Reconstruction of Hurricanes Ike and Gustav with Reanalysis Data

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Reanalysis is a comprehensive global meteorological data set from 1948 until the present. It is based on both observational measurements and model calculations (also called the assimilation system). The observational data range from the usual surface observations, to upper air soundings from weather balloons to measurements from satellites. The variables are classified as "A" variables, based solely on observations, "B" variables based on primarily from observations but with a small component of model calculations, and "C" variables (such as precipitable water, and surface energy fluxes (energy transfers)) which are based solely on model calculations. Many published studies have demonstrated that the outputs are reliable estimates of actual meteorological conditions, and, even the ones with the greatest error are generally accurate within a 5 -10% range of error.

Variables Analyzed

Pressure

Vector Winds

Omega, Vertical Velocity

Wind Shear

Humidity

Precipitable Water

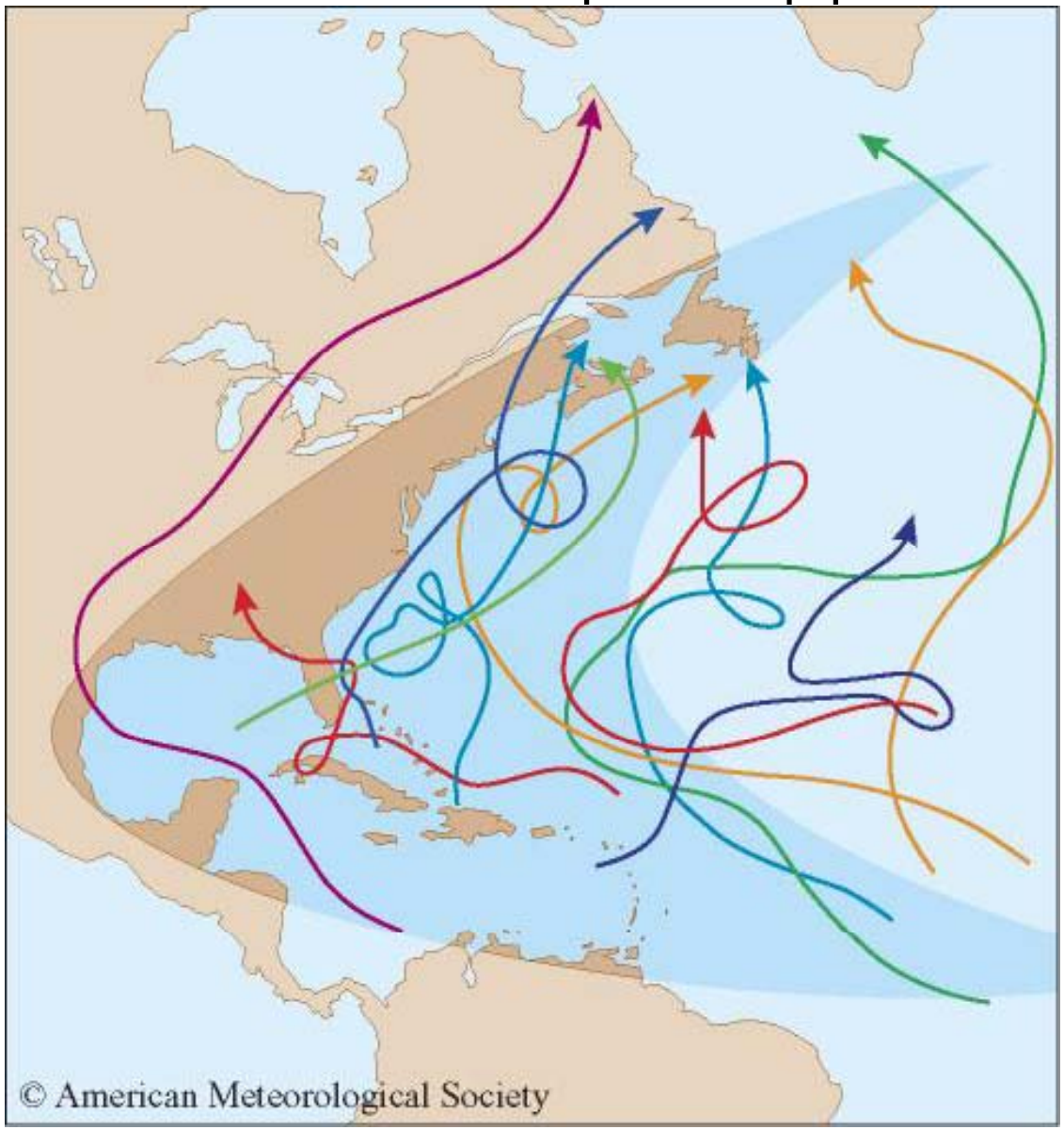
Wilma 21 October, 2005 Yucatan then Northeast into S.W. Florida, across Florida, then up Atlantic Coast

Gustav, Sept. 3, 2008 Southern LA to N.E. Texas and Arkansas.

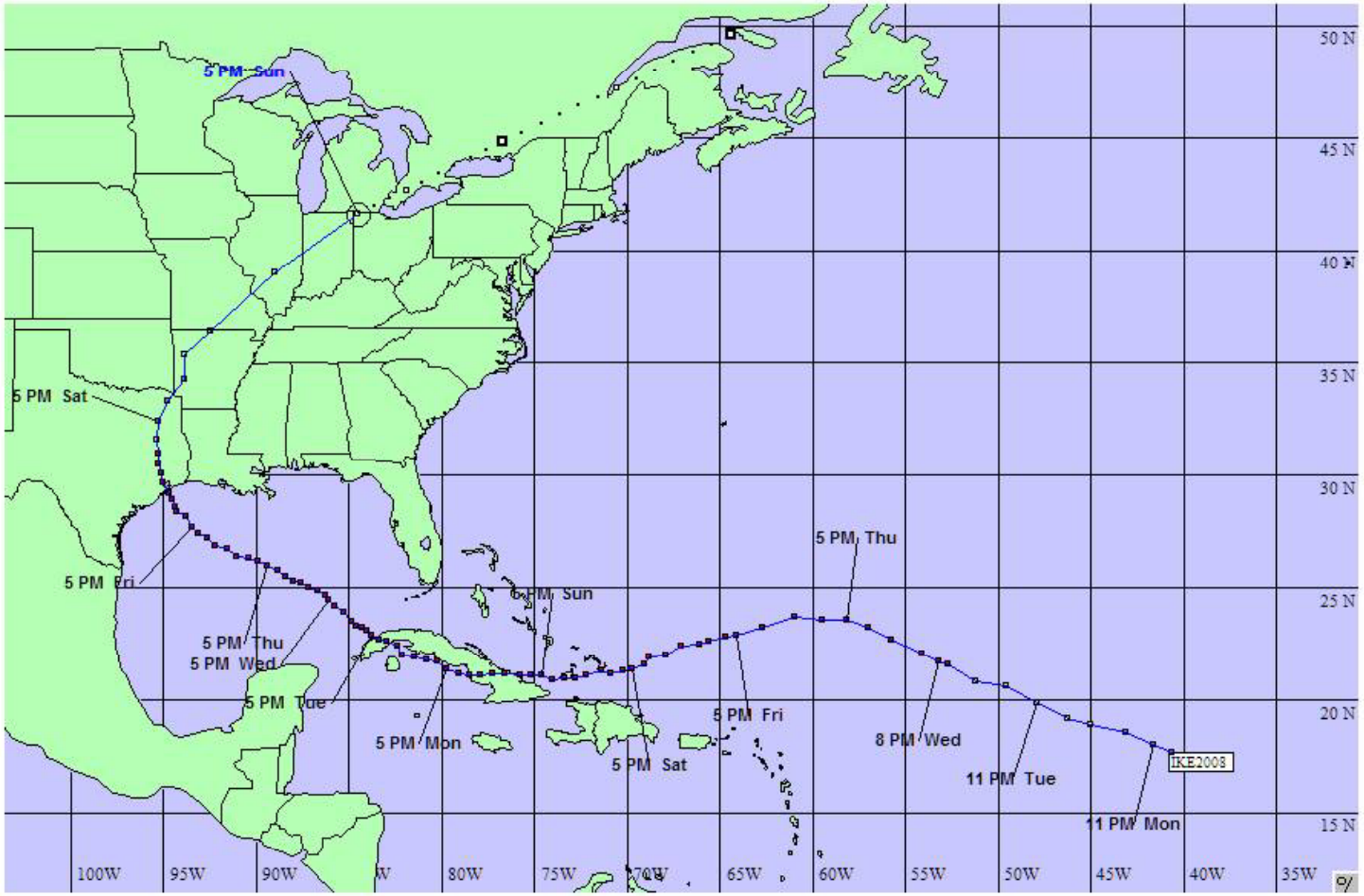
Ike, Sept. 13, 2008, Houston North in Texas near LA border.

Historic Hurricane Tracks Show Problems of Predicting Storm Track.

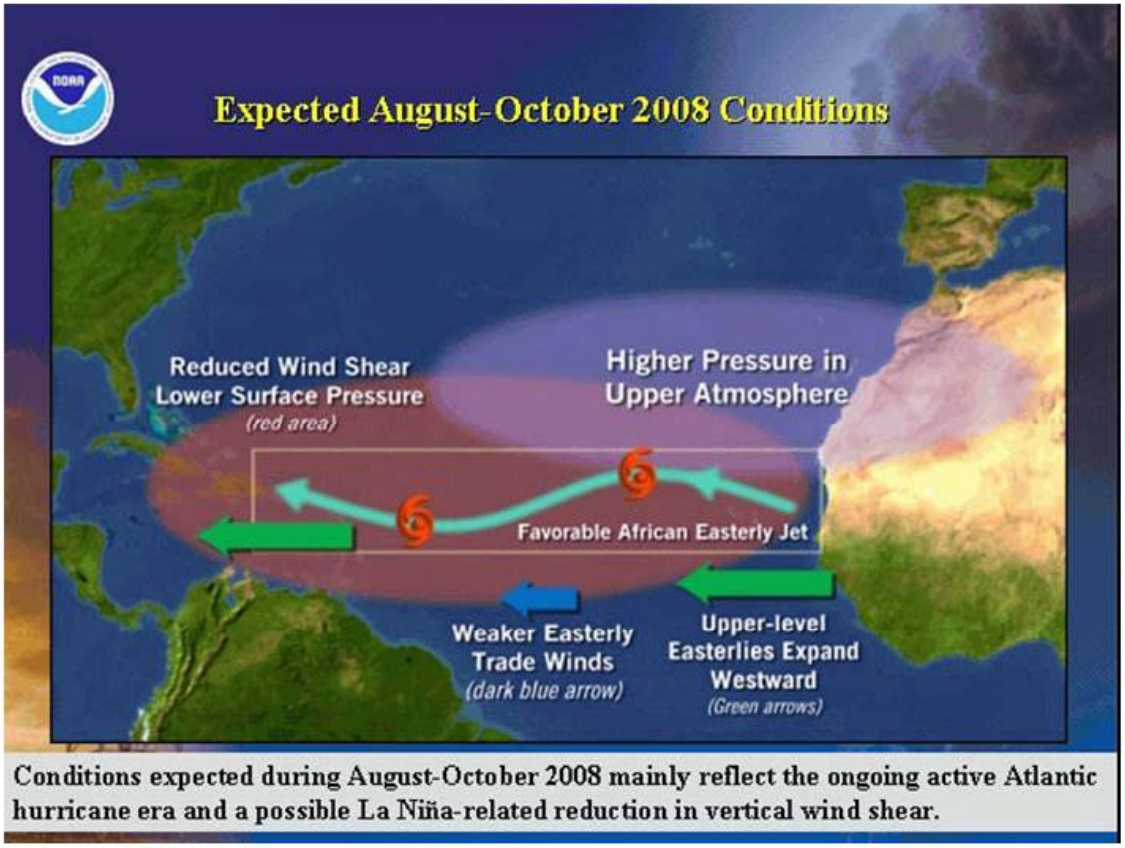
Note the number of loop-de-loop patterns.



