Geophysical Research Abstracts
Vol. 19, EGU2017-16955, 2017
EGU General Assembly 2017

The onshore and offshore propagation of convective storms in the Western Ghats region and how understanding these processes may contribute to improving predictions of the Indian monsoon

Peter Willetts (1), John Marsham (1,2), Cathryn Birch (1), Doug Parker (1), and Michael Reeder (3)

(1) School of Earth and Environment, The University of Leeds, Leeds, LS2 9JT, United Kingdom (eepdw@leeds.ac.uk), (2) National Centre for Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, United Kingdom., (3) School of Earth, Atmosphere and Environment, and Centre of Excellence for Climate System Science, Monash University, Clayton, Victoria, Australia

The principal moisture source of the Indian summer monsoon is the low-level west-to-southwesterly jet winds. These cross the Arabian Sea to reach the coastal Western Ghats mountains, which receive some of the highest monsoon rainfall totals in the whole sub-continent. Deep convection often develops upstream of the Ghats over the sea as well as over the mountains. Using CMORPH satellite rainfall retrievals, we have observed that, as in other regions of coastal orography, the majority of rainfall forms close to the orography in the afternoon, and then propagates offshore overnight. As well as offshore propagating rainfall, there are also distinct events where rainfall propagates onshore. New convection-permitting model simulations provide new capability to simulate the monsoon, but even the 2.2km grid-spacing configuration of the Met Office Unified Model with no convective parametrisation fails to capture the main process of rainfall propagating offshore, with rainfall consistently forming upstream of the orography, and then propagating onshore.

During the periods with the most onshore propagation, there are fewer storms, the low-level westerly winds are stronger over the Indian subcontinent and eastern Arabian Sea and the height at which the westerlies transition to upper-level easterly winds is higher ($\sim$400 hPa), when compared to periods with more offshore propagation, for which winds transition at $\sim$600 hPa. On 7-day timescales, onshore/offshore periods of rainfall appear to be related to anomalous cool/warm sea surface temperatures in the equatorial west Pacific, which appear to influence the wind differences over India.

The unified model wind profiles show no systematic difference to observations at coastal stations. Over the eastern Arabian Sea, the Western Ghats, and in north central India, the model generates too many storms that move eastward, and too few that move westward. The model therefore appears to capture the variations in the environment that control the propagation of the convection, but gives an incorrest response of the convection to its environment. Understanding the details of the mechanisms that the model fails to capture will demonstrate the processes that models must represent to give a realistic representation of this key aspect of the monsoon rains.