



SMOS sea surface salinity: status after one year of operations

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Overall SMOS scientific goal

To provide global coverage of Sea Surface Salinity fields, with repetition rate and accuracy adequate for oceanographic, climatological and hydrological studies and increase the present knowledge on:

- **Large-scale ocean circulation**
- **Water cycle exchange rates quantitative estimation**
- **Occurrence of natural catastrophic events**
- **Management of water resources**
- **Role of the ocean in the climate system**



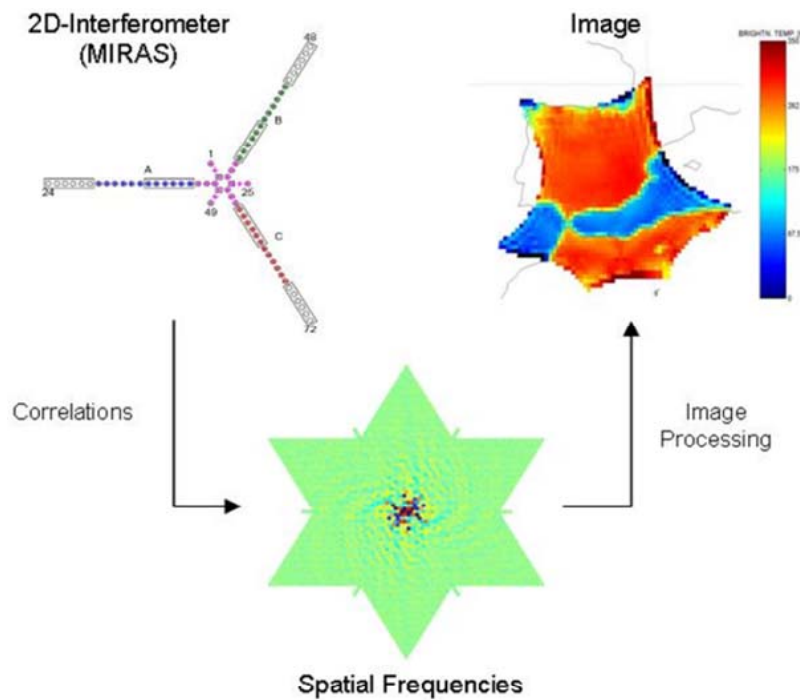
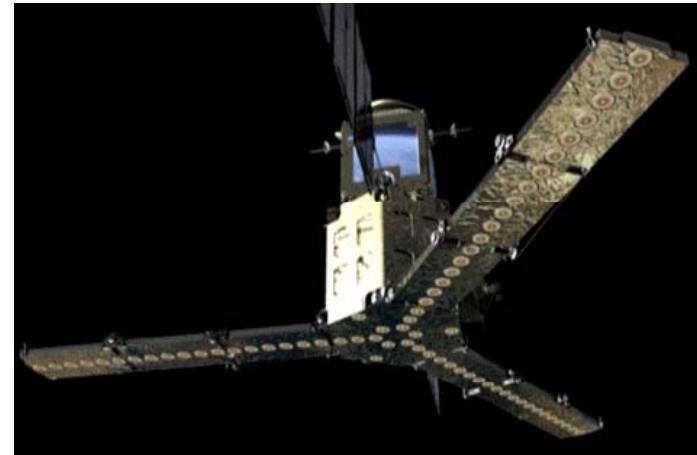
- The multiangular measurements of any point on the Earth's surface provided by the SMOS interferometric radiometer MIRAS at each satellite overpass are aimed at:

- Determining sea surface salinity with an accuracy of the order of 0.1 practical salinity units, 100 – 200 km spatial resolution and 10 – 30 days temporal resolution

