

# Convergence of snow bands in Northeast US storms

Laura Tomkins, Nicole Hoban, Matthew Miller, and Sandra Yuter

Department of Marine, Earth, and Atmospheric Science, N.C. State University, Raleigh, NC



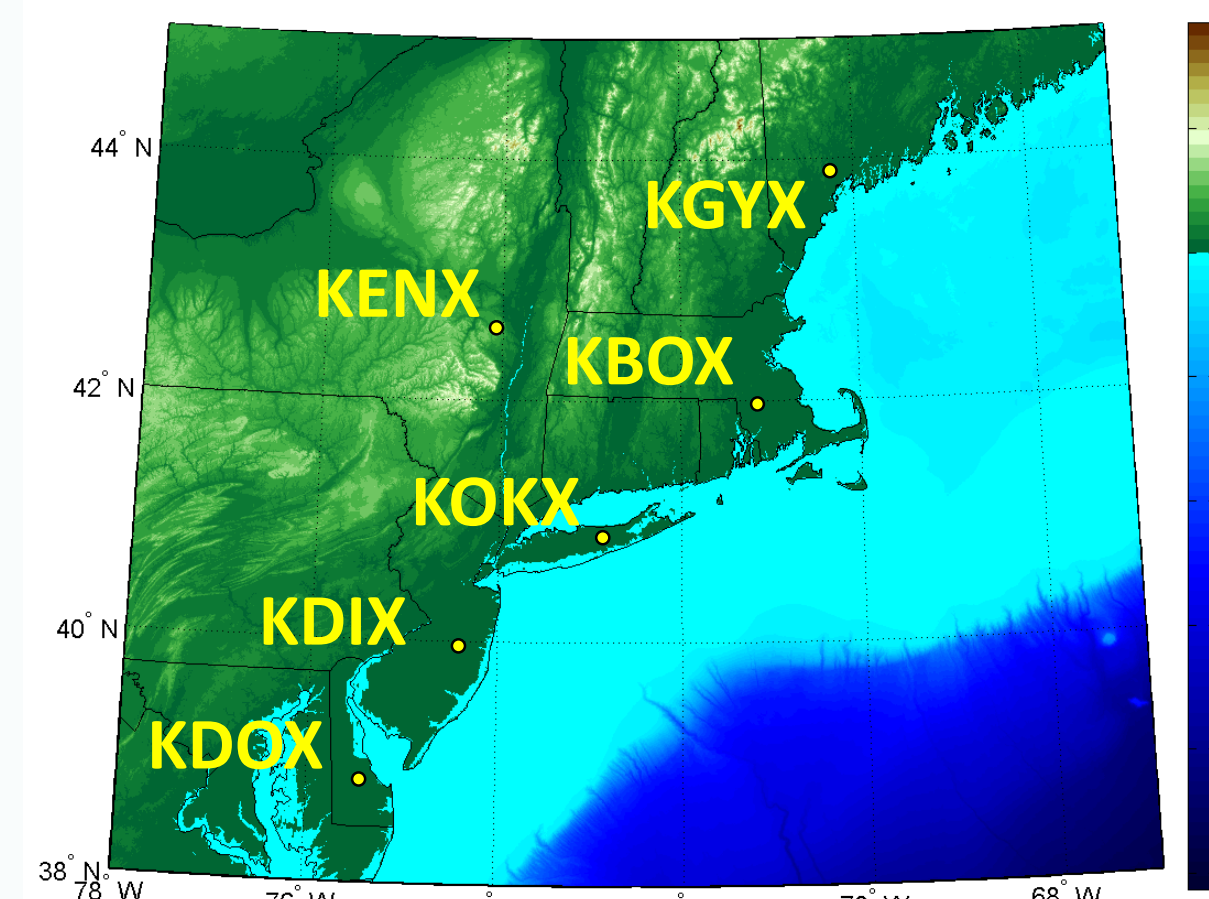
## Introduction

Winter storms in the Northeast U.S. often develop elongated bands with locally higher snow rates. Weather forecasting models have difficulty predicting these enhanced snowfall bands since the processes governing band characteristics are poorly understood. Radar observations show that snow bands occur in two main modes, single bands and multi-bands. Single bands are defined as snow bands that are > 250 km in length and usually only occur one at a time during a storm. Multi-bands are sets of smaller bands, usually roughly parallel to each other that move as group. Sometimes multi-bands will converge with a large single band. In other storms, multi-bands will move parallel to the storm motion and do not converge. This project seeks to better understand the conditions under which different types of snow bands occur.

