The Bering Sea and Typhoon Rule II: case studies

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Introduction

- Weather forecasting can be performed dynamically with the aid of numerical models out to about 10 – 14 days.

- Beyond this point, statistical methods can be used reliably, but NOAA is experimenting with ensemble techniques.

Introduction

- Long range forecasting (monthly and seasonally) are performed using statistical and dynamical methods along with using knowledge of the dominant teleconnection activity (e.g., ENSO, PNA, Blocking, etc...)

- Our previous study showed some skill in using the Bering Sea Rule (BSR) and Typhoon Rule (TYR) in forecasting extreme weather over North America in the 6 – 30 day period.

Motivation

- There is a large gap in predictability in the three and four week period. (NOAA is experimenting with probablistic outlooks using ensemble techniques.)

- Using simple indicies, there is a degree of predictability in the general conditions over North America using simple teleconnection indexes.

Dynamic Skill Scores

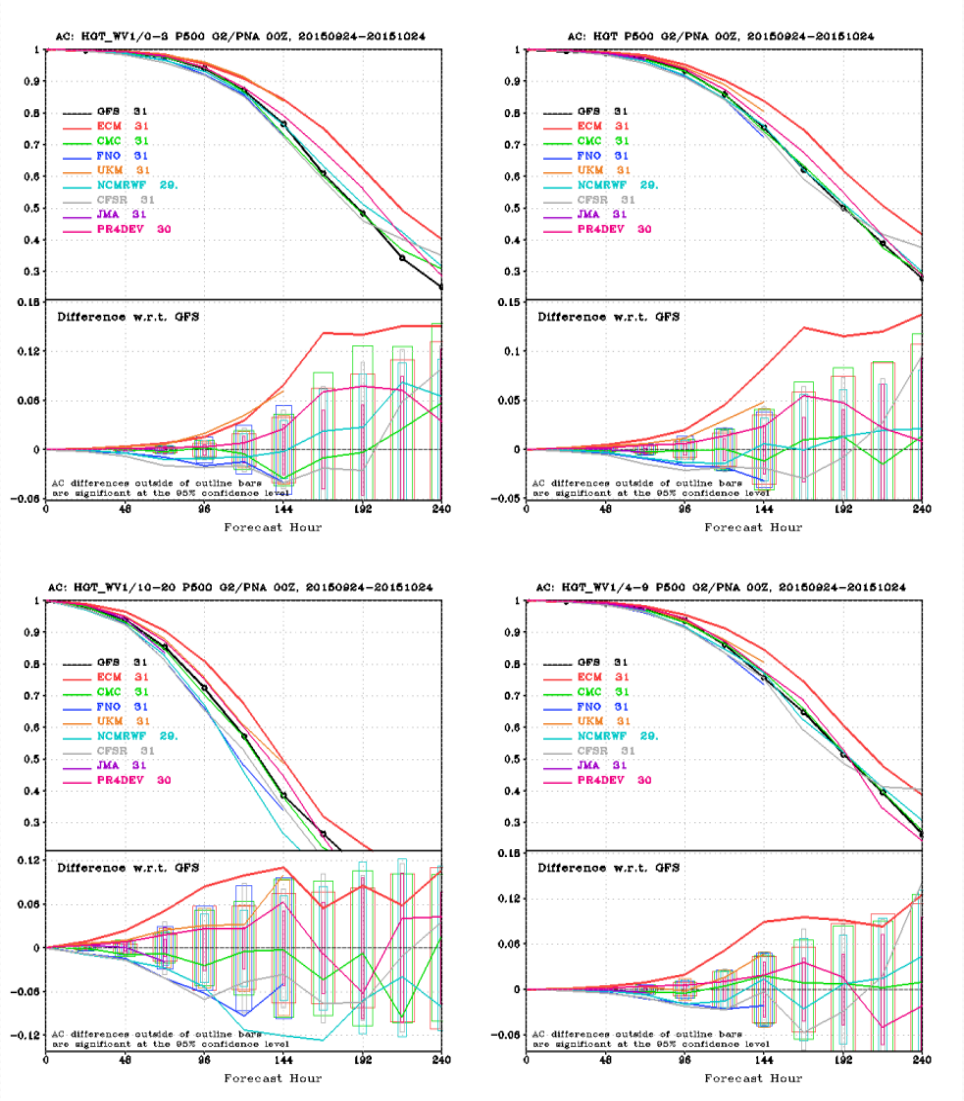
EMC Verification website:
http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/

PNA Region (20N-75N), (180E-320E)

AC: HGT P500 Skill Scores (Upper right graph)

Day 5: .863
Day 6: .7665
Day 8: .531
Day 10: .3235

Average loss of skill per day: .107886



Data and Methods

- Data can be extracted using the NCEP/NOAA re- analyses from 1951 – present.

- We extracted the daily PNA index using the Climate Prediction Center truncated NCAR/NCEP Reanalysis page. This ftp site utilizes 1981- 2010 for climatology.

- Data can also be extracted from the Climate Prediction Center Archive of Daily Indices page. This ftp page utilizes CDAS starting 01JAN50.

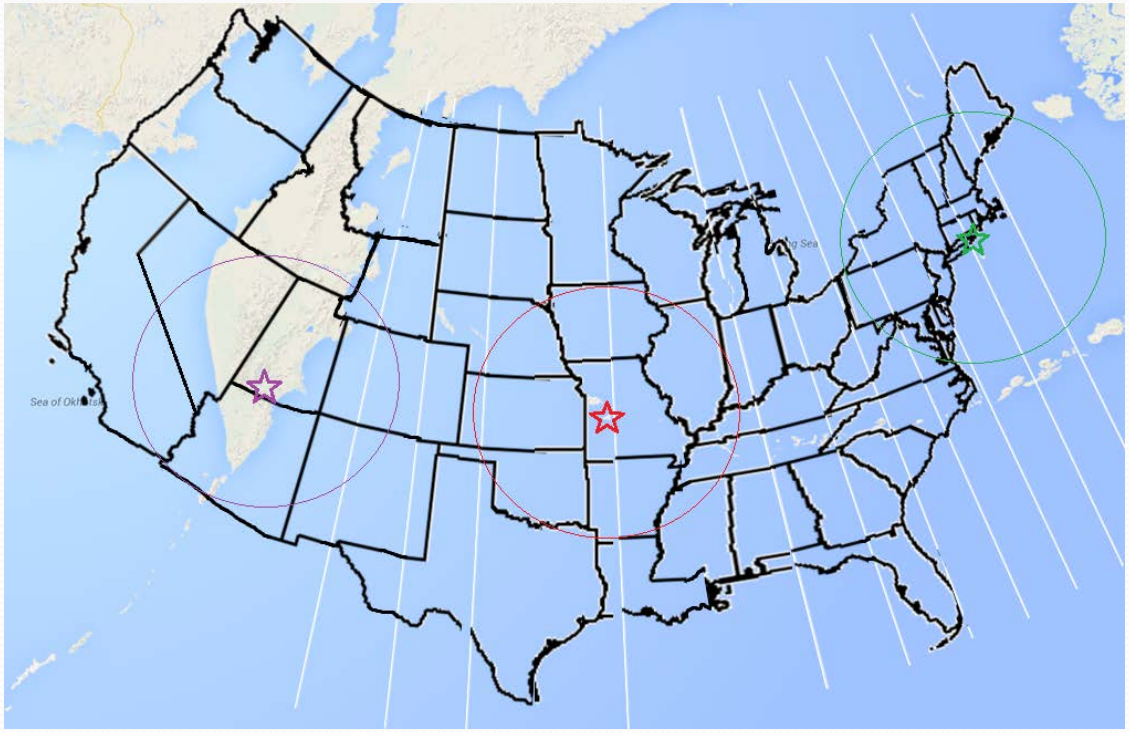
Methods

- Auto correlation and Fourier series was used to demonstrate that there is power in the 10 – 90 day period in the PNA region.

