# Multiscale Evolution and Predictabililty of a Warm Season Climate Anomaly in the U.S. Southern Great Plains

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CIMMS

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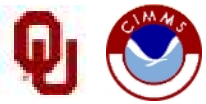
# U.S. Southern Great Plains, Summer 2002

- Weather Event:
  Flood near San Antonio, Texas, 30 June to 6 July, 2002
  - Local rainfall totals exceed 30 inches
  - 9 deaths, $65 million state and federal disaster assistance

- Climate Anomaly:
  Temperatures were 2-5 degrees below normal across TX and OK during July and early August 2002
  - Maximum temperature did not exceed 99 F in Norman, OK

- Are these related?



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# Prior to Onset of Climate Anomaly

20-km RUC analyses highlight spatial and temporal scales of weather events leading to the Texas flood

Mobile trough, or shortwave
Upper-level cutoff low
Texas flood

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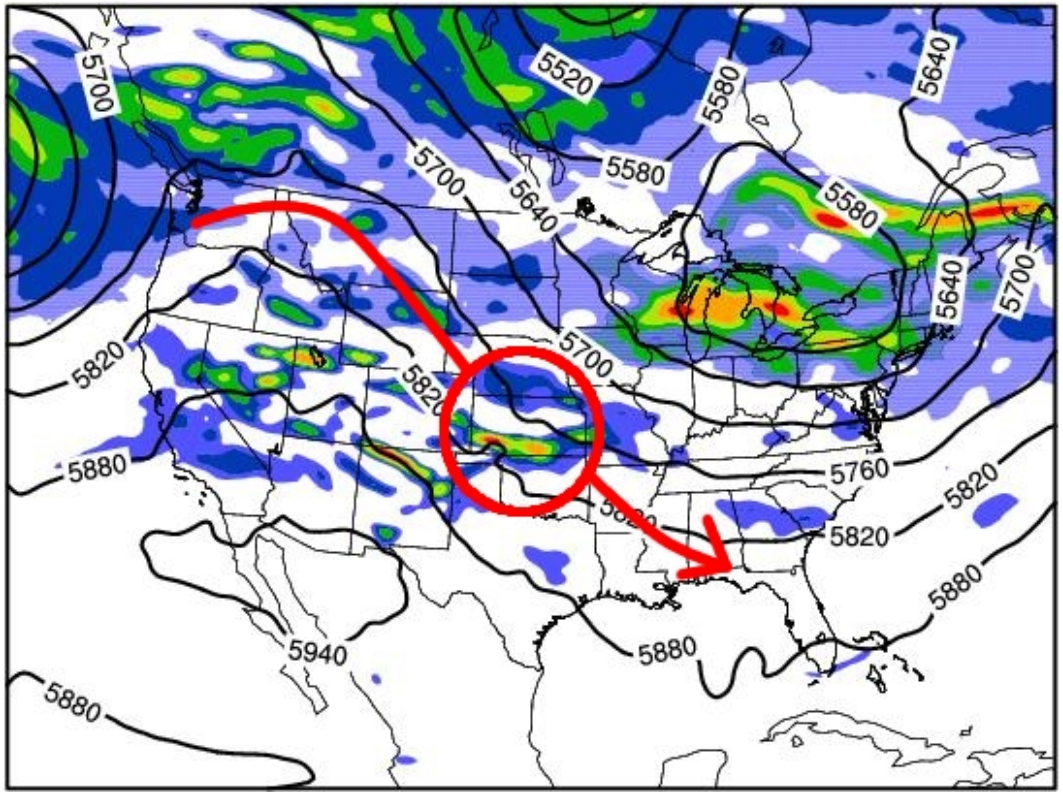
# 00Z 16 June 2002




RUC 500mb heights and absolute vorticity

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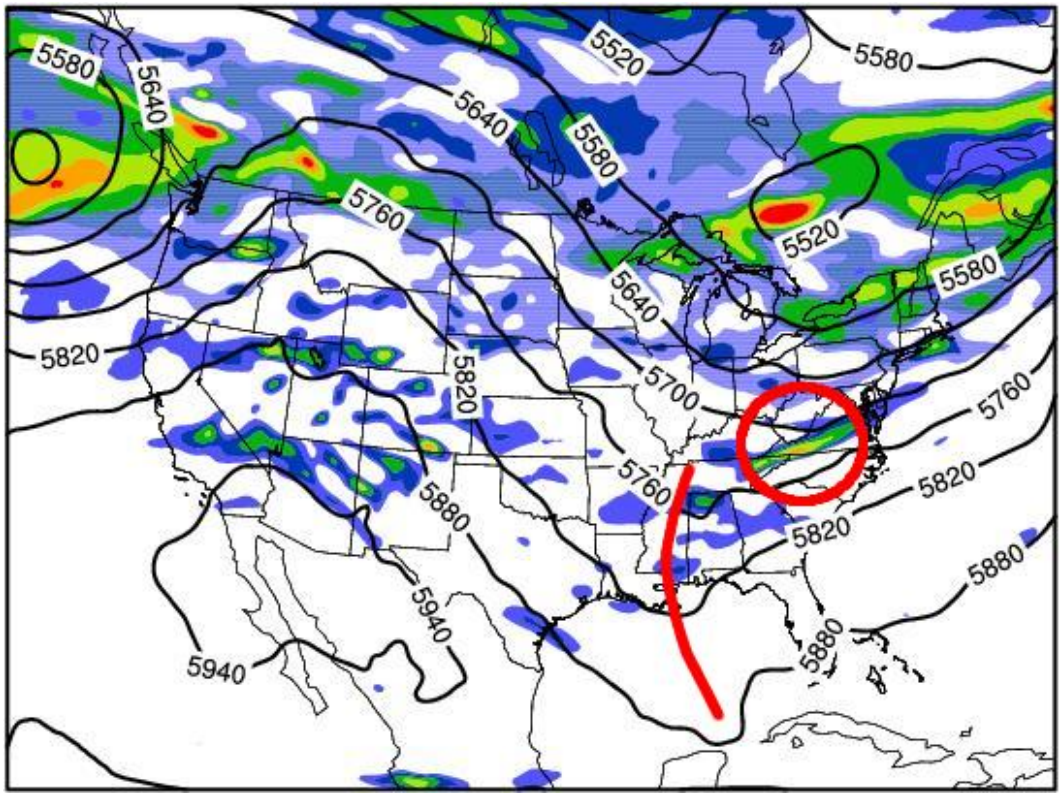


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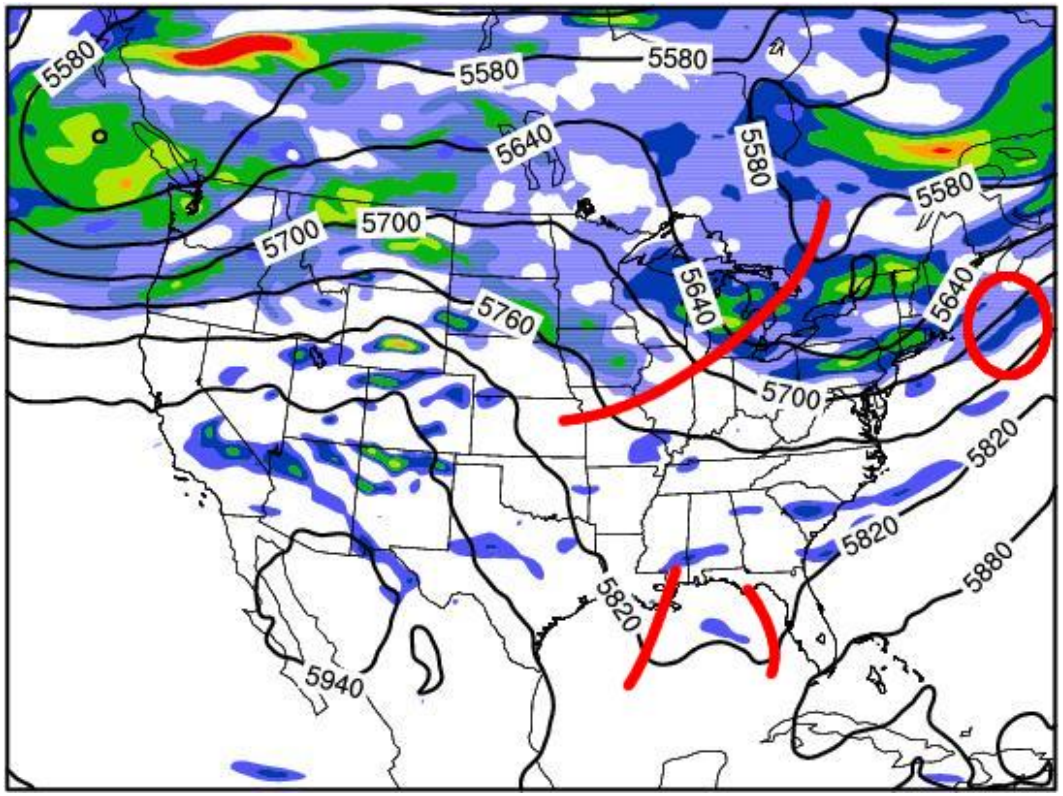


