

Integration of Satellite-Derived Rainfall and Soil Moisture for Enhanced Rainy Day Detection: Implications for Hydrologic Modeling (Oral)

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ABSTRACT

Daily rainfall estimates derived from remote sensing have often proven problematic in many regions of the world. This is particularly common in semi-arid areas where, in addition to overestimating the intensity of rainfall events, spatial rainfall products (SPPs) often fail to correctly detect many events. Whether events are missing or incorrectly detected, the overestimation of rainfall event frequency constitutes a real constraint for the calibration and validation of hydrological models. We therefore aim here to improve the ability of certain well-known SRP products from the Global Precipitation Measurement (GPM) and Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN) families to distinguish rainy from non-rainy events (using soil moisture) and to assess the impact this may have on the simulation of hydrological response. The focus was mainly on filtering the false alarms by identifying those induced by sensor failure from those that are the result of the spatial mismatch between the SPPs' areal coverage and the stations' point scale. To this end, the raw and filtered SPPs were used to feed the HBV conceptual hydrological model in watersheds with different climatic contexts.

When using raw SRP data, the HBV model's performance proved to be relatively poor and unstable over time. This is mainly due to uncertainties associated with SRP estimates. Even the best-performing product (GPM IMERG) was found to significantly underestimate rainfall by up to 50%. In particular, a prevalence was also observed in terms of detection capability, with a non-negligible number of missed events (according to the POD; Probability of Detection) and many detected as false alarms (according to the FAR; False Alarm Ratio). However, the filtering of false alarms has contributed to relatively improving the simulation of streamflow. A large percentage of false alarms were found to be actual rainfall events (corresponding to streamflow peaks) that were missed by the rain gauges due to low measurement network spatial representativeness.

Keywords: Rainfall; Soil moisture; Hydrologic Modeling; HBV.