- This power may reflect Rossby Wave propagation through the region beyond the limit of dynamic predictability.

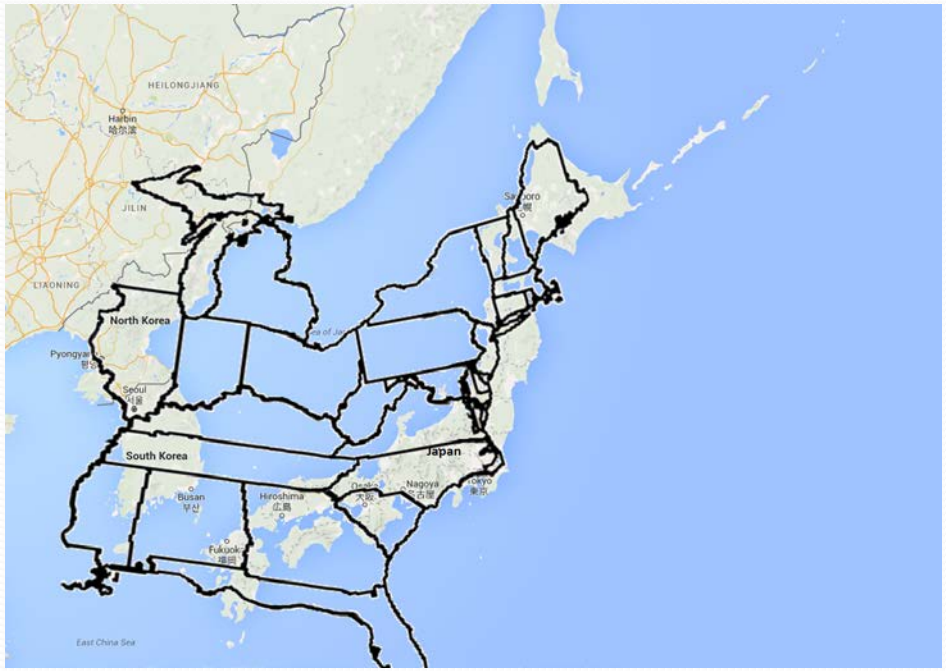
BSR and Typhoon Rule

- The BSR correlates 500 hPa heights in the Bering Sea to three points in the USA. Similar to the PNA index. Mean correlation is between 17- 21 days.



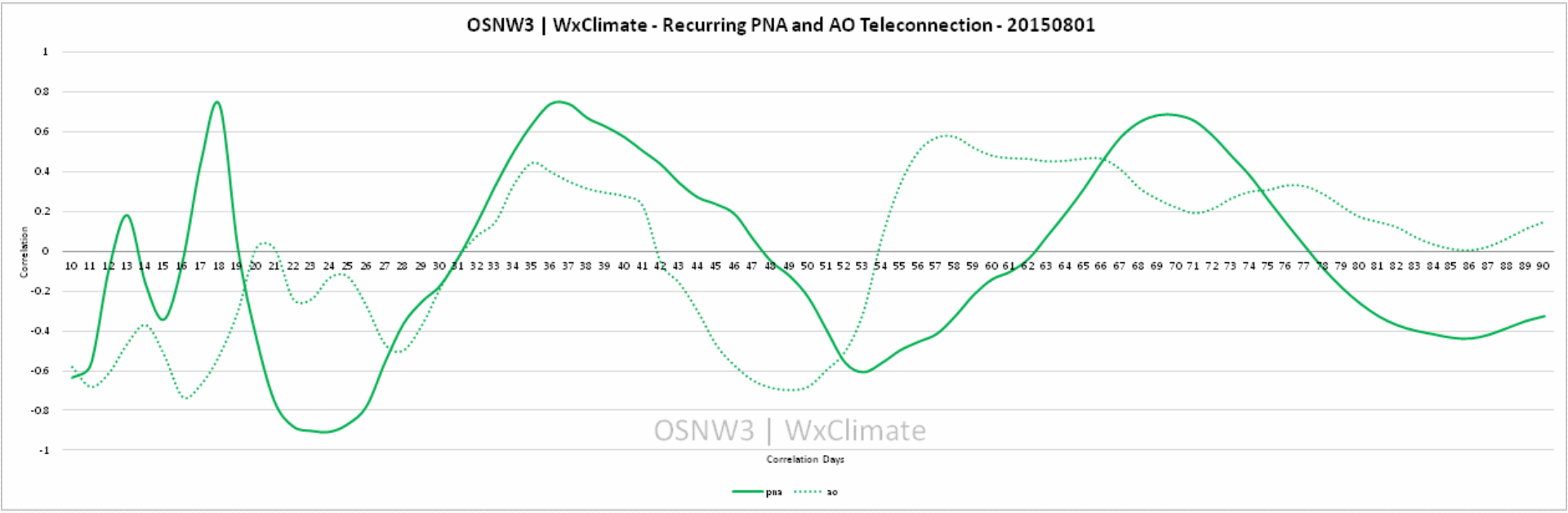
BSR and Typhoon Rule

- The TYR correlates 500 hPa heights in East Asia to three points in the USA. Mean correlation is between 6- 10 days.



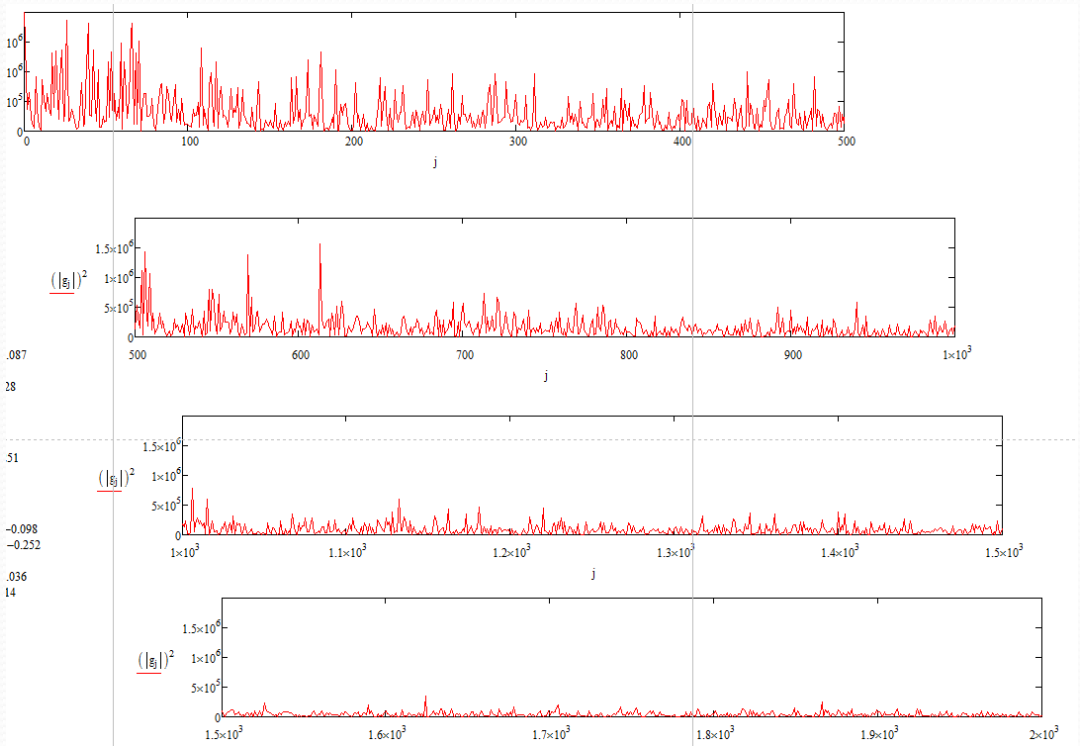
Auto Correlation

- This figure shows auto correlation in the PNA & AO index during the period from 01AUG15-24OCT15.



