



On the relation between satellite rainfall accuracy and the hydrological modelling performance

Stefania Camici, Luca Ciabatta, Christian Massari, and Luca Brocca

National Research Council, Research Institute for Geohydrological Protection, Perugia, Italy (s.camici@irpi.cnr.it)

Rainfall is the primary input for hydrologic models that simulate the rainfall-runoff processes at basin scale. Because rainfall is highly variable in space and time, accurate hydrological simulations require accurate rainfall data at the best possible resolution. The conventional rain gauge observations in many parts of the world are sparse and unevenly distributed. An alternative to traditional rain gauge observations could be satellite-based rainfall products (SRPs) that nowadays are available on a global scale at ever increasing spatial and temporal resolution. The global importance of satellite-derived rainfall has led a large number of studies aimed to compare the accuracy of various satellite rainfall products over land to meet the needs of various users. Generally, the satellite data and hydrologic communities characterize the accuracy of rainfall data using categorical (e.g., probability of detection, false alarm ratio, bias score) and/or continuous (e.g., bias, correlation coefficient, R, root mean square error, RMSE, standard deviation of error) metrics. These metrics have proved useful in assessing satellite rainfall algorithms at scales pertinent for climate modeling, weather prediction, or even large-scale water management studies. However, with the continued shift toward high resolution SRPs (5–10 km and hourly), there is an urgent need to investigate metrics that can more effectively advance the use of SRPs for hydrological applications, and specifically for flood modeling.

The objective of this study is to explore the connection between the accuracy of different SRPs and their performance in terms of flood modelling. The following research questions need to be addressed: which is the more appropriate error metric to be used to select the best performing rainfall product for flood modelling? Are a high R and a low RMSE informative of a better performance in terms of hydrological modeling? Is it better to consider the R and RMSE, or the categorical scores, or a combination between them?

To answer these questions, multiple SRPs (i.e. the Tropical Rainfall Measurement Mission (TRMM) Multi-satellite Precipitation Analysis TMPA; the Climate Prediction Center (CPC) Morphing algorithm, CMORPH, the Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks, PERSIANN) will be used to force a lumped hydrologic model (MISDc, “Modello Idrologico Semi-Distribuito in continuo”, Masseroni et al., 2017) over multiple (+900) basins throughout Europe with different sizes and physiographic characteristics. Preliminary results obtained for a small sample (15) of European basins have suggested that R is not a reliable metric to select the best performing rainfall for hydrological modelling whereas RMSE is more appropriate. Moreover, we observed that small variations of RMSE provide large variations in terms of flood peak simulation. More in-depth analysis will be carried out to explore the connection among the rainfall performances, the basins characteristics and the hydrological model performance, and will be presented at the conference.

REFERENCES

Masseroni, D., Cislighi, A., Camici, S., Massari, C., Brocca, L. (2017). A reliable rainfall-runoff model for flood forecasting: review and application to a semiurbanized watershed at high flood risk in Italy. *Hydrology Research*, in press, doi:10.2166/nh.2016.037.