18–22 September 2017, Pula, Croatia
ECSS2017-142

Exploring the influence of outflow surges on developing and mature tornadoes using a toy model

Valérian Jewtoukoff, Paul Markowski, and Yvette Richardson
Department of Meteorology and Atmospheric Science, The Pennsylvania State University, University Park, PA

Highly idealized simulations are performed with the Bryan Cloud Model (CM1) to exam- ine the role of outflow surges in the intensification of vertical vorticity within low-level mesocyclones. The initial wind field is a Rankine vortex that decays with height, the axis of which is co-located with a cylindrical heat source similar to that used in the ide- alized simulations of Markowski and Richardson (2014). In a control simulation featuring only this heat source, the vortex intensifies to tornado strength through convergence and stretching within approximately 20 min; the maximum vertical vorticity and horizontal wind speeds are 2 s^{-1} and 65 m s^{-1}, respectively. This baseline evolution is compared to the evolution in numerous additional experiments, in which heat sinks of various shapes and intensities are included, some distance from the central heat source and updraft. The heat sinks introduce surges of cold air and momentum perturbations into the tornado, both during its formative stages and mature stages (i.e. the timing of heat sink activation also is varied). We will present and discuss results from our simulations.