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Reliable validation of soil moisture estimates from ASCAT and AMSR-E sensors through four different approaches

Luca Brocca (1), Florisa Melone (1), Tommaso Moramarco (1), Patrick Matgen (2), and Wolfgang Wagner (3)

(1) Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, Italy, (2) Public Research Center - Gabriel Lippmann, Belvaux, Grand-Duchy of Luxemburg, (3) Institute of Photogrammetry and Remote Sensing, Vienna University of Technology, Vienna, Austria

The importance of soil moisture for hydrological applications is widely recognized. Nowadays, information about soil moisture variability in the space-time domain can be retrieved from several satellite sensors in the microwave band (e.g., AMSR-E, ASCAT, MIRAS, WINDSAT). Besides the improvement of inversion algorithms, the development of reliable validation techniques for soil moisture estimates obtained by remote sensing is a significant scientific and operational issue. In fact, the use of in-situ observations, giving information at local scale, for the assessment of coarse resolution (typically 25 km) satellite data may provide non-consistent results. Therefore, development and testing different validation strategies is of particular interest, mainly considering satellite missions that are specifically dedicated to soil moisture estimation (i.e. SMOS and, in the near-future, SMAP).

In this study, different validation approaches were applied for the analysis and inter-comparison of data stemming from two satellite sensors: ASCAT (Advanced SCATterometer) and AMSR-E (Advanced Microwave Scanning Radiometer - Earth observing system). In particular, two standard methodologies were employed: comparison with in-situ observations and modelled soil moisture data. Moreover, the capability of satellite sensors to estimate the soil wetness conditions before a storm event was assessed by using rainfall-runoff data at catchment scale (Brocca et al., 2009). Finally, the potential of satellite data to enhance runoff prediction by assimilating them into continuous rainfall-runoff models was tested (Brocca et al., 2010). These two latter methods are particularly remarkable as they offer a better understanding of the effective use of satellite soil moisture for hydrological applications.

The comparison of four different techniques and two satellite sensors (ASCAT and AMSRE) will furnish a better and in-depth understanding of the capability of these sensors for soil moisture estimation. Several sites across Europe, for which soil moisture and rainfall-runoff data are available, were used as case studies considering a three year and half period (January 2007-August 2010). Results can be summarized as follows: (i) ASCAT clearly outperforms AMSR-E in terms of their capability to reproduce in-situ observations and modelled data with correlation coefficients higher than 0.85, and (ii) thanks to their high accuracy, ASCAT soil moisture data can be effectively used to improve flood prediction and forecasting through its assimilation in rainfall-runoff modelling. It has to be noted that the techniques employed can be easily applied also for others satellite sensors (e.g. MIRAS on-board SMOS) and for different physiographic regions.

References

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