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Simulation of Indian Monsoon Variability in the Medieval Warm Period using ECHAM5 General Circulation Model

Stefan Polanski (1), Bijan Fallah (1), Sushma Prasad (2), and Ulrich Cubasch (1)

(1) Freie Universität Berlin, Institut für Meteorologie, Berlin, Germany (stefan.polanski@met.fu-berlin.de), (2) German Research Center for Geosciences (GFZ), Potsdam, Germany

Within the framework of the DFG research group HIMPAC, the general circulation model ECHAM5 has been used to simulate the Indian monsoon and its variability during the Medieval Warm Period (MWP; 900-1100 AD) and for recent climate (REC; 1800-2000 AD). The focus is on the analysis of internal and external drivers leading to extreme rainfall events over India from interannual to multidecadal time scale. An evaluation of spatio-temporal monsoon patterns with present-day observation data is in agreement with other state-of-the-art monsoon modeling studies. The simulated monsoon intensity on multidecadal time scale is weakened (enhanced) in summer (winter) due to colder (warmer) SSTs in the Indian Ocean. Variations in solar insolation are the main drivers for these SST anomalies, verified by very high temporal correlations between Total Solar Irradiance and
All-India-Monsoon-Rainfall in summer monsoon months (-0.95). The external solar forcing is coupled and overlain by internal climate modes of the Ocean (ENSO and IOD) with asynchronous intensities and lengths of periods.
In addition, the model simulations have been compared with a relative moisture index derived from paleoclimatic reconstructions based on various proxies and archives in India (Anoop et al., 2012 (under revision); Bhattacharya et al., 2007; Chauhan et al., 2000; Denniston et al., 2000; Ely et al., 1999; Kar et al., 2002; Ponton et al., 2012; Prasad et al., 2012 (under revision)). In this context, the reconstructed climate of the well-dated Lonar record in Central India has been highlighted and evaluated the first time (Anoop et al., 2012 (under revision); Prasad et al., 2012 (under revision)). Particularly with regard to the long continuously chronology of the last 11000 years, the Lonar site gives a unique possibility for a comparison of long-term climate time series. The simulated relative annual rainfall anomalies ("MWP" minus "REC") are in agreement with the reconstructed moisture index. The dry (wet) rainfall signal over Central India (Himalayas) can be detected from both. However, more sites and higher resolved regional climate model simulations have to be considered in the analysis with respect to the regional inhomogeneities in the rainfall distribution.