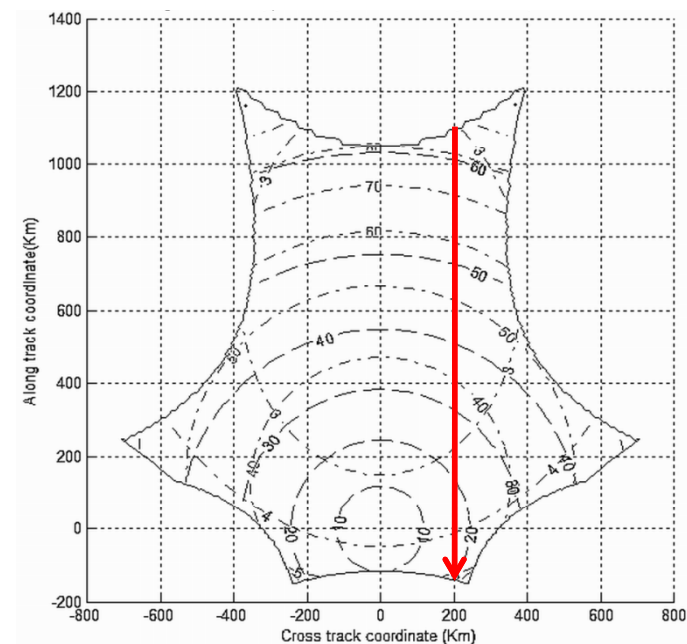


- SMOS launch: November 2, 2009
- Operations phase with full polarization mode: from May 20, 2010
- First general reprocessing: fall 2011
- Field-of-view: 1000 km
- Pixel size: 30-90 km, remapped to 15 km (ISEA grid)
- Incidence angle: 0-60°
- Earth full coverage: 3 days
- Level 1 and Level 2 (semi-orbits) provided by ESA to registered PIs
 - Expected L2 accuracy: 1-2 psu range, function of distance to track, depending on environmental variables (temperature, wind) <http://eopi.esa.int/esa/esa>
- Level 3 gridded maps provided by Spain (CP34) and France (CATDS)
 - Aimed at fulfilling mission requirements through noise reduction by averaging
 - CP34 registration <http://www.cp34-users.cmima.csic.es/>
 - CP34 provision of NetCDF files smos-bec@icm.csic.es
 - CATDS information http://www.cesbio.ups-tlse.fr/fr/smos/smos_catds.html

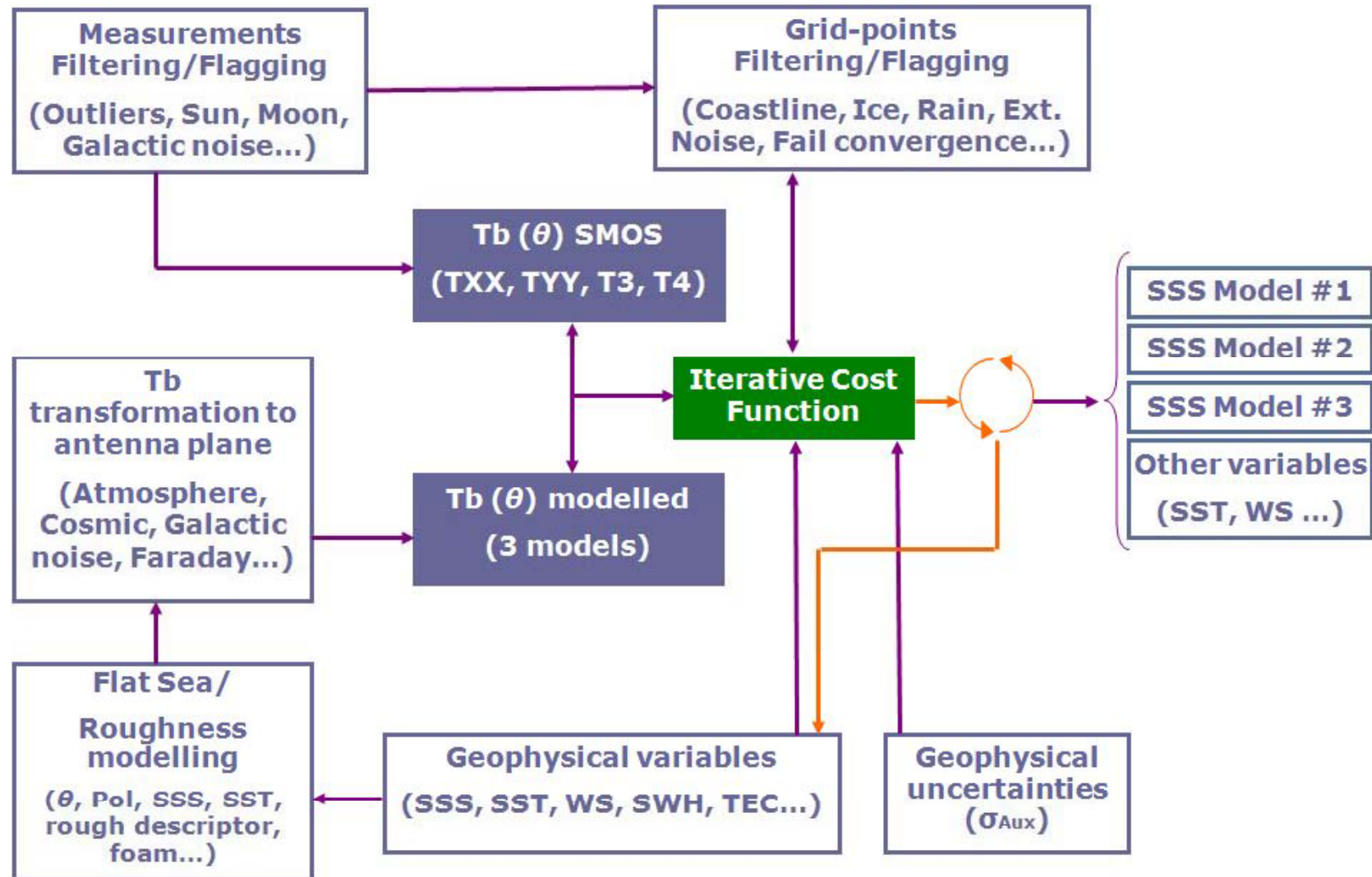
- MIRAS: Microwave Interferometric Radiometer using Aperture Synthesis