Track of Hurricane Ike



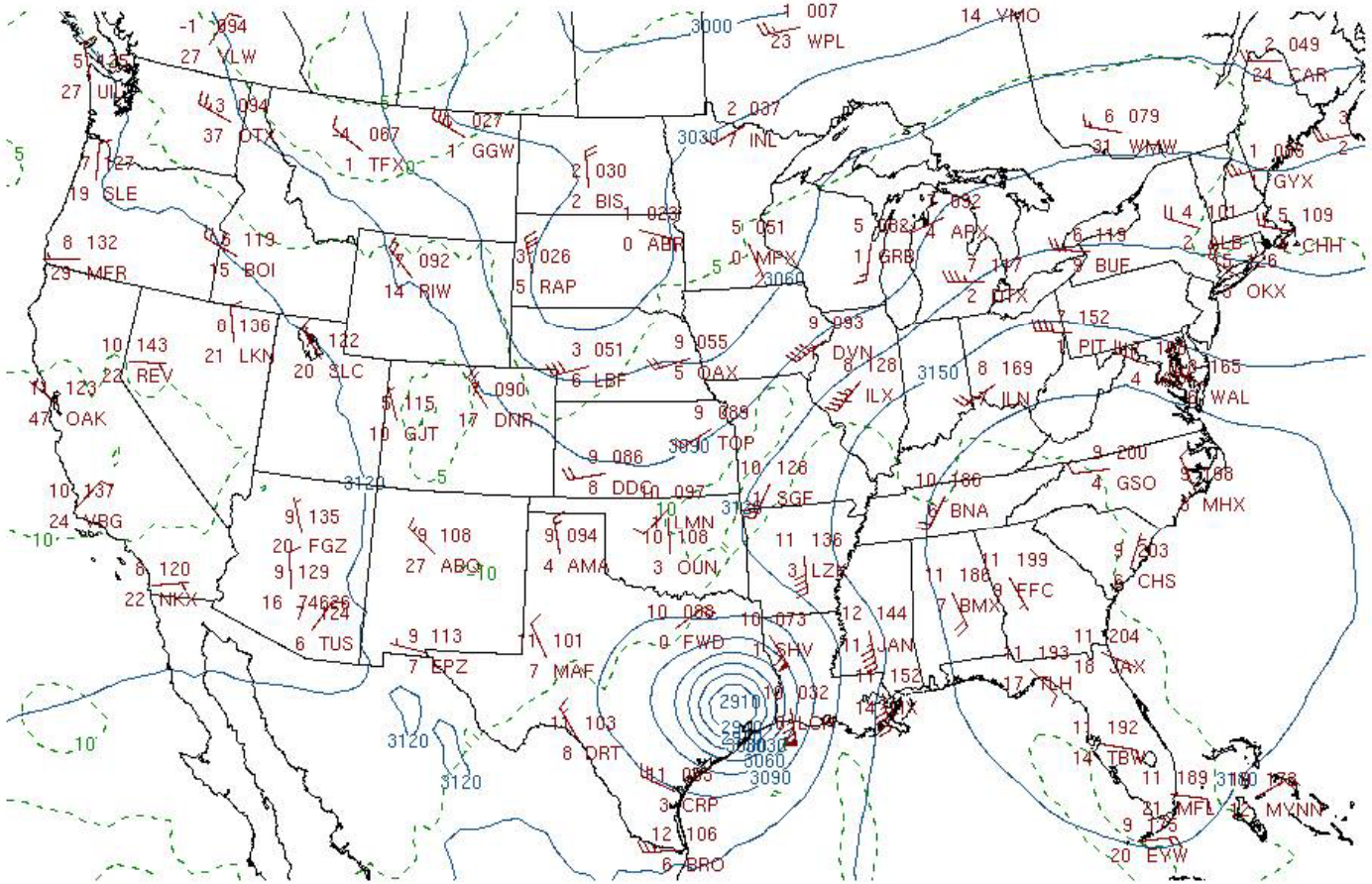
CPC Prediction for August-October 2008 Hurricane Season



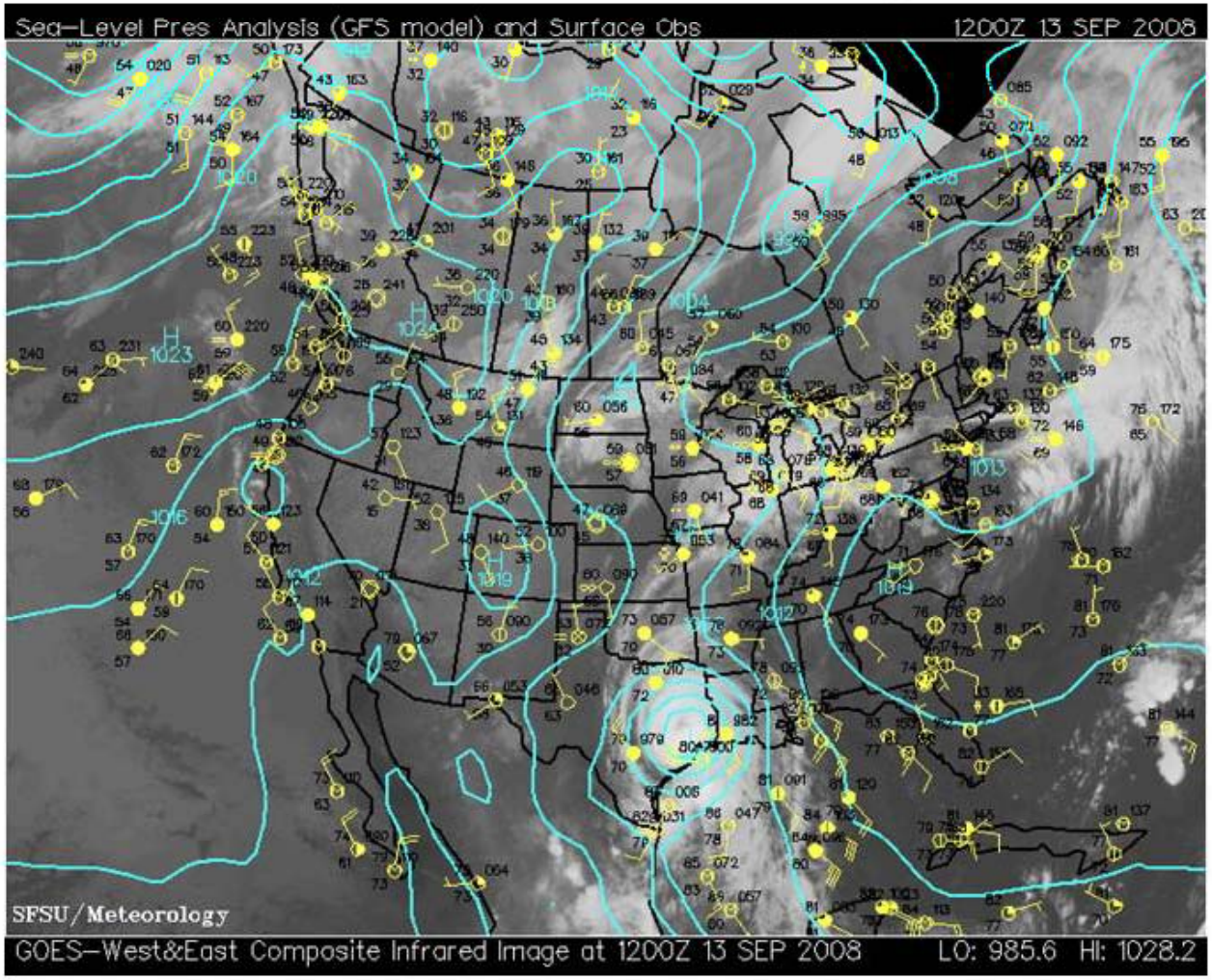
Conditions expected during August-October 2008 mainly reflect the ongoing active Atlantic hurricane era and a possible La Niña-related reduction in vertical wind shear.

