



On the paradigm of the Indian monsoon depression

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Reanalysis data from the last 34 years and satellite-derived precipitation data from the last 14 have been used with a newly developed feature tracking algorithm to generate composite three-dimensional structures of monsoon depressions occurring within these respective periods; centralising and rotating each one such that the centre falls on the origin and the system travels towards the relative north. Overall, 104 depressions comprise the composite, considerably more than any previous detailed research on monsoon depressions and their structure. Maxima of many fields are found to exist southwest of the depression centre with respect to the direction of propagation, including rainfall, convergence, and vertical wind velocity. The importance of the Himalayas is also discussed, with evidence of anomalous anti-cyclonic vorticity production in the foothills, extending from the surface to the tropopause. Detailed analysis of the temperature fields indicate that most depressions are cold-core cyclones with a central anomaly of around -1.5K , but some have more disorganised, neutral cores and, rarely, tropical cyclone-like warm cores. Analysis is performed on El Niño-minus-La Niña and active-minus-normal composites, showing that La Niña depressions tend to be wetter and warmer. The temporal distribution of depressions and their durations are also considered, as well as the state of the monsoon trough region during these events.