Tropical GRIP Forecast Discussion for August 31, 2010

Created 1600 UTC August 31, 2010

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Summary: The DC-8 has a no-fly day today, after returning from 3 great consecutive missions into Earl. It appears that the DC-8 successfully captured the rapid intensification phase of Earl. It will be ramping up for missions again Wednesday and possibly Thursday afternoon. The Global Hawk is being tasked to fly tomorrow and Thursday over the storm, and the WB-57 may be able to fly its first mission into Earl on Wednesday, due to mechanical issues with the plane that delayed science missions. So while no GRIP aircraft are currently flying, Wednesday and Thursday should be active days for flights of all three aircraft. Earl is a powerful category 4 hurricane and may be near its peak intensity. Earl's track will bring it north off the coast of the Bahamas and toward the Carolinas before recurving out to sea. Following in Earl's wake, Tropical Storm Fiona was declared so after a GV flight by PREDICT yesterday found tropical storm force winds, skipping the TD stage altogether. The models are still fairly divided on the track and intensity forecast for Fiona, with some models developing it and others barely analyzing it. Fiona is definitively having interaction with outflow from Earl, and as a much weaker and smaller storm, its development may indeed by hindered by Earl, if not eventually being absorbed into Earl later on. The powerful SAL dry air has been interacting with all of these systems recently, and with a classic-looking AEW season, it should continue to do so for some time. AL98/PGI-38L has better convective bursts today with it, but so far the models are not developing this system, and the NHC lists it as having a ten percent chance of formation. As PGI-39L begins to enter the Atlantic from the African coast, we see that the Atlantic Basin should remain fairly active for the near future.

Forecast for 1600 UTC 8/31/2010:

Synoptic Overview:

The surface analysis at 0600 UTC (**S1**) shows only a few changes from yesterday. High pressure over the eastern U.S. has edged southward to the Carolinas and intensified to 1025 mb. Virtually the entire East Coast now is dominated by high pressure. The mid Atlantic high is a bit weaker than yesterday (now 1020 mb). Danielle has transitioned to extratropical status and is located in the mid Atlantic between the two highs.

The IR image at 1245 UTC (**S3**) shows the tropical features of interest—Major Hurricane Earl northeast of Hispaniola, TS Fiona (PGI36) east of the Lesser Antilles, PGI38 southwest of Cape Verde, and PGI39 along the coast of Africa. Each of these systems is discussed in details in the sections that follow. Visible imagery (**S2**) also shows the excellent outflow associated with Earl and Fiona in the cloud features surrounding both systems as well.

The 700 mb parameters (**S7**) show well defined easterlies in the tropics. However, the orientation of the easterly jet seems to have changed slightly. The new orientation.is a

bit more east southeast to west northwest. The surface anticyclones, as well as the central Atlantic trough, mentioned earlier are well defined at 700 mb.

Water vapor imagery with upper level winds (**C1**) shows that the strong Gulf of Mexico anticyclonic flow of previous days has become weaker today. Earl exhibits strong upper level outflow (**E1, E2**), and some heads southward near the leading edge of TS Fiona (**F1, F2**). Although Fiona exhibits weak outflow, it is not well defined and certainly is being influenced by Earl. The interplay between Earl and Fiona will be interesting to monitor (**F2**). AL98/PGI-38L exhibits no discernable outflow, and its convection is very limited this morning (**98A**).

The analysis of precipitable water (**S3**) shows few changes from yesterday. Mid latitude drier air, subsidence, and Saharan outflow produce large areas of dry air. The Gulf of Mexico and the area of tropical systems continue to be moist. However, the eastern portion of the moist region is more narrow than previously. The southbound outflow from Earl has produced a strip of somewhat drier air between Earl and Fiona that may affect the development of Fiona. Most of PGI38 is in a region of moist air; however, SAL air is impinging its northern periphery (**S5**). This must be monitored carefully.

In agreement with the TPW analysis, the SAL aerosols are shown extending well over the middle Atlantic (**S5**). It is beginning to wrap around Fiona and is on the northern side of PGI38.

Features of Interest:

Hurricane Earl:

As of 1100 UTC on 8/31, Hurricane Earl was a category 4 storm with a minimum central pressure of 931 hPa. Maximum sustained winds were reported at 115 kts. The center of Earl was located at 67.2W/20.7N (**E1, E2**). Earl's eye is currently not visible, however 85 GHz microwave imagery from 0900 UTC suggests that the eye is still closed and symmetrical. Ridging over the Mid-Atlantic States is creating northerly flow in the near western environment of the storm (**E3**). Due to this, outflow from Earl is mostly to the north, northeast and south of the storm (**C1**). Sea surface temperatures are quite warm near 30 C, and the area within the storm's cloud shield is currently very moist. An AIRS pass occurred at 0530 UTC this morning and showed RH values over 60% at both 700 and 500 hPa surrounding the main cloud shield (**D1, D2**). Outside of this near envelope however, the atmosphere dries out quickly. Soundings show huge dewpoint depressions, especially to the south and to the east (toward Fiona) of Earl (**D3**). Interestingly, there is extreme cape in most of the near cloud-shield soundings (See 500 hPa RH from AIRS with overlaid soundings valid at 0550 UTC, **D1**). Possibly due to this increased CAPE, lightning has been frequent inside the cloud shield of Earl (**S6**). The environment factors listed above all suggest that Earl will continue to be a powerful hurricane in the near term. GFS forecasts vortex-adjusted shear to decrease over the next 24 hours and to remain low for 3-4 days. Dynamical and statistical-dynamical intensity forecast models expect Earl’s intensity to increase marginally over the next 24 hours, then to slowly decrease until it moves off the gulf stream on 9/4 (See model suite intensity guidance from 12 UTC on 8/31, **E5**). The gradual weakening of Earl will mostly be due to cooling

SSTs and a more shallow troposphere as it moves out of the tropics. Earl is expected to move along the US East Coast, with possible tropical storm force winds along Cape Hatteras, NC in the early morning on Friday 9/3, and in Cape Cod and eastern New England overnight and into early morning on Saturday 9/4 (See model track guidance from 12 UTC on 8/31, **E4**).

The following is the GFS forecast position of MSLP in Earl for the next 120 hours: 9/1 @ 0000 UTC: 68W/21N; 9/1 @ 1200 UTC: 70W/22.5N; 9/2 @ 0000 UTC: 72W/25N; 9/2 @ 1200 UTC: 74W/28N; 9/3 @ 0000 UTC: 75W/31N; 9/3 @ 1200: 75W/34N; 9/4 @ 0000 UTC: 73W/37N; 9/4 @ 1200 UTC: 70W/41N; 9/5 @ 0000 UTC: 65W/44N; 9/5 @ 1200 UTC: 60.5W/49.5N (extra-tropical).

The following is the ECMWF forecast position of MSLP in Earl for the next 120 hours: 9/1 @ 0000 UTC: 69W/22.5N; 9/2 @ 0000 UTC: 72W/27N; 9/3 @ 0000 UTC: 75W/33N; 9/4 @ 0000 UTC: 71W/39N; 9/5 @ 0000 UTC: 60.5W/49N (extra-tropical).

Tropical Storm Fiona:
Fiona looks fairly disorganized this morning with several areas of convection pulsating overnight on all sides of the storm (**F2**). GLD360 lightning data (**S6**) shows a very electrified environment during these pulses, but again, there is no organization; the lightning bursts are occurring on all sides of the storm. It is hard to pick out a center from visible satellite imagery (**F1**), but microwave imagery gives a better indication, and NHC has analyzed it at 15.8N/54.4W as of 1200Z. There is some decent outflow on the western side of the storm, though, which suggests that some future organization and intensification is not out of the question. At 1200Z, the initial intensity from NHC is 35kt.

Fiona is on the southwest side of the subtropical ridge and moving rapidly to the WNW (**S1**). This motion should continue for the next 24-36 hours. After that, the model track guidance is in good agreement through 48 hours that Fiona will encounter the same weakness in the subtropical ridge that Earl will encounter, and Fiona will turn more to the NW (**F3**). Beyond 48 hours, the models are in general agreement on the track of the storm, but they diverge with respect to the forward speed. At this time, most of the guidance has Fiona getting close to, but not directly hitting any of the Leeward Islands (**F3**).

The intensity forecast for Fiona is a tricky one, as there are many factors in play. Currently, Fiona is over warm SSTs and low wind shear, which would be favorable for intensification. But, Fiona is also moving very rapidly to the WNW and is currently getting closer to Hurricane Earl. It is entirely possible that outflow from Earl acts to shear Fiona, very similar to the way the outflow from Danielle interacted with Earl for a few days and prevented Earl from intensifying. The SHIPS intensity guidance seems to hint at this situation by forecasting wind shear to increase in 12 hours, which is about the time Fiona could be close enough to experience Earl's outflow. SHIPS shows shear decreasing in about 96 hours when Earl's influence should no longer be felt. It is important to note that SHIPS is based on the interpolated official forecast, which has

Fiona slowing down significantly by 72-96 hours, which is what allows for the separation from Earl and Earl's lessening effects on Fiona. If Fiona does not slow down as currently expected, vertical shear could be a hindrance to its development throughout its life cycle. Since the models disagree with respect to Fiona's forward speed (and thus the amount of time it will interact with Earl) it is no surprise that those models also show a wide spread regarding intensity. In fact, the GFS, which has been fairly reliable so far this season, dissipates Fiona in 36 hours. The high side of the intensity envelope shows Fiona as a category 2 hurricane in 120 hours. But, the consensus keeps Fiona at tropical storm strength (**F4**). As such, our forecast calls for Fiona to potentially intensify a little bit through 96 hours, but still remain a tropical storm during this time.

AL98/PGI-38L:
PGI-38L (Invest 98L) is centrally located near 10.6N/30.2W. There was a decent convective burst overnight near an apparent center; however that convection has weakened and perhaps left that center exposed (**98A**). Primarily the vorticity in the disturbance is connected to ambient east-west elongated ITCZ vorticity (**98A**). Deep layer vertical wind shear is easterly at about 20kt over the disturbance (**C5, 98B**). Dry air is located to the north with an apparent SAL outbreak from the past few days. The model consensus is that this will be a non-developing wave; the consensus forecast track (**98C**) is as follows: 01/0100 UTC 32.8W/11.0N; 01/1300 UTC: 37.3W/11.5N; 02/0100 UTC: 39.6/12.0N; 02/1300 UTC: 40.0W/11.5N; 03/0100 UTC: 38.4W/13.2N; 03/1300 UTC: 39.4W/13.4N; 04/0100 UTC: 41.1W/13.4N; 04/1300UTC: 42.8W/13.2N.

PGI-39L:
PGI-39L is centrally located near 15.9W/12.5N (**39A, 39B**). Convection is located along the coast and is rather unimpressive (**39B**); mostly convection developing off the Guinea Highlands. The wave is still in the early stages; however the following is the consensus track (**39A, 39B**) for PGI-39L: 01/0200UTC: 16.8W/12.7N; 01/1400UTC: 17.9W/12.6N; 02/1400UTC: 18.0W/12.4N; 03/0200UTC: 19.2W/13.5N; 03/1400UTC: 21.7W/13.0N; 04/0200UTC: 24.1W/12.7N; 04/1400UTC: 26.2W/12.4N.

