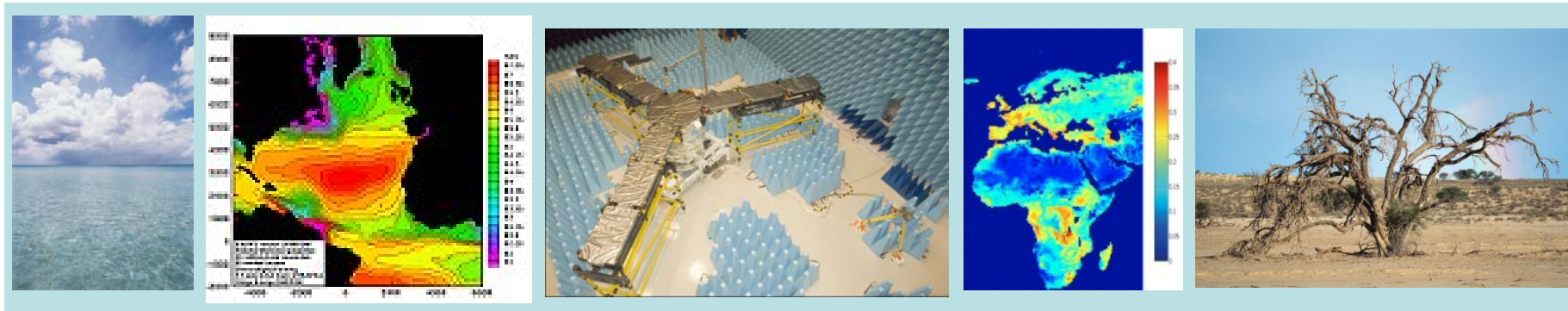


The Soil Moisture and Ocean Salinity Mission

- Status for PM with ECMWF -



Susanne Mecklenburg
SMOS Mission Manager

ECMWF, 2 February 2011

SMOS – ESA's water mission



Objective

provide global measurements of two key variables in the water cycle - soil moisture and ocean salinity

Requirements

Soil moisture

- Accuracy of 4% volumetric soil moisture
- Spatial resolution 35-50 km
- Revisit time 1-3 days

Ocean salinity

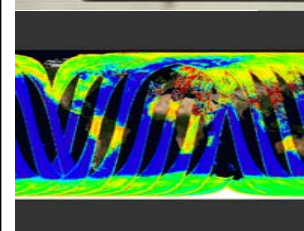
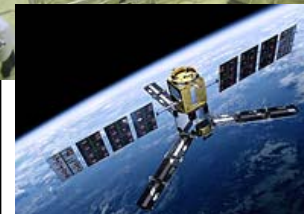
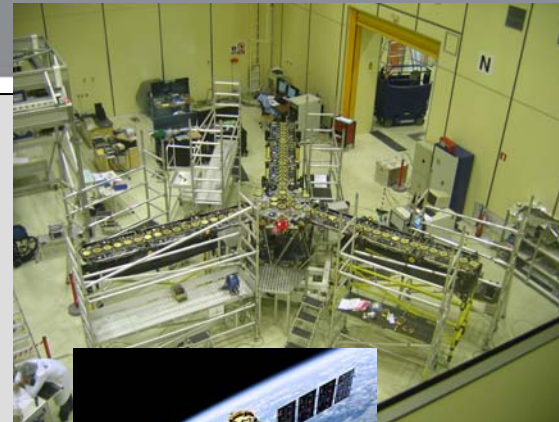
- Accuracy of 0.5-1.5 practical salinity units (psu) for a single observation
- Accuracy of 0.1 psu for a 10-30 day average for an open ocean area of 200 x 200 km

Payload Microwave Imaging Radiometer using Aperture Synthesis (MIRAS) instrument, passive microwave 2-D interferometric radiometer (L-Band, 21cm)