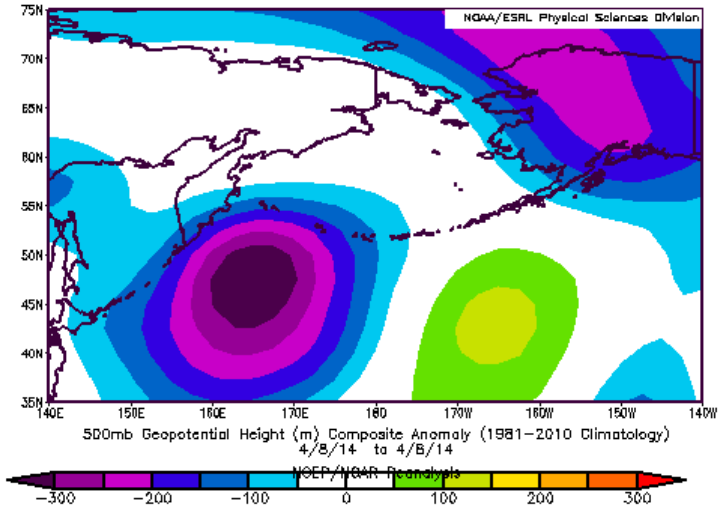
Fourier Analysis

- Fourier decomposition of the daily time series of the PNA index from 1 Jan 1951 – present shows significant power in the 23 and 38 day range.

