Emerging results from the INCOMPASS field campaign of the 2016 Indian monsoon

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The INCOMPASS project (Interaction of Convective Organisation with Monsoon Precipitation: Atmosphere, Surface and Sea) led the first ever detachment of the UK's Facility for Airborne Atmospheric Measurements (FAAM) Atmospheric Research Aircraft to India during May-July 2016. The INCOMPASS field campaign combines the aircraft measurements and other ground-based, upper-air and remote sensing instrumentation with model case studies at convection-permitting resolution. INCOMPASS aims to better quantify the impacts of gradients at the surface across coastlines, orography and soil moisture on atmospheric structure and the development of convection; this works towards better understanding and forecasting of the monsoon, which supplies more than 80% of India's annual rainfall.

Research flights were performed from twin airport bases at Lucknow in the northern plains/Ganges basin and at Bangalore, in the southern peninsula. Across northern India, changes in atmospheric structure were observed between the humid, forested east coast region near Bhubaneswar and the drier regions towards the Jodhpur in the west, where the monsoon rains begin much later. The interaction between the boundary layer and underlying surface was compared between the pre-onset period and as the monsoon advanced across northern India, moistening the soil. In southern India, we observed transitions from wet-to-dry regions across the Arabian Sea, Western Ghats and rain shadow region into southeast India and the Bay of Bengal.

The aircraft data were complemented by a new network of eddy covariance flux towers installed in various hydroclimatic zones and at irrigated and rain-fed agricultural sites, together with an intensive radiosonde launch programme to capture the diurnal cycle in the monsoon trough region, and other instrumentation.

Here we present an overview of the INCOMPASS field campaign design and its initial results, focusing on the evolution of contrasts in the monsoon as the rains advance, and showing emerging highlights of new measurements of cloud radiative forcing during the monsoon, and of the impact of gradients in soil moisture on the initiation of monsoon convection. We also demonstrate the advance of the monsoon in a 4-km convection-permitting nested version of the Met Office Unified Model, including the interaction of the retreating dry air intrusion and cloud development processes.

Key words: INCOMPASS, Indian monsoon, field campaign, observations, modelling

References

Turner, A. G., G. S. Bhat *et al.*, 2018: *Quarterly Journal of the Royal Meteorological Society*, **submitted**.