## Methods

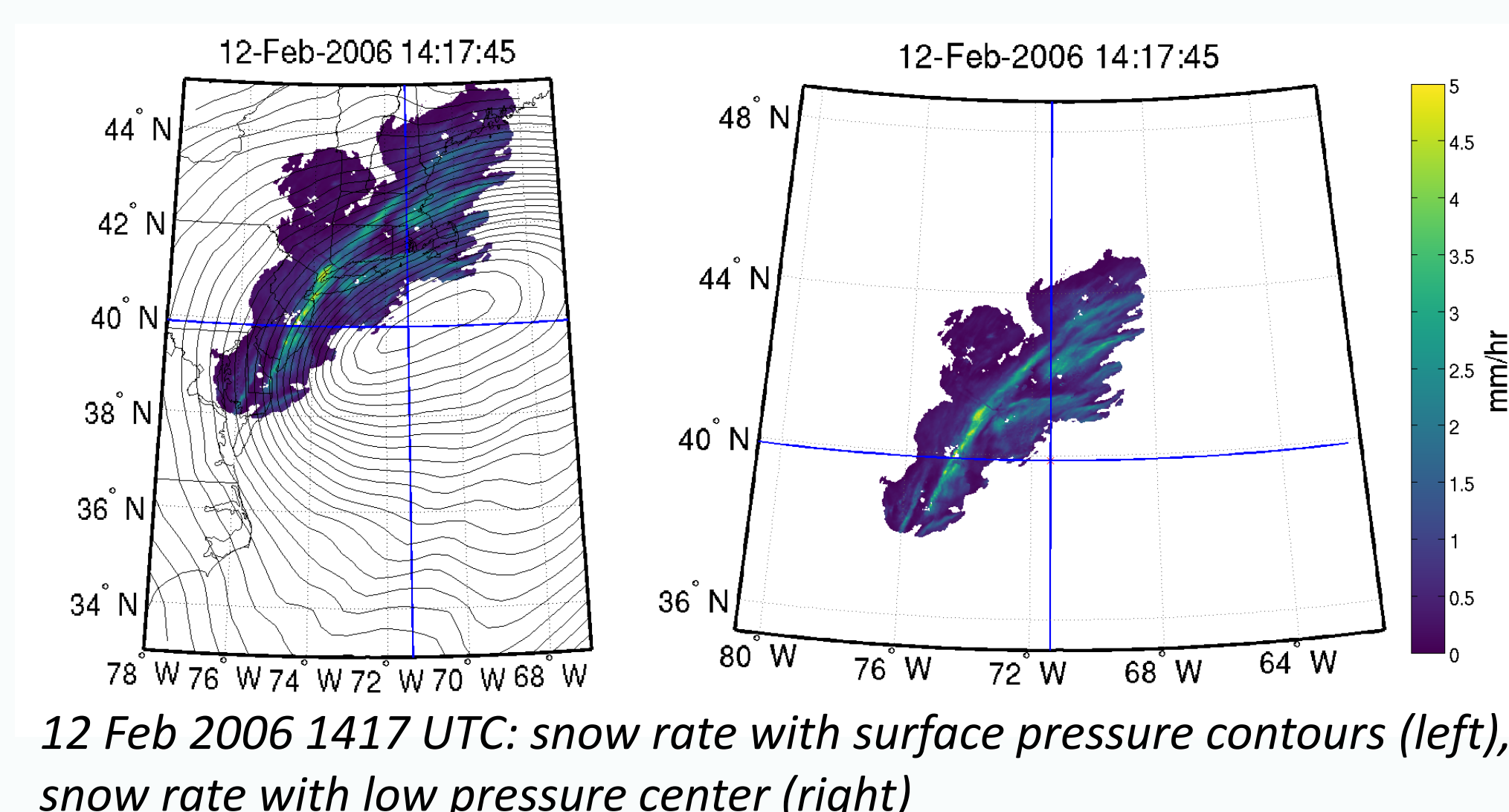
