SMOS FIRST IN FLIGHT RESULTS

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1. INTRODUCTION

It is now well understood that data on soil moisture and sea surface salinity are required to improve meteorological and climatic predictions. These two quantities are not yet available globally or with adequate temporal sampling. However, it was recognized that a spaceborne L-band radiometer with a suitable antenna was the most promising way of fulfilling this gap.
It is within this framework that the European Space Agency (ESA) selected the Soil Moisture and Ocean Salinity (SMOS) mission as its second Earth Explorer Opportunity Mission.
The development of the SMOS mission was led by ESA in collaboration with the Centre National d'Etudes Spatiales (CNES) in France and the Centro para el Desarrollo Tecnologico Industrial (CDTI) in Spain. SMOS carries a single payload, an L-Band 2D interferometric radiometer operating in the 1400-1427 MHz protected band [1]. The instrument receives the radiation emitted from Earth's surface, which can then be related to the moisture content in the first few centimetres of soil over land, and to salinity in the surface waters of the oceans.
SMOS will achieve an unprecedented maximum spatial resolution of 50 km at L-band over land (43 km on average over the field of view), providing multi-angular dual polarized (or fully polarized) brightness temperatures over the globe. SMOS has a revisit time of less than 3 days so as to retrieve soil moisture and ocean salinity data, meeting the mission's science objectives. The caveat being that it will have a somewhat reduced sensitivity when compared to conventional radiometers. The SMOS satellite was launched on 2 November 2009.

2. THE SMOS SATELLITE

The SMOS Satellite is composed of a platform, based on PROTEUS generic platform built by CNES and Thalès Alenia Space (TAS) and the SMOS Payload Module built by CASA EADS for ESA [2]. The system is designed to be able to operate for at least 5 years. The

SMOS satellite was injected into a low-Earth , polar Sun-synchronous orbit (6 am/6 pm) with a mean altitude of 758 kilometres on 2 November 2009. The launch vehicle was the Rockot-Breeze KM, operated by Eurockot from the Plesetsk Cosmodrome in Russia.

Table 1. Measured performances of SMOS (courtesy ESA DEIMOS)

System Parameter	Specified Value (0 = bore sight; 32 = edge of swath)	Measured Value (from tests)
Systematic Error	1.5 K rms (0) 2.5 K rms (32)	0.9 K rms in alias-free FoV
Level-1 SM Radiometric Sensitivity (1.2 s - 220 K)	3.5 K rms (0) 5.8 K rms (32)	2.23 K rms 3.95 K rms
Level-1 OS Radiometric Sensitivity (1.2 s - 150 K)	2.5 K rms (0) 4.1 K rms (32)	1.88 K rms 3.32 K rms
Stability (1.2 s)	4.1 K rms (< 32)	during 10 days inside EMC chamber 4.03 K rms
Stability (long integration)	0.03 K	< 0.02 K

The SMOS instrument was developed in Madrid by EADS-CASA and extensively tested in the ESA and then delivered to Thales Alenia Space in Cannes, France in mid2007 for assembly integration and testing. The satellite was thus fully tested and validated. Table 1 gives the performances as measured during tests at ESA-ESTEC and at Thales Alenia Space.. The numbers refer to both sea and land surfaces at 150K and 220K respectively for a 1.2 s integration time and at boresignt (0°) and at 32° away from boresight.

3. RESULTS

At time of writing SMOS is still in the so called Switch On and Data Acquisition Phase during which the all the equipments are being tested and calibrated. This phase will end on December 21st for the science data commissioning phase.

Nevertheless some results are already available and it was found that the instrument performs exactly as expected though the ground radio frequency interferences (RFI) i.e., man made emissions in a protected frequeny band are high.

Figure 1 shows some first results.

