Interaction of Convective Organization and Monsoon Precipitation, Atmosphere, Surface and Sea (INCOMPASS)

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The monsoon supplies the majority of water in South Asia, making understanding and predicting its rainfall vital for the growing population and economy. However, modelling and forecasting the monsoon from days to the season ahead is limited by large model errors that develop quickly, with significant inter-model differences pointing to errors in physical parametrizations such as convection, the boundary layer and land surface. These errors persist into climate projections and many of these errors persist even when increasing resolution. At the same time, a lack of detailed observations is preventing a more thorough understanding of monsoon circulation and its interaction with the land surface: a process governed by the boundary layer and convective cloud dynamics. The INCOMPASS project will support and develop modelling capability in Indo-UK monsoon research, including test development of a new Met Office Unified Model 100m-resolution domain over India. The first UK detachment of the FAAM research aircraft to India, in combination with an intensive ground-based observation campaign, will gather new observations of the surface, boundary layer structure and atmospheric profiles to go with detailed information on the timing of monsoon rainfall.

Observations will be focused on transects in the northern plains of India (covering a range of surface types from irrigated to rain-fed agriculture, and wet to dry climatic zones) and across the Western Ghats and rain shadow in southern India (including transitions from land to ocean and across orography). A pilot observational campaign is planned for summer 2015, with the main field campaign to take place during spring/summer 2016.

This project will advance our ability to forecast the monsoon, through a programme of measurements and modelling that aims to capture the key surface-atmosphere feedback processes in models. The observational analysis will allow a unique and unprecedented characterization of monsoon processes that will feed directly into model development at the UK Met Office and Indian NCMRWF, through model evaluation at a range of scales and leading to model improvement by working directly with parametrization developers. The project will institute a new long-term series of measurements of land surface fluxes, a particularly unconstrained observation for India, through eddy covariance flux towers. Combined with detailed land surface modelling using the Joint UK Land Environment Simulator (JULES) model, this will allow testing of land surface initialization in monsoon forecasts and improved land-atmosphere coupling.