P1.50

Pressure Variations of High-Impact Weather Events Using the USArray Network

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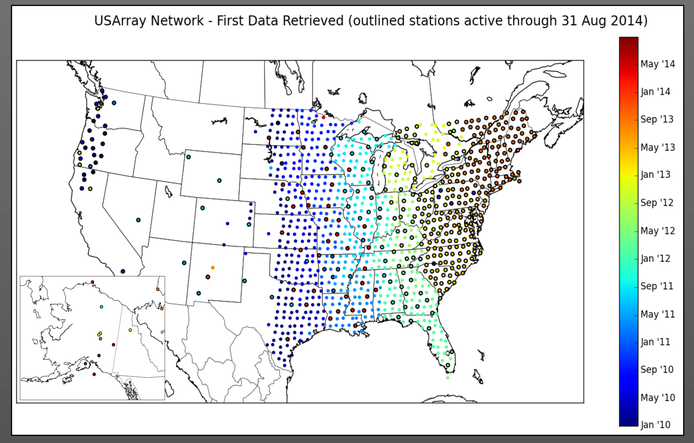
Project Objectives

- Catalog and analyze signatures/behavior produced by pressure variations at reporting sites across the central and eastern US
- Provide access and products to visualize observations:
  - Project Website: http://meso1.chpc.utah.edu/usarray
  - MesoWest: http://mesowest.utah.edu
  - Five-minute observations distributed in real-time to NWS Western Region, MADIS, and other NOAA entities
- More information in *Monthly Weather Review* accepted manuscript – Jacques et al. "Central and Eastern United States Surface Pressure Variations Derived from the USArray Network"

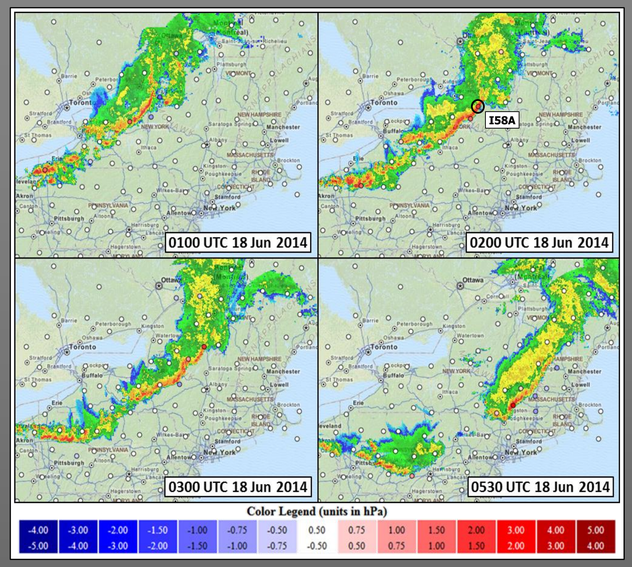
What is the USArray?

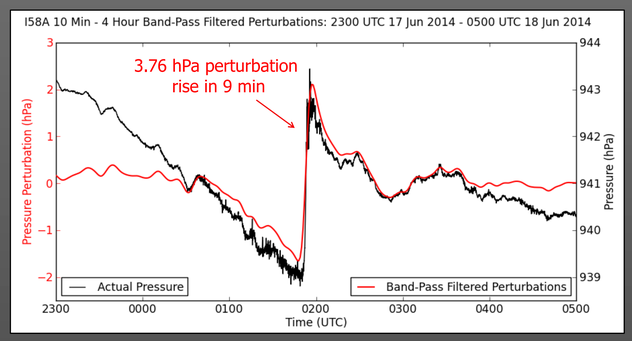
- EarthScope-sponsored network of 400+ seismic stations
- Platform spacing based on a ~70 km quasi-grid
- Equipment deployed for 1-2 yr, then redeployed east of array
- Pressure sensors added in 2010 (1 and 40 Hz sampling)
- 2014 main array location along eastern coast of US
- Subset of ~150 stations to remain in place over central and eastern US for next several years with more in Alaska



