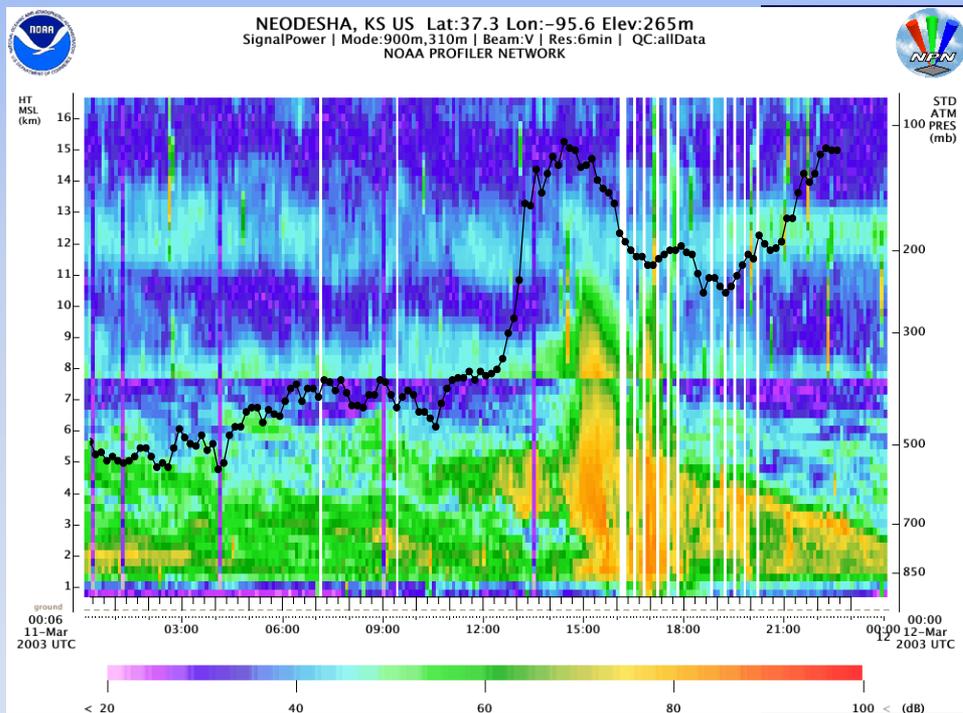


GPS Observations

Convective Weather & Thunderstorms

Seth I. Gutman
NOAA Earth System Research Laboratory



OAR/ESRL/GSD/Forecast Applications Branch

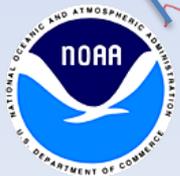
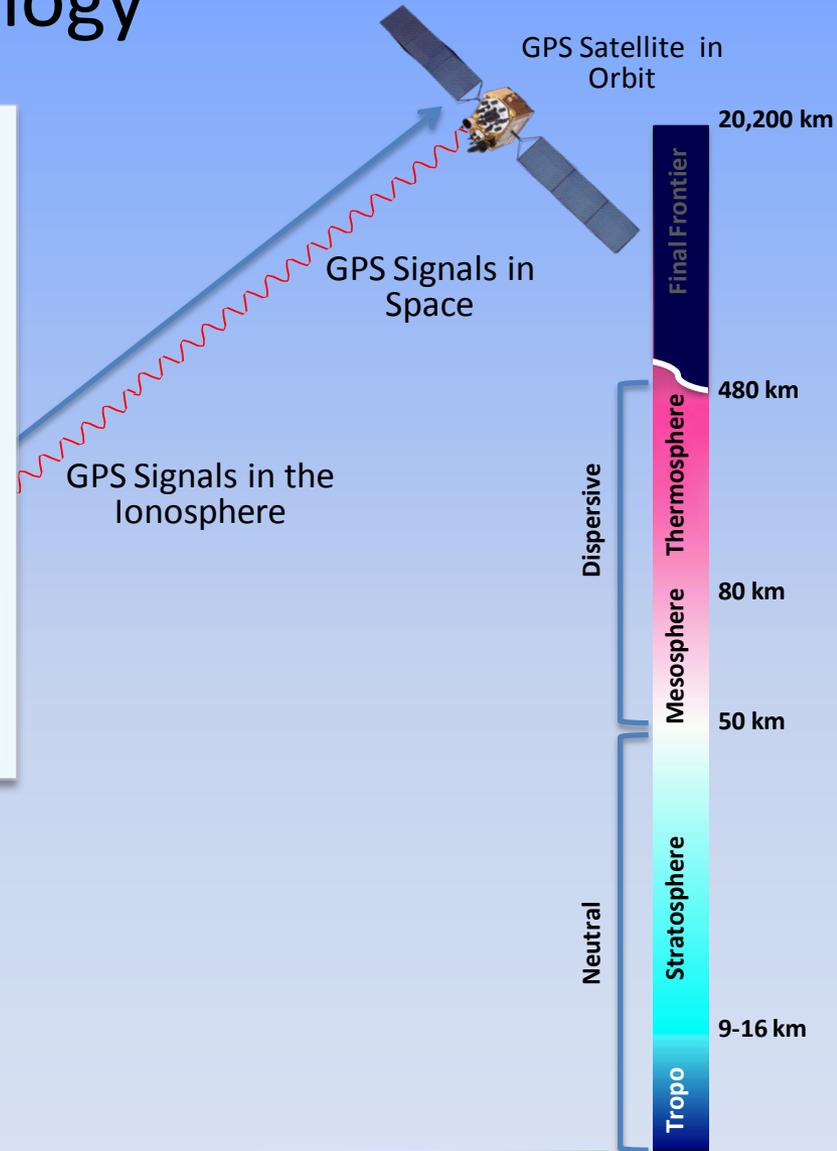
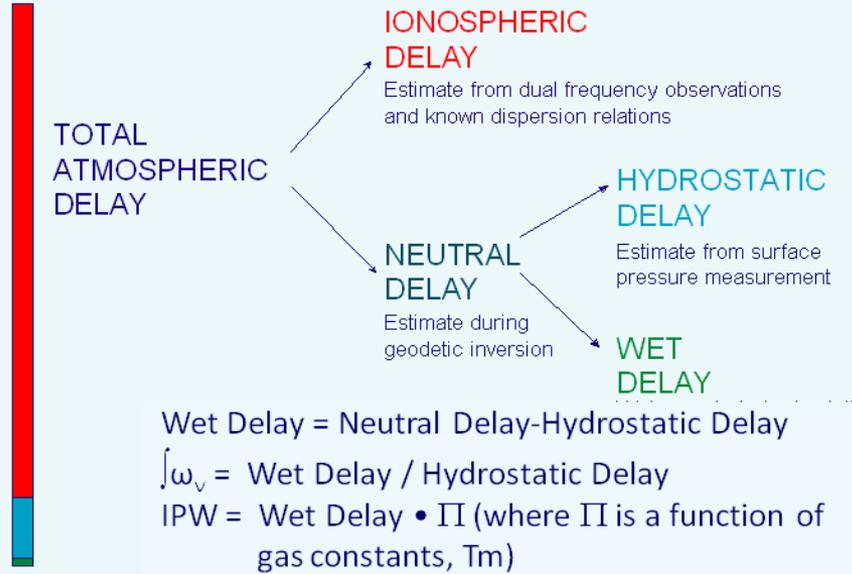
Overview

- GPS-Met is a remote sensing technique that allows us to continuously monitor TPW with high temporal resolution under all Wx conditions.
- Since most of the moisture in the atmosphere is concentrated near the surface, GPS measurements are very sensitive to the conditions associated with convective initiation and thunderstorm development.



GPS Metrology

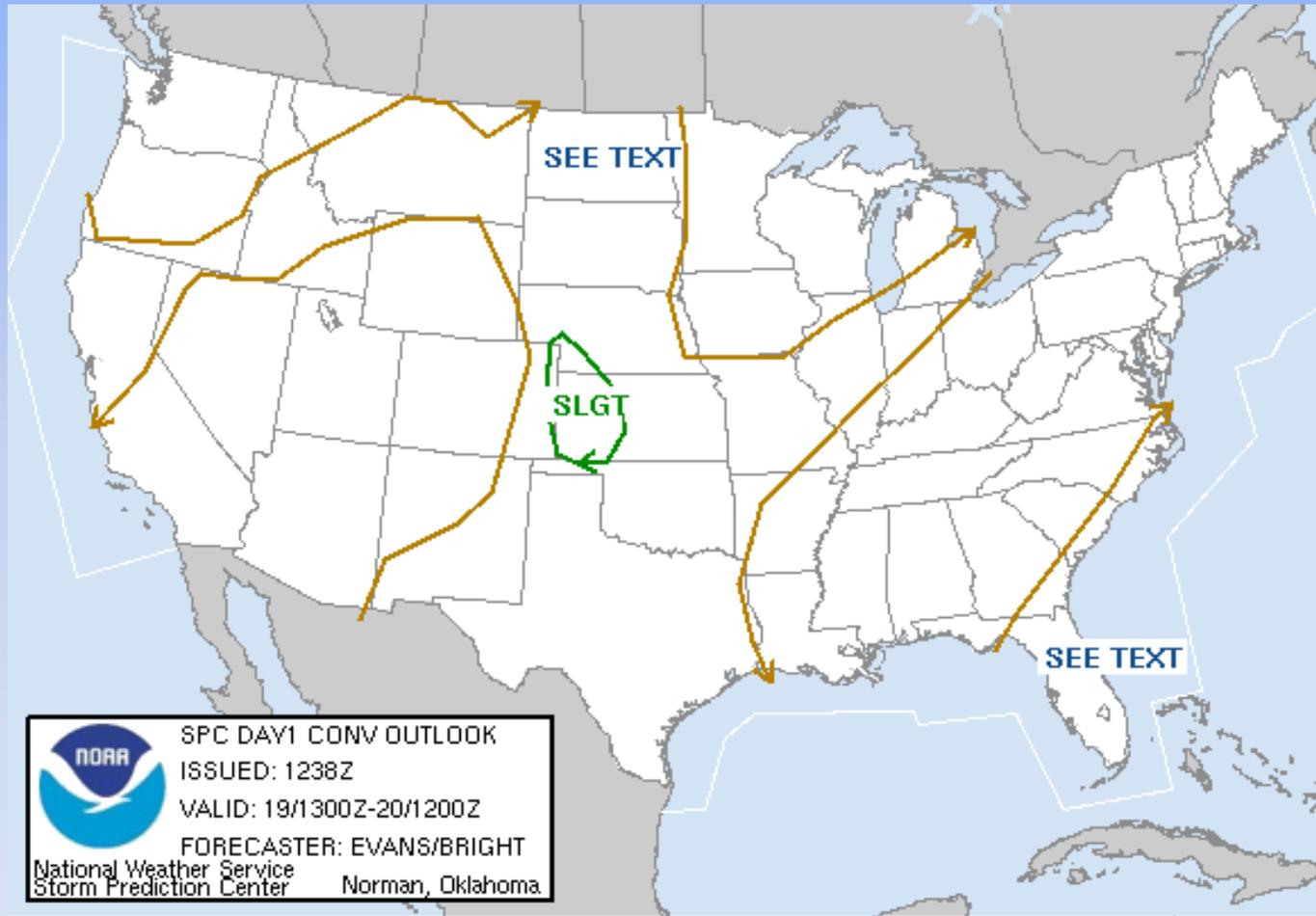
Signal Delay \Leftrightarrow Excess Path Length



