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Vortex identification in simulated supercells: a comparison of methods

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Supercells are highly-organized convective cells which are characterized by an rotating, persistent updraft. Moreover, supercells are often connected with high-impact weather such as flash floods, large hail, strong winds or tornadoes. Vortices within supercells seem to be closely connected to those high-impact phenomena. Hence, we will examine different kinematic vortex identification schemes such as the two-dimensional and three-dimensional versions of the kinematic vorticity number (W_k) method and the λ_2 method with respect to their performance and differences in identifying vortices within supercell simulations. An advantage of those methods is that they are based on a comparison of rotational vs. deformational flow properties instead of relying on vorticity thresholds alone.

Simulations will be done with Cloud Model 1 initialized by the Weisman-Klemp analytical quarter-circle supercell sounding. First results show that the different schemes identify similar vortex structures in large areas of the supercell. However, the identification differs significantly in the layers close to the surface. Since this is especially relevant for researchers concerned with the impacts of those cells, we will additionally test different bottom boundary conditions and compare the vortex identifications of those simulations, too. Finally, we will explain the interpretation of the methods in more detail since these vortex identification schemes can be applied to different convective set-ups and might be interesting for researchers of other topics.