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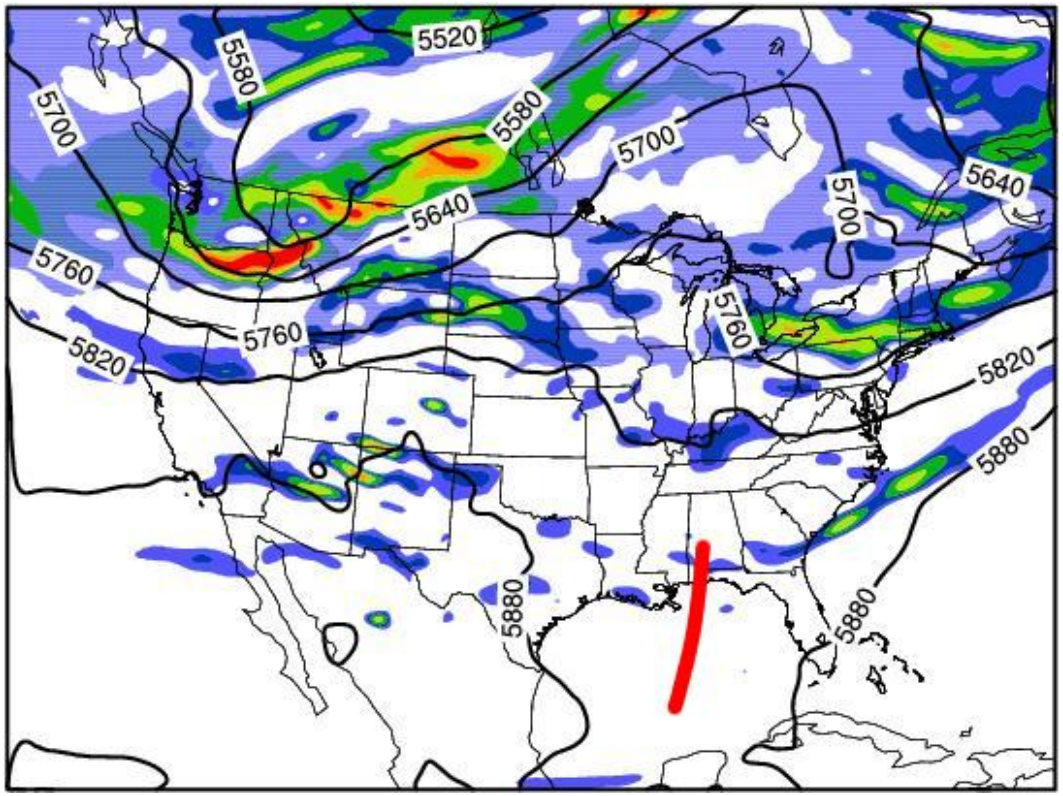


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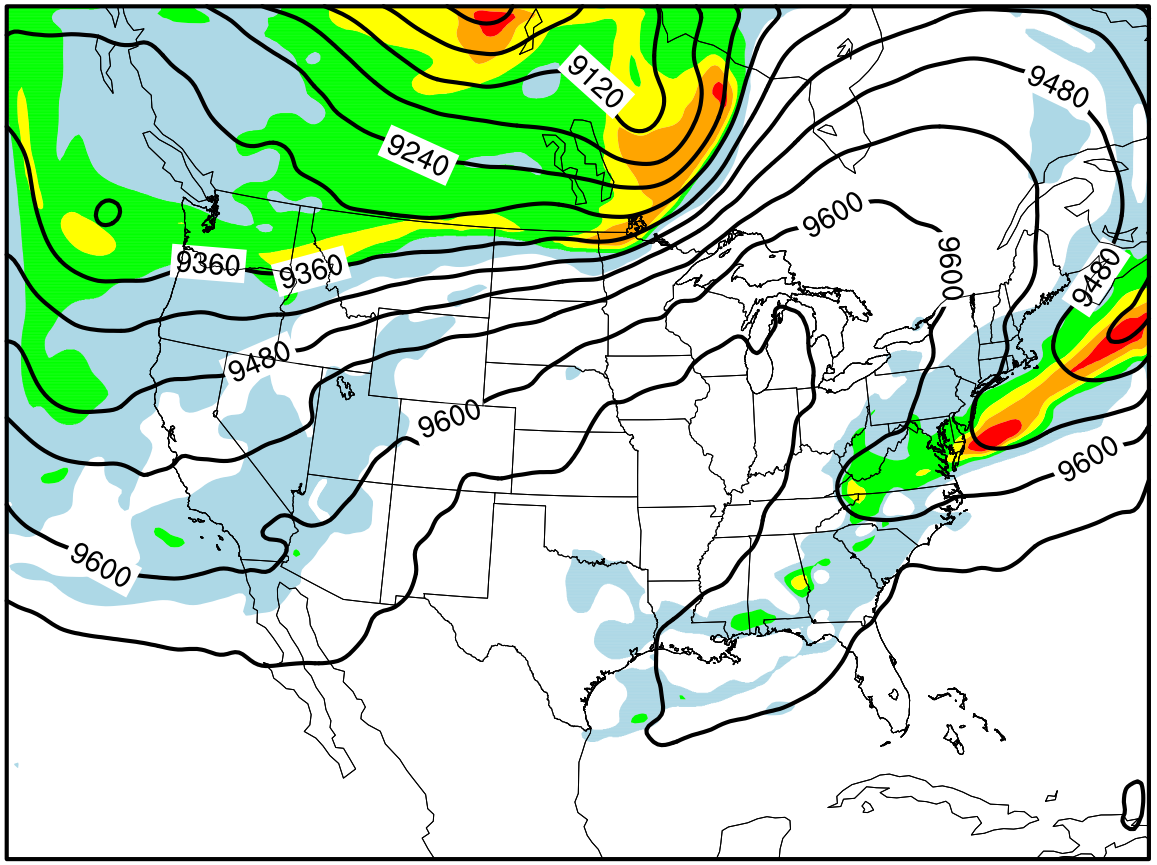
# 12Z 20 June 2002




RUC 300mb heights and tropopause pressure

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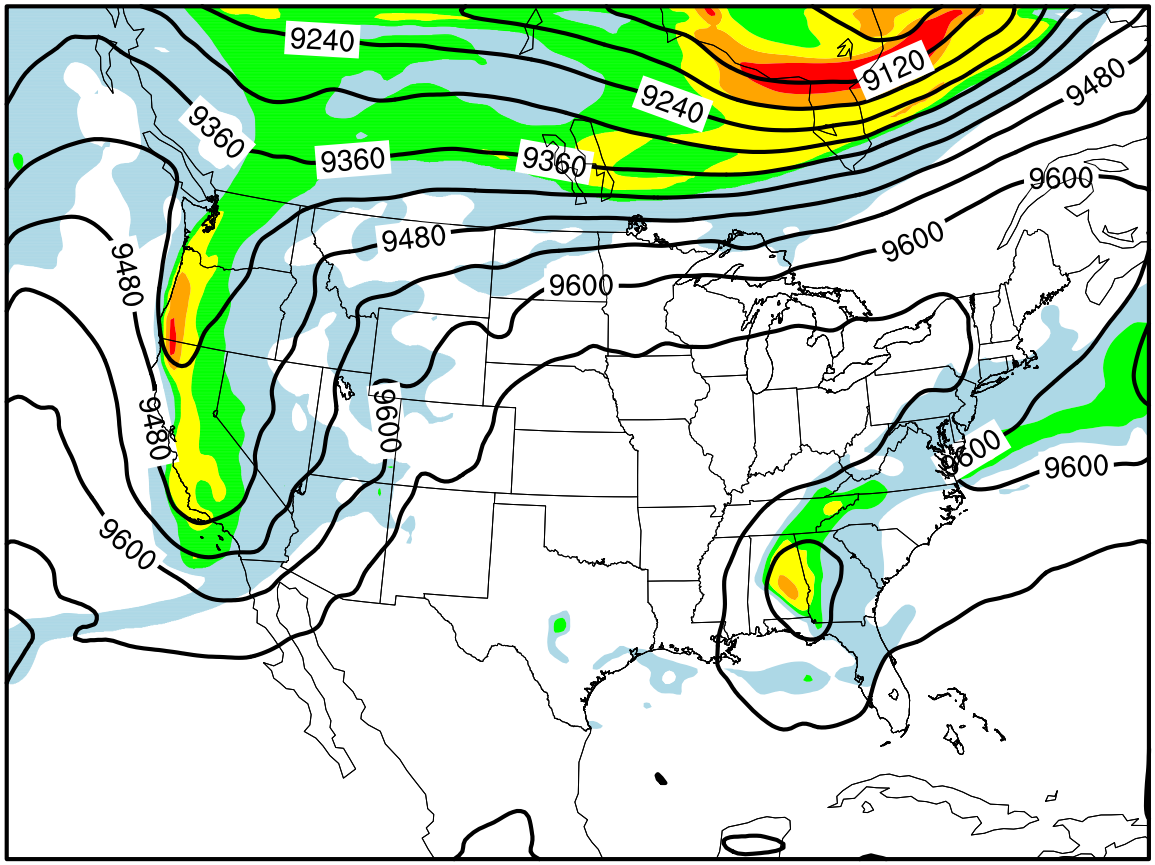
# 12Z 21 June 2002

