Correcting Satellite Based Precipitation Products Using SMOS Measurement

Thierry Pellarin*†[1], Samuel Louvet , Guillaume Quantin[2], Cedric Legout , Ahmad Al Bitar[3], and Yann Kerr[4]

[1]Laboratoire d'étude des transferts en hydrologie et environnement (LTHE) – CNRS : UMR5564 – ENSHMG - Domaine Universitaire 1023-1025 Rue de la piscine - BP 53 38041 GRENOBLE CEDEX 9, France

[2]Laboratoire de Physique Théorique et Modèles Statistiques (LPTMS) – CNRS, Université Paris XI : UMR8626 – France

[3]Centre d'études spatiales de la biosphère (CESBIO) – CESBIO – bpi 2801 18 Av Edouard Belin 31401 TOULOUSE CEDEX 4, France

[4]Centre d'études spatiales de la biosphère (CESBIO) – CNES – bpi 2801 18 Av Edouard Belin 31401 TOULOUSE CEDEX 4, France

Abstract

Since the early 80s, a number of studies have been conducted to obtain precipitation estimates from satellite data. However, despite a constant improvement of satellite sensor accuracy, and a regular development of many techniques for deriving rain estimates from infrared, microwave or combining both infrared and microwave measurements, there are still some significant discrepancies between satellite-based precipitation products.
One potential strategy for ameliorating these problems is the use of ancillary land measurements related to precipitation (McCabe et al. 2008; Pellarin et al. 2008; Crow et al. 2009; Pellarin et al. 2009). In particular, remotely-sensed surface soil moisture dynamics and rainfall share an obvious physical connection (Crow et al. 2011). The proposed approaches are generally based on adjusting the precipitation rate into a water balance model in order to match observed and simulated soil moisture. Results in Crow et al. (2009) demonstrate that the approach can correct a substantial fraction of root-mean-square error (RMS) in 2- to 10-day accumulation estimates obtained from existing multi-sensor, satellite-based rainfall products. In West Africa, Pellarin et al. (2008) show that the use of soil moisture measurements can be useful to suppress a large amount of untrue rain events. More recently, Pellarin et al. (2013) show that three satellite-based precipitation products (CMORPH, TRMM-3B42 and PERSIANN) can be improved over the Sahel region using a simple semi-empirical soil moisture model constrained with AMSR-E microwave measurements. This study point out the limit of the method when applied in more vegetated areas such as the Guinean coast. In the present paper, the SMOS measurements were used instead of AMSR-E and gives much better results particularly in vegetated areas. It was found that the overestimation of the three satellite-based precipitation products were strongly reduce with the proposed methodology.

*Speaker
†Corresponding author: thierry.pellarin@ujf-grenoble.fr

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