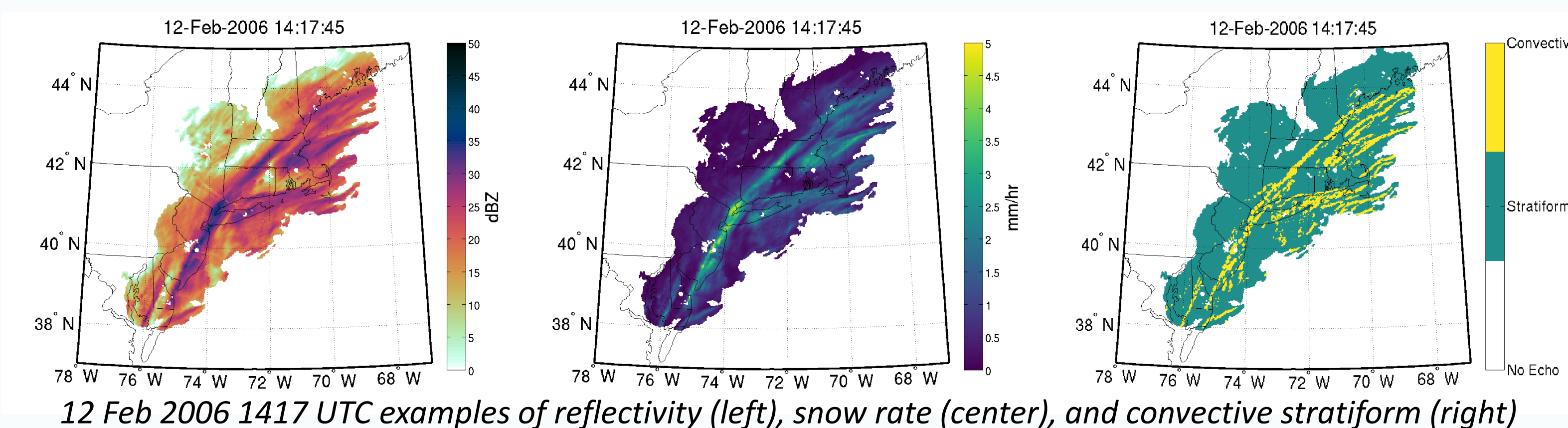
### Dataset