Multangular view of a single point



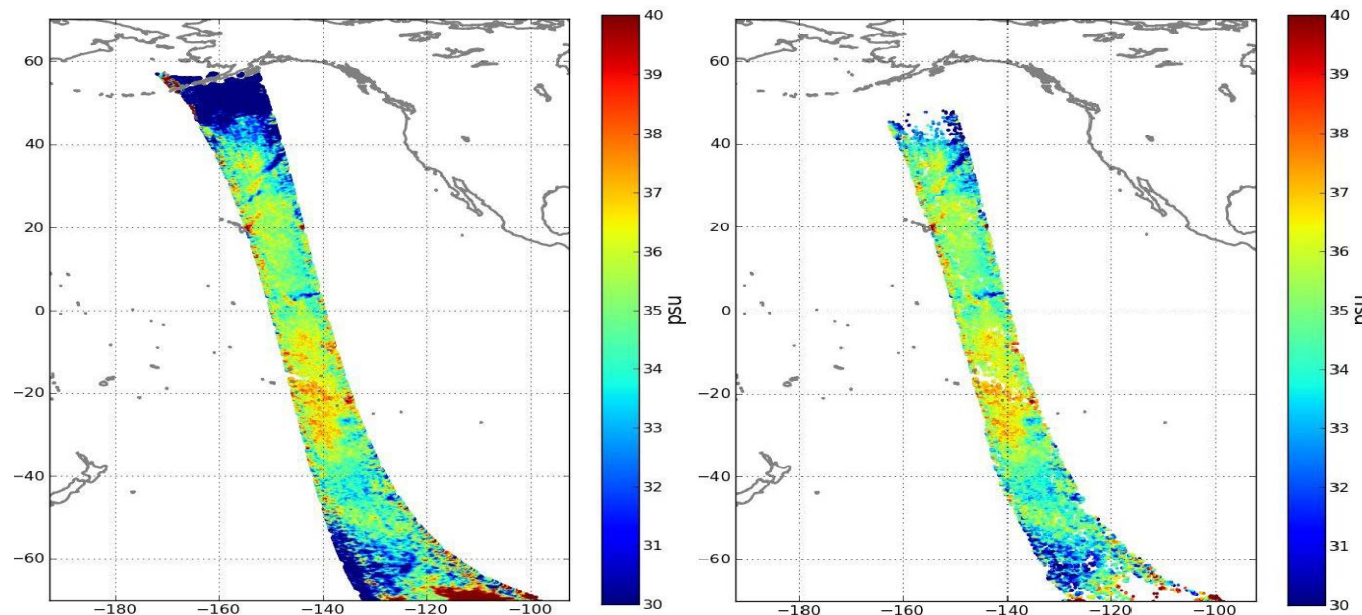
Computing SSS from brightness temperature for each ocean pixel:



Developed by the SMOS L2 OS team and implemented by ACRI-ST, Fr and Argans Ltd., UK

