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Moisture transports and synoptic patterns related to heavy rainfall events in India

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Most of the precipitation in India falls during the monsoon season and, as in other tropical monsoonal climates; precipitation is a phenomenon that occurs in spells. Frequency, rainfall amount, rainfall intensity, and duration of wet and dry spells have been studied worldwide in recent decades because of its direct socio-economic impact and because of its importance in the global climate.

While the identification of the moisture sources is of prominent importance to characterize the origin of precipitation, there are few published studies about the source and amount of moisture transported towards the Indian subcontinent and its relationship with the occurrence of different precipitation intensities during Indian monsoons. In addition, understanding the problem of heavy rainfall events, assume greater importance in the face of global climate change projections with higher precipitation intensity and larger number of dry days. For this purpose, we have used GPCP daily precipitation data to classify the rainfall days in three categories: low, moderate, and extreme rainfall events. Then we have tracked humidity changes in air masses residing over western and eastern India according to the mentioned classification events. We have used a Lagrangian diagnosis method which identifies the humidity contributions to the moisture budget over a region. This methodology computes budgets of evaporation minus precipitation by calculating changes in the specific humidity along back-trajectories. It has been tracked the origin of precipitation of air masses residing over each region during 10 days previous to low, moderate and extreme intensity rainfall events in India for June to September and during a period of 5 years (2000–2004). Finally, we have analyzed the weather types associated to this different kind of events.

It is found a direct relationship between the intensity of the precipitation events and the moisture transported by the Somali Jet. In the western India, the bigger differences (approximately 400 km3/year each day) appear between days -4 and -10 before the particles reach the precipitation zone, just when the jet reach the equator. Differences are greater between days -6 and -10 in the eastern side (approximately 600 km3/year each day). The increase in the amount of moisture transported by the jet appears clearly linked to convection along the Somali Jet trajectory, and the position and intensity of the “monsoon trough” across the India subcontinent.