



## **Breaks of the South Asian Summer Monsoon simulated with the HIRHAM5 Regional Climate Model**

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Current studies suggest that the observed summertime drying trend over South Asia can be attributed mainly to anthropogenic aerosol emissions. On the intraseasonal timescale the summer monsoon fluctuates between periods of enhanced and reduced rainfall. The frequency of occurrence of these active and break monsoon phases affects directly the seasonal monsoon rainfall.

This study investigates the regional patterns and their changes of the South Asian summer monsoon for the period 1979-2012 using the regional atmospheric model HIRHAM5 with a horizontal resolution of  $0.25^\circ$  forced at the boundaries with ERA-Interim reanalysis data. HIRHAM5 reproduces a number of important features of the South Asian summer monsoon. Despite the dry bias in the simulated summer monsoon rainfall over the Indian land, a realistic representation of the intraseasonal variability allows to analyze the dynamics of break monsoon events using daily rainfall anomalies and an identification tool according to Prasanna and Annamalai (2012). The model results capture break characteristics noted by observations including the dominant role of extended monsoon breaks ( $>7$  days) in the intraseasonal monsoon variability, which show persistence of break conditions over central India for about 15 days. Positive (negative) outgoing longwave radiation anomalies over the continental (oceanic) intertropical convergence zone during established breaks indicate a north-south dipole in convection and suggest the 'quadrupole' structure over the Asian monsoon domain, identified by Annamalai and Slingo (2001). It further points to generation of Rossby waves which can be discussed as the atmospheric response to the asymmetric diabatic heating. A performed moisture budget analysis reveals the important role of dry advection associated with descending motion from the upper troposphere as the primary initiator of the dryness over central India.

A Question of future interest is: How will human-influenced aerosol emissions alter patterns and frequency of monsoon extremes. Sensitivity experiments performed with different aerosol scenarios will be the scope of further investigations to understand the regional impact of aerosols to South Asian monsoon variability.