Case Example – 19 Sept 2007

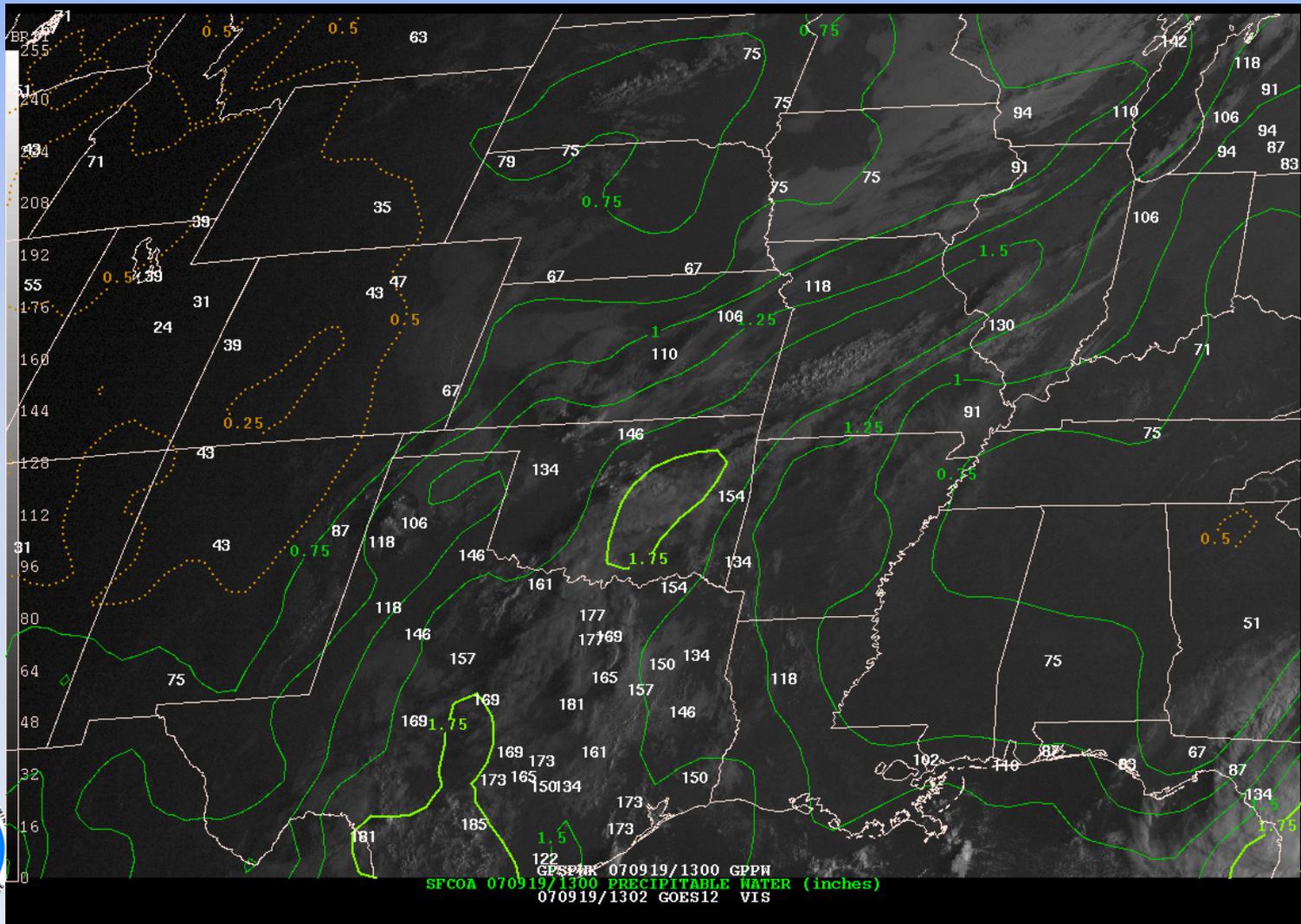
Courtesy S. Weiss/SPC

SPC Day 1 Convective Outlook Issued 13 UTC



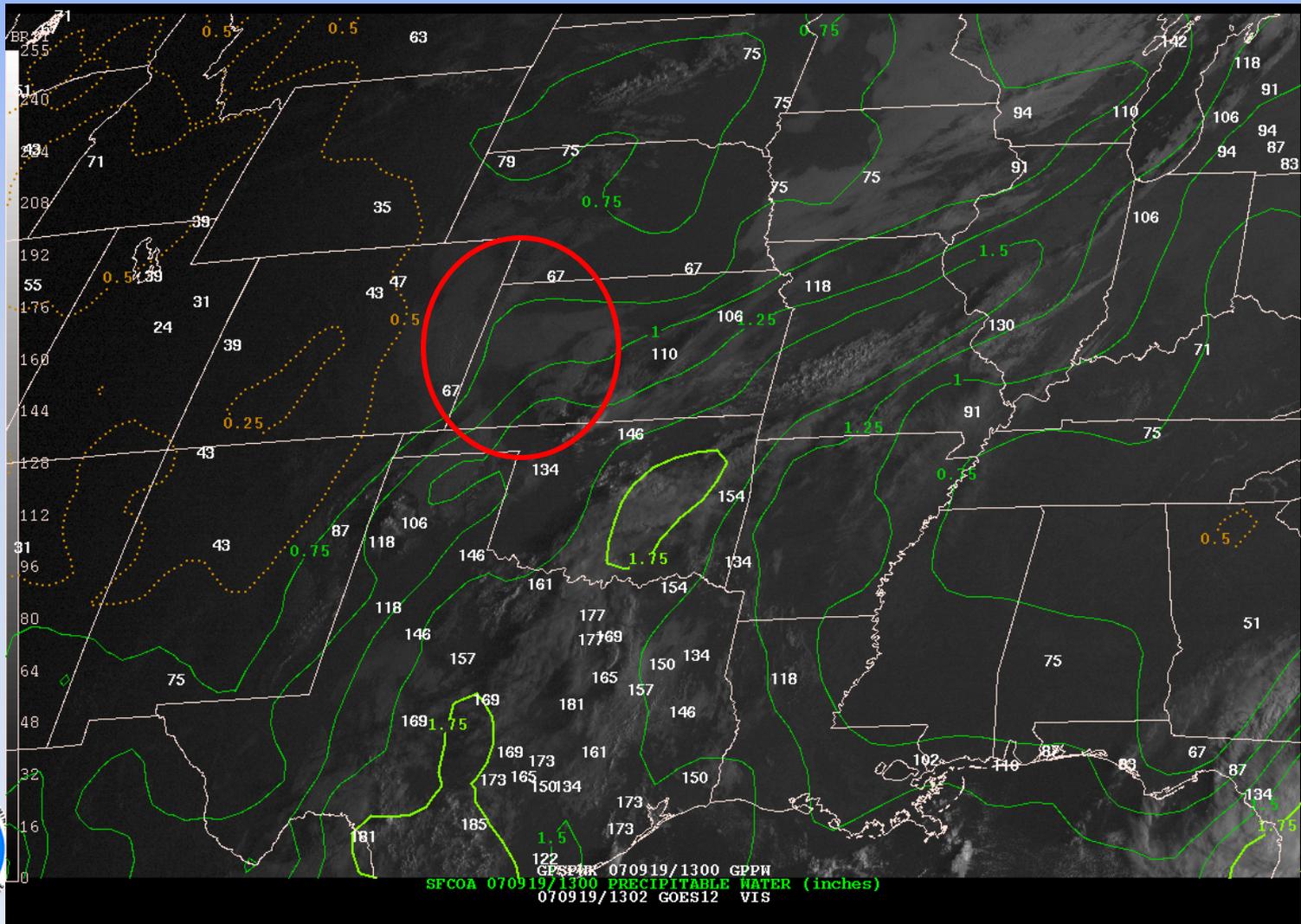
N-AWIPS Display 13 UTC 19 Sept 2007

GPS IPW Plot and Analysis



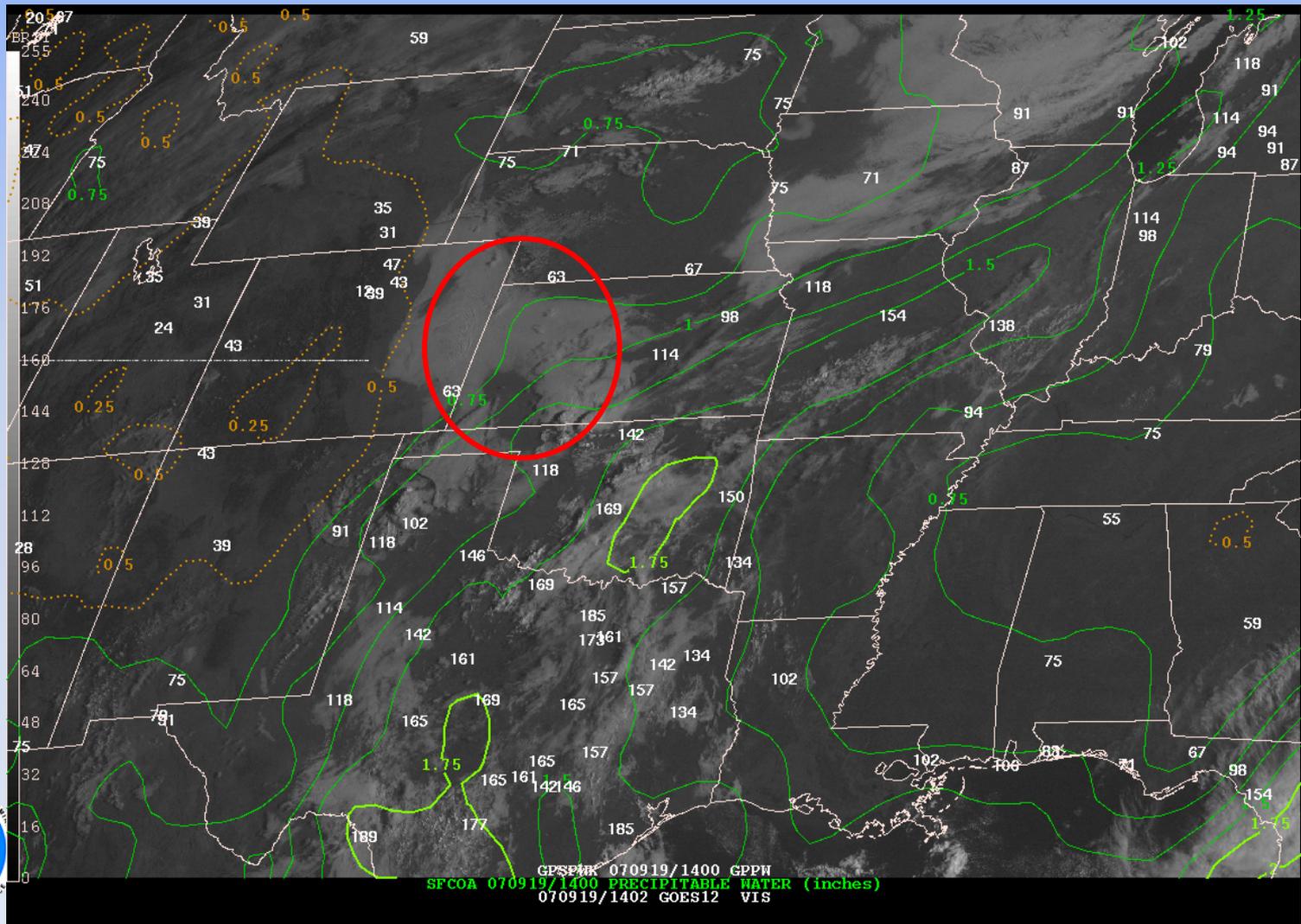
