AN EXPLORATION OF KINEMATIC WIND FIELDS OBSERVED DURING THE 02-07-2020 SNOWSTORM

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OVERVIEW

The IMPACTS Field Campaign:

- Collects observations to understand how microphysical, thermodynamic, and dynamical processes interact across multiple scales to produce snowbands during winter storms affecting the northeast United States.

This Poster:

- Explores one flight leg from 15:08-15:24 UTC during a storm on 7 February 2020 using Velocity Azimuthal Display (VAD) analysis to understand the kinematics properties of the wind field and how they contribute to heavier snowfall.

Guiding Research Question:

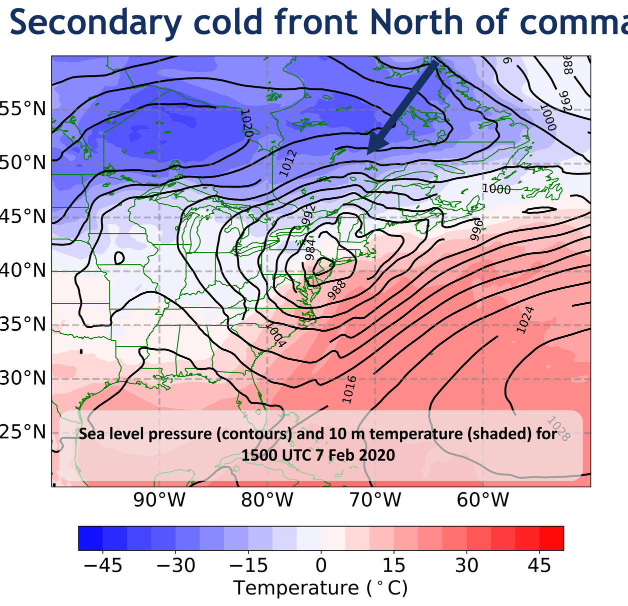
- What are the dynamical mechanisms causing mesoscale vertical motion, and how do these contribute to sustaining the snowbands we sampled?

BACKGROUND & DATA

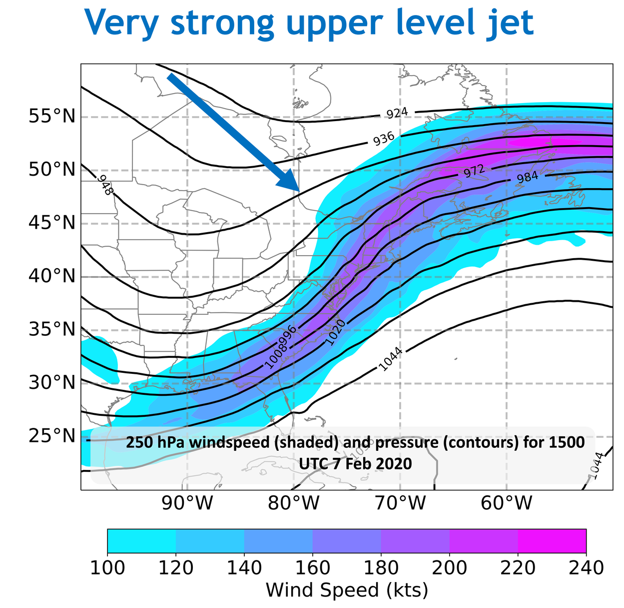
- **Snowband Definition:** A primary snowbands is defined by regions of enhanced reflectivity >250 km long, 20 - 100 km wide, and >30 dbz for at least 2hrs in NEXRAD 0.5° elevation scans (Novak et al. 2004).
- **Data we use to determine presence of primary snowband:** Composite reflectivity at a constant altitude of 1.5 km (see below)
- **Wind data:** Velocity Azimuthal Display (VAD) wind product created by C. Helms (Helms et al. 2020) from the IMPACTS EXRAD observations.
- **Surface precipitation:** Determined from the NYS mesonet observations. Precipitation type determined by the following: SNOW if precip rate > 0.5mm/hr, snow depth increases by > 0.25cm/hr, and temperature < 1C, rain otherwise

SYNOPTIC & MESOSCALE CONTEXT

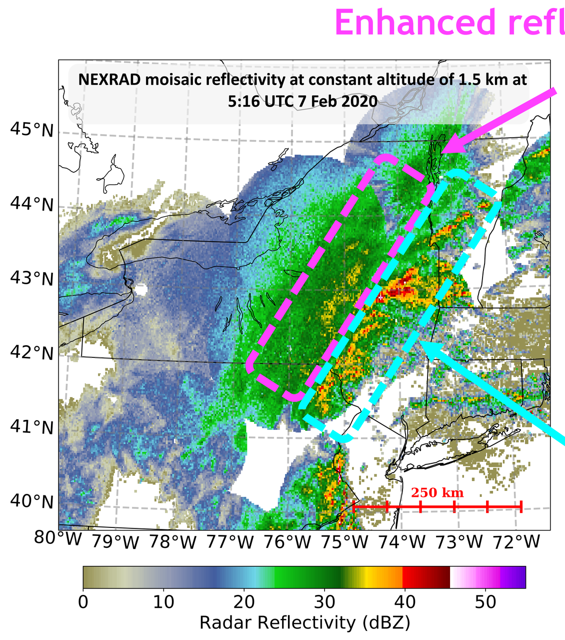
Secondary cold front North of comma head



