

## Implications for monsoon modelling from the 2016 INCOMPASS field campaign in India

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The INCOMPASS field campaign combined airborne and ground measurements of the 2016 Indian monsoon, towards the ultimate goal of better predicting monsoon rainfall. The monsoon supplies the majority of water in South Asia, but forecasting from days to the season ahead is limited by large, rapidly developing errors in model parametrizations. The lack of detailed observations prevents thorough understanding of the monsoon circulation and its interaction with the land surface: a process governed by boundary-layer and convective-cloud dynamics. INCOMPASS used the UK Facility for Airborne Atmospheric Measurements (FAAM) BAe-146 aircraft for the first project of this scale in India, to accrue almost 100 hours of observations in June and July 2016. Flights from Lucknow in the northern plains sampled the dramatic contrast in surface and boundary layer structures between dry desert air in the west and the humid environment over the northern Bay of Bengal. These flights were repeated in pre-monsoon and monsoon conditions. Flights from a second base at Bengaluru in southern India measured atmospheric contrasts from the Arabian Sea, over the Western Ghats mountains, to the rain shadow of southeast India and the south Bay of Bengal. Flight planning was aided by forecasts from bespoke 4km convection-permitting limited-area models at the Met Office and India's NCMRWF.

On the ground, INCOMPASS installed eddy-covariance flux towers on a range of surface types, to provide detailed measurements of surface fluxes and their modulation by diurnal and seasonal cycles. These data will be used to better quantify the impacts of the atmosphere on the land surface, and vice versa. INCOMPASS also installed ground instrumentation supersites at Kanpur and Bhubaneswar.

In this work we describe a range of emerging results from the INCOMPASS mission and discuss its implications for numerical modelling and prediction of the monsoon.