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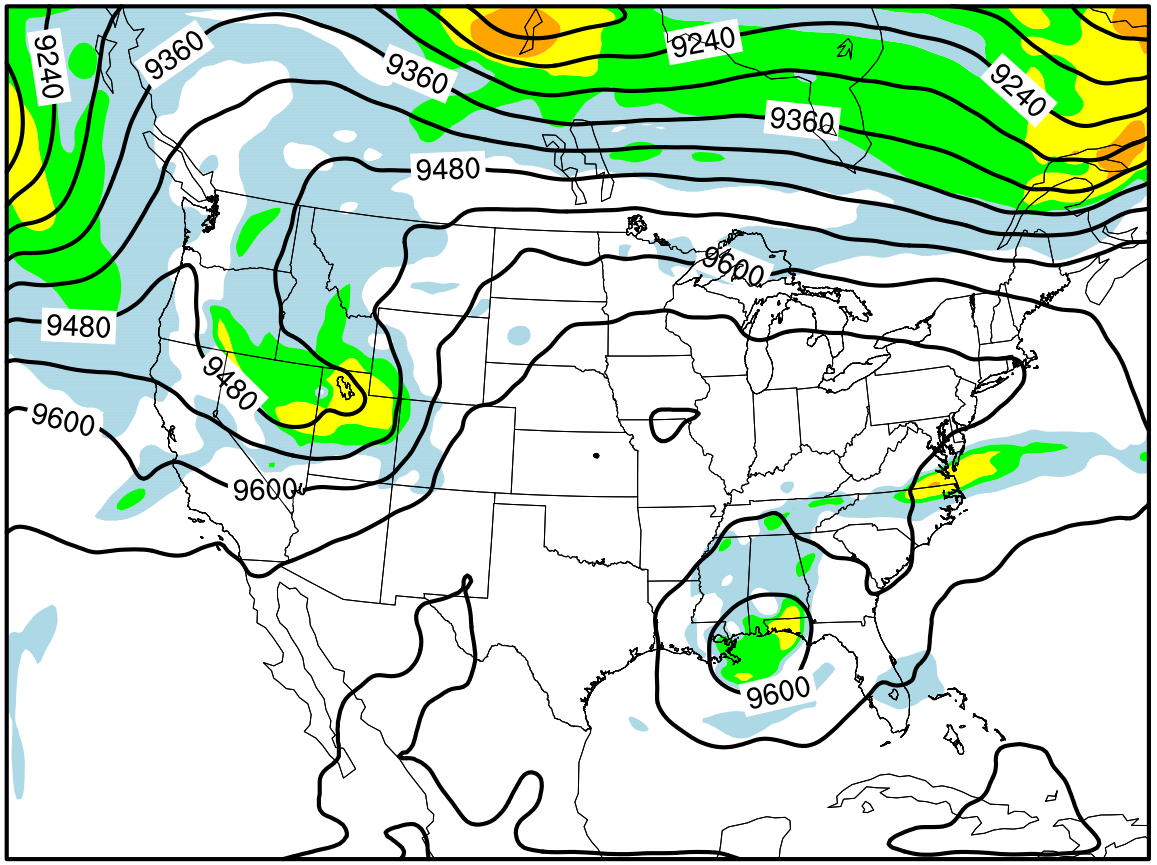
# 12Z 22 June 2002

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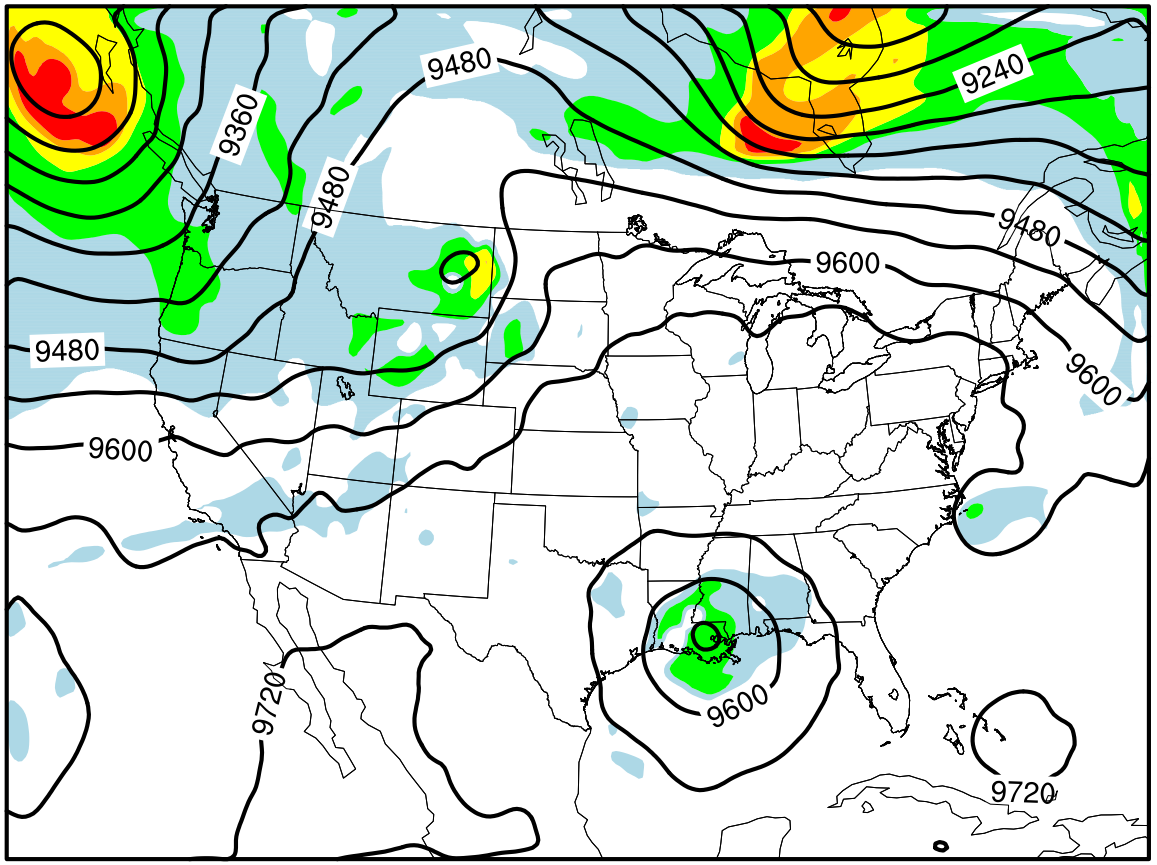


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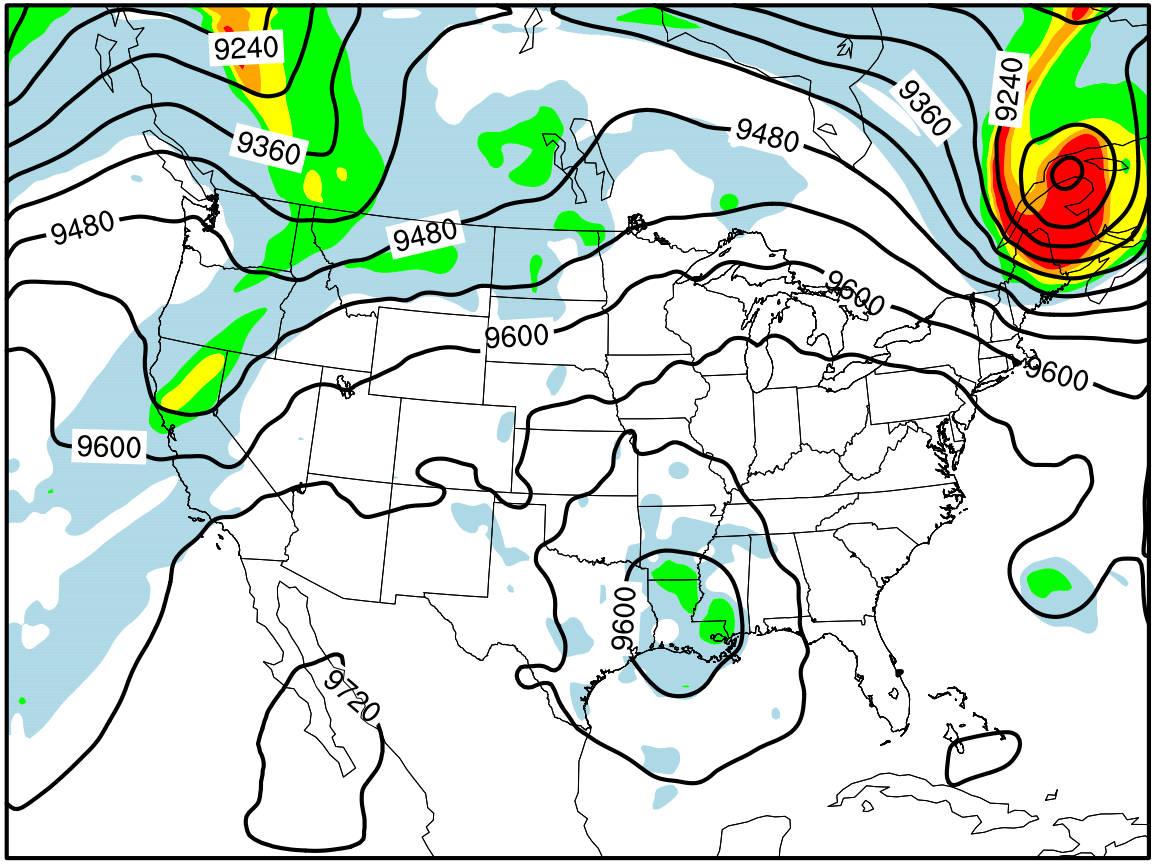


