EGU21-9639, updated on 05 Jul 2022
https://doi.org/10.5194/egusphere-egu21-9639
EGU General Assembly 2021

Toward Self-calibrated SM2RAIN-based rainfall product

Paolo Filippucci[1,2,3], Luca Brocca[1], Angelica Tarpanelli[1], Christian Massari[1], Wolfgang Wagner[2], and Carla Saltalippi[3]

[1]Consiglio Nazionale di Ricerca (CNR), Istituto di Ricerca per la Protezione Idrogeologica (IRPI), Perugia, Italy (paolo.filippucci@irpi.cnr.it)

[2]TUWien (Technische Universität Wien), Department of Geodesy and Geoinformation, Wien, Austria

[3]University of Perugia, Department of Civil and Environmental Engineering, Perugia, Italy

Reliable and detailed precipitation measurements are fundamental in many hydrological and hydraulic applications. In-situ measurements are the traditional source of this information, but the declining number of stations worldwide, the low spatial representativeness and the problems in data access, limit their relevance. In the last years, satellite products have been used to fill the gap of the ground data.

The estimation of precipitation by satellites can be conceptualized via two different approaches: the top-down approach, where the rainfall is estimated by exploiting the electromagnetic properties of clouds, and the bottom-up approach, where rainfall is indirectly obtained by exploiting the inversion of the water balance equation once soil moisture observations are observed by satellites. SM2RAIN algorithm **[Brocca et al., 2014]** belongs to the second methodology and has distinguished itself to provide accurate rainfall estimation, particularly in regions characterized by low density of rainfall gauges; however, the use of SM2RAIN relies upon a calibration dataset which represents a main limitation for its applicability.

In this study, starting from the kwowledge of Advanced SCATterometer (ASCAT) soil moisture, topography and climatology of each pixel of land surface, a methodology for the application of SM2RAIN without using observed rainfall time series for calibration is proposed. Four parametric relationships dependent from physical descriptors of each pixel are developed by using 1009 points uniformly distributed in Australia, India, Italy and the United States, allowing the estimation of SM2RAIN parameter values- A global validation of the methodology is conducted by comparing the performance of the parametrized product against those of a calibrated SM2RAIN product. The Final Run version of the Integrated Multi-Satellite Retrievals for Global Precipitation Measurement (IMERG) is used for the performance assessment, together with triple collocation techniques against gauge-based Global Precipitation Climatology Center (GPCC) product and the Early Run version of IMERG.

The approach was also applied to a high resolution (~1 km) Soil Moisture product over test regions in Italy and Austria obtaining promising results and showing that good quality rainfall estimates at 1 km of spatial resolution can be obtained also without calibration.