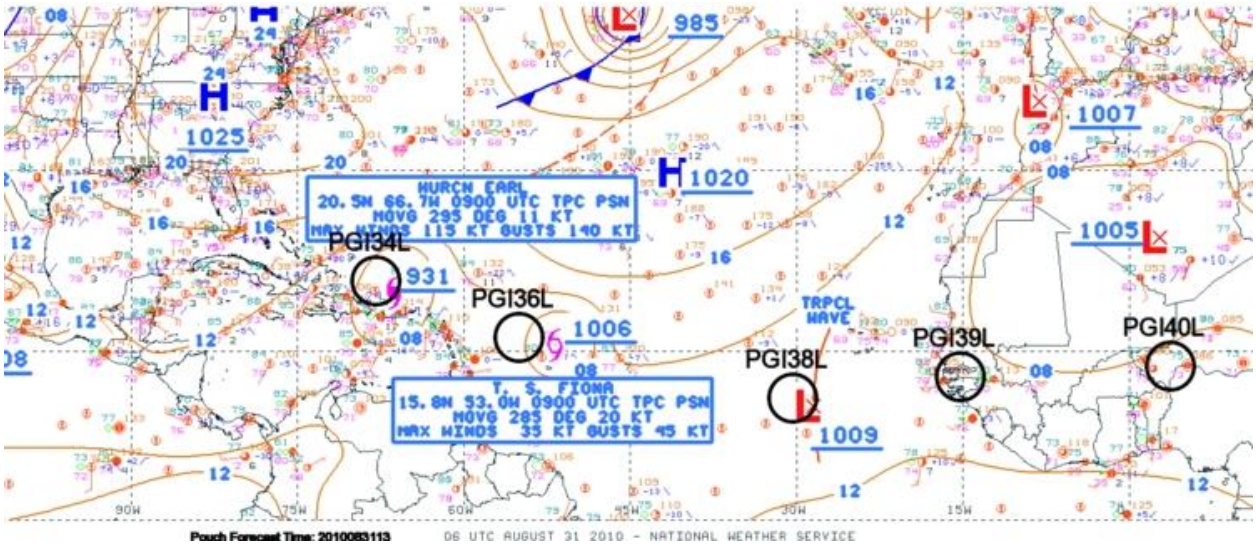
Dust/SAL Discussion:

On Sunday August 29, a large dust plume moved off the coast of northwestern Africa and over the Cape Verde islands. Aerosol Optical Depths in this plume have been well over 1.0. Also over the last 48 hours, the mid-Atlantic ridge has been building and moving westward (**S1**). This has caused a surge in low level northeasterly winds in the SAL region. These winds have driven the dust westward. MODIS imagery shows that there is a wedge in the dustiest air centered at 23W/22N. Enhanced easterlies due to the mid-Atlantic ridge have also advected more dust into the near environment of Fiona. Fiona's circulation has then transported some dustier air southward between 60W and 50W and between 20N and 10N (**S5**). GEOS-5 expects Fiona to be absorbed by the much more intense hurricane Earl over the next 72 hours. This is in good agreement with most other global models. After this, dust in the eastern near storm environment should trail Earl as it moves into the northwest Atlantic. The enhanced easterly flow over the Caribbean as Earl moves north should bring dust-laden air over the greater Antilles,

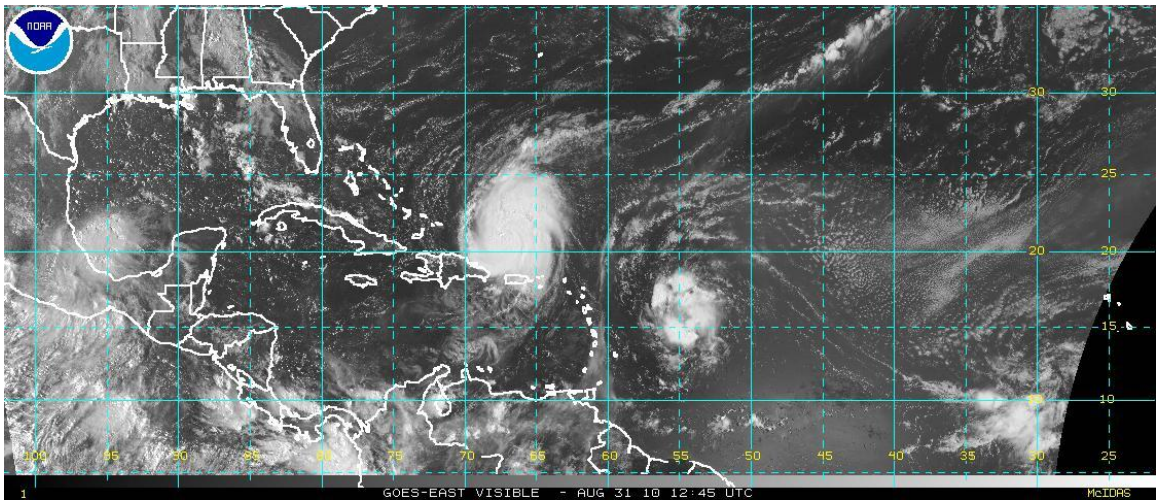
moving over Puerto Rico by 0600 UTC on 9/3 (See GEOS-5 forecast for dust AOT valid at 0000 UTC on 9/4, **D4**).

Images used in discussion:

S1



S2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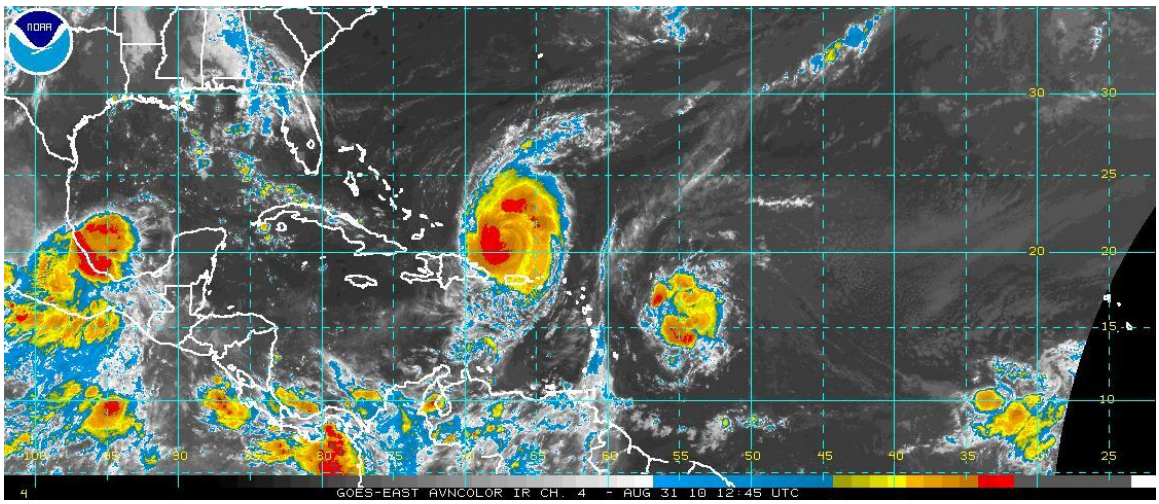
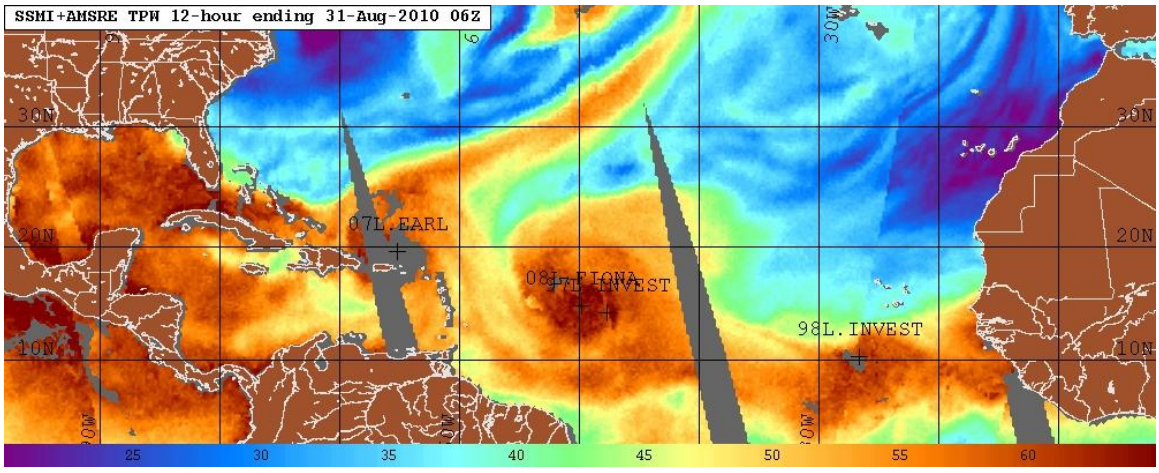
McIDAS

