Tropical GRIP Forecast Discussion for September 2, 2010

Created 1600 UTC September 2, 2010

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Summary: After 4 successful flights into Hurricane Earl by the DC-8, today will be its fifth and final flight into the powerful system. The WB57 also investigated it yesterday evening, and included an instrument validation coordination track with a NOAA P3. At 0000 UTC Sept 2 the Global Hawk took off from Edwards AFB in CA to join the multi-aircraft coordination of Earl, and will continue to sample the storm today in coordination with the DC-8 flight. The powerful category 4 hurricane re-intensified yesterday and the mission science goals for today include examining intensity fluctuations and examining the core of the storm. Elsewhere, Tropical Storm Fiona has continued to interact with Earl's shear and is much smaller and weaker than its neighbor. Fiona is not forecast to intensify beyond Tropical Storm status. Behind these two systems, Tropical Storm Gaston has formed, and while still at least a week from being flyable by GRIP aircraft, it is expected to intensify in the interim. PGI-39L is just off the coast of Africa, and is not currently forecast to be a genesis target.

Forecast for 1600 UTC 9/02/2010:

Synoptic Overview:

At the surface (**S1**), high pressure continues to dominate the Atlantic north of approximately 30 N. The general orientation of the high pressures protrudes south over the central Atlantic. The strongest portion (1022 hPa) is located off the East Coast. A weaker lobe (1018 hPa) is over the Carolinas and Virginia. Earl is moving along the western periphery of the stronger western lobe. Finally a middle latitude cyclone and frontal system is moving eastward over the eastern third of the U.S.

The IR image (**S3**) clearly shows Earl. However, Fiona, Gaston, and PGIs 39 and 40 have much less cloud cover and appear poorly organized (**S2**). The Gulf of Mexico and eastern Caribbean contain more disorganized convection and convective remnants than in previous days.

A well defined anticyclone over the eastern Atlantic dominates the 700 mb flow (**S4, S6**). A secondary center is over the Carolinas. Earl is moving between these two centers. The tropical easterlies are rather poorly defined compared to previous days.

Water vapor winds describe the flow in the upper troposphere (**C1**). In the middle latitudes, a trough is located over the Midwest; a ridge is off the East Coast; and a strong trough is located over the central Atlantic. Earl continues to produce impressive upper level outflow, with winds just north of the center reaching 50 kt from the south. Most of this outflow then merges with the middle latitude westerlies, while a portion of the arc shaped outflow heads toward the south in the vicinity of Fiona. Fiona is being greatly

impacted by Earl, and it is very difficult to isolate any outflow specifically related to Fiona. Gaston and the two PGIs are located in regions of disorganized upper level flow, that is mainly from the east (**C1, C4**). To the extent that circulations are evident, they appear to be cyclonic rather than anticyclonic. If these systems have any outflow, it is not evident. Finally, anticyclonic flow is no longer occurring over the Gulf of Mexico. Its flow is from the south.

The total precipitable water image (**S4**) shows a great deal of dry air over the Atlantic and Caribbean. In places, this dry air continues deep into the tropics. The band of humid air in which the eastern most tropical systems are embedded is quite narrow. This is a continuation of yesterday's conditions. Some of the dry air seems to be swirling around Earl. The northeastern Gulf of Mexico continues to be dry. The MODIS AOD agrees with TPW (**S5**). Dry, aerosol laden air continues to stream off Africa, extending to near 10 N over the central Atlantic. There is also a north-south band of dry air located east of Earl and Fiona.

Features of Interest:

Hurricane Earl:
Hurricane Earl is an intense category 4 hurricane today, and as of the latest advisory, it has a minimum central pressure of 932 hPa, maximum sustained winds of 145 mph. Earl's forward speed has begun to increase and its heading has shifted more NNW over the last 12 hours. Yesterday, Earl had weakened to a category 3 storm, but during the DC-8 science flight yesterday, it reintensified to a category four storm. The eye tightened in the late afternoon hours (AST) and convection around the eye strengthened as the pressure dropped toward the low 930's. Interestingly, this reinvigoration of convection was accompanied by lightning strikes in the eyewall at two distinct periods during the flight as well. Earl's eye looked impressive this morning on IR satellite imagery (**E1**), but the storm's eyewall began to erode on the west side this morning, before convection reinvigorated and recircled the storm. There is also some dry air to the west that has been entrained into the outer bands of Earl. Earl is currently encountering some southwesterly shear, which is expected to pick up throughout the day. Earl is expected to impact North Carolina today, and the first rain bands are already becoming visible on NEXRAD radar.

Earl has been consistently forecast by the numerical models to decrease in its intensity, but fluctuations such as the one yesterday can be expected with a powerful storm still over warm SSTs and overcoming environmental shear. However, as Earl continues its track north (**E3, GFS**), it will encounter much less favorable conditions, including increasing shear (see the impending trough interaction as well as CIMSS upper level winds to see where shear impact will be, [**C1, C2**]), and its forward speed will increase and take it quickly over waters that will not be as conducive to support the storm. Therefore, it is reasonable to assume that the storm will begin to weaken very soon (**E4**), and even become extratropical in about 72 hours.

NHC Forecast positions: INITIAL: 02/0900Z 29.3N 74.7W 125 KT
12HR VT 02/1800Z 31.7N 75.3W 125 KT
24HR VT 03/0600Z 34.8N 74.6W 115 KT
36HR VT 03/1800Z 38.1N 72.6W 100 KT
48HR VT 04/0600Z 41.6N 69.2W 85 KT
72HR VT 05/0600Z 50.5N 62.5W 50 KT...POST-TROP/EXTRATROP
96HR VT 06/0600Z...ABSORBED BY EXTRATROPICAL LOW

GFS Forecast positions:
02/0600 28N,73W
02/1800 32N,76W
03/0600 35N,76W
03/1800 38N,74W
04/0600 42N,69W
04/1800 47N, 64W (Over Canada)
05/0600 53N, 62W (Over Canada- extratropical)

Tropical Storm Fiona:
As of 8am EDT, Tropical Storm Fiona was located at 23.6N/65.5W with maximum sustained winds of 50 mph. Fiona continues to move towards the NW at 17 mph. Satellite imagery reveals that TS Fiona remains a compact storm, although convective activity has increased with this system over the past 12 hours. Fiona is still in a region of warm SSTs (> 29°C), and current wind shear values are around 15 knots (**F1**). Now, Fiona is located to the west of the strong upper-level outflow associated with Hurricane Earl. However, the SHIPS forecast calls for increasing wind shear values over the next 24-36 hours. If Fiona can survive Earl's outflow, it looks as if shear values will decline beyond 48 hours. By this time, though, cooler SSTs will inhibit any additional development of the storm. Fiona should continue along a NNW track for the next day before curving N/NE around the western edge of the subtropical ridge (**F2**). Further intensification appears unlikely as almost all of the intensity guidance models (**F3**) gradually weaken this storm over the next few days. At this point, Fiona only poses a threat to Bermuda.

Tropical Storm Gaston:
As of 5am EDT, Tropical Storm Gaston was located at 13.5N/38.2W with maximum sustained winds of 40 mph. Visible satellite imagery shows the well-defined circulation of TS Gaston; however, the convective activity is limited and mostly confined to the western side of the storm. Gaston is moving towards the west at 9 mph. The environment appears favorable for some intensification over the next few days as wind shear values should remain in the 10-knot range (**G1**). As Gaston slowly tracks westward, it will move into warmer waters, which will also contribute to a more conducive environment for storm development (**G1**). However, the dry air surrounding Gaston could pose a problem over the next couple days. The GEOS-5 model forecast (**G3**) indicates that some dry, dusty air is already wrapping into Gaston, so this bears watching as Gaston continues its trek across the Atlantic (**G2**). There is a fairly big spread in the intensity guidance (**G4**), but the general trend is for gradual strengthening of

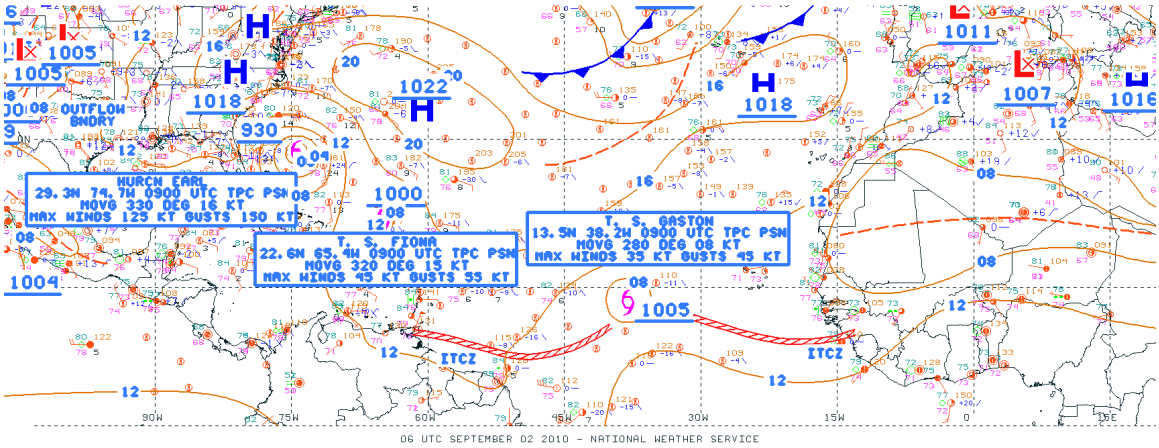
Gaston over the next few days. In terms of hurricane development, there is still some model disagreement as to if/when this may occur.

