CARIMA is a multi-partner interdisciplinary project funded by BMBF within the project cluster ‘ Tibet und Zentralasien, Monsun Geodynamik und Geoökosysteme’. It started on 1 April 2011 and will run until 31 March 2014. Work at MPI-M started in August 2011.

CARIMA aims at a better understanding of monsoon dynamics at timescales of societal relevance. High-resolution marine climate archives and novel proxies in combination with climate modeling will be employed in order to disentangle natural from human-induced variations in the Asian monsoon system. CARIMA will use proxies that reflect environmental conditions on land, specifically, changes in vegetation, hydrological and carbon cycles. Moreover, CARIMA intends to investigate how the occurrence of interannual climate modes and tropical cyclones are affected by climate change and how the interaction between climate and subsidence affects the vulnerability of coastal areas.

Study sites will be located in the Arabian Sea, the South China Sea, and the Bay of Bengal. The planned work will enhance the knowledge base of climate change in central Asia. It will provide insights into future monsoon behavior, a risk assessment of extreme events and an evaluation of the vulnerability of coasts in the monsoon region.

Major uncertainties exist with regard to the projected climate change for Asia (IPCC, 2007). Differences between climate models in representing monsoon processes contribute significantly to the uncertainty about future regional monsoon behavior. The profound changes in land use are of particular importance because their effect on monsoon dynamics is not well understood. Another major source of uncertainty results from the poorly constrained future trend in the probability of occurrence of tropical cyclones and the future evolution of the interannual modes, such as El Niño-Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD).

The Asian monsoon system consists of two subsystems: the Indian and the East-Asian monsoons (Fig1). Rainfall over the Indian subcontinent is associated with southwesterly winds that deliver moisture from the Arabian Sea to southern Asia. Monsoonal rainfall occurs from June-September. In contrast, during winter dry northeasterly winds inhibit the transport of moisture from the Arabian Sea to the Indian subcontinent. In eastern Asia, the summer monsoon transports moisture from the Pacific Ocean to the continent from June to September.

On interannual timescales, ENSO and IOD strongly affect the sea-surface temperature (SST) distribution in the equatorial Indian Ocean (e.g. Webster et al., 1999; Zhong et al., 2005). This in turn has been suggested to affect both the Indian and the East-Asian monsoon systems (Gadgil, 2003; Liet al., 2010).

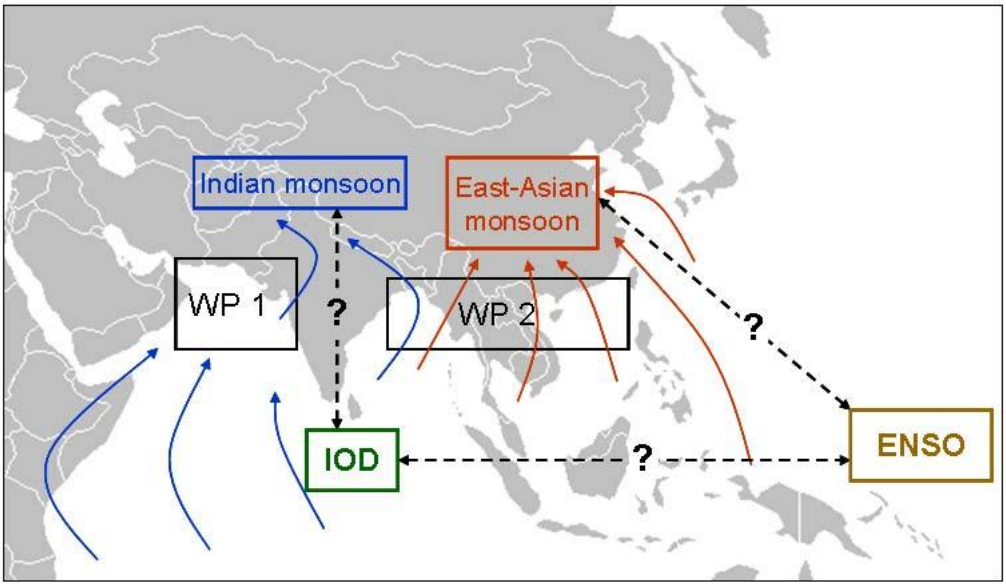

Figure 1. The Asian monsoon systems and their possible connection to the Indian Ocean Dipole (IOD) and ElNiño-Southern Oscillation (ENSO). Solid arrows show the main wind trajectories for the Indian (blue) and theEast-Asian (red) summer monsoons. Black rectangles indicate the study areas for the proposed work packages. MPI-M is part of WP1.

At MPI-M, it is foreseen to force the model system MPIOM/HAMOCC with data of past monsoon variability and to analyze the impact on the marine ecosystem and the flux of climate relevant gases. Model experiments over the NCEP periods are foreseen to compare recent with past observations, and a future scenario will be computed with the model adapted to the Arabian Sea to estimate future changes of the Arabian monsons systems and its consequences and feedbacks with the ocean biogeochemistry.

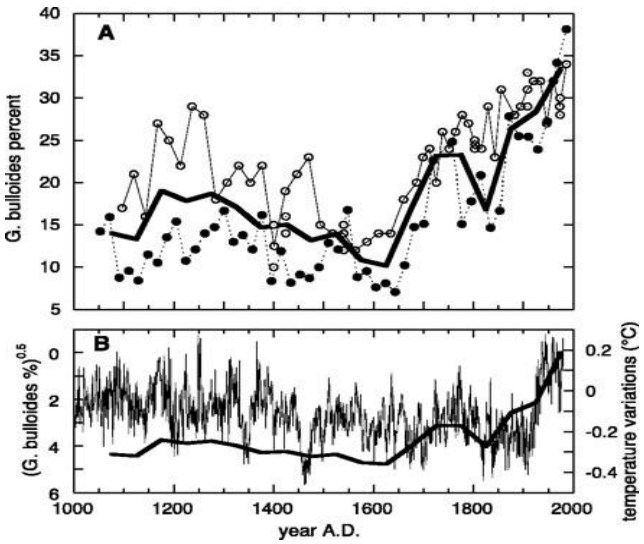

Fig. 2. Monsoon increase linked to global warming? First evidence for monsoon intensification since AD 1600 A) the SW-monsoon indicator foraminifer *G. bulloides*, mean=bold line; B) comparison to the Mann et al. Northern hemisphere temperature curve (from Anderson et al., 2002).