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Insights into Overshooting Convective Storms (OCS) over Western Ghats of India: A Comprehensive Analysis using multi-instrument observations

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Overshooting convective storms (OCS) generally extend beyond tropopause and hence play a significant role in the stratosphere-tropospheric interactions. These storms are associated with extreme rainfall often occurring for a short duration that causes immense damage to life and property. A comprehensive understanding of these clouds involves identifying the key parameters influencing their formation and characterizing their micro/macro attributes.

This study attempts to reveal the formation, micro-, macro-physical, and thermodynamic state of such an OCS developed over the Western Ghats region, India using X-band Doppler weather radar installed at the Mandhardev radar site. Radar observations revealed that the OCS initiated during the afternoon as individual convective cells and organized into a squall-line. The INSAT-3D observations indicate that the OCS is a part of the mesoscale convective system (MCS) developed in the southern parts of India. The radar polarimetric parameters such as horizontal reflectivity (Zh), differential reflectivity (ZDR), specific differential phase (KDP), and correlation coefficient (**ρ**hv) are analyzed to investigate the micro- and macro-physical structure of the OCS. The signature of hail and graupel can be noticed from the polarimetric variables with values ranging from 50-60 dBZ for reflectivity, and small negative values of ZDR and positive KDP near the surface. Further to explore the background dynamics and thermodynamics of this OCS, the ERA5 dataset has been utilized. The reanalysis data shows strong updrafts beyond the tropopause layer. The strong convergence at the lower levels and divergence at upper levels are observed, possibly the formation of an anvil structure during the OCS. In addition to the dynamics, background thermodynamics also play a major role in the development of OCS. The lightning location network (LLN) data also shows heavy lightning activity in line with the convective storm.