N-AWIPS Display 13 UTC 19 Sept 2007

GPS IPW Plot and Analysis



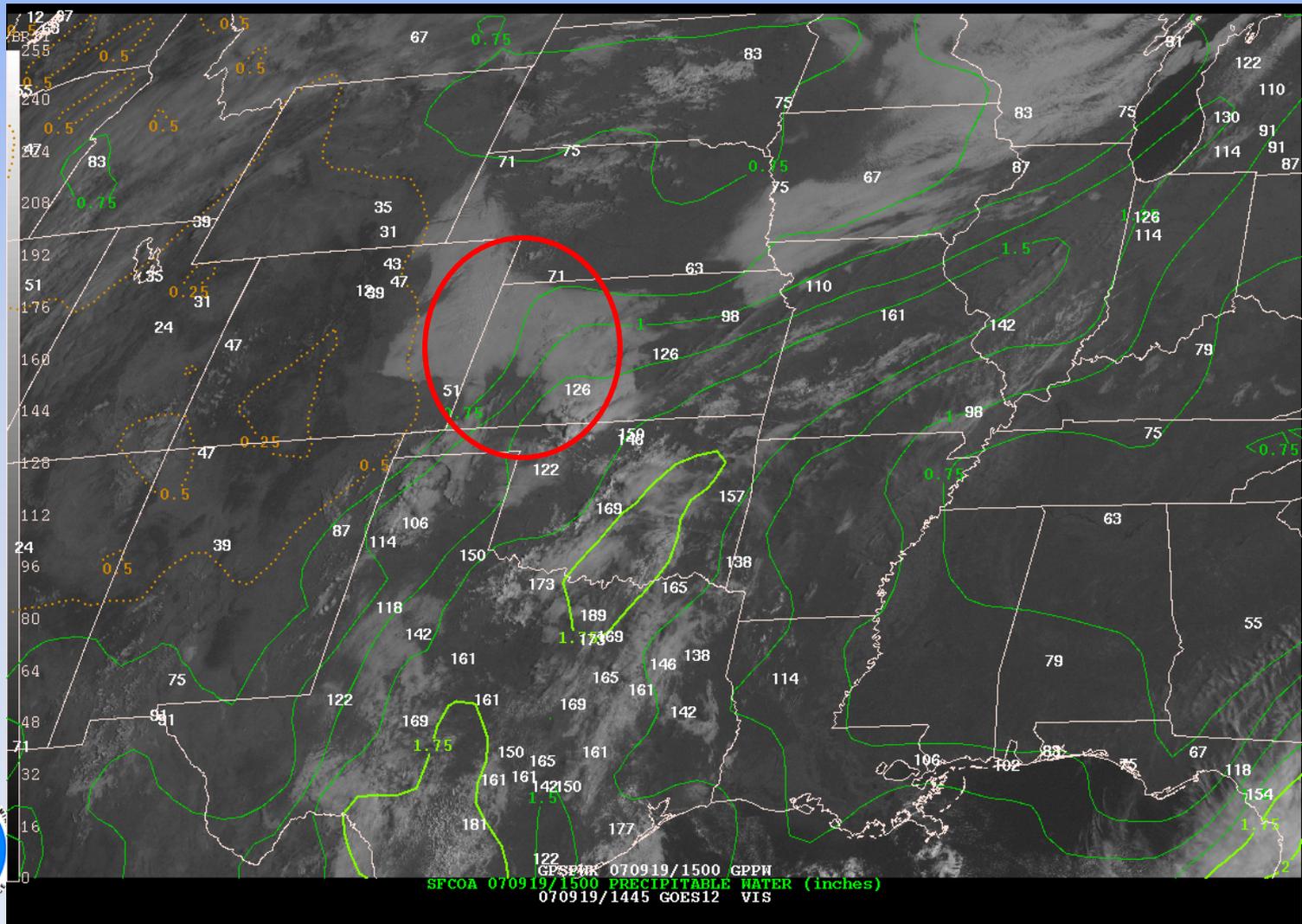
N-AWIPS Display 14 UTC 19 Sept 2007

GPS IPW Plot and Analysis



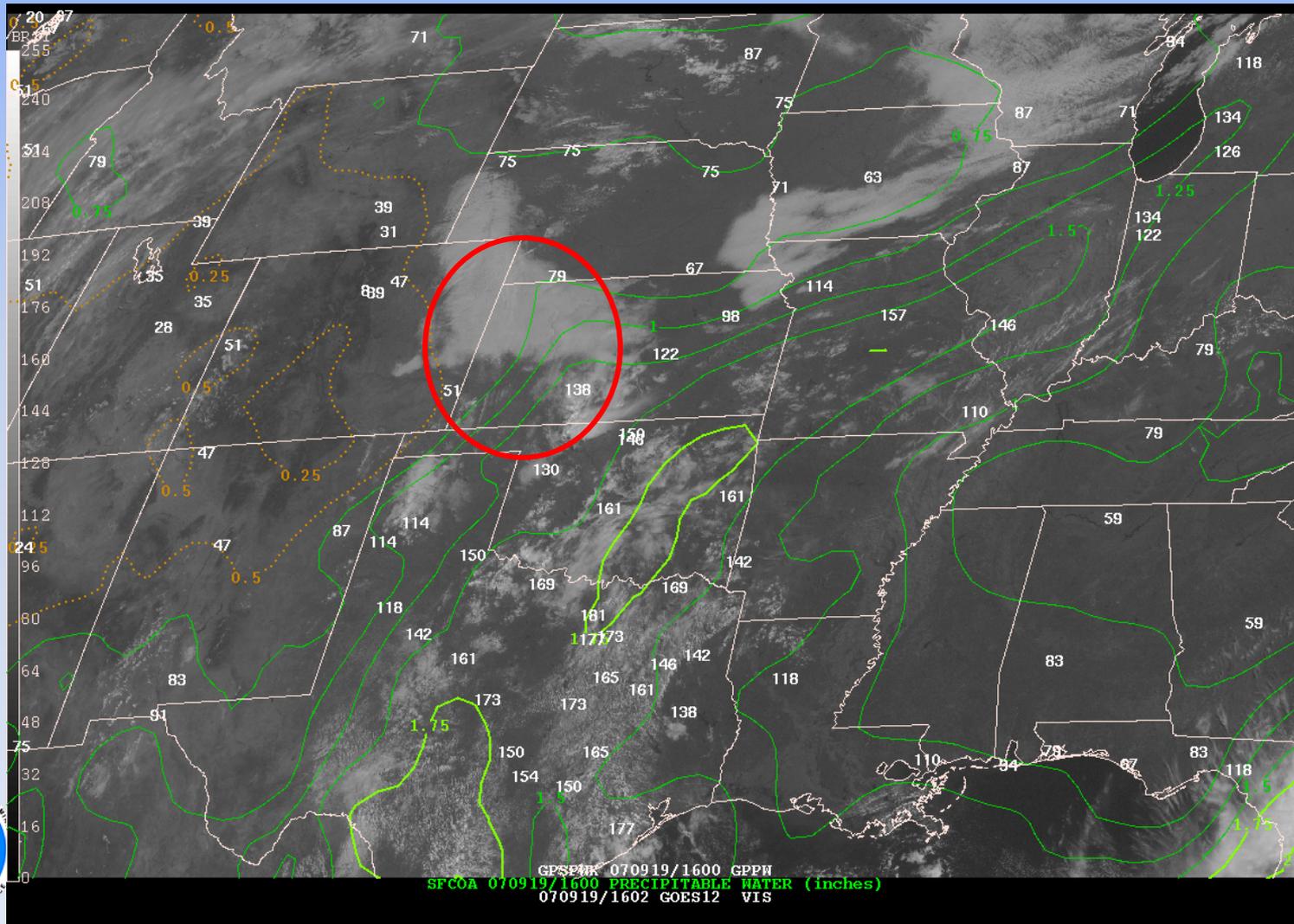
N-AWIPS Display 15 UTC 19 Sept 2007

GPS IPW Plot and Analysis



