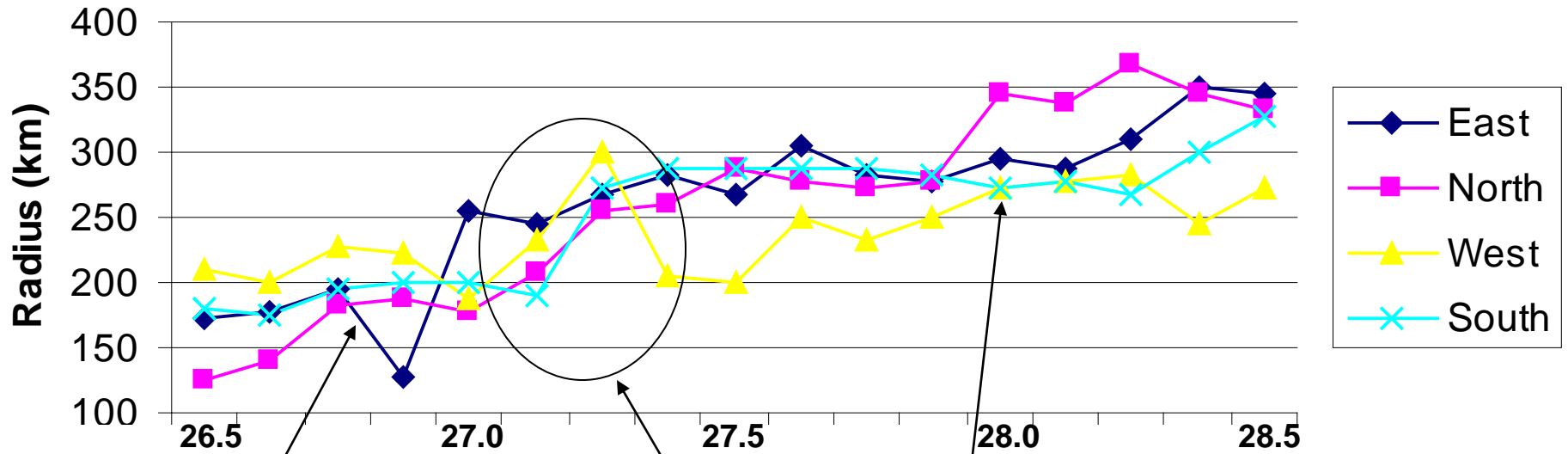


Some Ideas on Hurricane Katrina's Wind Expansion

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Stennis Space Center branch

Qingnong Xiao
NCAR
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Radius tropical storm-force winds



Land effect from Florida

North, west, east side increased between 70-100 km in first 6 h. Doubled in size by the 28th.

I. Some mechanisms for storm size growth

Angular momentum budget

$$M = v_t r + \frac{fr^2}{2}$$

$$\frac{\partial M}{\partial t} = - \frac{1}{r} \frac{\partial (rv_t u_r)}{\partial r} - rfu_r + rF$$

A B C

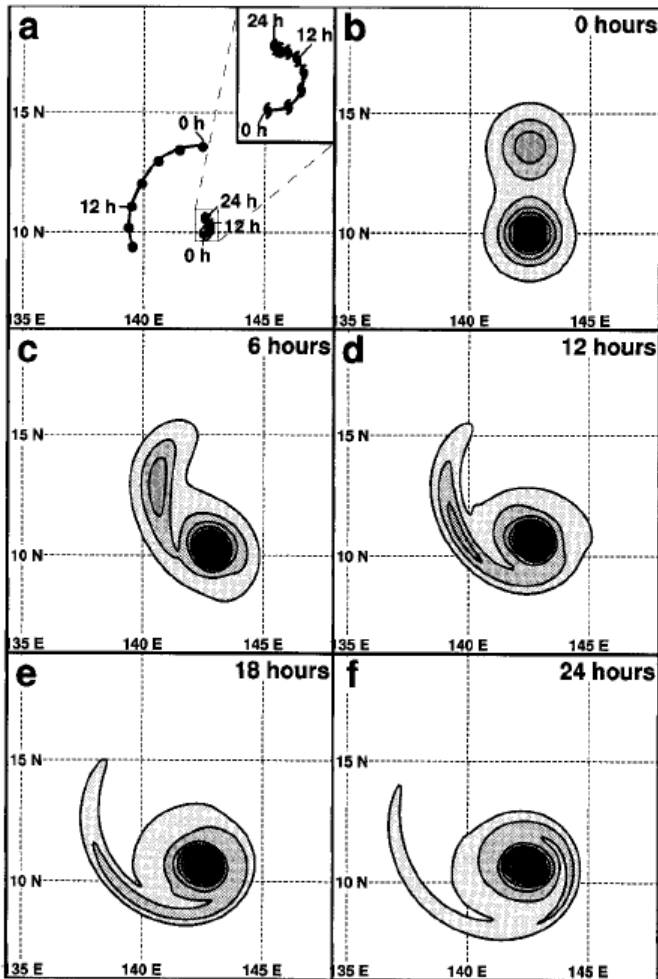
A – convergence of RAM

B – Coriolis torque

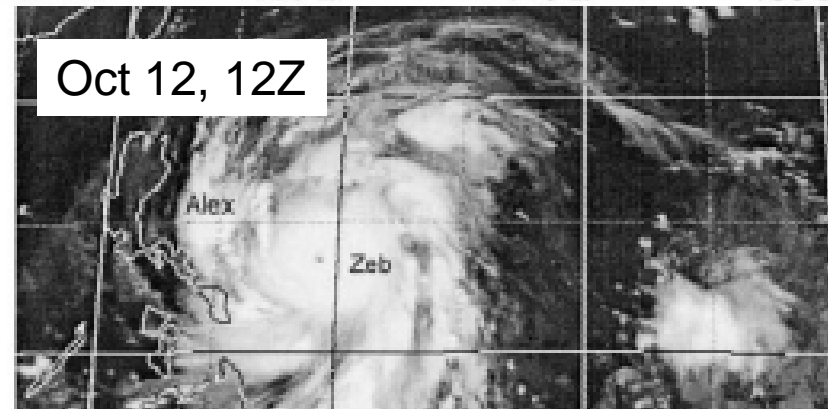
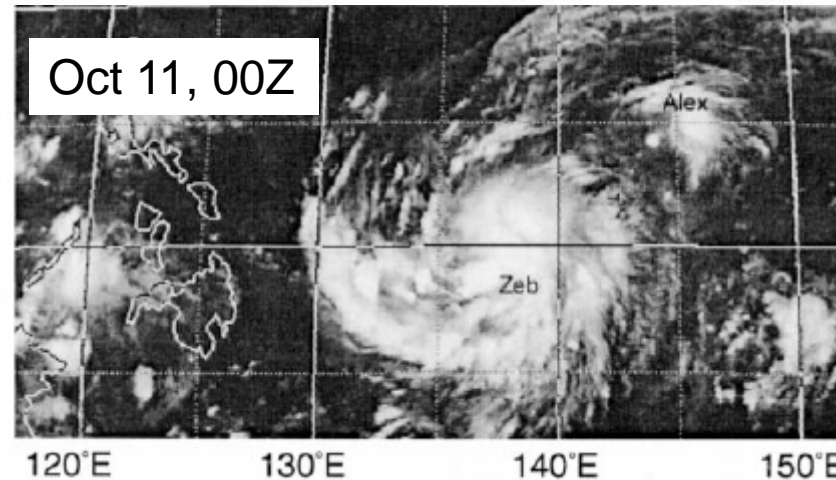
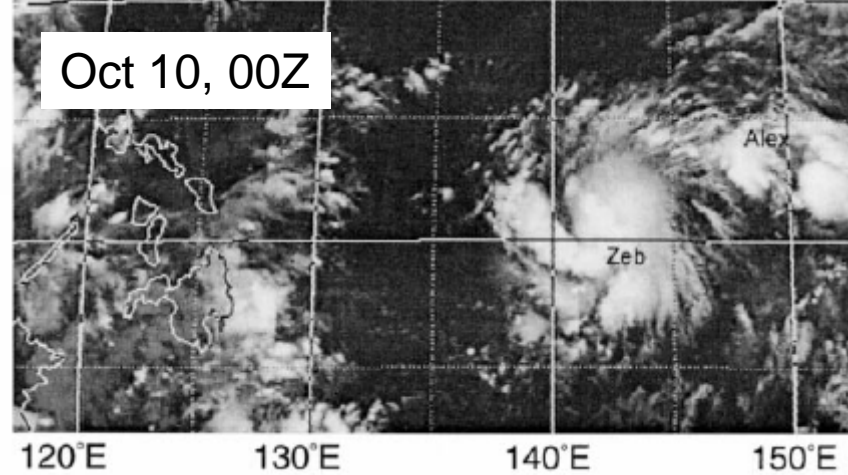
C – friction torque

Vortex merger ideas

(Lander, Holland,
Dietachmayer 1993, 1994)

