Climatology of Storm Reports Relative to Linear Jet Streaks

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Background

- Johnson-O'Mara (2006) identified favored quadrants for storm reports relative to linear jet streaks

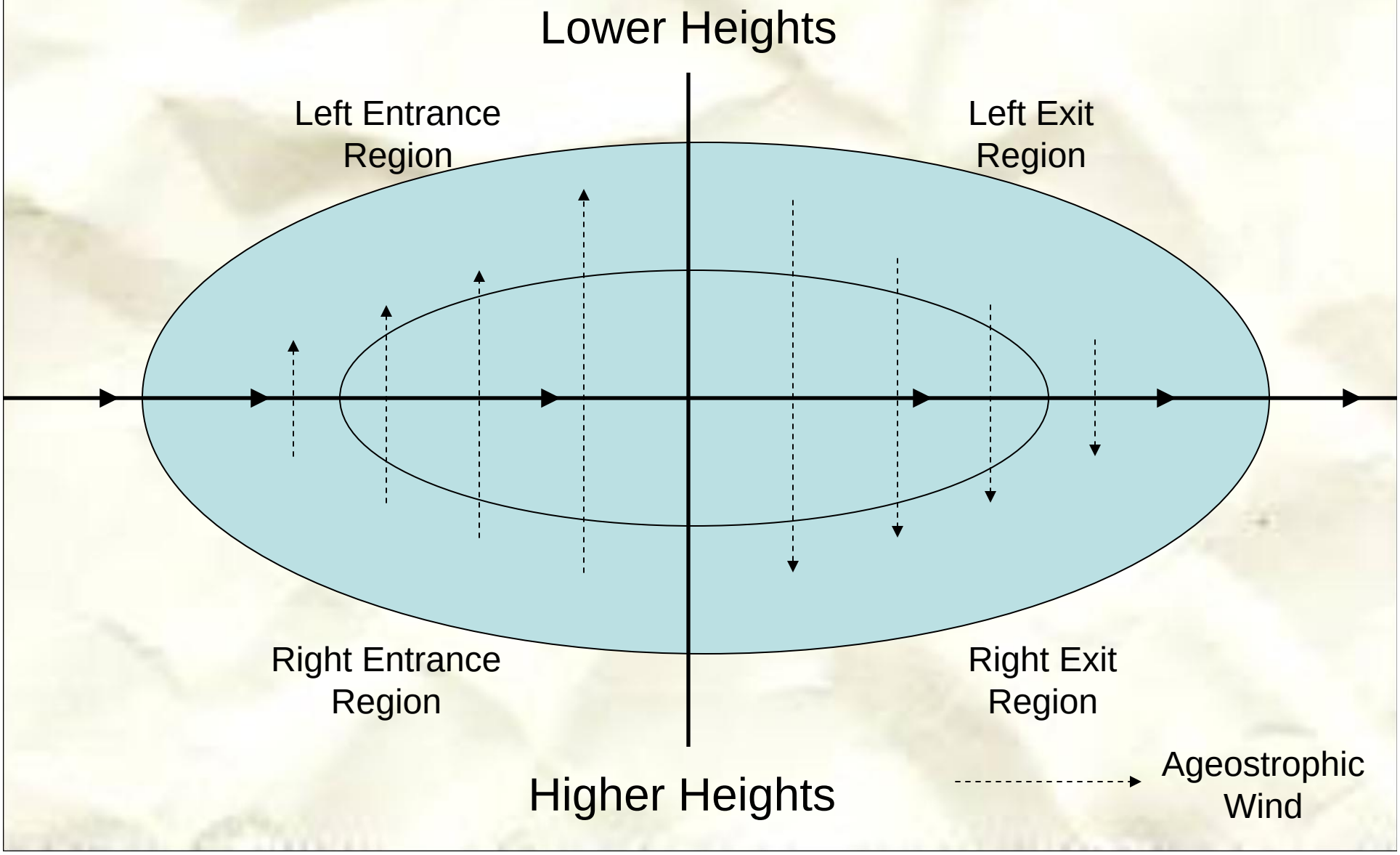
Purpose:

- Further examine climatology of storm reports (1994-2003)
- Investigate the area in and around the jet streaks to see how other factors alter the circulations associated with jet streaks and the related storm reports

