Characterization of convective updraft cells during MC3E using S- and C-band polarimetric radars and tri-Doppler vector wind retrievals

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Four deep convection events observed during the 2011 Midlatitude Continental Convective Clouds Experiment (MC3E) are analyzed using S- and C-band dual-polarimetric scanning precipitation radars in conjunction with vector wind retrievals from C- and X-band Doppler measurements. Analysis is focused on identifying robust signatures associated with convective cell Kdp and Zdr columns that extend above the melting level. Owing to the importance of convective cell evolution on time scales shorter than the quasi-steady duration of mesoscale convective precipitation features, individual convective cells are identified and tracked over their life cycles in order to better characterize their diversity. Across the four deep convection events observed, results indicate consistent cell-scale differences in updraft polarimetric signatures from one storm event to the next, and relatively more similar signatures within quasi-steady periods of a single event when accounting for cell lifecycle. Updraft mass flux calculated from collocated vector wind retrievals is found to vary systematically in time with polarimetric radar signatures during each event. Results thus indicate the occurrence of regimes of microphysical behavior in the life-cycles of storm updrafts, which vary from one storm to the next, that can be associated with observed updraft dynamics. Finally, to provide a foundation for developing future constraints in cloud-resolving model simulations, all four events were analyzed together to determine the horizontal scales required to resolve convective cell features in each case observed.