Mesocyclone Evolution Associated with Varying Shear Profiles during the 24 June 2003 Tornado Outbreak

Joshua M. Boustead
NOAA/NWS Omaha/Valley, NE

Philip N. Schumacher
NOAA/NWS Sioux Falls, SD

ABSTRACT

The morphology of mesocyclones associated with the regional tornado outbreak on 24 June 2003 is examined to illustrate the effects of changing shear profiles. The large-scale environment was supportive of deep moist convection, with forcing for ascent and extreme instability. Post-event analysis indicated there were significant changes in the shear in space and time across a small geographical area. The event was separated into sectors based on both the synoptic setting and the differing shear profiles. Near the surface warm front, the shear profile and mesocyclone evolution exhibited a classic appearance and produced strong tornadoes. In the warm sector, where no discernable surface boundaries were evident, classic supercells were initially favored but failed to produce more than weak tornadoes. The shear profile significantly changed as a low-level jet intensified and mid-level winds weakened after 0000 UTC 25 June. The majority of the shear became located below 3 km. As the shear profile changed, mesocyclone strength increased and became juxtaposed closer to the surface, and tornado frequency and strength increased, with the strongest of the tornadoes occurring late in the evening. It appeared the combination of a dynamically induced low-level jet became juxtaposed with extreme instability and an uncapped atmosphere to allow for the development of strong low-level mesocyclones and numerous tornadoes in the sector with no discernable surface boundaries.