Last version 3.17, operational from March 2011

Includes first modifications using roughness models fit to SMOS data

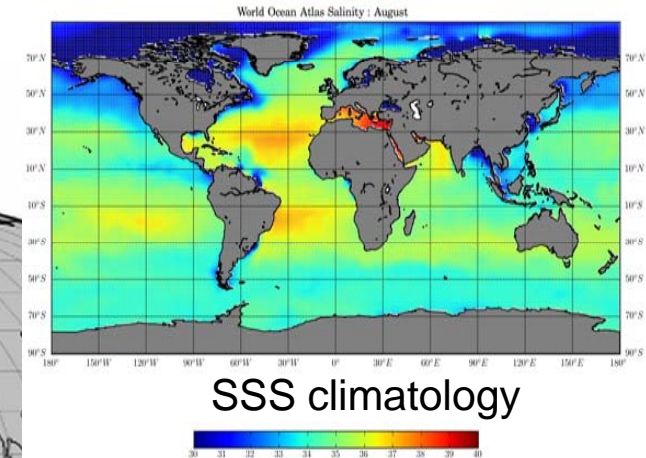
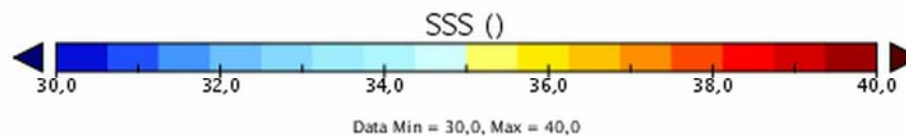
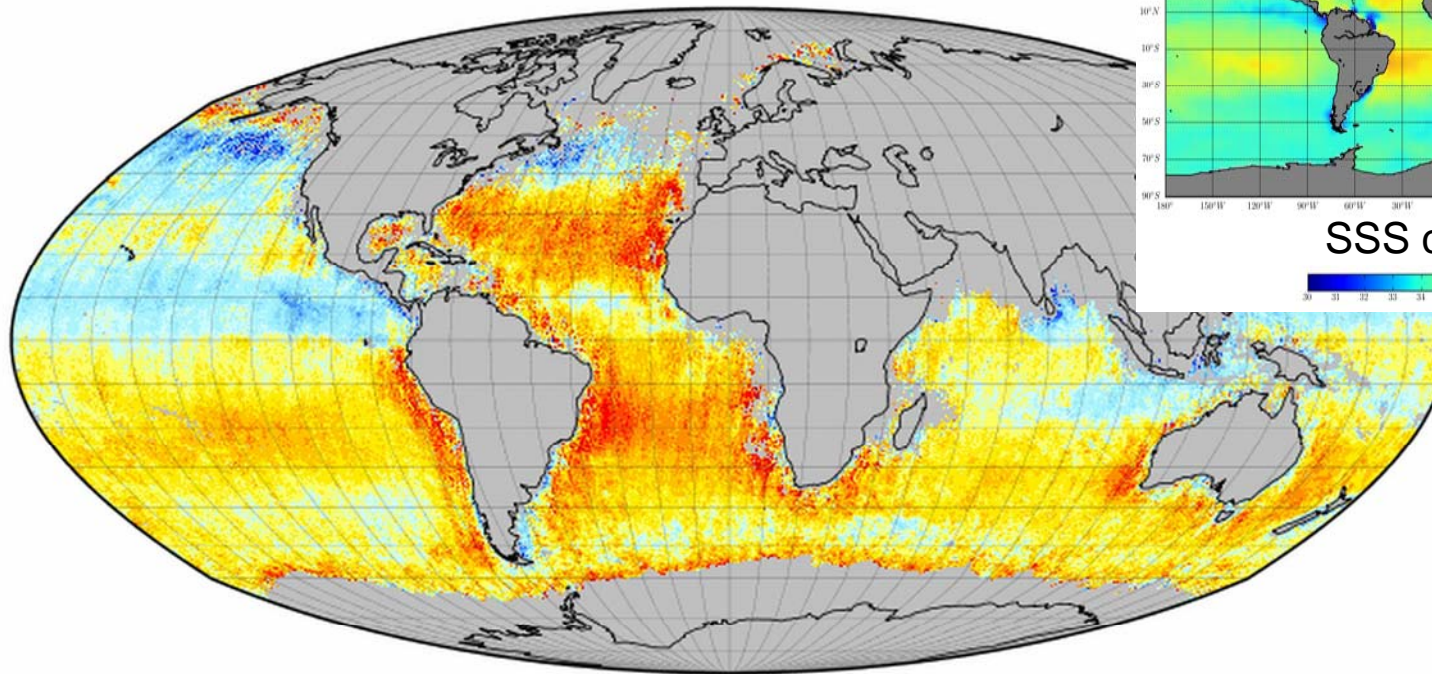


Retrieved SSS along a SMOS ascending orbit in the Pacific Ocean.
Unfiltered (left) and filtered (right, removing flagged data) values

SSS maps from L2OS processor

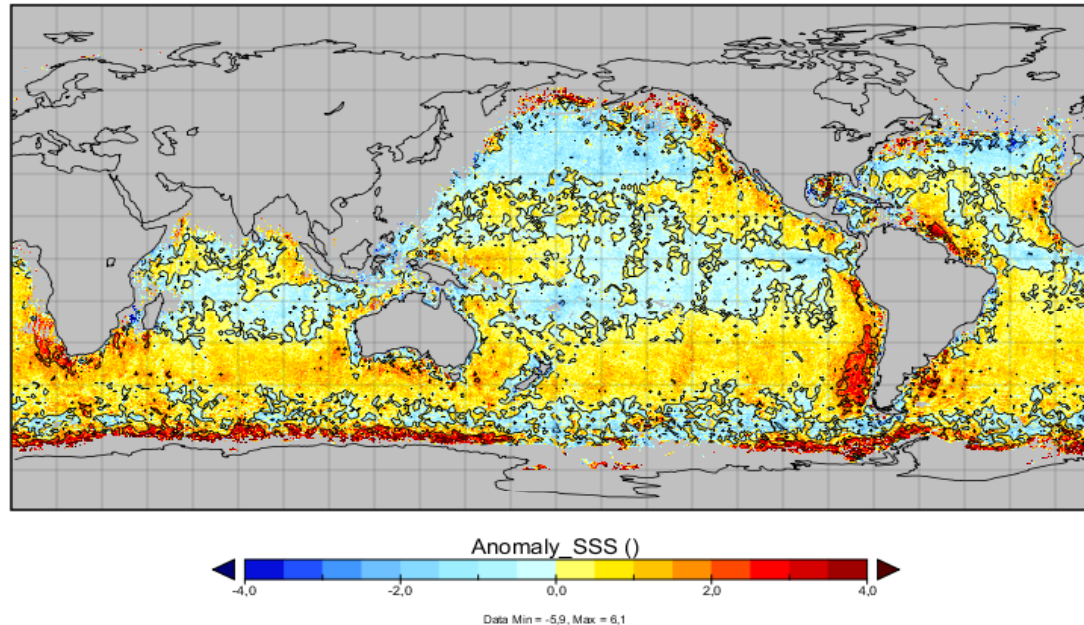
10 days average operationally generated by CP34