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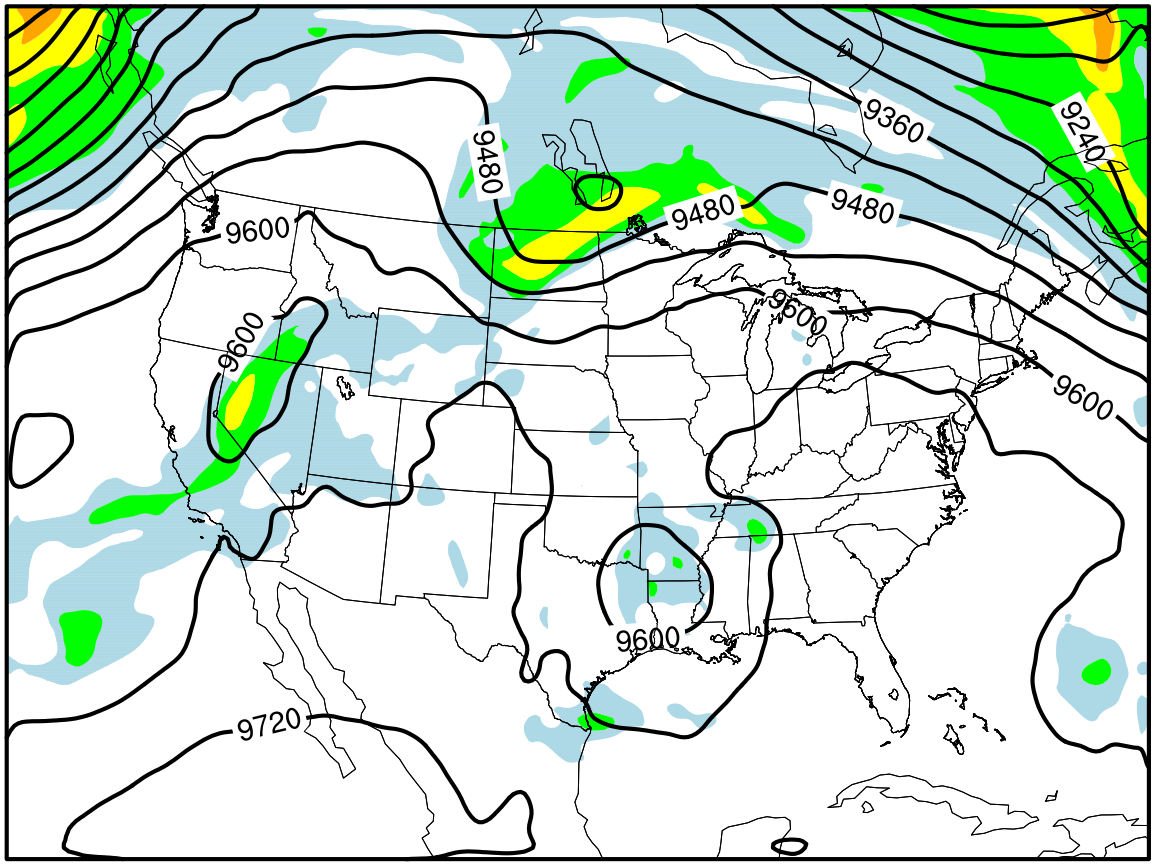


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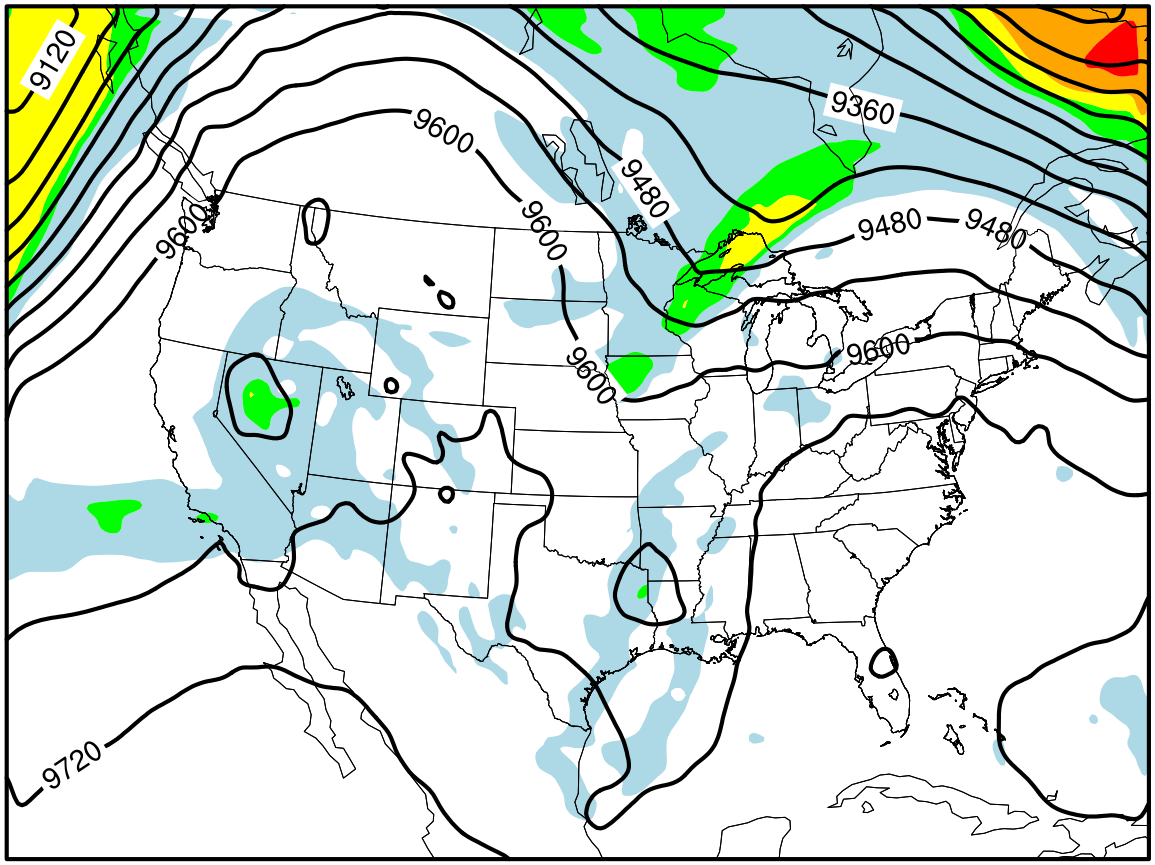


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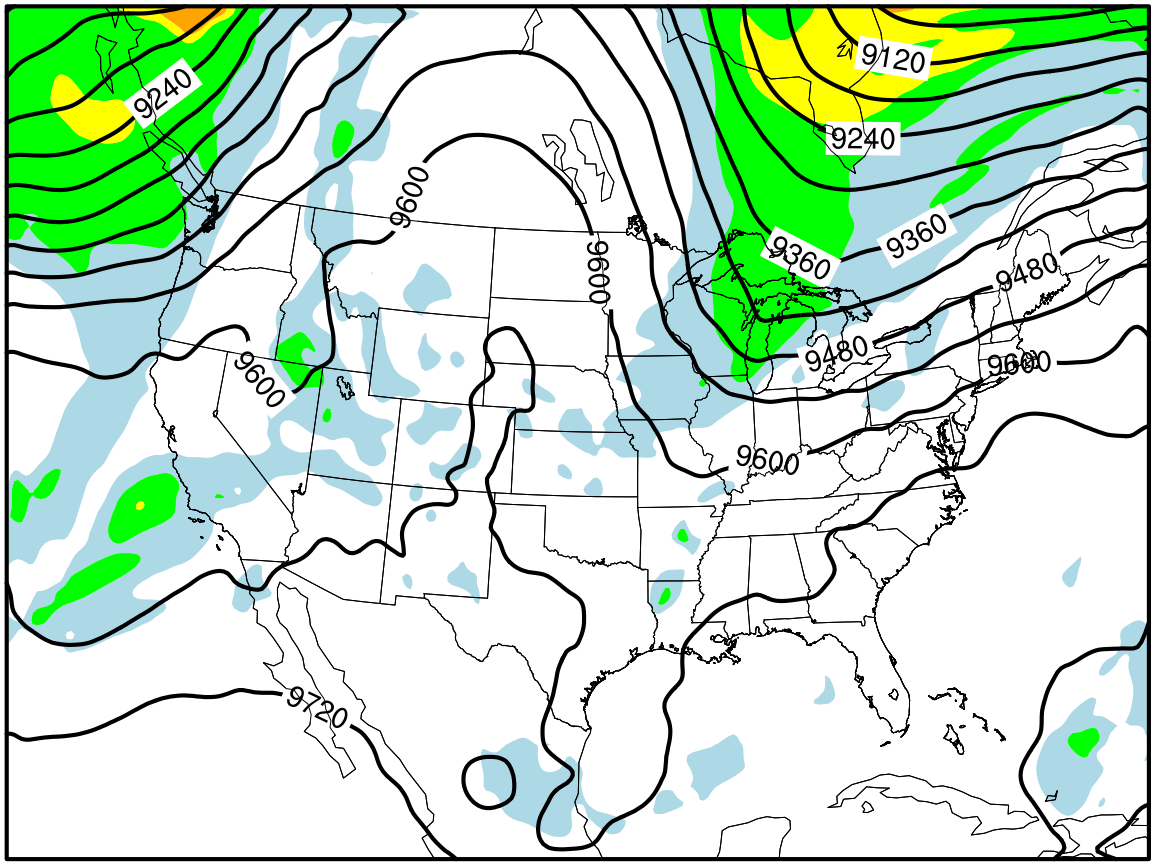
# 12Z 27 June 2002