S3


GOES-EAST AVNCOLOR IR CH. 4 - AUG 31 10 12:45 UTC

S4


SSMI+AMSRE TPW 12-hour ending 31-Aug-2010 06Z
30N
20N
10N
07L.EARL
08L.FIONA
97L.INVEST
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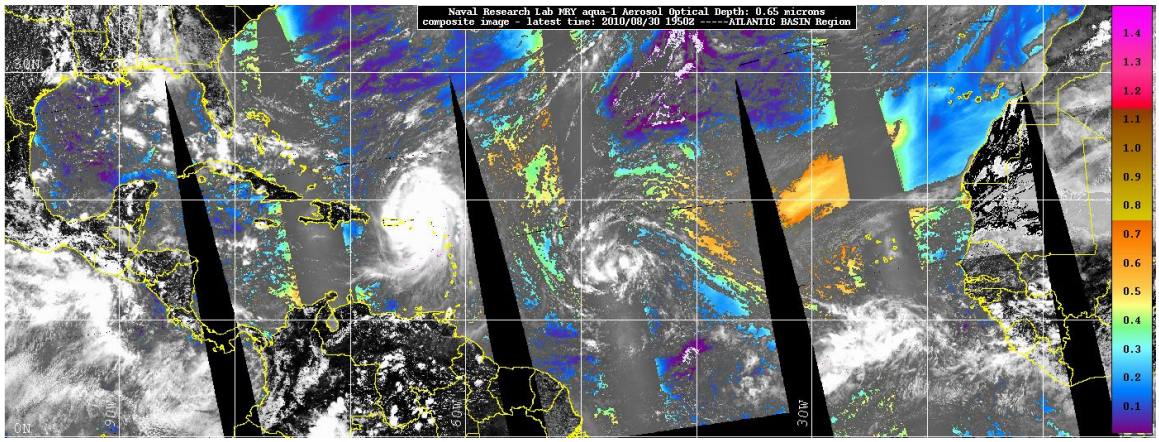
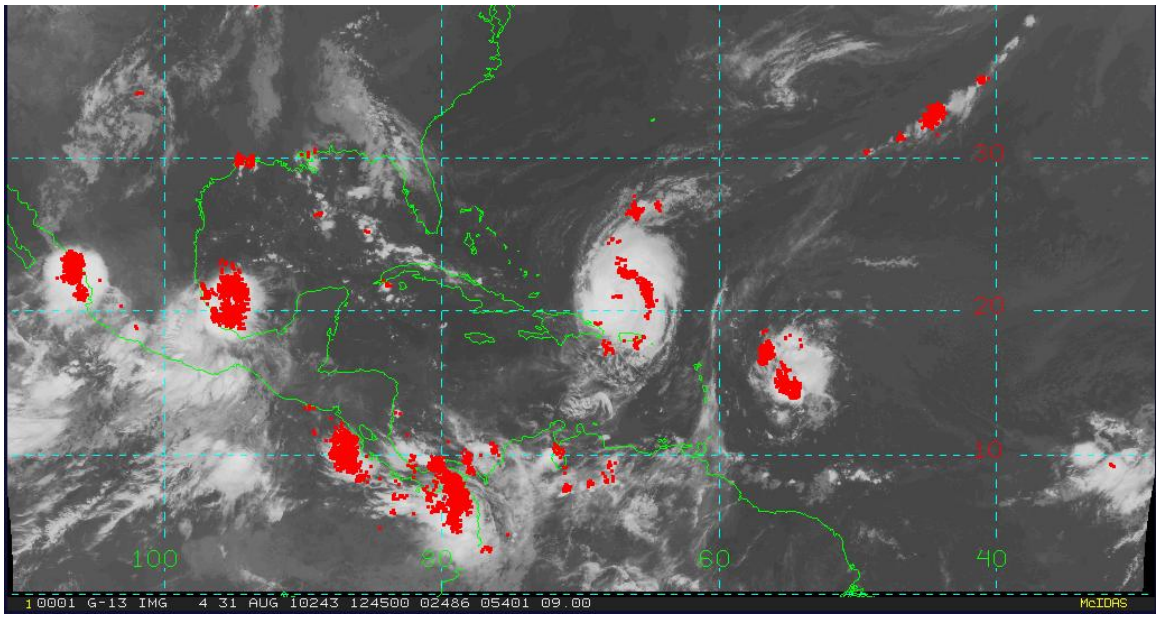
25
30
35
40
45
50
55
60

S5


Naval Research Lab MRY aqua-1 Aerosol Optical Depth: 0.65 microns
composite image - latest time: 2010/08/30 1950Z -----ATLANTIC BASIN Region
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1

S6


30
20
10
100
80
60
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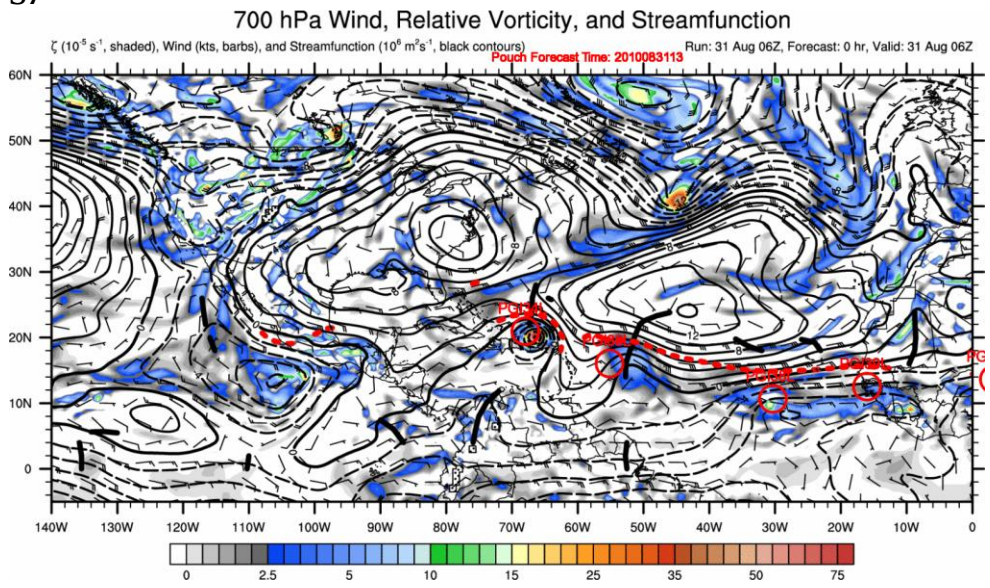
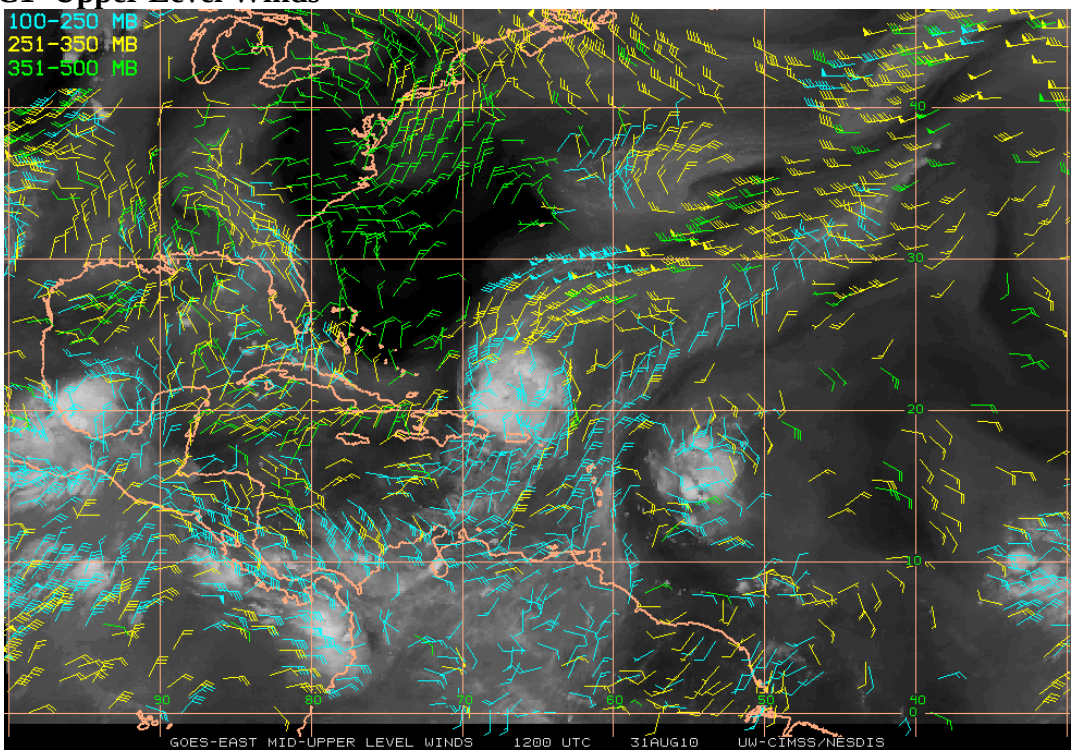
McIDAS

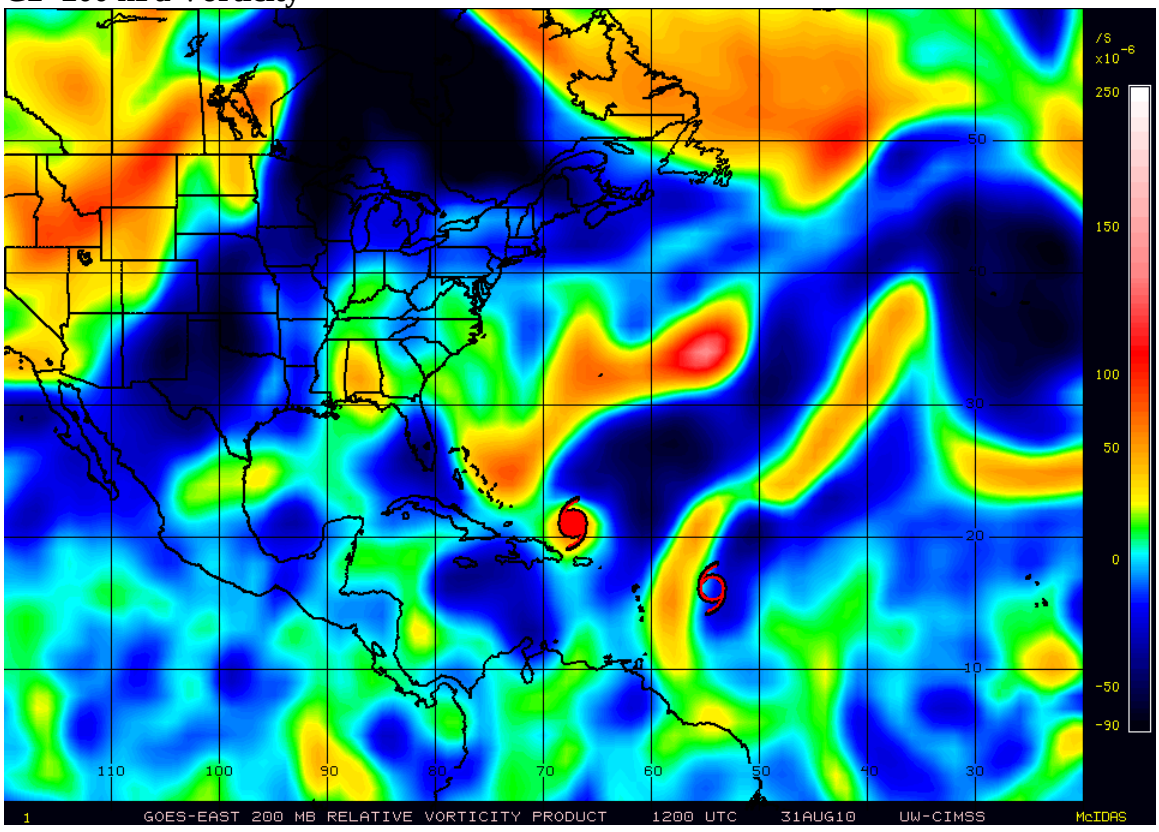
S7


700 hPa Wind, Relative Vorticity, and Streamfunction
ζ (10⁻⁵ s⁻¹, shaded), Wind (kts, barbs), and Streamfunction (10⁶ m²s⁻¹, black contours)
Run: 31 Aug 06Z, Forecast: 0 hr, Valid: 31 Aug 06Z
Pouch Forecast Time: 2010083113
60N
50N
40N
30N
20N
10N
0
140W
130W
120W
110W
100W
90W
80W
70W
60W
50W
40W
30W
20W
10W
0
0
2.5
5
10
15
25
35
50
75

