

Analysis of an EF4 supercell thunderstorm mesoscale structure

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The Enhanced Fujita 4 (EF4) Scale tornado outbreak in Funing county on 23 June 2016, was the strongest tornado in Jiangsu province since 1961. This paper addressed the synoptic environment, the thermodynamic condition, and the three-dimensional fine scale structure of the tornadic supercell thunderstorm. This thunderstorm developed under a convectively unstable environmental condition. The environmental wind vertical shear was intense at the low and middle level. Convergence lines and a γ -mesocyclone were observed on the surface. The supercell thunderstorm was a left-moving supercell with a hook echo and an inflow notch at the low level. A strong mesocyclone, located in the top of the hook echo, was observed clearly in Doppler radar image at the low and middle level. It lasted for more than 90 minutes. The tornado vortex signature (TVS) lasted for 12 volume scans, which was 46 minutes before the tornado occurred. In the period of tornado formation and intensification, the center of the storm mass, the storm top, and the height of the maximum reflectivity rose remarkably. The vertical integrated liquid (VIL) of the storm increased, too. The tornado occurred in the first time of the above-mentioned parameters decreased synchronously. The dual-Doppler retrieval wind fields revealed a mesocyclone at the low level of the convective storm. This mesocyclone was situated at the low and middle level of the hook echo high-reflectivity region. Moreover, a weaker anticyclonic circulation was located on the south of mesocyclone. The vertical vorticity couplets played an important role in the tornado formation, intensification, and maintenance.

Keywords: Tornado, Mesocyclone, Supercell thunderstorm