Analysis of a Complex Mesovortex Evolution during the Second 30 June -1 July 2014 Derecho Event

Adam Clayton¹, Anthony Lyza¹,²
¹Department of Atmospheric Science
²Severe Weather Institute – Radar and Lightning Laboratories

Overview
- A tornadic quasi linear convective system (QLCS) impacted northern Illinois and northern Indiana on 30 June – 1 July 2014.
- The QLCS produced a total of 29 tornadoes and was responsible for 2 fatalities.
- A mesovortex (named mesovortex G) formed in northeastern Illinois and then tracked east splitting into two subvortices (G-1 and G-2).
- G-1 (the northern subvortex) produced 8 tornadoes, with up to 3 simultaneous tornadoes in close proximity to each other.
- G-2 (the southern subvortex) produced 6 tornadoes with only one instance of 2 simultaneous tornadoes.
- Single-Doppler analysis showed significant structural and intensity differences between G-1 and G-2.

Key Findings
- G-1 measured nearly 9 km deep, which scales more closely with supercell mesocyclones more so than QLCS mesovortices.
- G-1 eventually became dominant, with the G-2 rotating around it.
- G-1 maintained a greater diameter than G-2 for much of its existence, and
- Low-level rotational velocity tended to be much higher in G-1 than G-2.

Future Work
- Future work will include comparing radar signatures to detailed damage surveys conducted along mesovortex G’s track.
- The dual-polarization radar data collected during this case will be analyzed with an emphasis on debris detection and evaluation of precipitation particle size sorting.

Impact
- Mesovortex G was responsible for 14 of the 29 confirmed tornadoes on 30 June – 1 July 2014.
- All 14 of the tornadoes produced by G-1 and G-2 were of EF-1 strength (86-110 mph).
- The subvortices also produced numerous straight-line wind damage reports.

Fig. 1. Overview radar image of the second 30 June – 1 July derecho (left), and subvortex tracks G-1 and G-2 and associated tornado tracks (right).

Fig. 2. Images of damage from surveys of Mesovortex G.

Fig. 3. 0.5, 1.3, 3.1, and 6.4 deg. plan position indicator (PPI) radial velocity (Vr) from the Chicago/Romeoville, IL (KLOT) weather surveillance radar – 88 Doppler (WSR-88D) at 0341 UTC 1 July 2014. White circles indicate location of subvortex G-1 at each elevation. The heights above ground level at each elevation are approximately 785 m (0.5 deg), 1803 m (1.3 deg), 3938 m (3.1 deg), and 7193 m (6.4 deg).

Fig. 4. Four-panel plot of rotational velocity (VROT; upper-left), vorticity (upper-right), diameter (lower-left), and depth (lower-right) for mesovortex G. Blue lines indicate subvortex G-1 and purple lines indicate subvortex G-2. Red and green lines indicate another vortex split not pertinent to this presentation.

Acknowledgements
Ryan Wade of UAH-SWIRLL was the faculty sponsor for this research. The Office of the Vice President for Research and Economic Development funded printing of this poster.