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The Indian Summer Monsoon and its Extremes during the last 1000 Years

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Climatic conditions of the Indian subcontinent are characterized by the Indian summer monsoon (ISM) regime, accounting for about 80% of the total annual rainfall amount over this region. The monsoon system shows high temporal variability from intraseasonal to millennial timescales.
The work presented in this study is embedded in the interdisciplinary project HIMPAC (Himalaya – Modern and past climates), with the the aim to gain a comprehensive knowledge on the ISM variability during the last 9000 years by the collaboration between geological derived information (meteorological proxies from e.g. lake sediment studies) and highly resolved regional (palaeo) climate modelling.
Here we focus on the investigation of the variability of the Indian monsoon during the last 1000 years, using the global climate simulations carried out within the Community Simulations of the last Millennium using the fully-coupled global climate model COSMOS (ECHAM5/MPI-OM/JSBACH/HAMMOC) in a spatial resolution of T31L19 (Jungclaus et al., 2010). Five ensemble members were analyzed to identify strong and weak ISM phases.
The conceptual framework is based on dynamical downscaling with regional climate model application for specific historic periods of interest. This cannot be done solely using the coarse resolution T31 simulations, but will need additional higher resolved data to drive the RCM. Thus, for selected time slices of 200 years, including the Medieval Warming Period (900-1100), Little Ice Age (1515-1715) and preindustrial time-period (1800-2000), simulations with ECHAM5 atmosphere-only global climate model with a spatial resolution of T63L31 are performed.
During this project, simulations using the regional climate model COSMO-CLM with a horizontal resolution of approximately 55km are carried out. The time slices of 20 years are selected regarding strong and wet phases of the Indian monsoon using the atmosphere-only ECHAM5 simulations. These simulations are used to investigate the spatial variability during extreme ISM periods with special focus on the occurrence of extreme events on intraseasonal timescales, e.g. droughts and floods.
First results show higher temporal ISM variability in T63L31 atmosphere-only simulations compared to coarse T31L19 fully-coupled simulations. Thus, the approach seems to be suitable to analyze extreme ISM episodes during the last 1000 years.