Very strong upper level jet

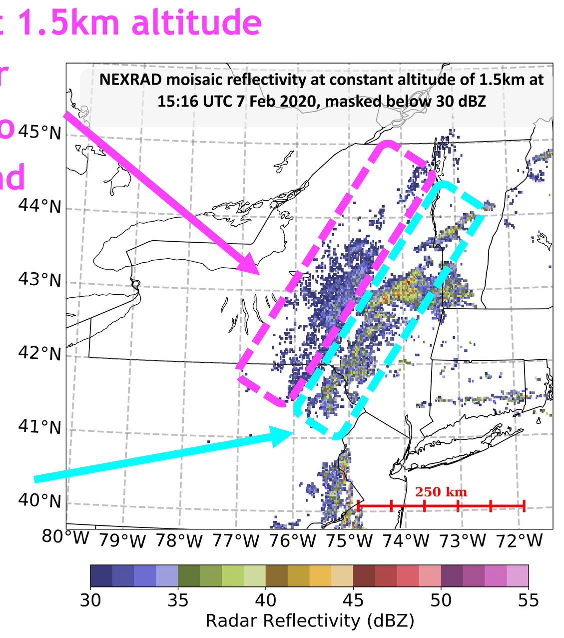


Enhanced reflectivity over 30dBZ at 1.5km altitude

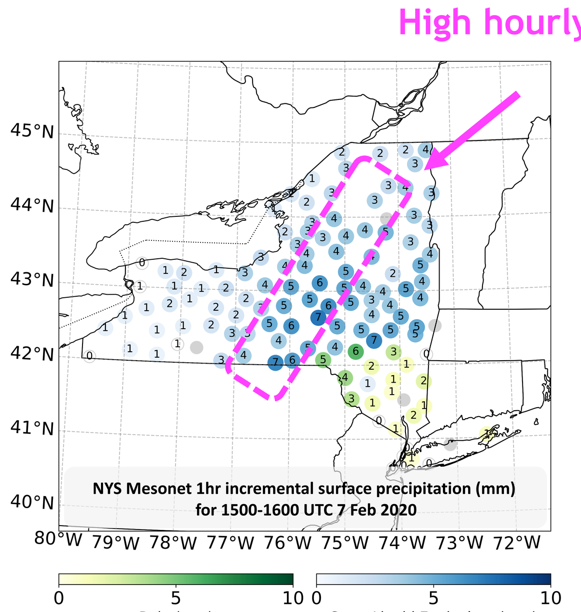


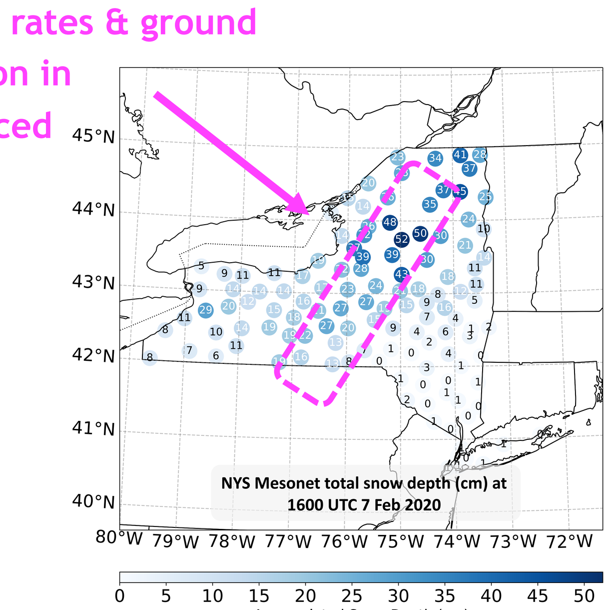
not well organized or long-lasting enough to be a primary snowband

