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Evolution of conserved variables related to storm cells during severe convection in a mesoscale model

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The WEX-MOP project aims at a next generation ensemble prediction system for the mesoscale. One goal of WEX-MOP is to quantify the role of conserved quantities during extreme convective weather. Conserved variables might offer new insight in the predictability of those events. An important conserved quantity is potential vorticity (PV), a fundamental property of the atmospheric flow on synoptic and planetary scales. However, investigations thereof on the atmospheric mesoscale are relatively new. PV has a close relation to rotation and balance, which is important in storm dynamics. Here we characterize the evolution of storm cells in terms of PV to provide new insights into storm dynamics.

Tracking of storm cells has been frequently performed using radar and/or satellite data. It received less attention using model data. We present storm cell tracks for cases of severe convection in 2011, 2012 and 2013 simulated using the non hydrostatic COSMO-DE weather model. The cases are selected with a different synoptic background, i.e. different background shear and CAPE. For each of the cases vertical velocity maxima are tracked. Composites of the typical evolution of a storm cell are made. For all cases there is a large variability in the cell characteristics. However, the PV dipole associated with the storm updraft is clearly visible for all cases. Generally, strong intensity cells show a large correlation between PV and vertical velocity anomalies. This has been attributed to a strong environment storm relative helicity and/or CAPE close to the surface. We discuss how the general characteristics of storm cells in terms of PV depend on the synoptic background.