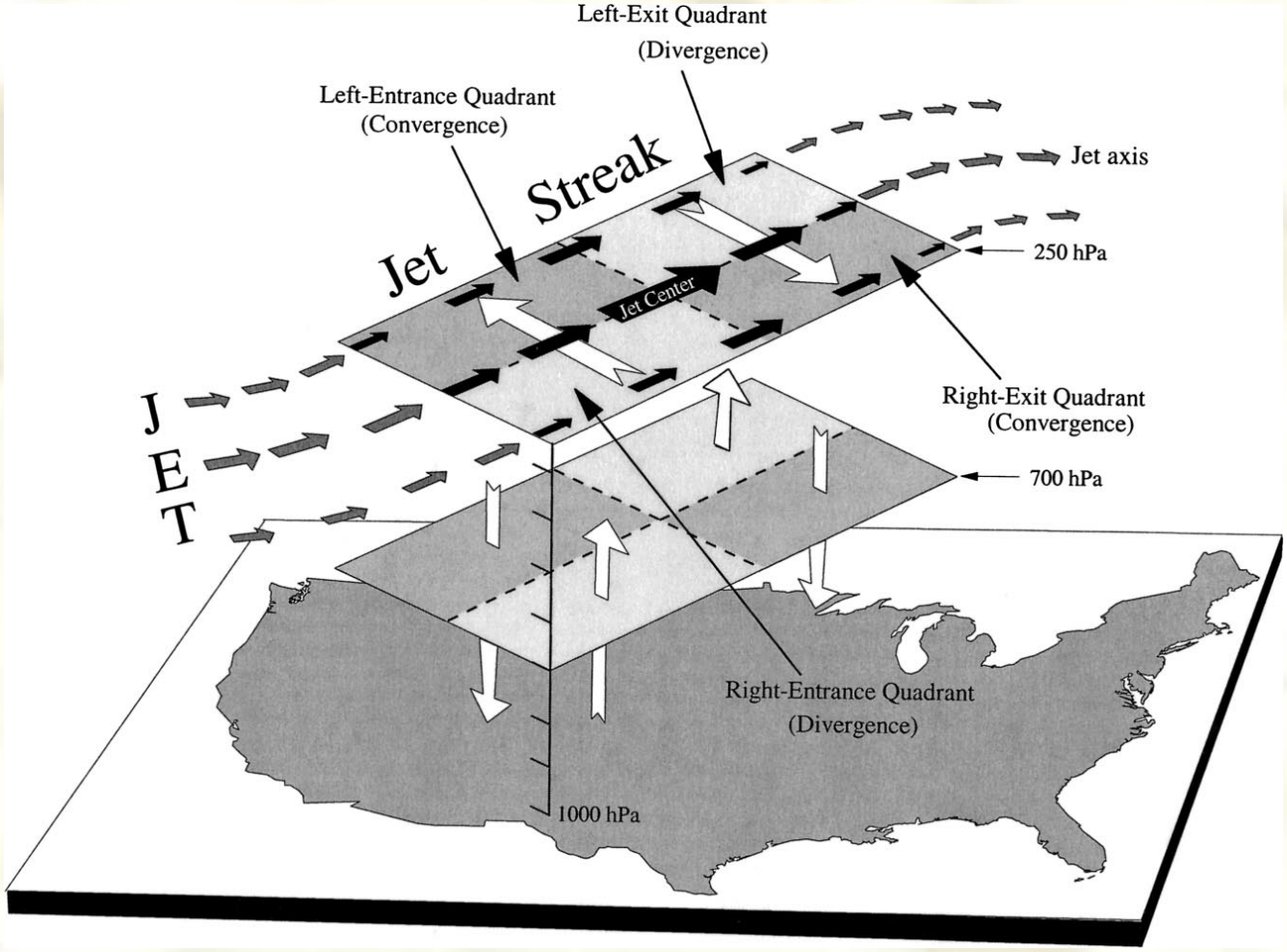
Hypotheses

- Jet quadrants with the highest average 250 mb divergence will also have the largest number of storm reports
- Average 250 mb divergence field will agree with the linear jet streak theory

Linear Jet Streak Description



Rose et al. (2003)

