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# The Relationship Between Radar-Observed Mesoscale Snowbands and their **Environment in a New England Explosive Cyclone during** the NASA IMPACTS Field Campaign

## Introduction

- On January 29th, there was a Nor'easter blizzard that impacted the east coast.
- The storm experienced a **rapid deepening** of 29 hPa in 18 hours classifying it as a bomb cyclone (Sanders and Gyakum 1980).
- NASA's Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) field campaign collected simultaneous datasets from multiple instruments for a variety of snow events (McMurdie et al. 2022).
- Preliminary analysis of the storm's snowbands suggested **three** different modes of organization.

# Why did the three snowband regimes behave the way they did?

# Methods

- Collected ERA5 and RaXPol data from archival databases for the specific times of the event, **12 UTC of the 29th** to 0 UTC of the 30th.
- **ERA5**: The 5th generation of ECMWF atmospheric reanalysis spanning the period of January 1940 to the present date.

#### • RaXPol:

- An X-band Polarimetric radar.
- Can provide volumetric data with 10 elevations in as little as 20 seconds.
- For this data, the operators chose a slower speed for higher resolution of polarimetric data.
- A beamwidth of ~1 degree in both azimuth and elevation and a minimum range resolution of 30m.
- 20-kW peak transmitted power ensures a high system sensitivity.
- Used Python to quantifiably and graphically analyze wind properties and thermodynamic variables to see why the snowband types formed the way they did.







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Three snowband regimes indicated by RaXPol:

- Westward movement of many small snowbands, 16:00 - 19:00 UTC.
- Steering level at 650 hPa indicated by sounding explains westward movement.
- Unstable layer begins at 650 hPa.
- Broad region of frontolysis ahead of the snowbands could explain their decreased intensity. • Slow eastward propagation of a single snowband,
- ~19:00 20:00 UTC.
- layer.
- Steering level winds remained at 650 hPa but weakened substantially.
- However, unstable layer lowered to 700 hPa.
- A hook is visible at ~20:00 UTC indicates the center of the low.
- UTC.
- Passage of central low pressure could indicate decreased lift.
- Winds at the steering level remained very weak.
- Region of frontogenesis at 700 hPa propagated north, and weakened over Cape Cod, which aligns with the dissipation of the single wide snowband.
- Look more deeply into the dynamics of the small-scale drivers of snowbands.
- A more detailed analysis of frontogenesis.
- Investigate the existence of gravity waves using the Scorer parameter. • Gravity waves are a possible driver for the snowbands and their dynamics.

Why?

impact the United States.

- Could improve forecasting accuracy for the amount and type of snowfall that comes out of the storm.
- Help communities enhance public safety and preparedness.
- McMurdie, L. A., and Coauthors, 2022: Chasing Snowstorms: The Investigation of Microphysics and Precipitation for Atlantic Coast-Threatening Snowstorms (IMPACTS) Campaign. Bull. Amer. Meteor. Soc., 103, E1243–E1269.
- 2. Sanders, F., and J. R. Gyakum, 1980: Synoptic-Dynamic Climatology of the "Bomb." Monthly Weather Review, 108, 1589–1606,.



#### Results

#### • Propagation aligns with **frontogenesis on unstable**

## • Wide quasi-stationary single dissipating band, 21:00

## **Future Research**

This could better help predict snowfall surrounding bomb cyclones that

#### References



17:00 UTC



20:00 UTC



21:00 UTC www.ncei.noaa.gov