Mission orbit sun-synchronous, dawn-dusk (6am/6pm), ~755km, 14 orbits per day

Launched on 2 November 2009

Mission lifetime 3+2 years including 6 months commissioning



SMOS status

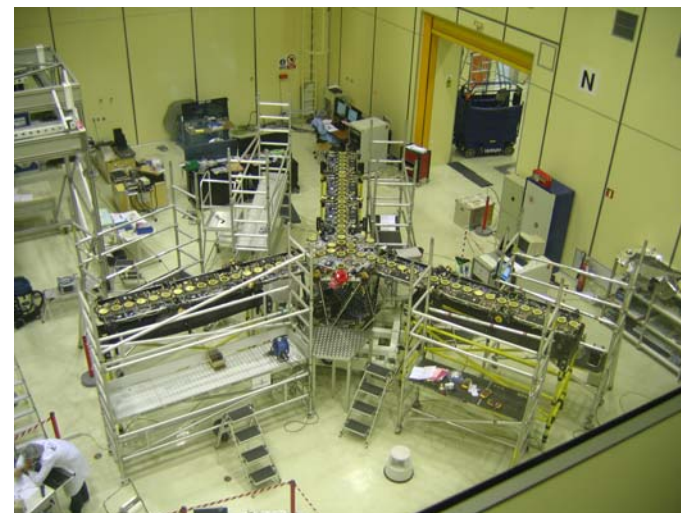


Space and ground system have been tested in the commissioning phase

- **Payload and platform functioning well with minor anomalies**
- **Ground segment is acquiring and processing data up to level 2 and providing data in NRT to ECMWF**

Data availability

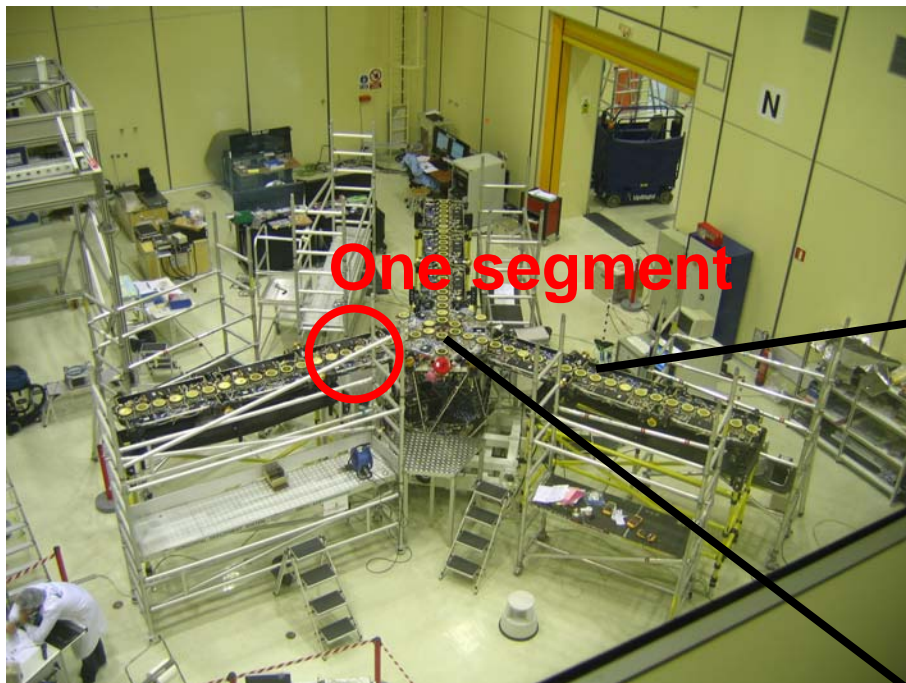
- **First Level 1C products (and some data sets for level 2) released to cal & val PIs mid April**
- **Official release of level 1C products in July 2010**
- **Official release Level 2 products in Oct 2010**
- **First entire reprocessing of data up to level 2 foreseen for Q3 of 2011**
- **Re-processing of data from commissioning ongoing (NRT data included)**