CP34 SSS average 20101129 - 20101209



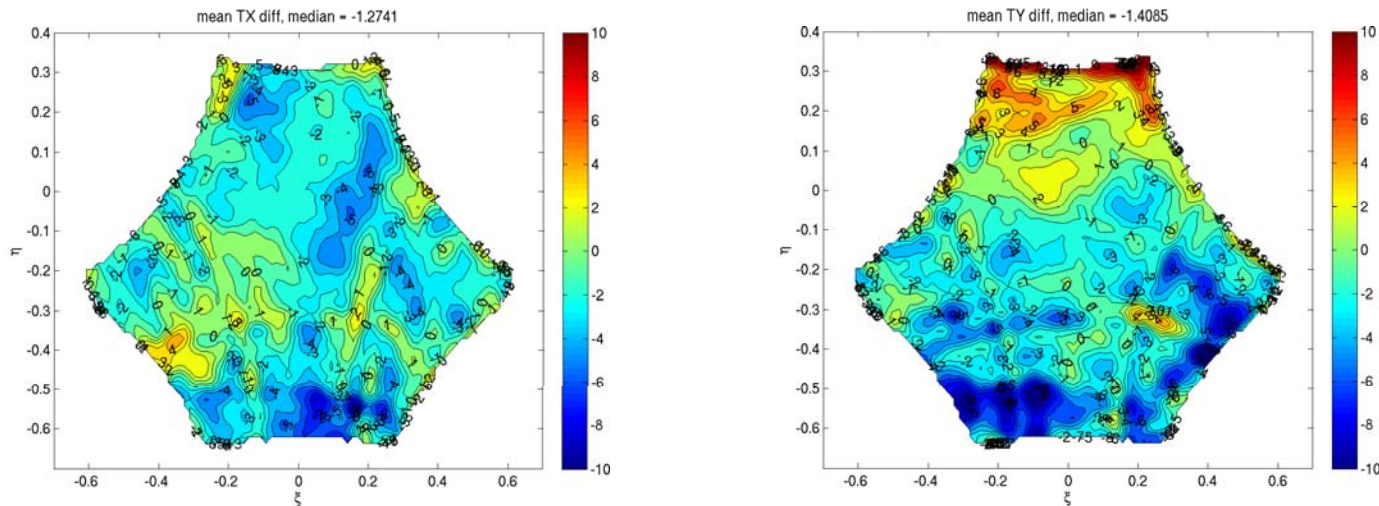
Difference SMOS - World Ocean Atlas 2005 climatology:

SSS Anomaly [2011-02-06 to 2011-02-16]



- Coherent spatial structures in open oceans
- Large areas without SMOS SSS retrieval (L1 flagged)
- Salty anomalies larger than known SSS variability in several zones

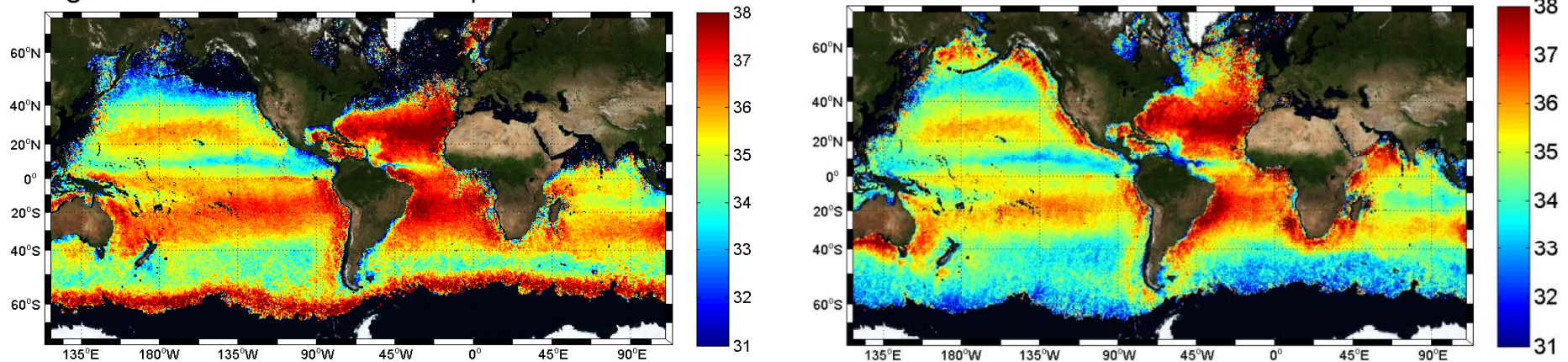
Bias in the comparison of measured and modeled Tb