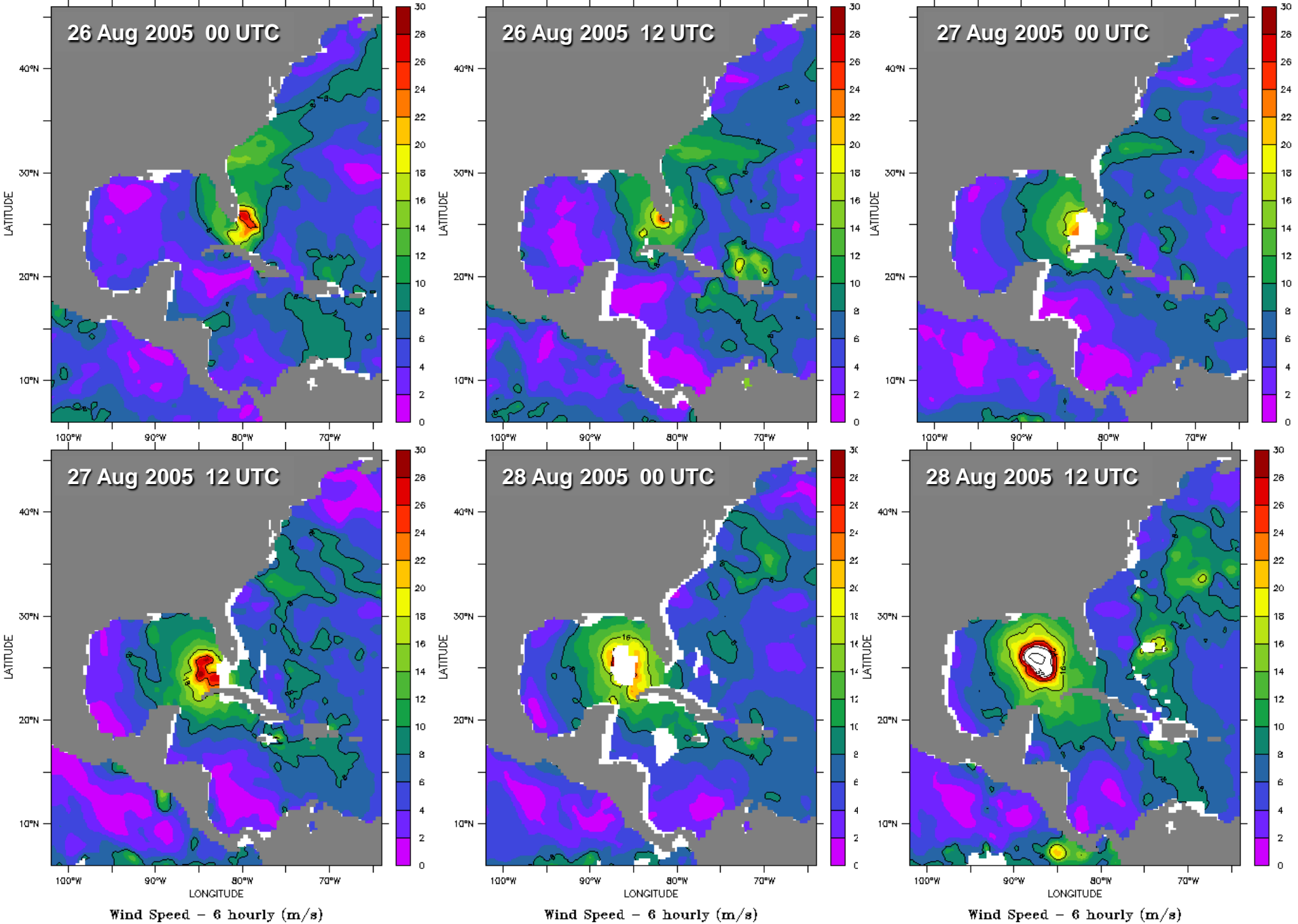


Ritchie and Elsberry 2000



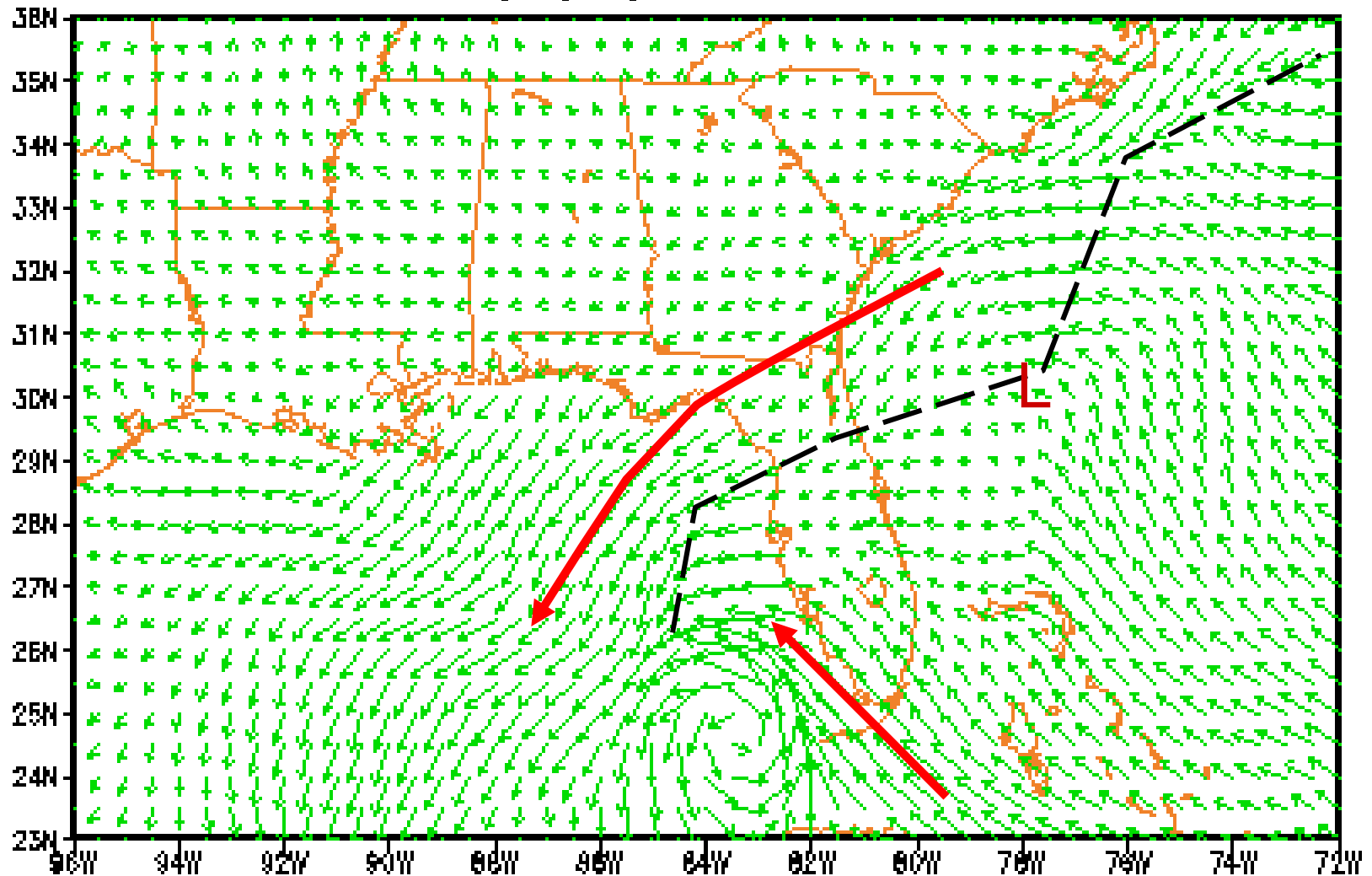
Kuo, Chen, and Lin 2000

II. Wind and satellite observations

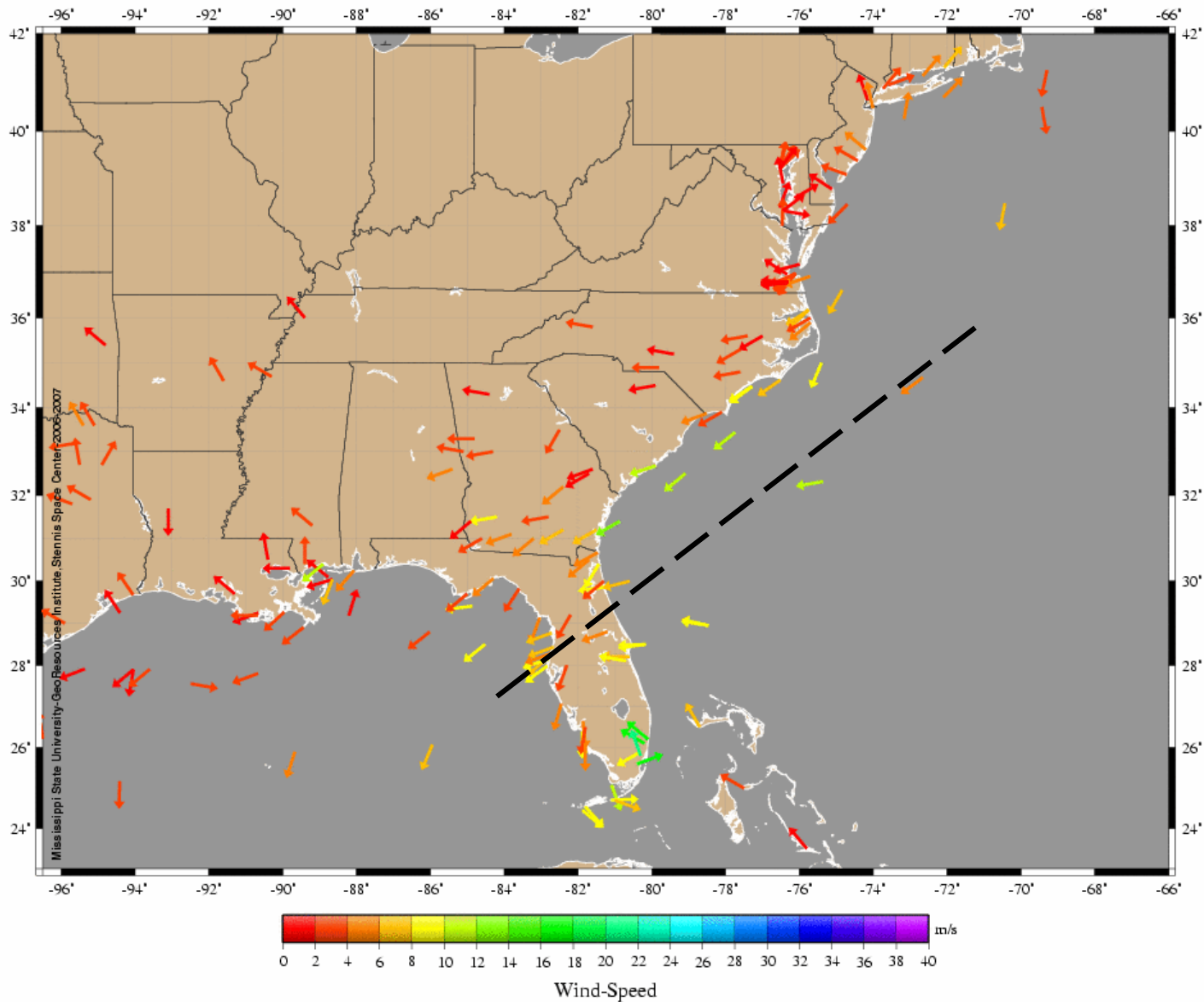


NAM analysis

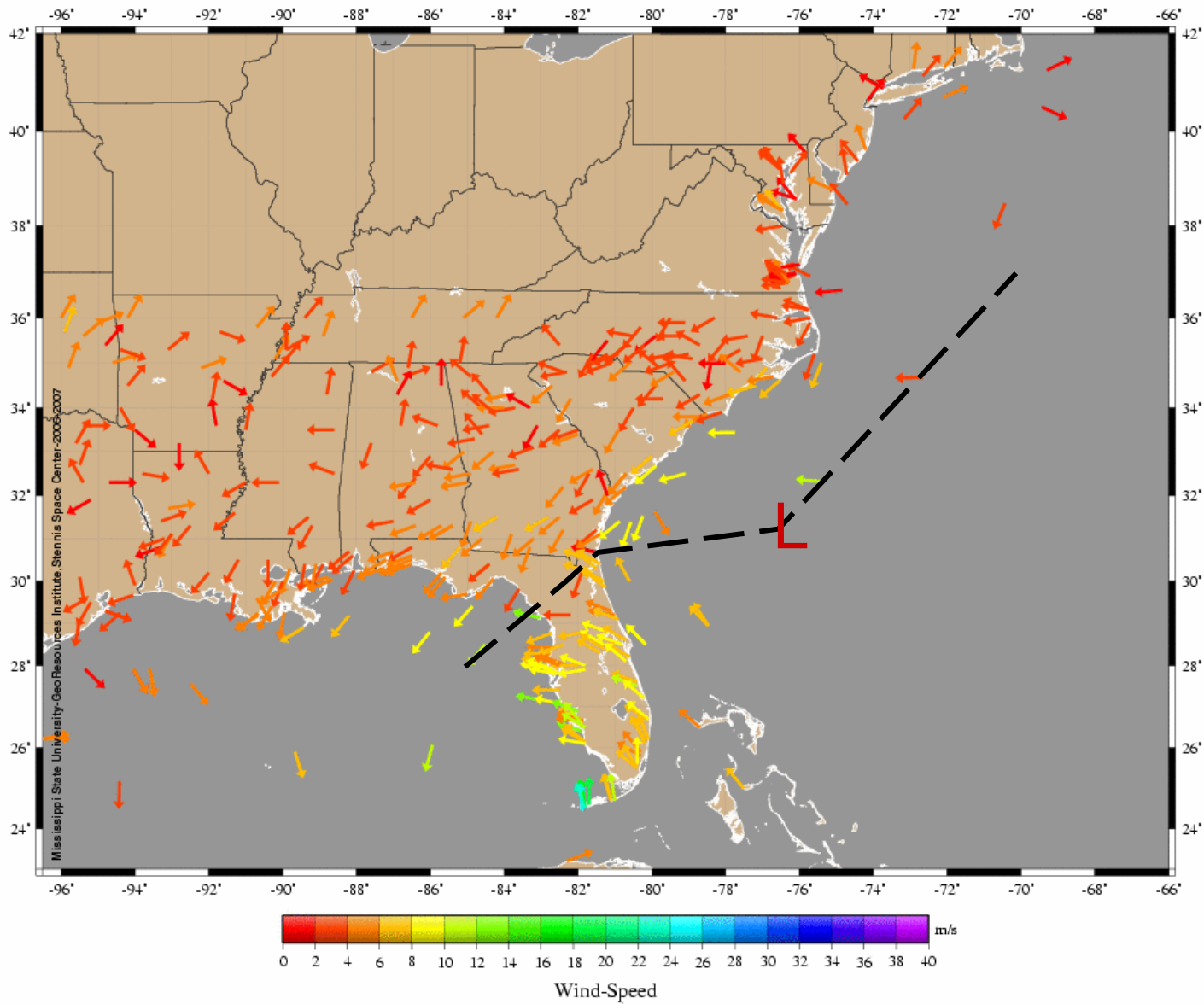