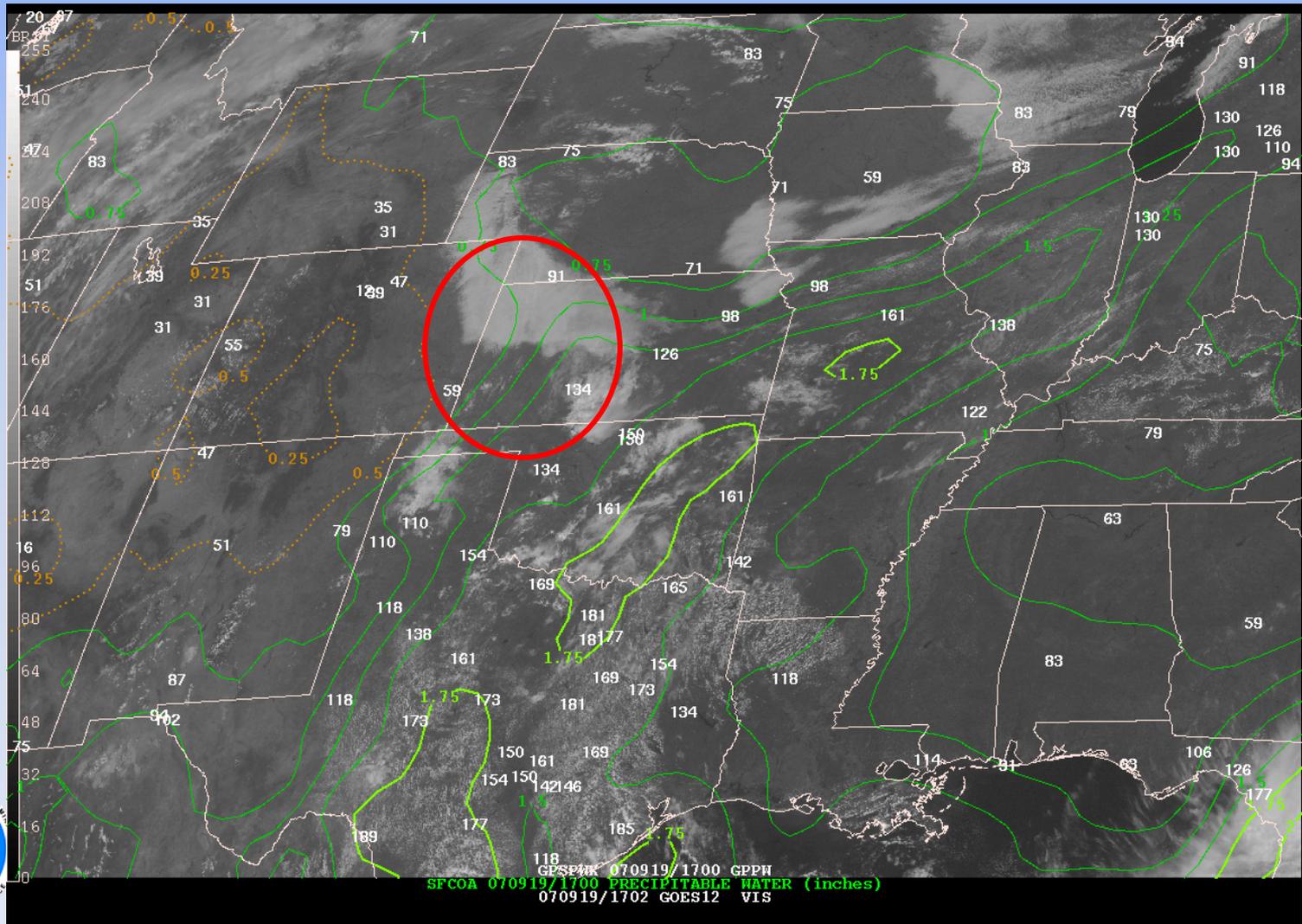
N-AWIPS Display 16 UTC 19 Sept 2007

GPS IPW Plot and Analysis



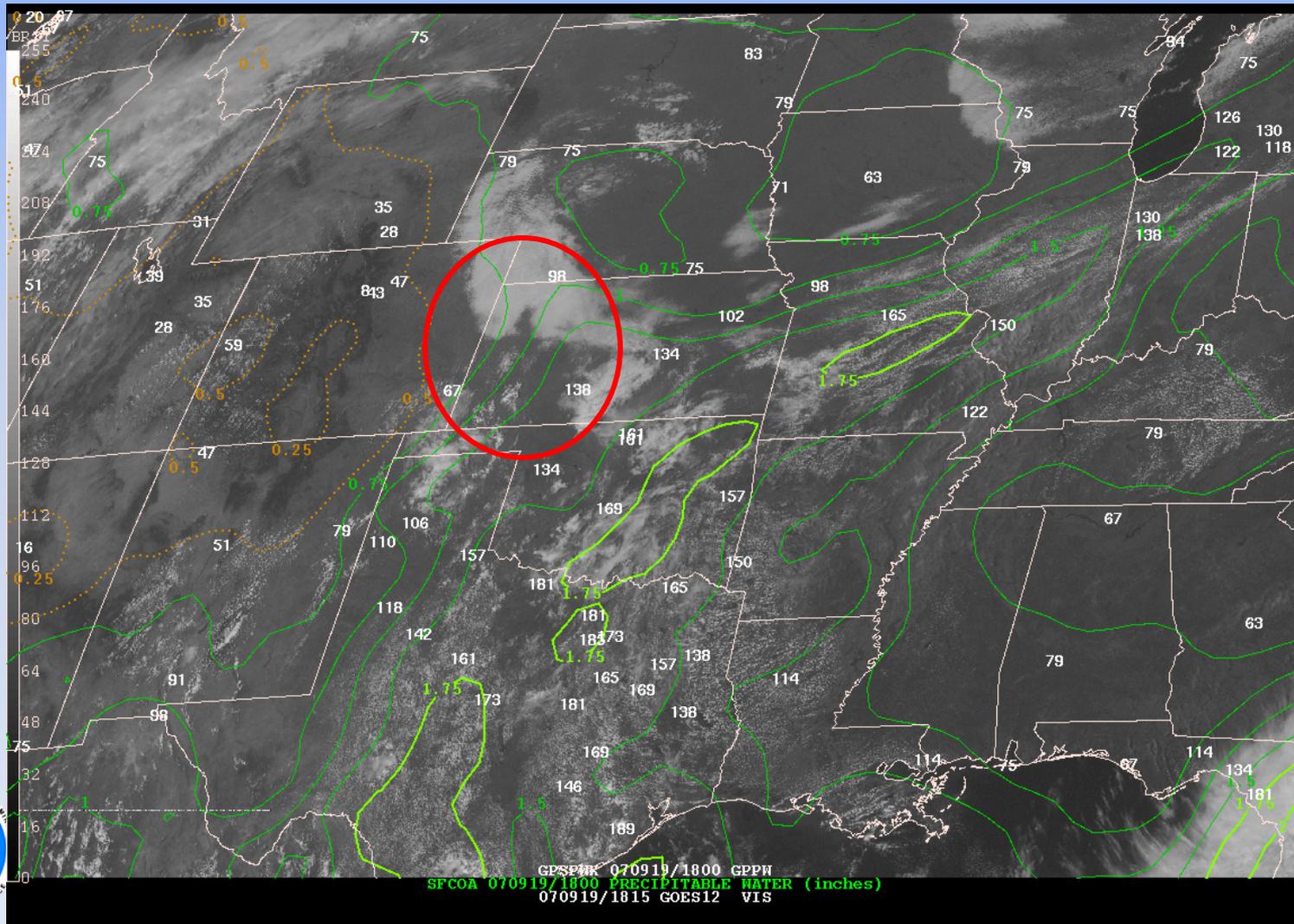
N-AWIPS Display 17 UTC 19 Sept 2007

GPS IPW Plot and Analysis



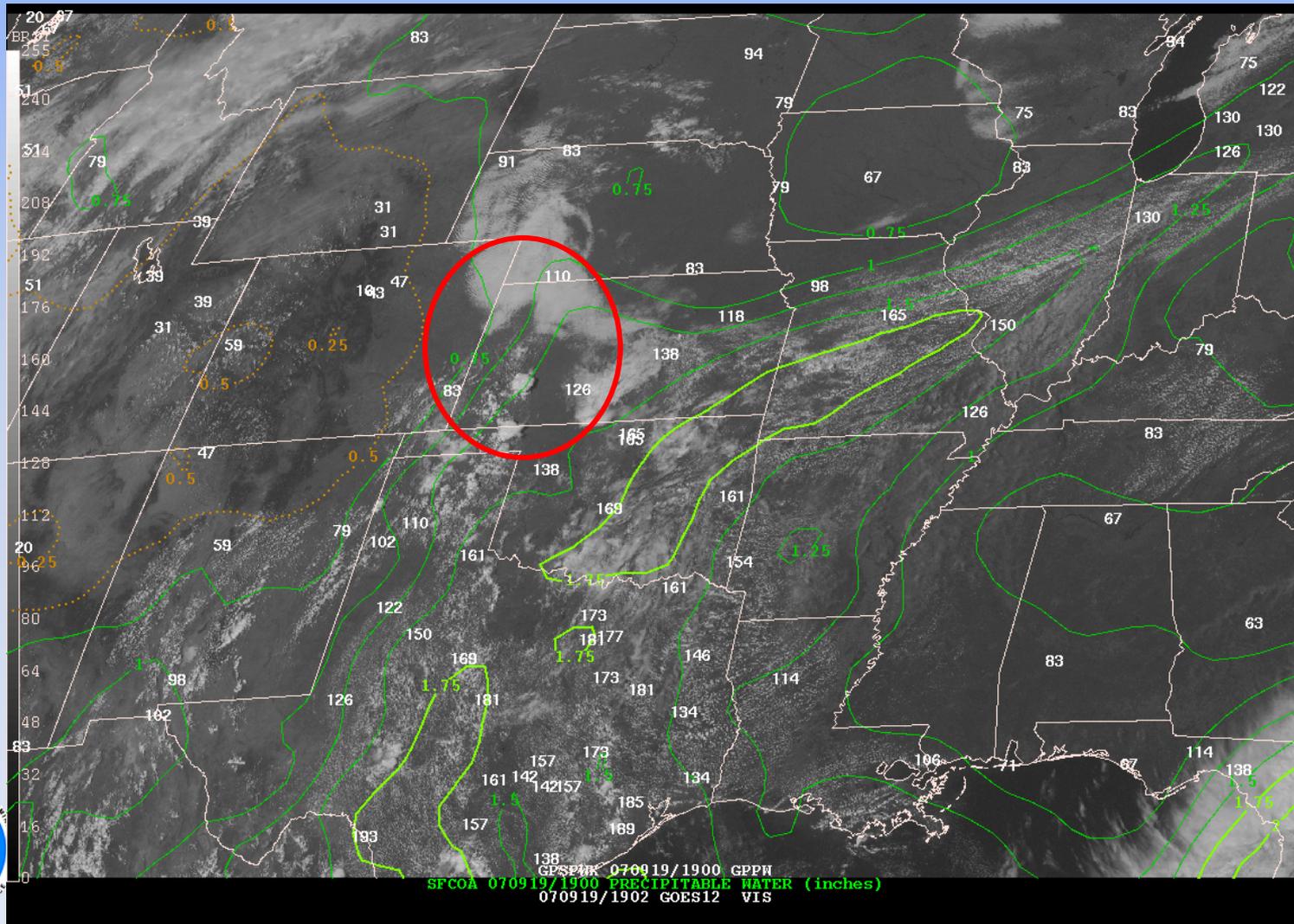
