PACMEDY: PAlaeo-Constraints on Monsoon Evolution and Dynamics

Monsoon systems influence the water supply and livelihoods of over half of the world. Observations are too short to provide estimates of monsoon variability on the multi-year timescale relevant to the future or to identify the causes of change on this timescale. The credibility of future projections of monsoon behavior is limited by the large spread in the simulated magnitude of precipitation changes. Past climates provide an opportunity to overcome these problems. This project will use annually-resolved palaeoenvironmental records of climate variability over the past 6000 years from corals, molluscs, speleothems and tree rings, together with global climate-model simulations and high-resolution simulations of the Indian, African, East Asia and South American monsoons, to provide a better understanding of monsoon dynamics and interannual to multidecadal variability (IM).

We will use the millennium before the pre-industrial era (850-1850 CE) as the reference climate and compare this with simulations of the mid- Holocene (6000 years ago) and transient simulations from 6000 year ago to ca 850 CE. We will provide a quantitative and comprehensive assessment of what aspects of monsoon variability are adequately represented by current models, using environmental modelling to simulate the observations. By linking modelling of past climates and future projections, we will assess the credibility of these projections and the likelihood of extreme events at decadal time scales. The project is organized around four themes: (1) the impact of external forcing and extratropical climates on intertropical convergence and the hydrological cycle in the tropics; (2) characterization of IM variability to determine the extent to which the stochastic component is modulated by external forcing or changes in mean climate; (3) the influence of local (vegetation, dust) and remote factors on the duration, intensity and pattern

of the Indian, African and South American monsoons; and (4) the identification of paleo-constraints that can be used to assess the reliability of future monsoon evolution.