10M Wind (m/s) 00Z 27 MAY 2005



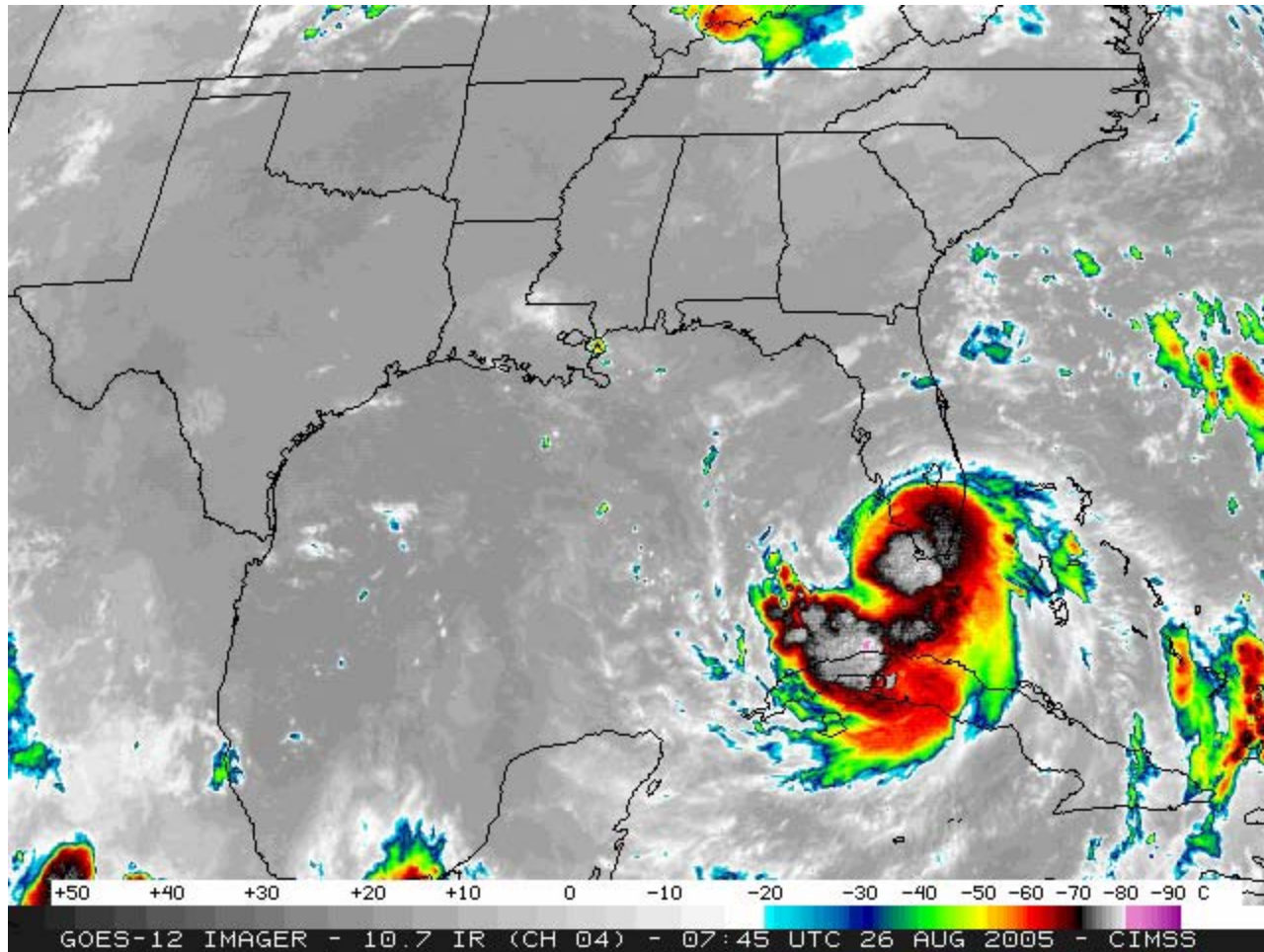
BUOY& SURFACE Data August 26 2005 00 hrs UTC
Wind Speed and Direction



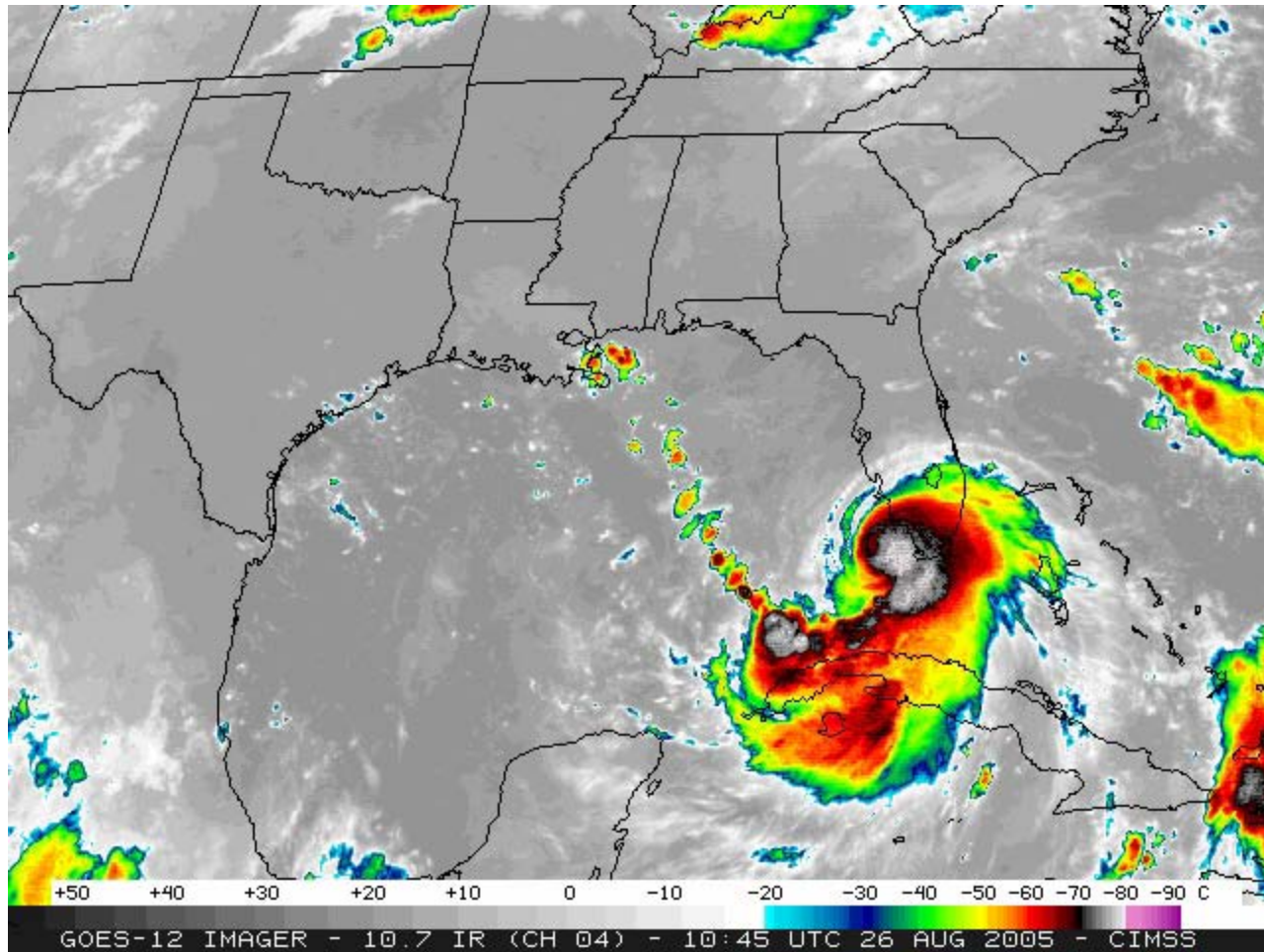
BUOY& SURFACE Data August 26 2005 18 hrs UTC
Wind Speed and Direction



