# Cross Section Analysis in MetPy

Jonathan E. Thielen [1]   Ryan M. May [2]   John R. Leeman [2]

[1]Dept. of Geological and Atmsopheric Sciences, Iowa State University   [2]Unidata/UCAR

Background

- Cross sections are a common meteorological plot, often used in analysis of:
  - Convective systems
  - Isentropic ascent
  - Tropopause folds
  - Conditional Symmetrix Instability (CSI)
- The General Meteorology Package (GEMPAK) has the ability to obtain and plot such vertical cross sections through three-dimensional data, however, this functionality has been lacking until recently in MetPy.
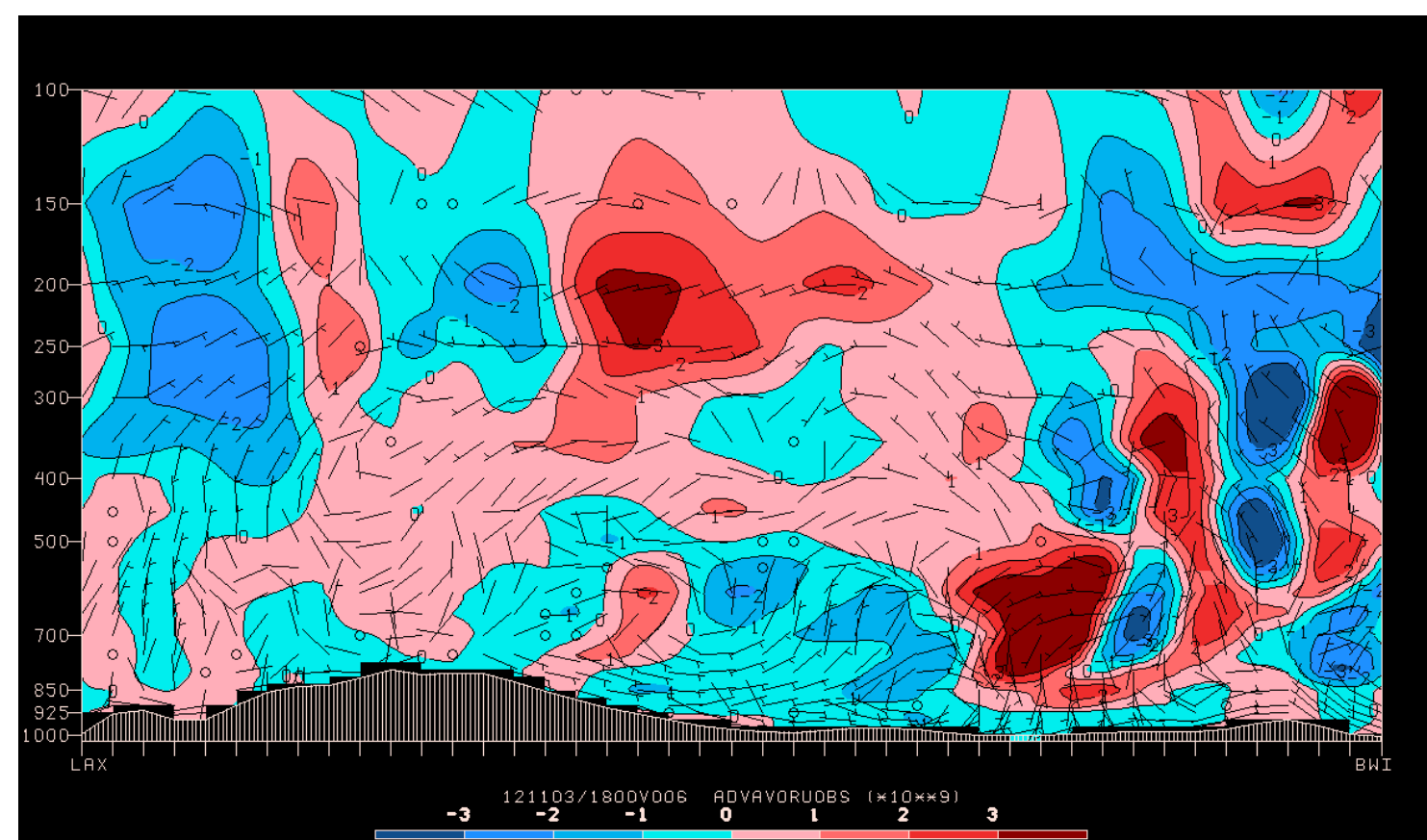
- Cross section interpolation (utilizing xarray) is now included in MetPy based on work undertaken during the 2018 Unidata Summer Internship.