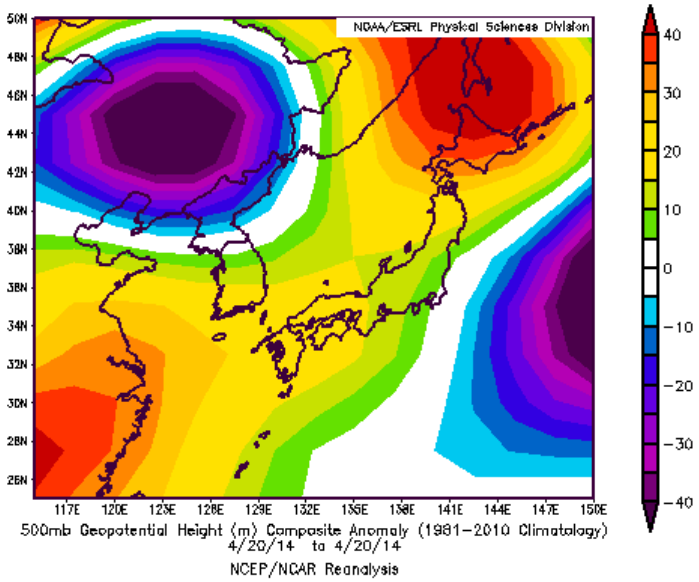


April 28, 2014 Case Study

April 8th, 2014 Bering Sea

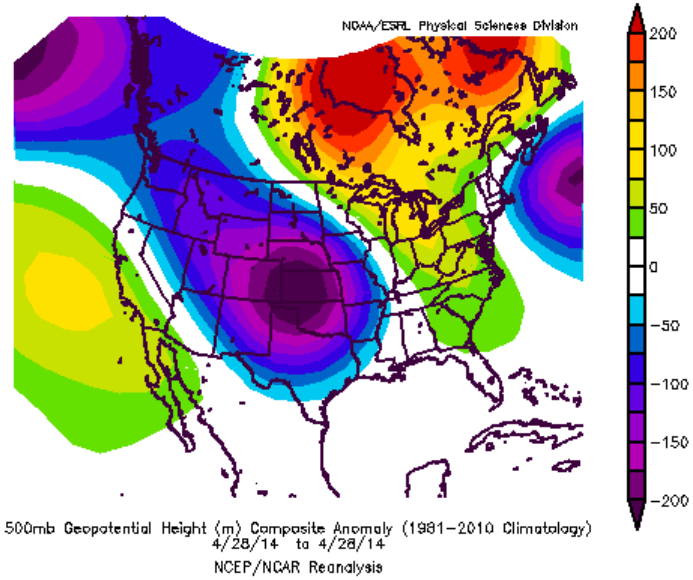


April 20th, 2014 East Asia

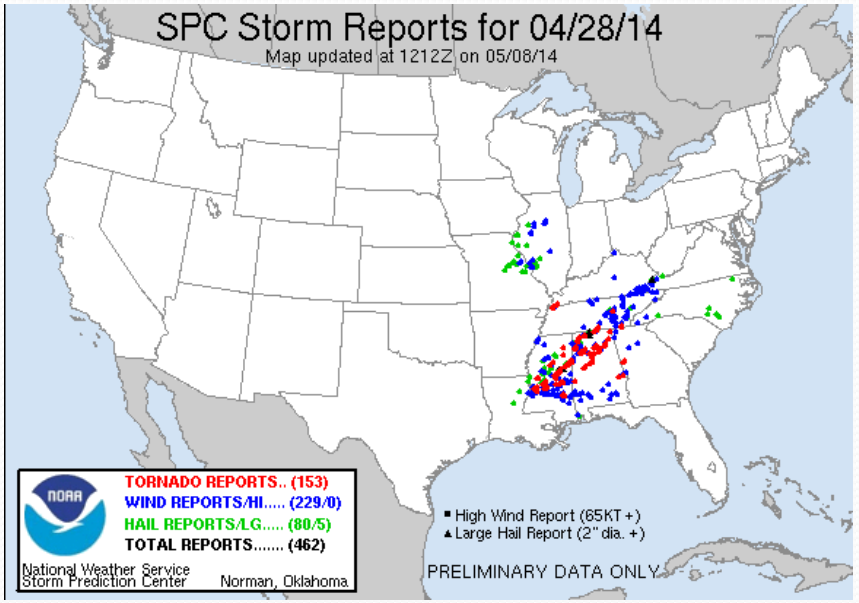


April 28, 2014 Case Study

Lower 48

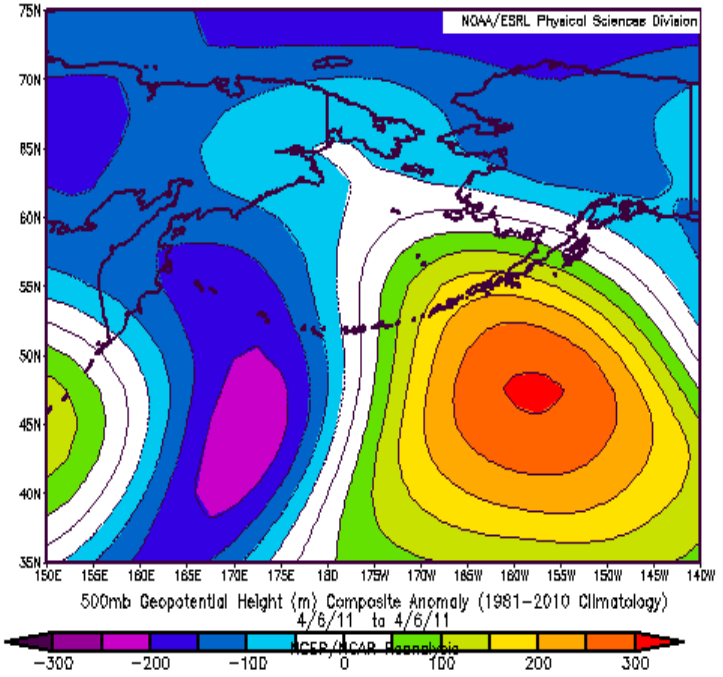


Storm Reports

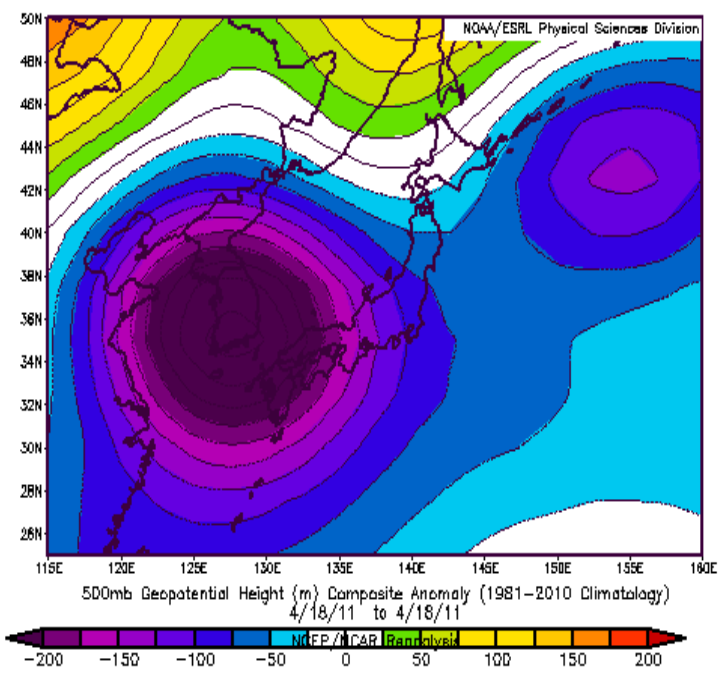


April 27, 2011 Case Study

April 6th, 2011 Bering Sea

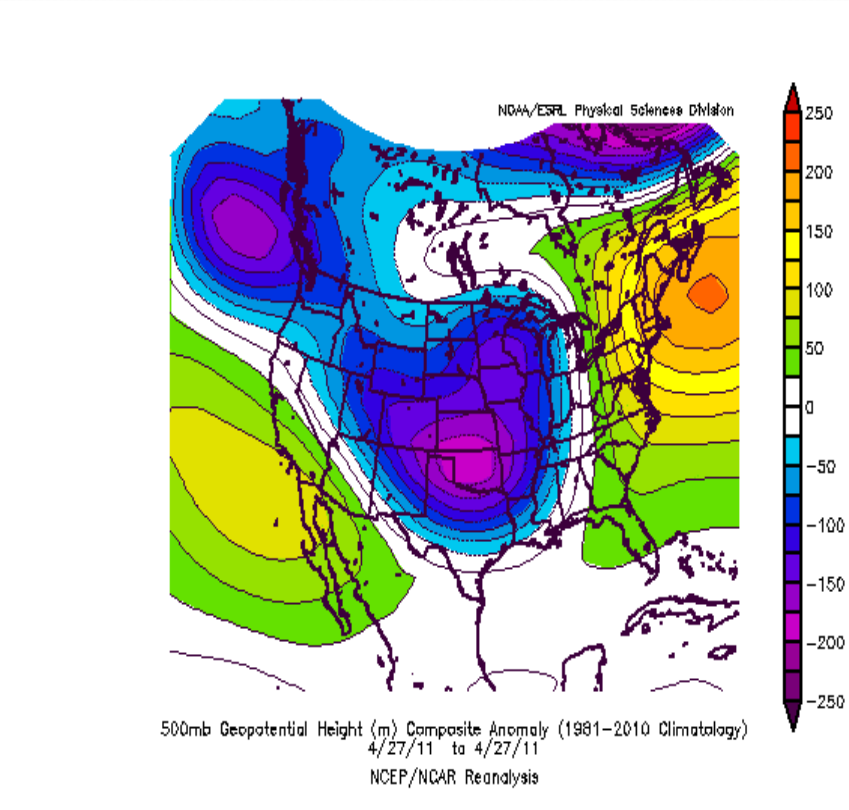


April 18th, 2011 East Asia

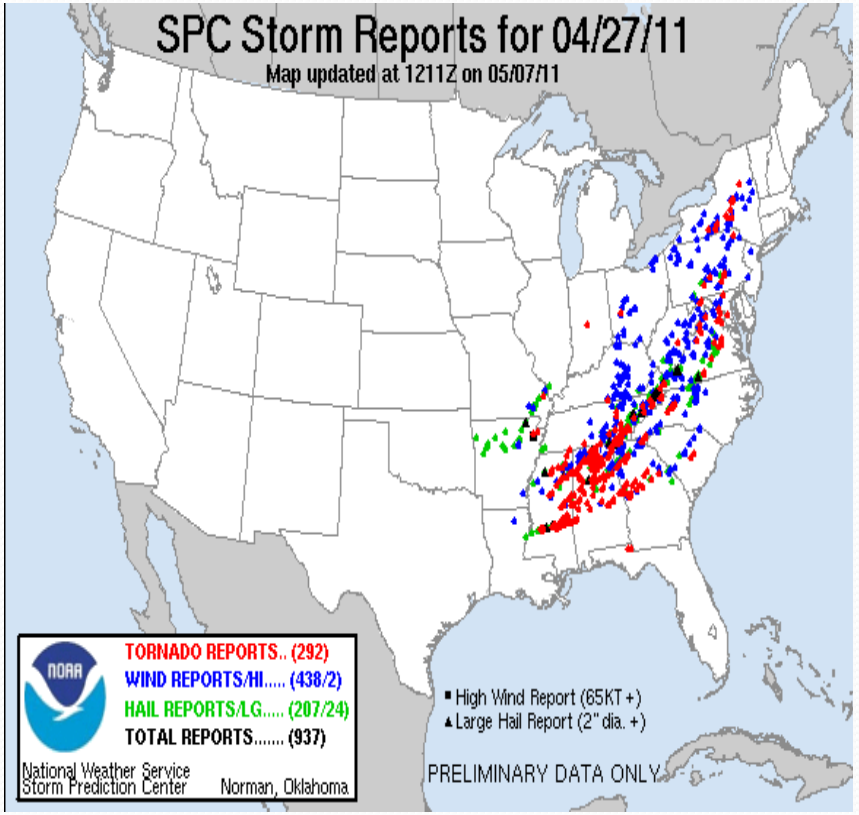


April 27th, 2011 Case Study

Lower 48

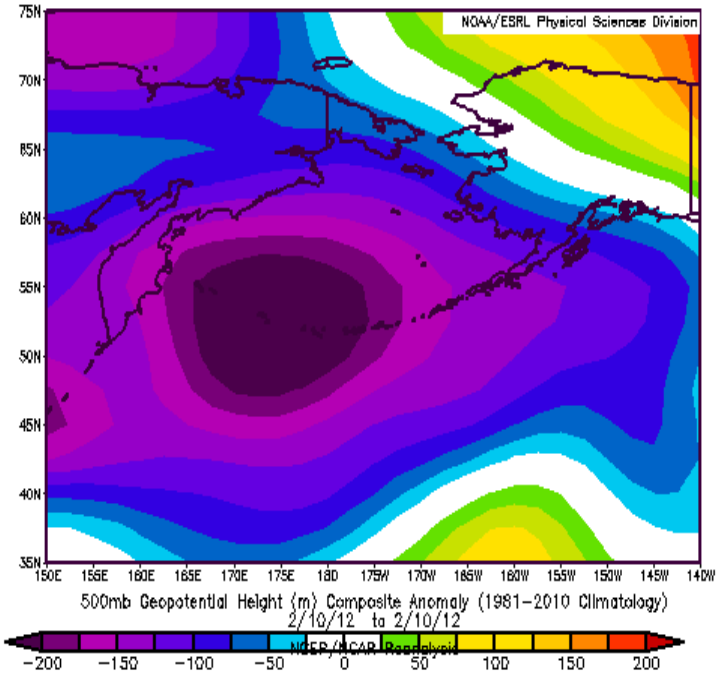


Storm Reports

