Monitoring Niger River Floods from satellite Rainfall Estimates : overall skill and rainfall uncertainty propagation.

Marielle Gosset, Claire Casse, christophe Peugeot, aaron boone, and vanessa pedinotti
IRD, DRE, toulouse, France (marielle.gosset@ird.fr)

Global measurement of rainfall offers new opportunity for hydrological monitoring, especially for some of the largest Tropical river where the rain gauge network is sparse and radar is not available. Member of the GPM constellation, the new French-Indian satellite Mission Megha-Tropiques (MT) dedicated to the water and energy budget in the tropical atmosphere contributes to a better monitoring of rainfall in the inter-tropical zone. As part of this mission, research is developed on the use of satellite rainfall products for hydrological research or operational application such as flood monitoring. A key issue for such applications is how to account for rainfall products biases and uncertainties, and how to propagate them into the end user models ? Another important question is how to choose the best space-time resolution for the rainfall forcing, given that both model performances and rain-product uncertainties are resolution dependent.

This paper analyses the potential of satellite rainfall products combined with hydrological modeling to monitor the Niger river floods in the city of Niamey, Niger. A dramatic increase of these floods has been observed in the last decades. The study focuses on the 125000 km2 area in the vicinity of Niamey, where local runoff is responsible for the most extreme floods recorded in recent years. Several rainfall products are tested as forcing to the SURFEX-TRIP hydrological simulations. Differences in terms of

rainfall amount, number of rainy days, spatial extension of the rainfall events and frequency distribution of the rain rates are found among the products. Their impacts on the simulated outflow is analyzed. The simulations based on the Real time estimates produce an excess in the discharge. For flood prediction, the problem can be overcome by a prior adjustment of the products - as done here with probability matching - or by analysing the simulated discharge in terms of percentile or anomaly. All tested products exhibit some skills in detecting the relatively heavy rainfall that preceded the flood and in predicting that the 95th percentile of the discharge (i.e. the flood alert level in Niamey) will be exceeded.

One outcome of the work is to show how different types of satellite information can be relevant and their scales complementing each-other for tropical hydrology. The red flood of the Niger river in Niamey is a good example of these scale complementarity. Satellite altimetry is needed to monitor the low frequency variation of the Niger outflow associated with early season rainfall far ahead of Niamey ; while high resolution satellite rainfall products are needed to model the fast response to the rainfall occurring during the heart of the monsoon season near Niamey.