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2016 Monsoon Convection and its place in the Large-Scale Circulation using Doppler Radars

Alex Doyle¹, Andrew Turner^{1,2}, and Thorwald Stein¹

¹Department of Meteorology, University of Reading, Reading, UK

²National Centre for Atmospheric Science, University of Reading, Reading, UK

Convective cloud development during the Indian monsoon helps moisten the atmospheric environment and drive the monsoon trough northwards each year, bringing a large amount of India's annual rainfall. Therefore, an increased understanding of how monsoon convection develops in observations will help inform model development. In this study, 139 days of India Meteorological Department Doppler weather radar data is analysed for 7 sites across India during the 2016 monsoon season. Convective cell-top heights (CTH) are objectively identified through the season, and compared with near-surface (at 2 km height) reflectivity. These variables are analysed over three time scales of variability during the monsoon: monsoon progression, active-break periods and the diurnal cycle. We find a modal maximum in CTH around 6–8 km for all sites. Reflectivity increases with CTH, at first sharply, then less sharply above the freezing level. Bhopal and Mumbai exhibit lower CTH for monsoon break periods compared to active periods. A clear diurnal cycle in CTH is seen at all sites except Mumbai. The phase of the diurnal cycle depends on the surface type being land or ocean for south-eastern India, with the frequency of oceanic cells typically exhibiting an early morning peak compared to those over land, consistent with the observed diurnal cycle of precipitation. The cell characteristics discovered are discussed in light of the differences in large-scale synoptic and mesoscale mechanisms responsible for different cell regimes. Our findings confirm that Indian monsoon convective regimes are partly regulated by the large-scale synoptic environment within which they are embedded.