xarray and MetPy

xarray is a powerful Python package that provides N-dimensional labeled arrays and datasets following the Common Data Model with many useful utility methods for indexing, interpolating, and reducing data. MetPy is transitioning to using xarray as its primary data model and includes of number of helper methods via an accessor interface, such a those below:

```python
import xarray as xr
from metpy.units import units


# Parse for CRS and coordinate types
data = xr.open_dataset('data.nc').metpy.parse_cf()


# Get a Cartopy CRS
data['temperature'].metpy.cartopy_crs


# Unit and coordinate helpers
data['temperature'].metpy.sel(
    vertical=500 * units.hPa)
data['u_wind'].metpy.convert_units('knots')
```
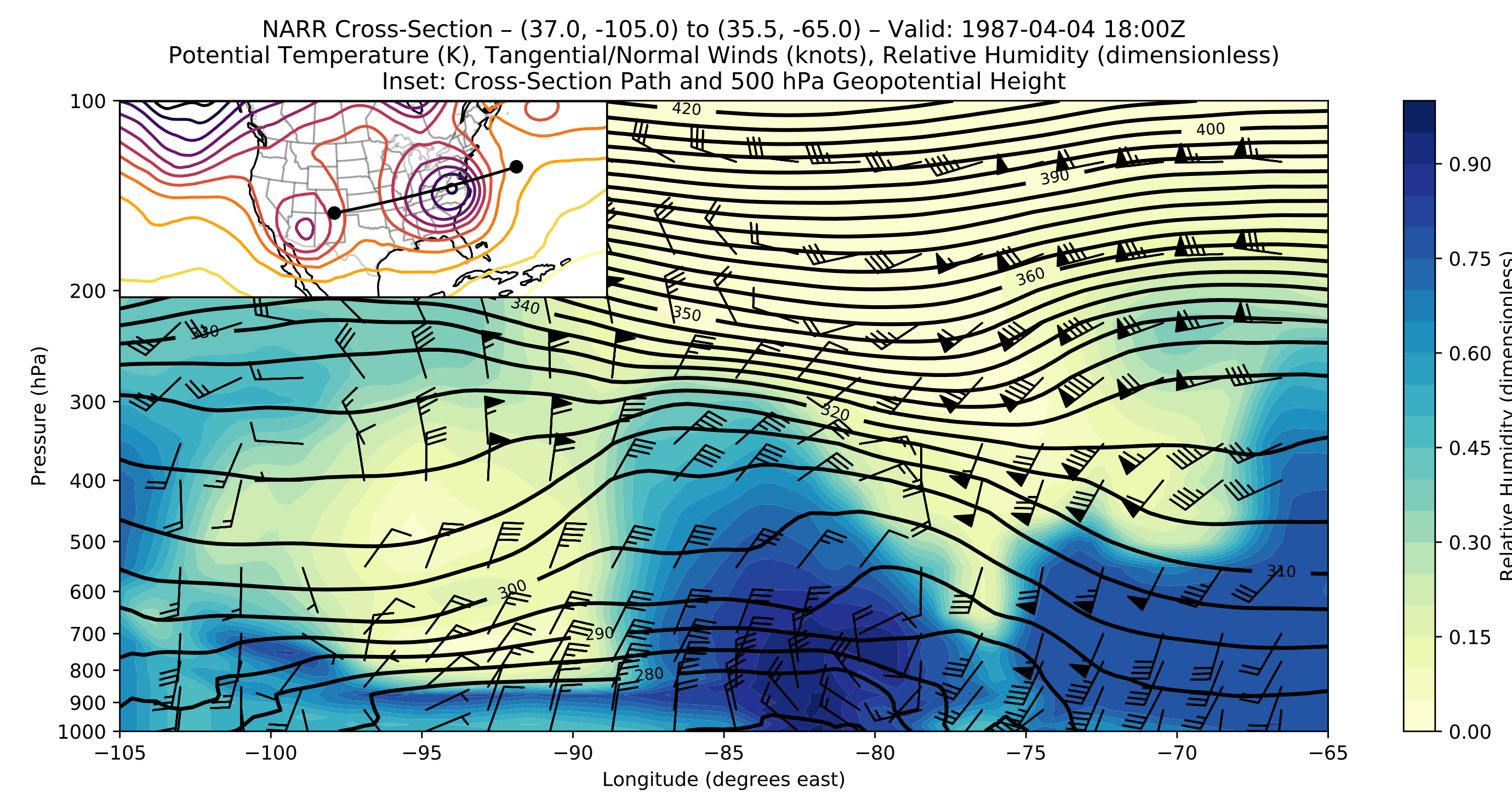

