as part of an interconnected system. These Research missions, exploiting Europe's excellence in technological innovation, pave the way towards new development of future EO applications.

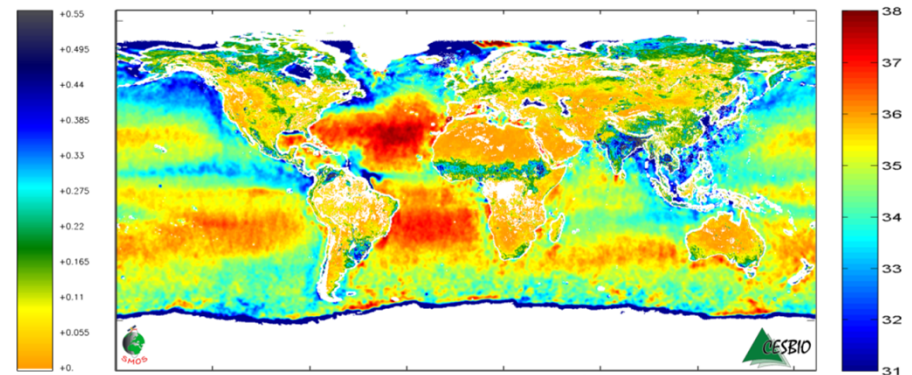
STATUS OF THE MISSION

Reliable instrument operations, data processing and dissemination to users.

- SMOS successfully launched on 2 November 2009 and in routine operations since May 2010
- **We successfully completed the nominal 3-years life time in November 2012!**
- The space segment -payload and platform - is functioning well with minor anomalies
- The ground segment is acquiring and processing data up to level 2 and providing data in Near-Real Time to ECMWF, and a NRT light product via GTS and EUMETCast to operational agencies
- Level 1 and 2 data products available to continuously growing science community since July/October 2010

MORE INFORMATION ON

ESA's SMOS webpage <http://earth.esa.int/SMOS>
 CESBIO's SMOS blog http://www.cesbio.ups-tlse.fr/SMOS_blog/



Merged global maps of soil moisture (August 2011) and ocean salinity (August 2010), morning orbits. Image courtesy CESBIO, IFREMER, CATDS, LOCEAN.

FROM 100% SCIENCE DATA AVAILABLE

- **ACQUISITION:** no data loss due to overlap of 2 orbits so far
- **CALIBRATION:** 1.68%
- **ANOMALIES:** Since May 2010 0.121% loss of data, 1.557% degraded data
- **DATA PROCESSING:** successfully processed to L1, L2SM, L2OS in 99.2%
- **NRT:** delivered in ~80 % of the sensing time within the requirement of 165 minutes

THE FUTURE: SMOS IN EOEP-4



Overall subscription to ESA programmes: **10,119 Billion Euro**

EO Budget: 1,9 Billion Euro

- **EOEP-4:** 1002 Meuro (64%)
- **Metop Second Generation:** 808 Meuro. It was the only oversubscribed program of CM12 with 103,65%; in addition there will be the Eumetsat contributions to this programme
- **GSC-3** (core elements Sentinel-5 and Jason-CS): 47 Meuro for phase 1 and an advance subscription of 43 MEuro for phase 2, open for subscription until 2014

SMOS operations form part of the EOEP-4 proposal until February 2017

Further extension of operations need to be confirmed through a mid-term/extension review in 2014, in coordination with CNES' extension procedure

Present Spanish contribution not sufficient to maintain Spanish operations contracts until 2017 (i.e. need for additional subscription)

1. First complete reprocessing of SMOS data up to level 2 completed in spring 2012, data available via ESA cal & val portal.
2. Continuous work to improve level 1 and level 2 processors, some updates over recent months.
3. **2nd SMOS mission reprocessing**
 - *Based on level 1 v600 TBC by QWG in July 2013*
 - *Start of level 1 reprocessing in autumn 2013, level 2 sea surface salinity reprocessing to commence beginning of 2014.*
 - *First reprocessed data available in spring 2014 via ESA cal & val portal (Brockmann).*
4. **NOW: catch-up reprocessing for level 2 sea surface salinity data**
 - *To align operationally available data to reprocessed data (1st campaign)*
 - *Covers period from Nov 2011 (=end of 1st reprocessing) to end of 2012*
 - *Includes improved OTT correction (computed every two weeks as opposed to the operational data set where it is computed monthly and applied with a delay of ~7 days)*

STATUS OF RFI DETECTION



RFI = Degradation of SMOS brightness temperature observations through interfering active sources emitting in same spectral band. RFI impacts data over land and ocean.