N-AWIPS Display 18 UTC 19 Sept 2007

GPS IPW Plot and Analysis



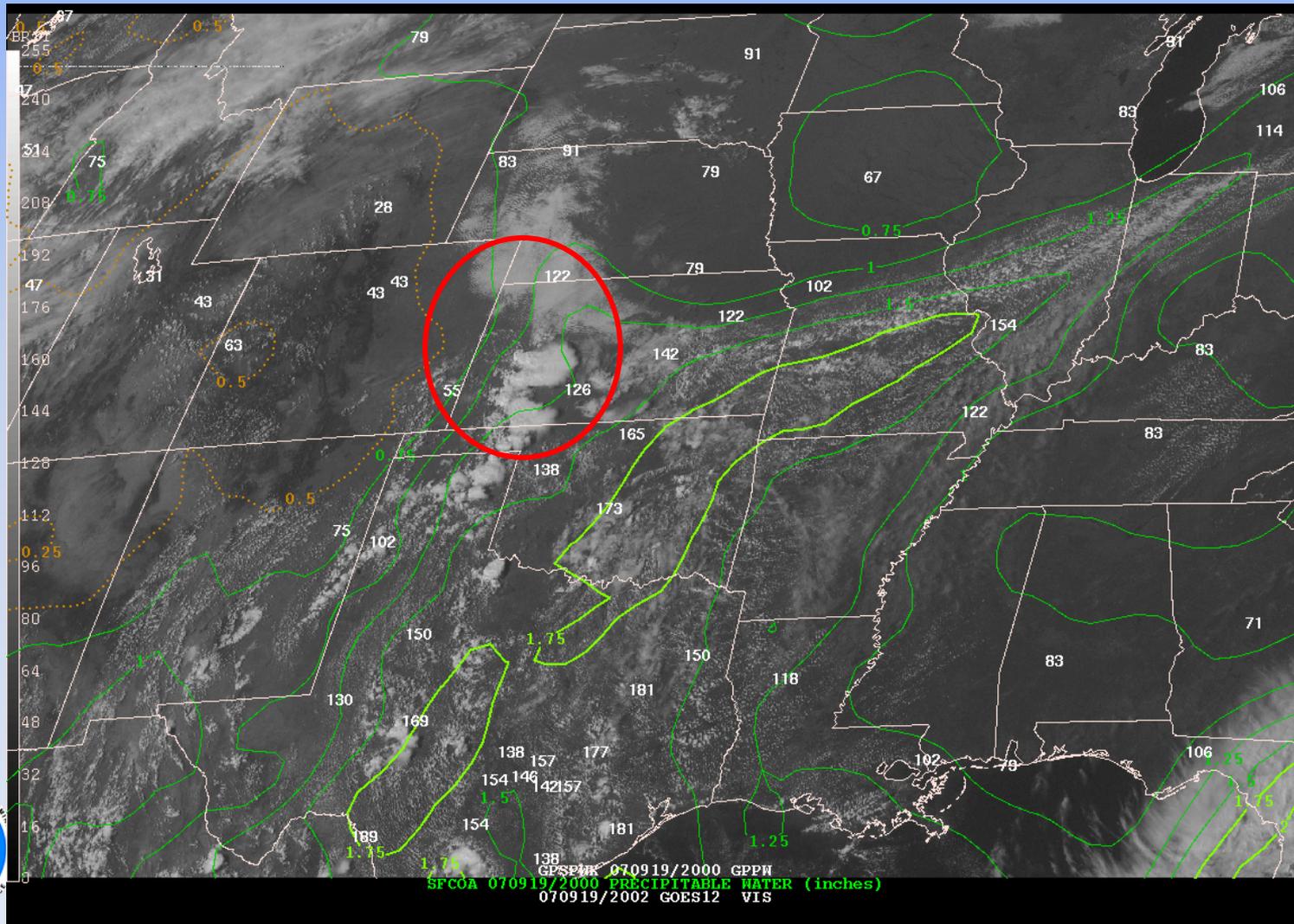
N-AWIPS Display 19 UTC 19 Sept 2007

GPS IPW Plot and Analysis



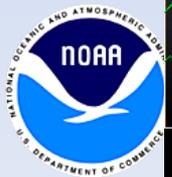
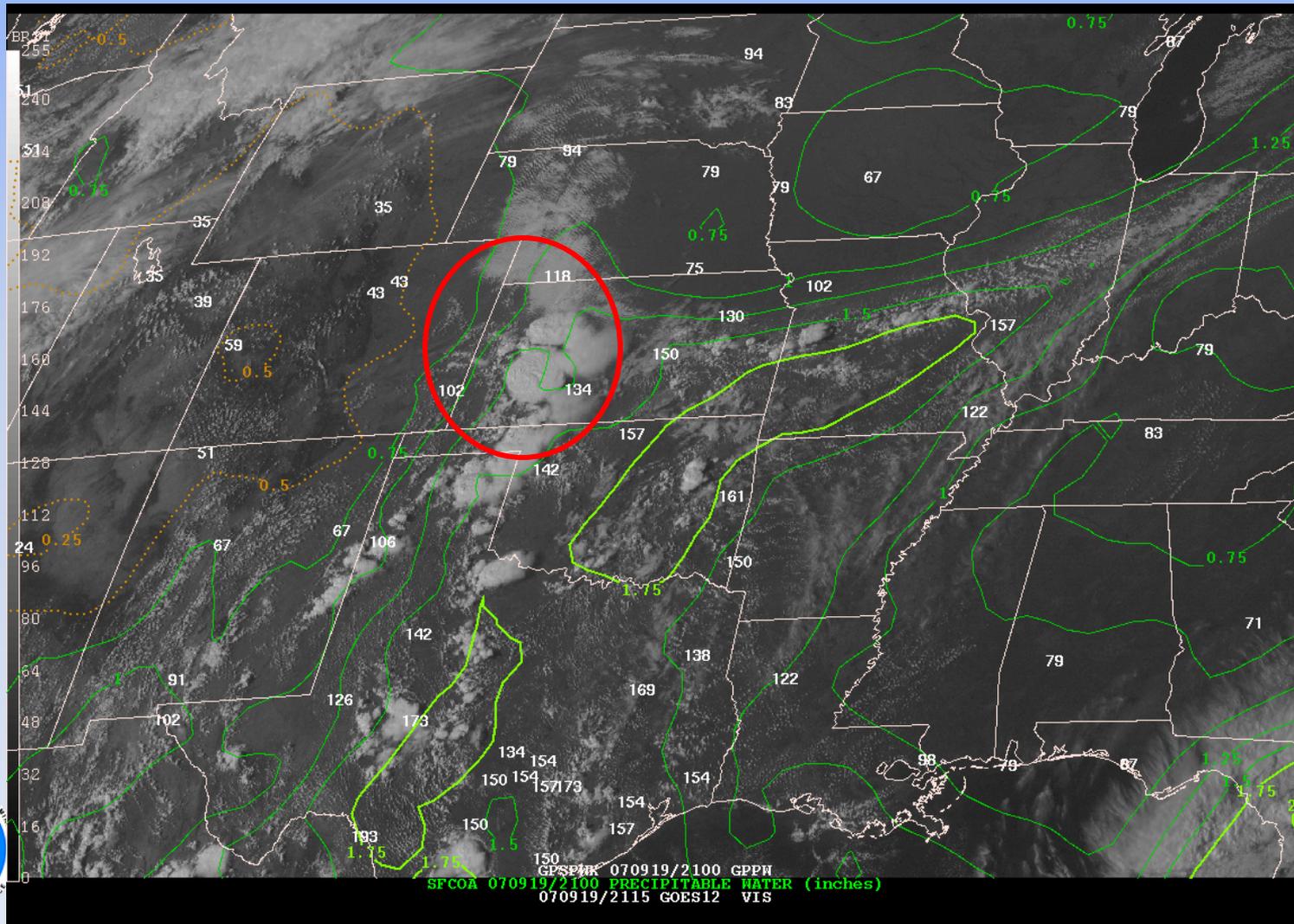
N-AWIPS Display 20 UTC 19 Sept 2007