110 winter storms within the coastal Northeast United States region from 1996-2016 were analyzed. Data from six weather radars (KOKX, KBOX, KDIX, KDOX, KENX, KGYX) was used in this project.



### Materials

Using the methods described in Hoban (2016), the radar reflectivity is converted into snow rate which is then used to isolate the snow bands. The snow bands are areas of intense precipitation which are shown in yellow. The green represents areas of stratiform (weak) precipitation.



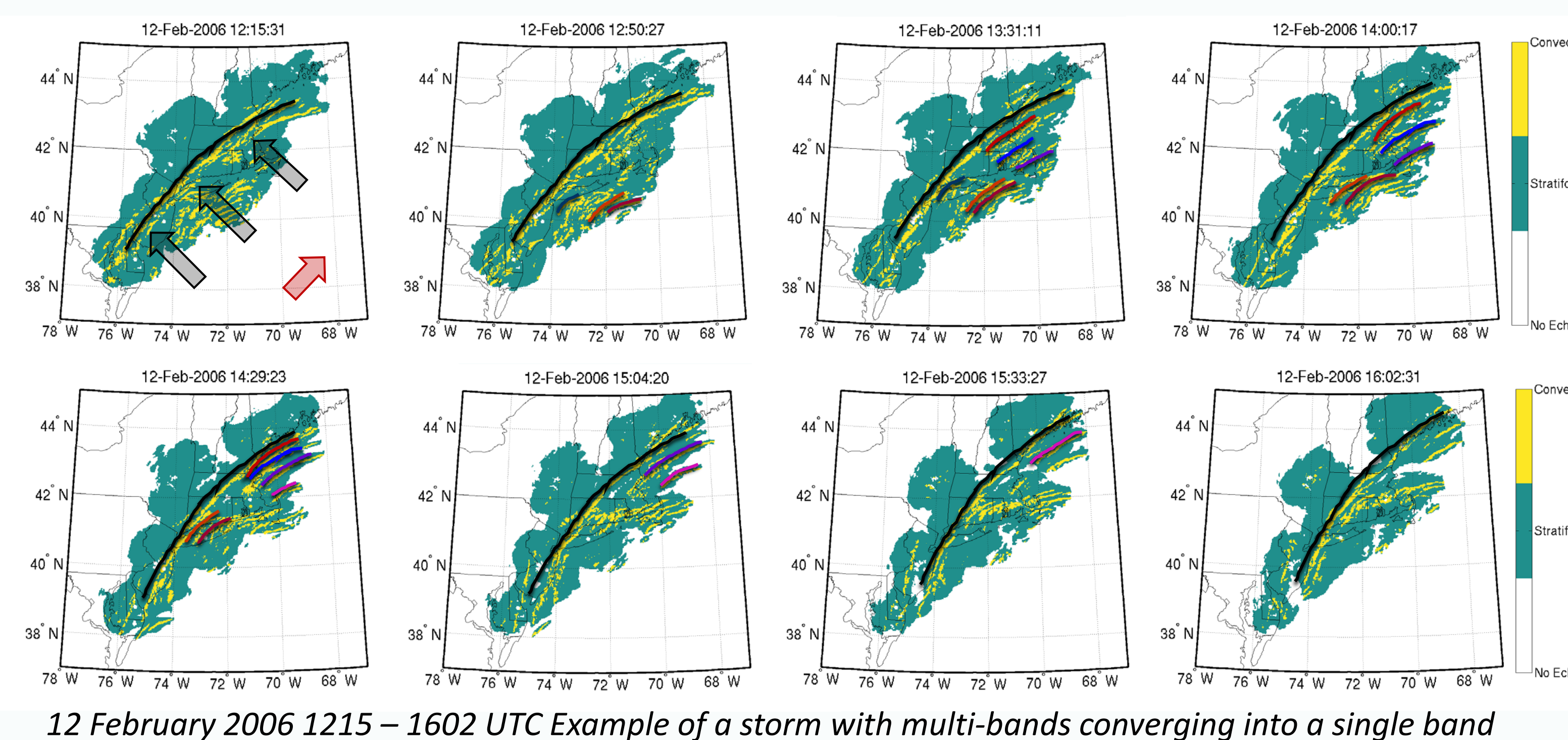
We use information on the track of the storm low pressure center to remove the overall storm motion. This allows us to focus on the bands' motion relative to the low center. The blue lines divide the storm into quadrants.

## Band Scenarios

Of the 110 storms that were studied, 79 storms were identified as banded storms (having a single band, multi-bands, or a combination of both present for a part of the storm duration). Of the 79 banded storms, 19 were identified with perpendicular-moving convergent bands and 21 were identified with parallel-moving bands.