Figure 1. Basic cross section example using NARR data, with demonstration of wind components (included in MetPy documentation).
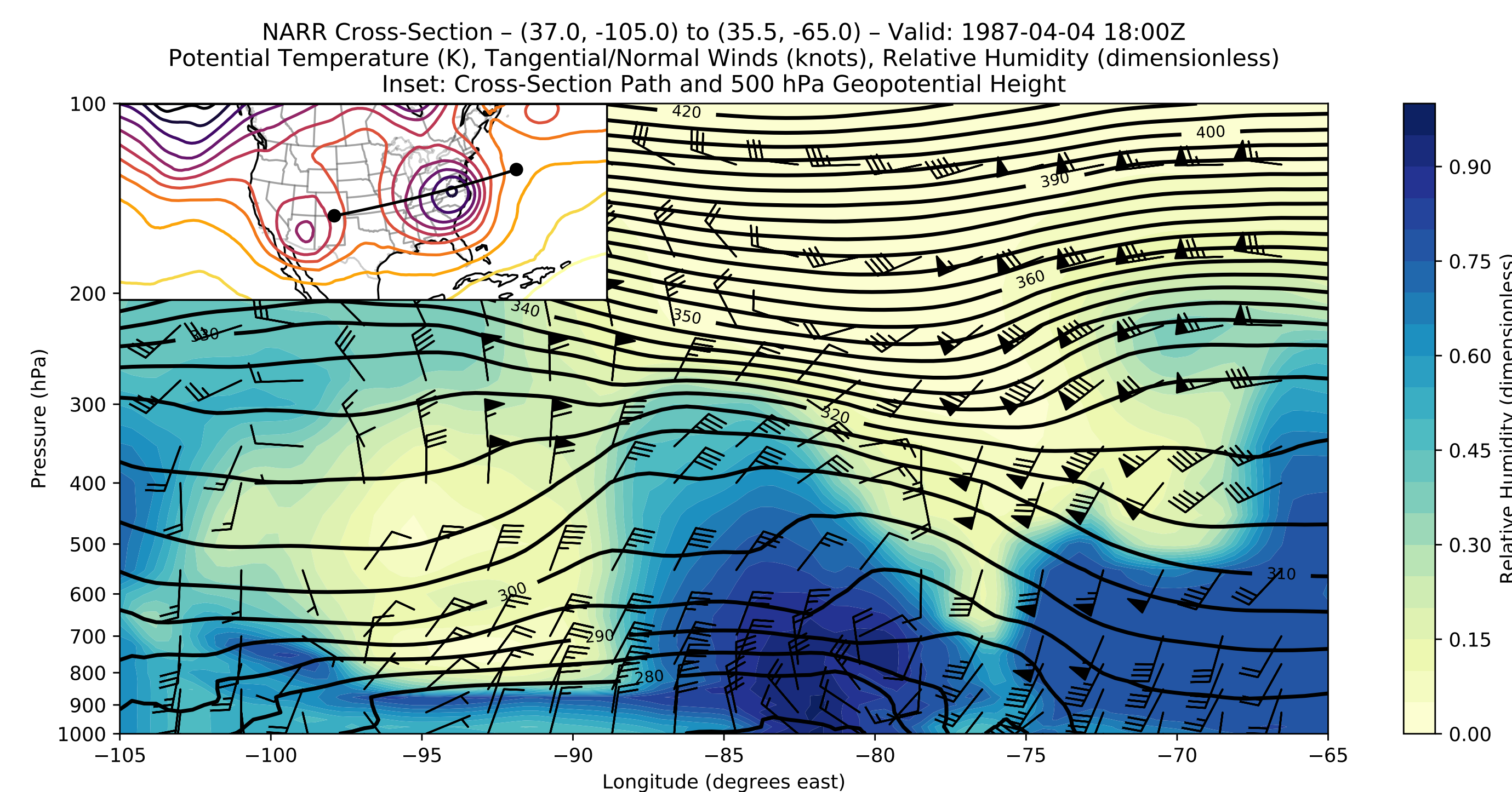