Ike Approaching Cuba and Bahamas

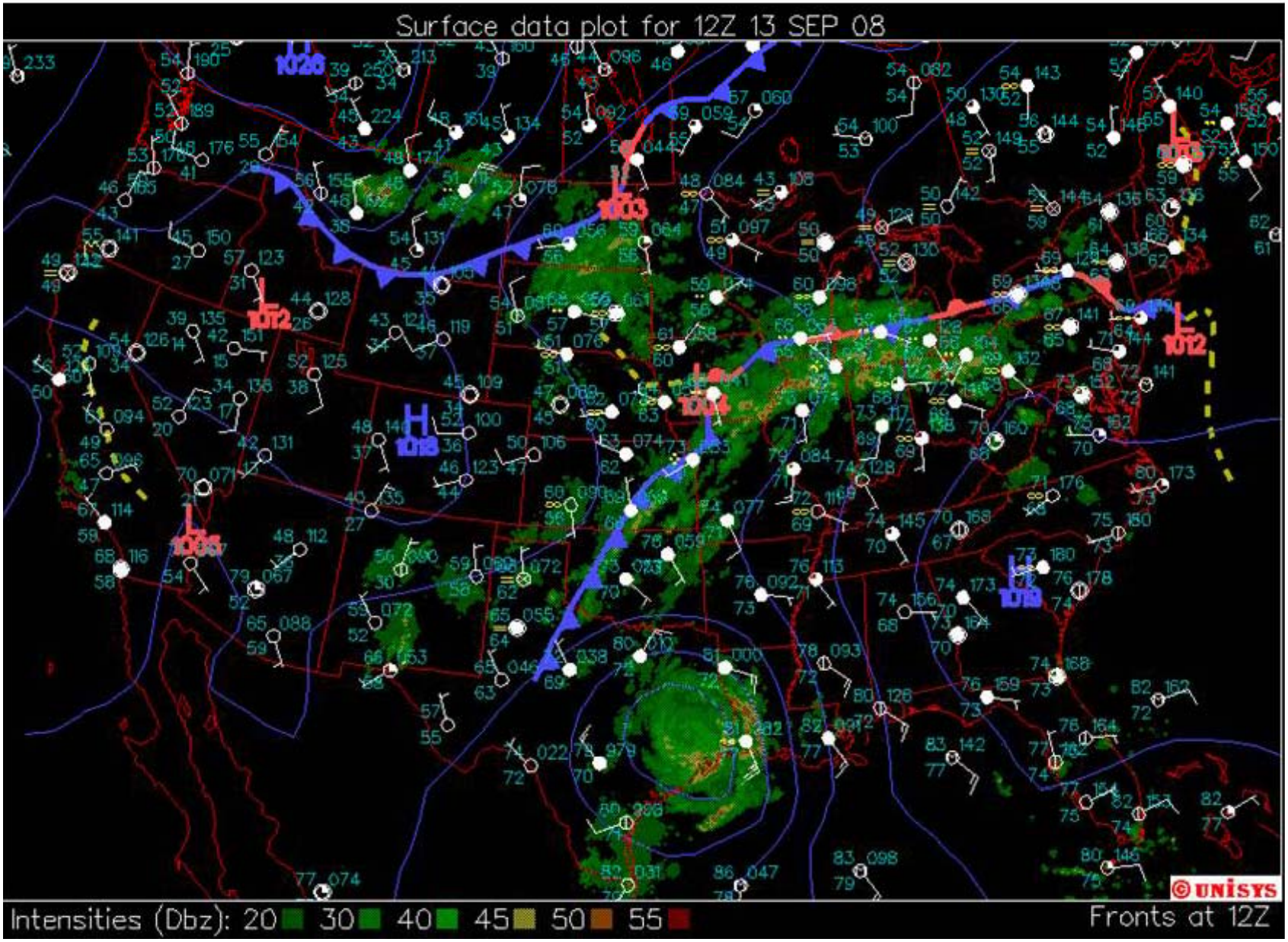
Ike at Landfall



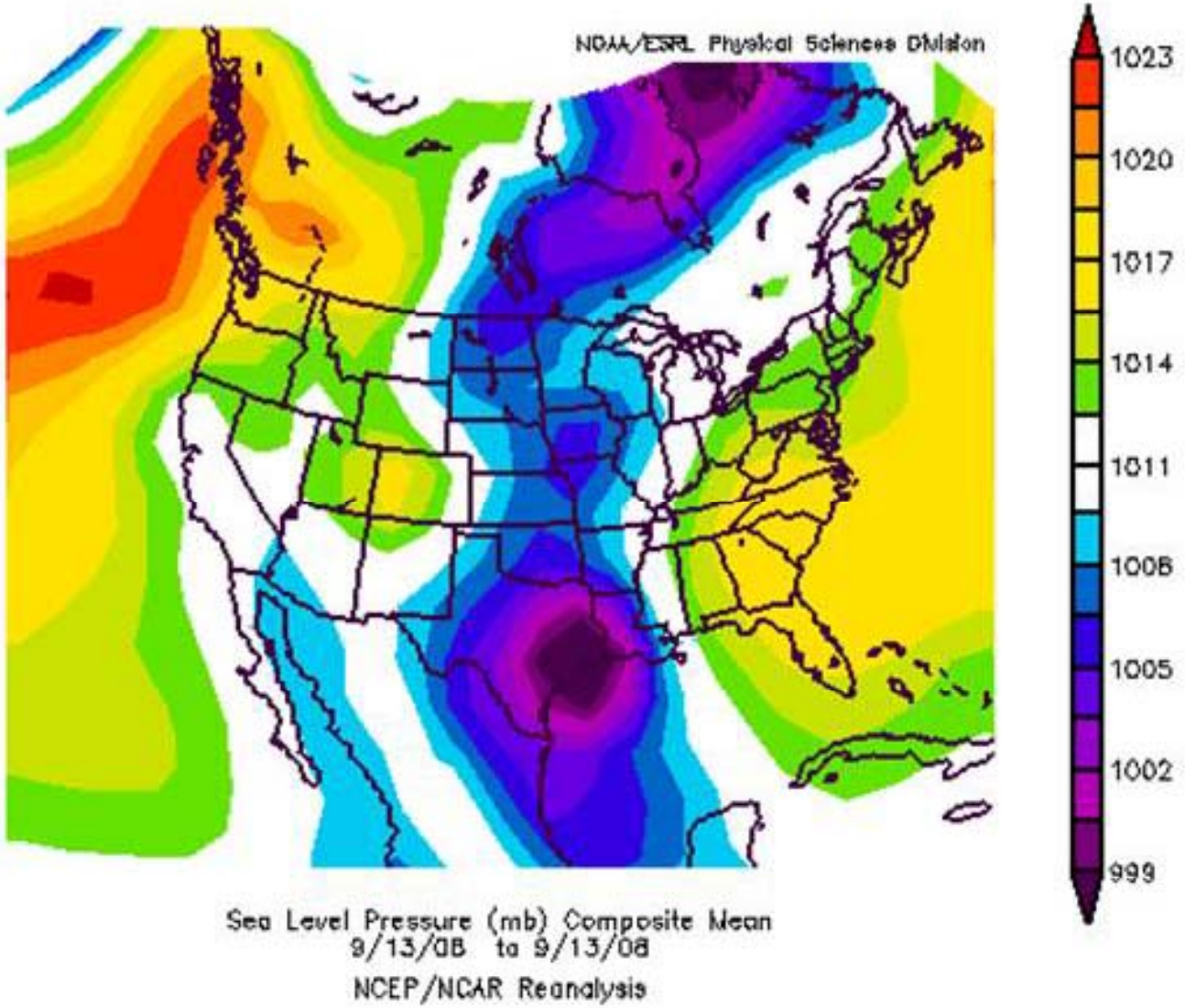
Ike Satellite Image Superimposed on Surface Pressure Map. High Pressure to Northeast and Northwest Will Direct Ike Straight Northward



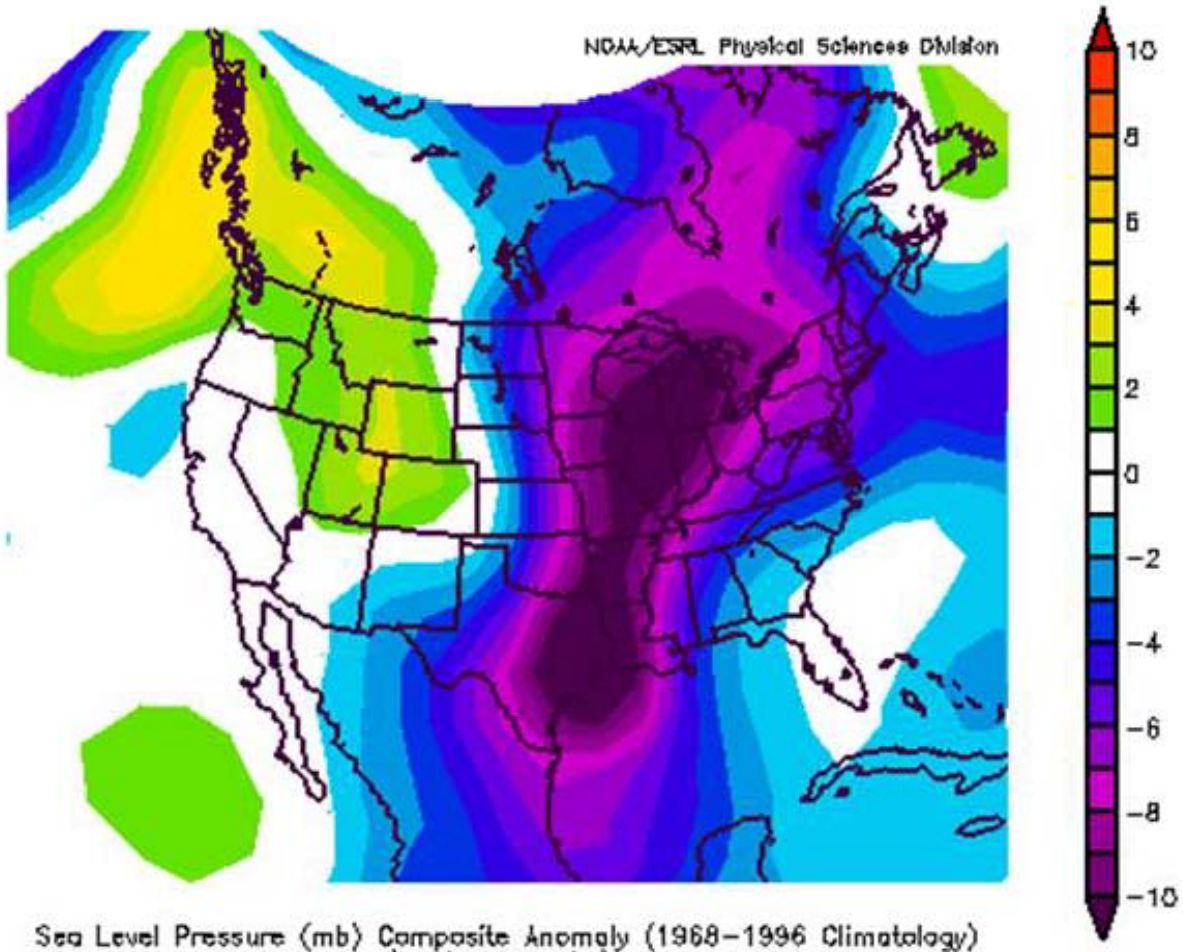
Ike About to Merge with Cold Front to Northwest