PGI-39L:
PGI-39L is located at 11.3N 21N. While unorganized, PGI-39L is associated with a good amount of convection (**39A**). However, the environment is not extremely favorable for development. Wind shear is moderate to high, near 20kts at the pouch center, and up to 30kts just ahead of the system (**39B**). SSTs are also not particularly conducive for development, around 26 to 27C. That said, SSTs are higher to the west, and thus will be more favorable within a few days (**39C**). No global models are currently forecasting any substantial strengthening. The GFS and UKMET maintain the system for the next several days, while the ECMWF and NOGAPS kill it off. Pouch tracking diagnostics for the GFS show no substantial increase in OW or vorticity for the next 5 days. However, it is worth mentioning that the OW exceeds 4 *1E-9 s^-2, which has been described as the nominal threshold for cyclogenesis, at 700hPa at multiple points during the forecast (**39D**). Based on the models that maintain the storm, a general SSW track is forecasted (**39A**). The forecasted position is 03/0000UTC 11.3N/21.0W; 03/1200UTC 10.8N/22.5W; 04/0000UTC 10.4N/24.4W; 04/12000UTC 9.9N/25.8W; 05/0000UTC 9.3N/28.4W.

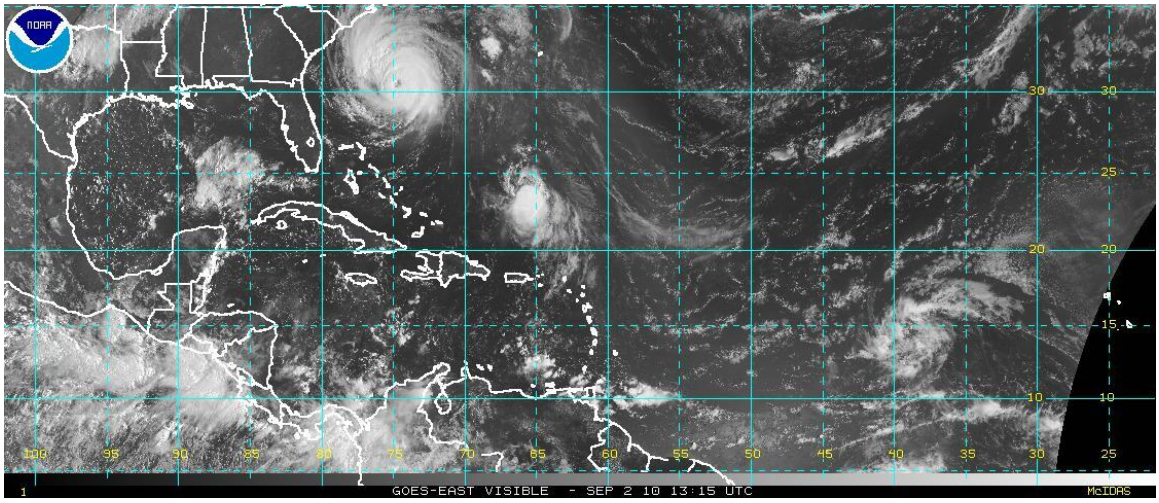
Dust/SAL Discussion:
The dust and SAL air is largely confined to an area between 40W and the coast of Africa, and north of 15N (**G3**). The only exception is a band of dry air between 50W and 60W. CIMSS SAL analysis indicates dry air on the northern and western side of Gaston and just north of PGI-39L. CIMSS TPW analysis agrees (**S4**), depicting the driest air just off of Africa. It does not appear that the dry air has made it into the circulation of Gaston, and we will have to see how the two interact in the short term. The GEOS-5 model suggests that dust will remain in the bounded region mentioned above and will spread into the Lesser Antilles and eastern Caribbean Sea in 24 hours and move slowly westward into the western Caribbean by 72 hours (**D1**).

Images used in discussion:

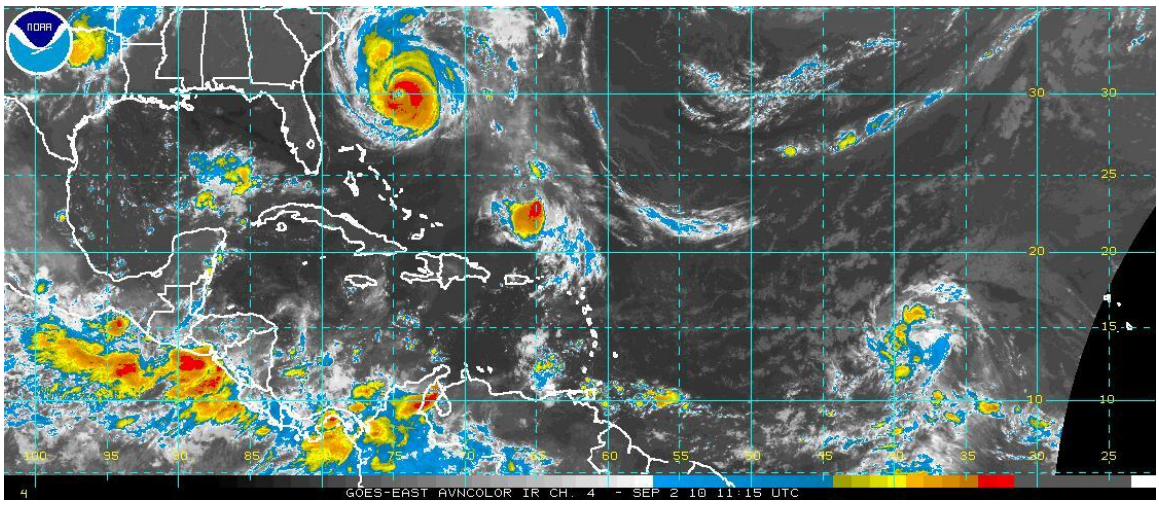
S1



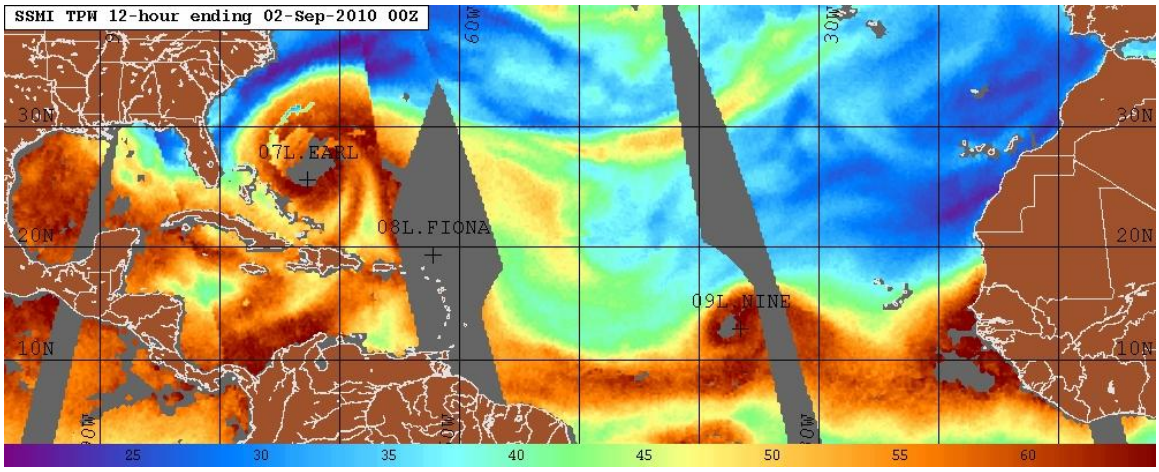
S2



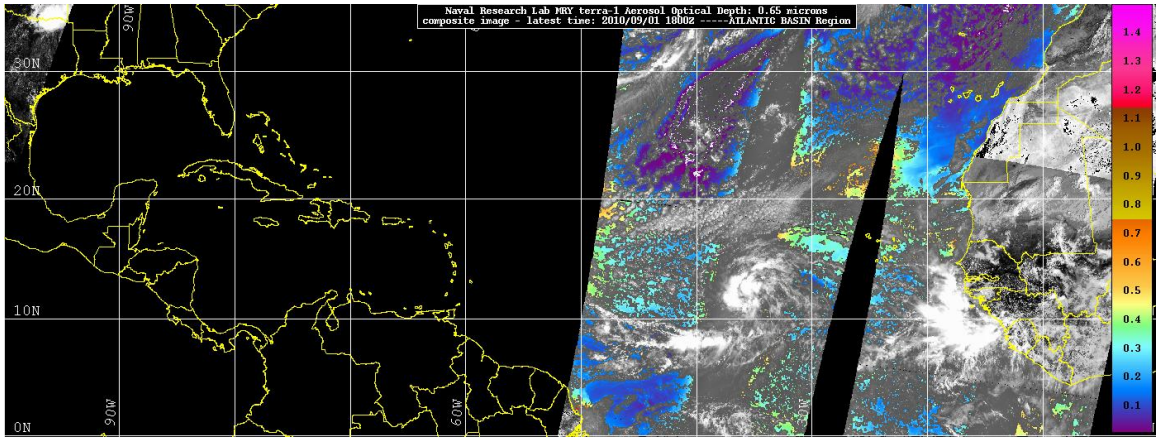
S3



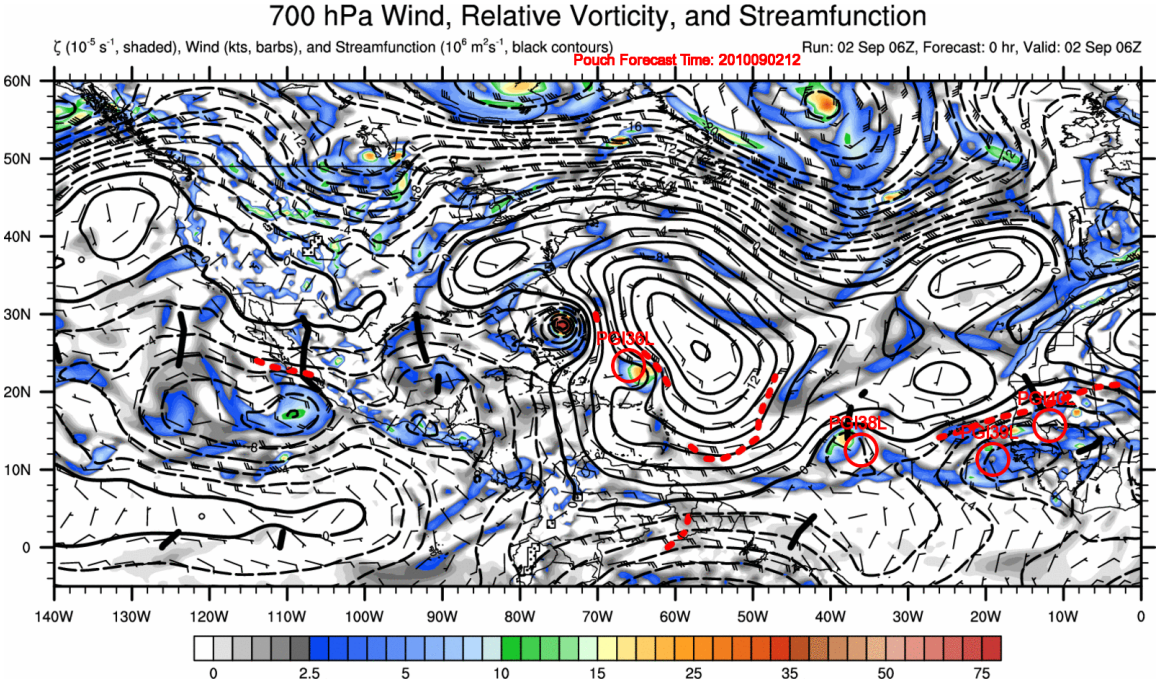
S4



S5 AOD from NRL



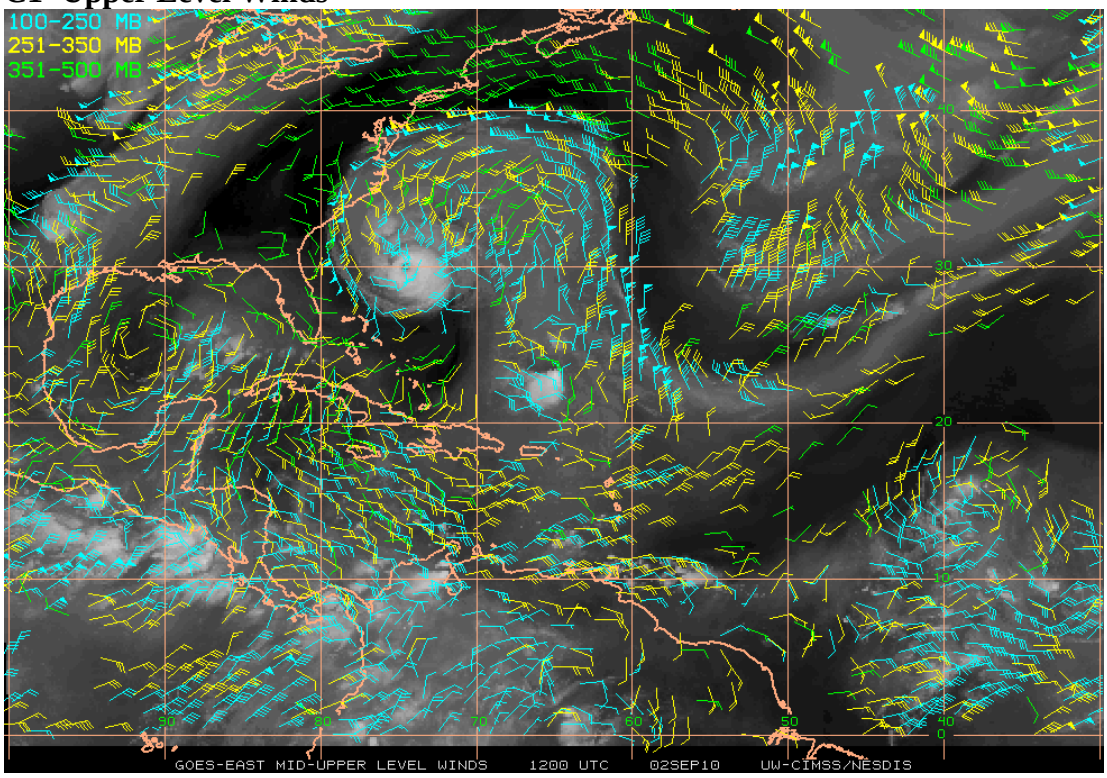
S6



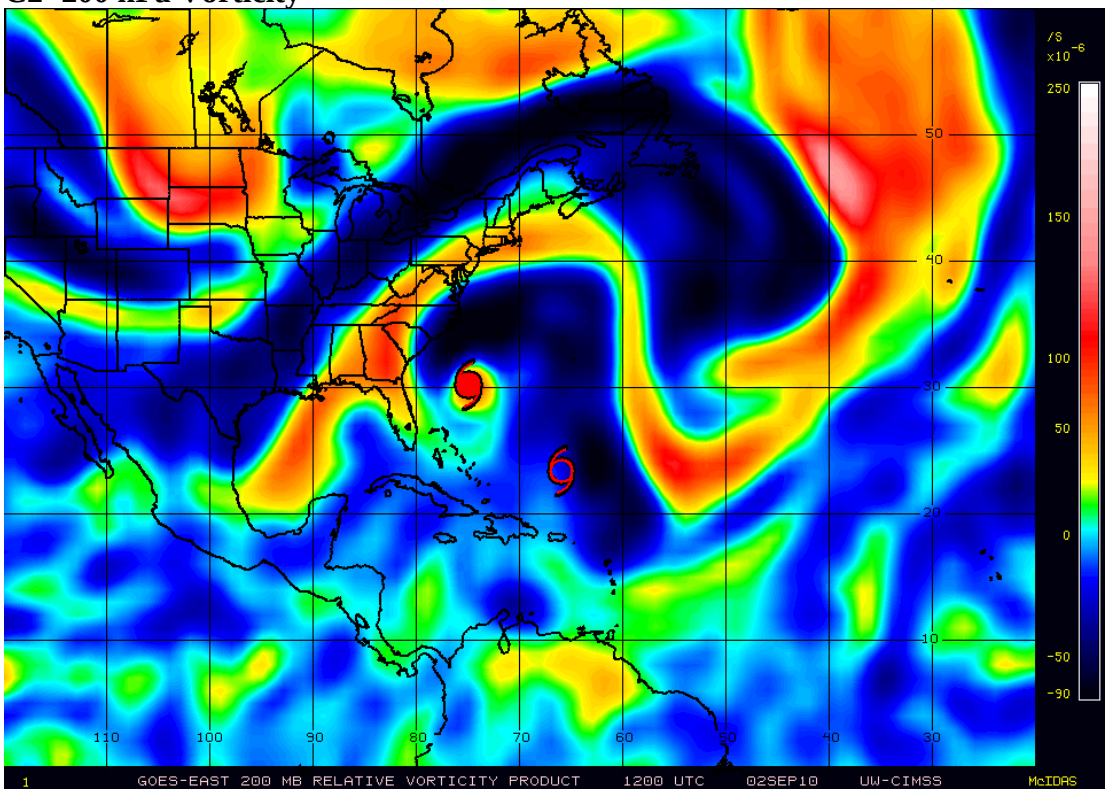
CIMSS Analyses:

Upper levels:

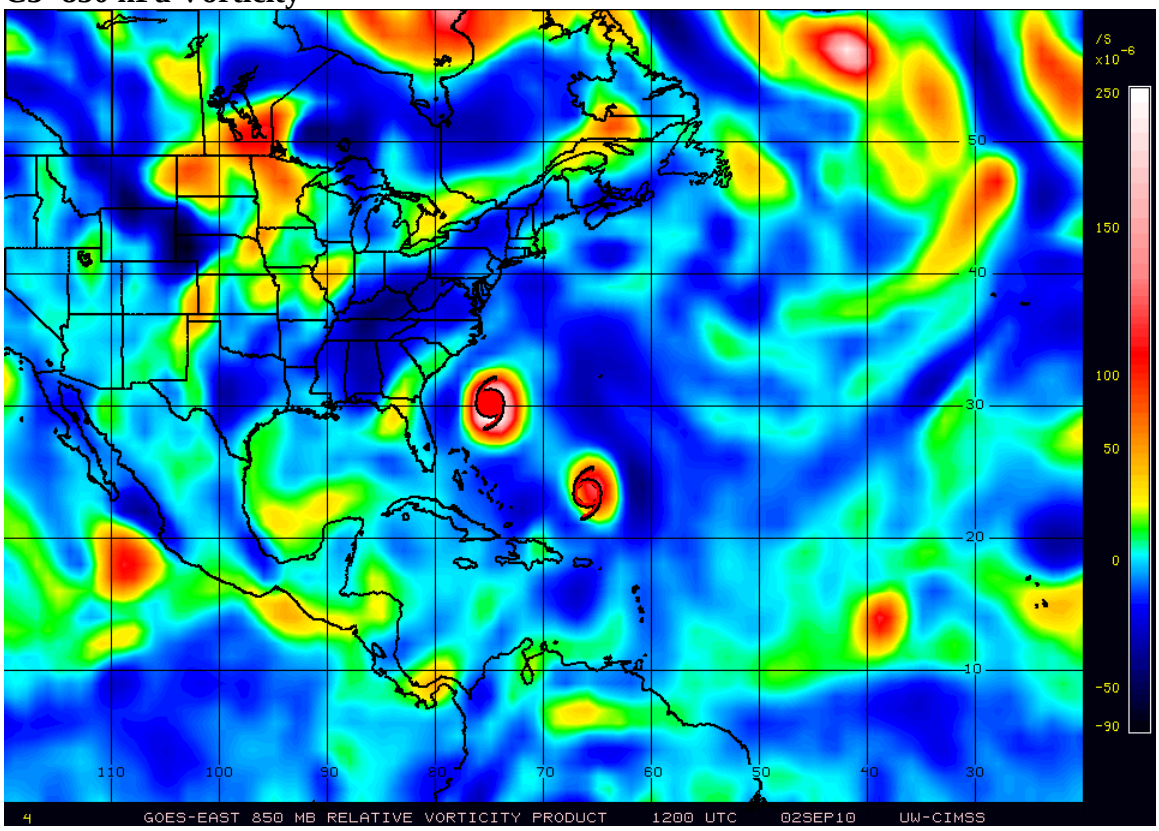
C1- Upper Level Winds



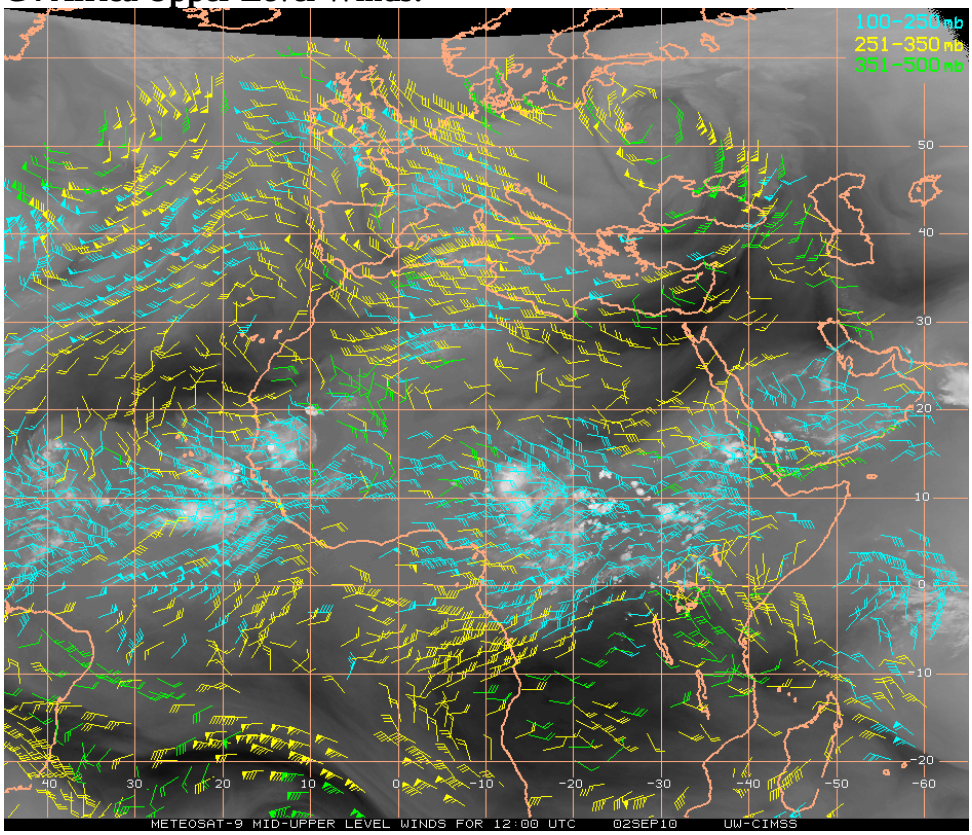
C2- 200 hPa Vorticity



C3- 850 hPa Vorticity

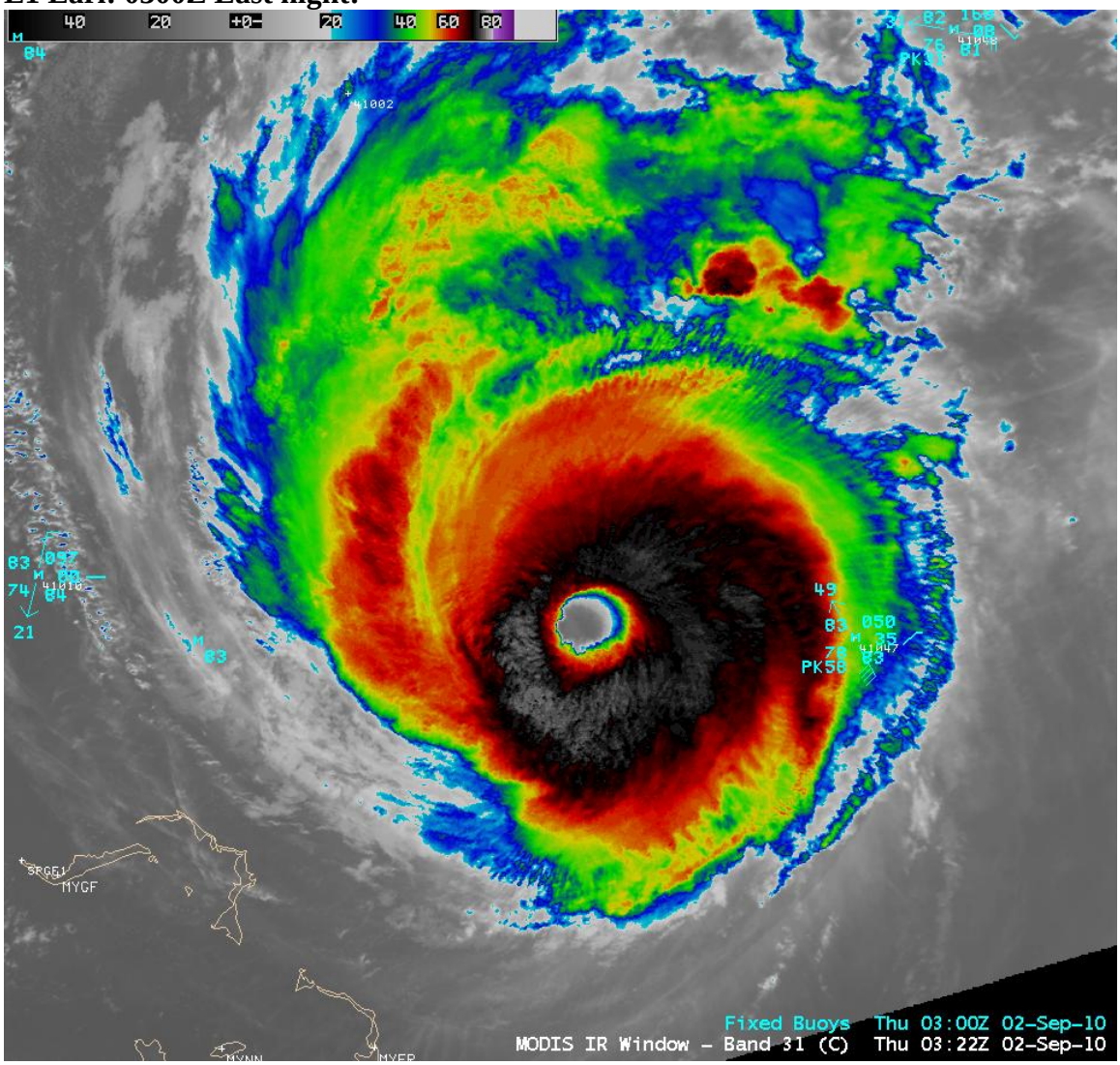


C4 Africa Upper Level Winds:

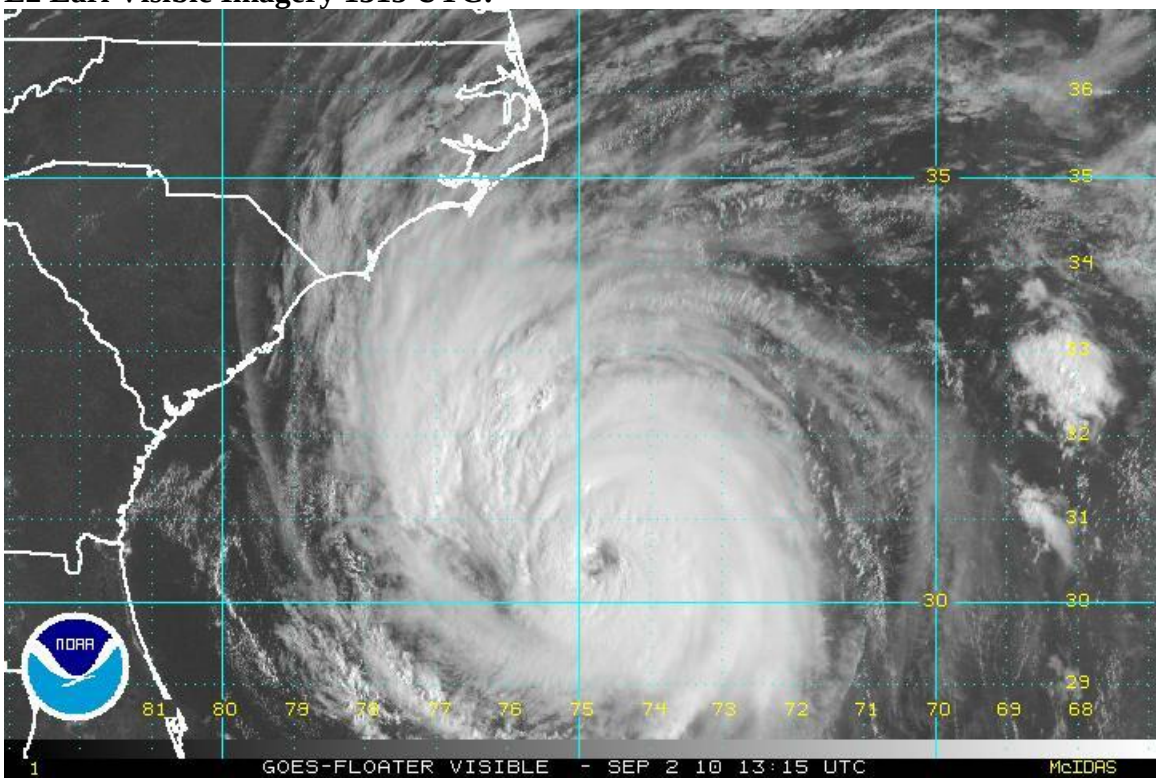


Hurricane Earl

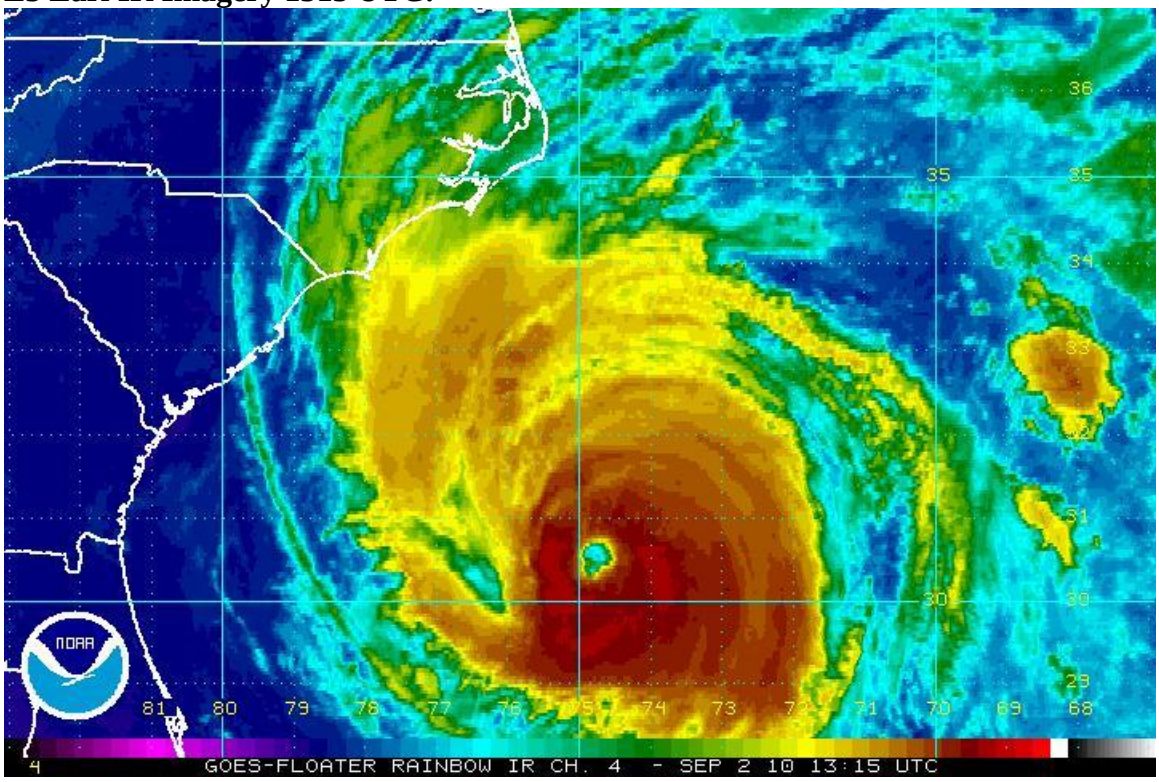
E1 Earl: 0300Z Last night:



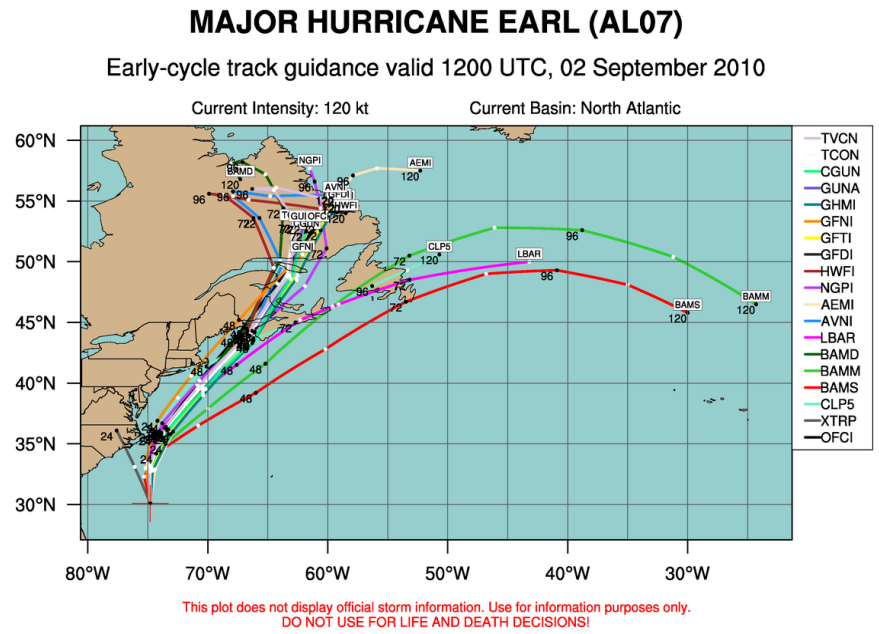
E2 Earl Visible Imagery 1315 UTC:



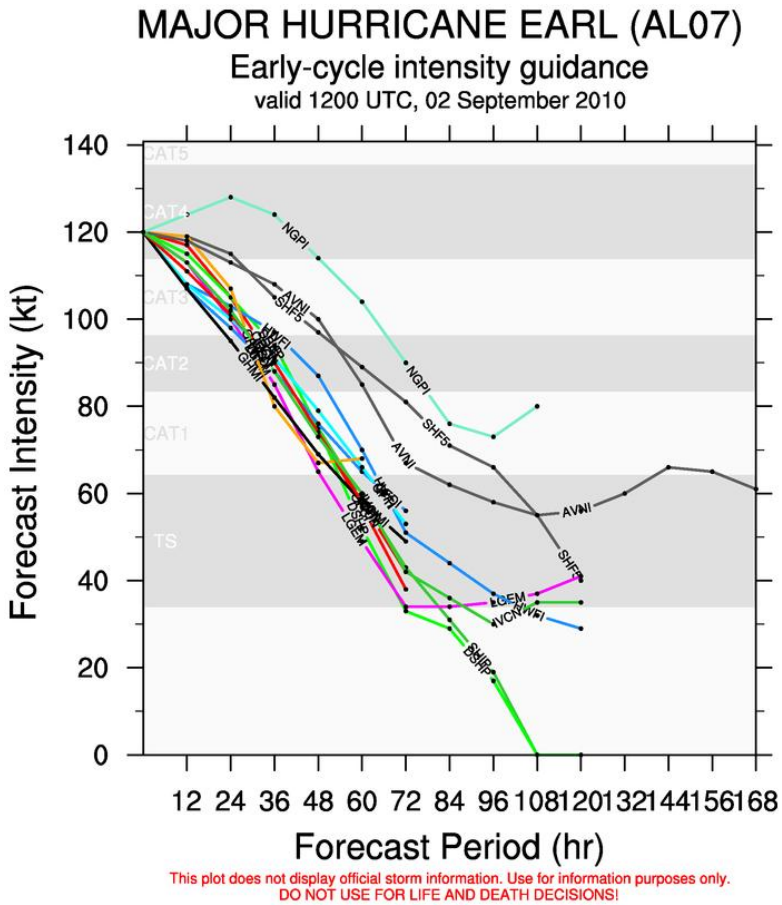
E3 Earl IR Imagery 1315 UTC:



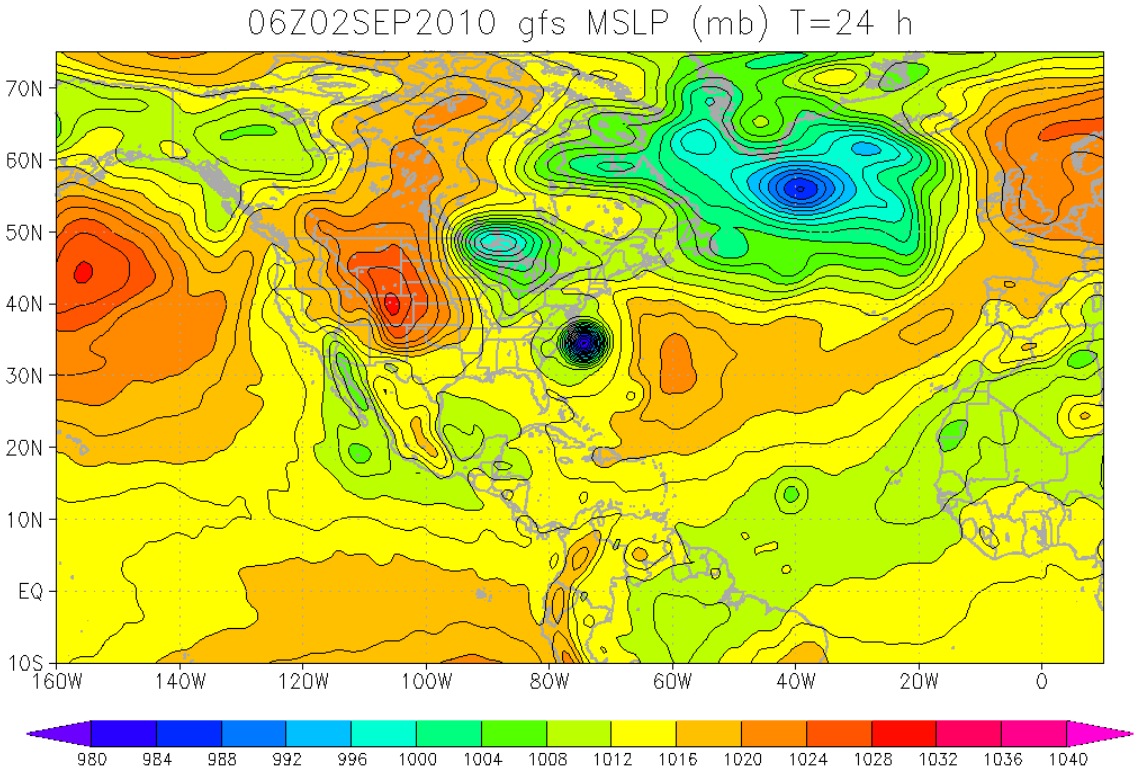
E4


MAJOR HURRICANE EARL (AL07)
Early-cycle track guidance valid 1200 UTC, 02 September 2010
Current Intensity: 120 kt
Current Basin: North Atlantic
60°N
55°N
50°N
45°N
40°N
35°N
30°N
80°W
70°W
60°W
50°W
40°W
30°W
TVCN
TCON
CGUN
GUNA
GHMI
GFNI
GFTI
GFDI
HWFI
NGPI
AEMI
AVNI
LBAR
BAMD
BAMM
BAMS
CLP5
XTRP
OFCI
This plot does not display official storm information. Use for information purposes only.
DO NOT USE FOR LIFE AND DEATH DECISIONS!

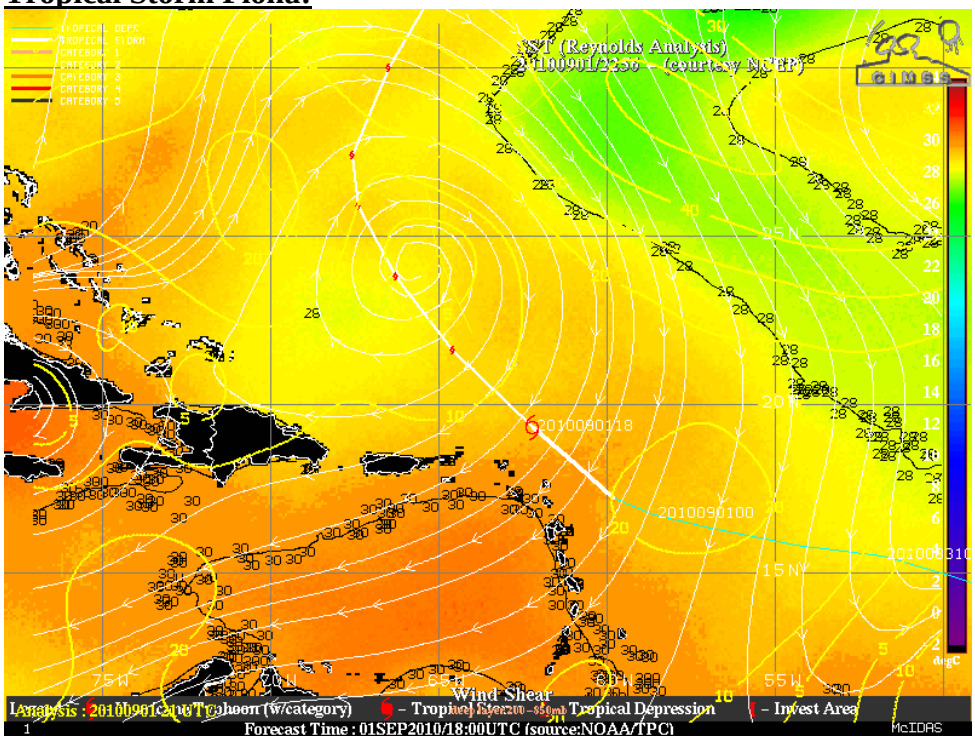
E5


MAJOR HURRICANE EARL (AL07)
Early-cycle intensity guidance
valid 1200 UTC, 02 September 2010
Forecast Intensity (kt)
140
120
100
80
60
40
20
0
CAT5
CAT4
CAT3
CAT2
CAT1
TS
12 24 36 48 60 72 84 96 108 120 132 144 156 168
Forecast Period (hr)
NGPI
AVNI
SHF5
GHMI
LGEM
This plot does not display official storm information. Use for information purposes only.
DO NOT USE FOR LIFE AND DEATH DECISIONS!

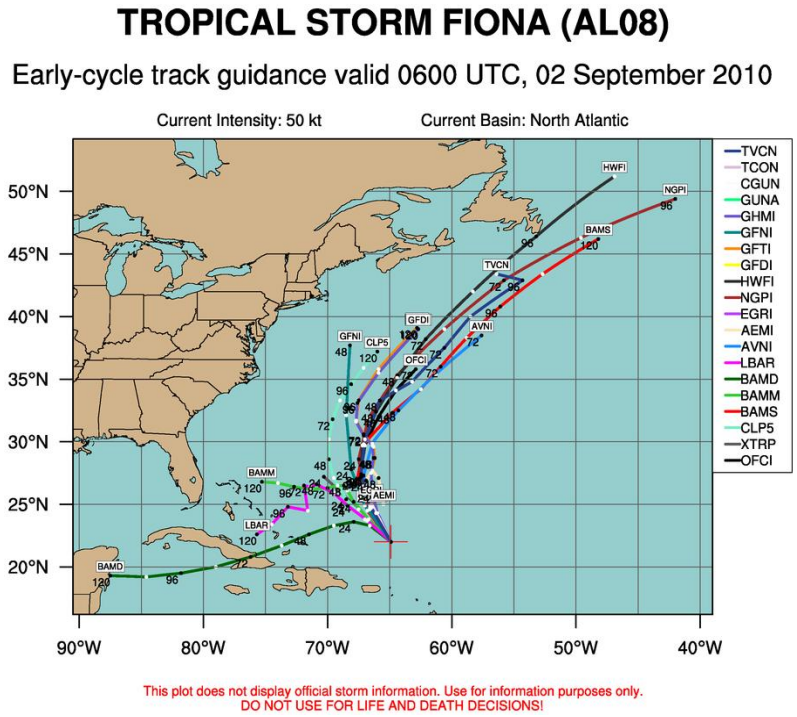
<u>GFS</u> at 24 hours from 0600 UTC Sept 02 initialization:



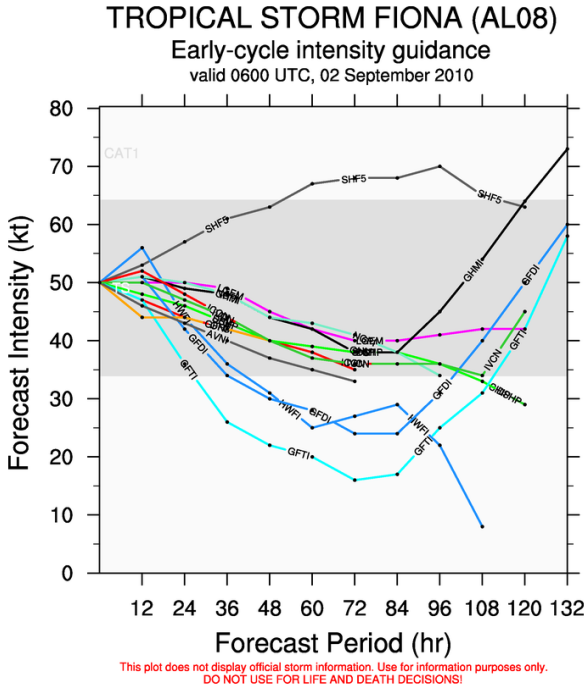
<u>Tropical Storm Fiona:</u>



F1. TS Fiona track forecast, along with CIMSS SST and wind shear analyses

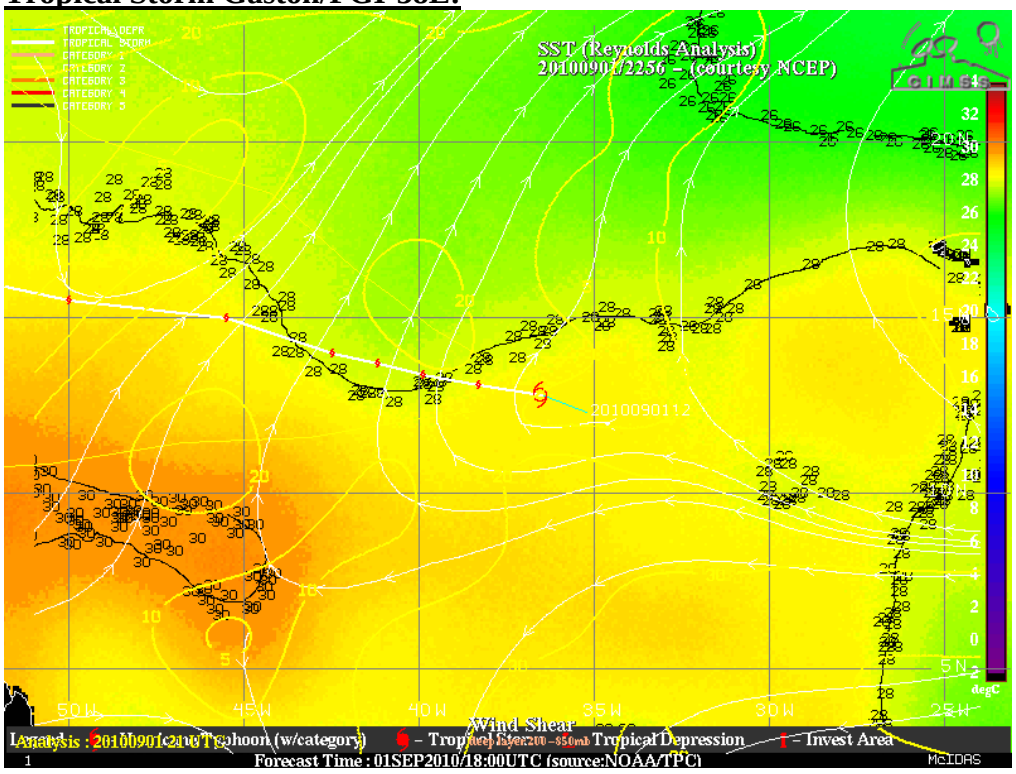


F2. Sept 2 0600 UTC track guidance for TS Fiona

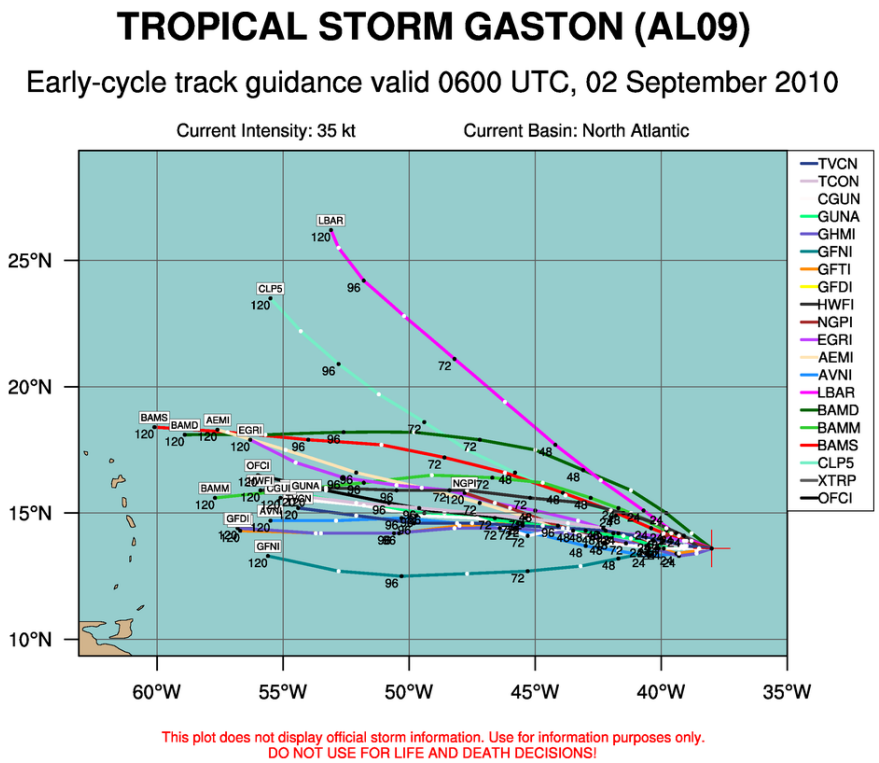


F3. Sept 2 0600 UTC intensity guidance for TS Fiona

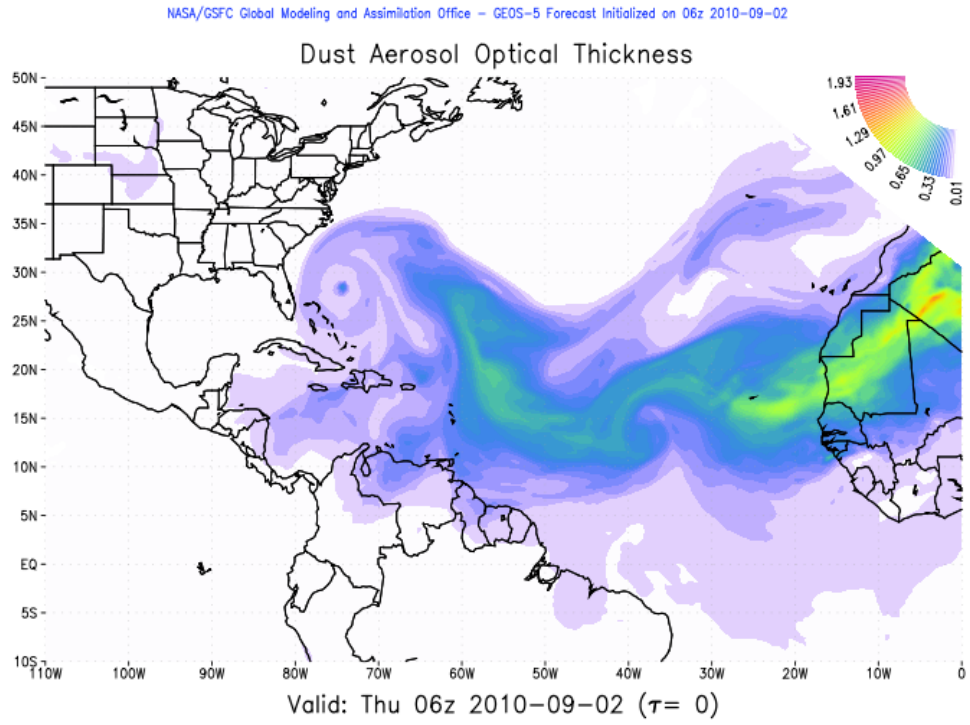
Tropical Storm Gaston/PGI-38L:



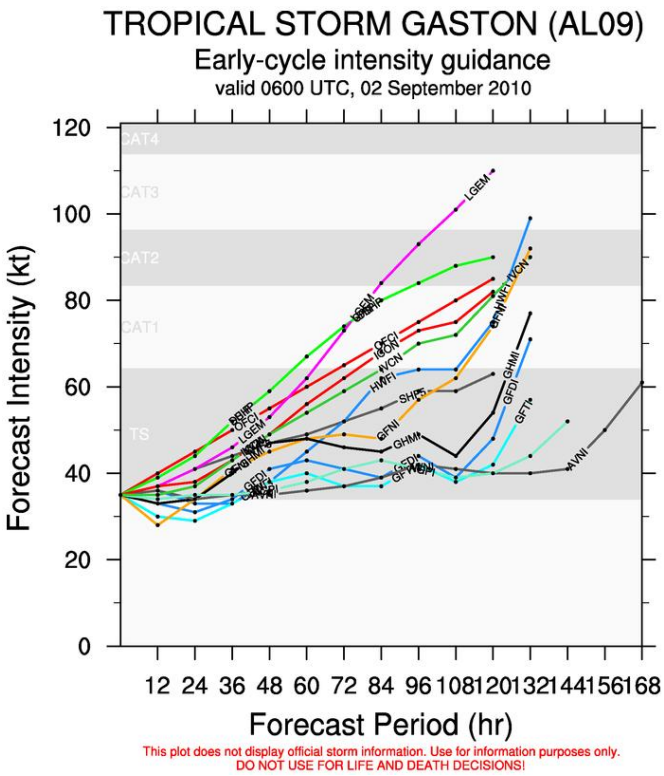
G1. TS Gaston track forecast, along with CIMSS SST and wind shear analyses



