

Impact of mesoscale convective systems (MCS) on large tropical basins' hydrological response: the case of Niger River flood intensification.

(Oral)

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ABSTRACT

With global warming, large tropical basins are experiencing an increase in the frequency and intensity of flood events, with dramatic consequences for the populations affected. This intensification and recurrence of floods is explained especially by the intensification of mesoscale convective systems (MCS) responsible for the extreme precipitation recorded in these regions. Here, we explore how satellite observations of these convective clouds and precipitation can be combined with a hydrological model to predict floods due to increased discharge of the Niger River in Niamey. Over the past few decades, the city of Niamey has been exposed for the last decades to a drastic increase of the floods during the rainy season, and specially to the so-called 'red flood' phenomena. Our approach consists of merging the convective system tracking (TOOCAN for the present study) and precipitation estimation (IMERG) databases in order to associate each MCS with the amount of rainfall it has produced over the basin. Hydrological simulation scenarios are then generated by removing MCSs for a given period using the fully distributed MGB rainfall-runoff hydrological model, which is already implemented in the basin. This original and novel approach makes it possible for the first time to analyze the impact of the intensity and spatio-temporal dynamics of convective systems on the genesis of recent extreme floods in the city of Niamey. The results highlight the importance of the rainiest MCSs, which led to exceedances of the critical flood flow threshold. The influence of these convective systems on the Niger River's discharge in Niamey can last several days between the moment they reach the basin and the peak of their contribution. This new hydrological monitoring tool can be applied to other river basins and is useful for analyzing in detail the impact of climate variability and change on MCS characteristics and the subsequent consequences on hydrological risks.

Keywords: Mesoscale convective systems (MCS), Floods, Satellite observations, Hydrological modelling, Niger River Basin.