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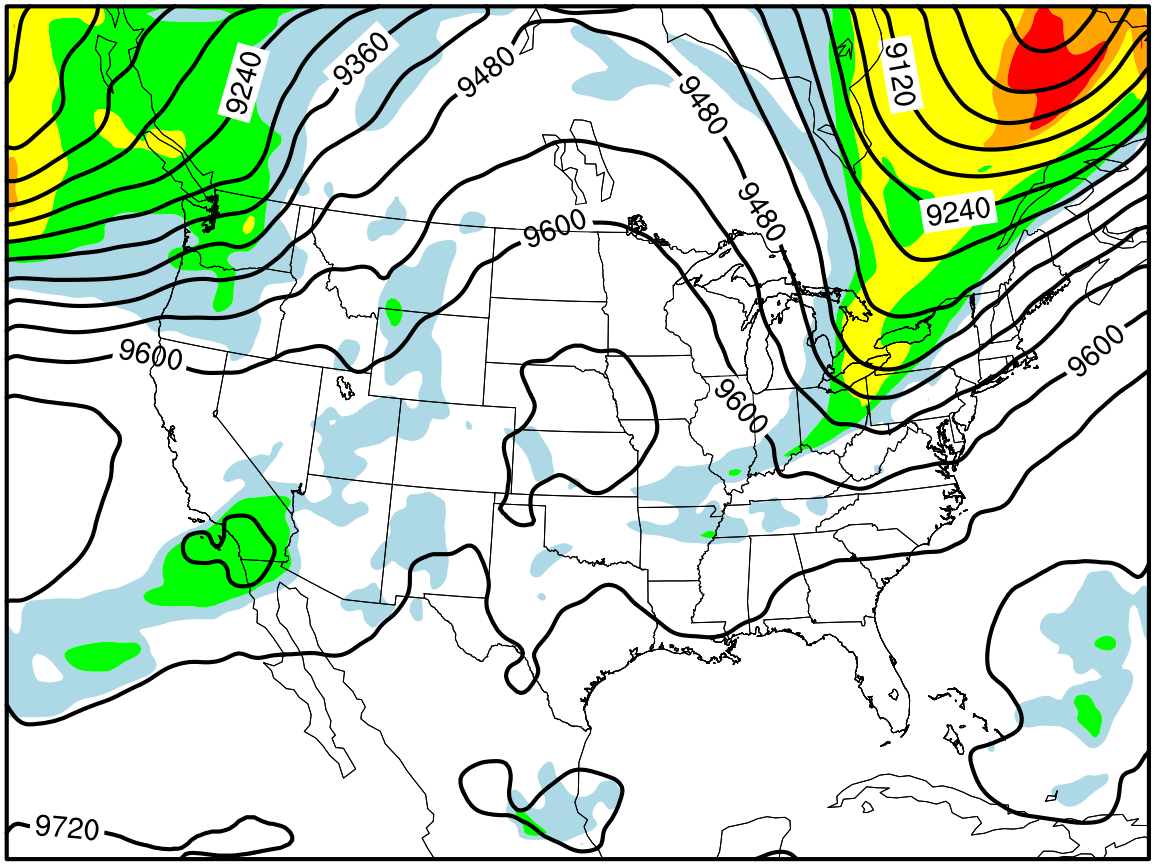
# 12Z 28 June 2002

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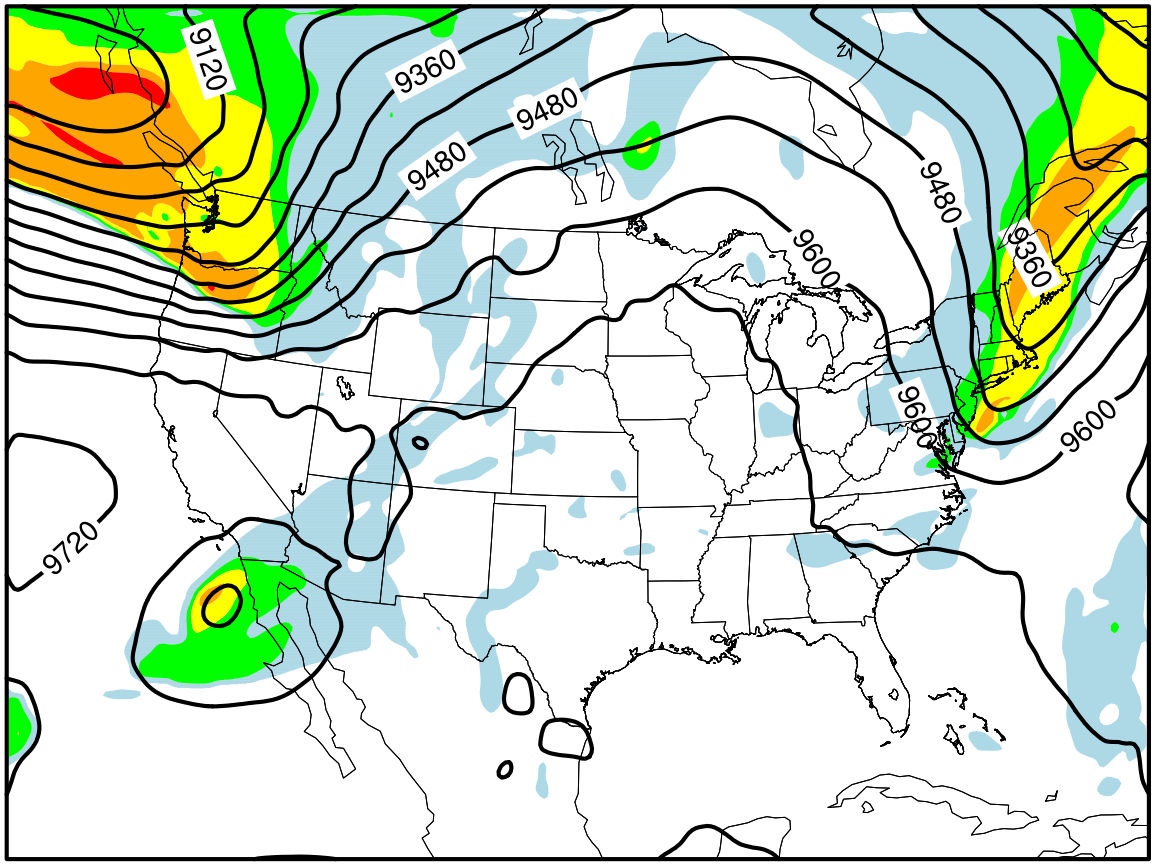


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# 18Z 01 July 2002

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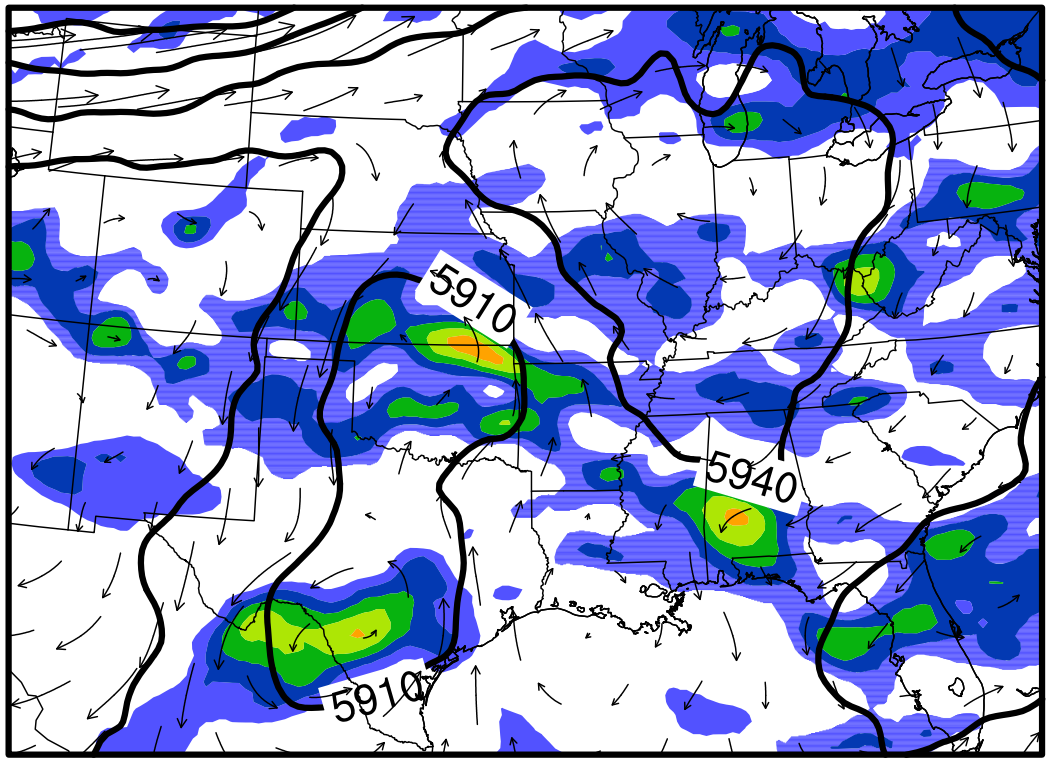