GPS IPW Plot and Analysis



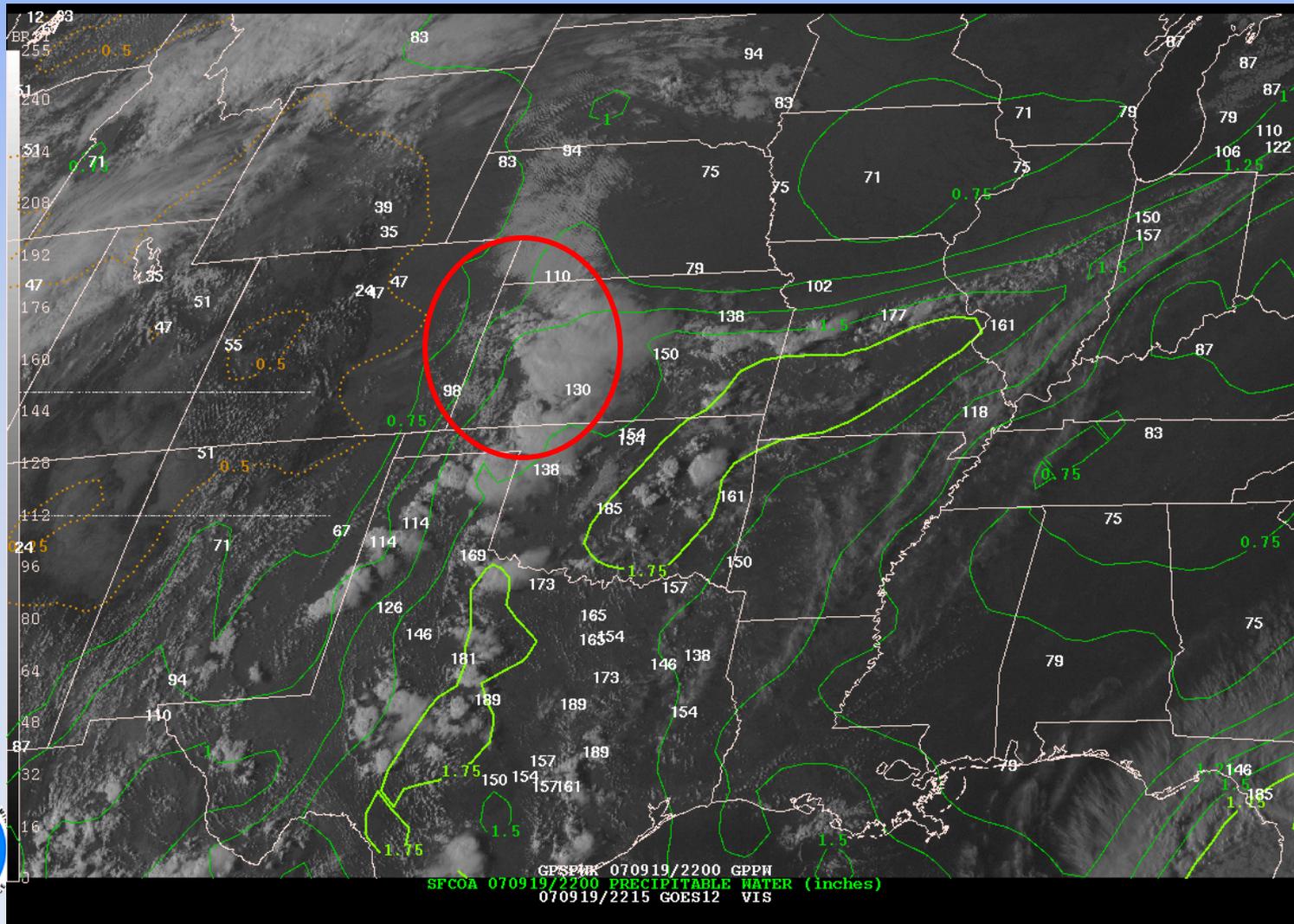
N-AWIPS Display 21 UTC 19 Sept 2007

GPS IPW Plot and Analysis



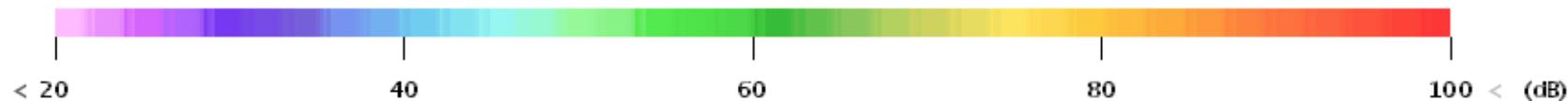
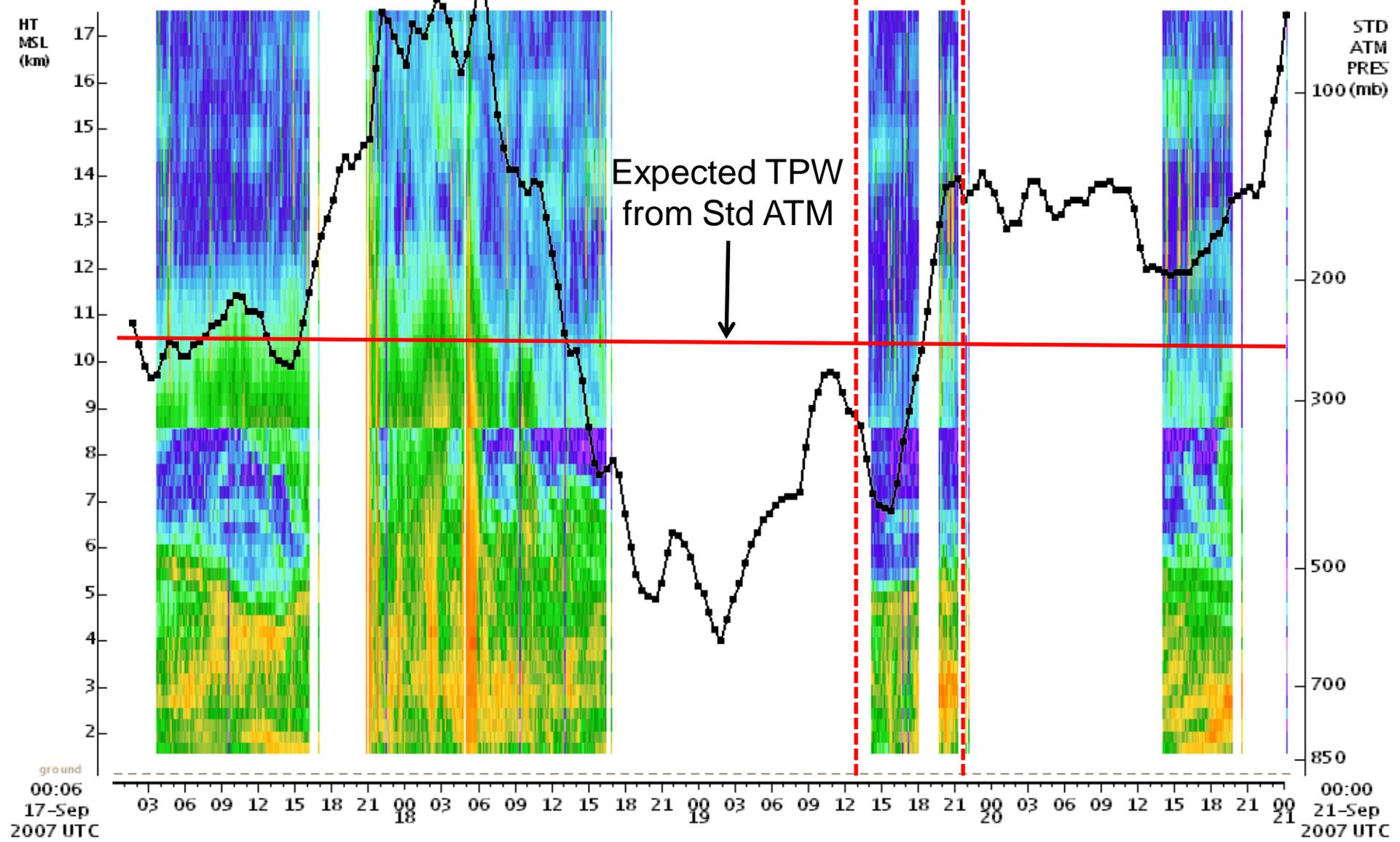
N-AWIPS Display 22 UTC 19 Sept 2007

GPS IPW Plot and Analysis



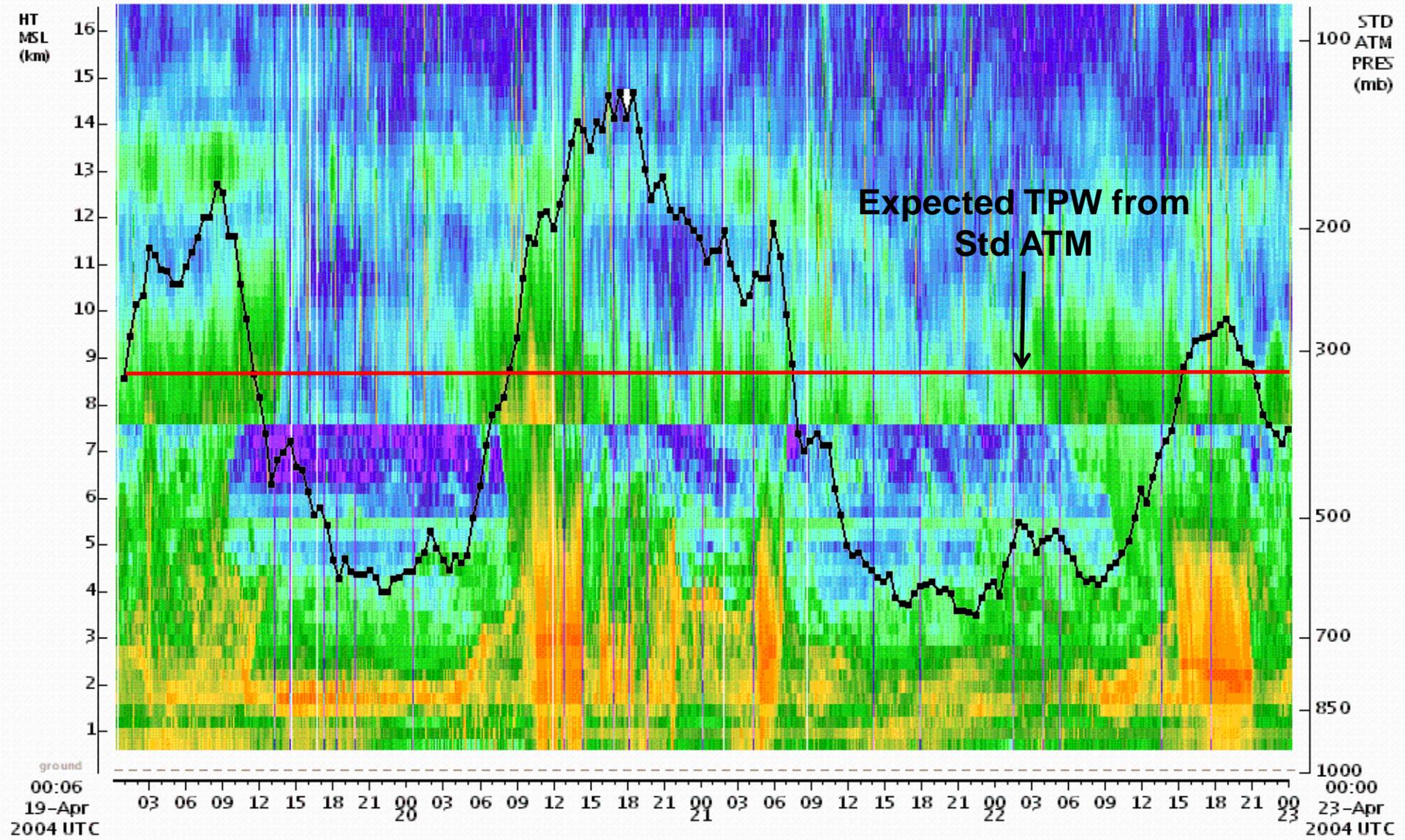


GRANADA, CO US Lat:37.77 Lon:-102.17 Elev:1,155m
SpectralPeakPower| Mode:900m,310m | Beam:V | Res:6min | QC:allData
NOAA PROFILER NETWORK





WINCHESTER, IL US Lat:39.65 Lon:-90.48 Elev:170m
SpectralPeakPower | Mode:900m,310m | Beam:V | Res:6min | QC:allData
NOAA PROFILER NETWORK

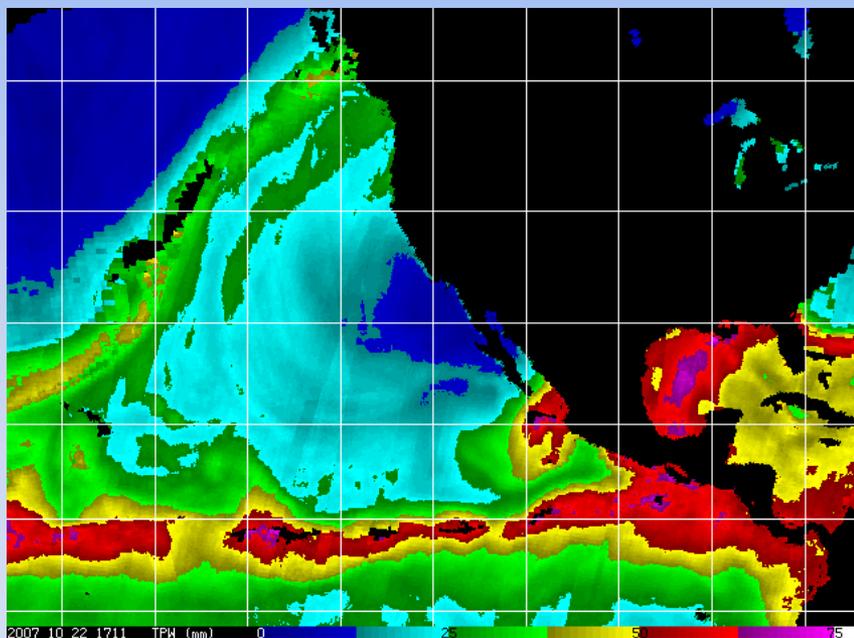


OAR/ESRL/GSD/Forecast Applications Branch

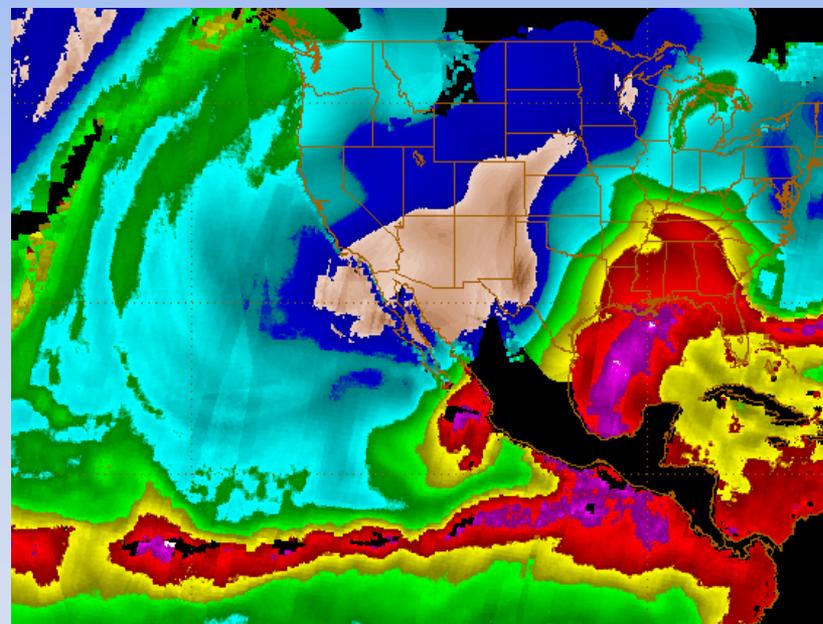
< 20 40 60 80 100 < (dB)