- Spatial pattern persistent along and in different orbits
- Similar using different ocean emissivity models: related to instrument and image reconstruction imperfections
- Removal technique: additive Ocean Target Transformation (mean residual bias over homogeneous ocean areas) now implemented in L2OP
- Other approaches under analysis

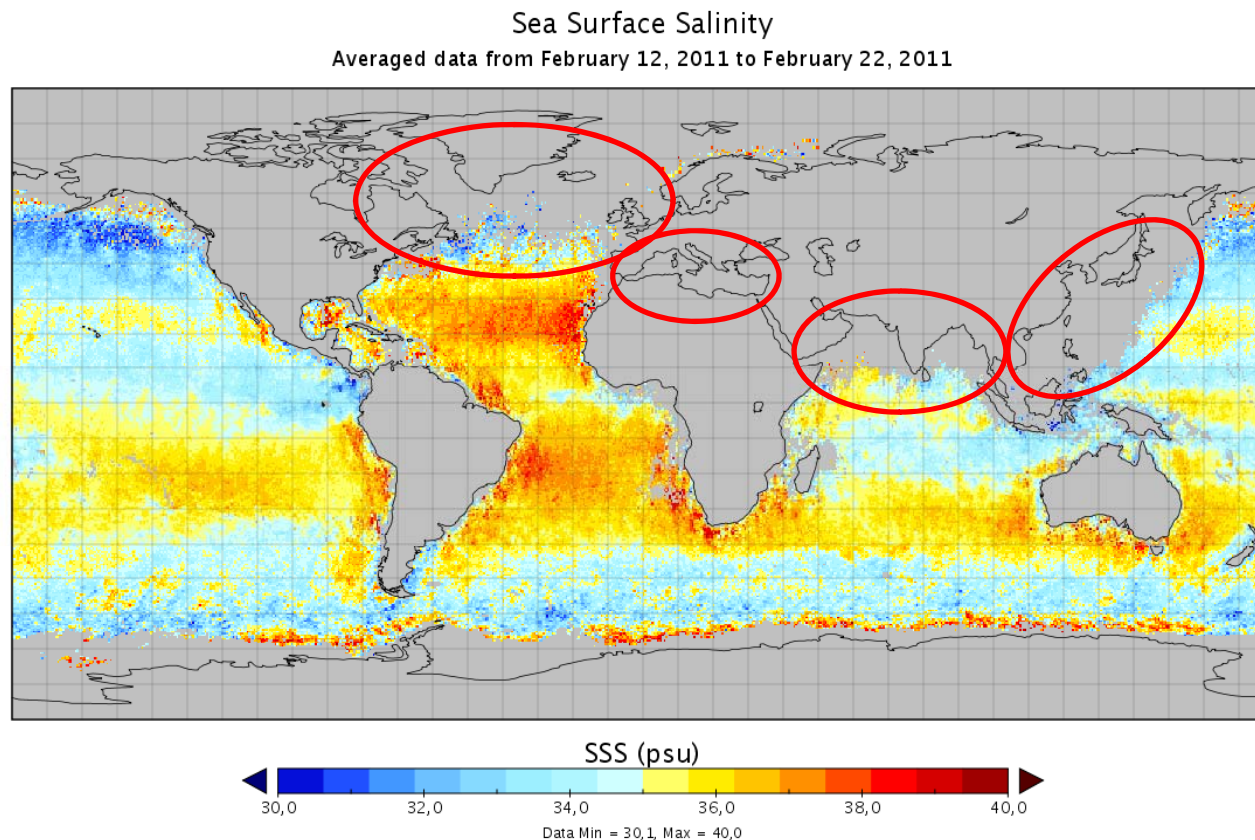
Systematic biases close to land and ice:

1-31 Aug 2010 SMOS Level 3 Data Asc passes from L2 DPGS 1-31 Aug 2010 SMOS Level 3 Data Desc passes from L2 DPGS



- Unrealistic SSS on large strips along continental or ice areas
- Impact of land-ice/sea transition on Tb bias patterns
- Image reconstruction issue: correlated with residual presence of land or ice masses in the extended field-of-view

Contamination from radio frequency interferences (RFI)