Two vortices embedded within an inverted trough positioned between nearly stationary subtropical anticyclones

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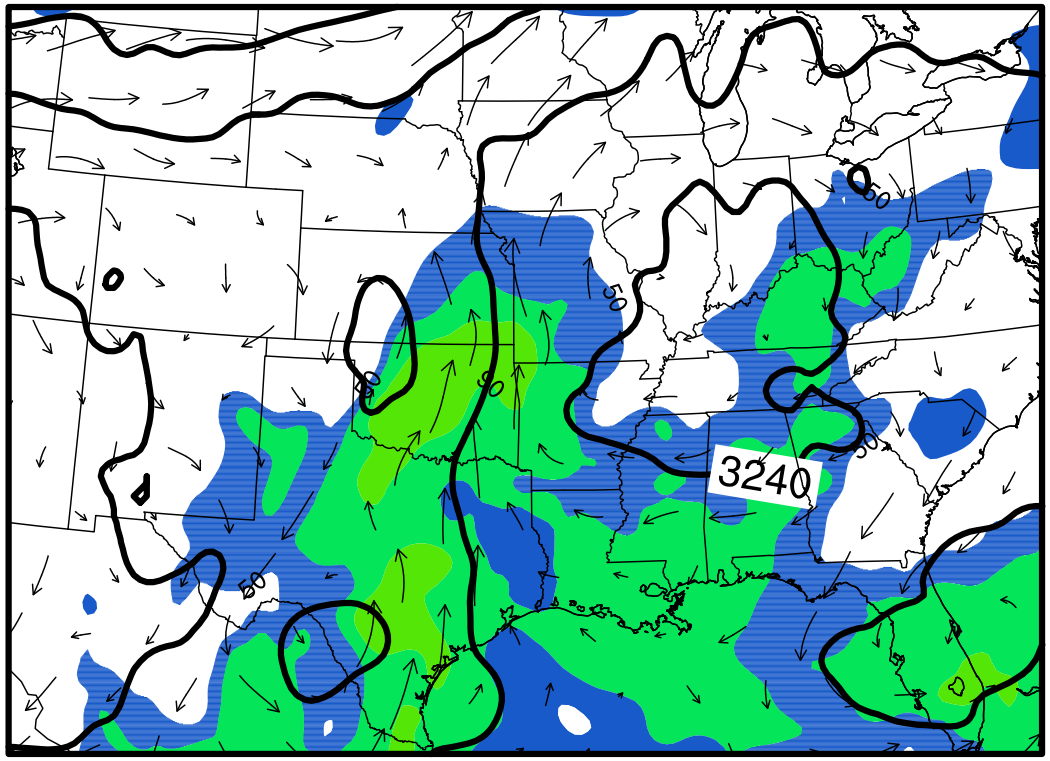
# 18Z 01 July 2002

RUC 700mb heights and relative humidity




Strong meridional moisture advection

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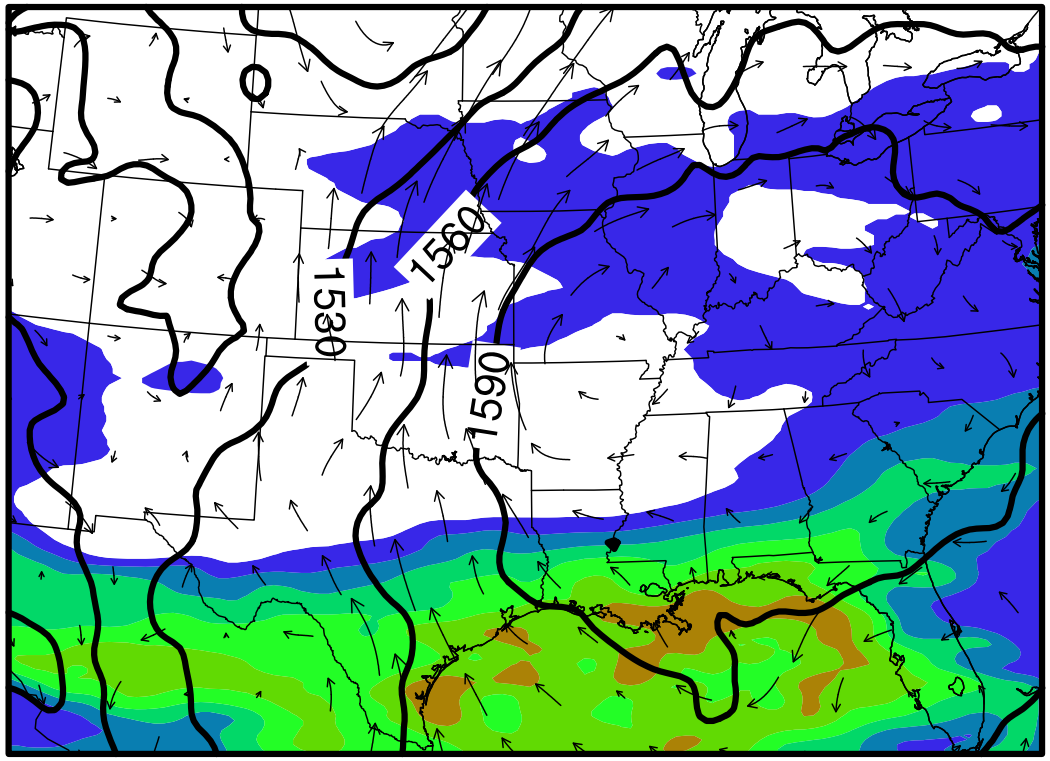
# 18Z 01 July 2002

RUC 850mb heights and temperature




Strong meridional temperature advection

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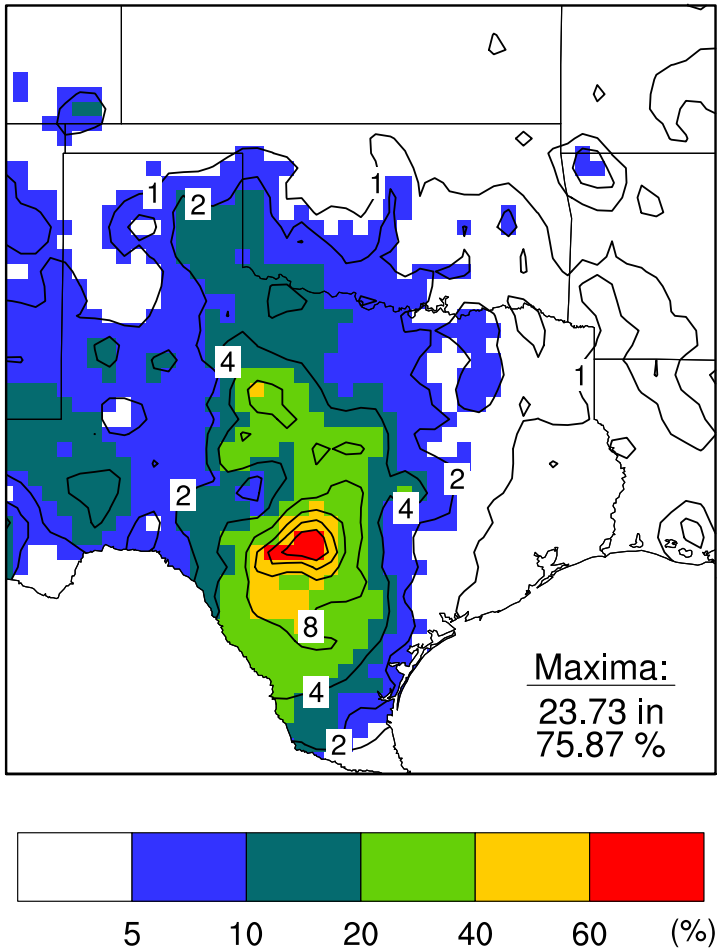
# Rainfall Totals, 1-7 July 2002

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# Integrating Weather to Climate

- These weather events appear related on:
  - Time scales ranging from hours to weeks
  - Spatial scales ranging from 10's to 1000's of kilometers
- Does the flood help initiate the regional climate anomaly?
- NCEP/NCAR Reanalyses characterize the anomaly and the mechanisms that help maintain it.


