ACCESS TO SOIL MOISTURE VALUES OVER A SAHELIAN AREA: MODELING, REMOTE SENSING, AND GROUND MEASUREMENTS.

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1. ABSTRACT

Soil moisture is one of the most important variables that influences the soil-vegetation-atmosphere fluxes. This is particularly true over the Sahelian region, soil moisture has an important feedback on precipitation. It is particularly difficult to access to soil moisture values because its high temporal and spatial variability. Different approaches exist, but microwave remote sensing is the more appropriated to measure soil moisture values and its variations [1]. The futur SMOS (Soil Moisture and Ocean Salinity) mission is the first dedicate to soil moisture measurements [2]. The passive microwave sensor will be launched in July 2009, and will record earth emissivity in L-band. This paper proposes an evaluation of three approaches to estimate soil moisture values over a Sahelian region based on ground measurements.

In the context of the AMMA (African Monsoon Multidisciplinary Analysis) project, the Gourma region, located in Mali, was instrumented. This site is representative of climatic, hydrological and environmental conditions of semi-arid areas. The soil moisture network is specifically designed to address the validation of remotely sensed soil moisture in the context of the preparation of the SMOS project. Soil moisture values are recorded at 15 minutes time-step at 5 cm of depth. An up-scaling function is applied to local information to convert to kilometre scale prior comparison with large scale informations [3].

Three methods to measure soil moisture values are evaluated:
1. The SMOS end-to-end simulations, are provided by a complete simulation of SMOS instrument and ground system prototypes [4]. This data set relies on ground measurements used as input data: soil moisture, soil and air temperature, and LAI. Brightness temperature at instrument input plane are first computed with the same radiative transfer as will be used at retrieval level. The instrument characteristics and satellite position are then used to evaluate the brightness temperature as could be measured by actual SMOS. At last, and making use of auxiliary data sets, soil moisture can be retrieved from these simulated brightness temperatures.
2. Several soil moisture products are already provided based on active and passive microwaves sensor. [5] shows the product provided by Amsterdam University based on AMSR-E (Advanced Microwave Scanning Radiometer - EOS) is the best over this area compared to others. This product is based on Land Parameter Retrieval Model [6].
3. The last one is a simple statistical inversion based on AMSR-E brightness temperature. The 6.9 and 10.7 Ghz channels are used at two polarizations (H and V). A part of the ground data is used to expand the algorithm. Thus, the statistical inversion is optimised over the Gourma region.

The goal of the study is an evaluation of three approaches to assess soil moisture values over the Gourma area during two months corresponding to monsoon period 2008. The aim is to measure, for each method, the ability to capture absolute values, variation amplitude and temporal variability of surface soil moisture. The spatial distribution is also investigated.

2. REFERENCES

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