CIRA - CSU Blended TPW

AMSU and SSM/I Over Oceans Only



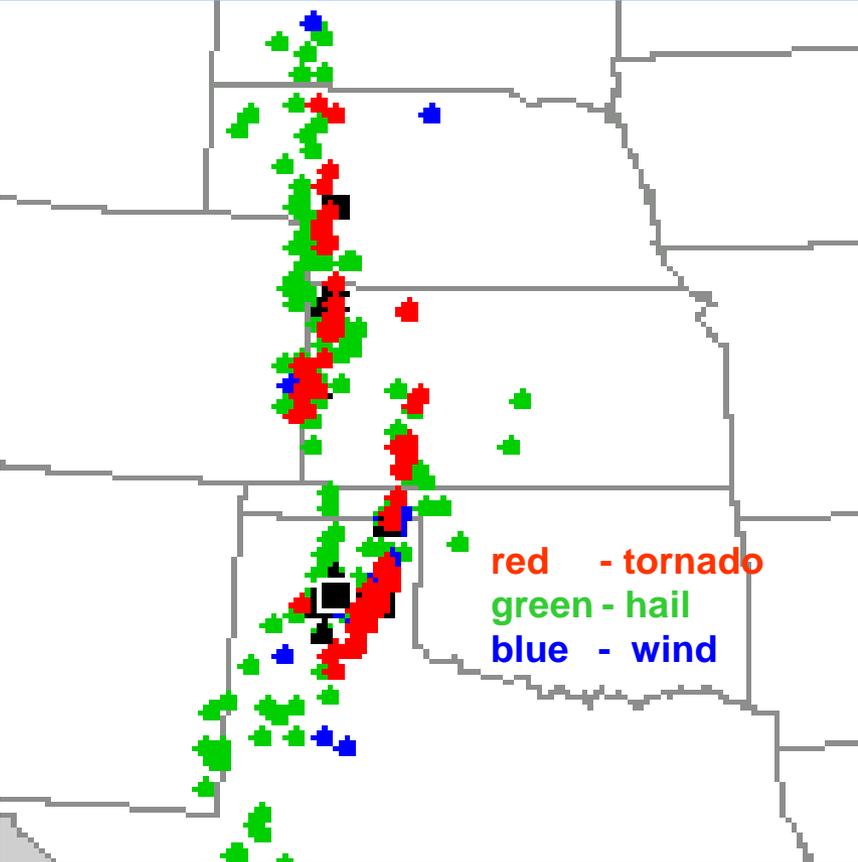
Now Include GPS over CONUS



Addition of GPS IPW provides MUCH better support for CONUS forecasters



Tornado Outbreak 28 March 2007



Oklahoma
Panhandle

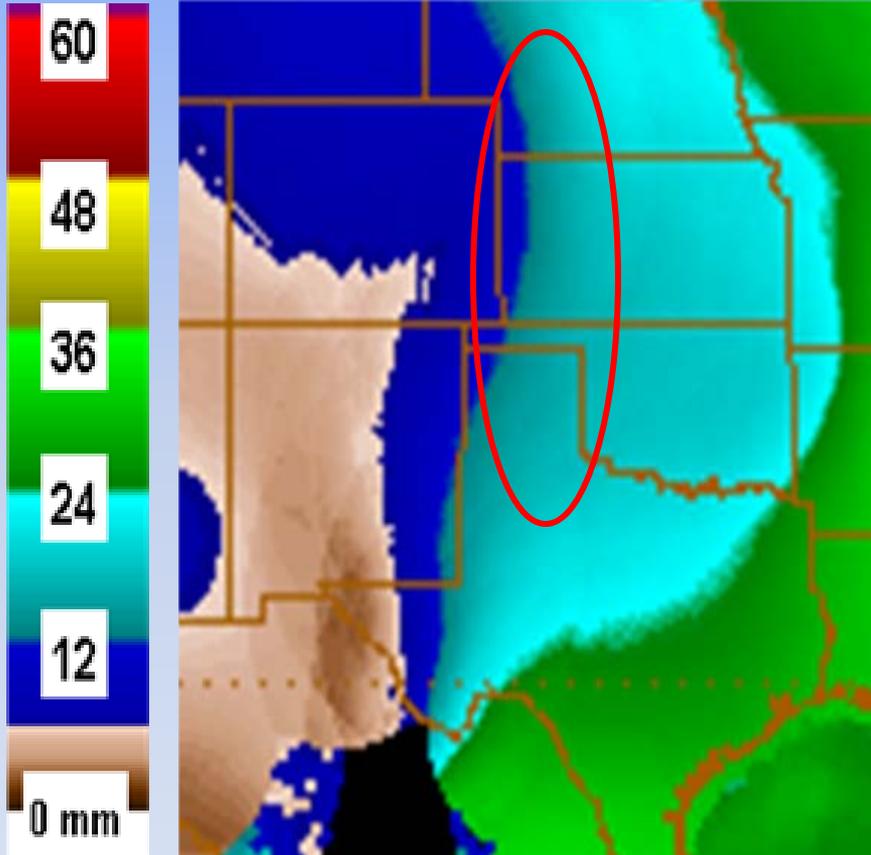


Silverton,
TX

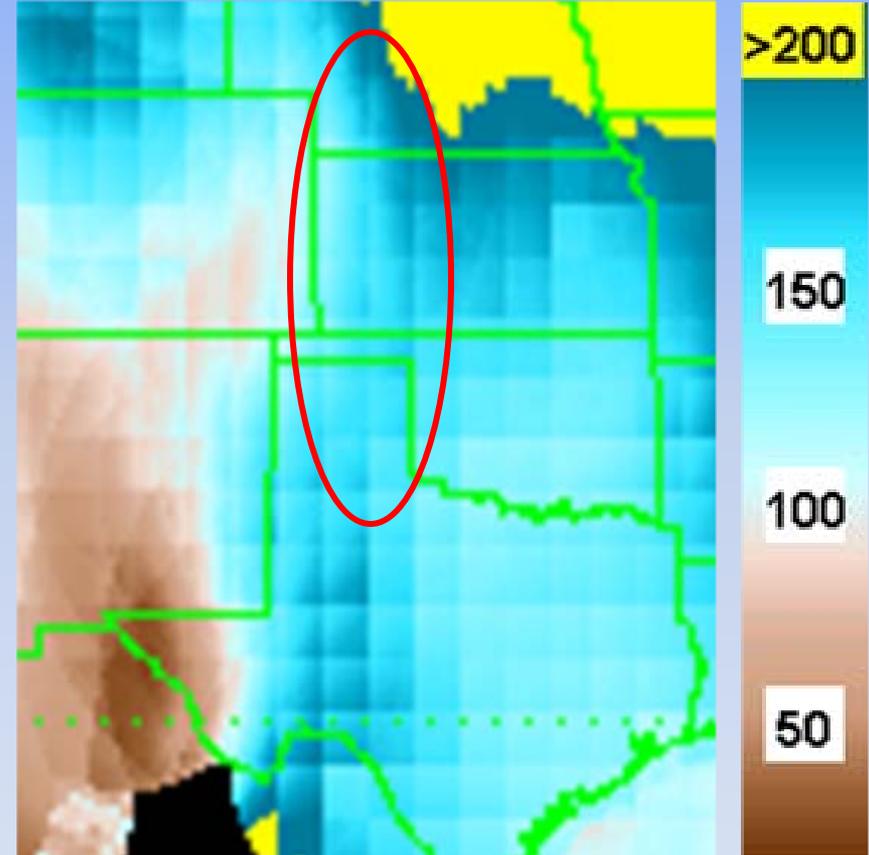


SPC Severe Reports (preliminary)