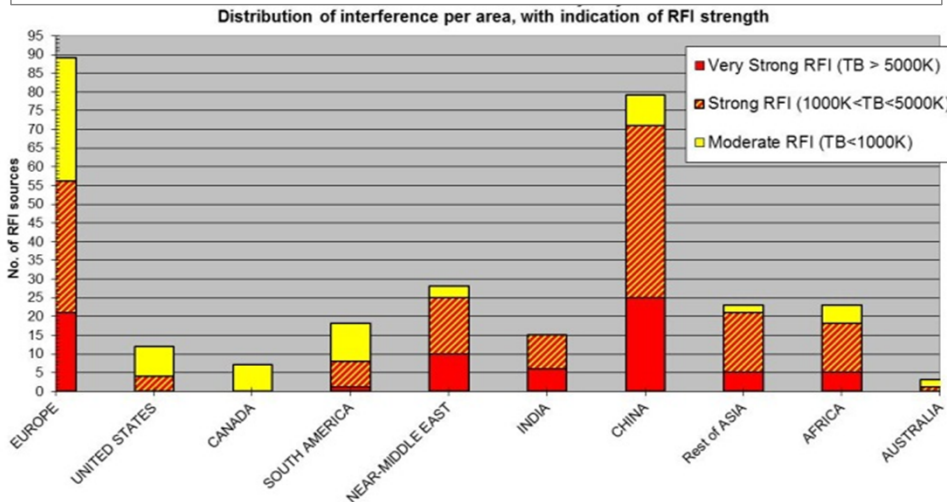
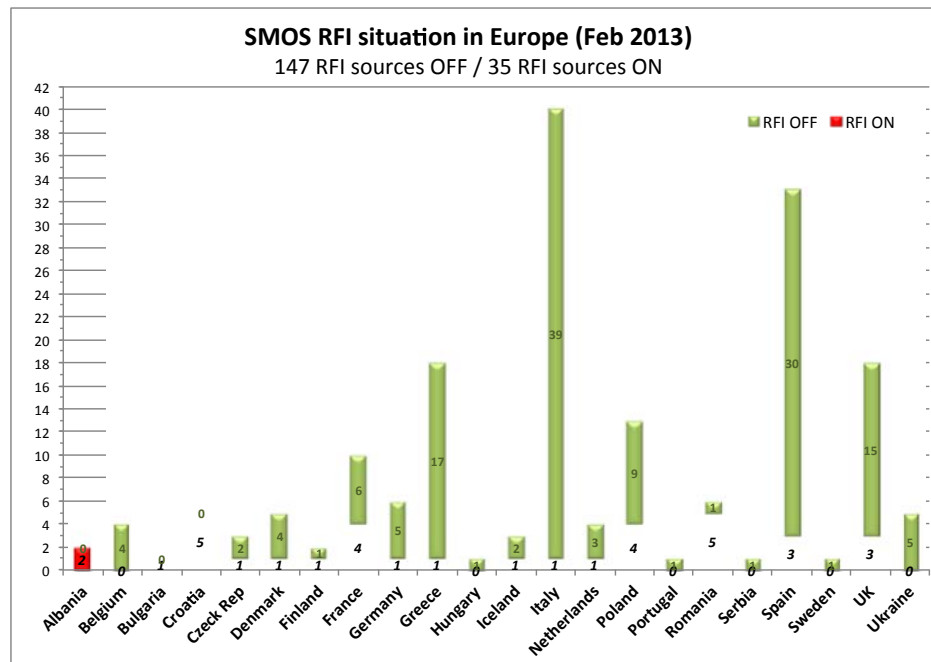
ITU and WRC resolutions were adopted to protect the passive L-Band (1400-1427 MHz) and prohibit all emissions in this band.

Nevertheless strong interference sources have been detected worldwide, especially in Southern Europe, China, Southern Asia and the Middle East.

ESA is in continuous contact with European and International National Frequency Management Authorities to investigate the RFI sources and initiate actions to cancel (or mitigate) these interferences.

Work into detection, mitigation or flagging of RFI sources in the SMOS data continuous, information provided to users

Major improvement of RFI situation over Europe and worldwide: by June 2012, 200 RFI sources have been switched off. BUT: still many sources are present or keep appearing and continue to negatively impact SMOS data.