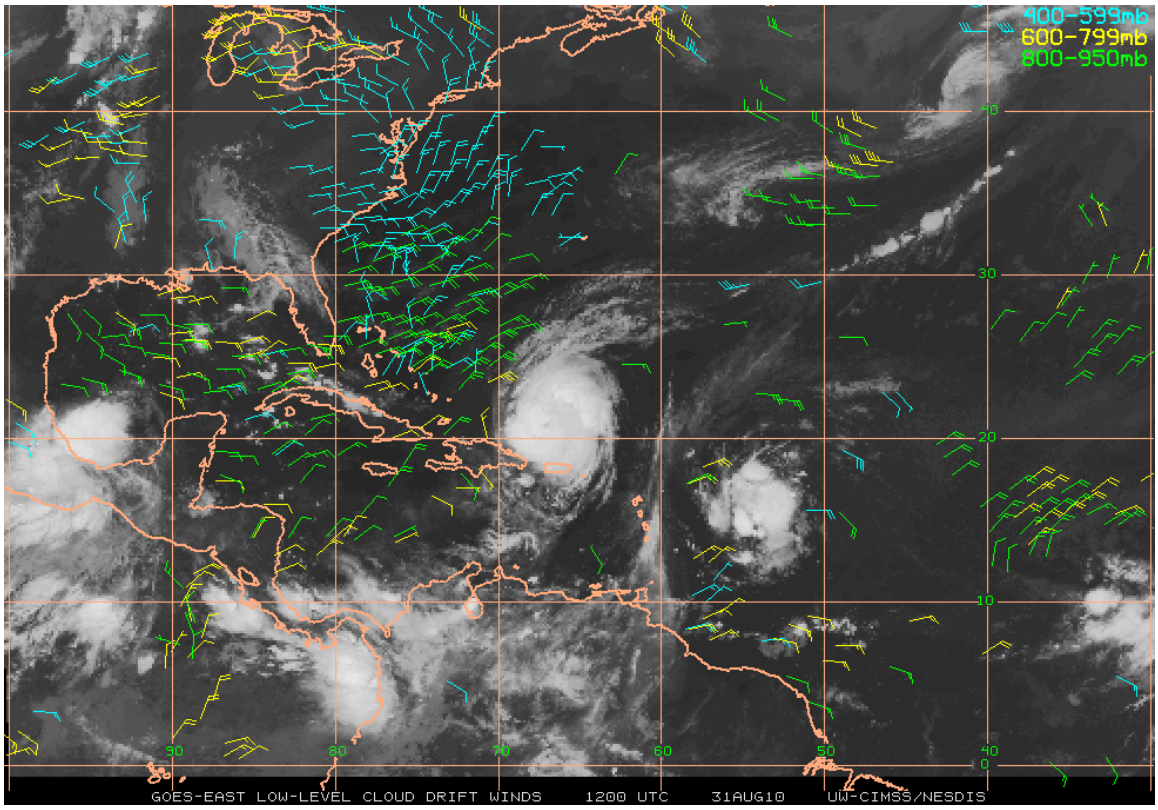
CIMSS Analyses:
Upper levels:
C1- Upper Level Winds



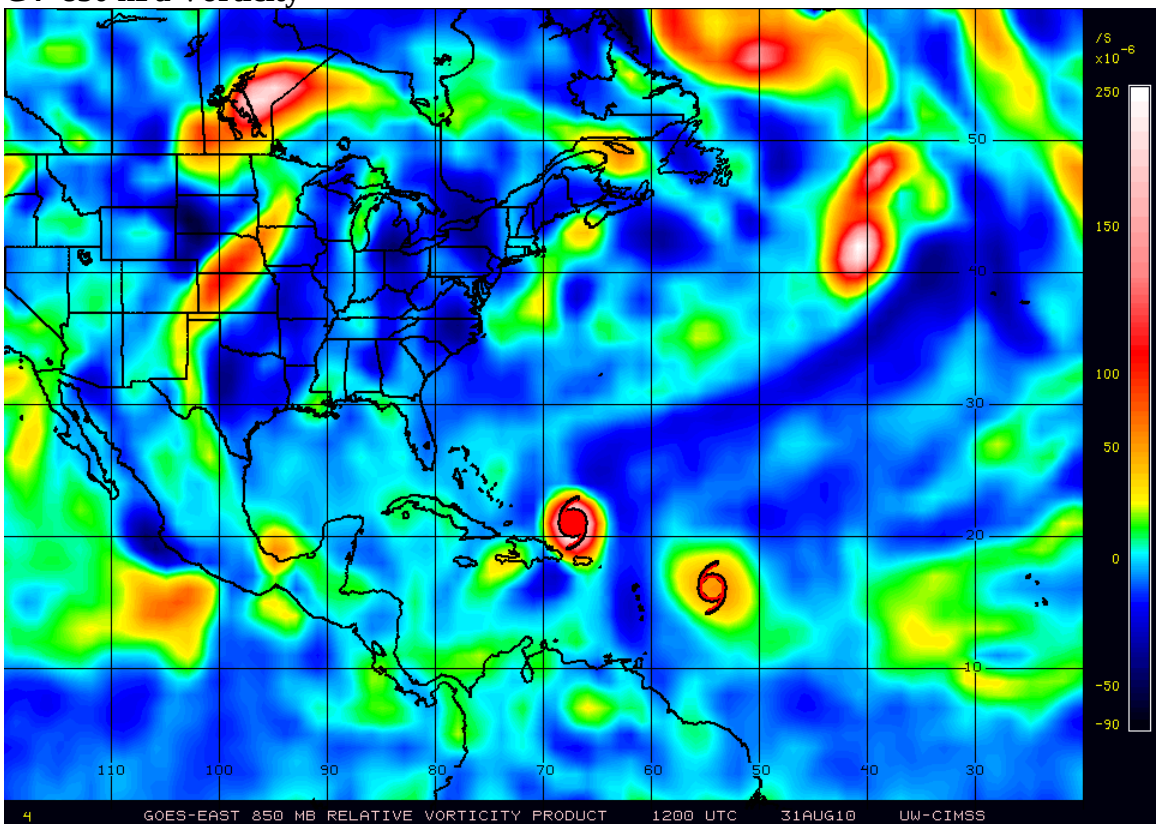
C2- 200 hPa Vorticity



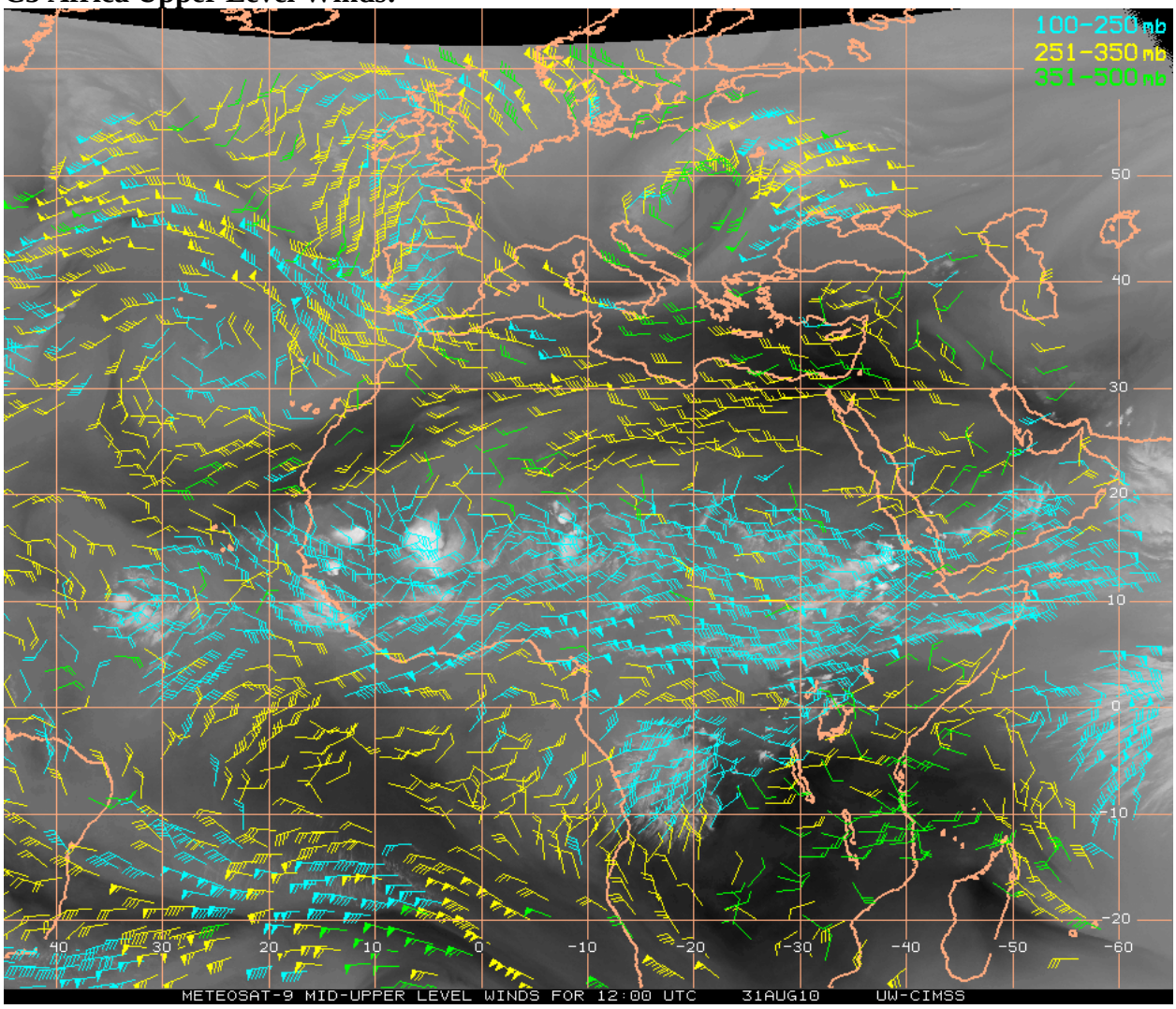
C3- Lower Level Winds



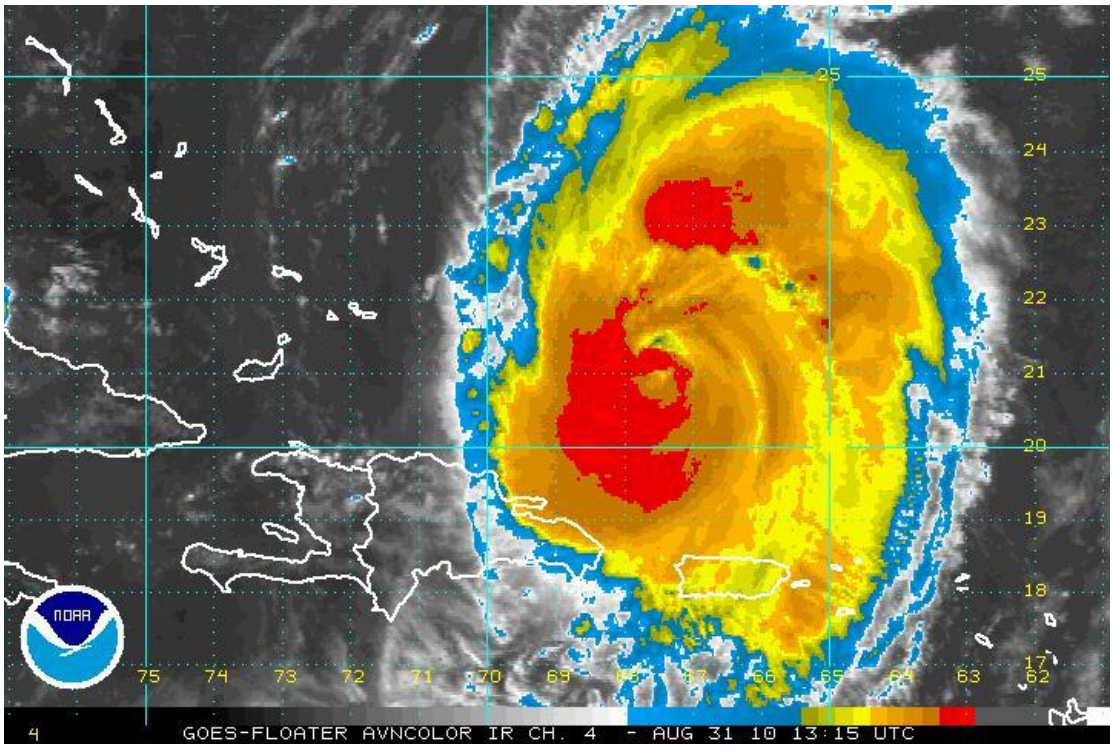
C4- 850 hPa Vorticity



C5 Africa Upper Level Winds:



E1 Earl: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24
23
22
21
20
19
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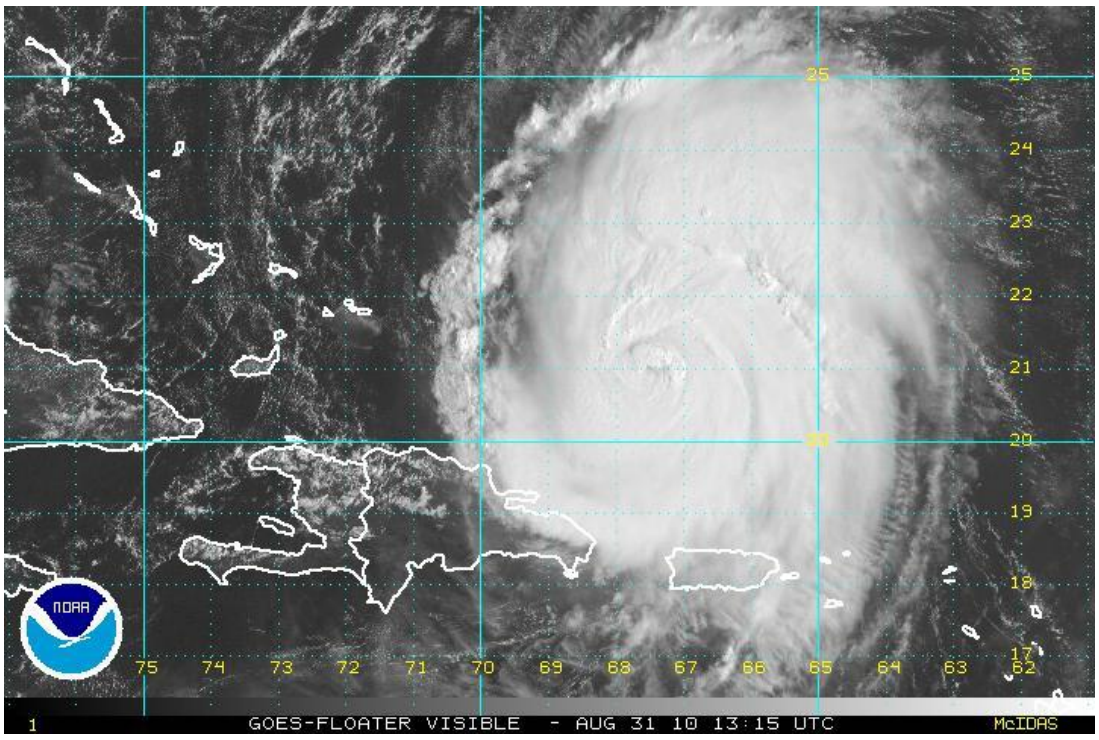
17
75 74 73 72 71 70 69 68 67 66 65 64 63 62
NOAA
4 GOES-FLOATER AVNCOLOR IR CH. 4 - AUG 31 10 13:15 UTC

E2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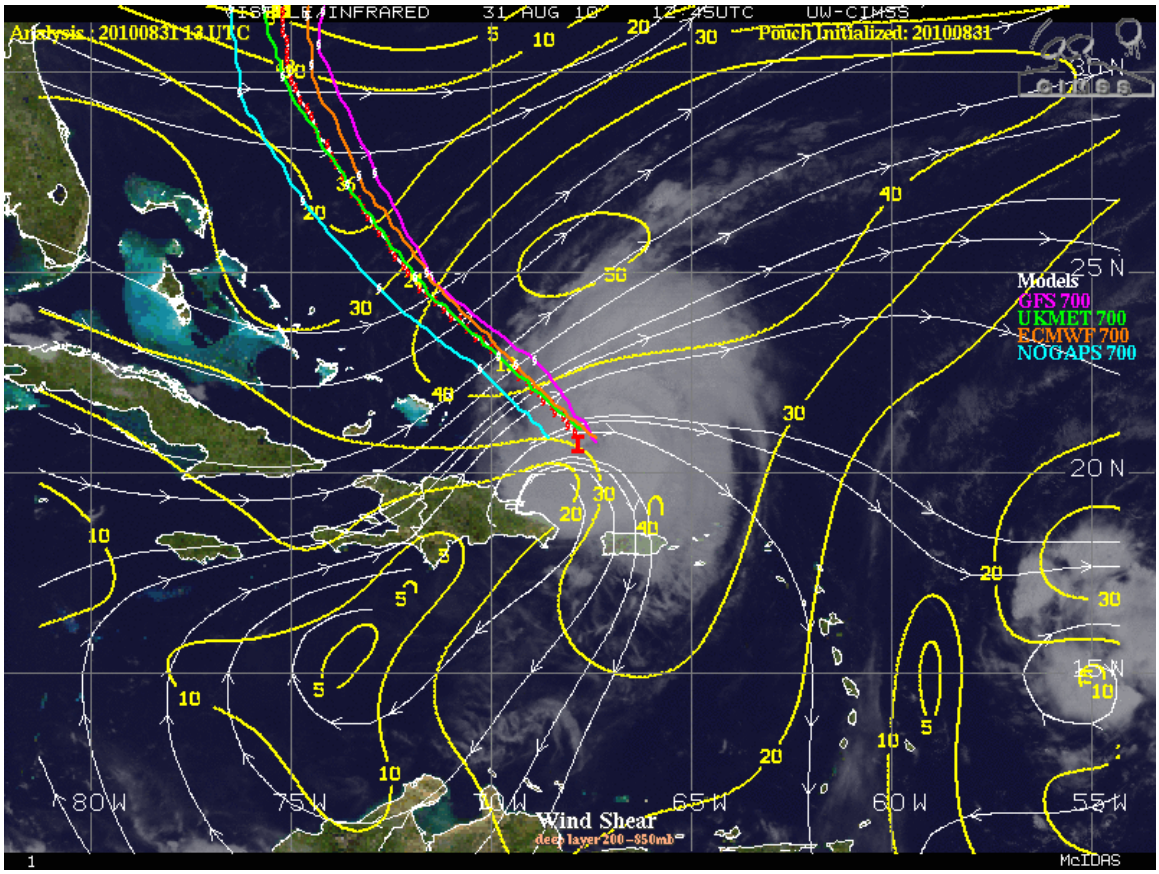
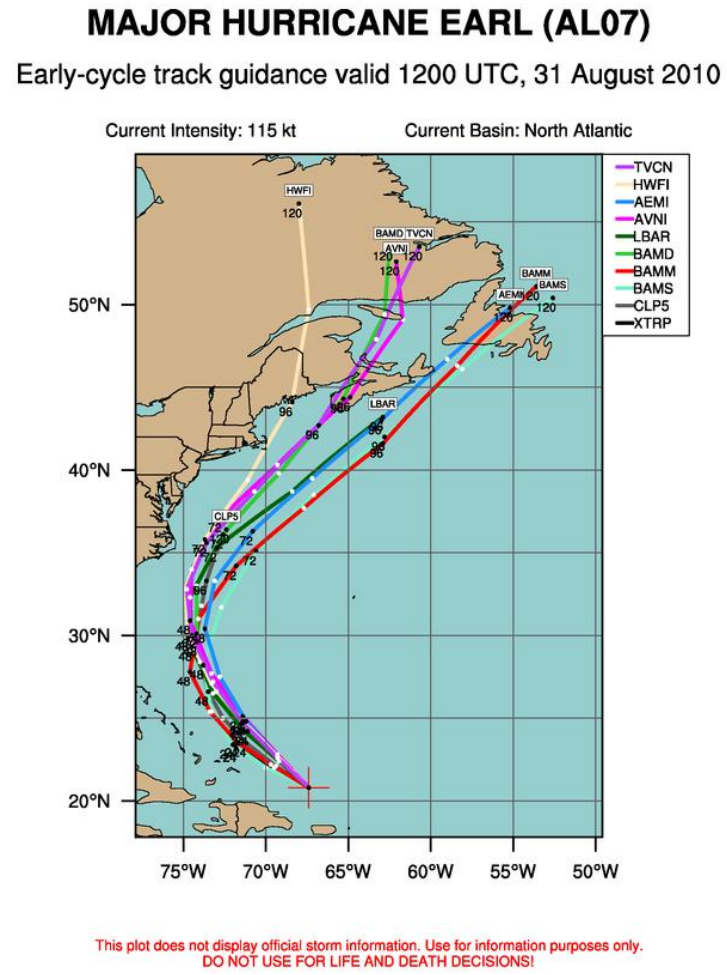
75 74 73 72 71 70 69 68 67 66 65 64 63 62
NOAA
1 GOES-FLOATER VISIBLE - AUG 31 10 13:15 UTC McIDAS

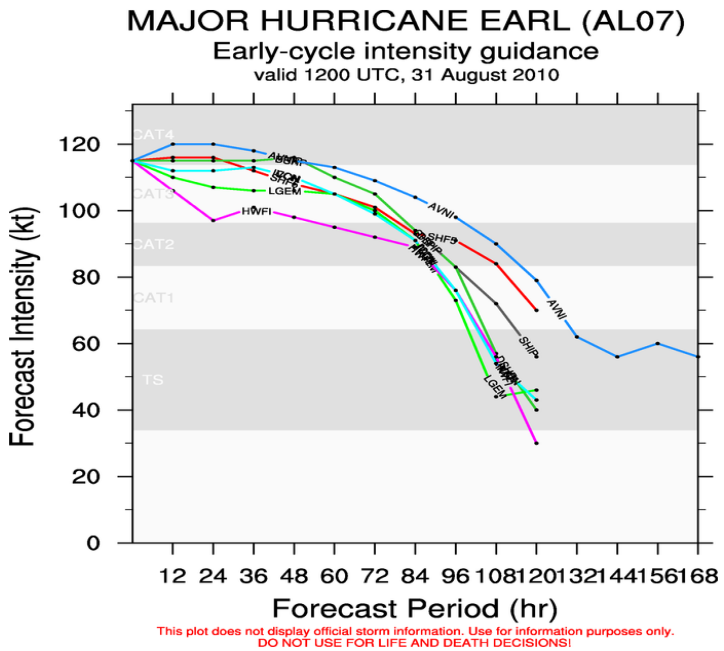
E3


INFRARED
31 AUG 10
UW-CIMSS
Analysis: 20100831 13 UTC
Pouch Initialized: 20100831
Models
GFS 700
UKMET 700
ECMWF 700
NOGAPS 700
Wind Shear
deep layer 200 - 850mb
McIDAS

