European Conference on Severe Storms 2015
14–18 September 2015, Wiener Neustadt, Austria
ECSS2015-22

Origin of Vertical Vorticity in Misocyclones along a Tornadic Narrow Cold Frontal Rainband in the United Kingdom

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Many studies concerning tornadogenesis focus on tornadic supercell thunderstorms in the United States. In the British Isles, however, most tornadoes are produced from linear convection. These tornadoes tend to produce less damage than in the United States and, over the past 33 years, have not been classified higher than F2 damage. Their smaller damage potential, however, does not preclude British Isles tornadoes from threatening lives and property. Therefore, it is important to understand the dynamics of tornadogenesis, particularly in other countries, produced from linear storms.

We present a case study of a tornadic narrow cold frontal rainband (NCFR) on 29 November 2011 that traversed Wales and northern England to help improve knowledge of tornado dynamics in linear convection. Seven tornadoes, ranging from T1 to T4 (F0 to F2) in damage, formed along the NCFR. Four of the tornadoes occurred along a bulge or in the gap between two heavier areas of precipitation, both radar signatures previously recognized as potentially producing tornadoes (e.g., Jorgensen et al. 2003; Smart and Browning 2009; Kawashima 2011; Clark and Parker 2014). Three tornadoes occurred without these radar signatures and are the focus of the case study.

Results from a WRF-ARW simulation of the case with 200-m grid spacing will be examined. The simulation produced a misocyclone along the NCFR in a region without gaps or bulges in a similar location to where the tornadoes were observed. Backward trajectories from this misocyclone will be analyzed using the vorticity tendency equation to determine the origin of vorticity. Additionally, a misovortex collocated with a gap in the NCFR will also be analyzed for comparison. Along-front variability in vorticity will also be discussed.