Tropentag, September 14-16, 2022, hybrid conference

"Can agroecological farming feed the world?
Farmers' and academia's views"

Reliability of gridded precipitation products for water management studies: a case study in the Ankavia river basin in Madagascar

Zonirina Ramahaimandimby[1], Alain Randriamaherisoa[2], François Jonard[3,1], Marnik Vanclooster[1], Charles Bielders[1]

[1] *Université Catholique de Louvain, Earth and Life Institute, Belgium*
[2] *Université d'Antananarivo, Génie Civil, Madagascar*
[3] *University of Liège, Earth Observation and Ecosystem Modelling Laboratory, Belgium*

Abstract

Hydrological modelling for water management in large watersheds requires accurate spatially distributed rainfall time series. In case of low coverage density of ground-based measurements, gridded precipitation products (GPP) from satellite/gauge/model-based merging products constitute an attractive alternative, the quality of which must nevertheless be assessed. The objective of this study was to evaluate at different time scales the reliability of six GPPs against a 2-year record from a network of 14 rainfall gauges located in the Ankavia catchment (Madagascar). The GPPs considered in this study are African Rainfall Climatology (ARC2), Climate Hazards groups Infra-Red Precipitation with station data (CHIRPS), the ECMWF Reanalysis (ERA5), Integrated Multi-satellitE Retrievals for Global Precipitation Measurement (IMERG v06 Final), Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks- Cloud Classification System (PERSIANN-CCS), African Rainfall Estimation (RFEv2) The results suggest that IMERG ($R^2 = 0.63$, slope of linear regression a = 0.96, root mean square error RMSE = 12 mm/day, mean absolute error MAE = 5.5 mm/day) outperforms other GPPs at the daily scale, followed by RFEv2 ($R^2 = 0.41$, a = 0.94, RMSE = 15 mm/day, MAE = 6 mm/day) and ARC2 ($R^2 = 0.30$, a = 0.88, RMSE = 16 mm/day, MAE = 6.7 mm/day).. All GPPs, with exception of the ERA5, overestimate the "no rain" class value (0 0.2 mm/day). ARC2, IMERG, PERSIANN, RFEv2 all underestimate rainfall occurrence in the 0.2 150 mm/day, whilst CHIRPS, ERA5 overestimate it. Only CHIRPS and PERSIANN could estimate extreme rainfall (>150 mm/day) satisfactorily. According to the Critical Success Index (CSI) categorical statistical criteria, IMERG performs quite well in detecting rain events in the range 2 150 mm/day, whereas PERSIANN outperforms IMERG for rain events larger than 150 mm/day. Because it performs best at daily scale, only IMERG was evaluated for time scales other than daily. At the yearly and monthly time scales, the performance is good with $R^2 = 0.97$ and 0.87, respectively. At the event time scale, the Probability Distribution Function PDFof rain gauge values and IMERG data show good agreement. However, at the hourly scale, the correlation between ground-based measurements and IMERG data becomes poor ($R^2 = 0.20$). Overall, IMERG products can be regarded as the most reliable precipitation source at monthly, daily and event time scale for hydrological applications in the study area, but the poor agreement at hourly time scale and the inability to detect extrem rainfall >100 mm/day may nevertheless restrict its use.

Contact Address: Zonirina Ramahaimandimby, Université Catholique de Louvain, Earth and Life Institute, Rue des sports 11/303, 1348 Louvain-la-neuve, Belgium, e-mail: zoramahaimandimby@gmail.com

Keywords: Ankavia catchment, GIRE SAVA, GPM-IMERG, madagascar, satellite precipitation products