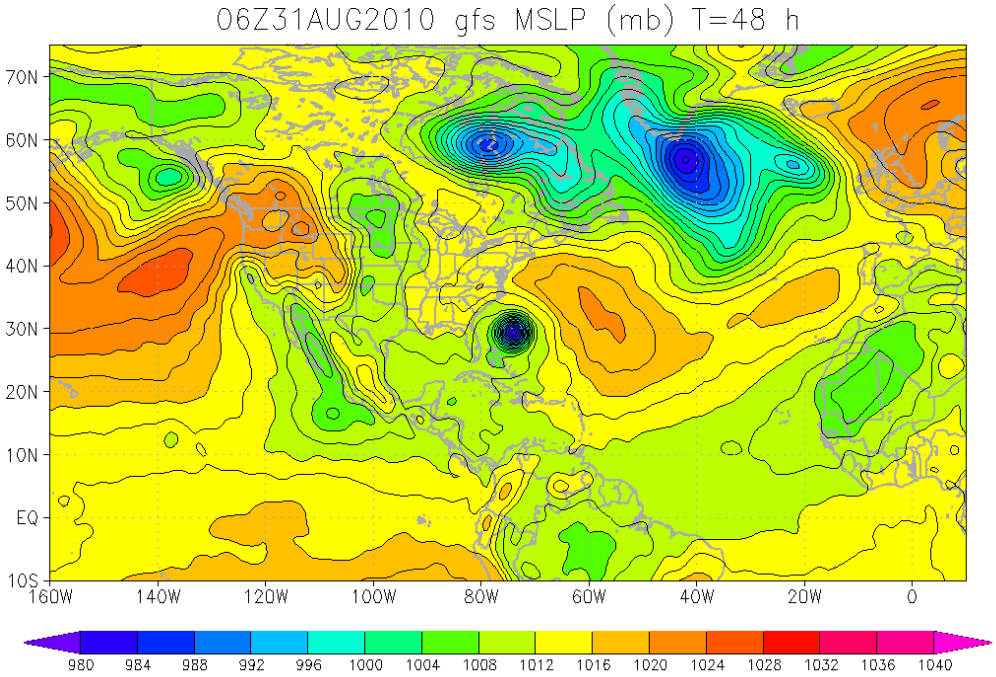
E4


MAJOR HURRICANE EARL (AL07)
Early-cycle track guidance valid 1200 UTC, 31 August 2010
Current Intensity: 115 kt
Current Basin: North Atlantic
TVCN
HWFI
AEMI
AVNI
LBAR
BAMD
BAMM
BAMS
CLP5
XTRP
50°N
40°N
30°N
20°N
75°W
70°W
65°W
60°W
55°W
50°W
This plot does not display official storm information. Use for information purposes only.
DO NOT USE FOR LIFE AND DEATH DECISIONS!

E5

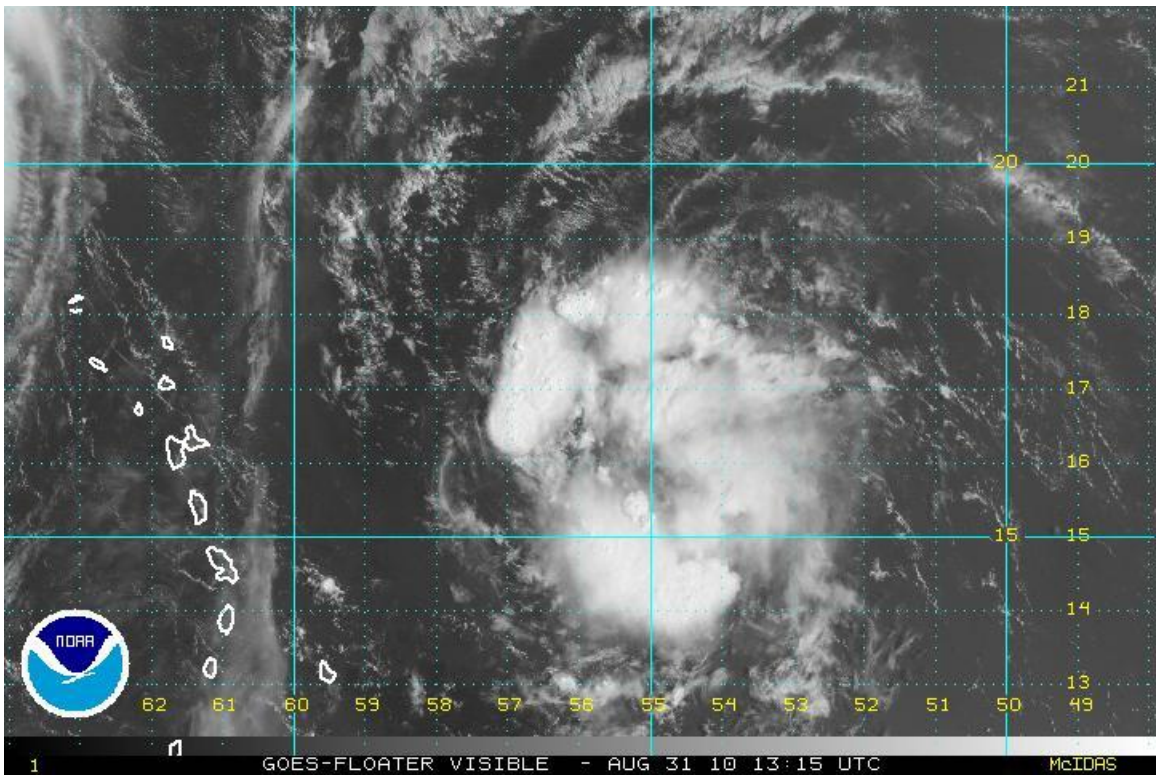

MAJOR HURRICANE EARL (AL07)
Early-cycle intensity guidance
valid 1200 UTC, 31 August 2010
Forecast Intensity (kt)
Forecast Period (hr)
CAT4
CAT3
CAT2
CAT1
TS
HWFI
LGEM
AVNI
SHIP
0
20
40
60
80
100
120
12 24 36 48 60 72 84 96 108 120 132 144 156 168
This plot does not display official storm information. Use for information purposes only.
DO NOT USE FOR LIFE AND DEATH DECISIONS!

GFS at 48 hours from 1200 UTC Aug 31 initialization:

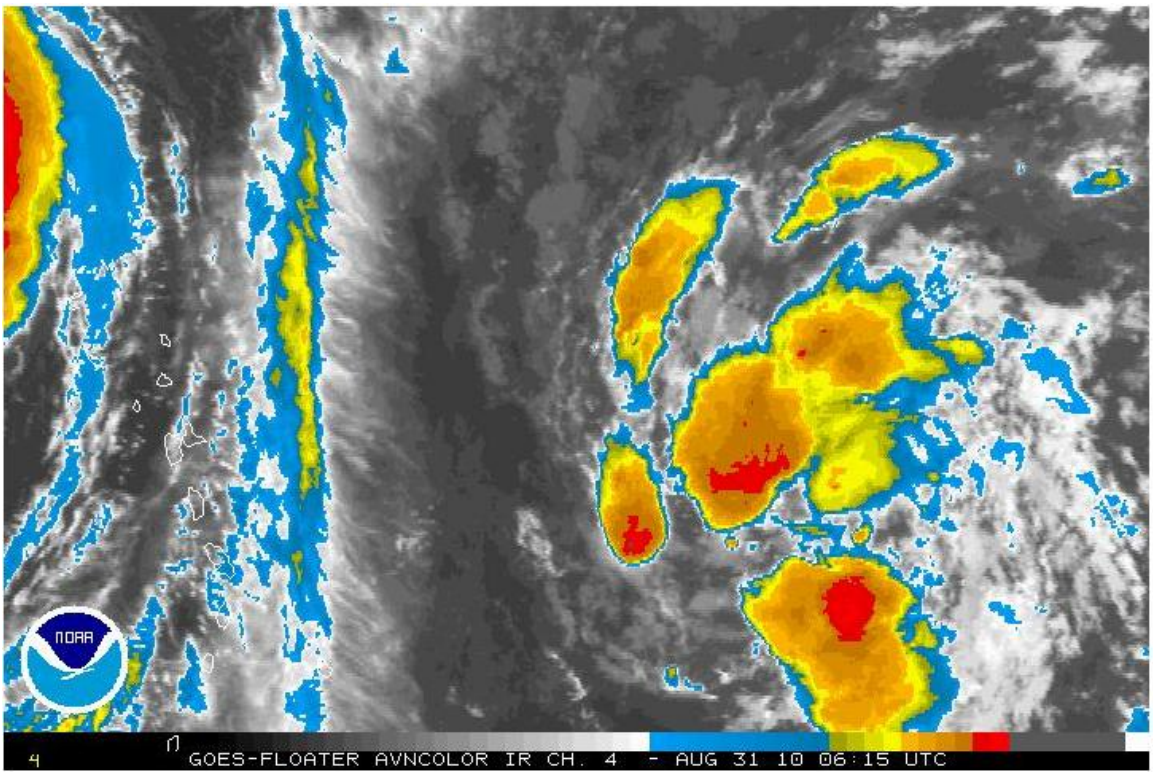


Tropical Storm Fiona:

