Geophysical Research Abstracts
Vol. 13, EGU2011-7210, 2011
EGU General Assembly 2011

Joint analysis of global soil moisture modeled fields and related satellite observations

Jimenez Carlos (1), Aires Filipe (2), Prigent Catherine (1), Clark Douglas (3), Blyth Eleanor (3), and Kolassa Jana (2)

(1) Observatoire de Paris, LERMA, Paris, France (carlos.jimenez@obspm.fr), (2) Estellus, Paris, France, (3) CEH, Wallingford, UK

Before the launch of the Soil Moisture and Ocean Salinity Mission (SMOS), there was no dedicated satellite mission to globally characterize soil moisture. Some satellite observations with sensitivity to soil moisture exist [1], but these observations were not optimized for land surface characterization, and the retrieved satellite soil moisture data from the observations typically exhibit large differences in annual means and temporal variability [2]. This makes it difficult to assess the performance of the moisture fields from land surface and hydrological models.

Any comparison or assimilation of satellite soil moisture typically requires a previous pre-processing of the satellite data to make it consistent with the model fields. For instance, satellite-model biases are usually removed through matching of distribution functions. We propose here a novel approach based on statistical models mapping the satellite observations onto the land model soil moisture fields [3]. The technique consists of calibrating a statistical model based on neural networks to produce soil moisture estimates consistent with the observations and the land surface model field. This approach allows: (1) to combine observations from different wavelengths to exploit their synergy and reduce the impact of the individual observation limitations; (2) to use directly the raw satellite observations, bypassing the estimation of the soil moisture state from the observations.

The technique is illustrated by linking a suite of satellite observations, including passive microwave emissivities, active microwave scatterometer data, and infrared estimates of the diurnal amplitude of the surface skin temperature, with the soil moisture fields of the land surface model JULES [4]. The statistical models are first calibrated and then used to produce observation-driven soil moisture estimates. The new soil moisture estimates can then be used to check the consistency of the land surface model and the observations. The comparison of the soil moisture from the observation-driven statistical model and the land surface model soil can reveal particular problems in the land model outputs (and satellite observations), in terms of geographical distributions or seasonality, which can be used to guide further model development. The statistical modelling can also serve as the basis for a variational assimilation of the satellite observations into the surface model. The statistical model soil moisture estimates are assimilated instead of the raw satellite observations, or the retrieved satellite soil moisture. This is particularly useful when a good forward model does not exist, or when the retrieved satellite soil moisture differs substantially from the land surface model fields.

[1] Prigent, C., F. Aires, W. B. Rossow, and A. Robock (2005), Sensitivity of satellite microwave and infrared observations to soil moisture at a global scale: Relationship of satellite observations to in situ soil moisture measurements, J. Geophys. Res., 110, D07110, doi:10.1029/2004JD005087.

[2] Reichle, R. H., R. D. Koster, P. Liu, S. P. P. Mahanama, E. G. Njoku, and M. Owe (2007), Comparison and assimilation of global soil moisture retrievals from the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E) and the Scanning Multichannel Microwave Radiometer (SMMR), J. Geophys. Res., 112, D09108, doi:10.1029/2006JD008033.

[3] Aires, F., C. Prigent, and W. B. Rossow (2005), Sensitivity of satellite microwave and infrared observations to soil moisture at a global scale: 2. Global statistical relationships, J. Geophys. Res., 110, D11103, doi:10.1029/2004JD005094.

[4] Blyth, E., M. Best, P. Cox, R. Essery, O. Boucher, R. Harding, C. Prentice, P.L. Vidale and I. Wood-

ward (2006) JULES: a new community land surface model, Global Change NewsLetter, pp. 9-11, No. 66.