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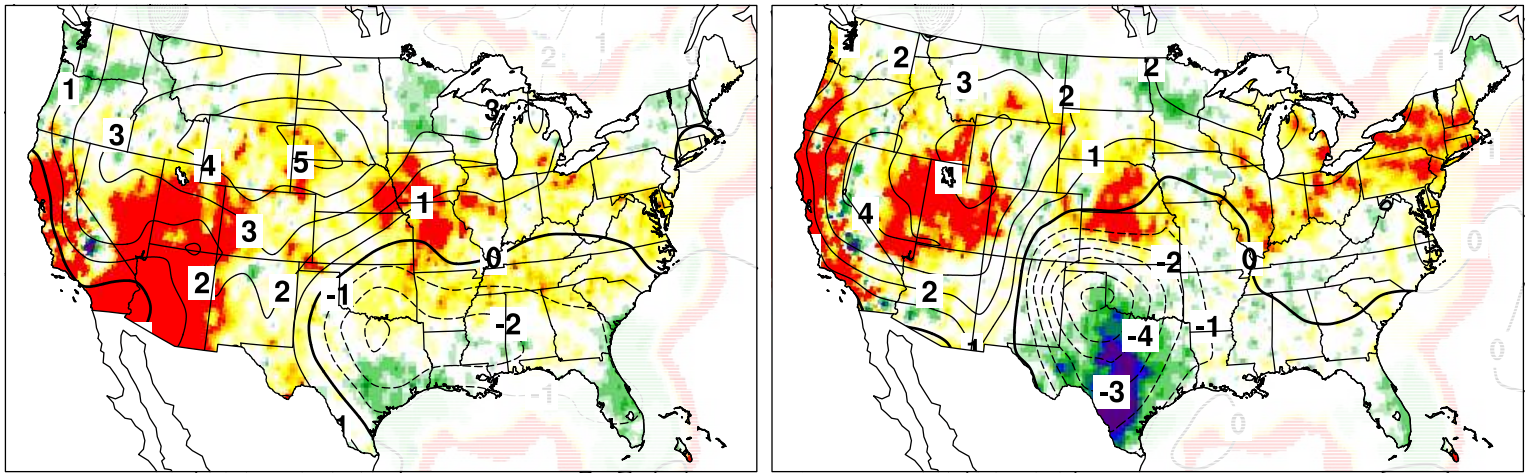
# Fraction of Normal Rainfall, and 2m Temperature Anomalies

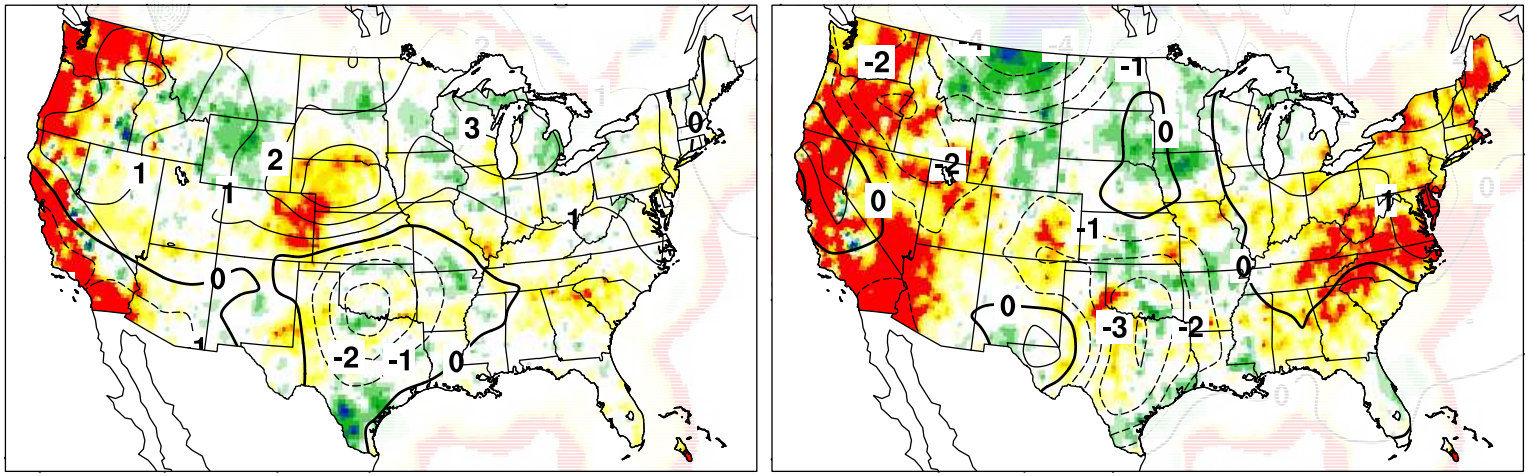
a) 16 Jun to 30 Jun 2002

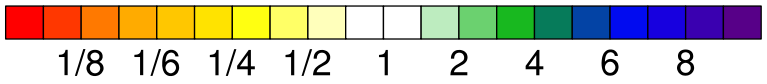
b) 1 Jul to 15 Jul 2002



c) 16 Jul to 31 Jul 2002

d) 1 Aug to 15 Aug 2002



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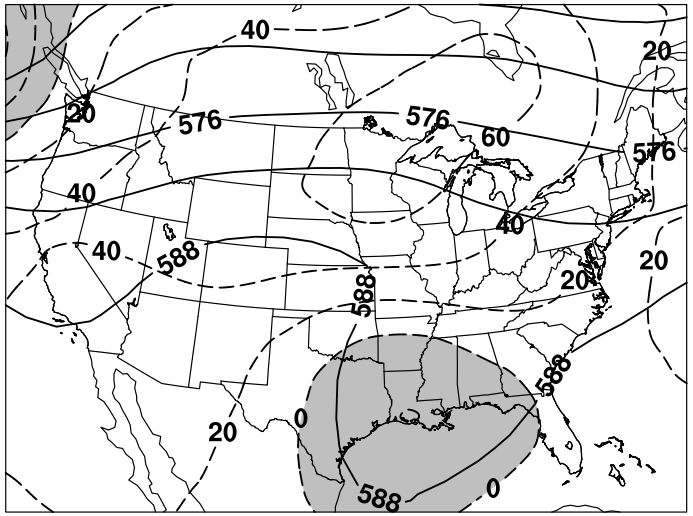
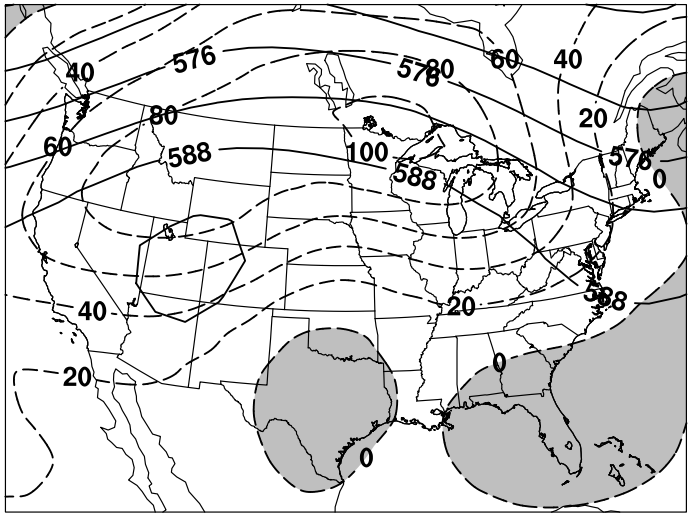
# 500mb Height Anomalies

a) 16 Jun to 30 Jun 2002




b) 1 Jul to 15 Jul 2002

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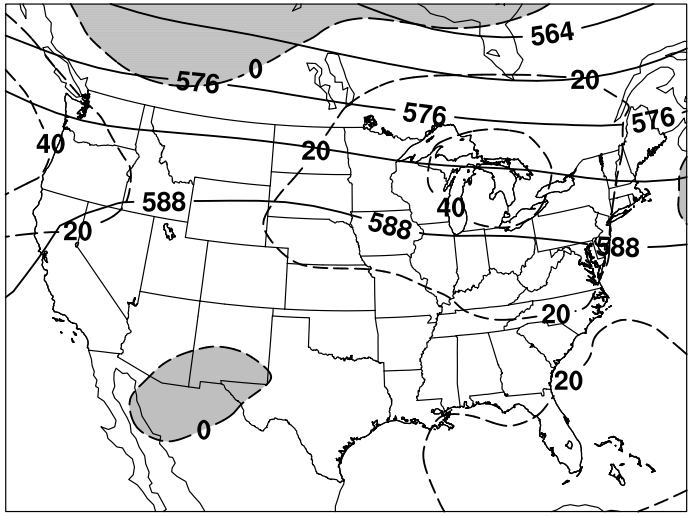


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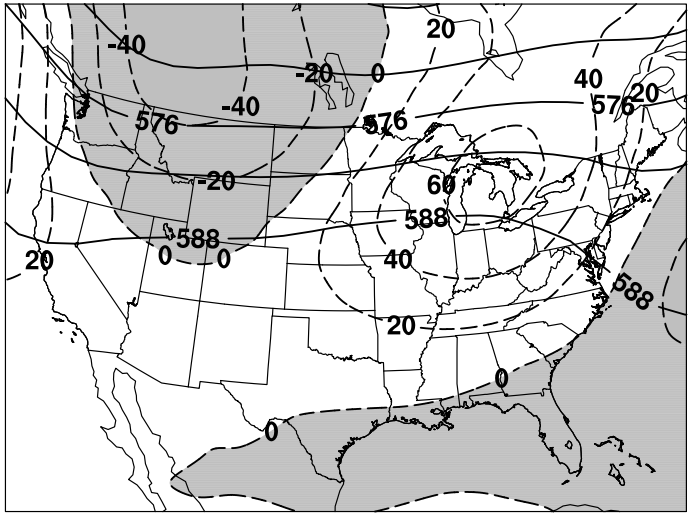