### Convergent bands

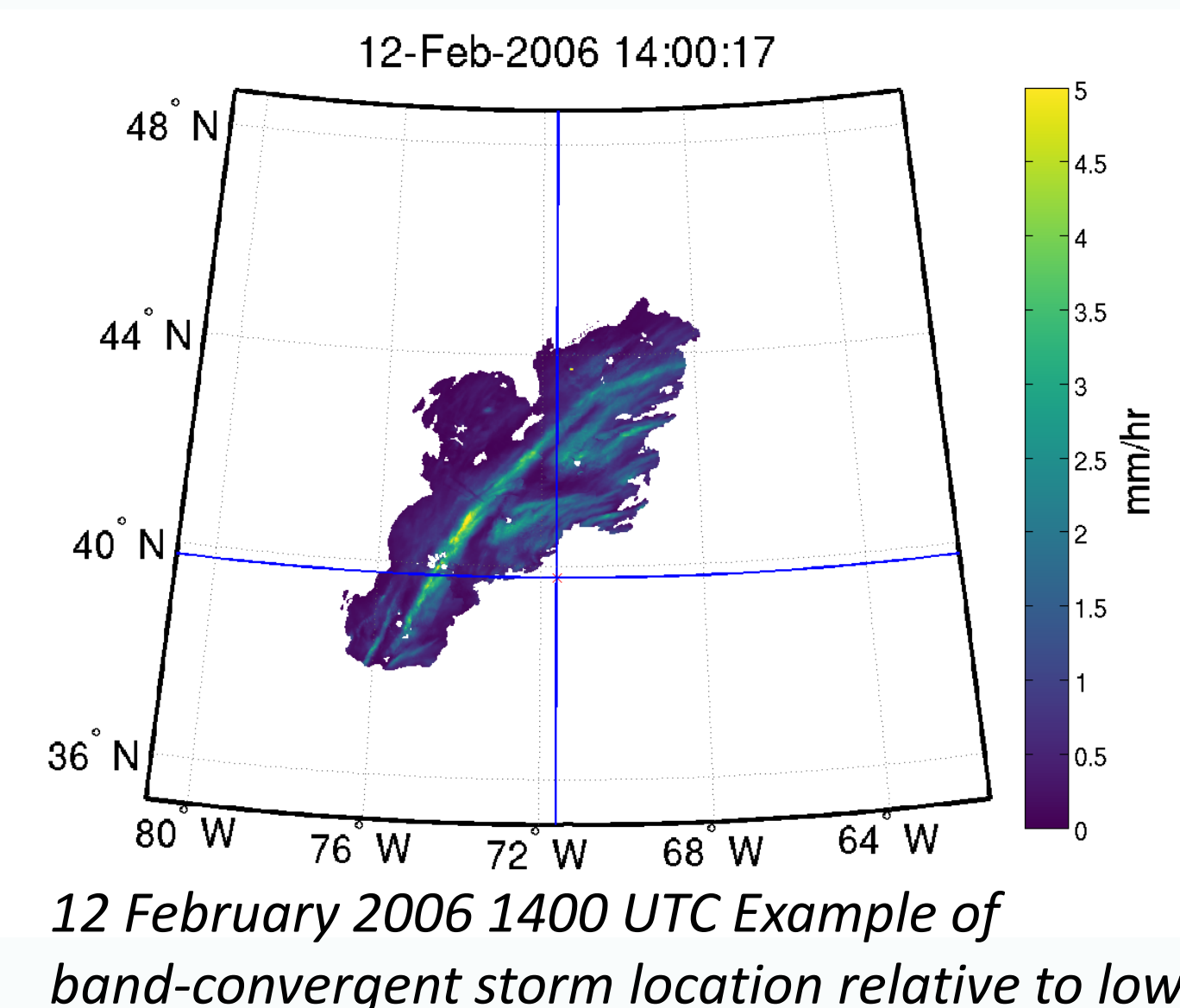
Some snow bands move perpendicular relative to the storm motion. Below is a sequence of images every ~30 minutes that illustrates the convergence of multi-bands into a single band. In the first image below, the direction of the bands movement is represented by the black arrows and the overall storm direction is represented by the red arrow. This convergence may in effect 'fuel' the single band.



