SMOS SOIL MOISTURE VALIDATION: STATUS AT THE UPPER DANUBE CAL/VAL SITE EIGHT MONTHS AFTER LAUNCH

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1. INTRODUCTION

The Soil Moisture and Ocean Salinity (SMOS) mission, launched by the European Space Agency (ESA) in November 2009, has the objective of providing a global dataset of the key state variables soil moisture and ocean salinity [1]. In order to validate the Level 2 soil moisture products, the maintenance of long term soil moisture monitoring sites is required, matching the spatial resolution of the sensor in the order of 40 km. The Upper Danube catchment, a temperate agricultural area situated mostly in Southern Germany, has an area of 77.000 km² and is one of two major SMOS cal/val test sites in Europe. Its main part is situated in the alpine foreland with heterogeneous land cover and large natural gradients from the Alps northwards. The SMOS cal/val approach is based on local in-situ soil moisture measurements, distributed high resolution land surface modeling, use of ancillary remote sensing data as well as ground based radiometer measurements and airborne campaigns.

2. IN-SITU MEASUREMENTS

Since 2007, the University of Munich routinely collects in-situ soil moisture data within the test site. A network of soil moisture measuring stations has been installed. Soil moisture is measured in various depths. Additionally, meteorological data like precipitation, air temperature and humidity is collected. All data is recorded, transferred and quality checked automatically.

3. LAND SURFACE MODELING

The hydrological model PROMET (Process Oriented Multiscale EvapoTranspiration model, [2], [3]), based on high resolution GIS, is used to simulate hydrological parameters on various scales up to a 1 km grid with hourly resolution over the Upper Danube river basin. It is spatially distributed and describes all important water and energy fluxes related to radiation, vegetation, soil and snow. The model has been extensively validated in different geographic locations in the world.

4. ANCILLARY REMOTE SENSING DATA

Active microwave measurements from ENVISAT ASAR are collected and processed on a regular basis in order to perform a cross-validation of SMOS soil moisture products at the regional scale [4]. Also, a comparison with AMSR-E soil moisture products is conducted.

5. GROUND BASED RADIOMETER

A ground based microwave radiometer (ELBARA-II) was installed in September 2009 on an experimental farm in Southern Germany about 30 km west of Munich. It is mounted on a four meters high scaffolding that allows to turn the radiometer to look at two different fields with grass and winter rape as land use respectively. The radiometer measures the natural emission of the two fields in the microwave domain with a wavelength of 1.4 GHz. Its working principle is similar to that of SMOS, so that it can be used for the validation of the radiative transfer model LMEB, which is used in the SMOS Level 2 processor, on the field scale. To support the validation, extensive environmental measurements are being made at the test site. Vegetation and snow parameters are also recorded on a regularly basis. Soil roughness is measured with a photogrammetric approach.

6. AIRBORNE CAMPAIGNS

Best soil moisture retrieval performance is expected in the smaller catchment of the river Vils, situated in the Northeast of the city of Munich [5] with relatively flat terrain and fairly homogeneous soils. This area, whose size roughly matches that of a SMOS pixel, is the focus of airborne campaigns. No open water bodies or large urban areas considerably affect the passive microwave signal in that area and radio frequency interference (RFI) is expected to be low. In April 2008, the SMOS Validation Rehearsal Campaign was conducted. Two radiometers (EMIRAD, HUT-2D) were flown within a multi-week period and extensive ground data was collected. During the SMOS Validation Campaign in spring and early summer 2010, an entire SMOS pixel shall be covered.

7. CONCLUSIONS

In the Upper Danube cal/val site, an operational framework has been developed to compare SMOS soil moisture products against in situ measurements, land surface model simulations, ancillary satellite data and airborne radiometer data in an efficient way. The paper will give an overview about the existing data sets, the developed infrastructure and ongoing activities in the Upper Danube SMOS validation site about eight months after SMOS launch. First comparisons of SMOS data with other data sets will be presented.

8. REFERENCES

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