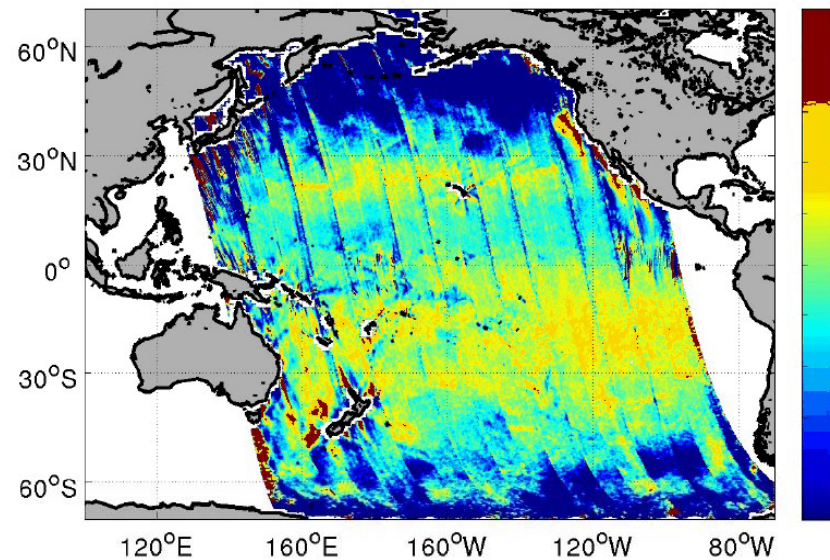


N. Atlantic
Mediterranean
N. Indian
China

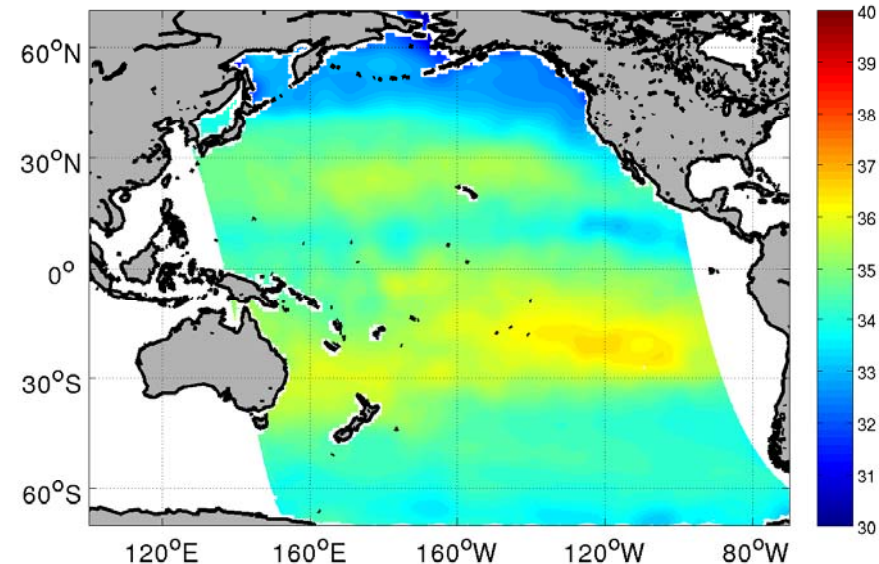
- Emissions within the protected band used by SMOS (1400-1427 MHz)

Imperfect roughness correction models

Pacific SSS as Seen by SMOS (Same OTT Applied to All Orb)



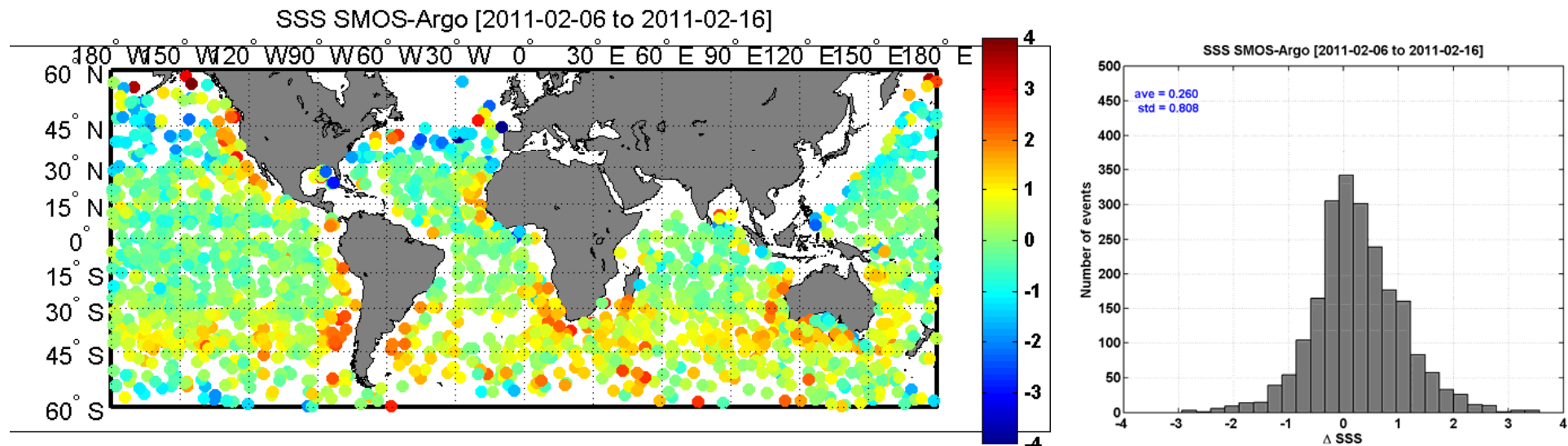
WOA SSS Climatology [psu]



- Simplified SMOS SSS retrieval (3 days in January 2010)
- WOA 2005 climatology for January
- Retrieval fails in areas of strong winds