Blended TPW 18 UTC 28 Mar 2007



Blended TPW



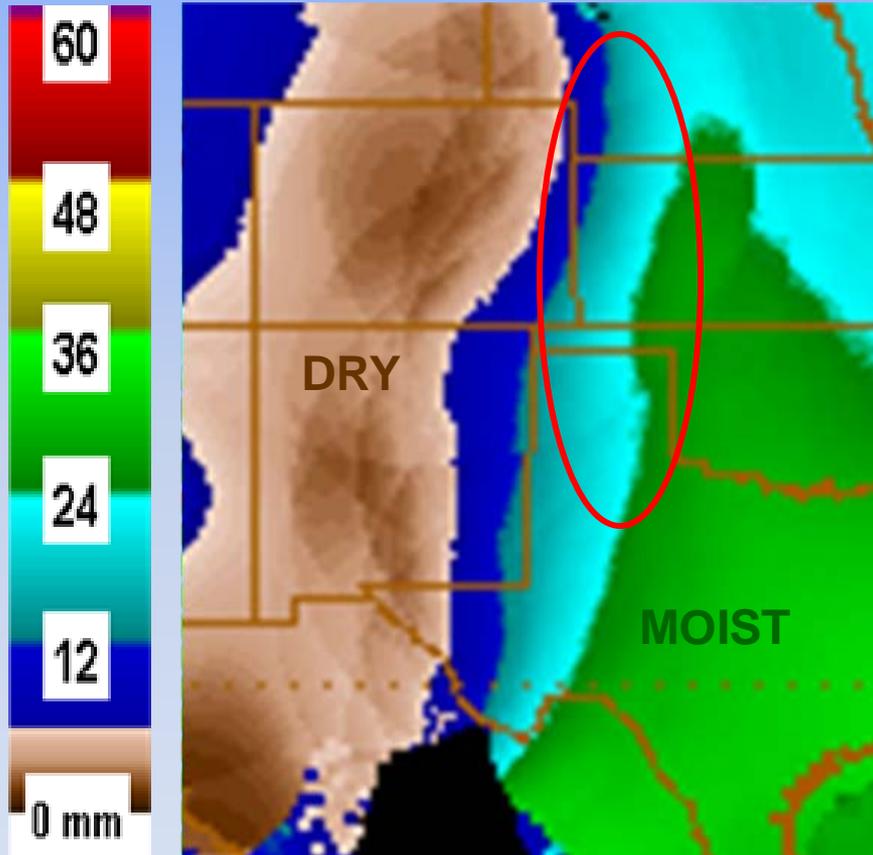
Blended TPW Anomaly



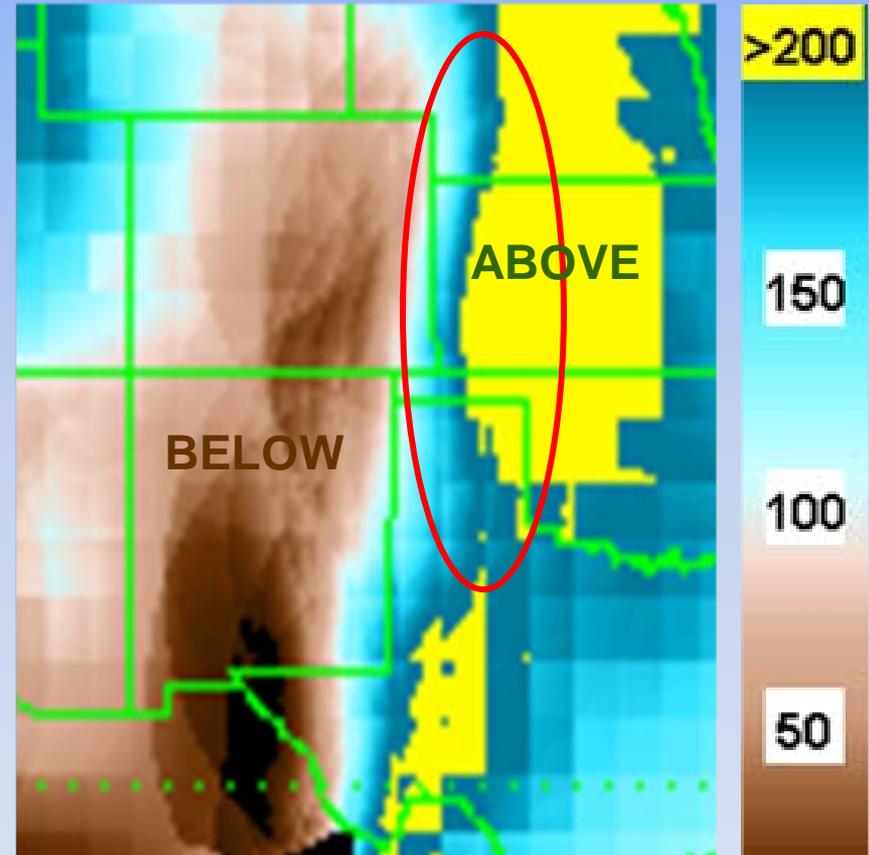
Blended TPW 00 UTC 29 Mar 2007

Note increase

in anomaly magnitudes and moist/dry gradient



Blended TPW



Blended TPW Anomaly



Example of Watch MD

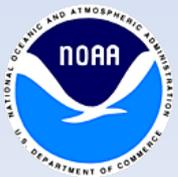
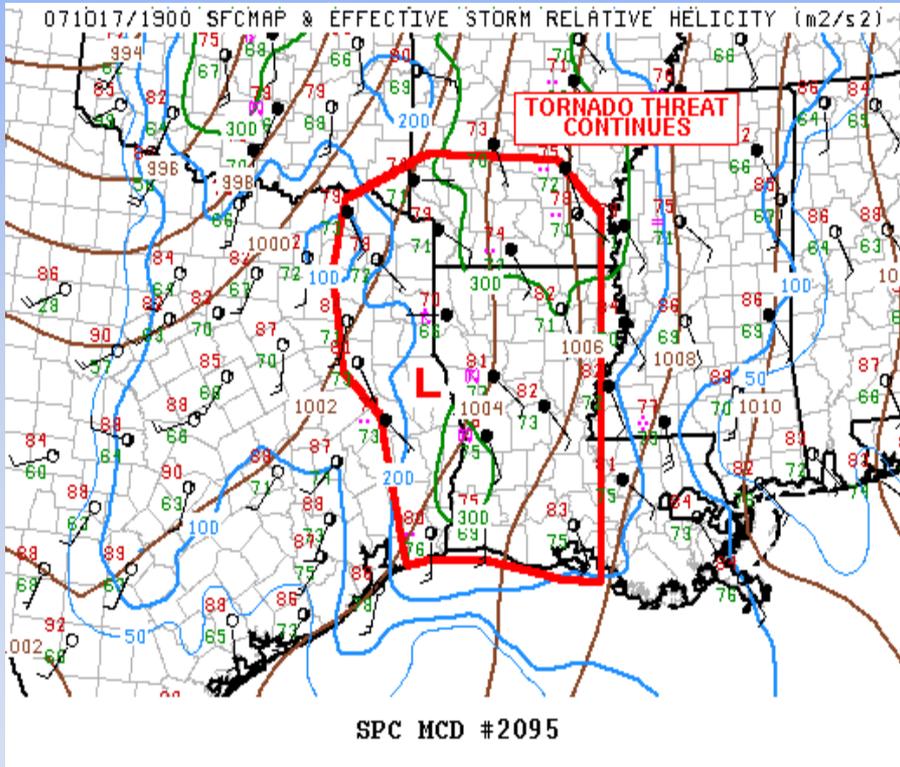
MESOSCALE DISCUSSION 2095
NWS STORM PREDICTION CENTER NORMAN OK
0236 PM CDT WED OCT 17 2007

AREAS AFFECTED...ERN TX...LA...SRN AR
CONCERNING...TORNADO WATCH 710...
VALID 171936Z - 172130Z

THE SEVERE WEATHER THREAT FOR TORNADO WATCH 710
CONTINUES. THE THREAT FOR TORNADOES CONTINUES WITHIN
WW 710. **LOW LEVEL WARM/MOIST ADVECTION CONTINUES
WITH GPS WATER VAPOR SENSORS CURRENTLY INDICATING
2.00-2.32 INCHES FROM LA INTO SRN AR.**

MEANWHILE...SATELLITE IMAGERY INDICATES LOW LEVEL
VORTICITY CENTER MOVING NWD ALONG THE SABINE
RIVER...ON CYCLONIC SIDE OF 700 MB JETLET OVER THE
LOWER MS VALLEY. THIS FEATURE IS HELPING TO FOCUS
CONVECTION AND WILL CONTINUE NWD INTO AR. SHEAR
PROFILES ARE ALREADY FAVORABLE FOR ROTATING
UPDRAFTS AND TORNADOES...ALTHOUGH RELATIVELY WARM
PROFILES AND WEAK LAPSE RATES HAVE ACTED TO SLOW
DEVELOPMENT. SHEAR PROFILES WILL LIKELY INCREASE WITH
TIME AS UPPER TROUGH CONTINUES TO DEVELOP NEWD. THIS
WILL MAINTAIN OR INCREASE TORNADO THREAT FARTHER N
INTO AR...AND POSSIBLY SERN MO...WHERE AN ADDITIONAL WW
MAY BE REQUIRED LATER TODAY INTO THIS EVENING.

...JEWELL.. 10/17/2007
ATTN...WFO...JAN...LIX...LZK...LCH...SHV...HGX...FWD...

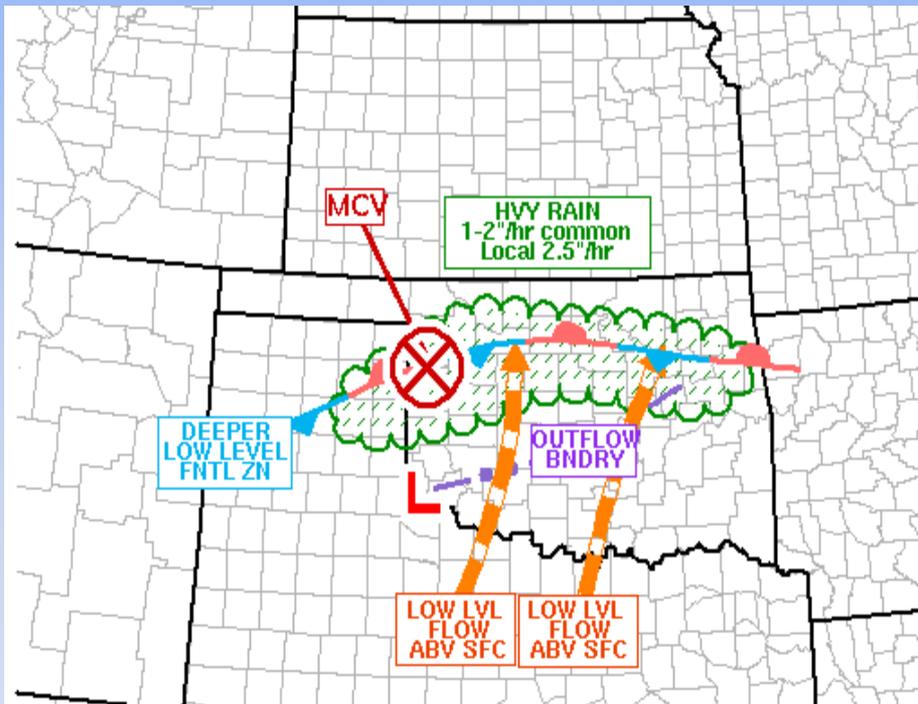


Example of Heavy Rain MD

MESOSCALE DISCUSSION 1949
NWS STORM PREDICTION CENTER NORMAN OK
0114 AM CDT SAT SEP 08 2007

AREAS AFFECTED...PORTIONS NRN/WRN OK...E-CENTRAL/NERN
PANHANDLE OF TX.
CONCERNING...HEAVY RAINFALL
VALID 080614Z - 080915Z

BAND OF TSTMS HAS BEEN INCREASING IN COVERAGE FOR A
COUPLE HOURS...FROM CHEROKEE-GARFIELD-ROGER MILLS
COUNTIES OK INTO GRAY COUNTY TX. THIS ACTIVITY SHOULD
PERSIST WITH MINOR FLUCTUATIONS IN ITS MESOSCALE
GEOMETRY...PERHAPS INCLUDING SLGT NET SWD DRIFT...
THROUGH 9Z. RAIN RATES 1-2 INCHES/HOUR WILL BE COMMON...
LOCALLY AROUND 2.5 INCHES/HOUR IN HEAVIEST CORES. WITH
LITTLE MOVEMENT EXPECTED FOR ASSOCIATED MAIN ZONE OF
LOW LEVEL LIFT...PERSISTENT HEAVY RAIN EVENT WITH
TRAINING/MERGING OF CELLS WILL ENHANCE HEAVY RAIN
HAZARD.



SPC MCD #1949

RUC FCST SOUNDINGS AND GPS DATA INDICATE PW COMMONLY
AROUND 2 INCHES ACROSS THIS CORRIDOR...AND AS MUCH AS
2.3 INCHES IN VOF TUL...WITH 500-1500 J/KG MUCAPE IN
SUPPORT OF TSTM POTENTIAL.

..EDWARDS.. 09/08/2007
ATTN...WFO...TSA...OUN...AMA...



Thanks for your attention!

Any questions?



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Boulder, CO 80305-3328

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FAX: (303) 497-6014

Email: Seth.I.Gutman@noaa.gov
Web: <http://gpsmet.noaa.gov/test/>

OAR/ESRL/GSD/Forecast Applications Branch