Ike, Sea Level Pressure

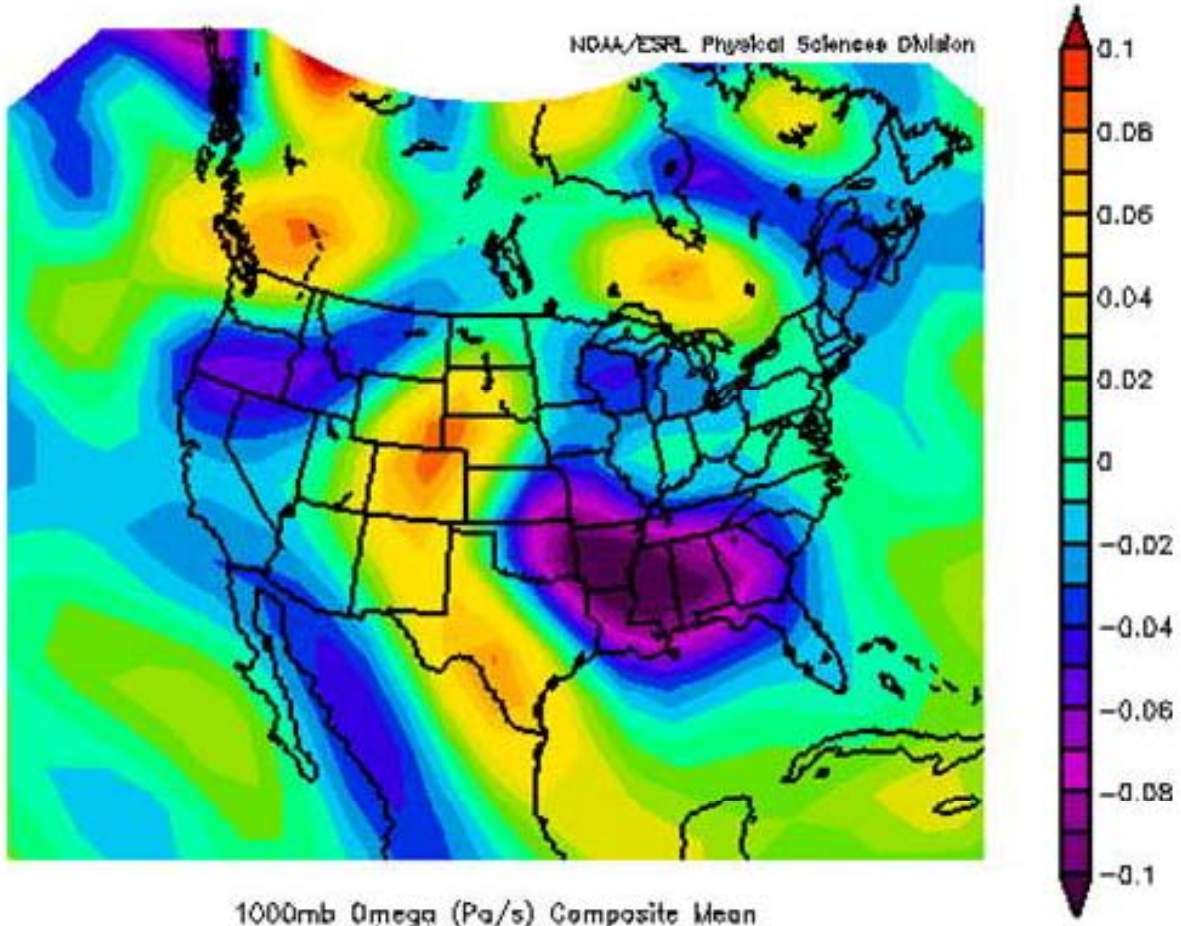


Ike, Pressure Anomaly



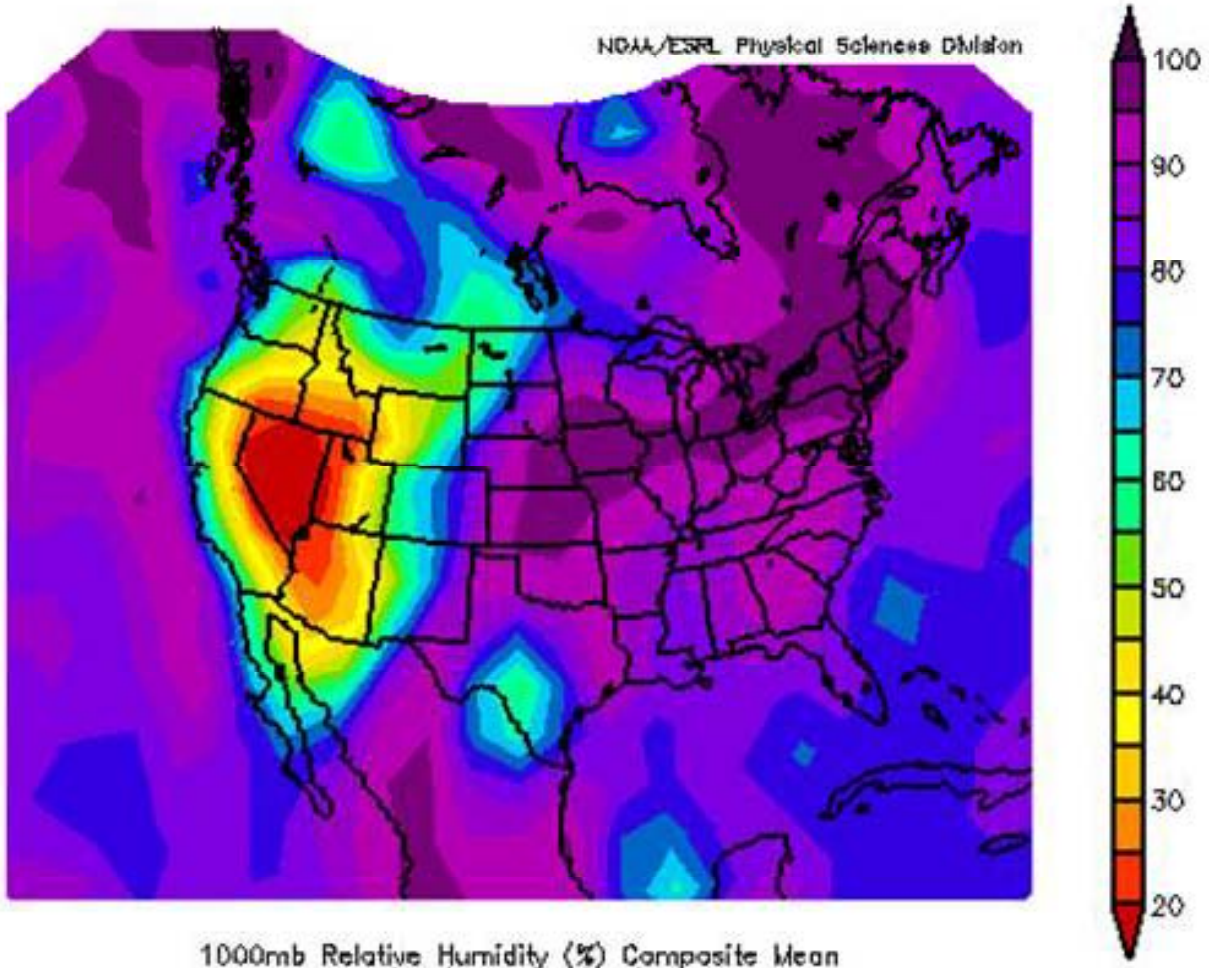
Sea Level Pressure (mb) Composite Anomaly (1968−1996 Climatology)
Omega (Vertical Velocity) Anomaly
NCEP/NCAR Reanalysis

Ike, Omega, Vertical Velocity

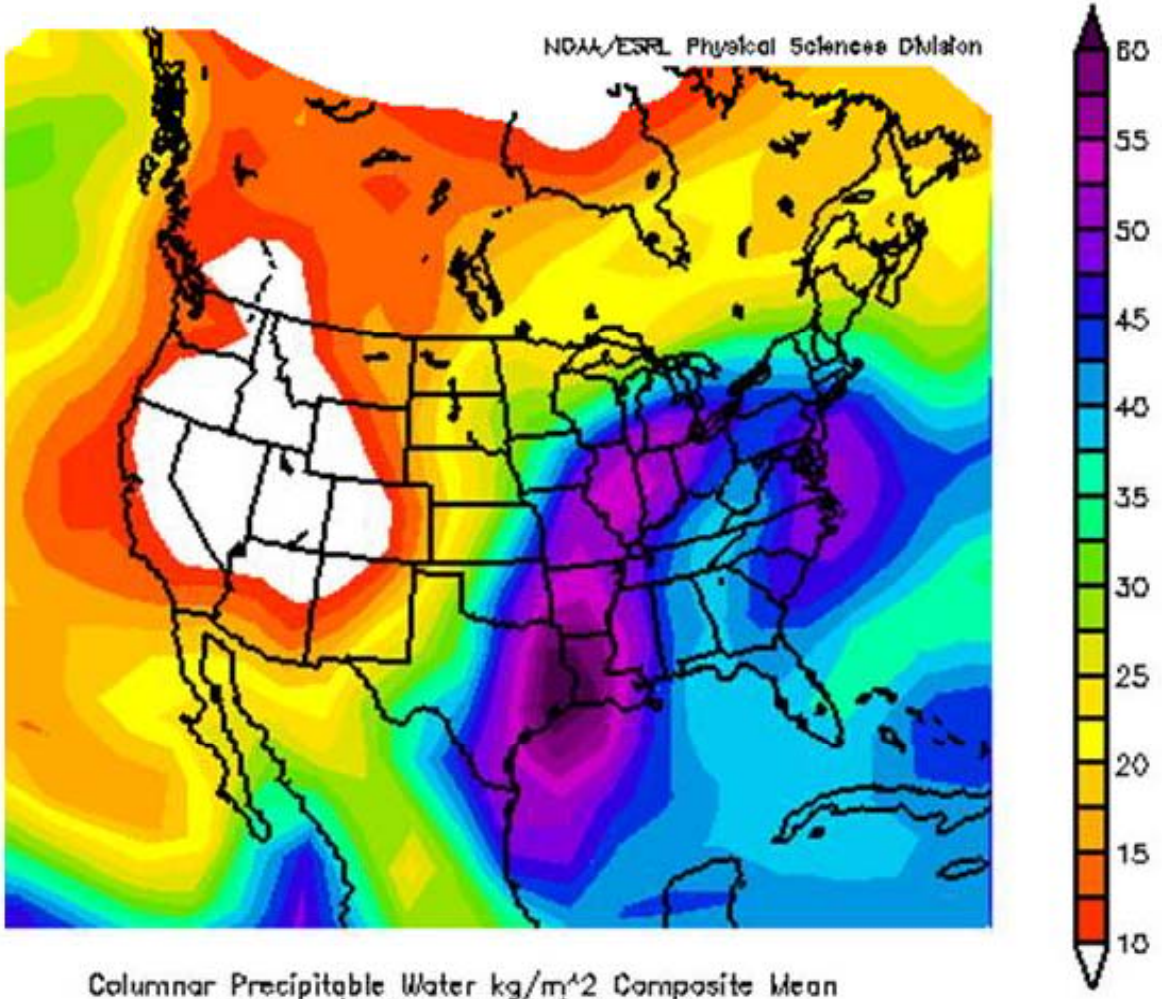


Ike, Relative Humidity

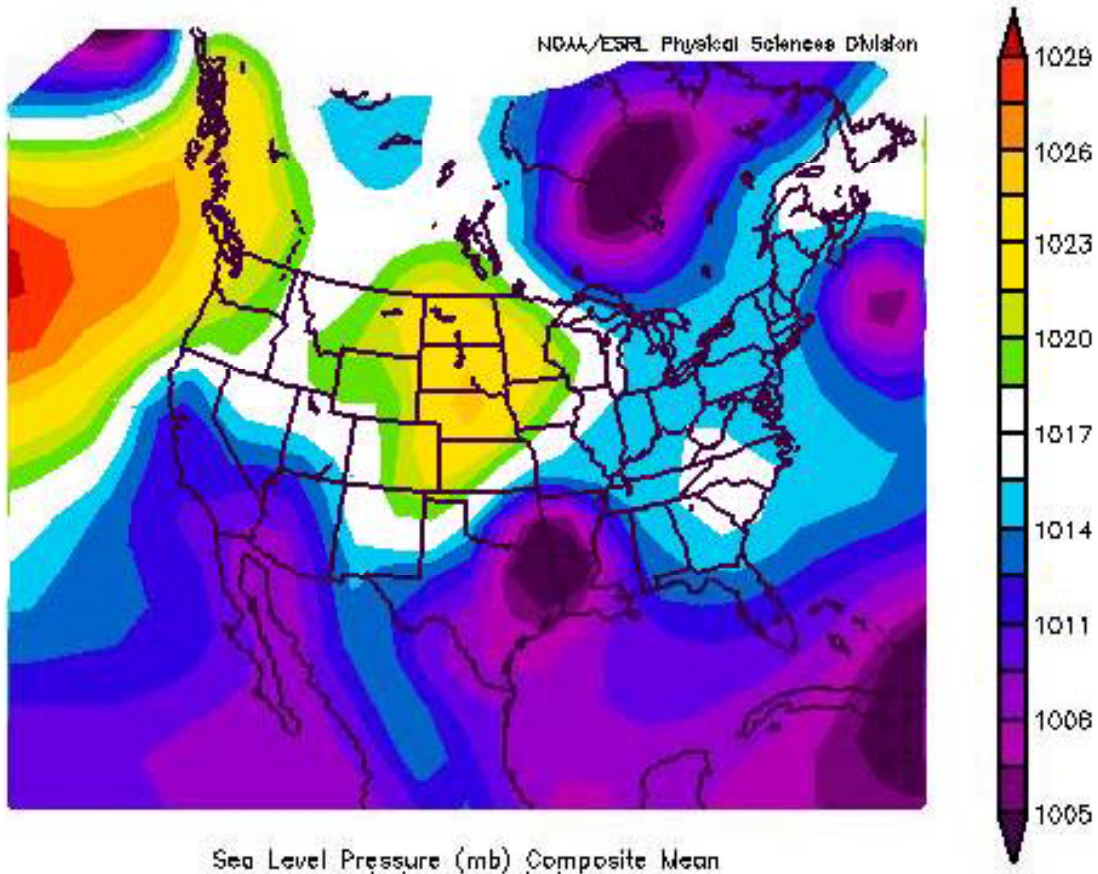
The green spot over South Texas is not Ike.
Ike is the maroon color nearer Louisiana