Anomalies SMOS – ARGO, 6-16 February 2011

SMOS SSS 10 days average L3 generated by CP34
ARGO observations at 7.5 m



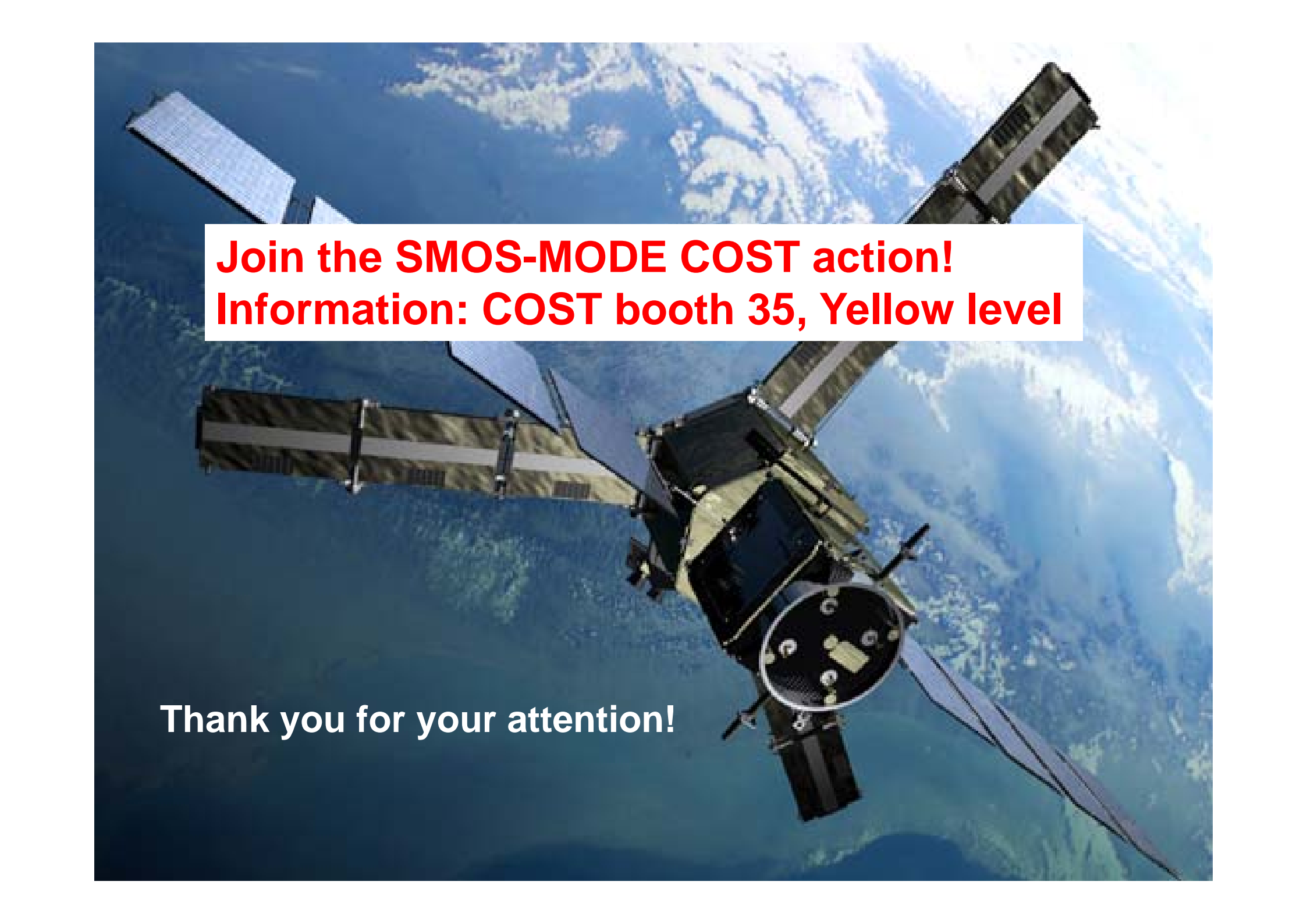
Global bias 0.26, standard deviation 0.81

Skewed to positive anomalies

Still displays impact of land contamination

Worst results in cold and high wind regions

- MIRAS performance above requirements
- Limitations of SSS retrieval due to low Tb sensitivity
- Realistic initial retrievals
- Several processing issues to be solved
 - Systematic biases after calibration
 - Land and RFI contamination
 - Roughness correction models to be improved
 - Impact of antennas temperature (seasonal or asc/desc drifts)
 - Imperfect galactic noise model
 - Errors in cross-polarised information
- SMOS SSS validation at L3 encouraging
- Forward models start being improved with SMOS data

A satellite with multiple solar panels and a central body is shown in orbit against the backdrop of Earth's blue and white clouds. The satellite is oriented diagonally across the frame.

Join the SMOS-MODE COST action!
Information: COST booth 35, Yellow level

Thank you for your attention!