An Observational Study of a Cylindrical Tornadic Storm in South Dakota on 18 June 2014

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Event Overview

- Third consecutive day of severe weather and significant tornado activity across the Great Plains (Fargo-G/6, Colorado-G/7)
- Localized conditions became very favorable for tornadas across central South Dakota by the afternoon of the 18th, with over a dozen tornadoes documented in the state between 2100 UTC to 0400 UTC – several of these tornadoes were visually large and intense. Fortunately many remained over open fields.
- The most prolific tornado-producing storm exhibited several interesting traits worthy of further examination. Specifically, the environment, storm mode and evolution, lightning activity, and its rapid cyclical mesocyclonic evolution.

Mesoscale Environment

- Visible satellite imagery. The yellow arrow highlights the approximate location where lowering convective cloud began to form.
- Apparent location of Mesoscale Convective Systems (MCSs) (purple arches)
- Pronounced capping inversion (300-350 mb 10-15°C; not shown) prevented robust convection development south of the warm front.
- New convection developing north of the warm front had a deep storm root at 300 mb.
- As the rainband moved north, it pushed the east-west boundary.

Documented Tornadoes – 18 June 2014

- All tornadoes were in both RDA (≤ 14 km) and RDA (≤ 27 km) limits for one tornado (13%) contained TDS during event.
- Generally increases in analysis of low-level radar weather phenomena.
- WRF-88D Signatures and Scanning Strategies

- Storm Summary

- Propagation of the storm was strongly influenced by a capping of upper-levels 400 hPa over the central-eastern United States.
- Storms move southward, resulting in a capping of upper-levels 400 hPa over the central-eastern United States.
- Rapid cyclical mesocyclones (“20-30 minute cycle”) occurred during much of the event, with virtually all tornadoes originating from one or a few well-defined mesocyclones. Mesocyclones were not always noted along the lower part of the observed data; however, all tornadoes occurred between 6 and 9 km.

Cloud-to-Ground Lightning Characteristics

- HZS2 from both 60 km (≤14 km) and RDA (≤ 14 km) limits.
- WRF-88D Signature and Scanning Strategies

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