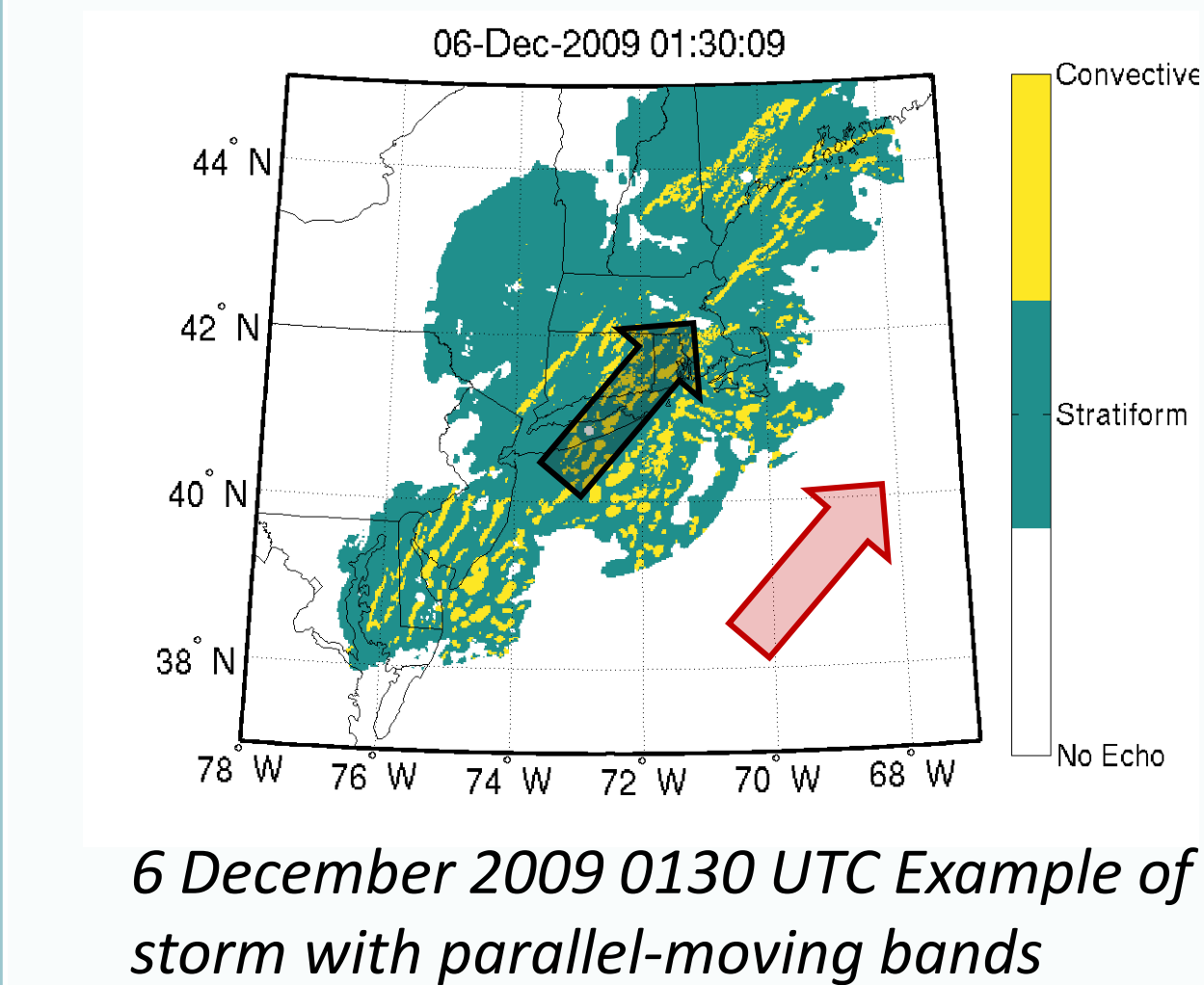
The single band is highlighted with black line and the colored lines show various multi-bands in the storm. Highlighted multi-bands of the same color correspond to the same multi-band in the previous frame. Each of the highlighted multi-bands moves closer to the single band. Some of these multi-bands apparently disappear once they reach the single band.

Converging bands occurred in the northeast and northwest quadrants relative to the low pressure center, Illustrated by the image on the right.

Please note that **movies** of these storms presented can be accessed online by scanning the QR code in the upper right of this poster.