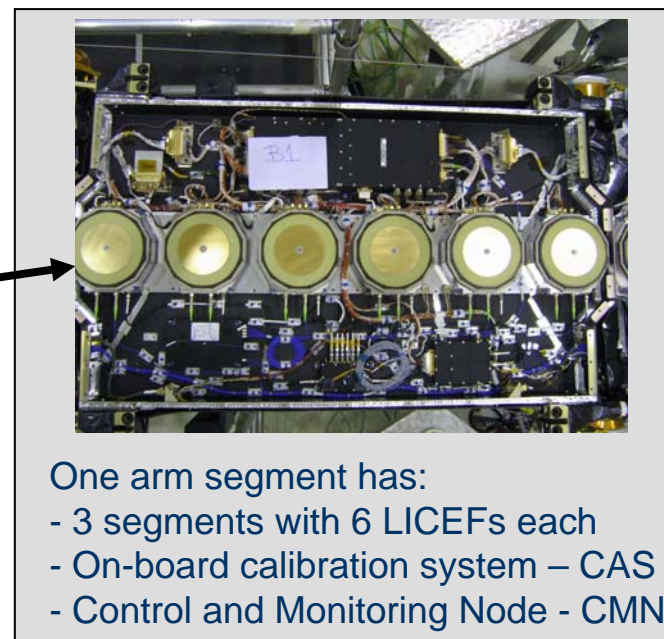
In general: Anomalies in Q4 2010 amount to on-board data loss of 0.053% (58'), the degraded data amount to 0.563% (10h 16'), which lies well within the system performance requirement of 98% for generating observation data (99.384% SMOS data are available)

→representative for SMOS performance since launch on 2 November 2009 (i.e. very reliable)