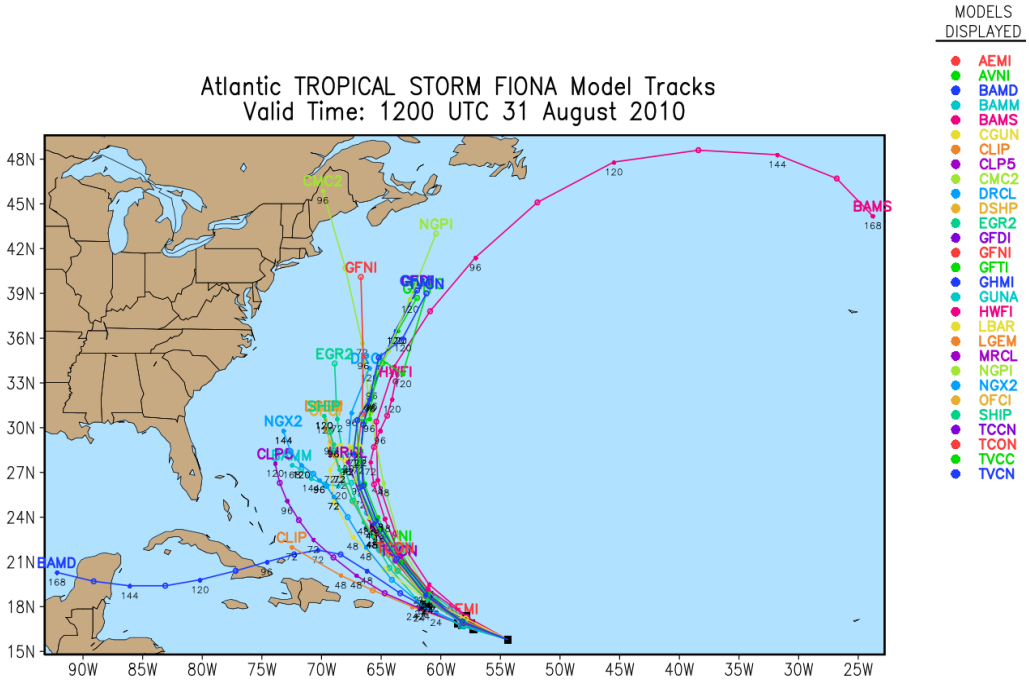
F1



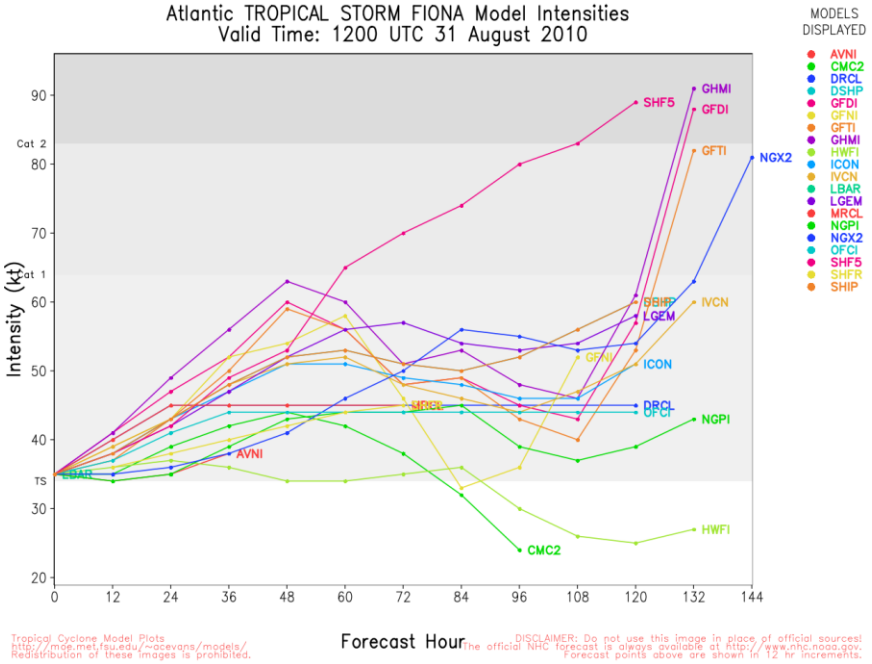
F2- Earl Fiona interaction



F3

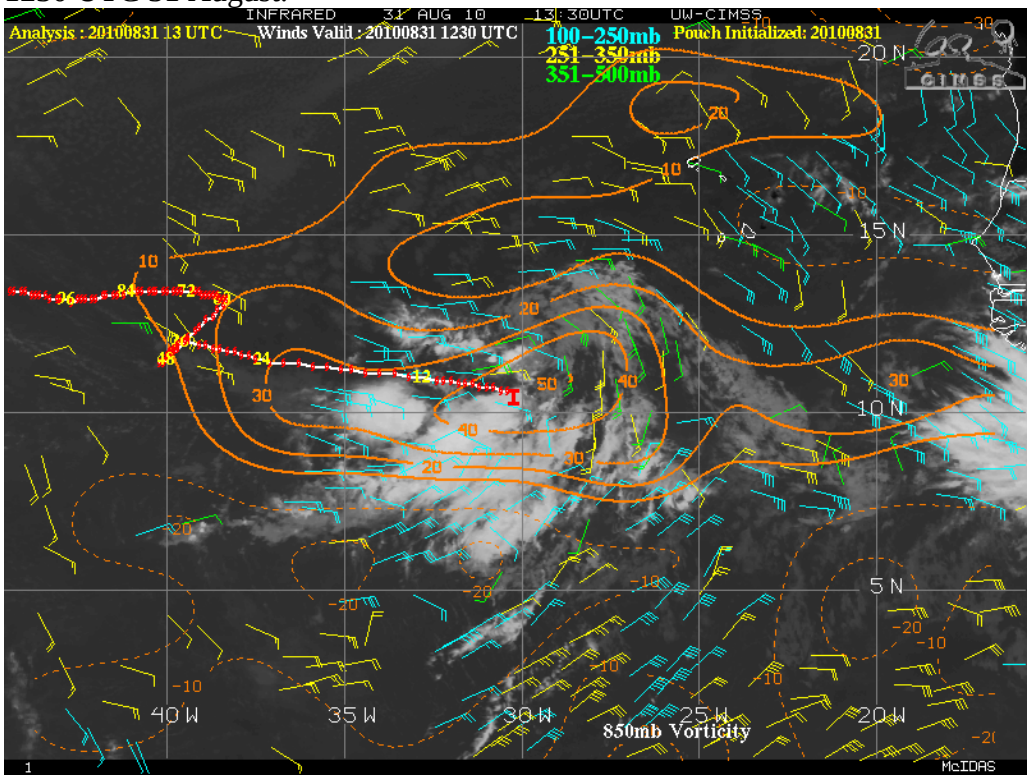


F4

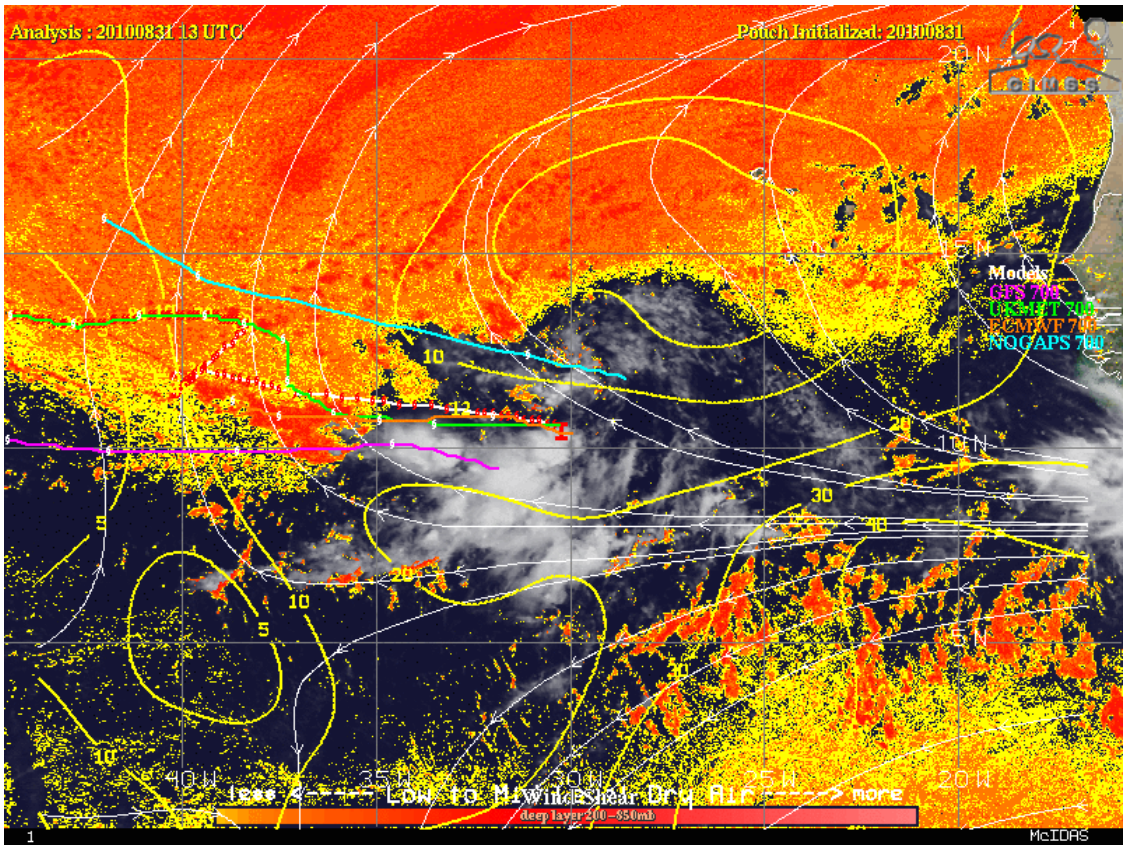


AL98/PGI-38L:

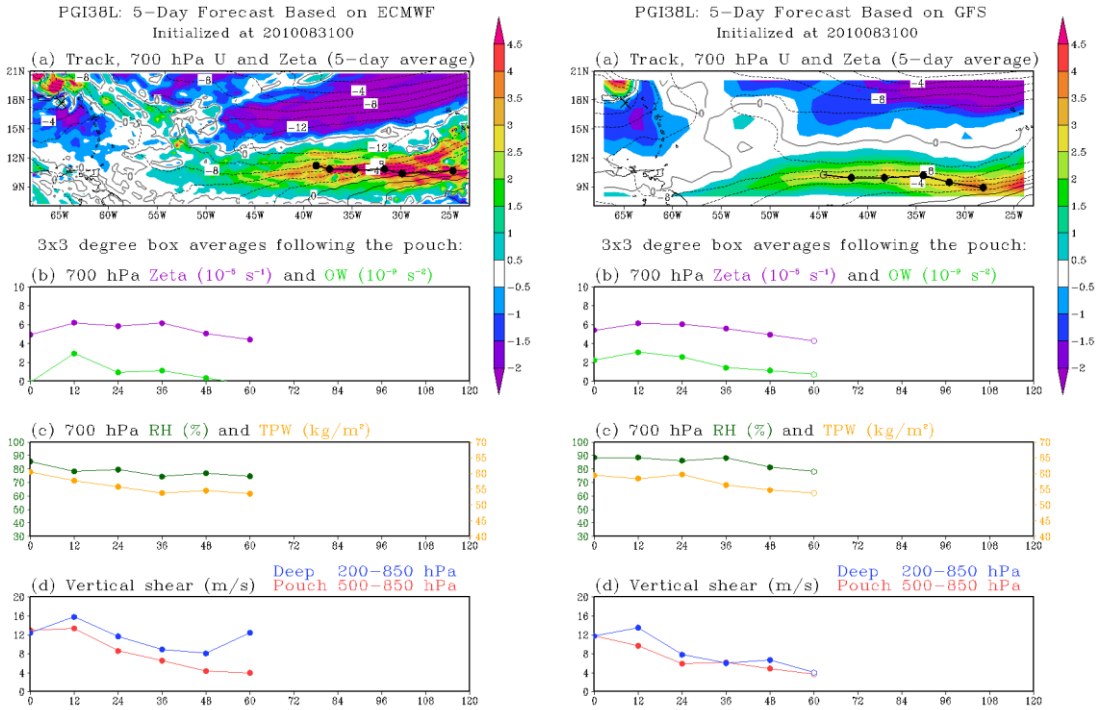
98A IR Imagery of PGI38L with 850-hPa vorticity and upper level winds overalain at 1230 UTC 31 August.