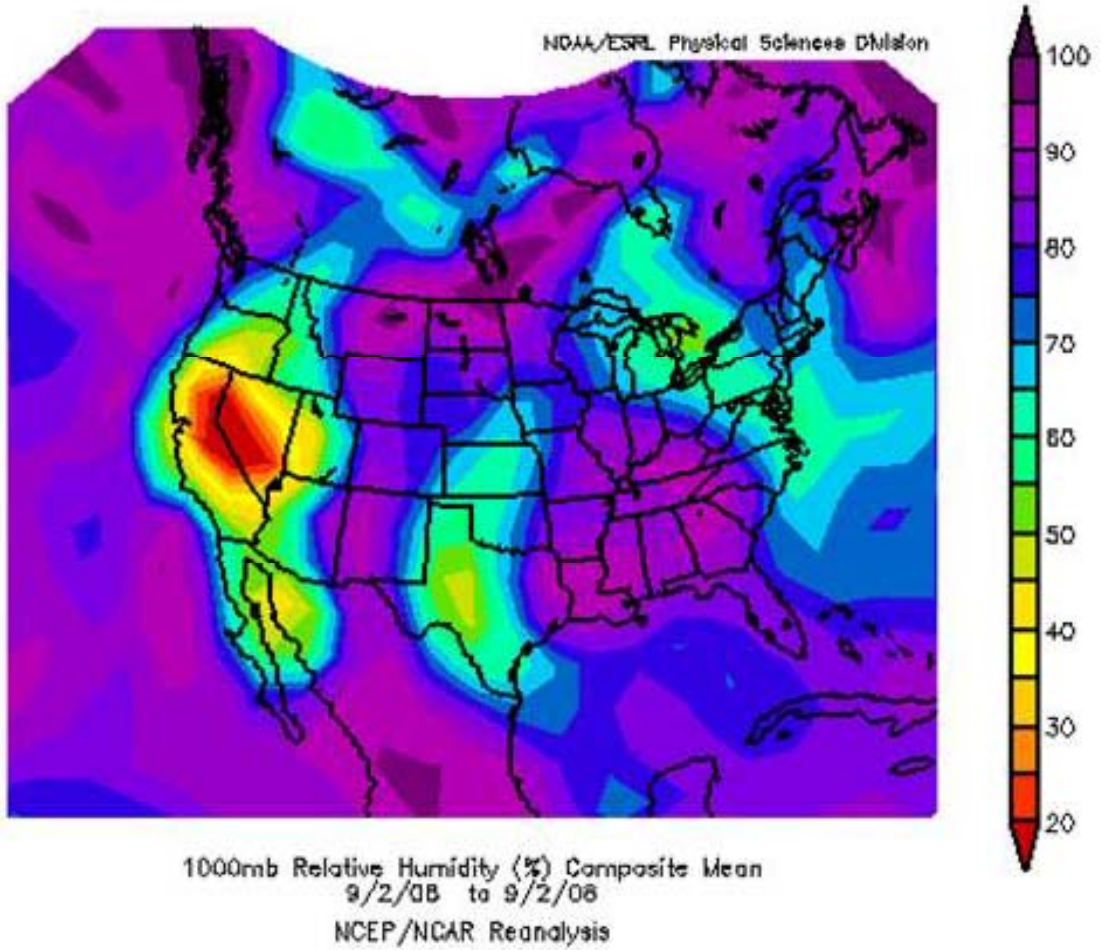
Ike, Precipitable Water of 80 kg/m^2



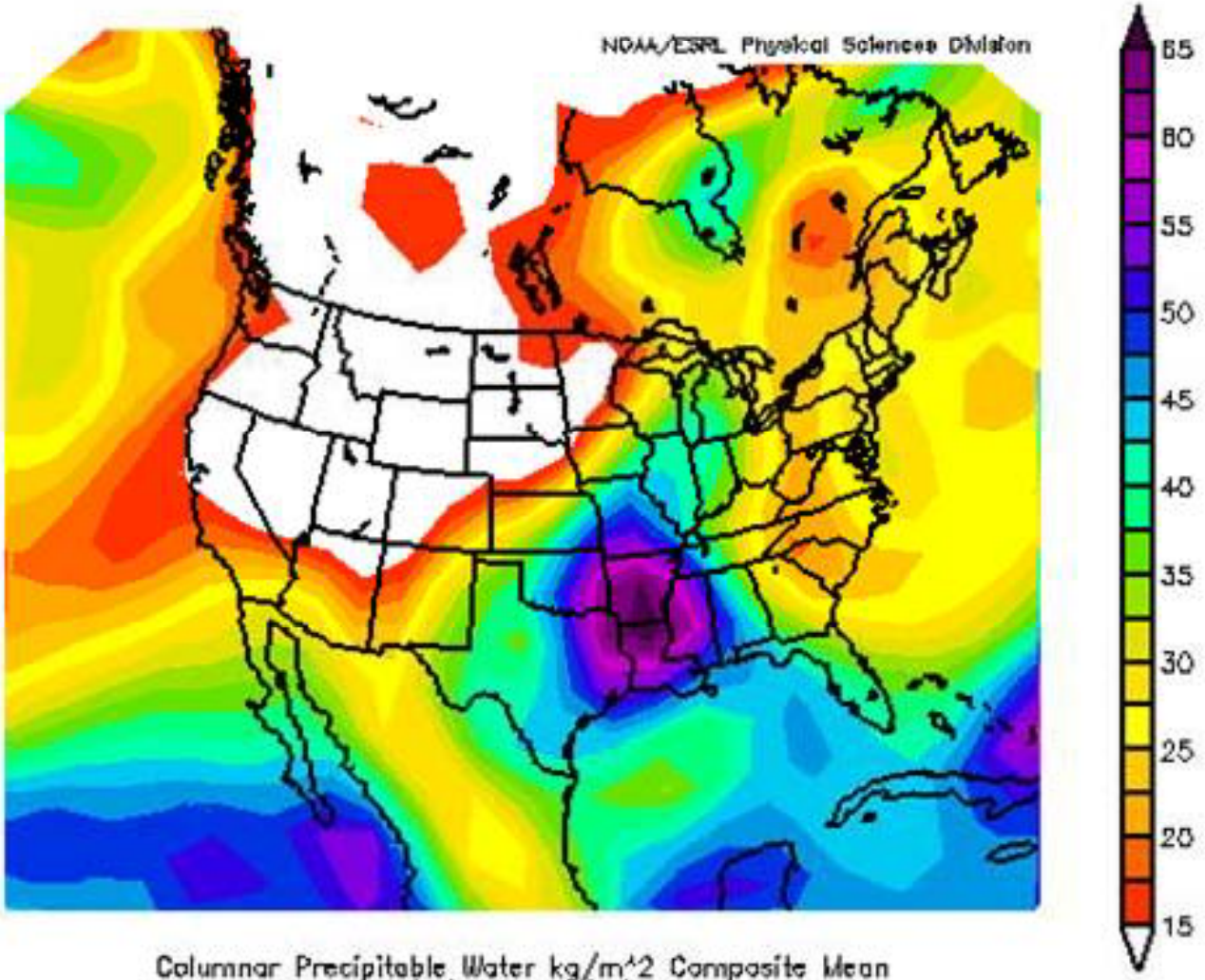
Gustav,
Sea Level Pressure



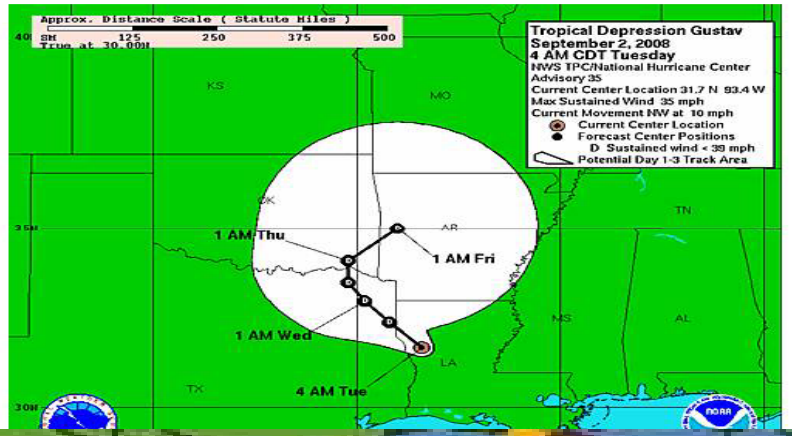
Gustav, Relative Humidity



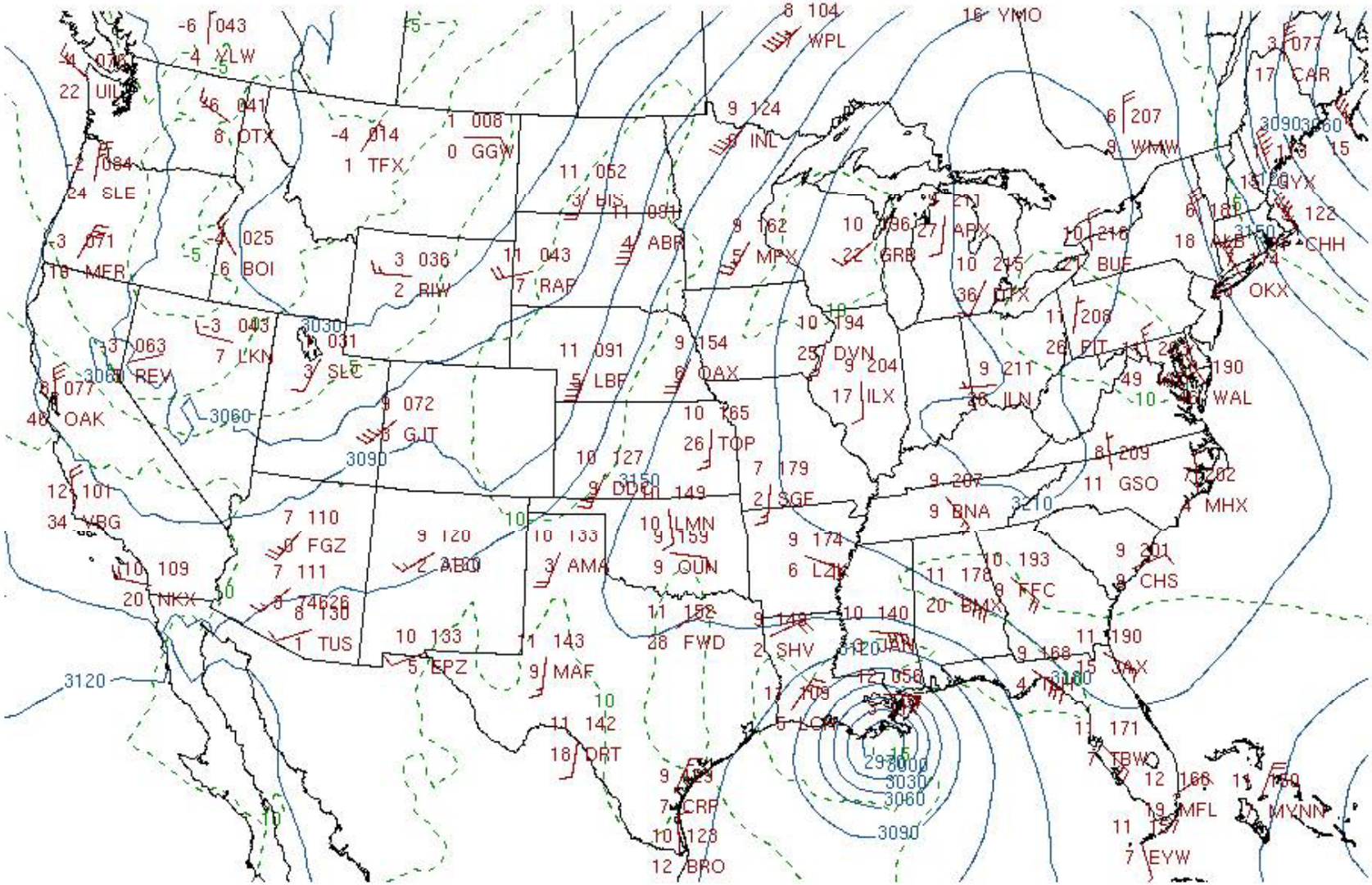
Precipitable Water



Gustav Track Slowed Because Of High Pressure to North



Gustav Landfall, High Pressure to the North