Recent anomaly in arm segment B1: MIRAS

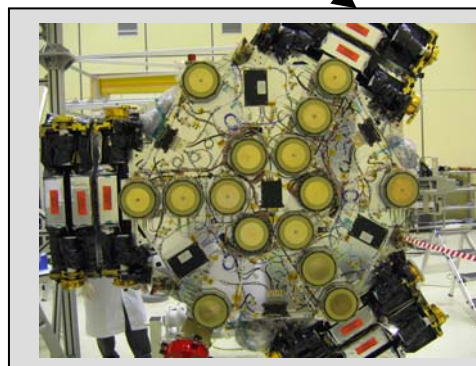


One segment



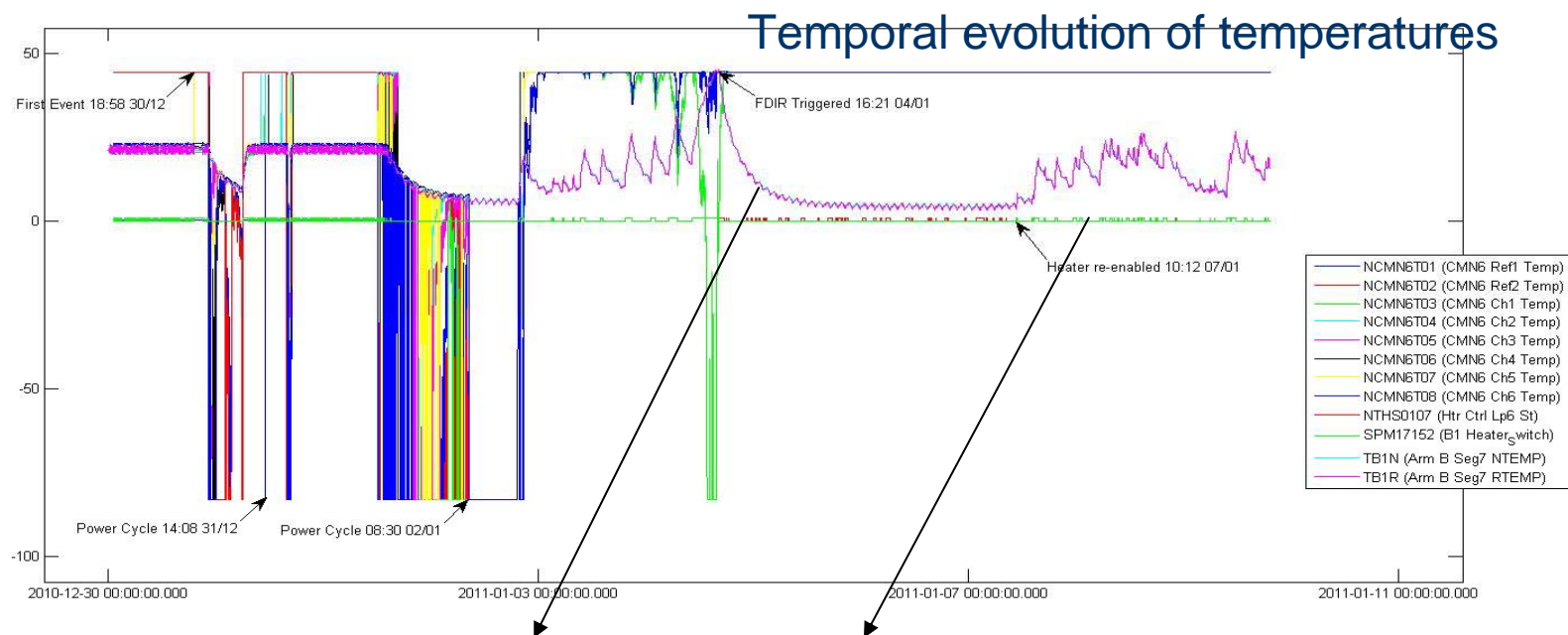
- One arm segment has:
- 3 segments with 6 LICEFs each
 - On-board calibration system – CAS
 - Control and Monitoring Node - CMN

SMOS during assembly and integration consisting of 3 arms and hub, 69 LICEFs in total (= light weight cost effective)



- Hub is divided into 3 sectors, each one being identical to one arm, and has
- 15 LICEFs, CAS, CMN
 - Correlator and Control Unit (CCU)