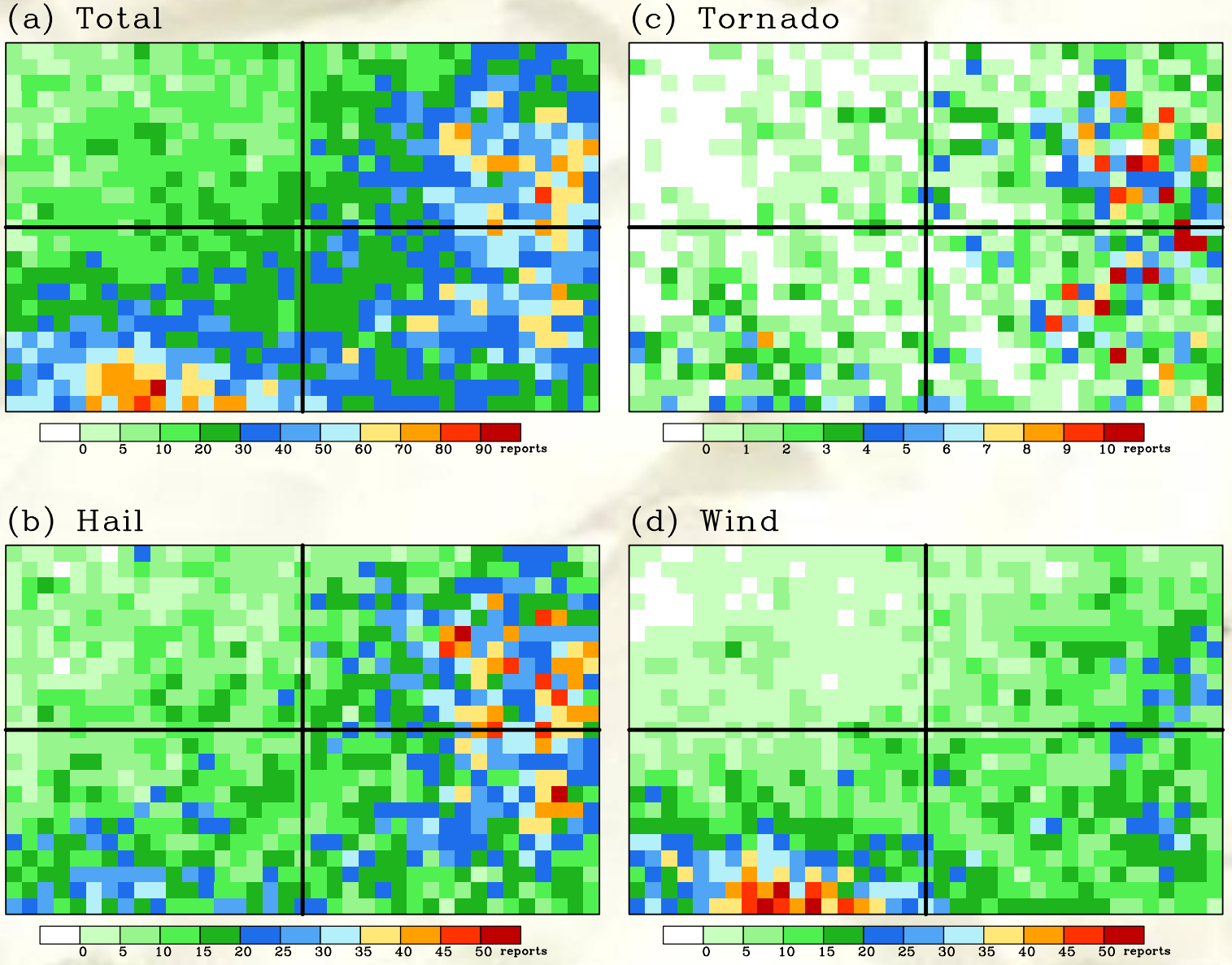


Rose, S. F., P. V. Hobbs, J. D. Locatelli, and M. T. Stoelinga, 2003: A 10-yr climatology relating the locations of reported tornadoes to the quadrants of upper-level jet streaks. *Wea. Forecasting*, **19**, 301-309.

Method

- NCEP/NCAR NARR Reanalysis (Mesinger et al. 2006), SPC storm reports (NOAA 2007), and an analysis of linear jets by Johnson-O'Mara (2006)
- The storm reports occurred within a six-hour time period from 21 UTC to 3 UTC during the months from March until September of each year (1994-2003)
- A combination of FORTRAN programs and GrADS scripts was used to analyze the data and create related images

