SMOS SMAP SYNERGISMS FOR THE RETRIEVAL OF SOIL MOISTURE

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1. INTRODUCTION

It is clear there is a dire need of both soil moisture measurements and sea surface salinity retrievals as they are key parameters of the Earth system. To access them in a global and reliable fashion it seems that – even if complemented by other measurements, L-band radiometry is currently the best choice. The advantages are linked to an optimal trade off between high sensitivity to soil moisture and sea surface salinity versus antenna size and Faraday rotation effect, minimal impact of atmospheric effects, and the fact that the L-band has a protected bandwidth (1400-1427 MHz), reducing the RFI risk. So, up to the late 1980s the main limiting factor for an L-band radiometer was antenna size.

The first dedicated Soil Moisture and Ocean Salinity mission (SMOS) has been launched by the European Space Agency in November 2009 [1]. The Soil Moisture Active and passive (SMAP) concept proposes another approach with a real antenna spinning at a fixed angle. The aim of this paper is to present differences and synergisms between the two approaches [3].

2. THE TWO CONCEPTS

Two options could be envisage in terms of antenna: either use a real aperture antenna or a synthetic one. If a real antenna option had been selected again two options were possible: either relax the antenna size constraint or devise a means to deploy a large antenna in space. Using a smaller antenna meant degrading the spatial resolution and is quite acceptable when the priority is signal purity rather than spatial resolution as encountered over ocean surfaces.

Aquarius is an example of this option with a moderately large antenna used in a push broom mode with three contiguous beams of around 100 km spatial resolution to achieve a 300 km swath [2]. The other option was to devise a way to embark a large but deployable antenna. This venue was explored with many different approaches including IRIS and OSIRIS in the 1990s which were based on inflatable antennas that would be eventually discarded for the deployable light wire mesh antenna – a robust concept already used in several satellites with antennas of >10 m. This concept was proposed for HYDROS [3] and is currently being investigated under the name of Soil Moisture Active and Passive (SMAP). It is a 6 m rotating antenna. It is worth also noting that both Aquarius and SMAP will carry an active L-band system along with the radiometer. SMOS was designed to fulfill the science requirements described in [1]. Logically these requirements are also those of SMAP. The only difference is that SMOS relies on a new instrument concept. Actually, one novel aspect of the SMOS innovative space borne sensor is the use of 2D interferometry and use of the multi angular observations for soil moisture retrieval [4-5]. Previous studies have shown that there are significant look angle dependencies of land surface variables on the measured brightness temperature, meaning that other ancillary data required for soil moisture retrieval can also be estimated, thus resulting in a more accurate retrieval.

3. STEP FORWARD

With SMOS being launched, it is now possible – for the second time - to have spaceborne L band measurements (SKYLAB 1977 gave the first opportunity). But it is the first time the data is available for a continuous and hopefully long period of time and at an adequate resolution. It is thus possible to built SMAP like data and not from simulated (synthetic) estimates but with actual measurements.

For the time being SMOS produces a SMAP like product at 42.5 ° incidence angle (see fig 1) but- at the cost of a reduced swath – it will be possible to elaborate a SMAP footprint. This will enable to foster SMAP algorithm preparation and validation as well as to establish closer links between SMOS and SMAP products and prepare a seamless transition between the two missions when the time comes. It will also enable to evaluate the relative merits and disadvantages of many angles and only one frequency vs one angle and an active device.

The presentation will deal with the first results gained from the inter-comparison.

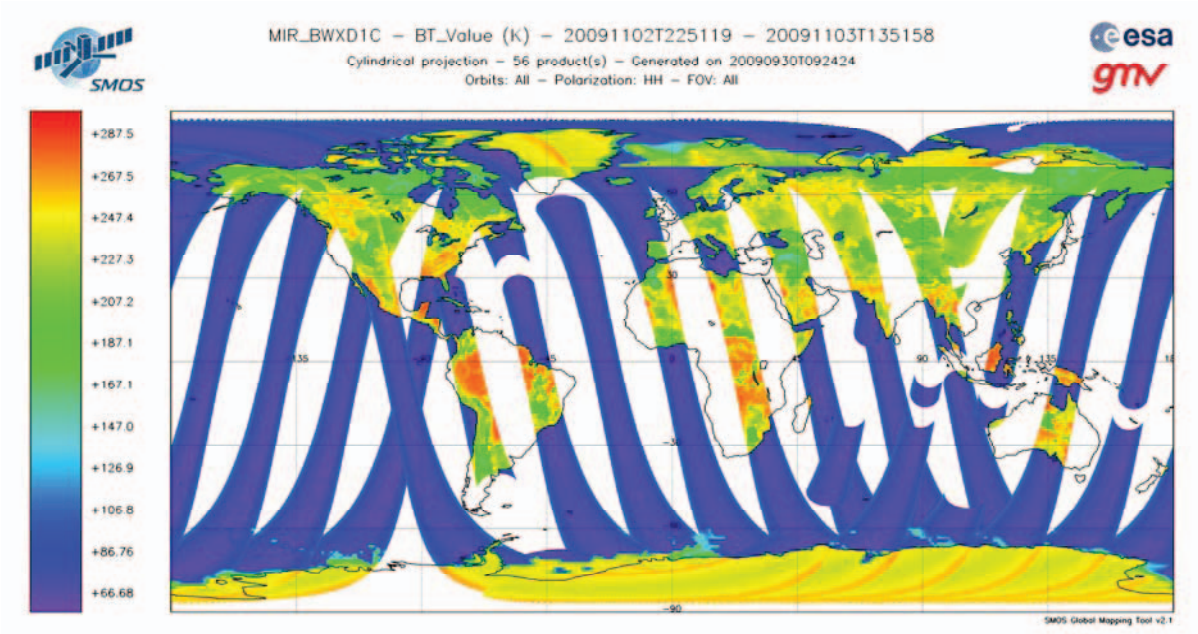

Figure 1 Typical SMAP like SMOS Browse product (data simulated at CESBIO)

4. REFERENCES

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