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Rainfall estimation from soil moisture data: crash test for SM2RAIN algorithm

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Soil moisture governs the partitioning of mass and energy fluxes between the land surface and the atmosphere and, hence, it represents a key variable for many applications in hydrology and earth science. In recent years, it was demonstrated that soil moisture observations from ground and satellite sensors contain important information useful for improving rainfall estimation. Indeed, soil moisture data have been used for correcting rainfall estimates from state-of-the-art satellite sensors (e.g. Crow et al., 2011), and also for improving flood prediction through a dual data assimilation approach (e.g. Massari et al., 2014; Chen et al., 2014).
Brocca et al. (2013; 2014) developed a simple algorithm, called SM2RAIN, which allows estimating rainfall directly from soil moisture data. SM2RAIN has been applied successfully to in situ and satellite observations. Specifically, by using three satellite soil moisture products from ASCAT (Advanced SCATterometer), AMSR-E (Advanced Microwave Scanning Radiometer for Earth Observation) and SMOS (Soil Moisture and Ocean Salinity); it was found that the SM2RAIN-derived rainfall products are as accurate as state-of-the-art products, e.g., the real-time version of the TRMM (Tropical Rainfall Measuring Mission) product. Notwithstanding these promising results, a detailed study investigating the physical basis of the SM2RAIN algorithm, its range of applicability and its limitations on a global scale has still to be carried out.
In this study, we carried out a crash test for SM2RAIN algorithm on a global scale by performing a synthetic experiment. Specifically, modelled soil moisture data are obtained from HTESSEL model (Hydrology Tiled ECMWF Scheme for Surface Exchanges over Land) forced by ERA-Interim near-surface meteorology. Afterwards, the modelled soil moisture data are used as input into SM2RAIN algorithm for testing weather or not the resulting rainfall estimates are able to reproduce ERA-Interim rainfall data. Correlation, root mean square differences and categorical scores were used to evaluate the goodness of the results.
This analysis wants to draw global picture of the performance of SM2RAIN algorithm in absence of errors in soil moisture and rainfall data. First preliminary results over Europe have shown that SM2RAIN performs particularly well over southern Europe (e.g., Spain, Italy and Greece) while its performances diminish by moving towards Northern latitudes (Scandinavia) and over Alps. The results on a global scale will be shown and discussed at the conference session.

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