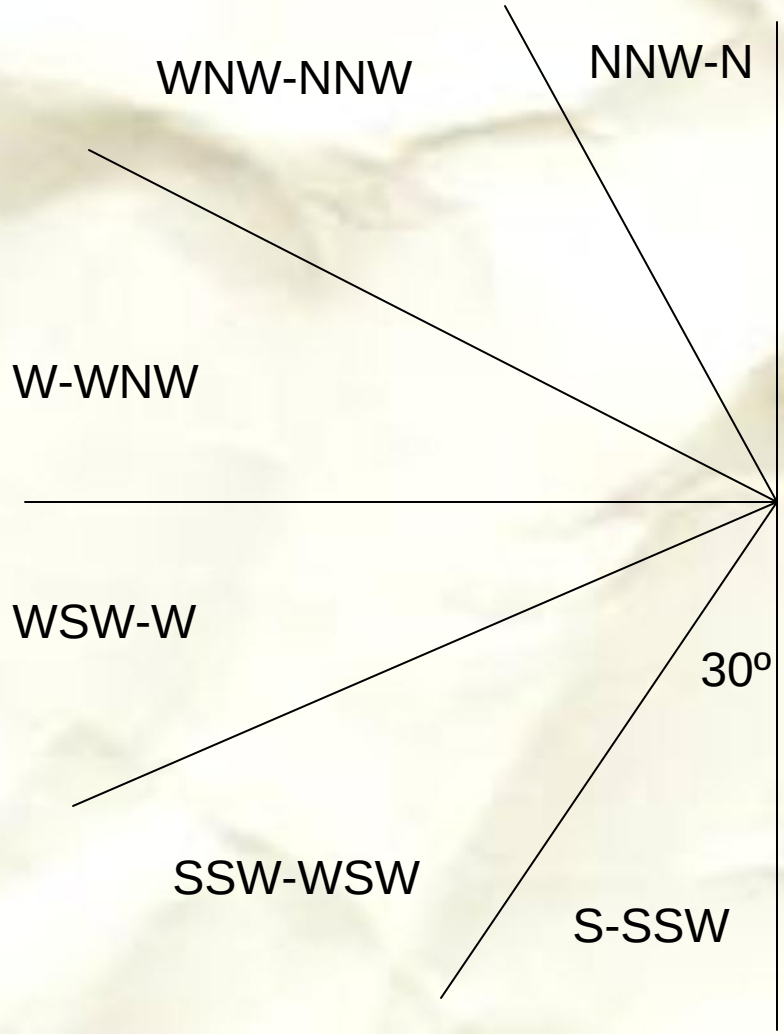
Overall Storm Report Densities



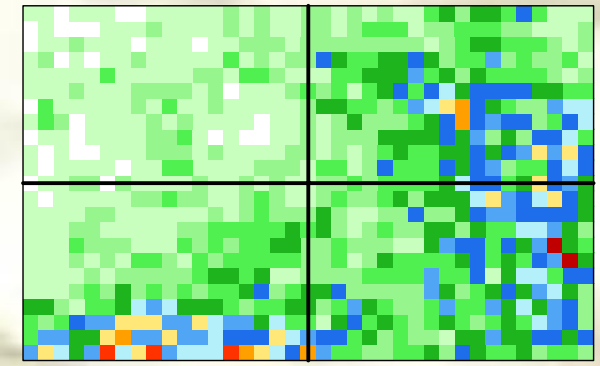
Jet Data (All reports)

Left Entrance Quadrant Storm Reports: 2802 (10.14%) Divergence: 1.80×10^{-5} sec^{-1} (2^{nd} largest)	Left Exit Quadrant Storm Reports: 7983 (28.92%) Divergence: 1.52×10^{-5} sec^{-1} (3^{rd} largest)
Right Entrance Quadrant Storm Reports: 8363 (30.30%) Divergence: 2.74×10^{-5} sec^{-1} (Largest)	Right Exit Quadrant Storm Reports: 8456 (30.63%) Divergence: 9.68×10^{-6} sec^{-1} (4^{th} largest)

