18–22 September 2017, Pula, Croatia
ECSS2017-40

Simulations of devastating tornadoes embedded within supercell thunderstorms

Leigh Orf
United States (leigh.orf@ssec.wisc.edu)

The processes involved in tornado genesis, maintenance, and decay within supercell thunderstorms remain elusive. While the majority of observed supercells produce no tornadoes or weak, short lived tornadoes, a small fraction produce long-path devastating (rated EF4/5 on the Enhanced Fujita scale) tornadoes. Our research aims to explore the processes occurring within these least common, but most devastating, supercells via the use of a numerical model.

We present results from CM1 numerical model simulations of tornadic supercells run on the Blue Waters supercomputer at 20 and 30 meter grid spacing. The model is initialized with conditions adjacent to the 24 May 2011 El Reno EF5 tornadic supercell. Similar to the observed storm, our simulated storm produces a long-path EF5-strength tornado. We examine processes occurring during tornado genesis, maintenance, and decay, presenting results in video form made up of individually volume-rendered frames sampled at 1 second intervals. We examine a feature we call the streamwise vorticity current, a helically flowing horizontal "tube" of air embedded within the forward flank cold pool that tilts into the storm's vigorous updraft near the ground. We also explore the behavior of cylconic and anticylonic misocyclones that move along the storm's forward flank downdraft boundary into the tornado's circulation, as well as a near-surface sheet of streamwise vorticity embedded within the storm's cold pool that converges into into the tornado just above ground level.