17-18 Jun 2014 Severe Storms

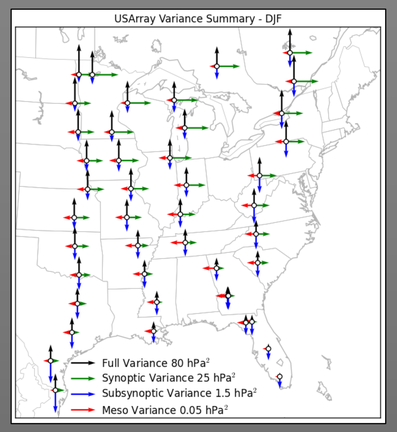
- Squall line with embedded bowing segments moved across upstate New York late 17 Jun into 18 Jun 2014
- Numerous reports of straight-line wind damage, with one EF-1 tornado confirmed in Verona, NY around 0200 UTC

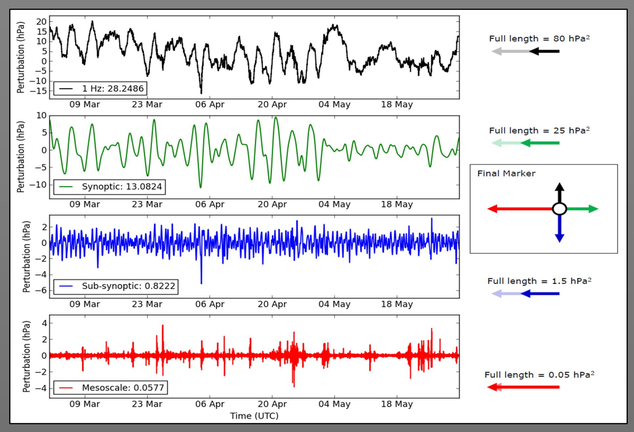


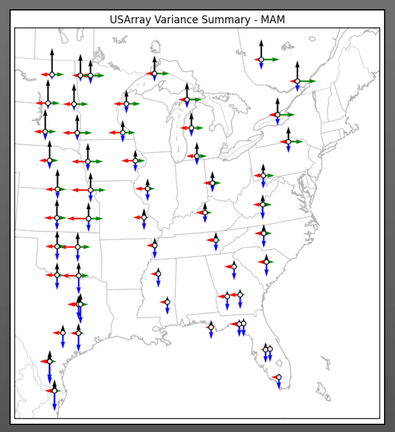


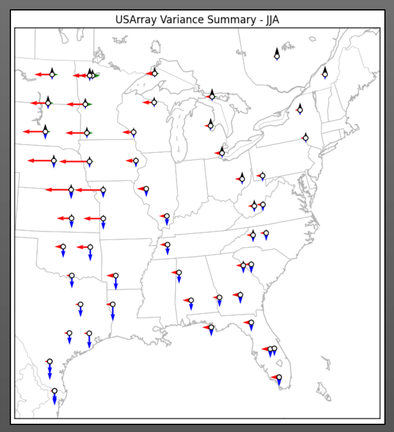
Temporal Filtering and Clustering

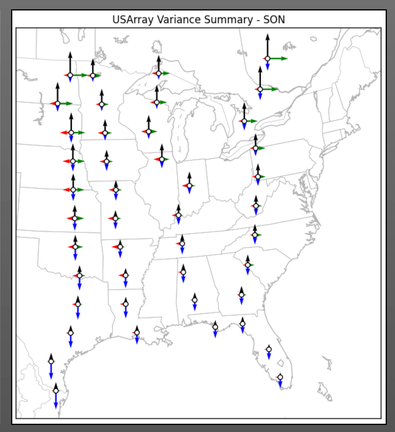
1) Perturbation time series generated by applying digital band-pass filters corresponding to **meso** (10 min – 4 h), **sub-synoptic** (4 – 30 h), and **synoptic** (30 h – 5 days) scales
2) Pressure signatures determined through consecutive maxima/minima pairings within filter time window
3) Variances calculated for seasonal perturbation time series and arranged into markers (as seen below)
4) Stations clustered into latitude-based bins for each season using longitudinal proximity to other active stations