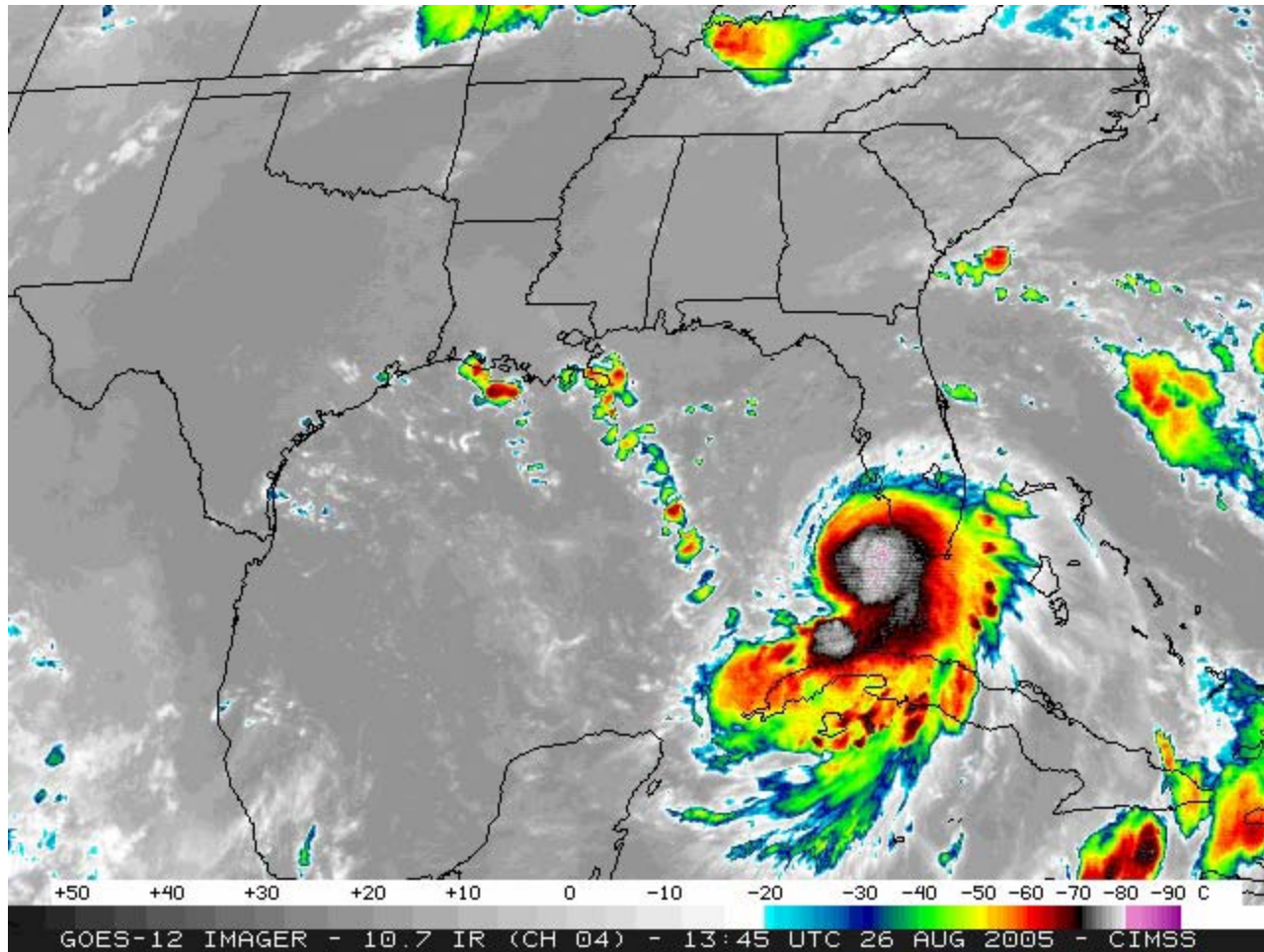
August 26, 08Z



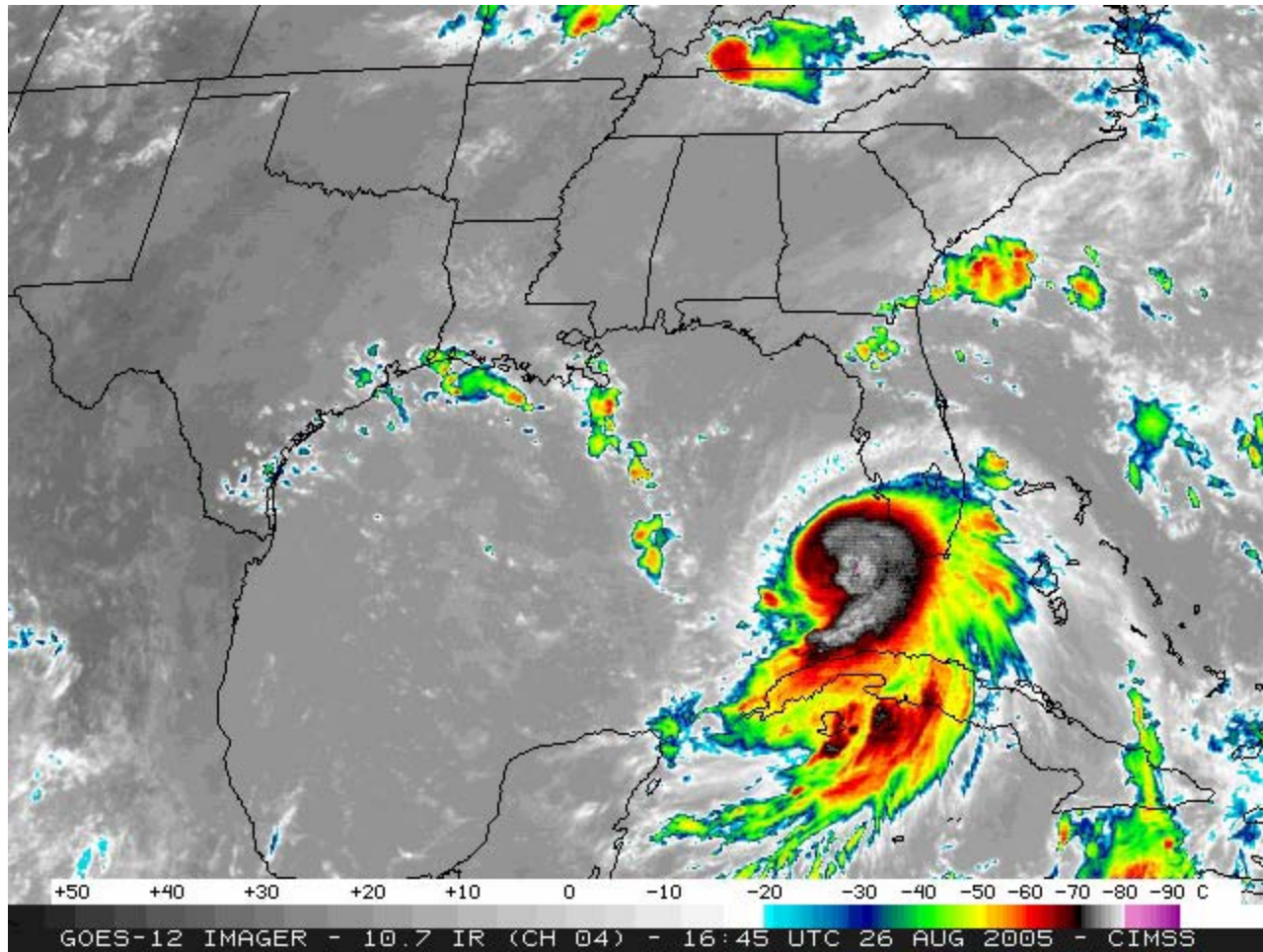
August 26, 11Z



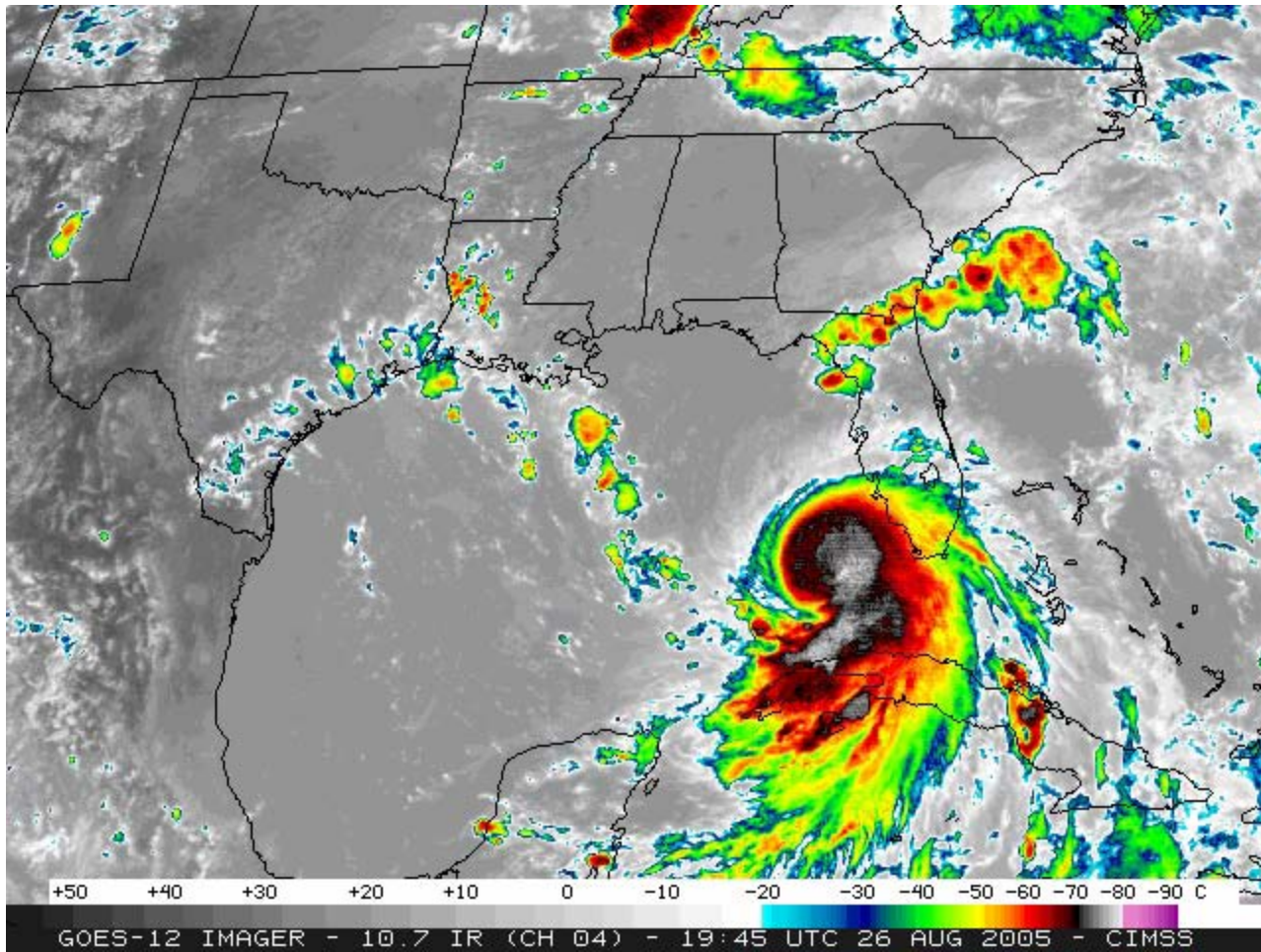
August 26, 14Z



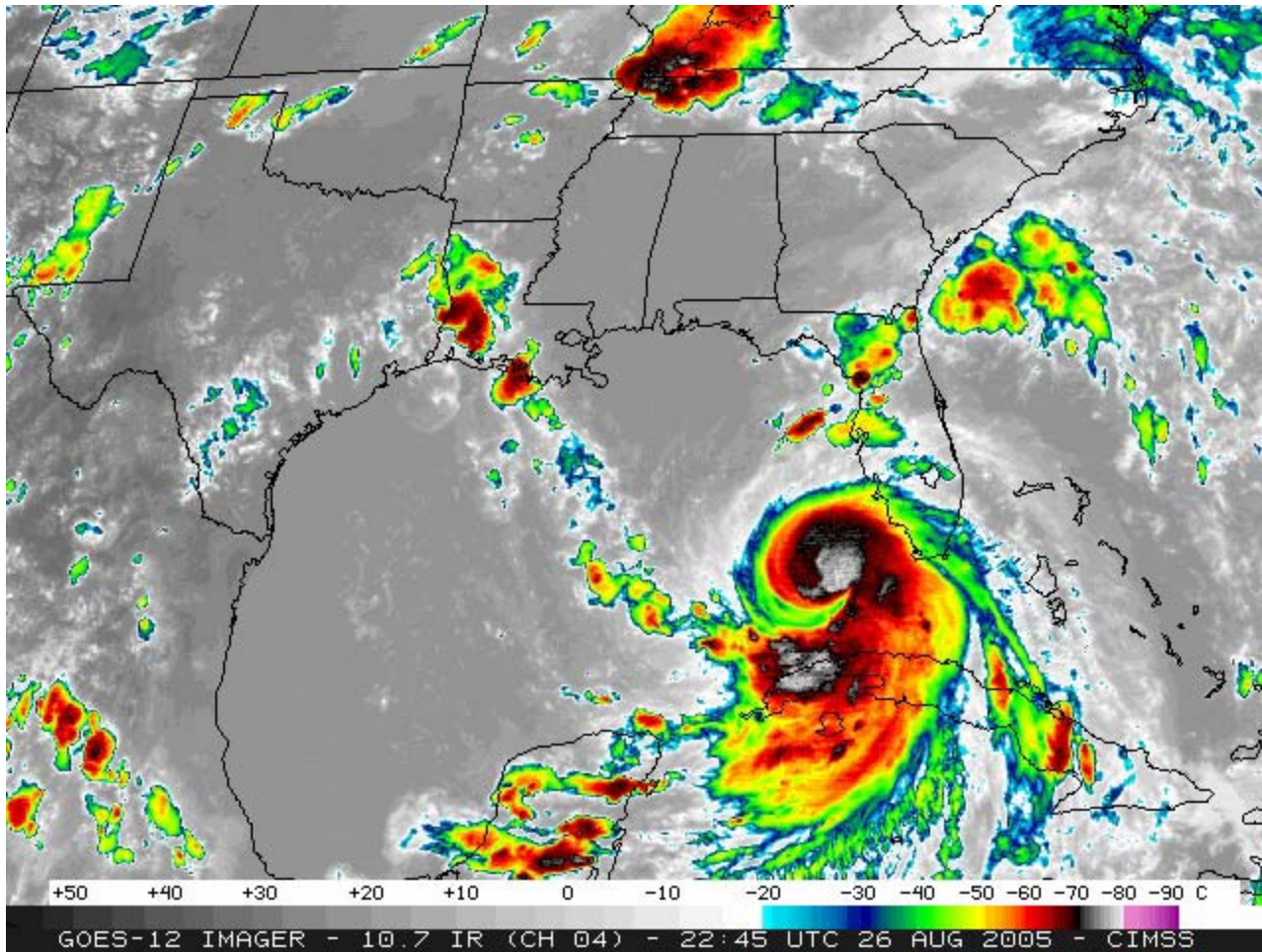
August 26, 17Z



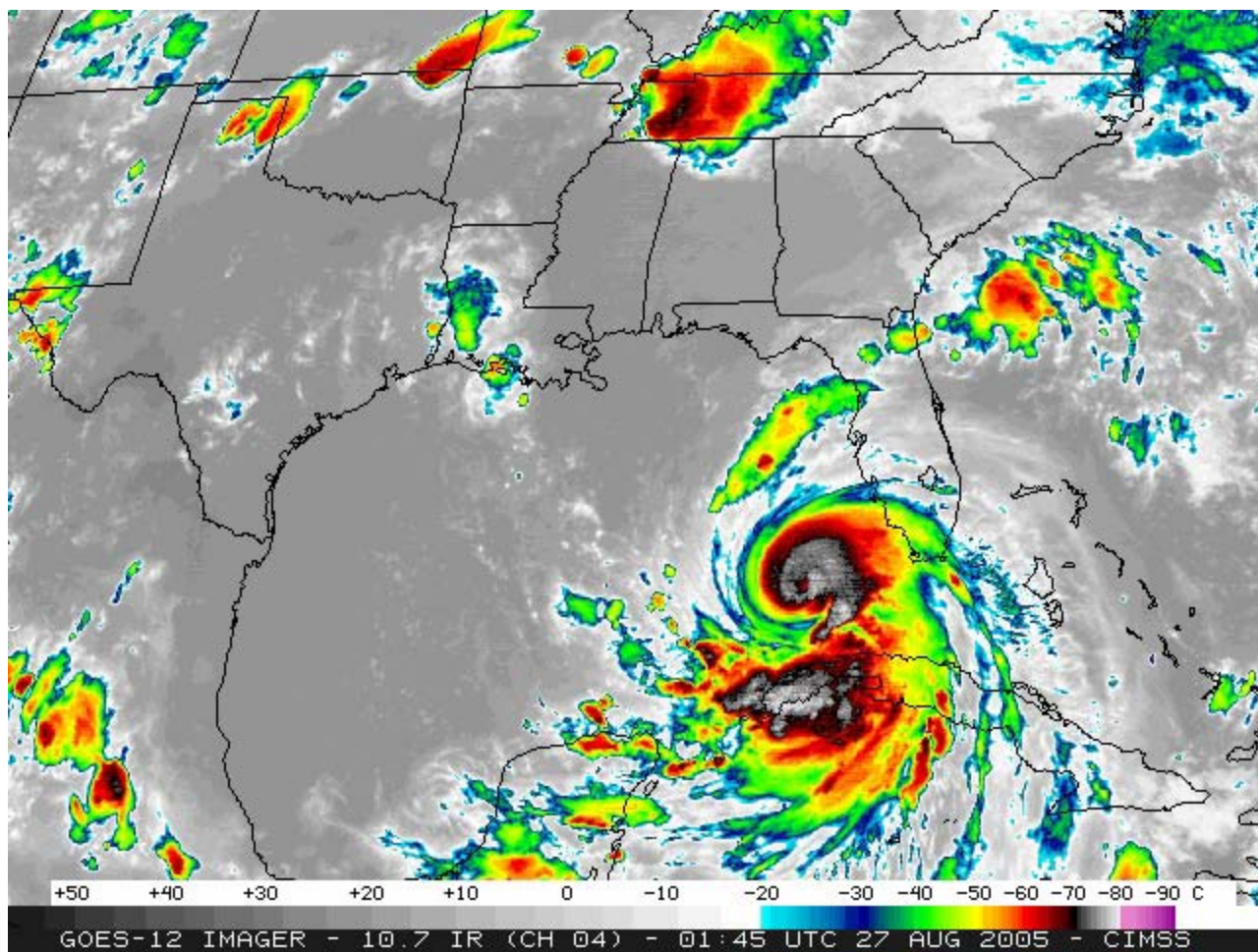
August 26, 20Z



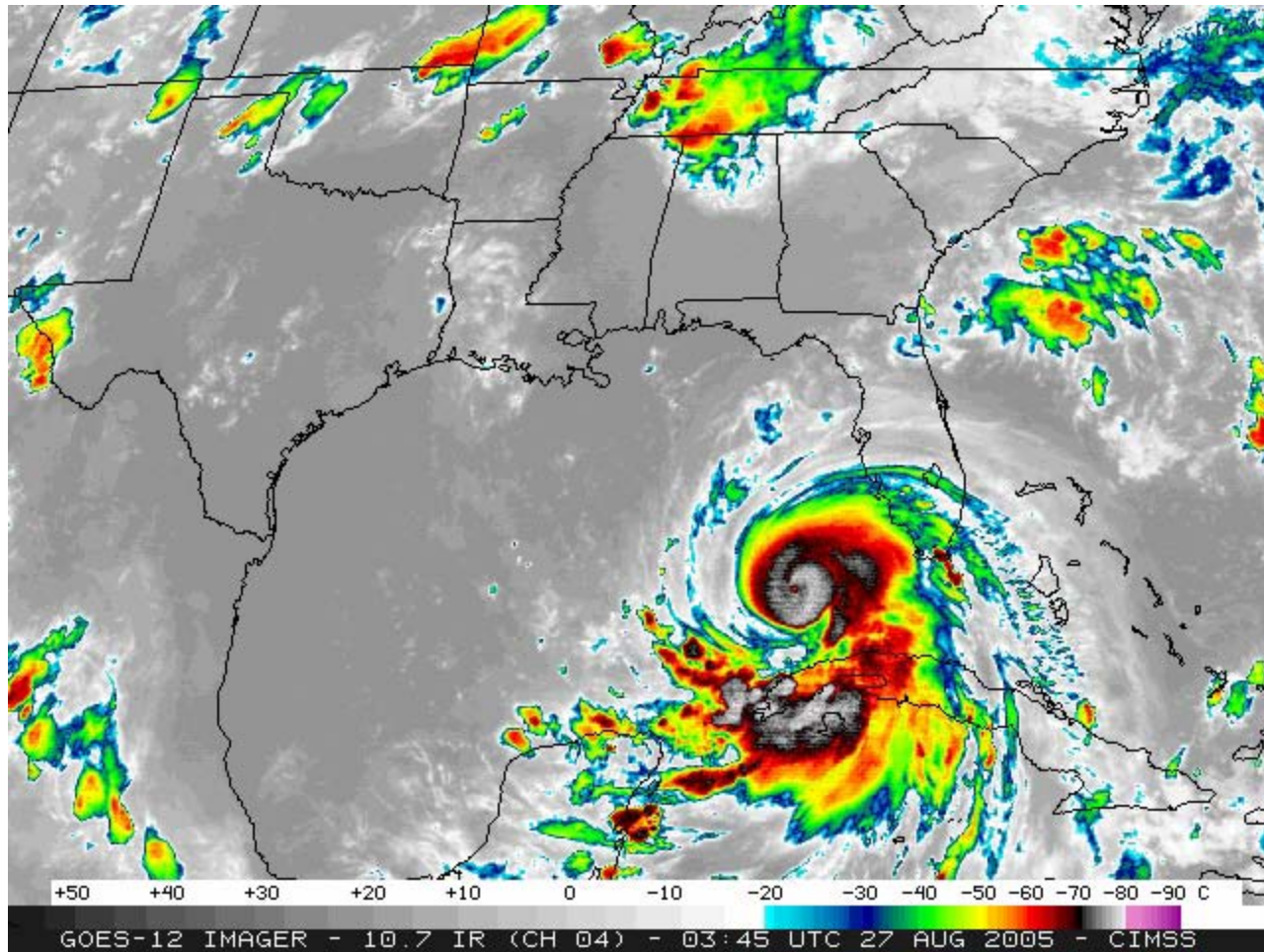
August 26, 23Z



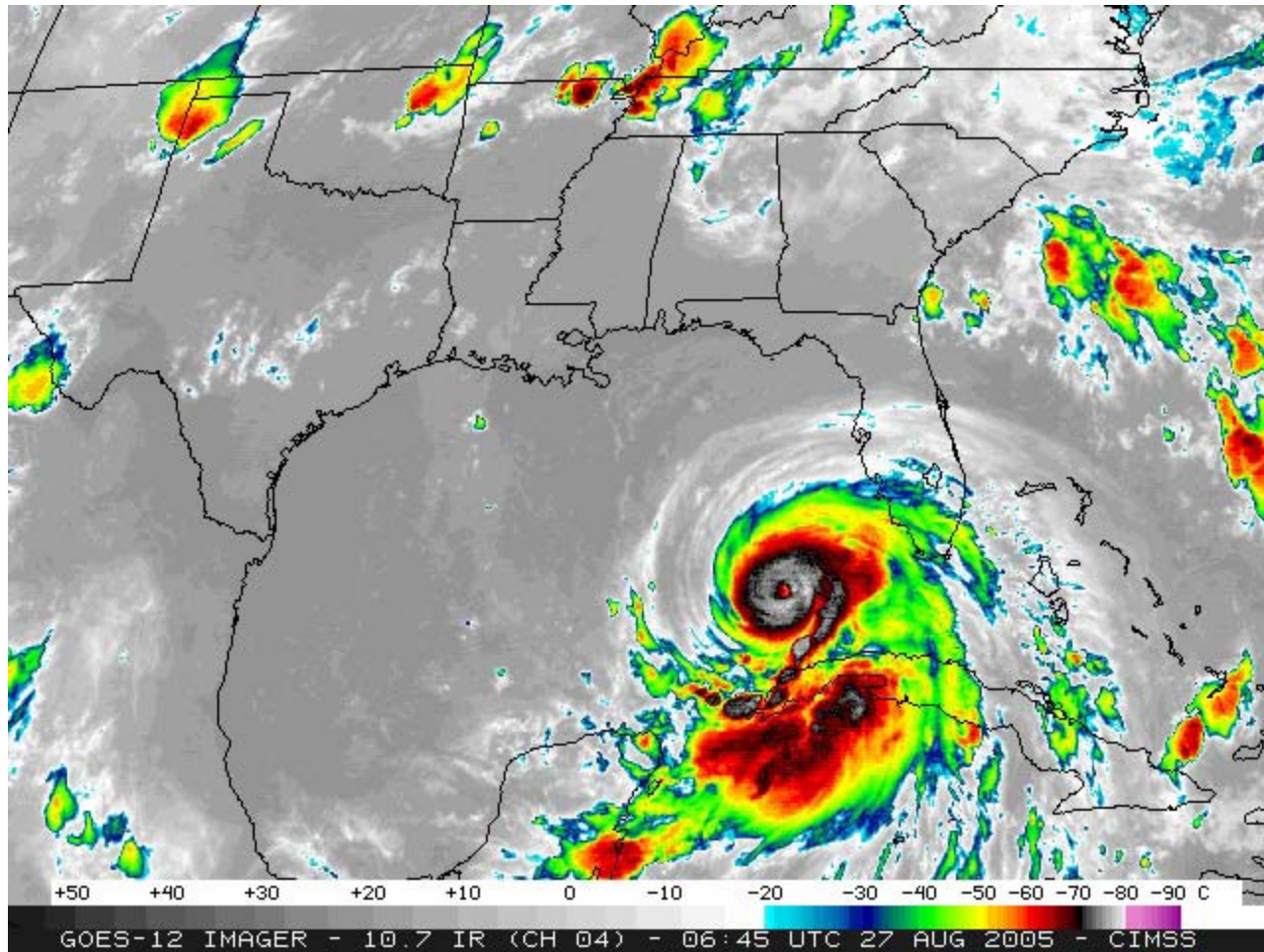
August 27, 02Z



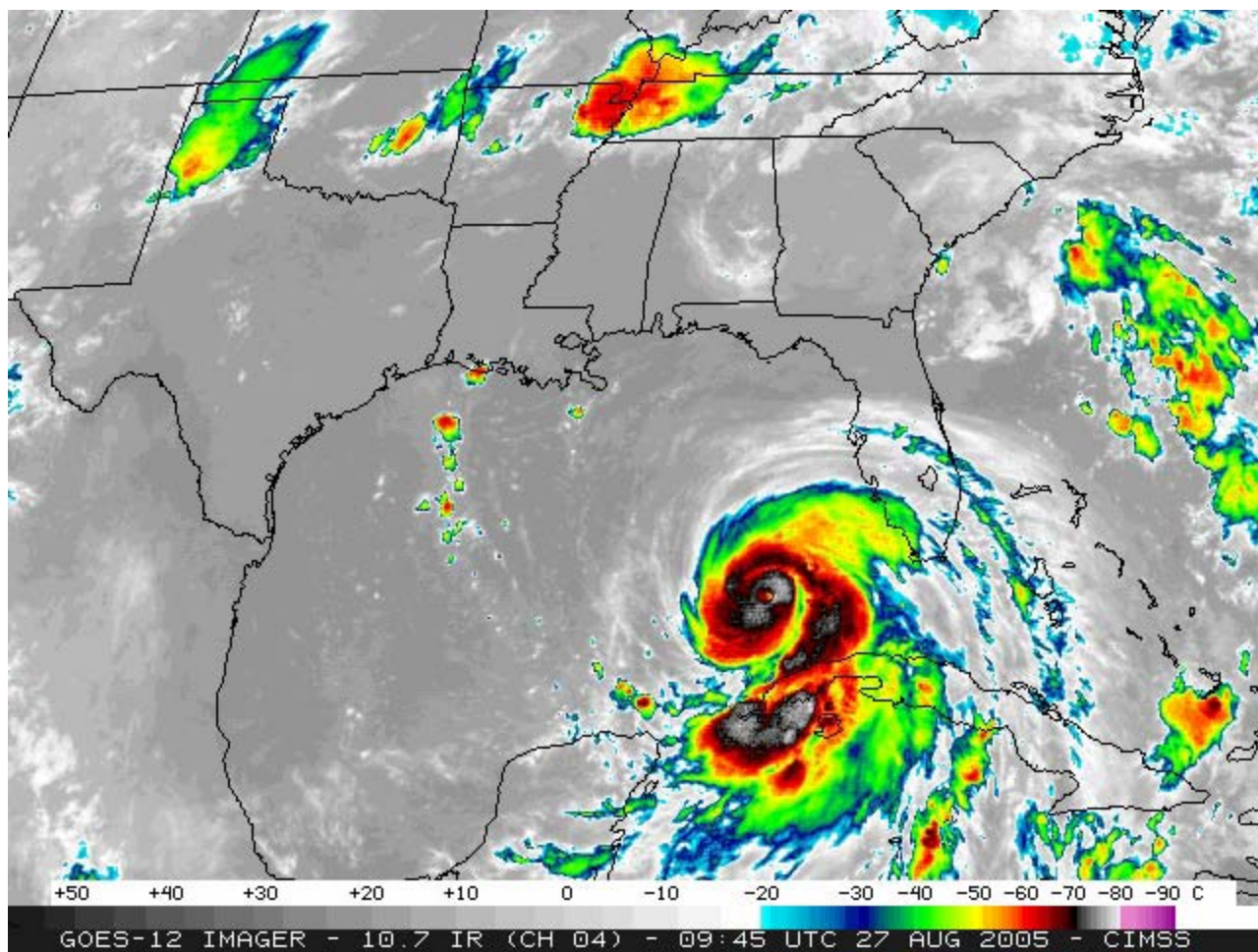
