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Extreme monsoon precipitation events over South Asia in a warming world

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The recent series of flood events over Pakistan and Northwest India during the monsoon seasons of 2010 and 2011 are examples of extreme phenomena during the last century that have evoked considerable interest among various scientific communities. One of the causes for the 2010 intense precipitation over Pakistan has been attributed to the interaction between the tropical monsoon surge and southward intruding extra-tropical circulation anomalies (Hong et al. 2011). On the other hand, it has been hypothesized by Mujumdar et al. (2012) that the westward shift of the West Pacific Subtropical High (WPSH) in response to the strong La Nina conditions during 2010 was instrumental in altering the convection and circulation over the Bay of Bengal and the monsoon trough region, which in turn sustained the moist convective activities over Indo-Pak through transport of moisture from the Arabian Sea. However several aspects of the dynamics of these intense monsoon precipitation events are not adequately understood especially when atmospheric convective instabilities are expected to amplify in the backdrop of the ongoing global warming. Here, we have carried out a set of ensemble simulation experiments using a high-resolution global climate model to understand the evolution of intense monsoon precipitation events over Pakistan and Northwest India as in 2010. The results based on the model simulations indicate that while interactions among the WPSH, the South Asian monsoon trough and sub-tropical westerlies are conducive for development of convective instabilities over the Indo-Pak region, the local convective activities are found to significantly amplify in response to the large build up of moisture associated with global warming. The present results have implications in understanding how extreme monsoon precipitation events in the Indo-Pak region might have responded to past climatic variations.

References:

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