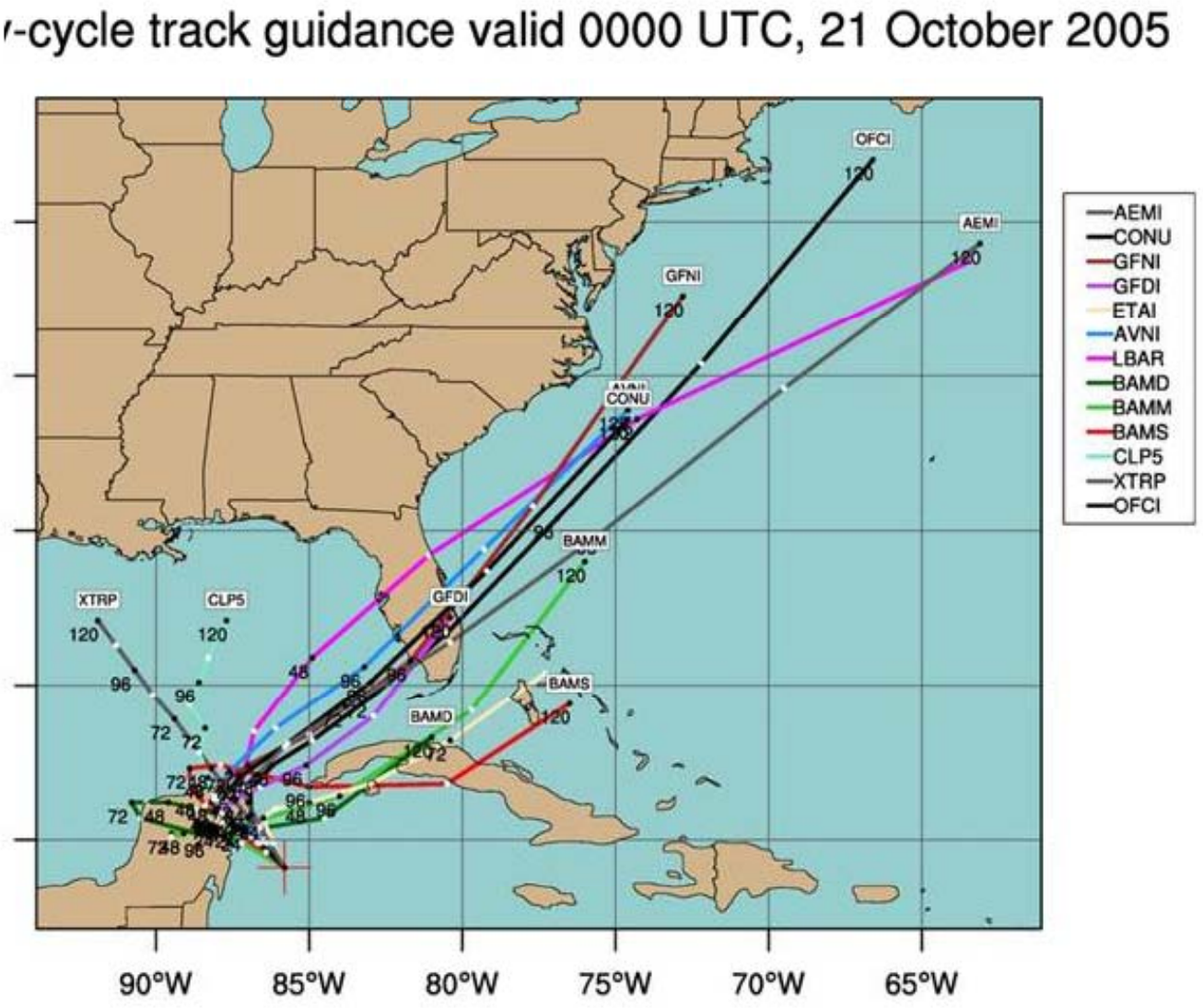


12Z 01 Sep 2008 700 mb

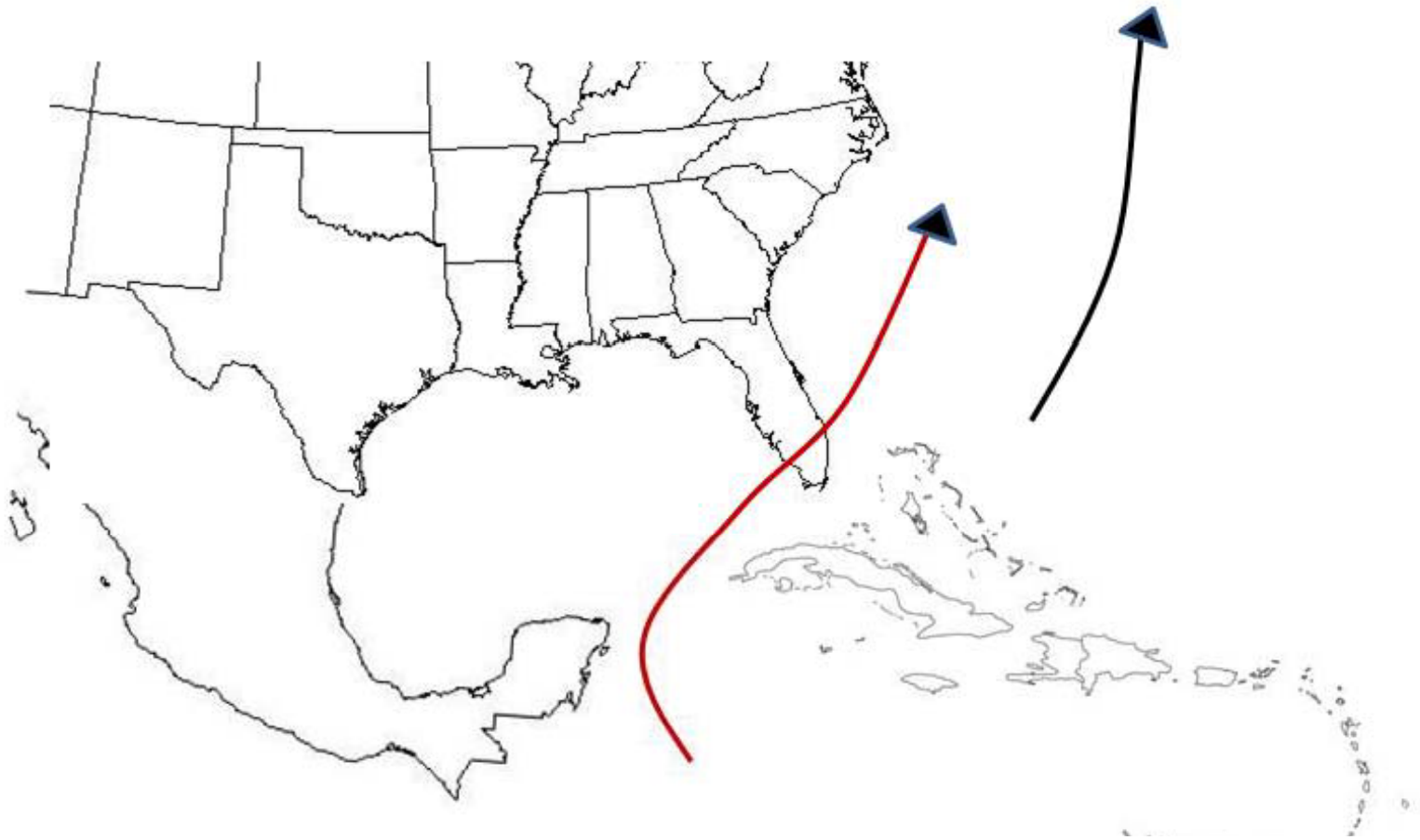
University of Wyoming

Gustav and Ike Followed Typical September Tracks, Gustav from Caribbean to Louisiana, Ike across Cuba Toward Texas Coast

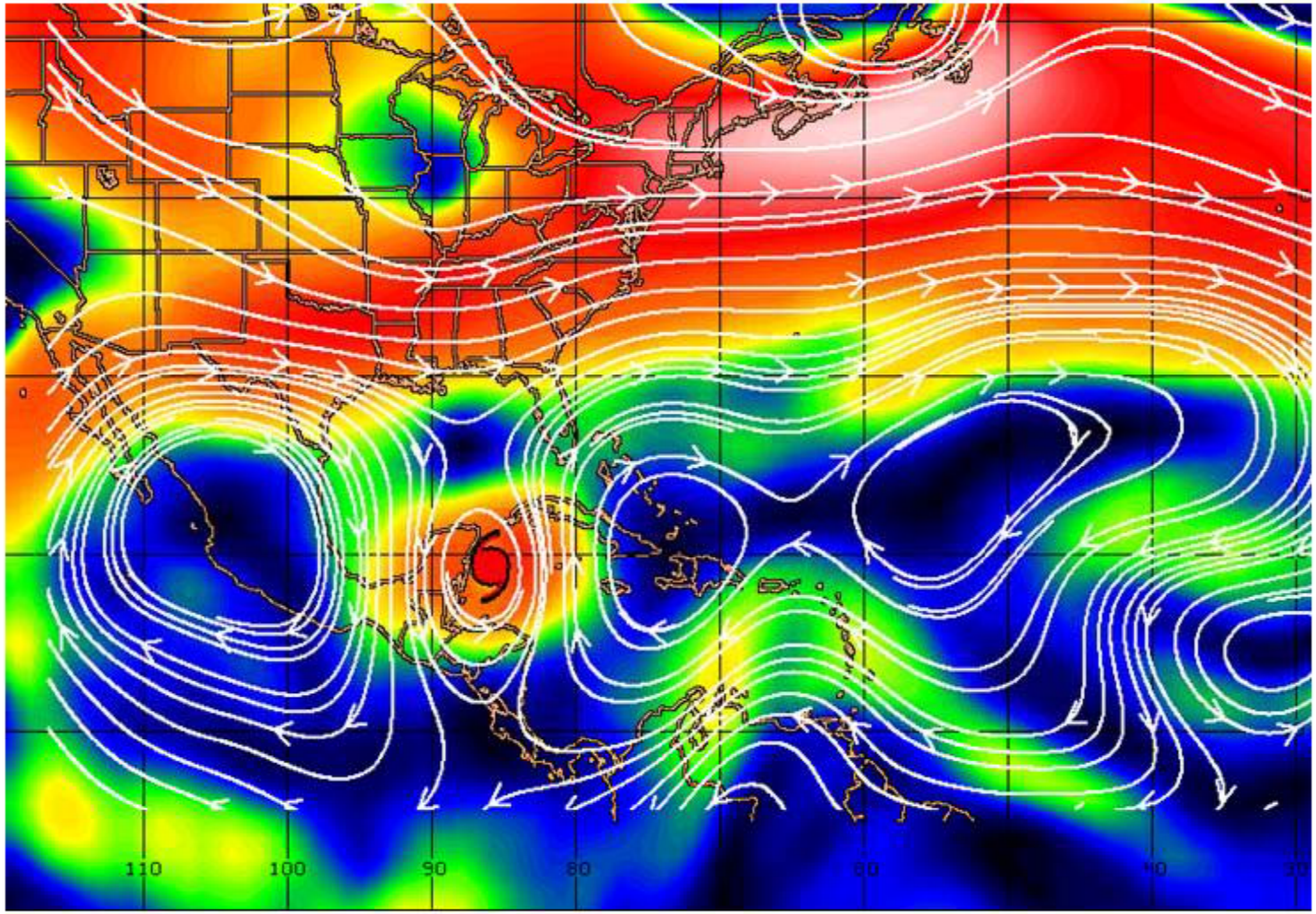
Spaghetti Map Showing Predicted Path for Hurricane Wilma from 11 Different Models