August 27, 04Z



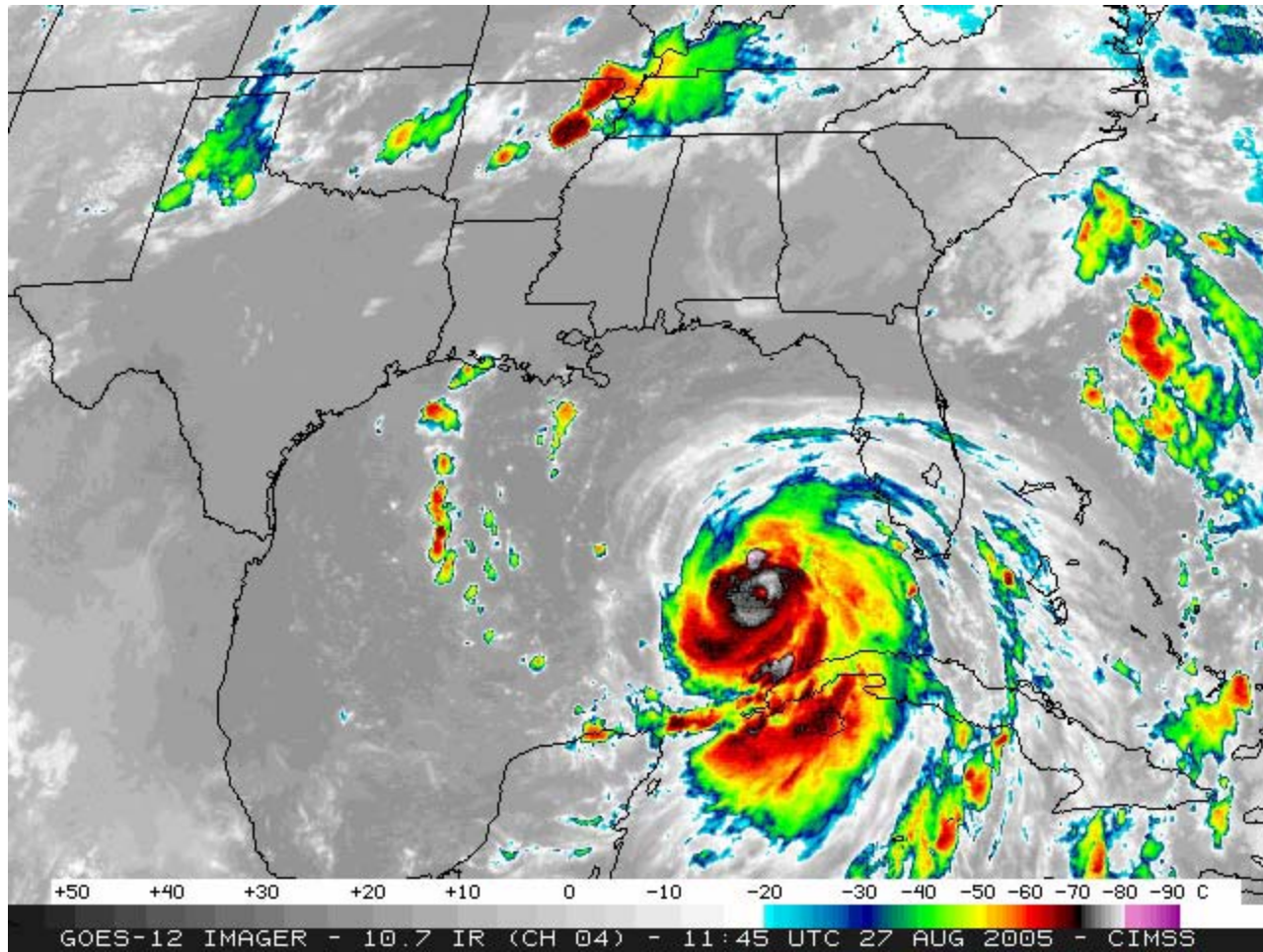
August 27, 07Z



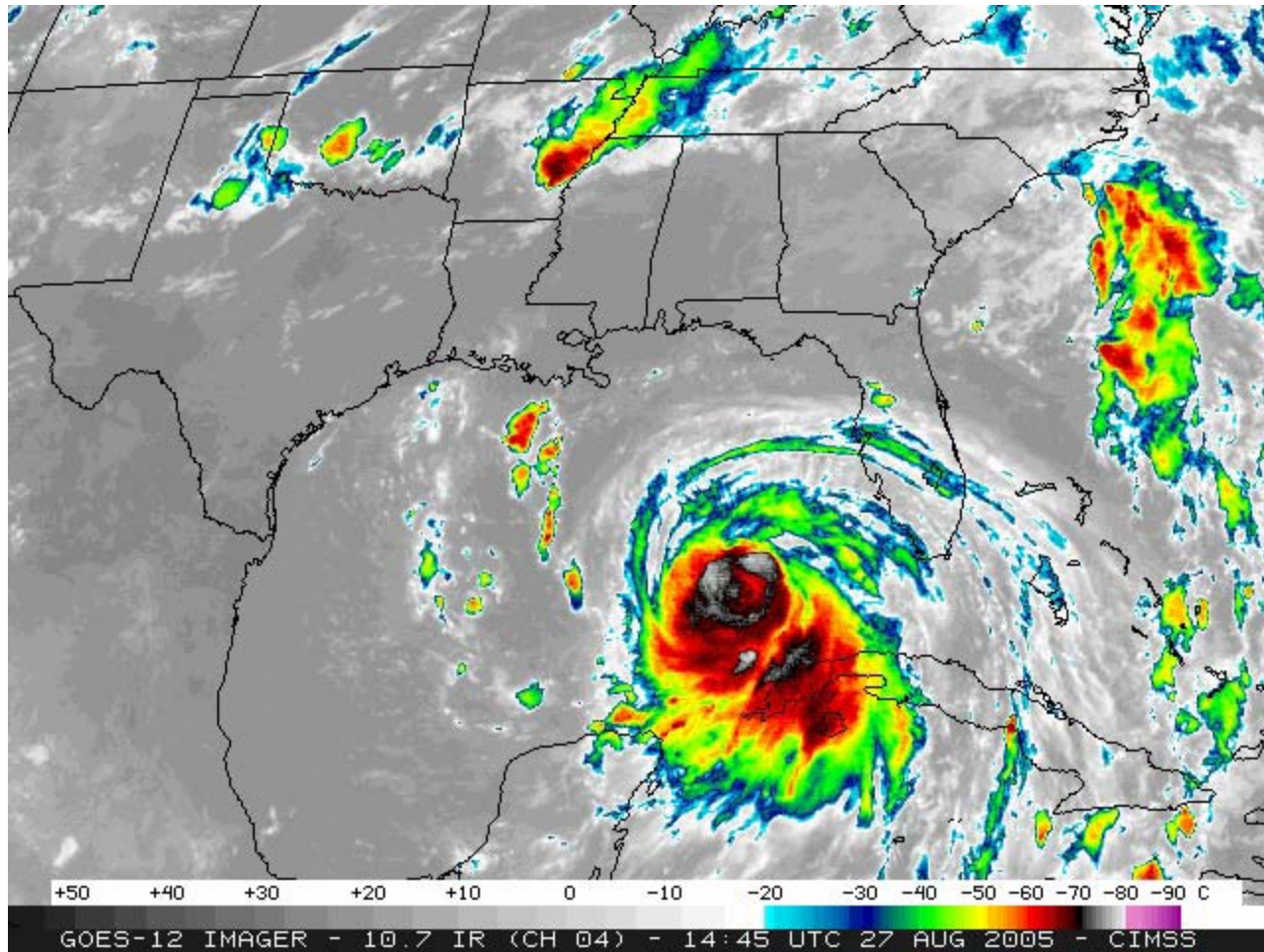
August 27, 10Z



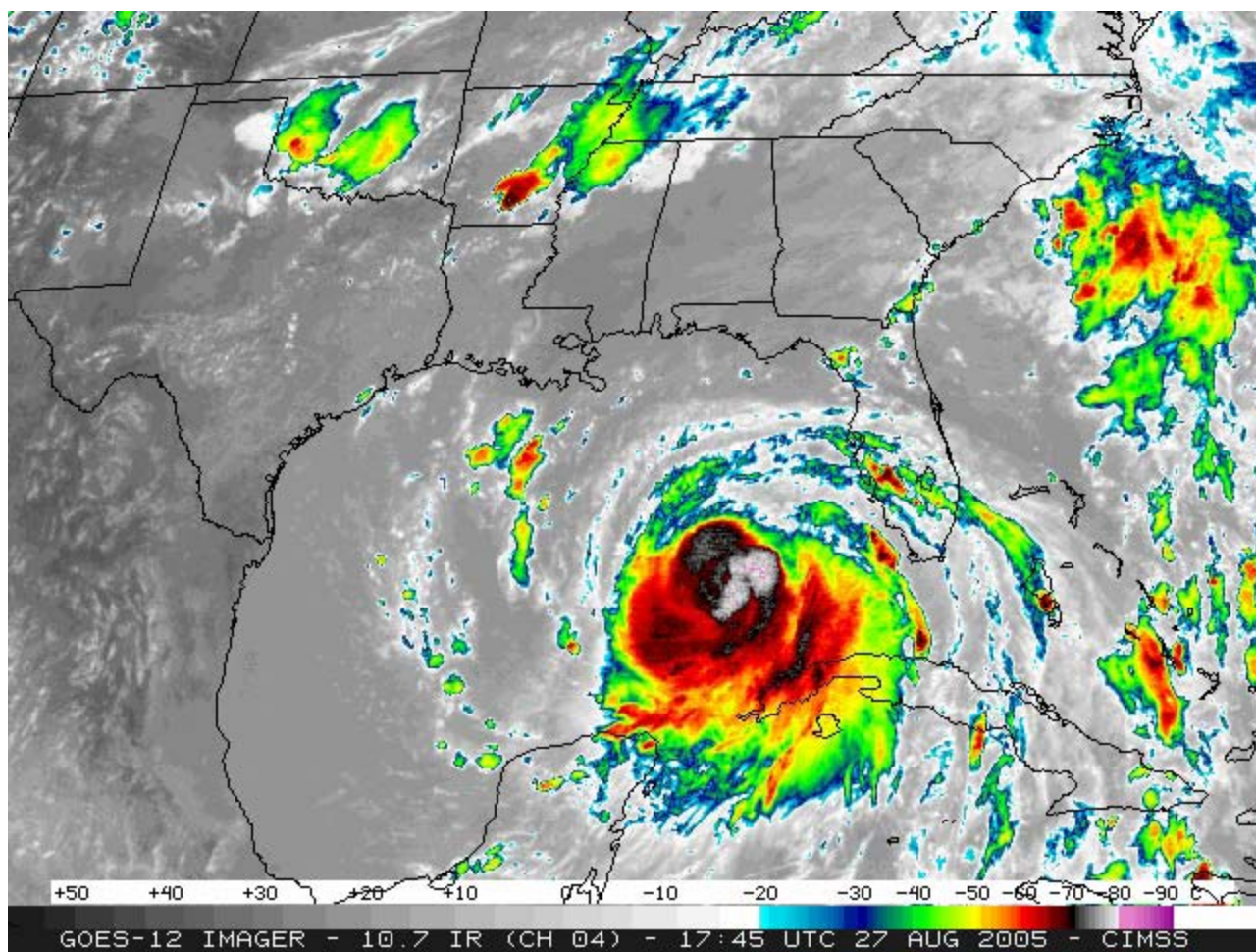
August 27, 12Z



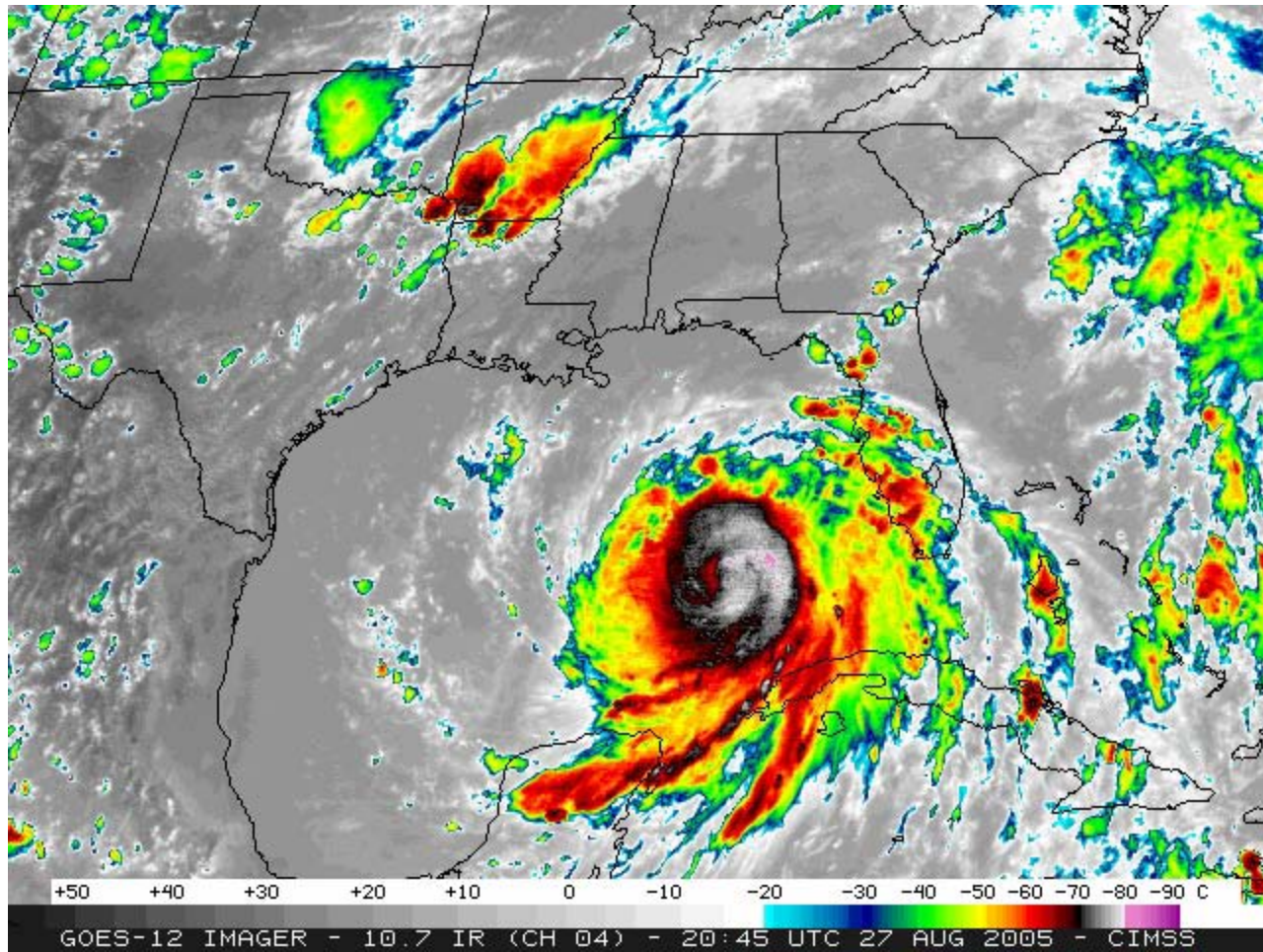
August 27, 15Z



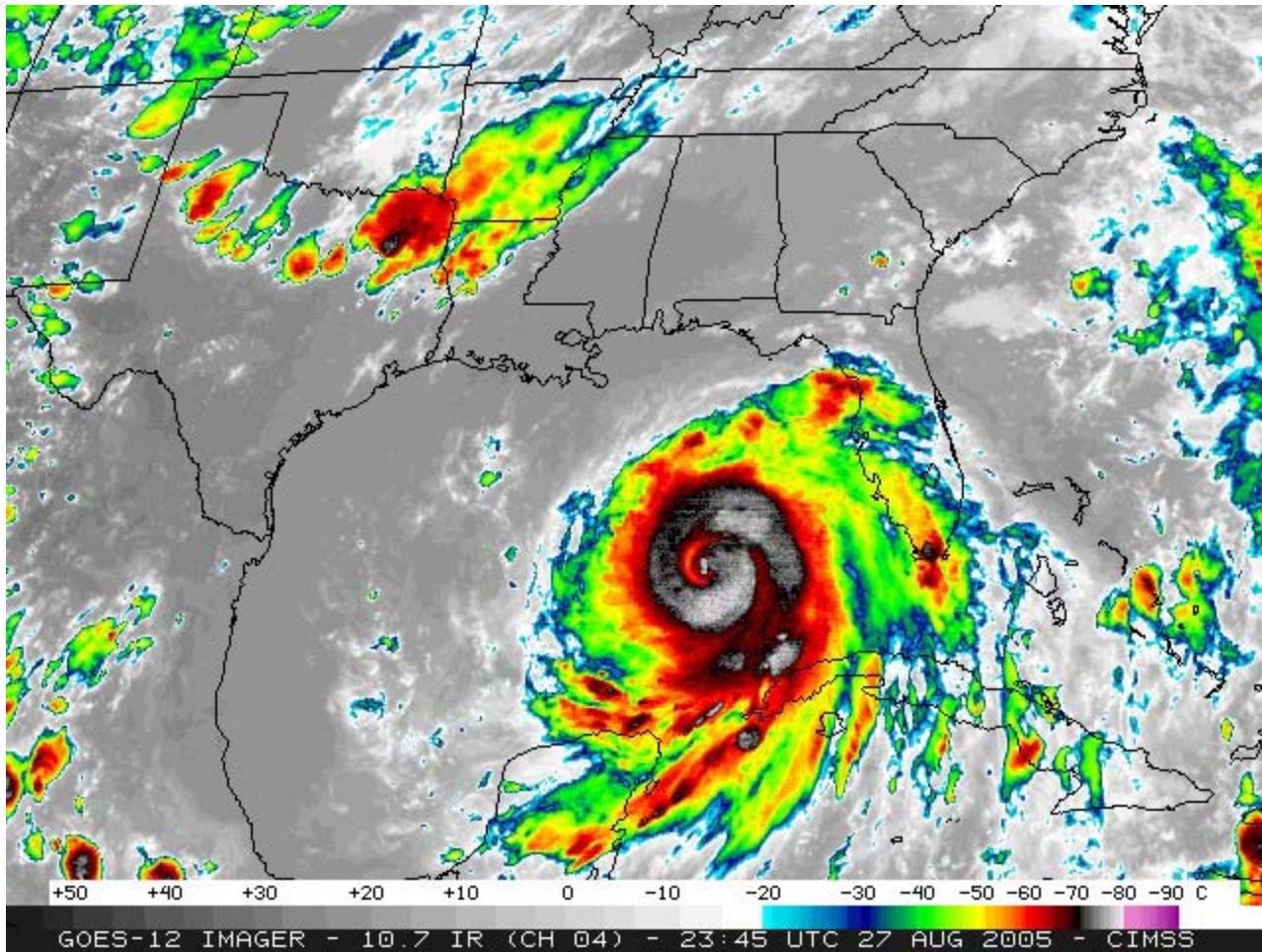
August 27, 18Z



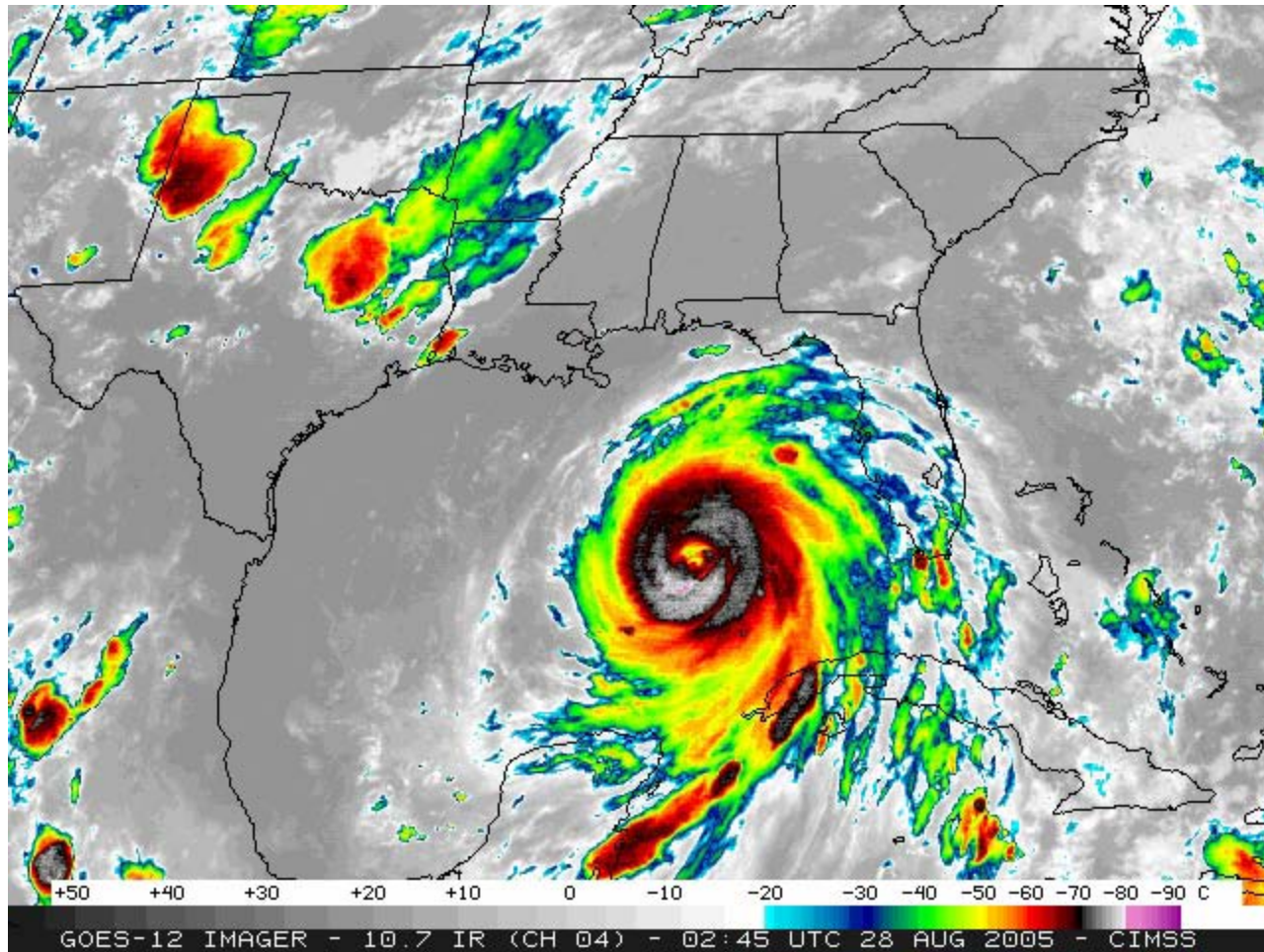
August 27, 21Z



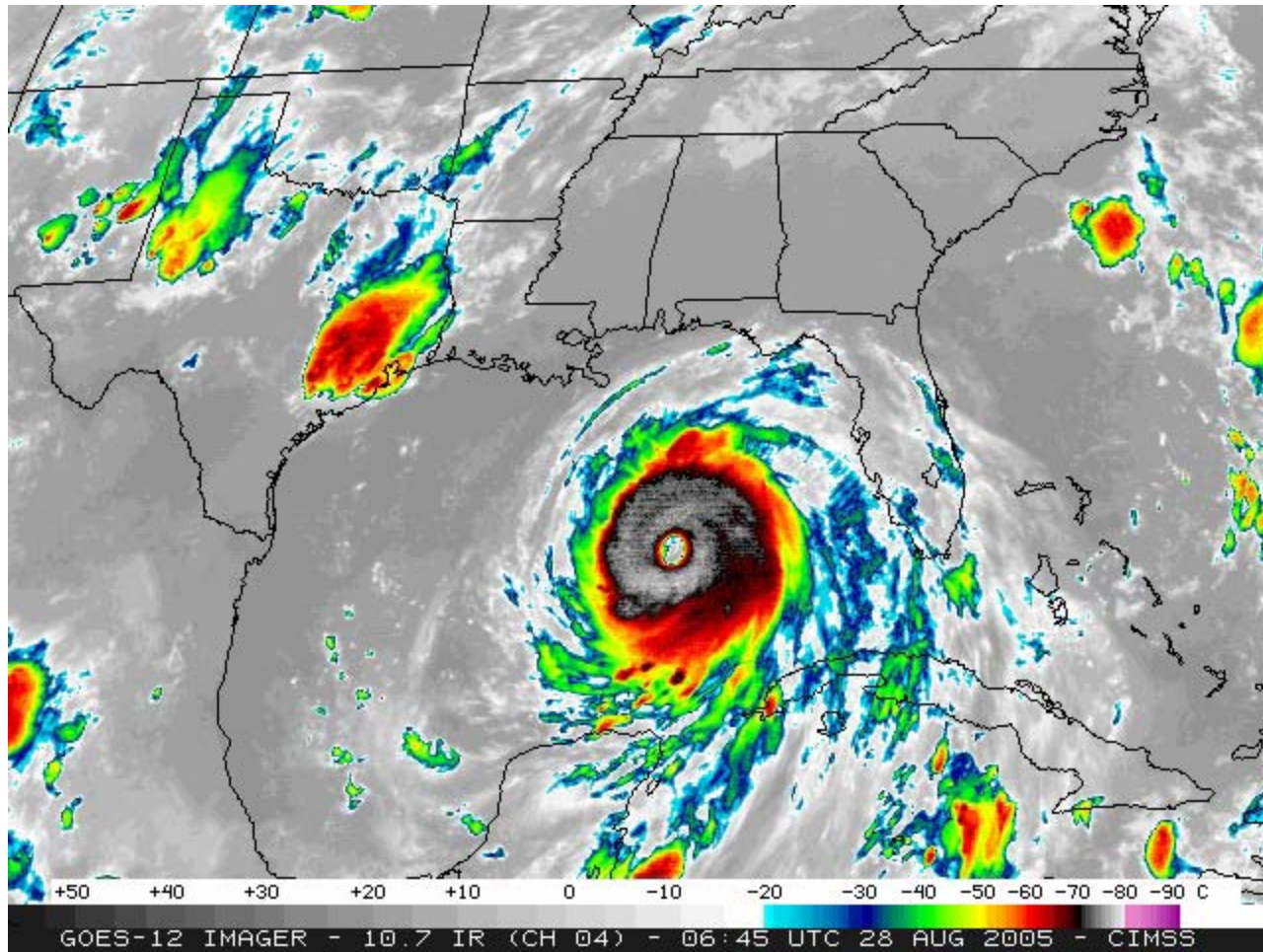
August 28, 00Z