G2. Sept 2 0600 UTC track guidance for TS Gaston

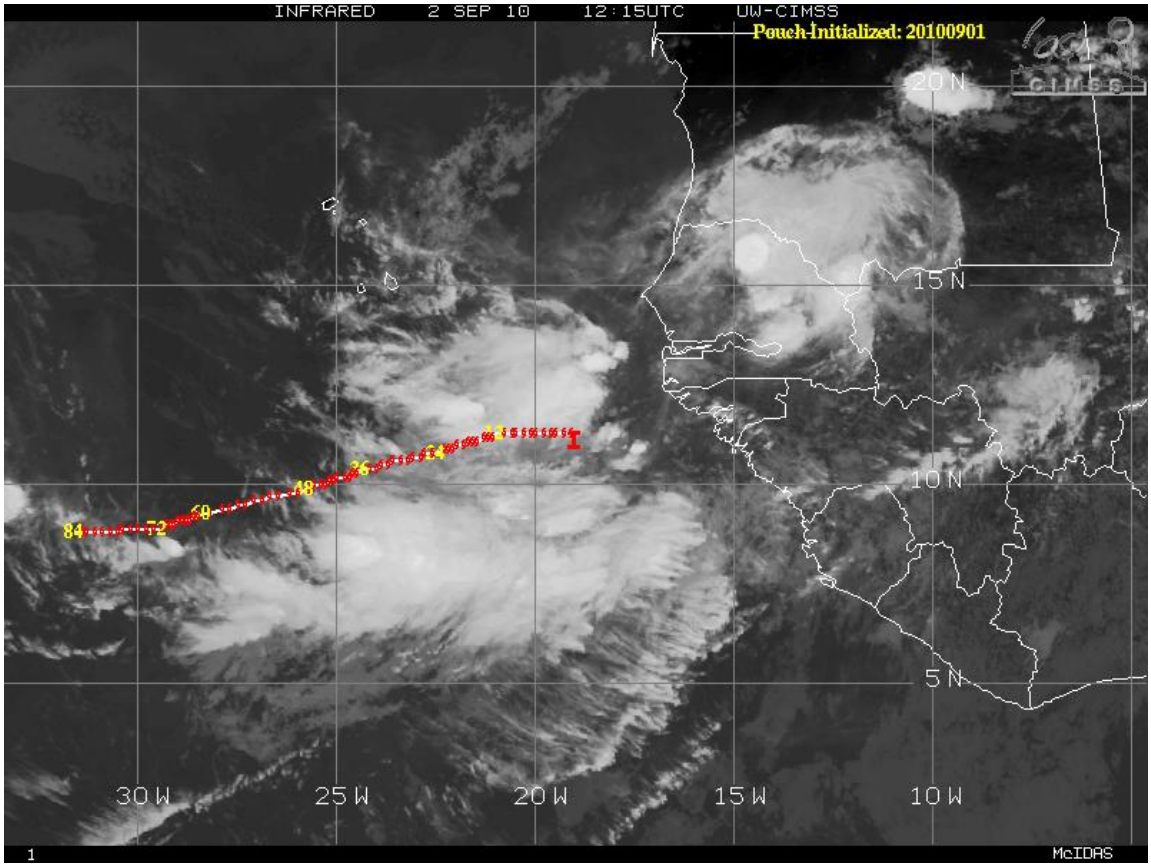


G3. GEOS-5 dust aerosol optical thickness

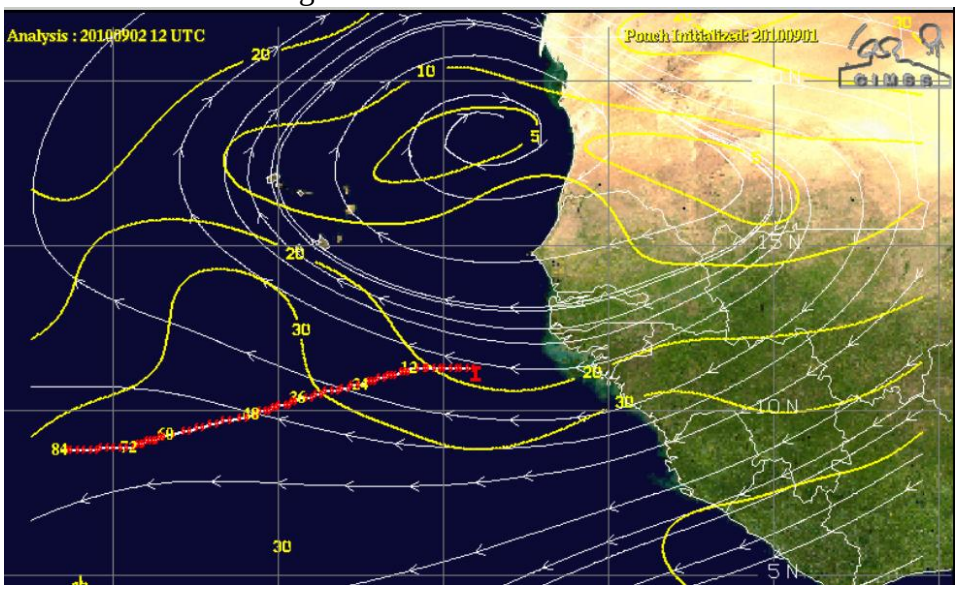


G4. Sept 2 0600 UTC intensity guidance for TS

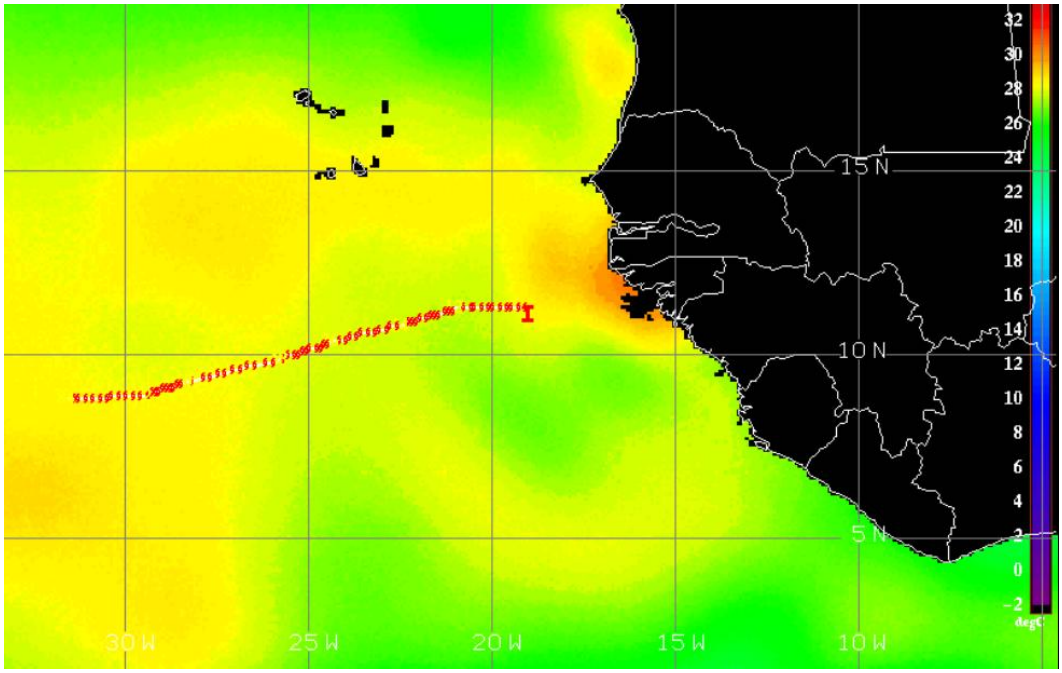
PGI-39L:



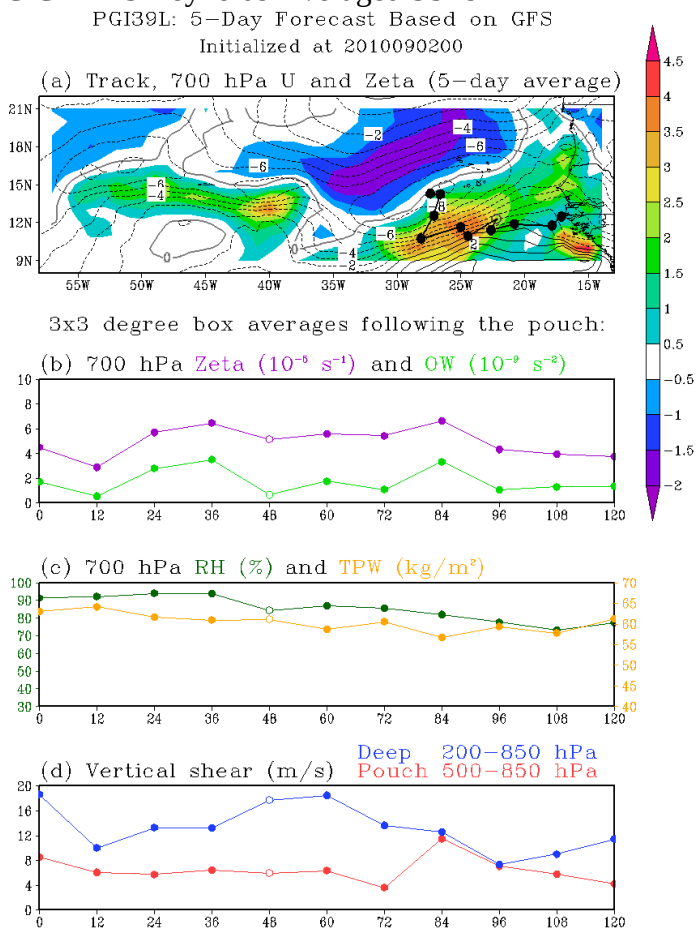
39A 1215UTC IR image and model consensus track for PGI-39L



39B CIMMS 1200UTC wind shear analysis



39C CIMMS Reynolds Averaged SSTs



39D 00Z GFS Pouch diagnostics for PGI39L

Dust

D1- GEOS-5 AOT Model forecast at 72 hours, initialized at 0000 UTC Sept 02