ATMO 574b: Weather Analysis and Forecasting II
Homework 2: Mesoscale Analyses

You are provided IDV compatible data for the three severe weather cases in the previous homework. Data and formats follow the Tuscaloosa, Alabama, tornado case as presented in class. These include:

- Radar: digital hybrid reflectivity and storm relative velocity
- Satellite: VIS, IR, and water vapor imagery
- Reanalyses: NARR data, NAM model analyses
- Surface METAR observations
- Upper-air observations

We will be conducting mesoscale analyses approximately coincident with the time when the most significant weather was observed as recorded in the METARs:

- Station #1, Wilmington, OH: 21 UTC, 29 June 2012
- Station #2, Phoenix, AZ: 00 UTC , 6 July 2011
- Station #3, Norman, OK: 18 UTC, 20 May 2012

Part 1: IDV data plotting and mesoscale analysis

For each of the three stations plot the following maps using IDV software, coincident to the time when severe weather was observed:

- METAR data only
- Digital hybrid reflectivity and METARS
- Infrared satellite imagery and METARS

The plotting domain should be the vicinity of the radar site.

Using your METAR data only plot:

- Perform (by hand) a surface analysis of temperature by plotting isotherms.
- Indicate any local maxima or minima in the mean sea level pressure, by labeling “H” and “L” on your maps.
- Draw any additional corresponding synoptic and/or mesoscale features on your map with appropriate notation (e.g. gust fronts, dry lines, etc.)

Part 2: Estimating outflow boundary speed, storm motion

For any clearly defined outflow boundaries you identify in your mesoscale analysis, estimate the speed of the outflows, assuming they can be approximated as a density current. Show your steps and explain your reasoning. How does your computed values compare with actual observed wind speeds in the vicinity of any outflows?

Compute a storm motion vector by estimating the velocity of storm cells around the time when the most significant weather was observed (e.g. within a twenty to thirty minute window). I suggest just track the maxima in radar reflectivity of an individual storm cell. We will use these estimates for the next assignment.

Part 3: Mesoscale analysis discussion

Based on your results from Parts 1 and 2, write a brief severe weather discussion for each case, similar to the operational products issued by NOAA-NWS Storm Prediction Center (SPC) https://www.spc.noaa.gov/products/md/

Your discussion should describe:

- Type(s) of severe weather occurring
- Mesoscale meteorological environment, per your analysis of satellite, radar, sounding, and surface data
- The geographic locations where severe weather hazards are imminent (next few hours). In SPC graphics this area is usually highlighted in some way on the mesoanalysis map, so I suggest do something similar using your maps from Part 1.