



Understanding monsoon cloud development using Doppler weather radar and high-resolution modelling

Lead Supervisor: Dr Andy Turner, University of Reading, Department of Meteorology
(a.g.turner@reading.ac.uk)

Co-supervisor: Dr Thorwald Stein, University of Reading, Department of Meteorology
(t.h.m.stein@reading.ac.uk)

Monsoons are vital to society, affecting approximately 2.5 billion people with their rains providing the majority of water for agriculture and industry. In India, 80% of rainfall occurs from June to September, so variations in monsoon timing, duration or intensity have clear impacts on agriculture and economic development. Unfortunately, models used for weather prediction or future climate have poor representations of the monsoon. Convection, the process that drives tropical rainfall, is very difficult to incorporate in a model. In particular, the timing of rainfall during the day, and the transition between shallow and deep clouds, are very difficult to model. Cloud development feeds back onto the monsoon winds, further worsening errors in the monsoon forecast.

Fortunately, following the INCOMPASS field campaign of 2016, we have a new dataset of Doppler weather radar (DWR) spread across India (e.g., Figure 1). In this project, you will use the India DWR data, together with satellite data, to determine the occurrence of monsoon clouds and their vertical distribution and how they change as the monsoon develops. The project will further examine the influence of modelled cloud processes on the monsoon using experiments at convective-permitting scales in the Met Office Unified Model. Questions of interest include:

- What are the depths and occurrence rates of different clouds during advance of the monsoon across India?
- What are the processes related to cloud development and how do they relate to larger-scale weather conditions?
- How are monsoon cloud processes simulated in the Met Office Unified Model?
- What are the impacts of cloud behaviour on monsoon winds and variations in the monsoon rains?

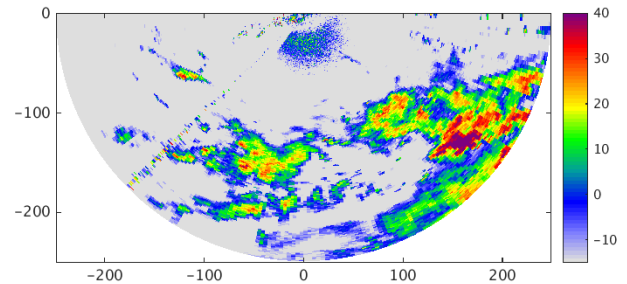


Figure 1: Near-surface radar reflectivity measured from an Indian Doppler weather radar during the INCOMPASS field campaign of 2016. Units are dBZ. Values greater than 30 dBZ indicate heavy rainfall.

Training opportunities:

You will learn programming in languages such as Python, as well as the ability to interpret radar, satellite data and meteorological observations. After training courses in using the Met Office model, you will be able to design and critically analyse experiments simulating the monsoon. Results will be discussed with India's National Centre for Medium Range Weather Forecasting.

Student profile:

This project would be suitable for a student with a degree in physics, maths, or a closely related science. The student would need the aptitude to develop skills in programming although no prior experience is required.

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