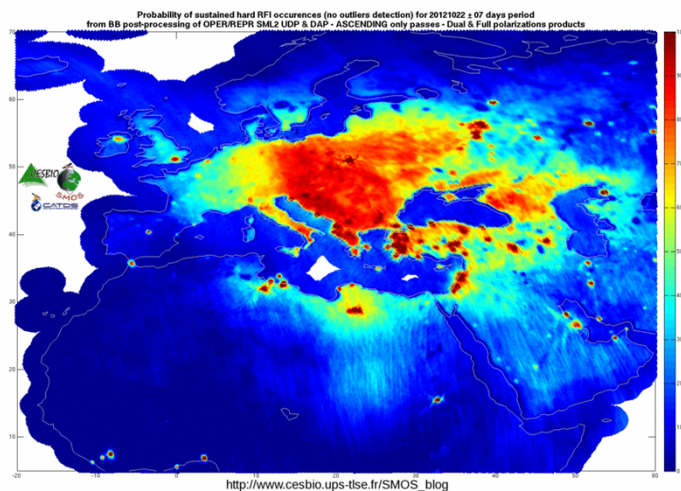
Good progress in improving the RFI situation detected in the 1,400-1,427 MHz passive band → ~ 40% of RFI sources have been switched off worldwide

- **POLAND** – Very strong RFIs able to blind the instrument were detected in Aug 2012. Investigations initiated by Polish Freq Regulatory Authorities (UKE) have led to significant decrease of RFI strength. Action on-going.
- **JAPAN** – Since Sept 2011 extended RFI emissions observed. Investigations initiated by Japanese Regulatory Authorities.
- **USA** – Most RFI sources due to civil sources have been solved thanks to actions taken by FCC. Now initiated contacts with NTIA concerning radar emission in Alaska
- **ITALY and GREECE** – These countries were initially heavily polluted with strong RFIs. Thanks to good cooperation of authorities the scenario is now quite clean
- **SPAIN, ICELAND, BELGIUM and GERMANY** – Several RFIs caused by radar emissions were detected. Authorities have taken actions to adjust their systems in order to reduce the out-of-band emissions in the passive band
- **RUSSIAN FEDERATION, ISRAEL and TURKEY** – Slow progress. Contacts resumed recently to ensure that investigations are initiated by authorities