Figure 2. Cross section through a bow echo as simulated in a 1-km WRF-ARW run, with demonstration of vertical coordinate interpolation.
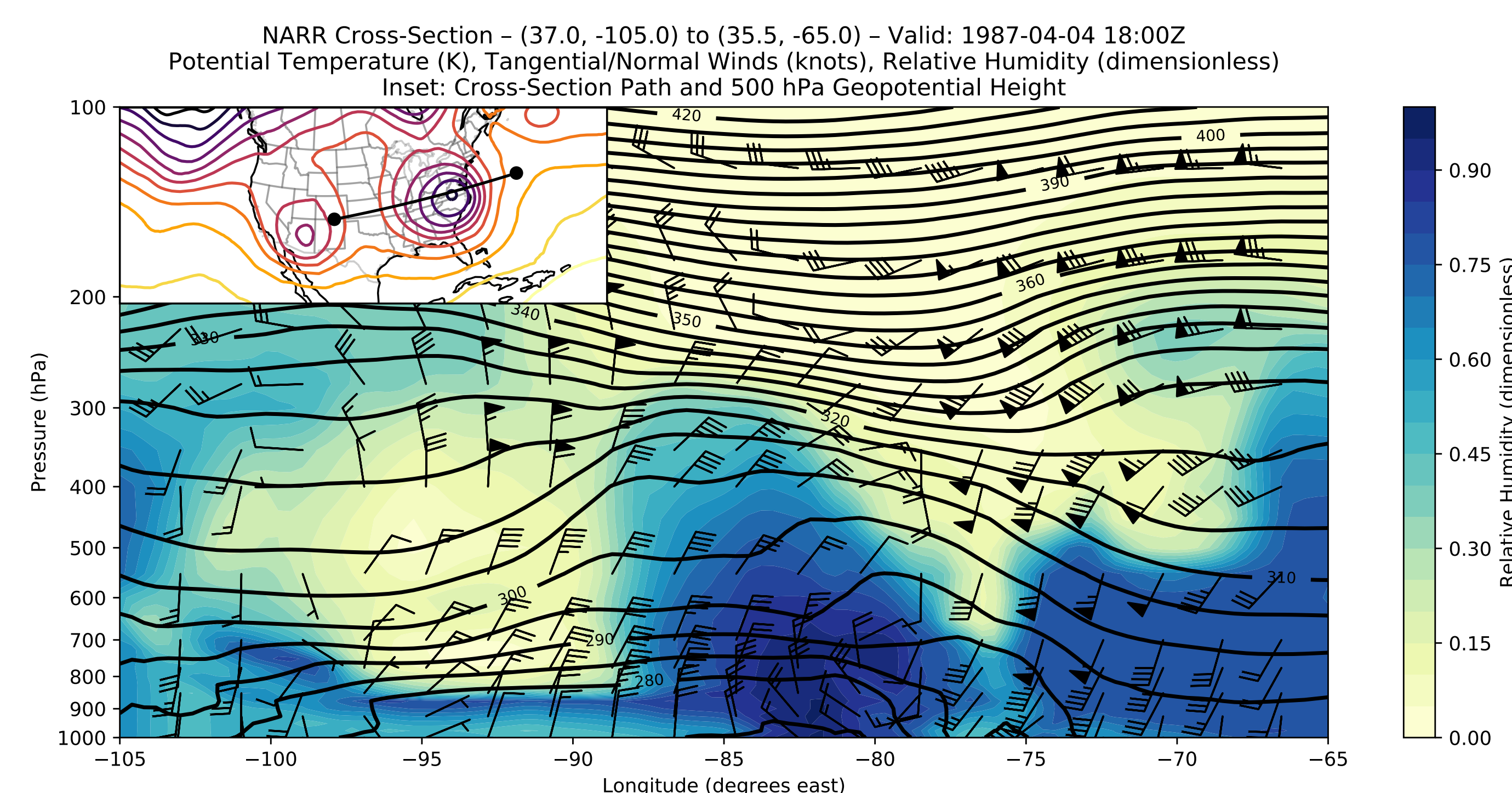

Figure 3. Cross section of Moist Potential Vorticity (MPV) for assessing CSI. (Cross-sectional absolute momentum calculation also available.)

Implementation

Details about implementation. Et cetera, ad litora torquent per conubia nostra, per inceptos himenaeos. Phasellus libero enim, gravida sed erat sit amet, scelerisque congue diam. Fusce dapibus dui ut augue pulvinar iaculis.

Future Work

Details about future work. Et cetera, ad litora torquent per conubia nostra, per inceptos himenaeos. Phasellus libero enim, gravida sed erat sit amet, scelerisque congue diam. Fusce dapibus dui ut augue pulvinar iaculis.

Interested in finding out more or exploring some demo notebooks? Check out

```
https://github.com/jthielen/
metpy_cross_section_ams_2019
```