98B

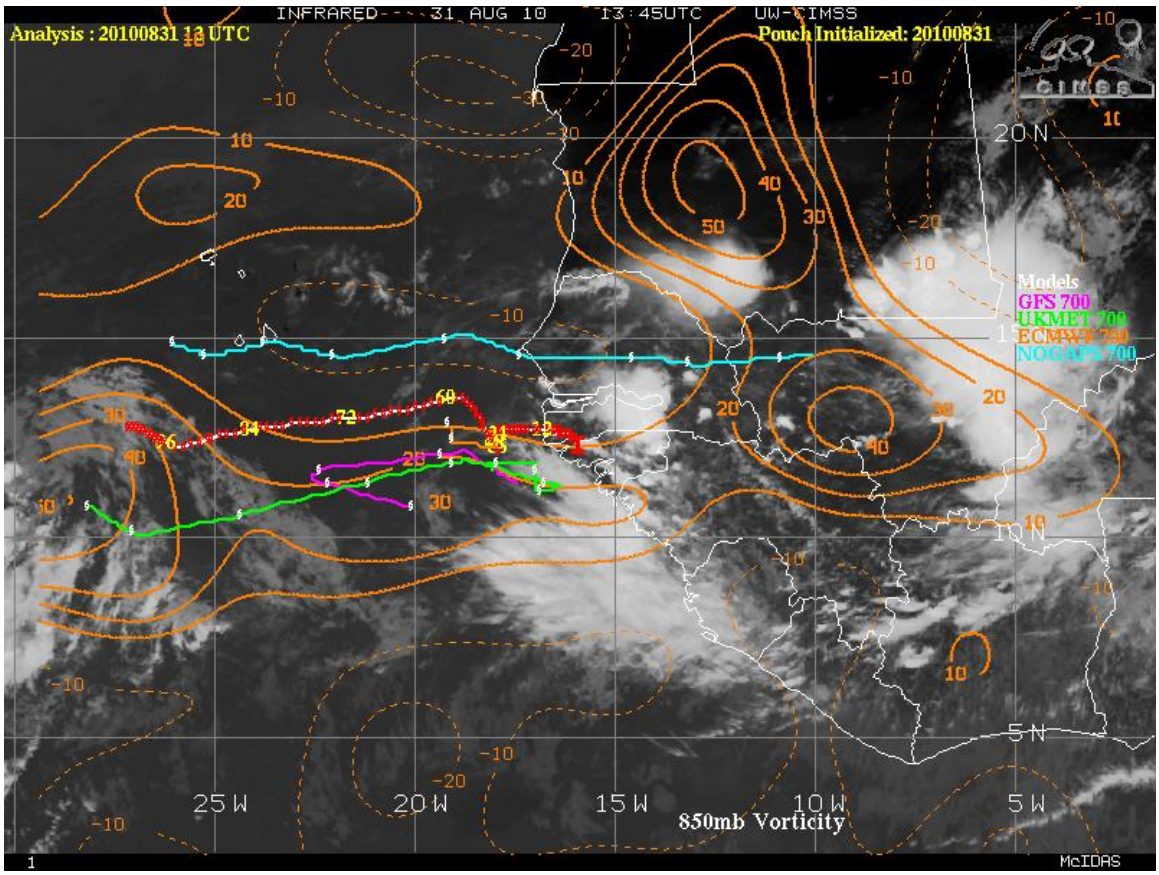


98C Pouch analysis valid at 0000 UTC 30 August from (left) the GFS and (right) the ECMWF.

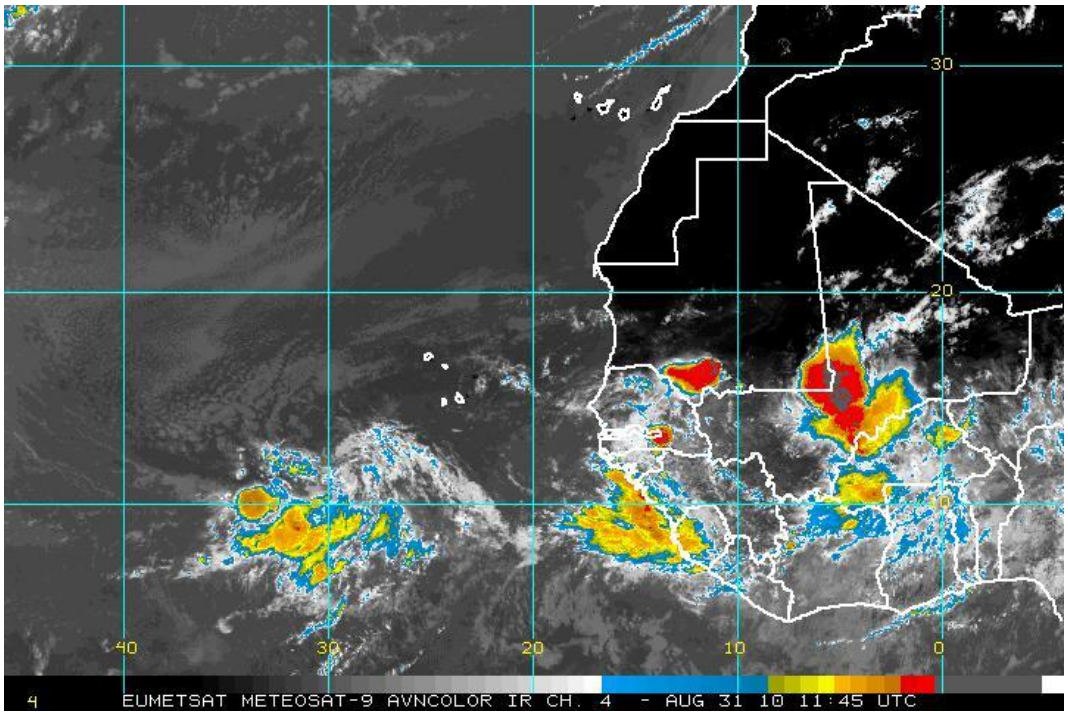


PGI-39L:

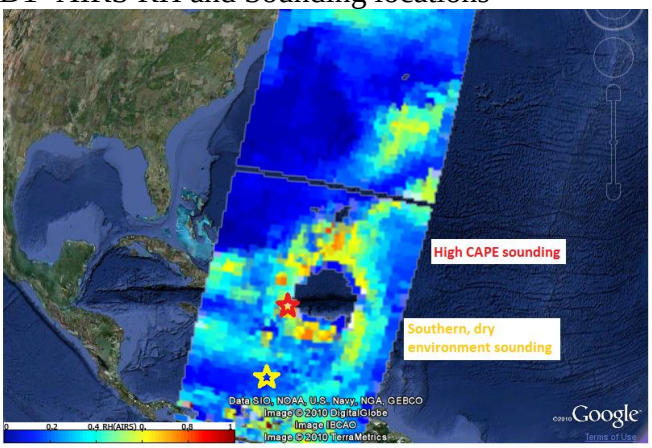
39A



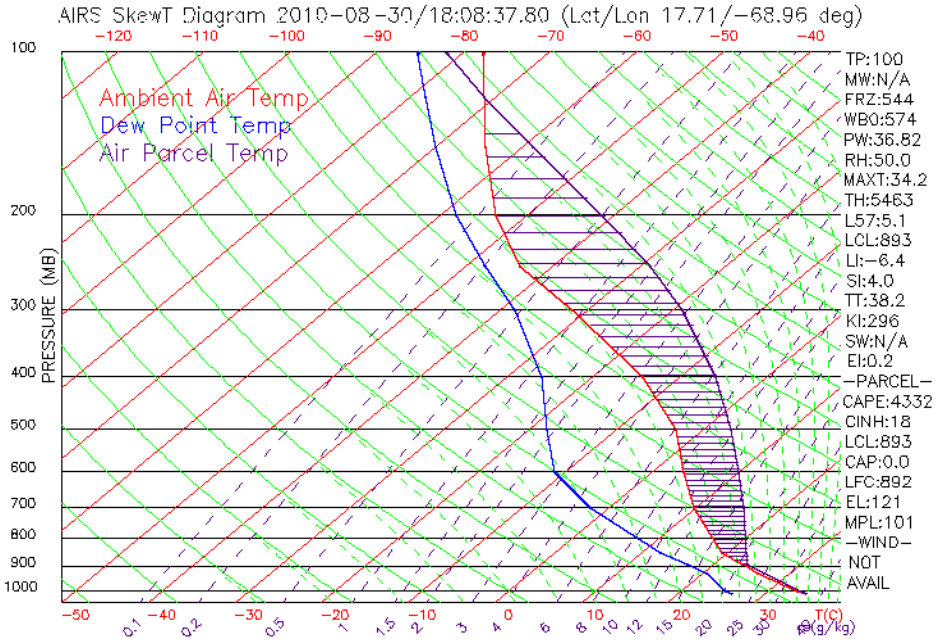
39B



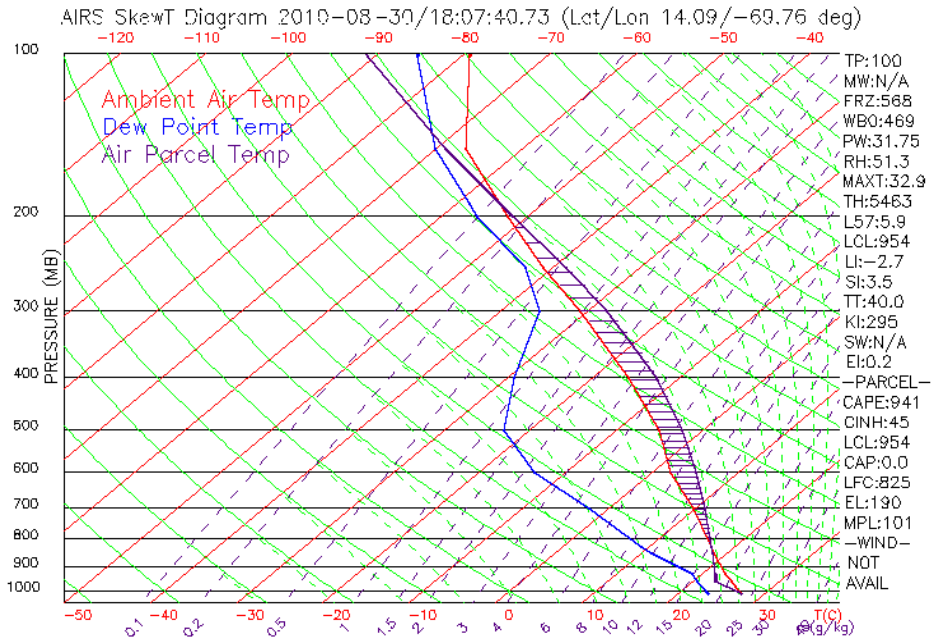
D1- AIRS RH and Sounding locations



D2- High Cape Sounding



D3- Southern Dry Sounding



D4- GEOS-5 AOT Model forecast at 96 hours, initialized at 0000 UTC Aug 31