4. REFERENCES

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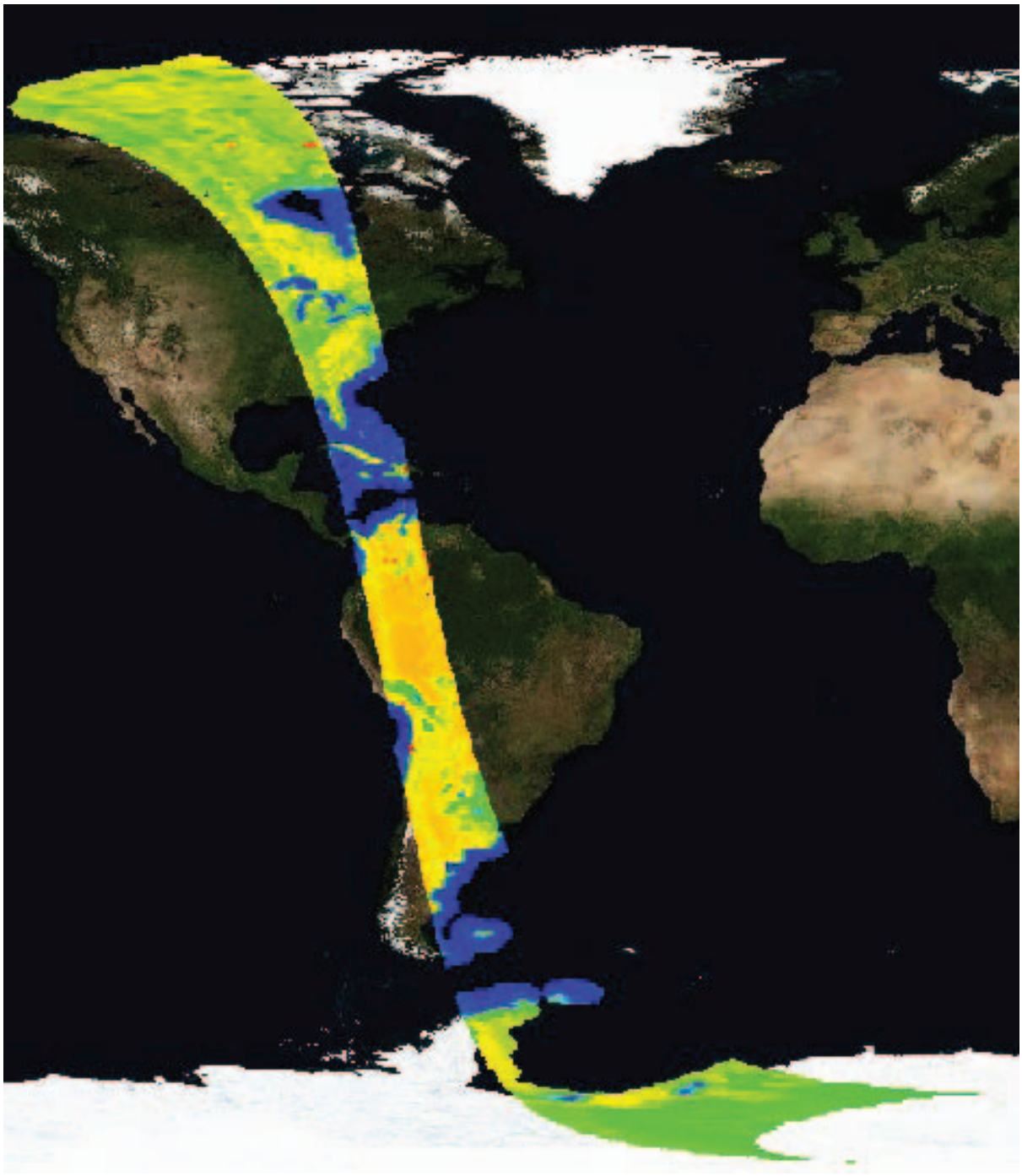

Figure 1 SMOS half orbit acquired on December 4 2009 over the Americas. The brightness temperature range is not indicated here (un-calibrated data) but ranges from 150 (blue to 300) the dark red points are potential RFI sources