Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11678, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11678
EGU General Assembly 2008

ALMIP-MEM: AMMA Land surface Models Inter-comparison Project - Microwave Emission Model

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Soil moisture is a key variable modulating land-surface-atmosphere feedbacks as it controls the water and energy exchanges between the surface and the atmosphere. West Africa is theorized to be one of the regions of the Earth where the coupling between soil moisture and precipitation is most significant. The role of soil moisture on the West African Monsoon is addressed within the ALMIP project, for which an ensemble of state-of-the-art land surface models have been run at a regional scale over western Africa for the period from 2002 to 2006 (see the ALMIP presentation by Boone and de Rosnay). ALMIP provides the simulated soil moisture for this period at a 3-hour temporal resolution.

Regional scale validation of simulated soil moisture requires the use of remote sensing approaches to ensure the consistency of the soil moisture data set over large temporal and spatial scales. One of the most promising approaches for soil moisture remote sensing is the use of low frequency passive microwave measurements. Within this context, the Advanced Microwave Scanning Radiometer (AMSR-E) on the Earth Observing System (EOS) Aqua satellite was launched in May, 2002. It measures radiation at six frequencies in the range 6.9-89 GHz of which the lowest frequencies (C-band 6.9 GHz and X-band 10.7 GHz) are highly suitable for surface soil moisture monitoring. The SMOS (Soil Moisture and Ocean Salinity) mission is scheduled for launch in 2008 and one of the goals is to deliver global fields of surface soil moisture using L-band (1.4 GHz) radiometry, which has been shown to be the frequency most sensitive to soil moisture. In this context, AMMA is an evaluation site for the future SMOS sensor for 2008-2010.

In this paper, we propose a coupling between ALMIP and a Microwave Emission Model in order to produce a set of C-band and X-band brightness temperatures for the different ALMIP models, as seen by the AMSR-E 6.9 sensor. For the simulation of the brightness temperatures associated with soil wetness, we have chosen the CMEM (Community Microwave Emission Model) from ECMWF (European Centre for Medium Range Weather Forecasts). This model is specifically designed to be coupled to Land Surface Models used in Numerical Weather Prediction and Climate Modelling. It is based on the state of the art in microwave emission modelling which has been developed within the context of the preparation for the SMOS mission. It is able to simulate the brightness temperature for the L-band (as will be seen by SMOS after 2008), C-band and X-band (as seen by AMSR-E).

The range of simulated brightness temperature by the different models will be evaluated against AMSR-E C-band and X-band data set, which will provide an evaluation tool for the simulated soil moisture. The approach and preliminary results are presented here.