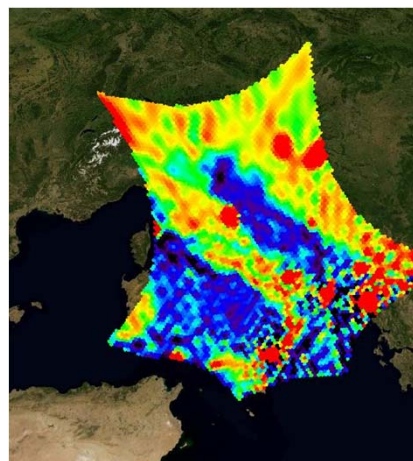
IMPROVEMENTS IN EUROPE



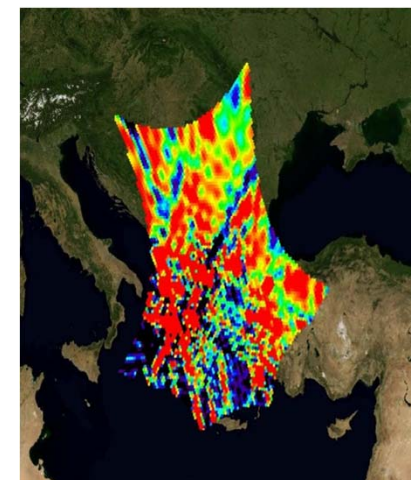
POLAND: Oct 2012



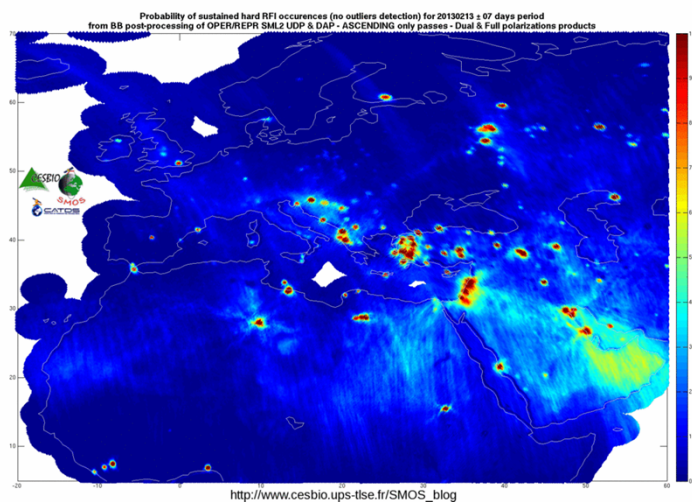
ITALY: May 2010



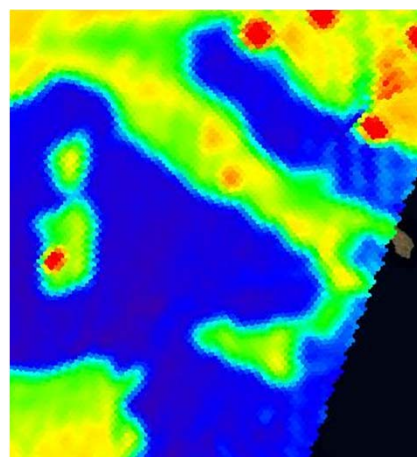
GREECE: June 2010



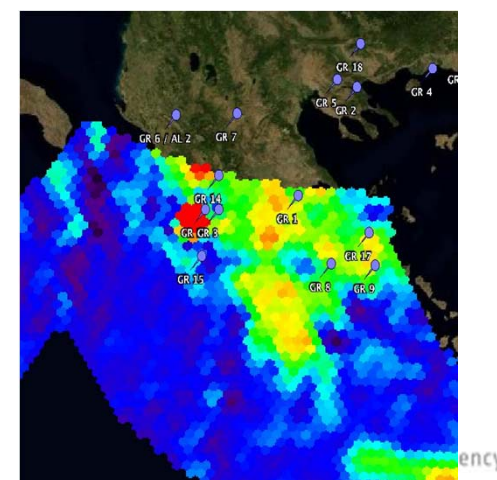
POLAND: Feb 2013



ITALY: Feb 2013



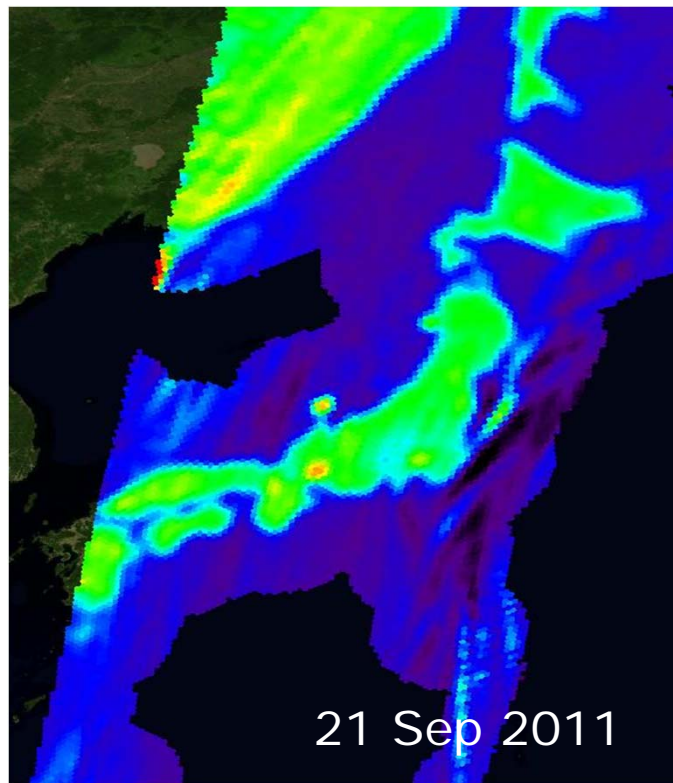
GREECE: Jan 2013



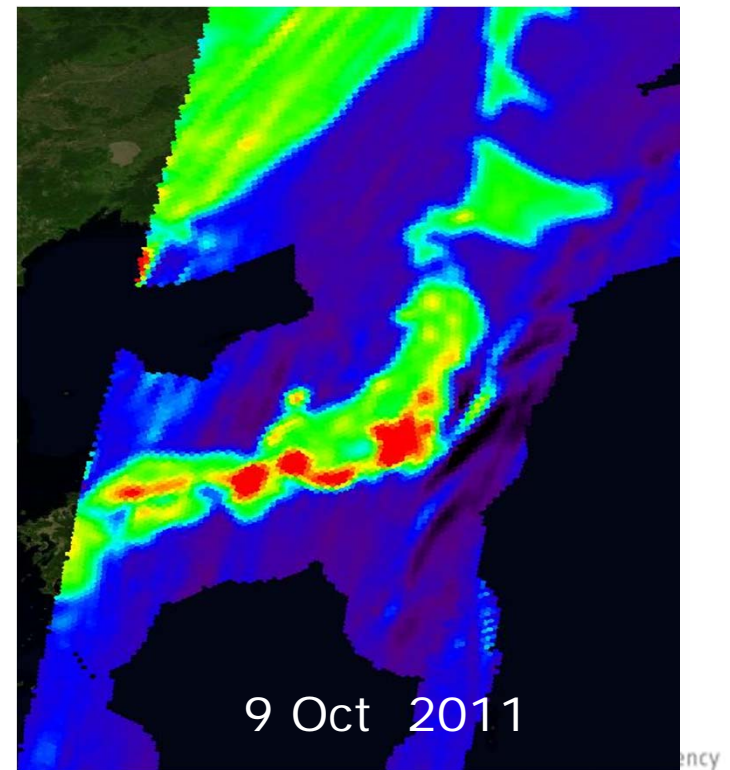
RFI in JAPAN



- Sudden increase of RFIs over Japan observed in Sept 2011
- RFIs appear as extended interference sources mainly concentrated in urban areas
- Suspected cause: Deployment of new mobile systems in adjacent bands
- Regular contacts have been established with the Japanese: Investigations are on-going



← →
18 day
difference



ency

OBJECTIVE OF THE WORKSHOP



- Provide the SMOS & Aquarius science communities with an overview on the present quality of the provided data, and an outlook on future algorithm developments.
- Explore common L-band sensor and algorithm issues for sea surface salinity and soil moisture retrievals derived by SMOS and Aquarius data.
- Present broader science achievements of both missions, including modeling results.
- Explore synergistic use of and validation approaches for SMOS, Aquarius and other sensors' data over land and ocean.
- Provide a forum for discussion on specific topics related to improving sea surface salinity and soil moisture retrievals through dedicated working groups.



- **More than 80 abstracts**
- **4 oral sessions & posters**
- **2 working groups**
- **Focused discussions**
- **Your feedback**
- **Recommendations**

THE SESSIONS



SESSION	TOPIC	CHAIRMAN