Bright band due to melting layer

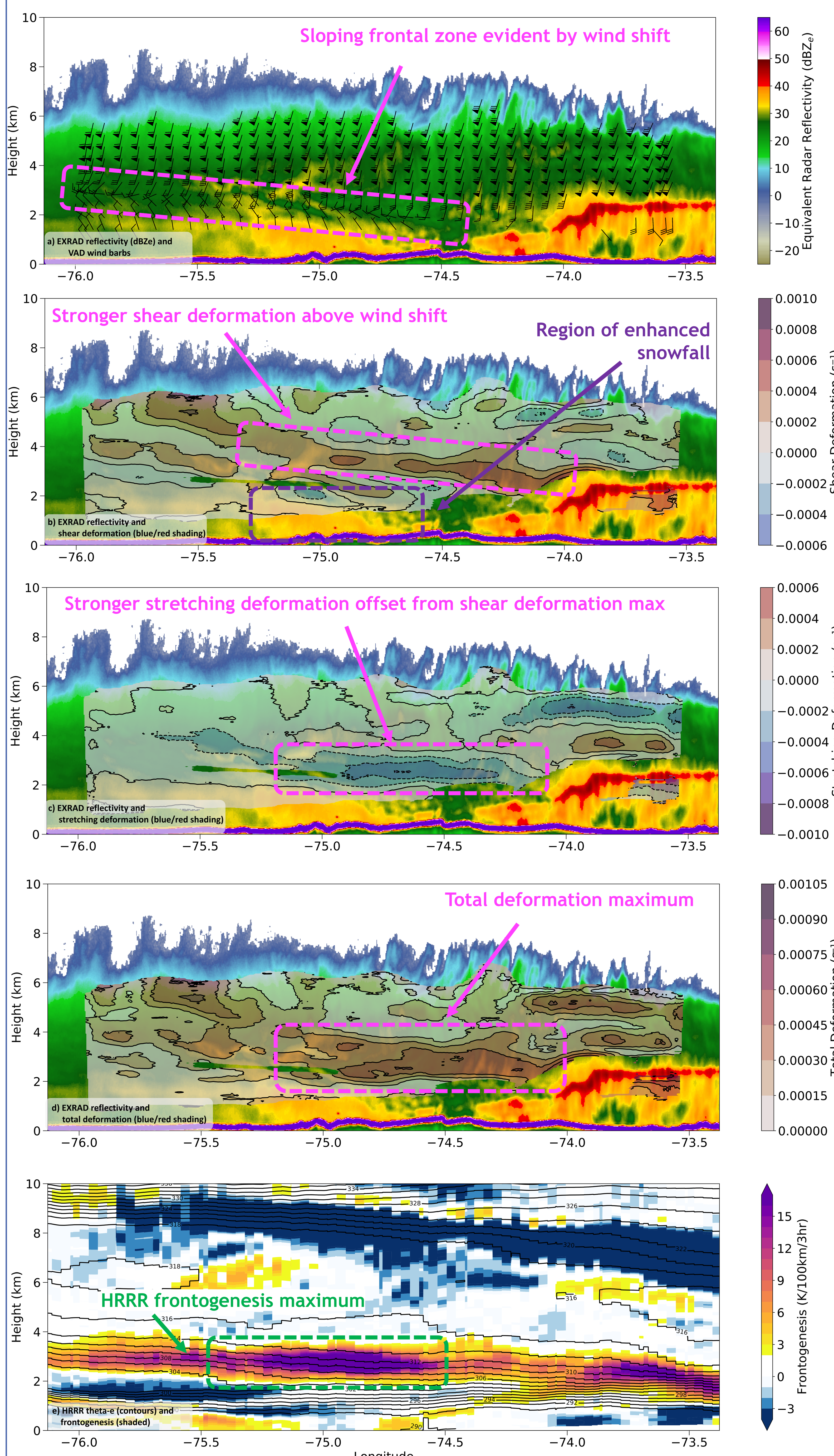


High hourly surface snowfall rates & ground snow accumulation in region of enhanced reflectivity



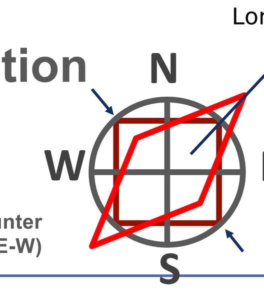


VAD WIND ANALYSIS FOR 15:08-15:24 FLIGHT LEG



Shearing Deformation

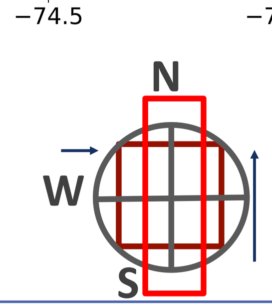
$\partial v/\partial x + \partial u/\partial y$



Positive axis of dilatation 45° counter clockwise of along track (this leg E-W)