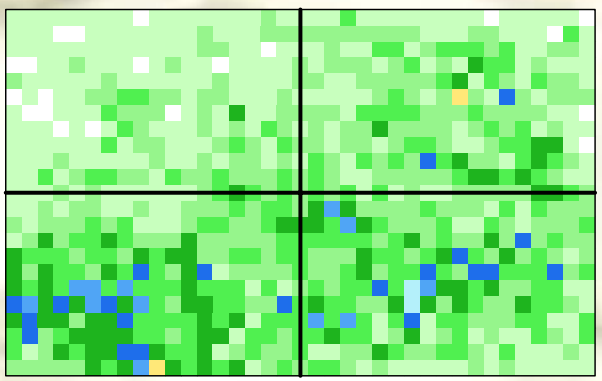
Storm Densities by Direction



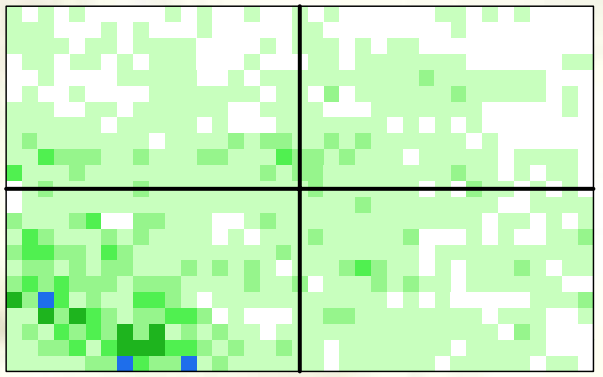
S-SSW



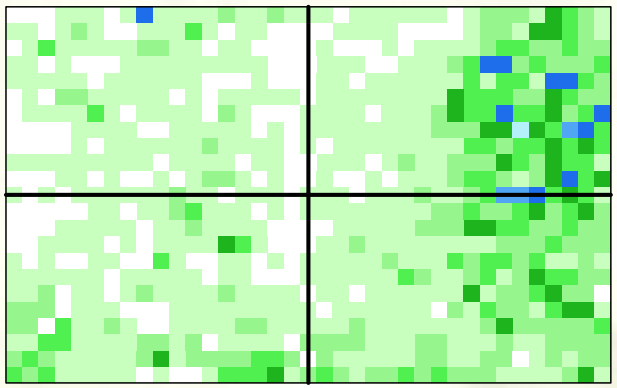
SSW-WSW



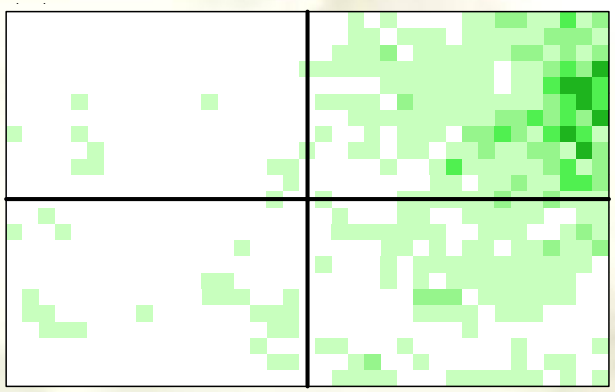
WSW-W



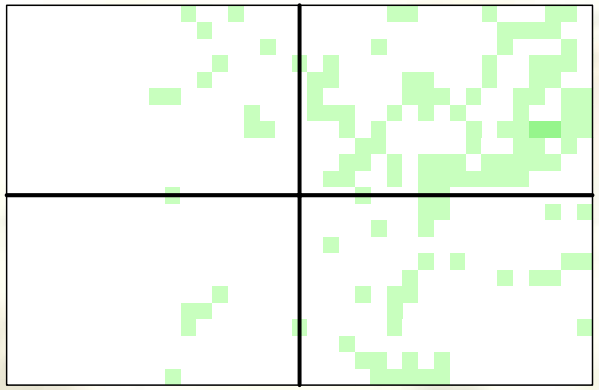
W-WNW

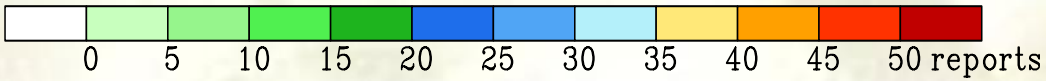


WNW-NNW



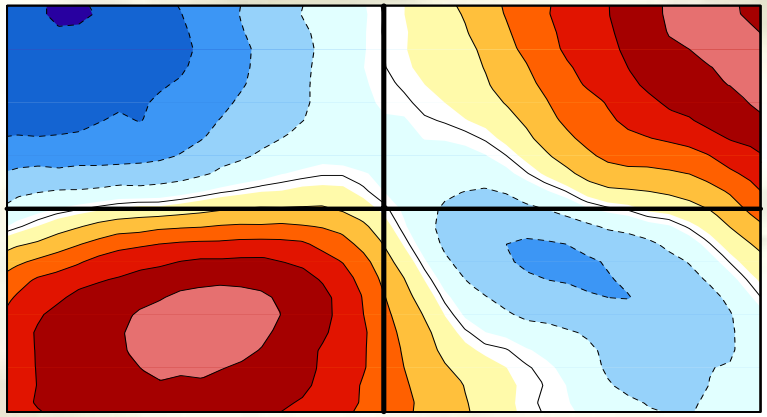
NNW-N



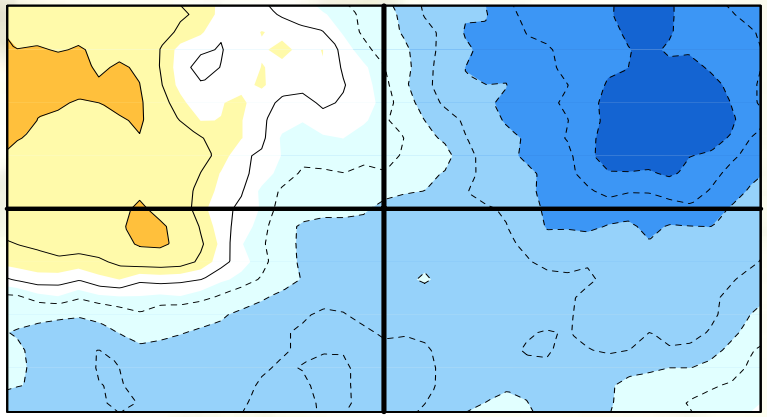


Divergence through mb levels

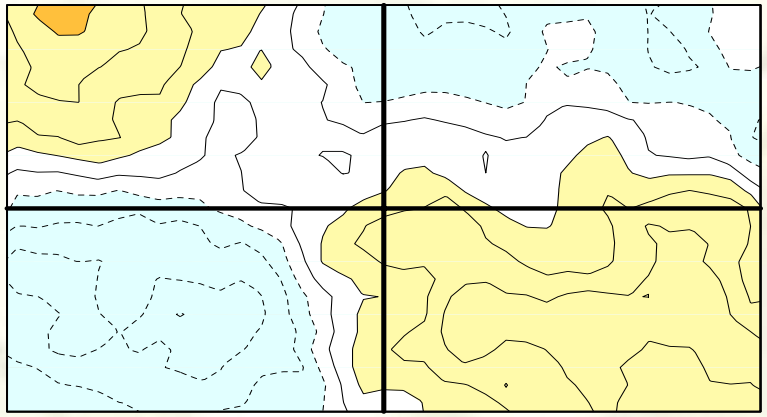
(a) Divergence at the 250 mb level



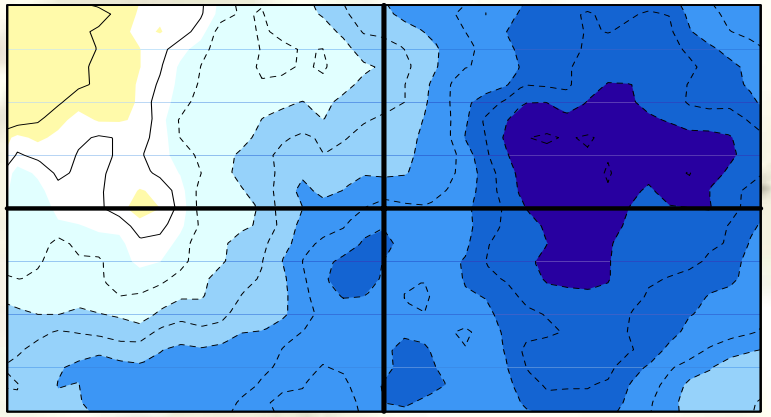
(c) Divergence at the 850 mb level