Recent anomaly in arm segment B1: summary

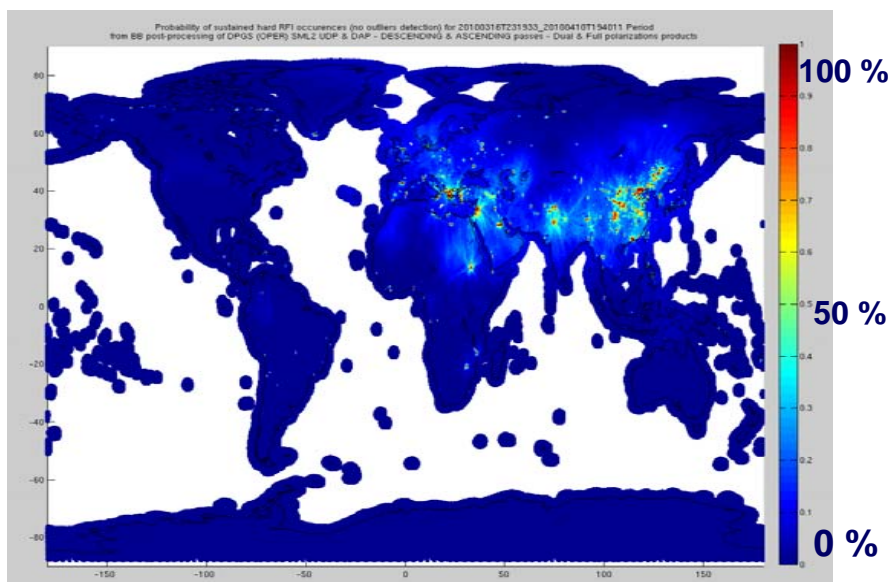


- Concentrate on reference **temperature TB1R** and **heater status**
- What happened? - Erroneous temperature readings in one of the segment of arm B (=B1), essentially a problem with the thermal control of the instrument
- Cause identified: most likely cause under- performance of the multiplexer in charge of temperature channel acquisition inside the Control and Monitoring Node (CMN)
- Potential cure: a) switch to nominal (=redundant) side of the instrument, b) thermal control of segment B1 with neighbouring segments
- Performed a) on 12 January and MIRAS is since back into nominal mode
- This requires re-calibration activities which are presently performed and assessed to return to nominal data production and dissemination
- Effect on data: Interruption of temperature readings has made unavailable the instrument for scientific data during the event, since knowledge of LICEFs temperatures is required in scientific data processing.

Where are we with RFI?

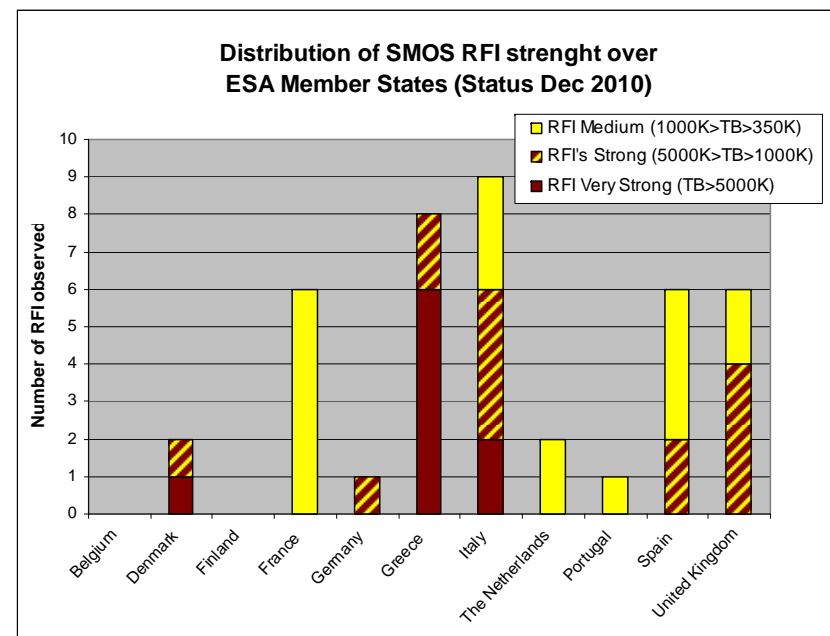
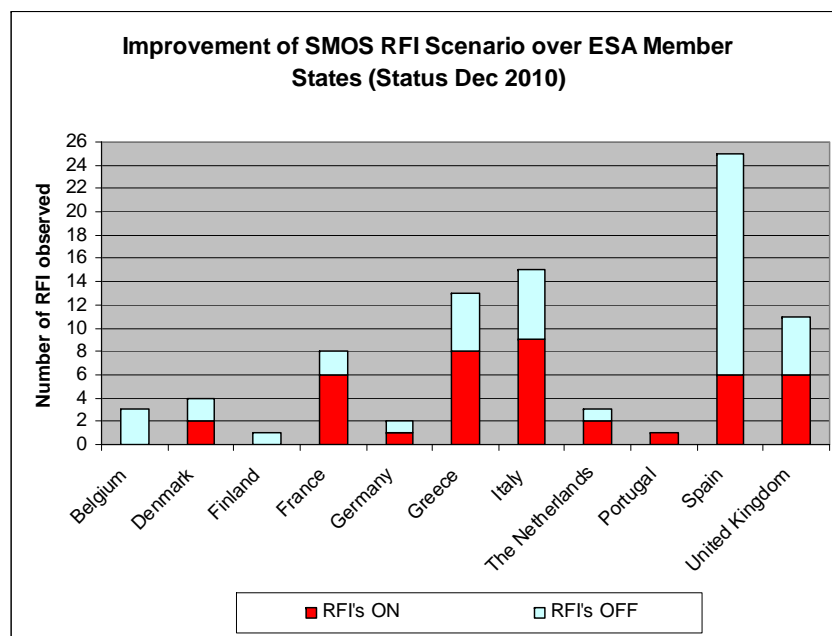