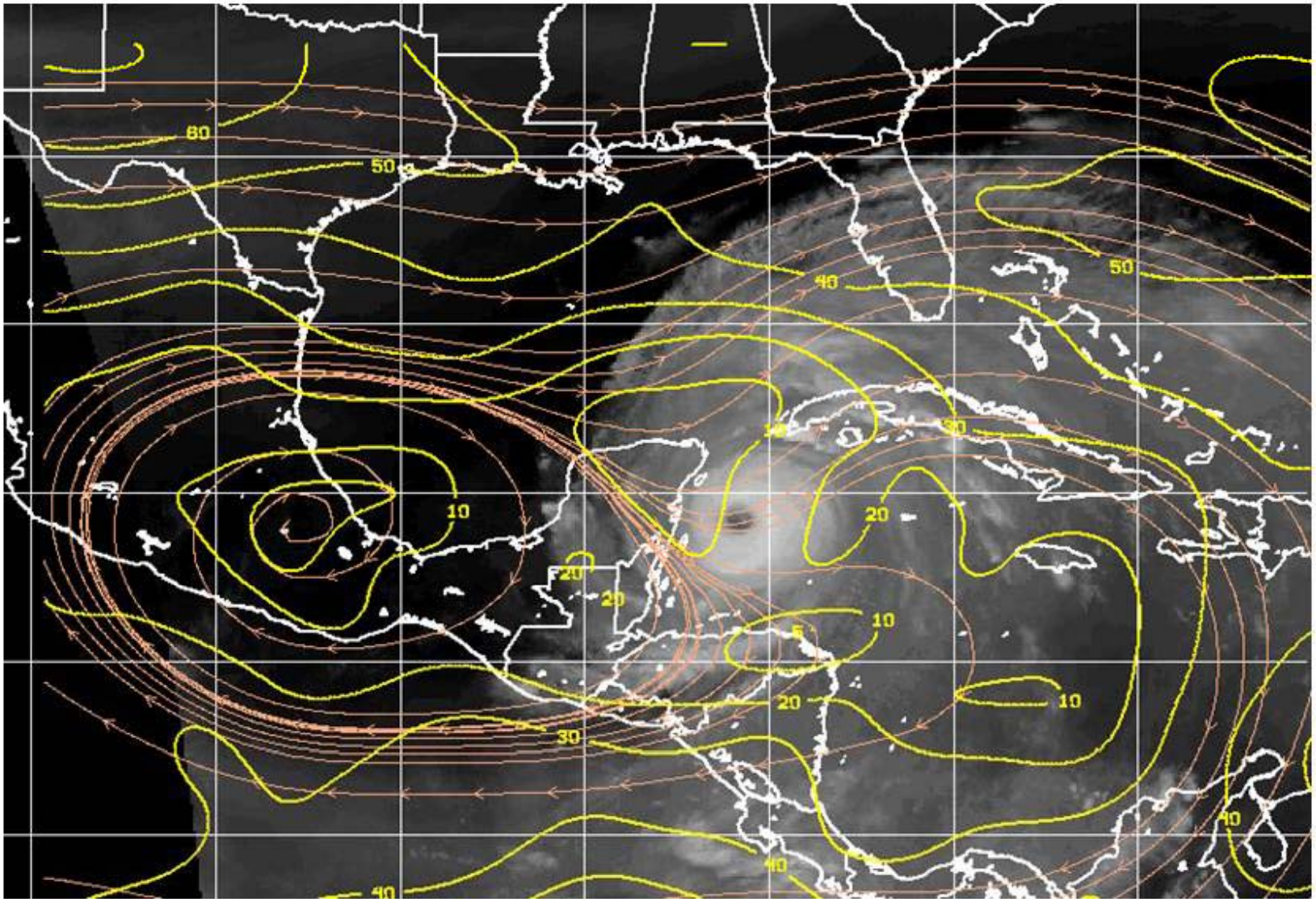
Wilma Followed Typical October Track From Yucatan Across Florida



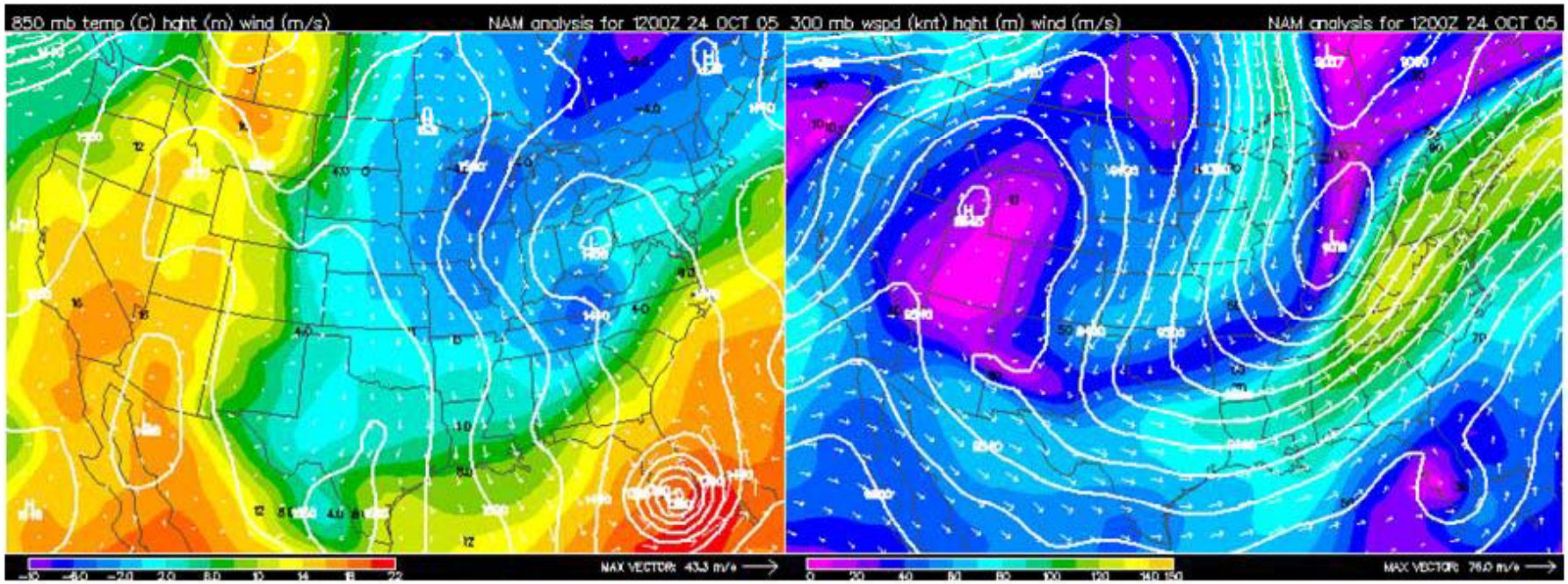
Hurricane Wilma Sandwiched Between Two High Pressure Systems Directing Hurricane Northward, But Westerlies Near Gulf Coast Will Push Storm Eastward



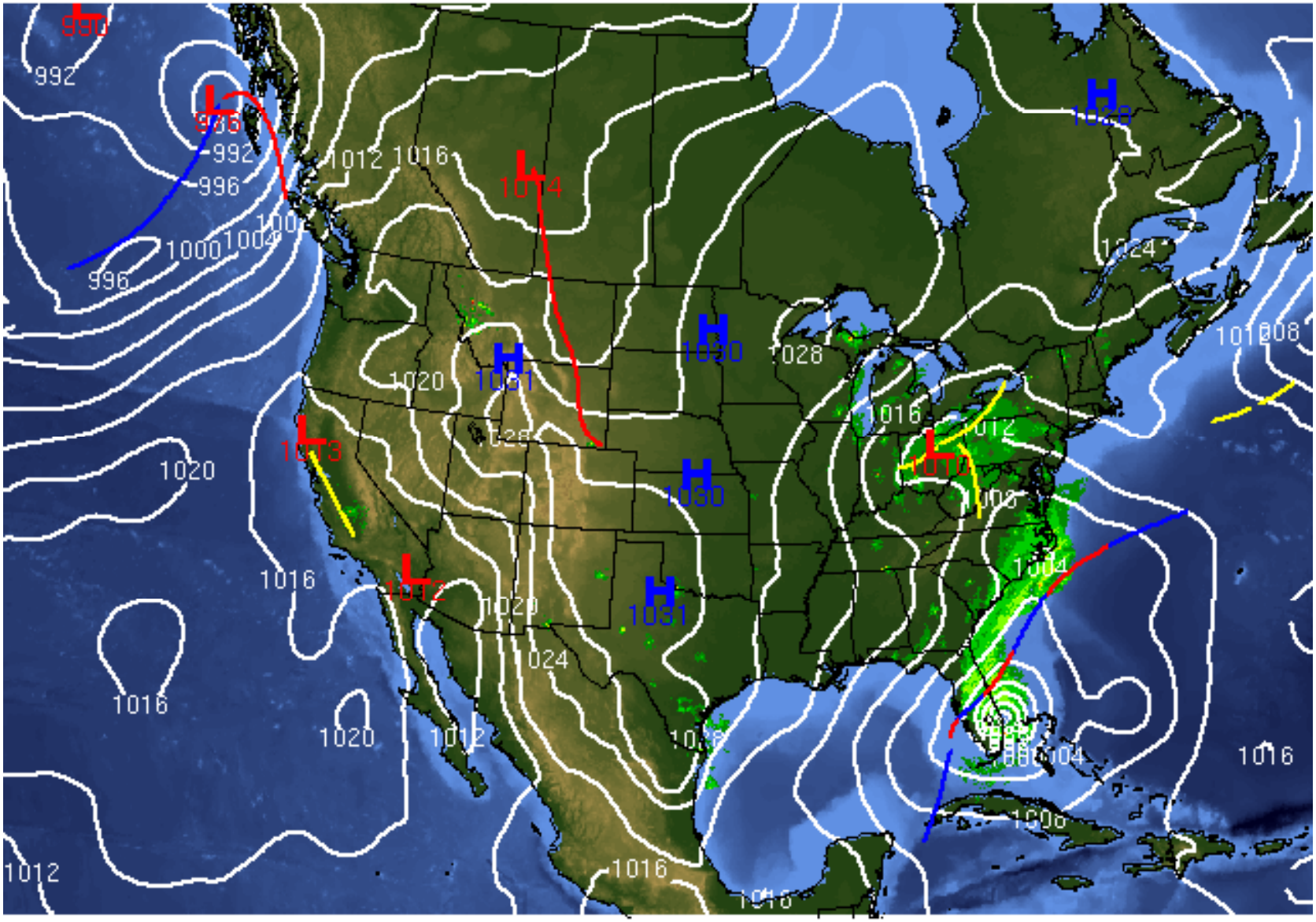
Yellow Indicates 10 – 15 knot Wind Shear. Streamlines Indicate Winds Nudging the Storm to Northeast