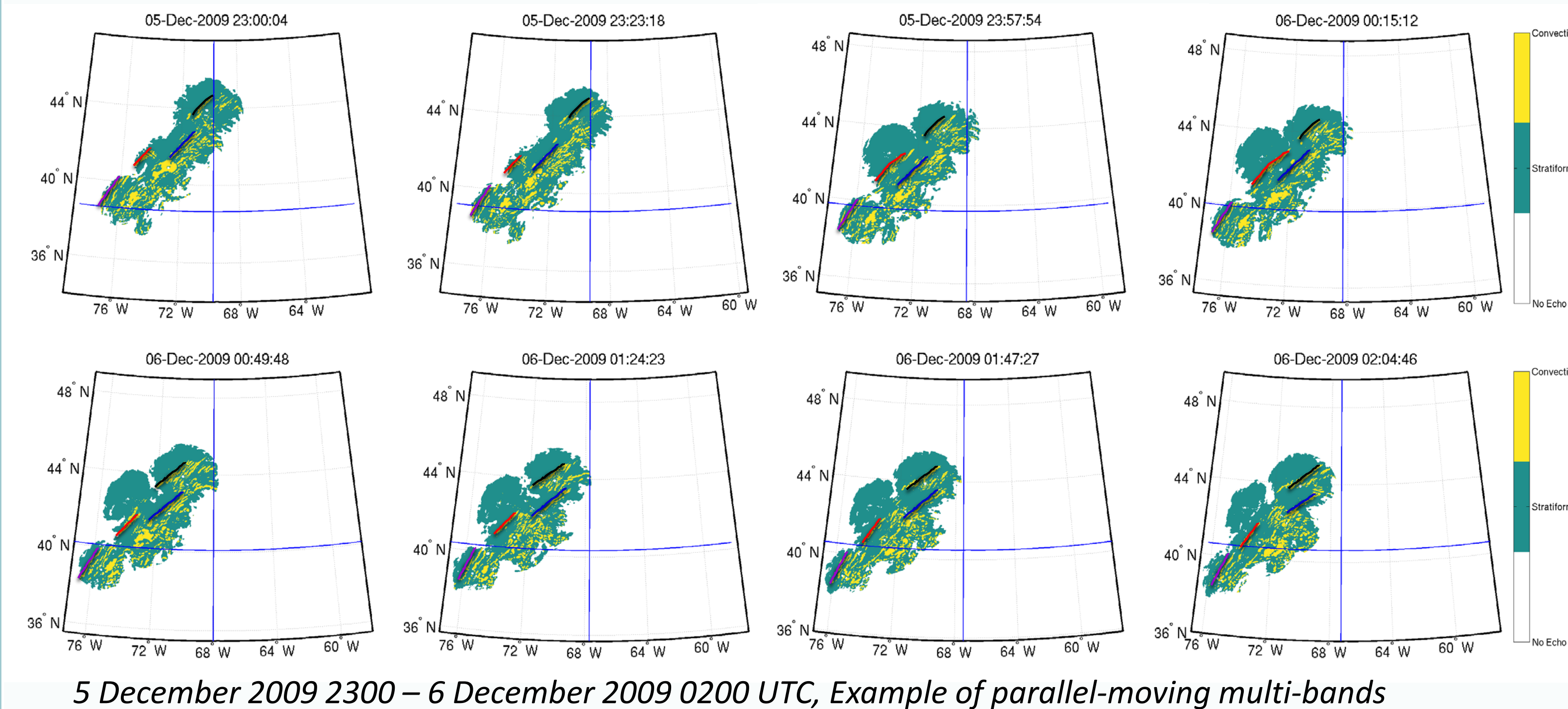


## Parallel-moving bands



Some snow bands move parallel to the storm motion. The multi-bands moving in these storms do not converge into a single band. The black arrow overlaid on the storm in the image on the left represents the direction of the band motion and the red arrow represents the overall direction of the storm.

The images below are another sequence of images showing the features of a storm with parallel-moving bands. In this case, we remove storm motion by using a grid with the center of the low pressure system at the origin. The bands are highlighted with black, red, blue, and purple lines. The multi-bands stay in roughly the same area and do not move relative to the storm or each other. The bands are in the northwest quadrant relative to the low which is a common feature of storms with parallel-moving multi-bands.



## Summary

- Multi-bands within winter storms can move roughly perpendicular or parallel relative to the overall storm motion.
- Multi-bands which move perpendicular can converge into single bands and in effect fuel the single band.
- Convergent bands are situated in the northeast and northwest quadrants relative to the low pressure center.
- Parallel-moving bands do not converge and do not move relative to the storm or each other.
- Parallel-moving bands generally occur to the northwest of the low center.

**Reference:** Hoban, N.P., 2016: Observed Characteristics of Mesoscale Banding in Coastal Northeast U.S. Snow Storms, M.S. Thesis, Dept. of Marine, Earth, and Atmospheric Sciences, North Carolina State University.  
**Acknowledgements:** Special thanks to Spencer Rhodes and Michael Tai Bryant for their assistance and advice. This research is supported by NSF grant AGS-1347491