1	Overview on SMOS and Aquarius missions	Susanne Mecklenburg
2	Instruments' performance and inter-calibration, algorithm development	David Levine and Yann Kerr
3	Product validation & stratification	Jacqueline Boutin and Yi Chao
4	SMOS and Aquarius science application and synergies	Nicolas Reul and Antonio Turiel
5	Beyond Salinity: Soil Moisture, Storms and Cryosphere	(posters)

Summary discussions in WG and at end of each day.

1. INTER-CALIBRATION → *Session 2*

- Aiming at merged and validated data product;
- Solving several key common geophysical modeling issues related to galaxy, roughness, emissivity, ascending-descending biases, RFI, etc., as well as direct inter-calibration of brightness temperatures and salinity products.
- Potential aim for this workshop would be to present some findings and recommendations for adopting certain models or methods, and for follow-on work.

WG chairs: G. Lagerloef, D. LeVine, Y. Kerr, J. Font, M. Portabella

2. SURFACE STRATIFICATION → *Session 3*

- Quantify methods to extrapolate near-surface in situ salinity data to the surface microwave optical depth to improve the satellite calibration and validation,
- Quantify methods to apply satellite sea surface salinity measurements to provide estimates of a mixed layer salinity and its effective depth scale. The methods would employ in-situ data, mixing parameters, wind stress, surface freshwater flux, etc.
- Potential aim for this workshop is to recommend a set of working definitions for sea surface salinity, similar (if simplified) to the ones put forward by the GHRSSST community

WG chairs: J. Boutin, Yi Chao, C. Banks, B. Ward



**HAVE AN INTERESTING
WORKSHOP!**

Thanks to the organizers at all organisations!