August 28, 03Z

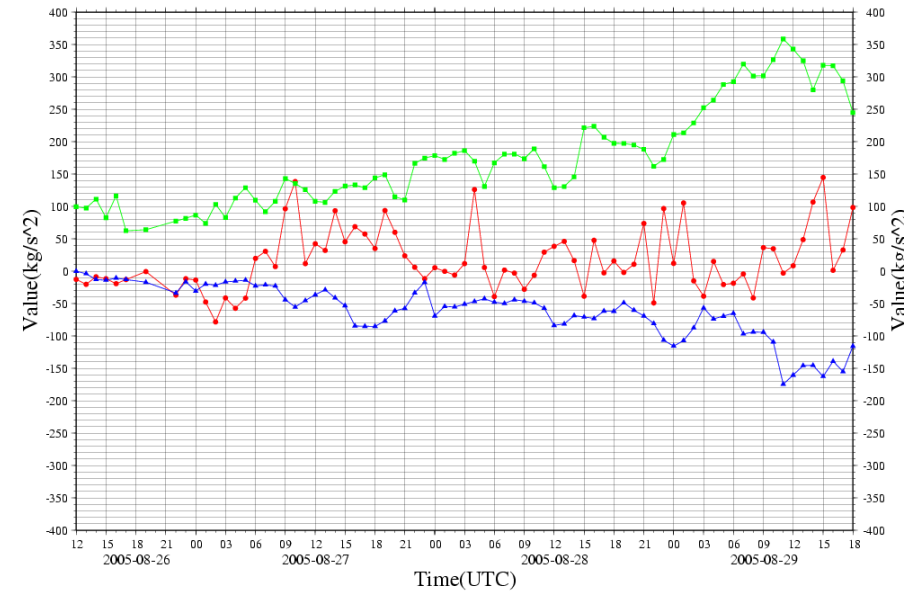
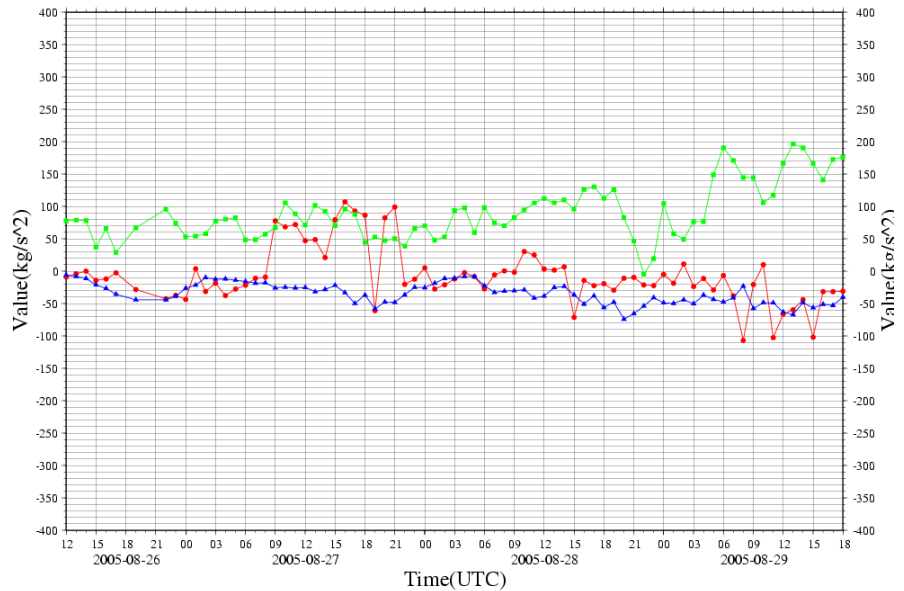
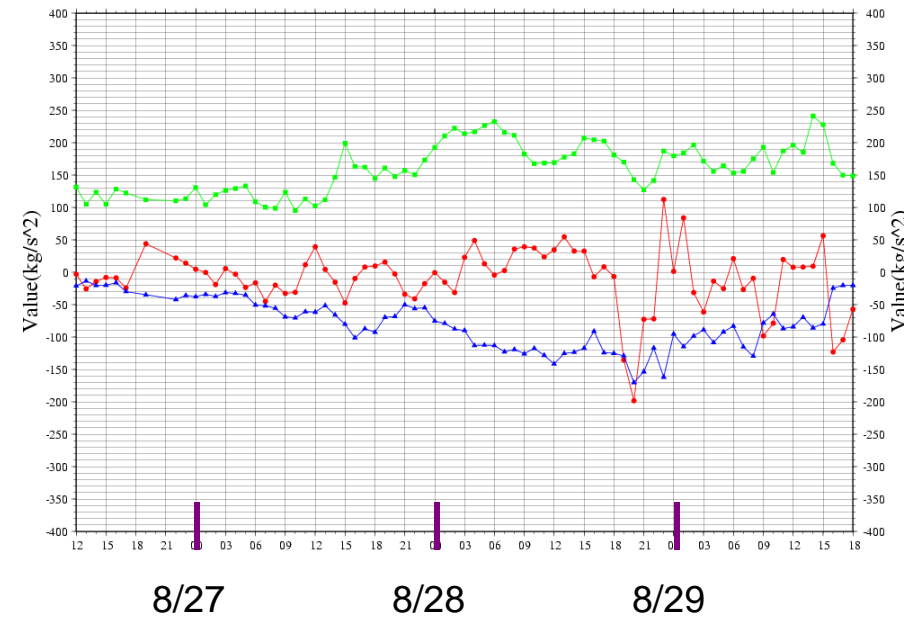
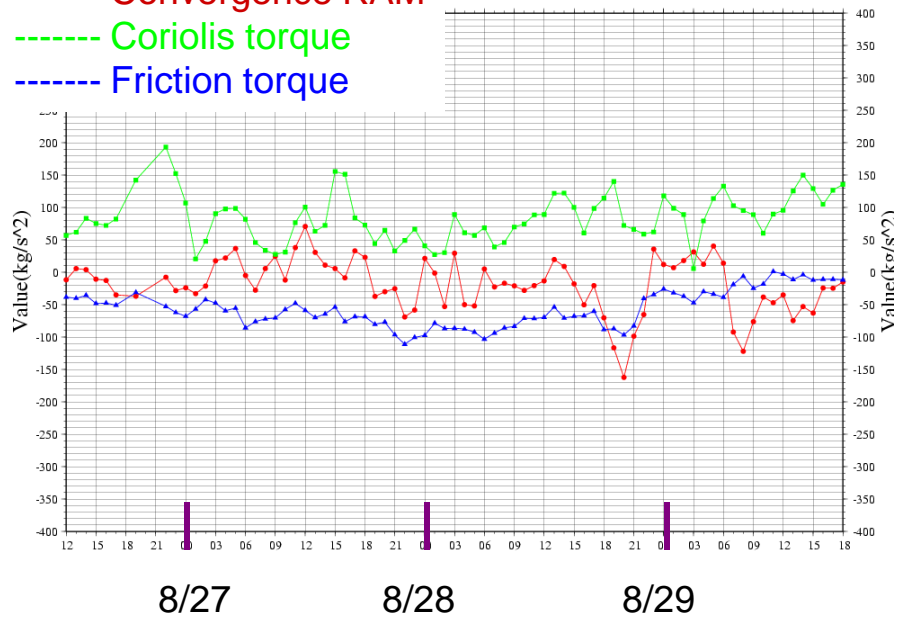


August 28, 07Z



Angular momentum budget by quadrant using RUC data, r=460 km

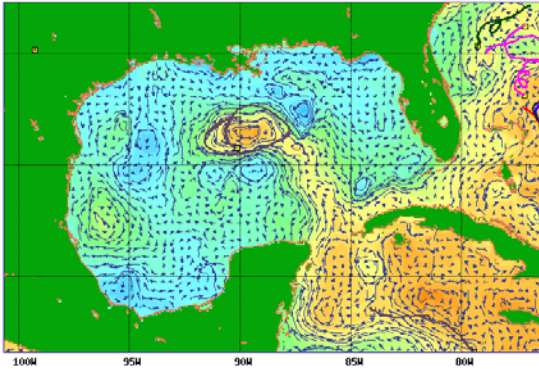
----- Convergence RAM
----- Coriolis torque
----- Friction torque



Interaction with loop current

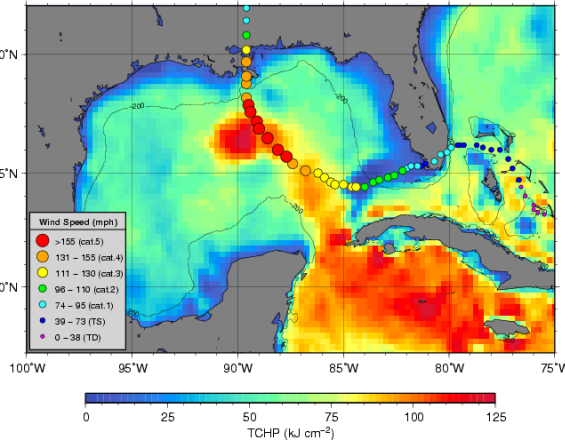
8/22/05