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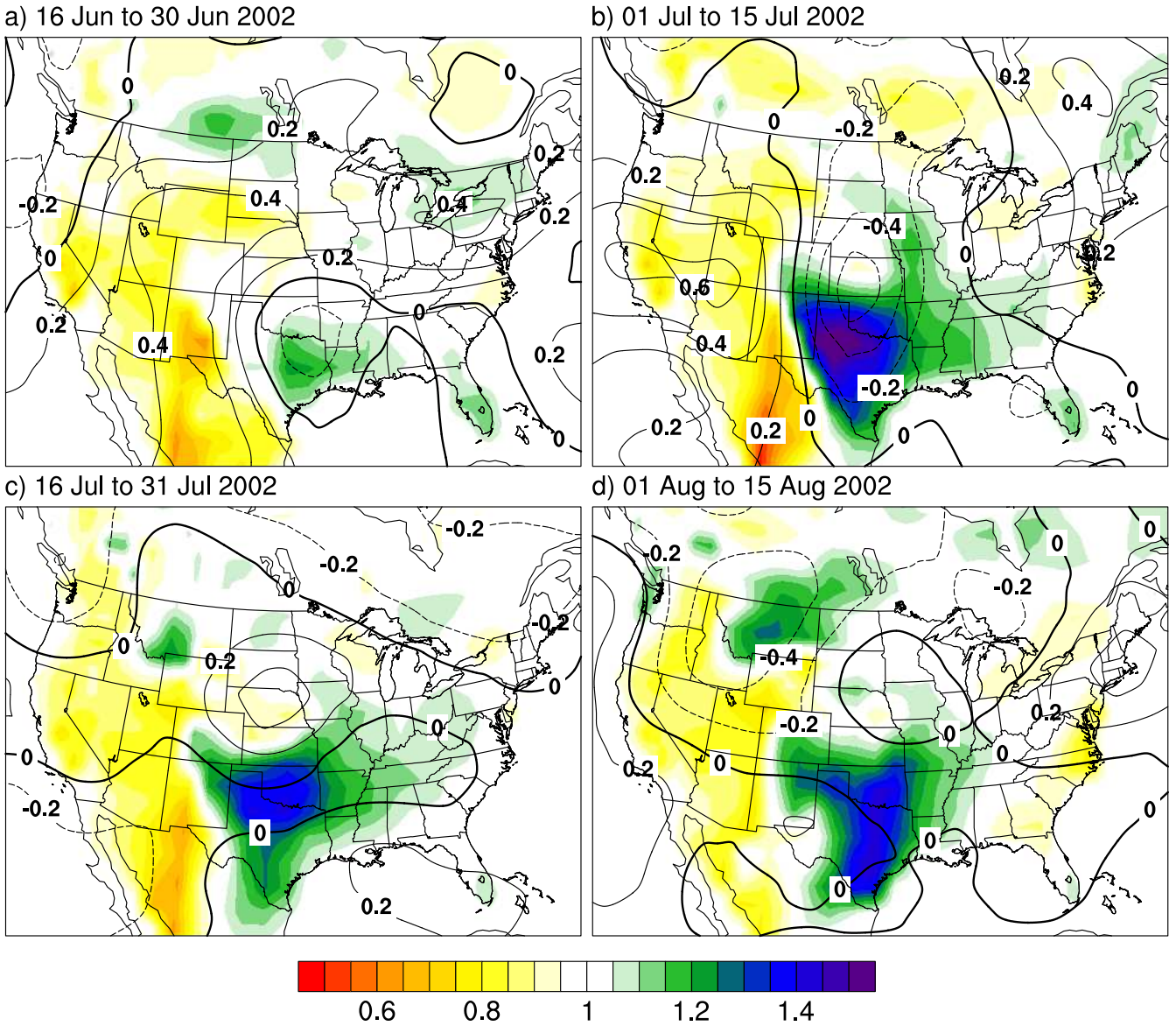
# Fraction of Normal Soil Moisture, and 500-700mb L-Rate Anomalies

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# Maintenance of Regional Climate Anomaly

- Persisted for  6 weeks after TX flood
- TX flood saturated soil, creating probable feedback to temperature
- Enhanced temperature gradient strengthens LLJ and meridional moisture transport (?)
- Anomaly ends when planetary scale pattern shift overwhelms local feedback processes

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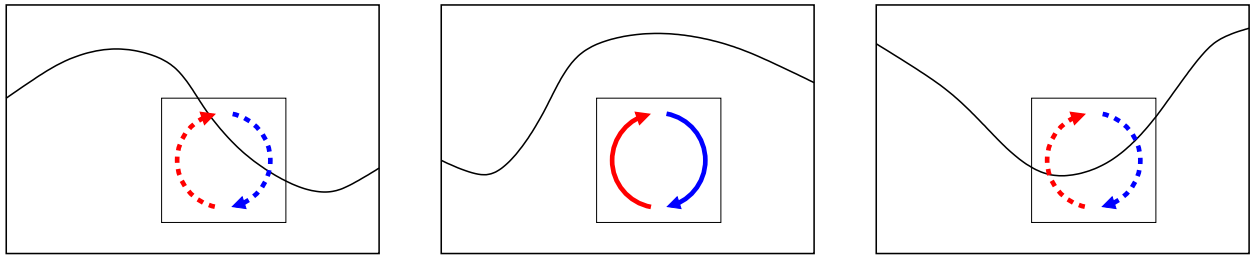
# Life Cycle of a Regional Climate Anomaly




- During **onset** phase, small-scale weather events form within the larger scale environment and help initiate regional feedback processes.
- During **maintenance** phase, feedback processes continue to function mostly independent of the large scale environment.
- During **dissipation** phase, changes in the large scale environment overwhelm regional feedback processes.

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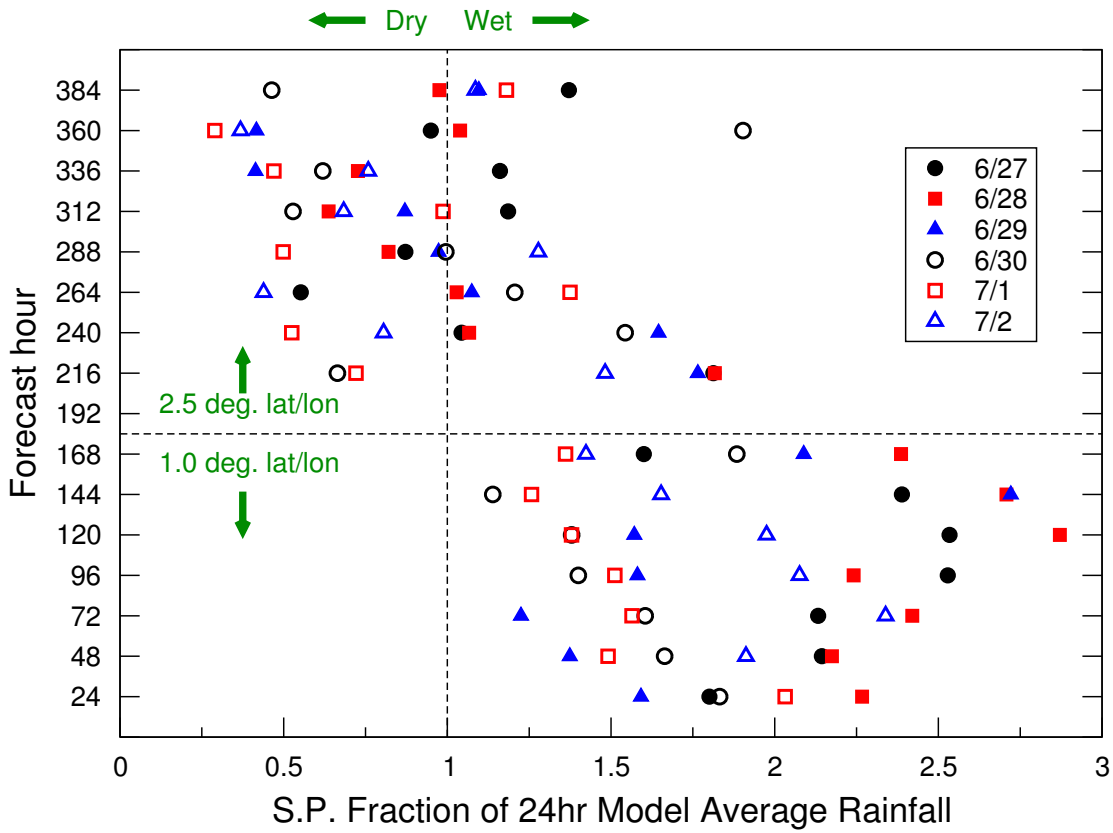
# Implications of Resolution on Predictability

## Trends in GFS Regional Rainfall Forecasts





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# Summary

- The regional climate anomaly forms, persists, and decays in response to the integral effects of weather at all scales.
- Accurate prediction requires adequate resolution of smaller scale weather events and simulation of feedback processes.
- Truncating forecast models may limit the ability to predict events leading to the onset of the climate anomaly.
- We will continue to develop scale-dependent measures of predictability throughout the life cycle of the climate anomaly.


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