SMOS Global map of probability of RFI occurrence from 16 March -10 April 2010 (Descending + Ascending passes; dual & full pol products)



- Strong interference sources have been detected worldwide, and specially in South of Europe, China, South Asia and Middle East
- ESA is in contact with most European National Frequency Management Authorities to proceed with investigations about type of RFI source and to initiate actions to cancel (or mitigate) these interferences
- Major improvement of RFI situation over Europe:
From March to December 2010, **48 interferers were successfully located and SWITCHED-OFF** in Europe (see details in next slide)
 - In most cases the RFI sources were due to either illegal emissions in the passive band 1400-1427 MHz or unwanted emissions from the fixed and mobile services in neighboring bands → *radiolinks, broadcasting systems and wireless networks*
 - Up to 28 RFI observed by SMOS over Europe are compatible with radiolocation systems in the 1300-1400 MHz band.
 - Out-of-band emissions from radar systems have already been confirmed as RFI sources in several cases

RFI: Reaction of ESA member states



Reprocessing of SMOS NRT data



Reprocessing requirements as identified by users that will be covered

“Validation” reprocessing to test processor months of settings

The plan is ...

- BUFR conversion developed by INDRA
- To be installed in DPGS reprocessing platform by March
- L1OPv346 optimum cal reprocessing starts in March
- BUFR conversion for fixed cal probably in March
- BUFR conversion for opt cal in parallel with reprocessing
- Data distribution: via ESAC ftp or HD

“Commiss consistent period until

OP buted

) based v400

based on L1OP v346 fixed and opt cal

→ L2SM v400 based on L1OP v346 fixed and opt cal

Annual baseline change = reprocessing of entire data set

→ reprocess complete data set for processor versions L1OP v500, L2OS v500 and L2SM v500

NRT performance



→ Present data processing performance as of Q4 2010

The acquired data were successfully processed to

98.4% for level 0

98.0% for level 1

98.8% for both level 2 soil moisture and ocean salinity

98.4% for the NRT product

for the period October to December. The NRT product was delivered in 54.3% of the sensing time within the requirement of 165 minutes. 80% of data are delivered within 200 min from sensing.

→ Main causes for NRT under-performance are:

→ *network problems between ESAC and Svalbard*

→ *level 0 under performance*

→ *on-board events (CCU resets etc)*

→ *dependence of NRT chain in main-nominal DPGS chain*

→ **all of the above under investigation, action on ops manager to improve NRT performance!**

→ Improve NRT data dissemination to other than ECMWF users, working with the UK Metoffice

SMOS VRT workshop – some points



Level 1

Improvements in level 1 processor needed to improve level 2 data products, in particular related to

- Drift: long-term instrument drift as well as difference in ascending and descending passes
- Land-sea contamination
- RFI
- Stokes 3 and 4
- Continue DOME-C measurements?
- Use data assimilation for testing level 1

Level 2

Ocean salinity

- Investigate potential of three roughness models
- Galactic model
- Salinity stratification: in-situ (Argo, 5m) versus SMOS (1 cm)
- Does SMOS really see anomalies, i.e. something different to climatology?

Soil moisture

- Validation of SM product against in-situ measurements to provide assessment of accuracy of data (need for long term data set, independent comparison)

A few other points ...

TGRS call for special volume on SMOS: instrument performance and first results → deadline 31 March 2011

→ SMOS presentation at Eumetsat in May 2011 → need to include ECMWF results

→ ESA SMOS workshop planned for September (w/c 26) 2012 in France together with CNES