1. Introduction

On 19 May 2013, two supercells moved through central Oklahoma and produced seven tornadoes, including one of EF-3 and one of EF-4 intensity. High temporal and spatial resolution observations were collected in both strong tornadoes by a mobile, rapid-scan, X-band, polarimetric radar (RaXPol). In conjunction with the nearby WSR-88D Twin Lakes radar, dual-Doppler analyses were synthesized to produce the three-dimensional wind field and analyses of vertical vorticity throughout the tornadoes’ lifecycles. Presented herein is a vertical vorticity analysis of the Norman-Shawnee supercell, which includes data from three separate RaXPol deployments (left). Analysis of the dual-Doppler wind field with respect to differential reflectivity (ZDR) columns are also examined for the Edmond-Carney supercell (top right).

2. Methods and Radar Characteristics

Characteristics of the radars used to collect data on 19 May 2013, as well as the methods used to process and create the dual-Doppler wind syntheses, are described below:

- **Raw RaXPol Data**
  - High-temporal resolution – radar scans every 2 seconds
  - Characteristic strengths represented) and identify areas where this technique may exacerbate dual-Doppler errors.

- **Objective Analysis**
  - Observation Processing and Wind Syntheses (OPAWS) (e.g., Kosiba et al. 2013) was used to map the data to a Cartesian grid using a two-pass Barnes analysis, and a grid spacing of 250 m.

- **KTLX Analyses**
  - Spatially variable advection correction technique employed to interpolate KTLX data linearly, in a Lagrangian sense, to the RaXPol analysis times (Shapiro et al. 2010a, b).

- **Interpolated KTLX volumes are paired with RaXPol volumes at each corresponding time to create a dual-Doppler synthesis valid at each RaXPol volume.**

3. Dual-Doppler Analysis - Norman-Shawnee Supercell

For the Edmond-Carney supercell (top right), analysis of the Norman-Shawnee supercell (top left), and vertical profiles of \( \zeta \) (right) at five selected times during RaXPol deployment 4. At 22:29:34 UTC, RaXPol was 2.5 km from the tornado. Black contours represent \( \zeta > 0 \), and are plotted every 0.5x10⁻¹ s⁻¹. BELOW: Time series plots of \( \zeta \) (left) at 0.75 km, 1 km, 2 km, and 3 km, and vertical profiles of \( \zeta \) (right) at four selected times during the dual-Doppler analysis.

4. Z<sub>DR</sub> Column Analysis - Carney-Edmond Supercell

LEFT: Analysis of \( Z_{DR} \) with respect to dual-Doppler derived wind field. Positive (negative) vertical velocity \( \omega \) is plotted every 10 m s⁻¹ in black (blue). Dashed contours represent \( \omega = -0.5 \) m s⁻¹ (bottom). \( Z_{DR} \) column height (km), a \( Z_{DR} \) column designated as \( Z_{DR} > 1 \) is also presented (bottom row).

BELOW: Time series plots of the maximum \( Z_{DR} \) column depth (red line), and mean (black) and maximum (blue) updraft intensity.

5. Conclusions

This study demonstrates that it is possible to use time interpolated radar data to supplement rapid-scan radar data where a second radar can be used to provide additional insight on the physical processes within a convective storm. Qualitatively, this technique yielded reasonable results. However, additional studies are needed to better understand the quantitative results (e.g., how well are the updraft strengths represented) and identify areas where this technique may exacerbate dual-Doppler errors.

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