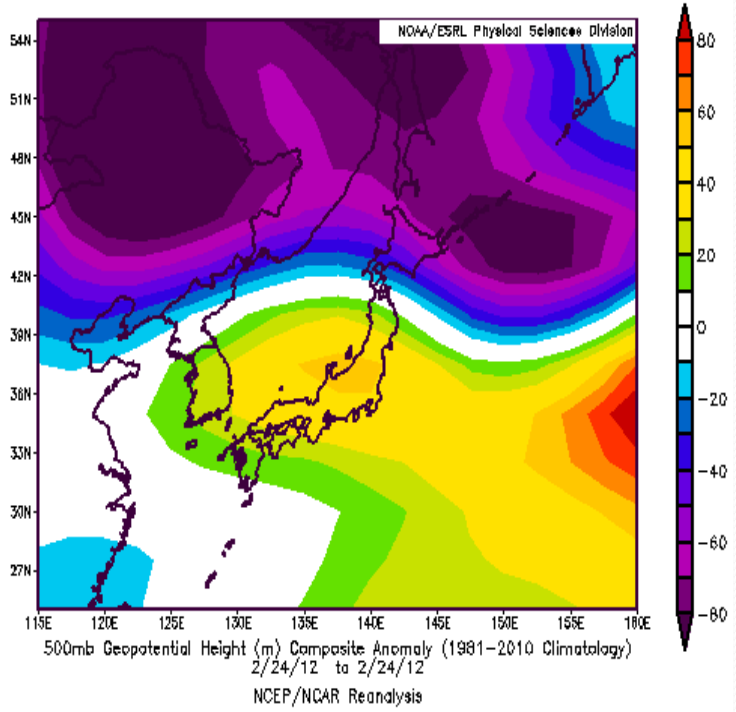


March 2nd, 2012 Case Study

February 10th, 2012
Bering Sea

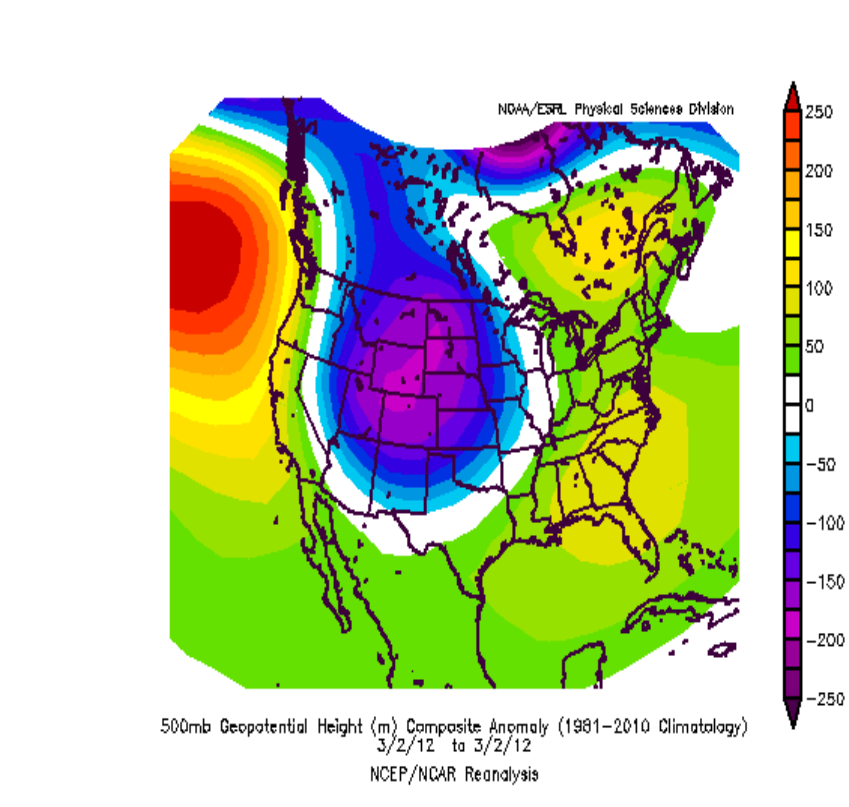


February 24th, 2012
East Asia

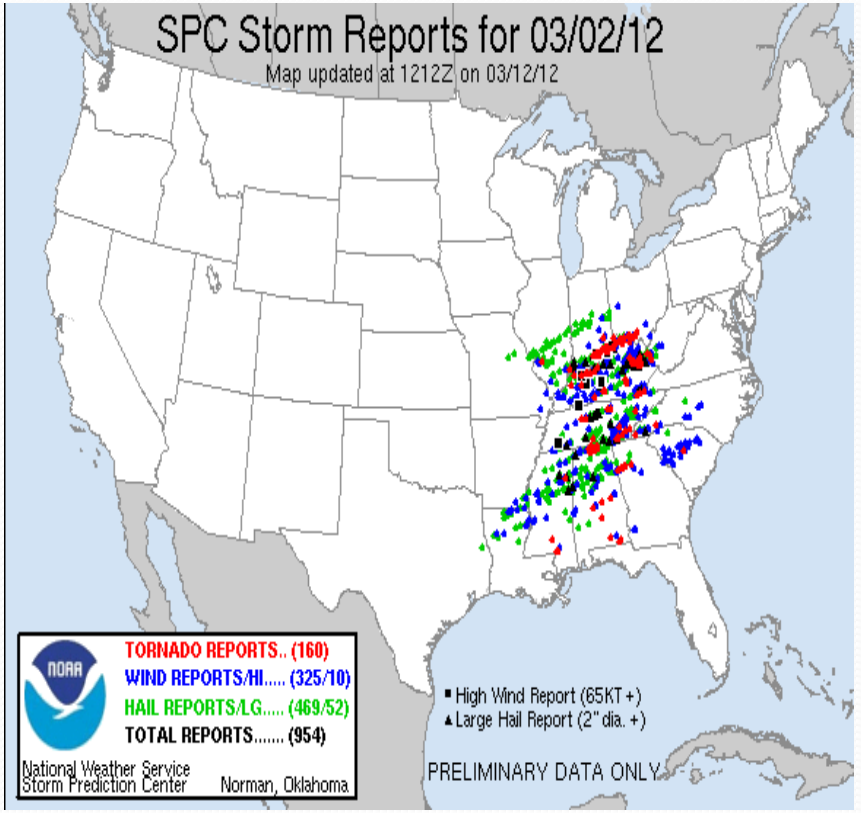


March 2nd, 2012 Case Study

Lower 48th

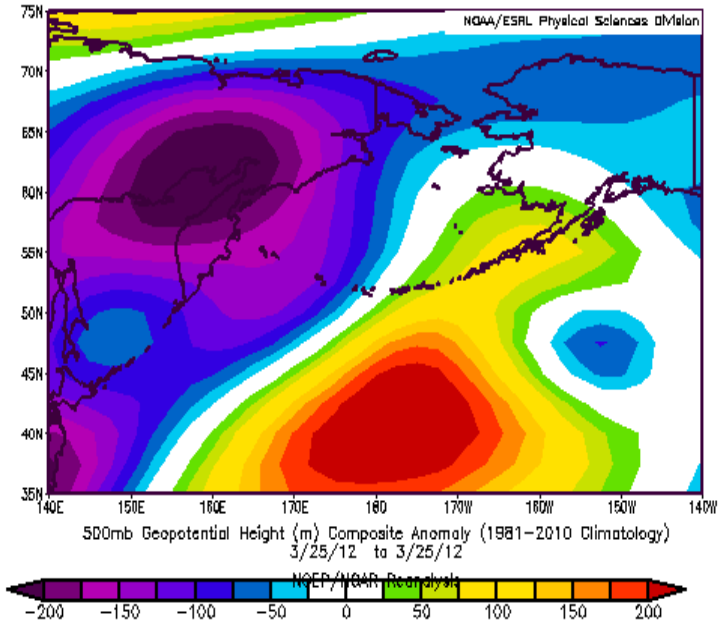


Storm Reports

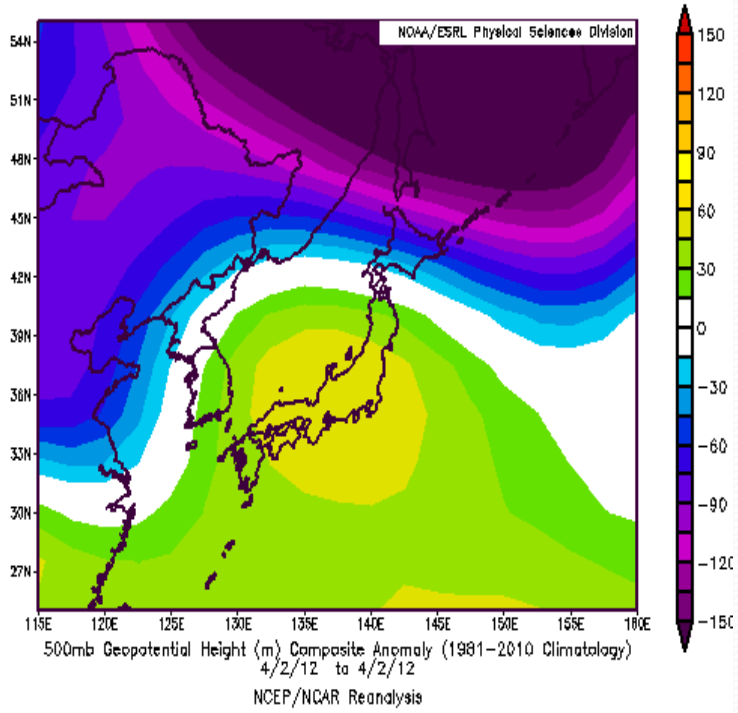


April 14th, 2012 Case Study

March 25, 2012 Bering Sea

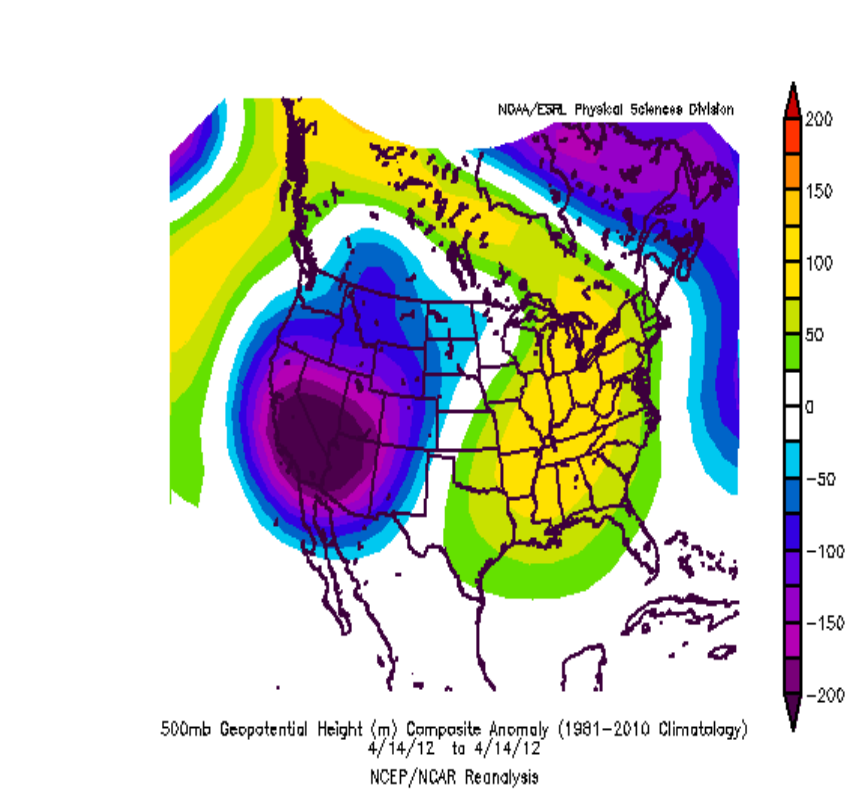


April 2, 2012 East Asia

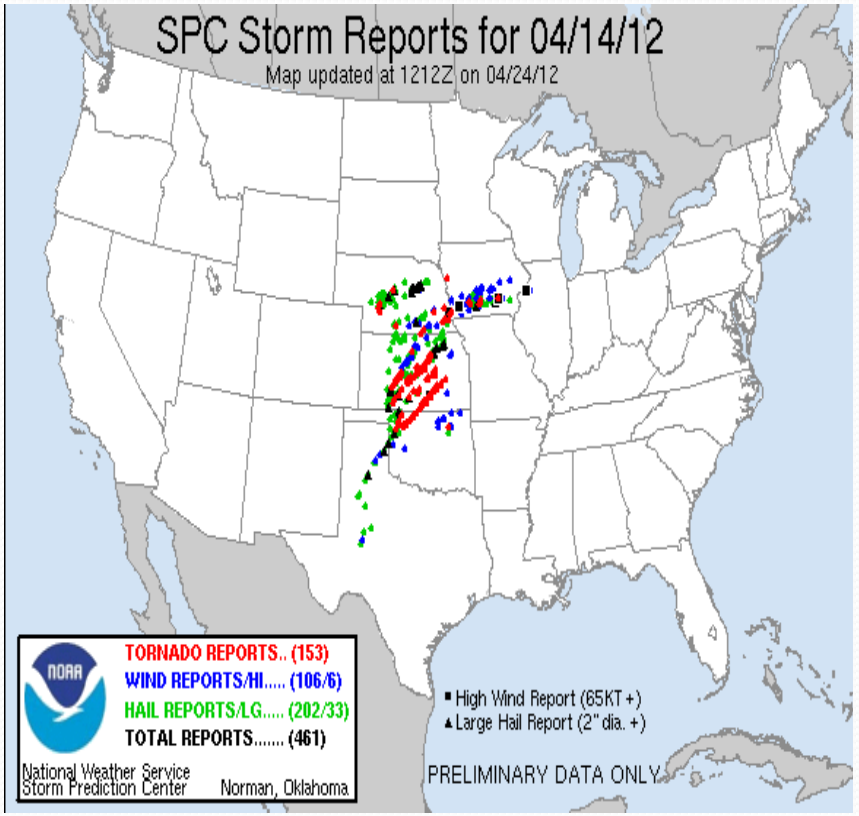


April 14th, 2012 Case Study

Lower 48

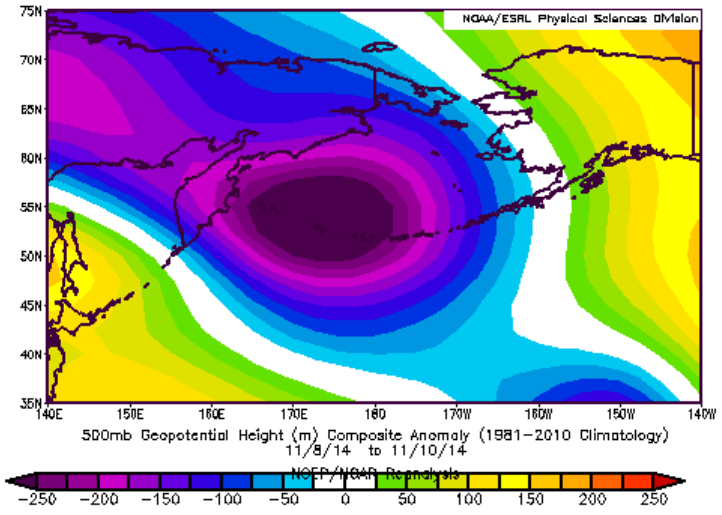