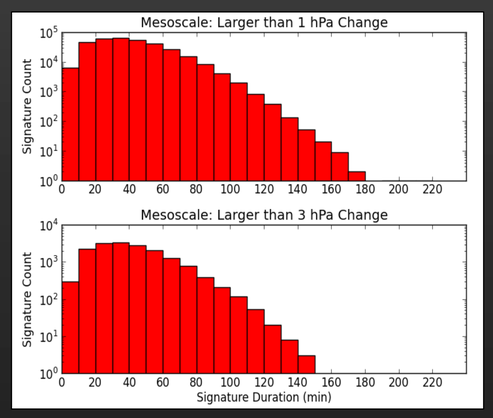


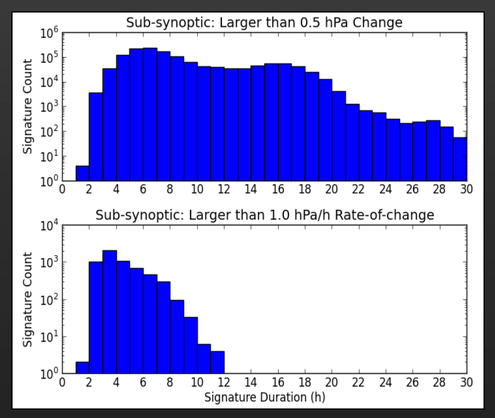
Quality Control and Signatures

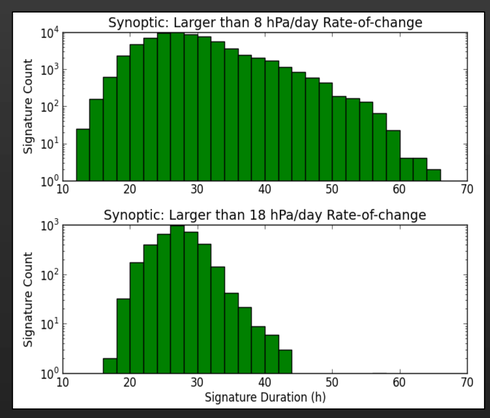
- Objective and subjective QC procedures identified missing and spurious data periods (e.g., discrete pressure fluctuations)

Statistics for 1 Jan 2010 – 31 Aug 2014	
Total Stations	**1,021**
Total 1 Hz Observations	**55,077,275,475**
Median Station Active Period	**637.9 days**
Percentage of Obs Retained	**97.35%**

Pressure Signatures for 1 Jan 2010 – 31 Aug 2014	
Mesoscale ≥ 1 hPa change	**333,838**
Mesoscale ≥ 3 hPa change	**16,890**
Sub-synoptic ≥ 0.5 hPa change	**1,351,630**
Sub-synoptic ≥ 1 hPa h^{-1} rate-of-change	**5,753**
Synoptic ≥ 8 hPa day^{-1} rate-of-change	**69,686**
Synoptic ≥ 18 hPa day^{-1} rate-of-change	**3,620**







Summary and Future Work

- Variations in signature frequency and variance for all band-pass filters indicative of seasonal shifts in meteorological phenomena (e.g., synoptic storm tracks, convective seasons, etc.)
- Temporal variations indicative of some interannual variation (e.g., more active 2010-2011 convective seasons as opposed to 2012-2013)
- All 1.7 million+ analyzed signatures can be examined individually through the project website as potential case events, such as the 17-18 Jun 2014 severe weather event described here

- Continue the archival and dissemination of five-minute USArray pressure observations to MesoWest/MADIS in real time as part of the MesoWest data repositories
- Continue to quantify signatures and seasonal variations for the remainder of 2014 and beyond
- Develop additional capabilities for project website products
- Assess perturbation pressure observations against gridded perturbation analyses for high-impact events (wind ramps, convection, gravity waves, etc.)
- Examine perturbation pressure gradients relating to wind ramp and other high impact events

Acknowledgements and References

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