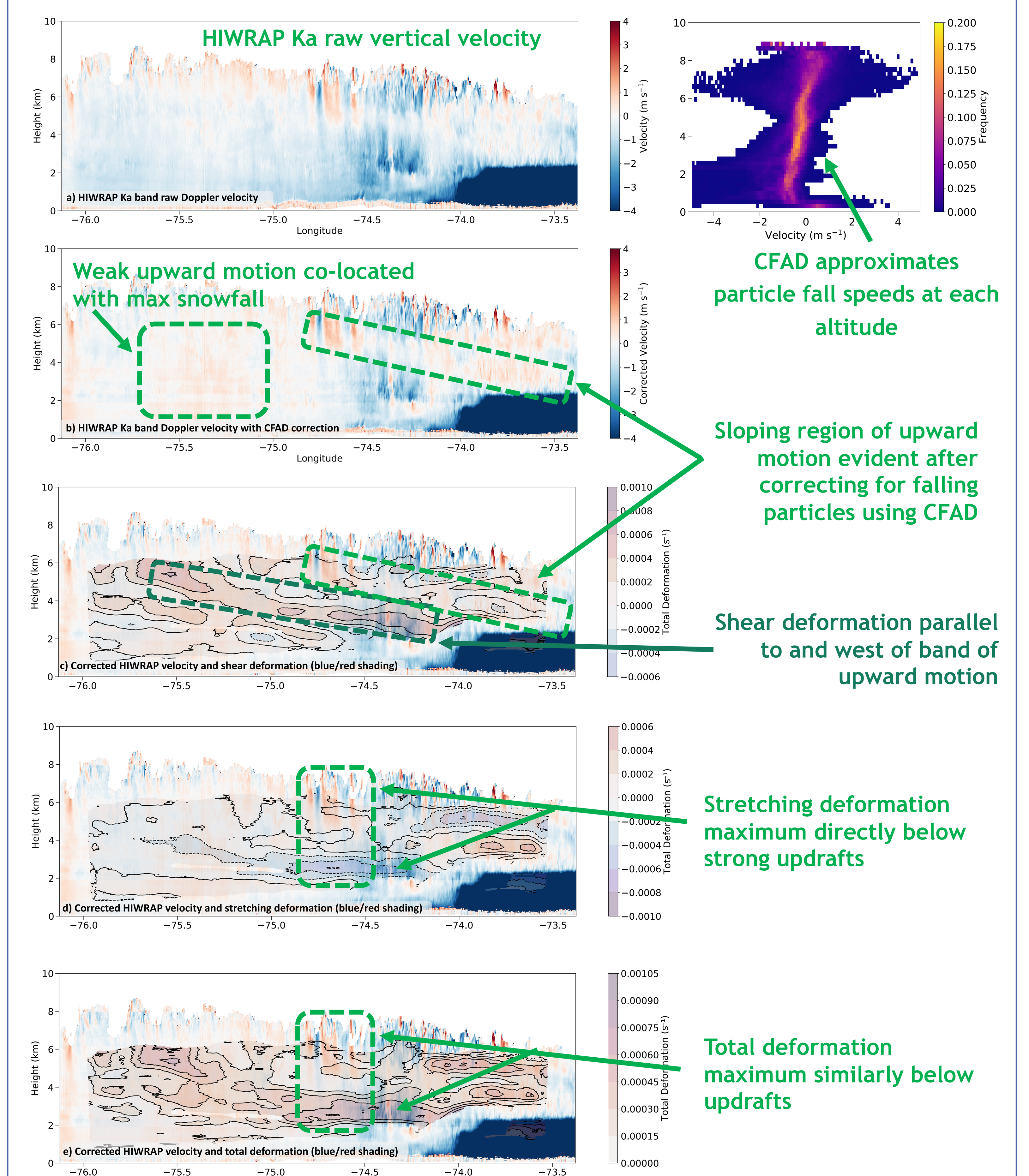
Stretching Deformation

$\partial u/\partial x - \partial v/\partial y$



Positive axis of dilatation across track (this leg N-S)

VERTICAL MOTION



DISCUSSION POINTS & FUTURE DIRECTIONS

- Region of heavy snowfall is not well-organized into a primary snowband as defined by Novak et al. 2004
- Strong deformation is associated but not exactly co-located with a sloping frontal zone and frontogenesis maximum
- Weak, broad area of upward motion is co-located with frontogenesis maximum and heaviest snowfall
- Strong updrafts located directly above deformation maximum are not oriented such that they would indicate hydrometeor lofting (Lackmann & Thompson 2019)
- Next steps will include:
  - Analyzing the microphysics data from the P-3 and comparing with regions of deformation and vertical motion
  - Assessing mesoscale horizontal wind kinematics to compare with flight-leg cross-sections

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Lackmann, G. M., and Thompson, G., 2019. Hydrometeor Lofting and Mesoscale Snowbands. *Mon. Wea. Rev.*, *147*, 3879-3899. doi:10.1175/MWR-D-19-0036.1