SMOS Payload Performance Assessment

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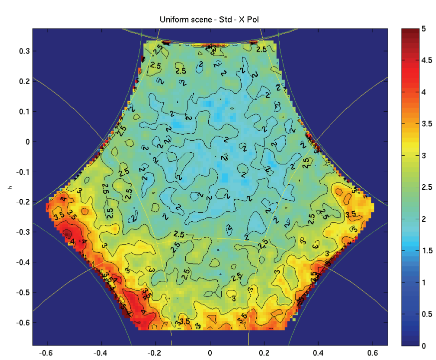
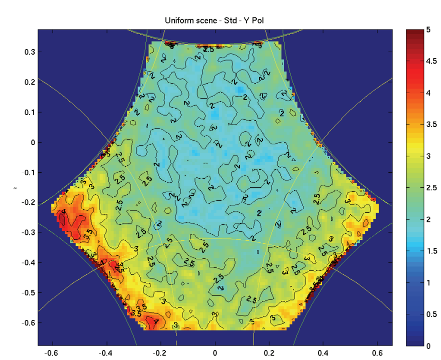
SMOS, ESA's Earth Explorer water mission with the objective of producing global maps of Soil Moisture and Ocean Salinity, was launched 2 November 2009. It carries a single payload, MIRAS, the first-ever spaceborne L-band Microwave Imaging Radiometer with Aperture Synthesis in two dimensions flown into space [1].

The performance requirements of the SMOS payload are demanding in terms of spatial resolution, accuracy, stability and precision, all critical to fulfil its scientific objectives. For this reason a commissioning plan for MIRAS was carefully devised to verify, calibrate and characterise, all instrument parameters which could have an impact on its performances. This presentation describes the most important results from the instrument commissioning phase.

Carefully selected areas are used to assess radiometric accuracy of the final brightness temperature maps, and performances at the system level, including instrument characterisation, processing fine tuning and soil moisture retrieval optimisation and validation.





The plots above illustrate the performance assessment of SMOS at brightness temperature map level. These measurements were acquired over south tropical pacific ocean, considered here as uniform and show the temporal standard deviation of the measured brightness temperature within the SMOS field of view. The observed results fall perfectly within the theoretical expected accuracy of around 2.5K at boresight.

Geolocation biases due to launch shift and arms deployment is assessed using the linear coast of south east Madagascar and a simple instrumental model. Biases consistent with prelaunch error budget are being retrieved and need to be consolidated using more extensive data coverage. Besides, an attempt at using earth horizon during external calibration manoeuvres is also done and will be presented.

At instrument level the most relevant results related to the different subsystems and to the produced calibrated visibilities will be shown, including the performance of the noise injection radiometers, the receivers and the on-board calibration system, as well as the calibration techniques which have been employed.

At higher level, very promising preliminary results have been obtained, despite incomplete characterisation of the instrument. The picture below shows a map of soil moisture retrieved from SMOS data on December 4th, 2009. Only considering nominal vegetation cover, we can make out dominant features of land classes and climatic areas. Of course, these results need much further in depth assesment and validation, which will be carried on within the last months of in orbit commissioning of the SMOS mission.

References

[1] McMullan K., Brown M., Martín-Neira M., Rits W., Ekholm S., Marti J., Lemanczyck J., “SMOS – the Payload”, IEEE Transactions on Geoscience and Remote Sensing, Vol.46, No.3, March 2008.