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Quantitative Precipitation Estimation Using Weather Radar and Rain Gauge Data Fusion with Machine Learning

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Abstract

Quality Data in quantitative precipitation estimation (QPE) is an important tool for many applications such as flash flood forecasting and hydropower generation management. Precipitation estimates have been generated using different radar Z-R and polarimetric relationships, both from the literature and locally adjusted, with reasonable adjustments with rain gauges and distrometers, considering data filtering, range from radar, orography, signal propagations among other factors that may affect the estimates. We have developed and used operationally a QPE multi-sensor fusion approach with the usage of weather radar, satellite and rain gauge data which does not require frequent processing to update the weights of the data sources, as in other schemes. However, we have noticed that an improvement in the radar QPE would benefit the operational algorithm, reducing the errors and numerical instabilities. This work introduces a machine learning model for Quantitative Precipitation Estimation based on the combination fusing polarimetric variables and rain gauge data with more frequent updates (5 to 15 minutes). The proposed method is based on machine learning (tree based methods). Initially, we used random forest and gradient boosting techniques to improve the accuracy of the estimates and evaluated the impact of these algorithms on the operational environment.

Keywords: Precipitation, Radar, Machine Learning, Nowcasting.