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Vertical Velocity Retrievals using the ARM Heterogeneous Radar Network at SGP

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The representation of convective clouds in numerical models underlines one of the most challenging problems to date faced by the modeling community. Since the dynamical, thermodynamical, and microphysical processes of convective systems occur at spatial and temporal scales not resolved by large-scale models, parameterization schemes must be implemented in order to represent these processes. A key component in these parameterizations is vertical velocity, since many of these schemes rely on mass-flux closure: a model grid cell is decomposed into an updraft region within the cloud layer, compensated by both a downdraft which is part of the convective system as well as slow subsidence of the environment. Despite this, observations of vertical velocity are sparse, either from aircraft studies or vertically-pointing radars, both of which cover a limited area. As a result, evaluation of large-scale models is primarily done with other, small-scale models, not observations. Scanning Doppler radars, though unable to directly measure vertical velocity, are able to observe mesoscale convective systems at high spatial resolution. Utilizing the unprecedented observing infrastructure at ARM's Southern Great Plains (SGP) site, we retrieve vertical velocity from multiple Doppler radars using a 3D-VAR technique. Multiple convective events observed during the Midlatitude Continental Convective Clouds Experiment (MC3E) provides an appropriate dataset to study the statistical properties of vertical velocity as well as draft morphology in convective clouds. Furthermore, these retrievals are evaluated by comparing them with independent vertical velocity retrievals from vertically-pointing UHF radars.