Storm Reports

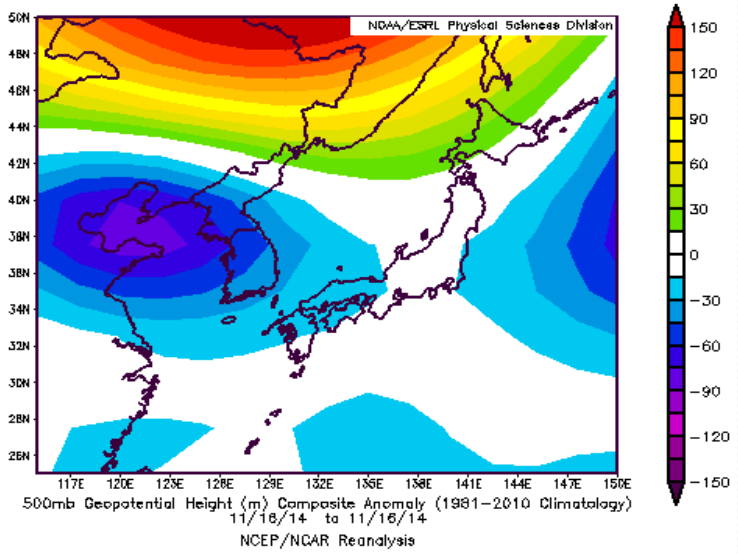


Typhoon Nuri Case Study

Bering Sea

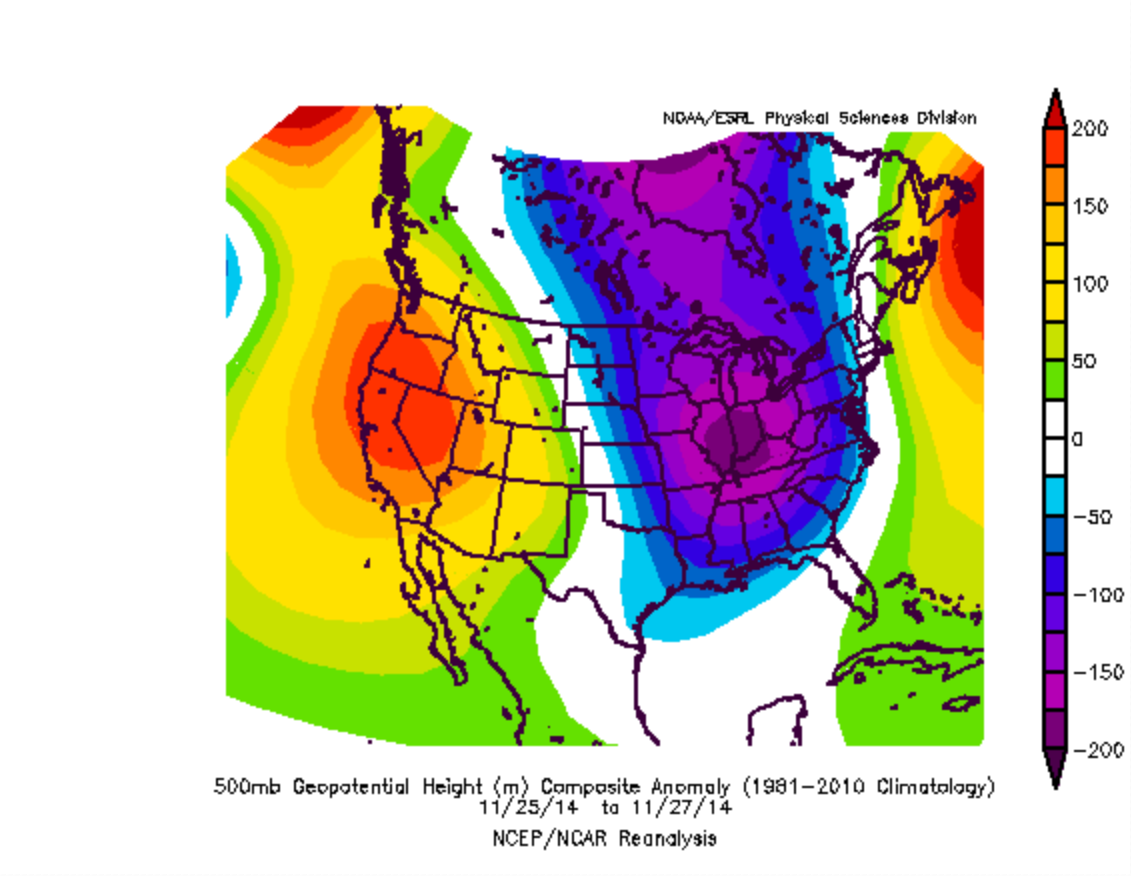


East Asia



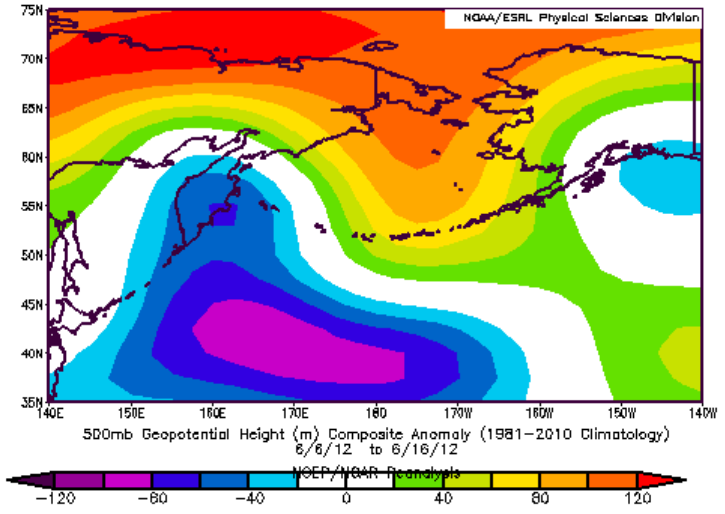
Typhoon Nuri Case Study

- Lower 48



June 2012 Heat Wave Case Study

Bering Sea



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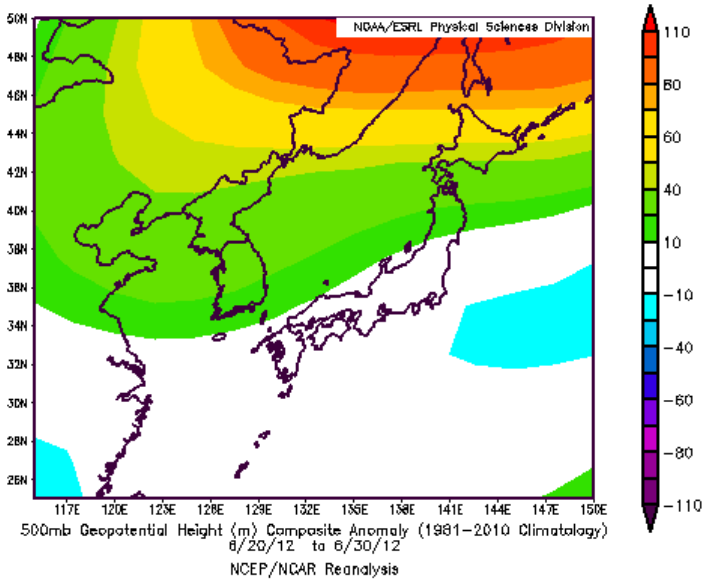
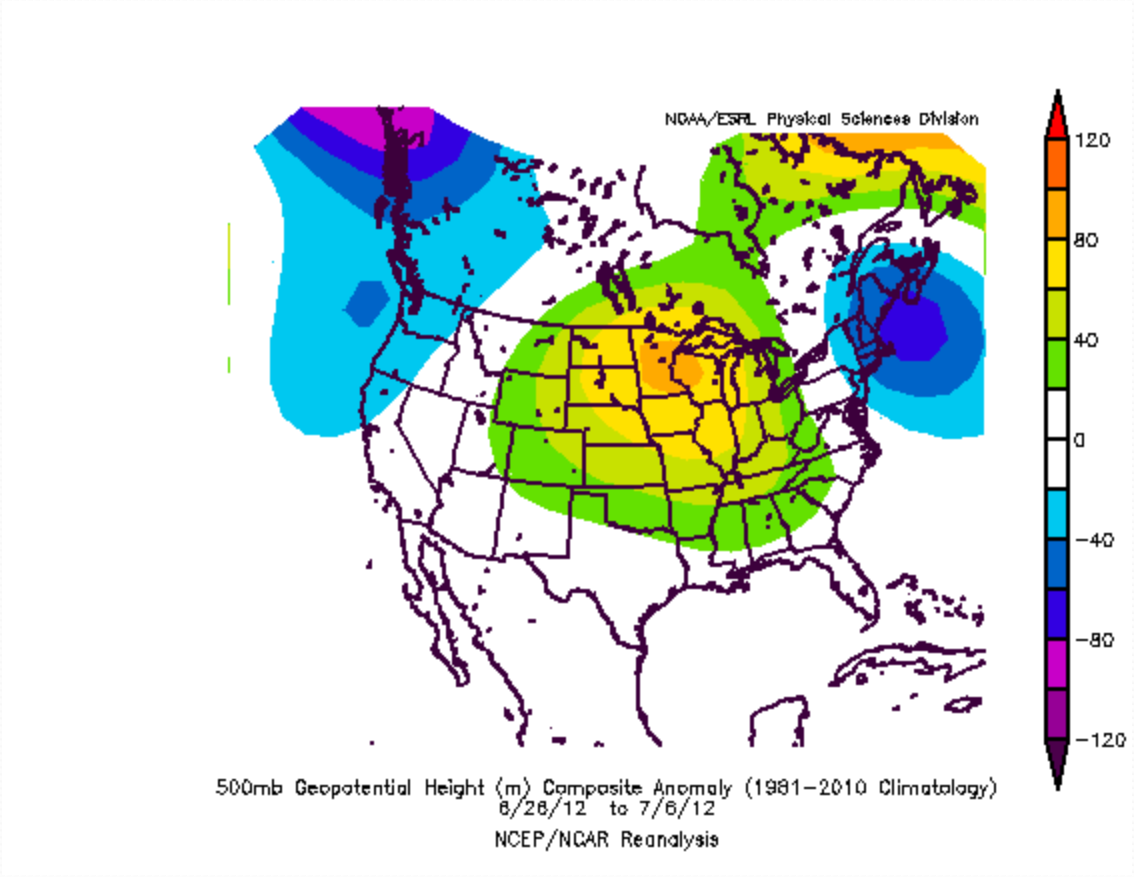


June 2012 Heat Wave Case Study

- Lower 48

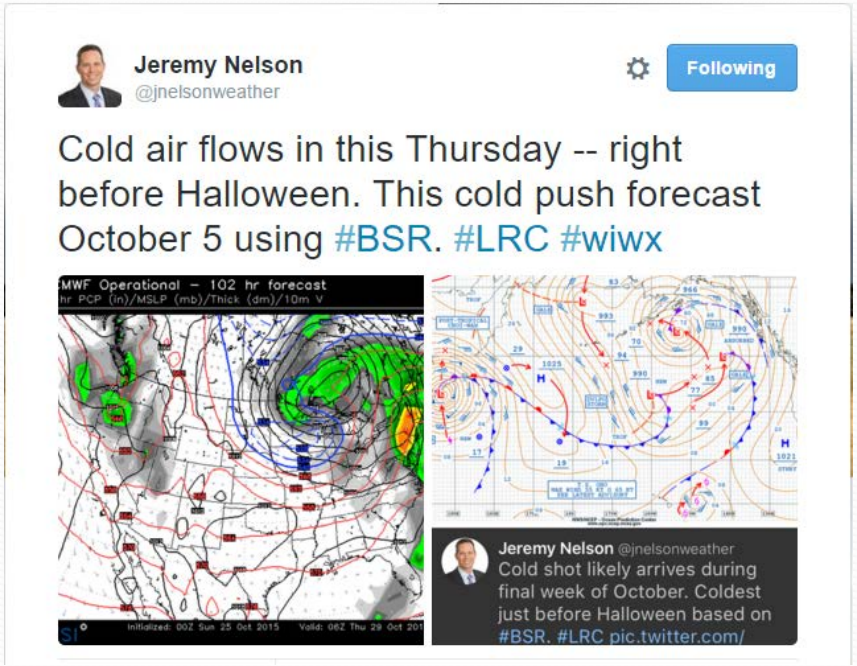


Conclusions

- The case studies demonstrated that even though there isn't a "perfect" correlation, we can match the pattern very well and give various government, energy, agriculture, and other sectors forewarning about the potential for severe weather.

Meteorologist Verification

Jeremy Nelson, WISN-Milwaukee



Michael Clark, BAMChase-Indianapolis

Summary

- In this study, we analyzed the PNA index using autocorrelation and Fourier Analysis in order to demonstrate that predictability in the three to four week time frame is possible.

- We looked at case studies that encompass arctic spells, heat waves, and severe weather outbreaks from 1977- 2015.

Conclusions

- Simple indicies such as the BSR and TYR have utility in aiding prediction for the one to four week time frame.

- Some possible shortcomings to this technique would include rapidly changing character to the waves over the region, or influence from the tropics (e.g., MJO).

- These indicies may be useful along with ensemble prediction to enhance predictability.

The End

- Please reference this site for more information like our correlation statistics, lag time, and regional forecasting based on SLP and temperature anomalies.
  - http://beringsearule.blogspot.com/
- Questions?
- Comments?
- Criticisms?
- Email: lupoa@missouri.edu , jdrenken7@gmail.com