Gulf of Mexico - Dynamic height and geostrophic velocity 08/22/05



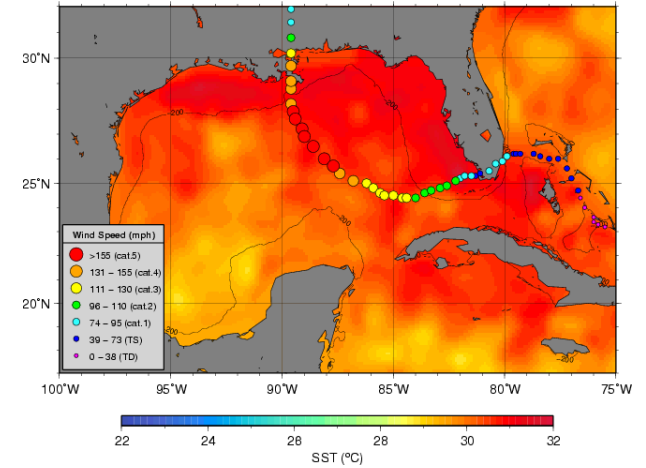
8/28/05

Gulf of Mexico - Tropical cyclone heat potential (TCHP) 08/28/2005

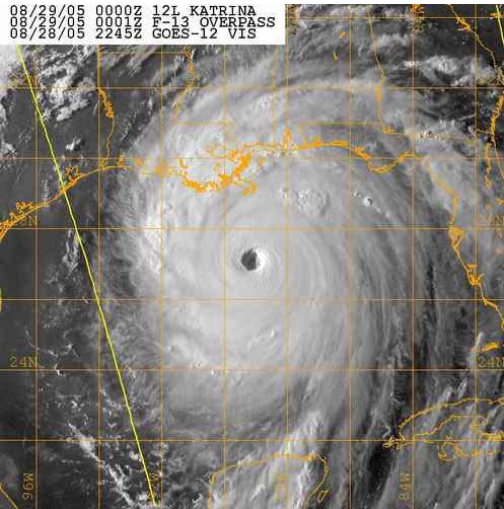


8/28/05

Gulf of Mexico - Sea surface temperature (SS I) 08/28/2005



8/28/05



8/30/05

8/31/05

III. Very Tentative Conclusions

- Convergence of RAM gave a possible kickstart on August 27th
- Coriolis torque provided continuous angular momentum throughout the period
- Overall, it appears two low-level jets, in combination with loop current interaction, contributed to the wind expansion
- A barotropic model simulation (not shown) shows Interaction with these jets, especially on the north side
- Some kind of merger process may have contributed to wind field expansion

Future plans include WRF modeling with sensitivity runs to test some of these ideas