



Radar observations of monsoon onset over the Western Ghats of India

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The onset of Indian summer monsoon is characterized by distinct changes in the atmospheric circulation features in the lower and upper troposphere along with sustained increase in rainfall over the Indian land mass. Frequent convective events during the onset phase help moisten the atmospheric layers and facilitate the progression of monsoon. However, studies on clouds and their association with large-scale atmospheric circulation during the transition of monsoon are limited. To improve our physical understanding of the monsoon onset, high-resolution spatio-temporal observations of clouds and related dynamical fields are needed around this period.

In the present work, we examine the features of clouds, associated dynamics and physical processes during the onset and progression of monsoon over the Western Ghats (WG) of India. Data collected with an X-band radar in the WG during the summer monsoon season of 2018 has been used. Using radar reflectivity data, we identified four different cloud types during the onset phase, namely, Shallow cloud, Medium cloud, Deep cloud and High-level cloud. During the pre-onset, high-level clouds show highest occurrence frequency (60 %) followed by deep clouds but their occurrence frequencies gradually decrease while the shallow clouds become more dominant with the progress of monsoon. A corresponding shift in modal value of reflectivity from ~15 dBZ occurring at 9 km to ~20 dBZ and 1.5 km height (agl) has been observed. We also attempt to understand the physical processes occurring in the monsoon onset by analysing associated dynamics and thermodynamic conditions along with the large-scale circulation features.