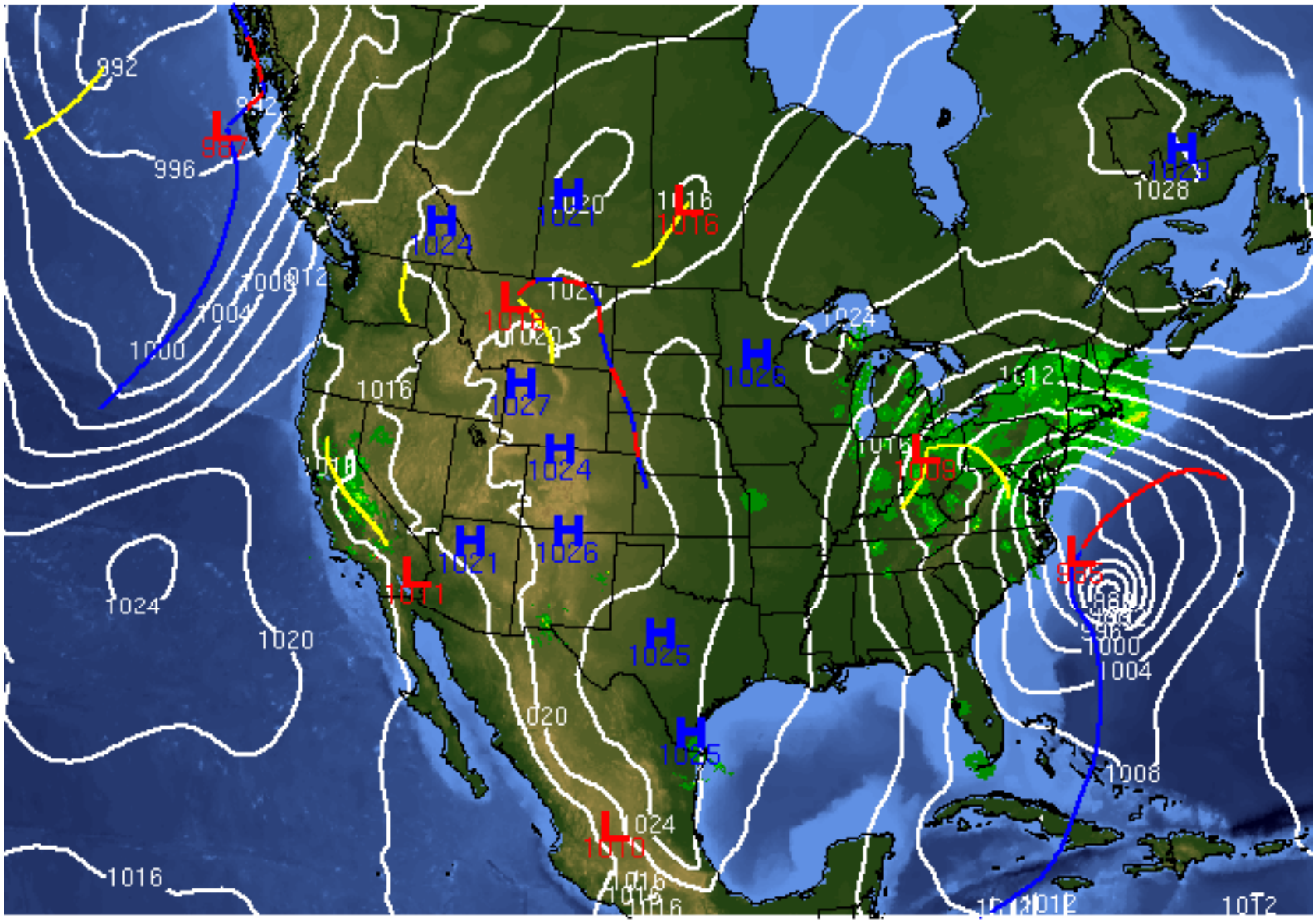
Surface and Upper Level Charts for Hurricane Wilma Showing Winds Guiding System to Northeast



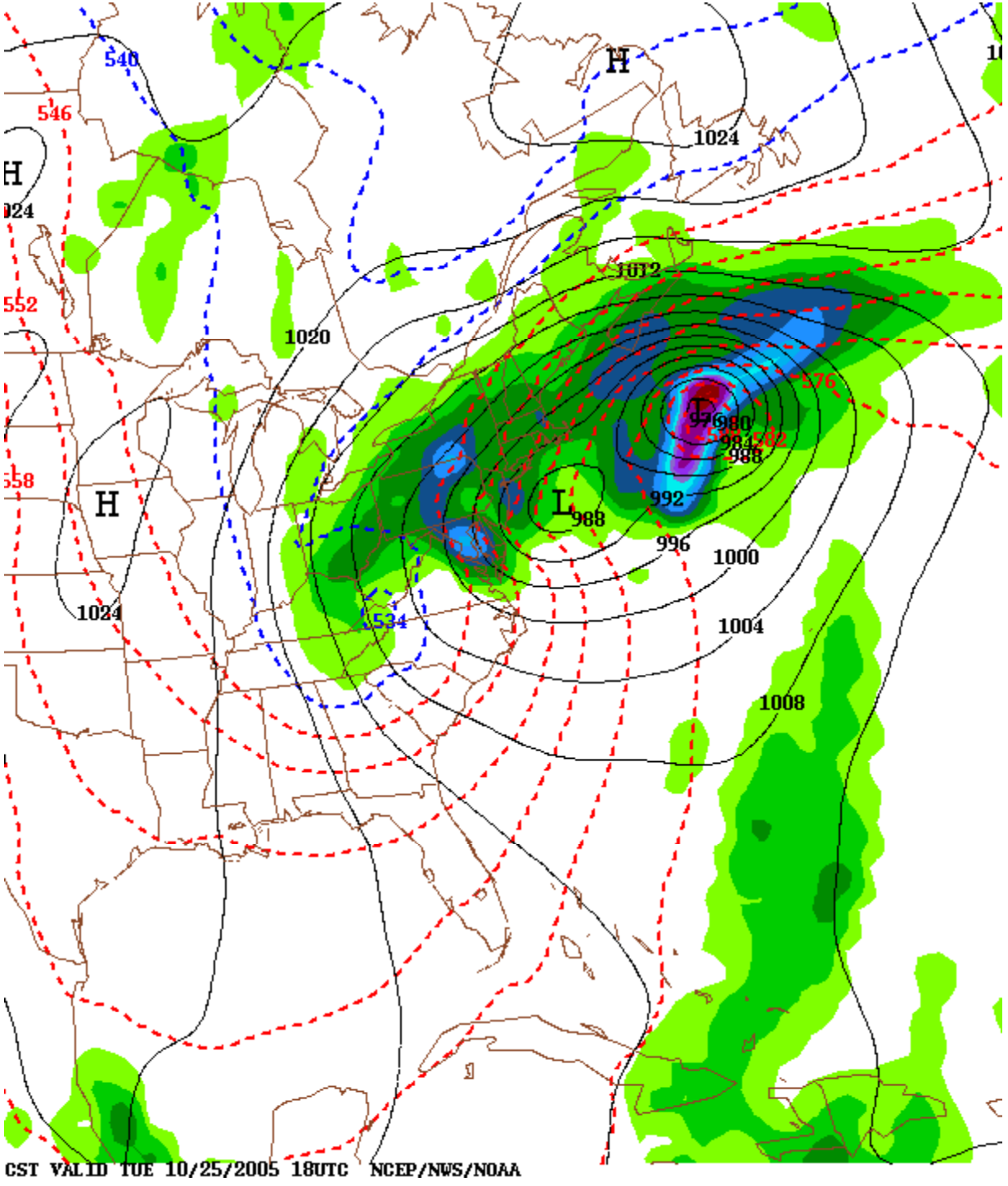
Wilma in South Florida.
Note Stationary Front.



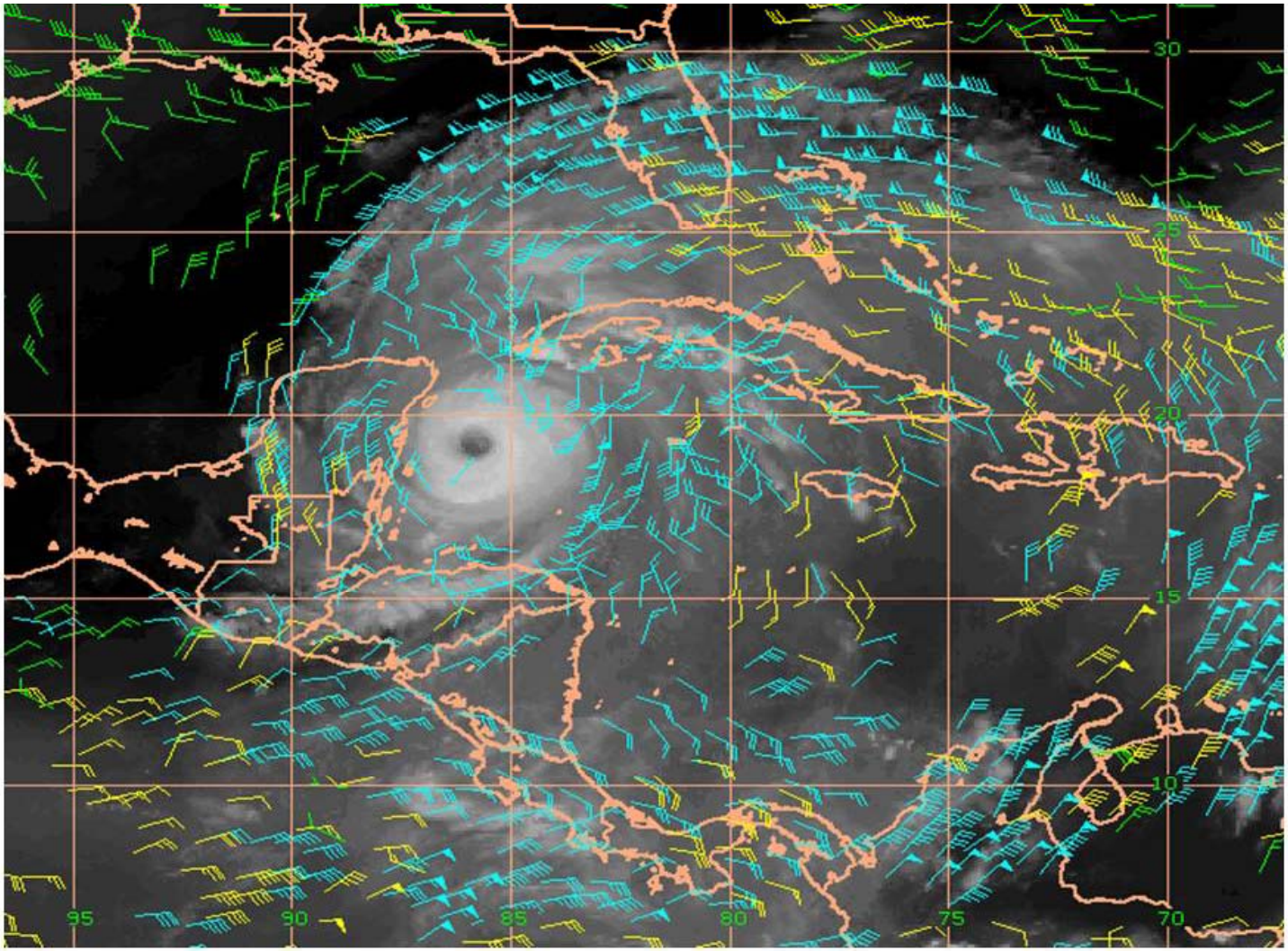
Wilma Is Still a Hurricane, But Will Become a Mid Latitude Cyclonic Storm in a Few Hours.



Wilma is now a Mid-latitude Cyclonic System with two centers of low pressure and occluding. Other low was near Great Lakes the previous two days.



Classic View of Hurricane Wilma showing counter clockwise rotation at surface, but clockwise circulation at higher levels. As the dry, exhaust air settles back toward the surface, it develops clockwise (anticyclonic) rotation indicated by blue symbols.



Conclusions:

1. NOAA Climate Prediction Center's hurricane forecast for the late summer was reasonably accurate indicating an east to west path.

2. Hurricanes Gustav and Ike followed tracks typical for the month of September. Wilma followed a track typical for October, more directly north.

3. Hurricanes Gustav developed in the trade winds and moved west along the southern edge of the Bermuda High Pressure Cell

4. The hurricanes avoided high pressure cells of both subtropical and mid-latitude (anticyclone) types.

5. All hurricanes recurved to the north, north east and merged with mid-latitude cyclonic systems. Their speed of movement increased as they developed more mid-latitude characteristics.