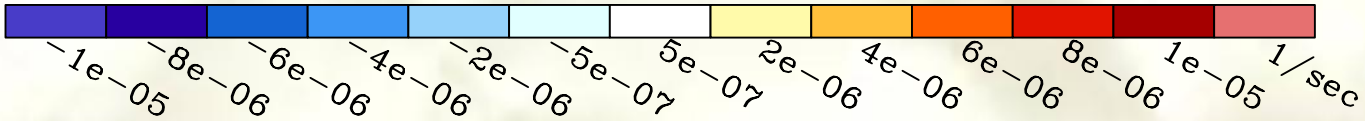


(b) Divergence at the 500 mb level

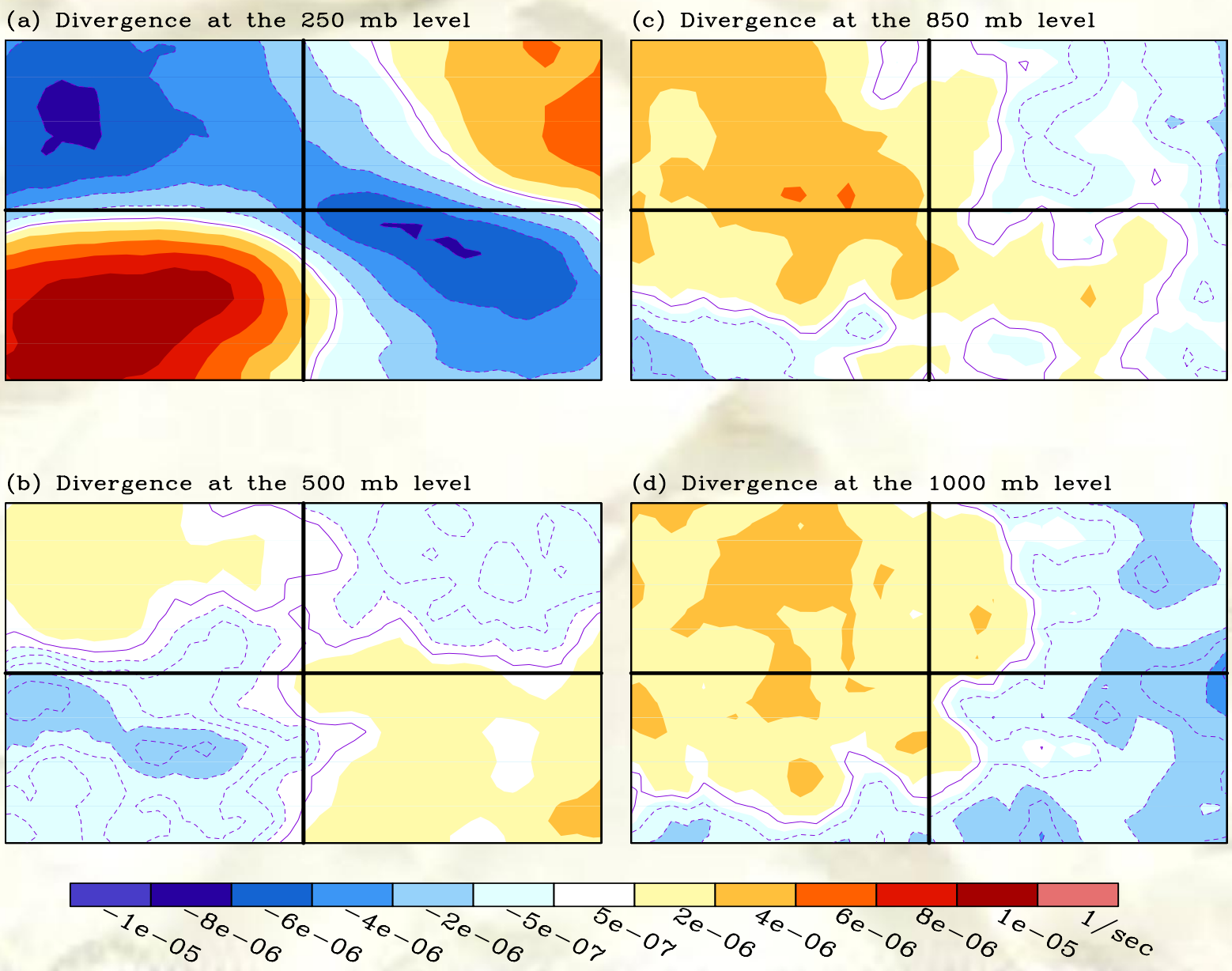


(d) Divergence at the 1000 mb level

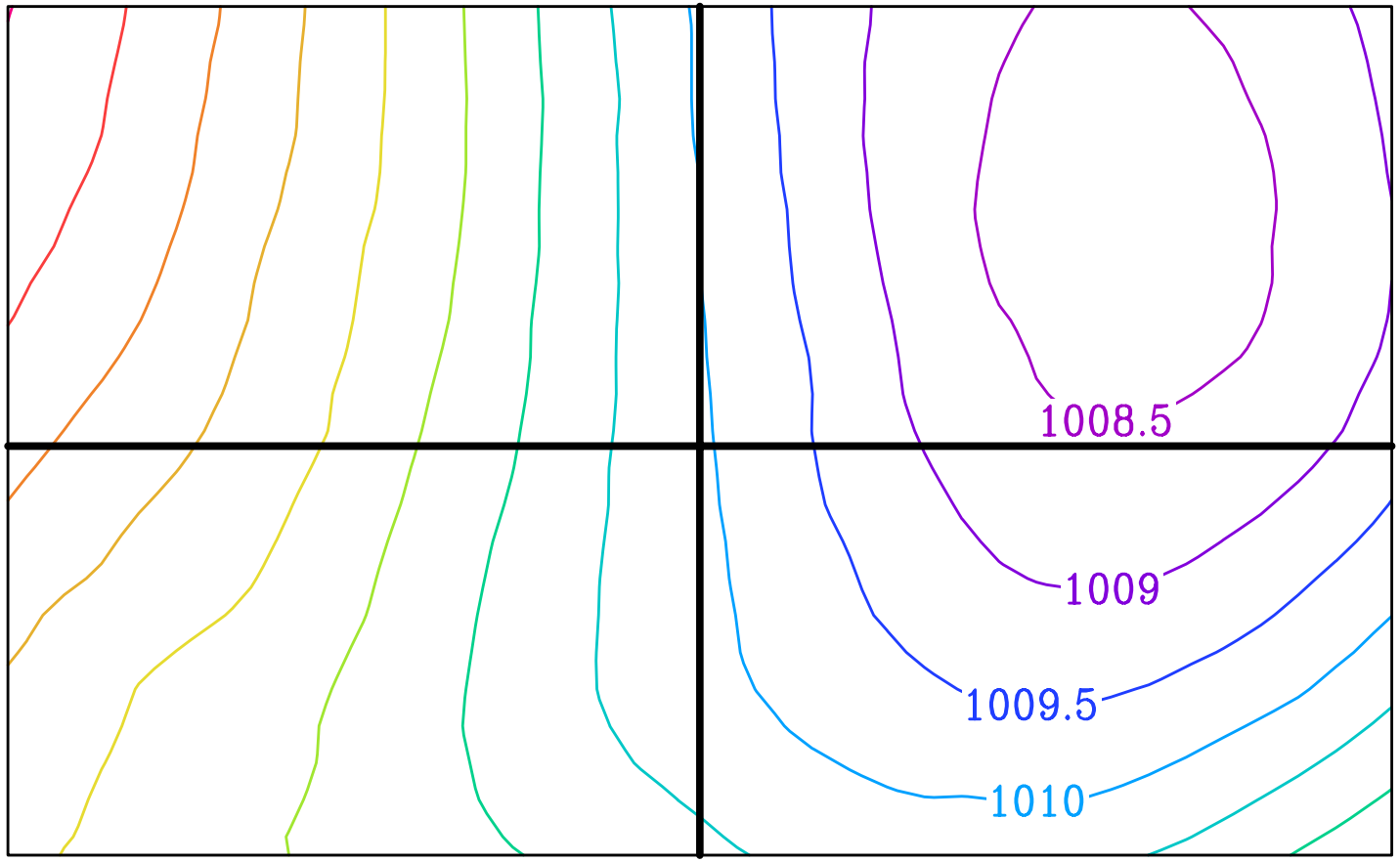


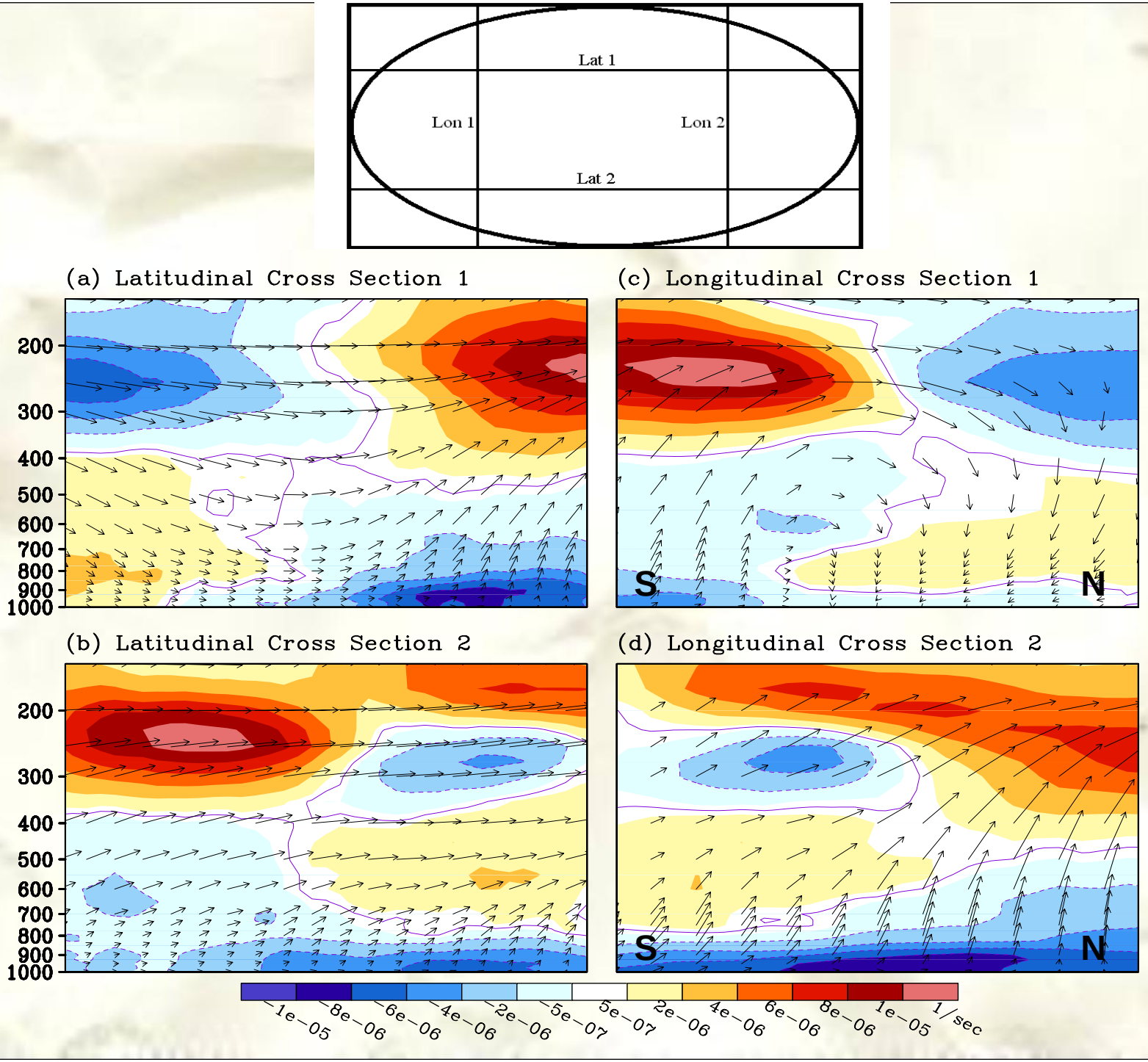


Divergence for “report-less” cases



Mean sea level pressure (mb)




Lat 1
Lon 1
Lon 2
Lat 2
(a) Latitudinal Cross Section 1
(c) Longitudinal Cross Section 1
(b) Latitudinal Cross Section 2
(d) Longitudinal Cross Section 2
200
300
400
500
600
700
800
900
1000
S
N
S
N
-1e-05
-8e-06
-6e-06
-4e-06
-2e-06
-5e-07
5e-07
2e-06
4e-06
6e-06
8e-06
1e-05
1/sec

Conclusions

- Maxima
  - Tornado and hail reports - exit regions
  - Wind reports - right entrance region
- Quadrants with greatest divergence at 250 mb did not have the greatest amount of storm reports
- Divergence at the 250 mb level agreed with the linear jet streak theory, though low-level divergence was influenced by a low pressure center in the left exit region
- The low, fronts associated with the low, and convection altered the jet-induced circulations, and fronts determined the distribution of storm reports

Further Research

- Examining a larger normalized area
- Considering surface temperature gradient in relation to pressure gradient used to identify fronts
- Plotting ageostrophic wind vectors and vorticity to further investigate circulations
- Closer examination of the relationship between the divergence associated with storm reports and the number of storm reports in a quadrant

Acknowledgments

- Adam Clark for his guidance and programming expertise
- Dr. Gallus for his help with the thesis paper and direction of the research
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Questions?

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