RaXPol DOPPLER-RADAR OBSERVATIONS OF MESOSCALE STRUCTURES IN WINTER STORMS IN THE NORTHEASTERN U.S. DURING IMPACTS 2022 AND 2023

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A group from OU participated in NASA's IMPACTS field campaign during the winters of 2022 and 2023 (McMurdie et al. 2022). It used RaXPol, a mobile, rapid-scan, X-band, polarimetric Doppler radar, designed primarily for probing severe convective storms (Pazmany, et al. 2013), to probe the mesoscale aspects of the wind field and precipitation in snowstorms in the northeast U.S., and also an MRR in 2023. This poster highlights some of the data collected in three storms.

1. 29 JANUARY BLIZZARD IN PLYMOUTH, MA

1458 - 0014 UTC (DELAYED BEGINNING DUE TO HIGH TIDE; V CHANNEL FAILED ~ 1824 UTC DUE TO EXCESSIVE RIMING) PPI VOLUME SCANS 0, 2, 4,20 DEG PULSE LENGTH MAINLY 60 m; PRF MAINLY 3000 Hz (V_{max} = 23.25 m s⁻¹; R_{max} = 50 km) I/Q RAW DATA: POLARIMETRIC DOPPLER SPECTRA (D. Schvartzman) VERTICALLY POINTING DATA S+ MAINLY; ~ 24 INCHES 2 BLOCKS AWAY AT HOTEL; MUCH LESS AT SITE, OWING

TO TIDAL FLOODING; VERY HIGH WINDS E MAX G70 mph (NEARBY OBS)

25 FEBRUARY SNOWSTORM IN ALBANY, NY

0923 - 1509 UTC PPI VOLUME SCANS 0, 2, 4, ... 20 DEG

PULSE LENGTH MAINLY 30 m; PRF MAINLY 2000 Hz (V_{max} = 15.5 m s⁻¹; R_{max} = 75 km) RHIs ALONG ER-2 FLIGHT PATH, BOTH COMING AND GOING; PULSE LENGTH 30, 20, 10 m, CHANGED EVERY ~ 5 SCANS (RESOLUTION vs. SENSITIVITY) S+ EARLY; LARGE AGGREGATES ~ 1305 - 1326 UTC; IP- AND S- ~ 1432 - 1455 UTC;

RHI

S- > 1457 UTC: ~ 7 - 8 INCHES



RaXPol probing a snowstorm in Albany, NY, on 25 Feb. 2022



Transition from dry snow to wet snow



RaXPol probing a blizzard in Plymouth, MA on 29 Jan. 2022. © H. Bluestein



Rimed waveguide on 29 Ian. 2022. C H. Bluestein



RHIs pointing to SSE, along flight track of NASA ER-2 aircraft at 20 km, 1251:44 UTC, 25 Feb. 2022. A SSEly LLJ is seen at ~ 2 km ARL; a maximum in Z is seen near the location of the LLJ and a 2^{nd} maximum in Z is seen ~ 5 km ARL, co-located with a maximum in Nly wind component.





Snowbands, 29 Jan. 2022 (top) moving bands (1755 UTC); (top, right) moving and propagating Surface weather bands (1943); (right) stationary band (2038). map, 1700 UTC, Acknowledgments 29 Jan. 2022

IMPACTS 2022 Case 1 Jan. 29th, 2022 - Plymouth, MA

Polarimetric Spectra



Data are from ~~17:22 UTC Data are from ~14:39 UTC Vertically-pointing polarimetric spectra

3. 25 JAN. 2023 SNOWSTORM IN ALBANY, NY

RHIs along path of ER-2 Metek MRR PRO vertically pointing data



2023

RaXPol RHI of Z during ER-2 overflight, 2207 UTC 25 Jan.

IMPACTS 2022 Case 2 Feb. 25th, 2022 - Albany, NY

Polarimetric Spectra





MRR data: moderate snow at KALB at 2207 UTC 25 Jan. 2023

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References

Dunnavan, E. L. and coauthors, 2023: Highresolution snowstorm measurements and retrievals using cross-platform multi-frequency and polarimetric radars. Geophys. Res. Let., 50, 11 pp.

McMurdie, L. and coauthors, 2022 Chasing snowstorms: The Investigation of Microphysics and Precipitation for Atlantic Coast-threatening Snowstorms (IMPACTS) campaign. Bull. Amer. Meteor. Soc., 103, 1243-1269. Pazmany, A. L., I. B. Mead, H. B. Bluestein, I. C. Snyder, and J. B. Houser, 2013: A mobile rapid-scanning, X-band, polarimetric (RaXPol) Doppler radar system. J. Atmos. Ocean. Technol., 30, 1398-1413.