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Microphysical Characteristics of Overshooting Convection from Polarimetric Radar Observations

Abstract

Overshooting convective storms contain strong upward motion capable of deep, rapid vertical transport of air from the lower troposphere to the stratosphere and above the level of neutral buoyancy. Irreversible transport across the tropopause from turbulent mixing atop these storms can have significant impacts on chemistry and climate. This paper present observations of the microphysical characteristics of deep convection that overshoots the altitude of the extratropical tropopause from analysis of the polarimetric radar variables of radar reflectivity factor at horizontal polarization Z_H, differential reflectivity Z_{DR}, and specific differential phase K_{DP}.

In the process of verification, the paper utilize the method of merging data from individual radars into high-resolution three-dimensional composite. Identified overshooting convective storms are separated by their organization and intensity into three classifications: organized, discrete ordinary, and discrete supercell convection. With deep columns of highly positive Z_{DR} and K_{DP} representing lofting of liquid hydrometeors within the convective updraft and above the melting level. In addition, organized and discrete supercell classifications show distinct near-zero Z_{DR} minima aligned horizontally with and at altitudes higher than the updraft column features, likely indicative of the frequent presence of large hail in each case. Composites for organized convective systems show a similar Z_{DR} minimum throughout the portion of the convective core that is overshooting the tropopause. Additional analyses of the evolution of overshooting storms reveal that the Z_{DR} minima indicative of hail in the middle and upper troposphere and graupel in the overshooting top are associated with the mature and decaying stages of overshooting.

Keyword

Overshooting convection

Polarimetric variables

Reference

Homeyer, C. R., and M. R. Kumjian, 2015: Microphysical Characteristics of Overshooting Convection from Polarimetric Radar Observations. *J. Atmos. Sci.*, **72**, 870–891, https://doi.org/10.1175/JAS-D-13-0388.1.