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Development of an error model for the Megha-Tropiques combined precipitation product

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Satellite products based on the combination of observations from geostationary cloud top sensitive channels together with microwave imagers channels have shown a tremendous increase of their overall quality, especially at the meteorologically relevant scales, over the recent decade. The need for a comprehensive error estimate along with the basic rain amounts has also become a key issue for a good utilization of these second generation products.

The Megha-Tropiques (MT) Level 4 combined Infrared Microwave rainfall estimation product aims to provide daily rainfall accumulations and their associated errors due to sampling, calibration and algorithmic issues at one-degree resolution over all the Tropical belt. The current developments of the sampling error model for the MT precipitation product are based on previous efforts dedicated to variogram computations. Work is ongoing to study the sensitivity of the error estimations to the variability of the space and time variogram characteristics. This error model is used to feed a novel methodology of validation for rainfall estimation products that accounts for both rain gauge and satellite product uncertainties. An overview of this validation technique is presented and the sensitivity of the validation statistics to different assumptions is investigated. In particular, the rainfall estimations of three operational products (TMPA, GSMAP-MVK and EPSAT-SG) as well as of the preliminary MT Level 4 product are compared to rain gauge products at several meteorologically relevant scales during the 2006 monsoon season over the West African region. The CILSS rain gauge network is used over the Sahelian band for a 1°-10-day comparison, as well as ground data from two dense rain-gauge networks of the AMMA program near Niamey in Niger and near Ouémé in Benin for a daily and 3-5 day-filtered daily analysis. One of the findings of the present study over a semi-arid region is the significant contamination of classical validation scores by uncertainties on both ground and satellite products. Also it is noticed that the precipitation variability is described by the satellite products as well as by the ground measurement products, at least at the 10-day scale.

This methodology of validation, taking into account both rain gauge and satellite product uncertainties, is used as a framework for the development of the MT L4 rain product with its sampling error model. It is a very general method that could be applied again with other products and another rainfall estimation error model.