Tropical GRIP Forecast Discussion for September 11, 2010

Created 1600 UTC September 11, 2010

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Summary: Although today is a Hard Down day for the DC-8, and the Global Hawk and WB-57 aircraft are not flying either, PGI-44L has piqued the interest of the tri-agency coordination such that tomorrow both the DC-8 and the Global Hawk have planned investigations into the system. The invest has become much better organized, and as PGI-44L/AL92 moves further west, gradual intensification is expected, however the model initializations for the storm have been varied, and there is also a good degree of spread in the expected track and intensity forecasts for the system. The vorticity in this system has yet to organize properly, but the environment for the system is favorable for further development. Elsewhere, Tropical Storm Igor is make a westward progression and could enter the GRIP flight domain in 6-7 days, PGI-43L is exiting the coast of Africa with decent convection that is beginning to organize, and the SAL is interacting with both Igor and PGI-43L. The GRIP domain is expected to remain active for the next week.

Forecast for 1600 UTC 9/11/2010:

Synoptic Overview:

The Atlantic Basin has a fair amount of activity present, especially in the East Atlantic and southeast Caribbean Sea (**S1**). In the western half of the basin, there are a few targets of particular interest. Dry air and subsidence dominate most of the Gulf of Mexico under the influence of an upper level anticyclone (**S6, C1**). Convection is limited to the Bay of Campeche and off the coast of Nicaragua (**S3**), where the remnants of Ex-Gaston/PGI-38L are coming ashore in Central America (**S4**). Wind shear is mostly low, and northerly over the Gulf (**C2**), becoming westerly over most of the Caribbean Sea. There is an upper level cold low present near eastern Cuba and western Hispaniola (**C1, C3**). Water Vapor imagery indicates that the Caribbean is dry in the center (**S6**), with moisture present to the west and an abundance of moisture in the east surrounding PGI-44L. This is a particular target of interest for GRIP, who will be investigating the system tomorrow and possibly for a couple of days after that. Low level moisture is evident in Total Precipitable Water imagery (**S4**), showing the moist pocket of air that accompanies PGI-44L/AL92. 850 hPa vorticity analysis from CIMSS shows a broad area of negative vorticity present west of the Lesser Antilles associated with the system (**C4**), and it resides in an area of low to moderate shear (**C2**).

A mostly stalled frontal zone extends into the Atlantic from the east coast of the United States from Georgia (**S1**) and a strong jet is present along the base of the trough (**C1**), defining the western extent of the Subtropical High. The 1030 hPa ridge has a southern reach to about 18N. Most of the tropical easterly waves are on a purely westward track, as a result, because the ridge is strong enough to prevent a northward turn. Dry air generally has accompanied this high pressure influence (**S4**), but is also beginning to track westward, staying ahead of the moisture associated with Tropical

Storm Igor, now nearing the central Atlantic, with an intensity of 60kt (**S1**). Igor's position is approximately 17.4N/39.5W. Igor is located in a TPW moisture maximum at low levels, and resides in upper level easterly flow, with excellent upper level outflow evacuating the system's air via strong upper level diffluence (**S2**). Wind shear is generally low over the tropical East Atlantic (**C8**), with stronger wind shear of 20-30 kts located near and to the south of Igor. Good banding features are notable in both visible and infrared imagery, and low level vorticity values indicate the presence of a strong tropical storm (**C6**).

A newly emerging AEW is currently associated with a vigorous blow up of convection and is clearly evident on the current IR satellite imagery (**S7**). CIMSS analysis shows high southwesterly 40-50-kt winds at upper levels to the northwest of the west coast of Africa north of the Cape Verde Islands (**C5**). Across northern Africa the upper level winds are generally westerly at 30-40-kts, and over much of central Africa, upper level 30-40-kt westerly winds prevail and extend westward to the eastern Atlantic (**C5**).

The low level wind field shows well defined cyclonic flow surrounding PGI43L emerging off the coast of Africa (**C7**). Northwest of the African coast low level winds are generally northerly at 15-25-kts and become more westerly further out over the eastern Atlantic. To the west of PGI44L winds become more southerly.

The 200-900-hPa wind shear analysis over the eastern Atlantic shows that there is a minimum over the Cape Verde islands with a maximum of deep layer shear to the north and south. The highest values appear near the Cape Verde islands with over 50-kts of westerly shear. To the south of the Cape Verde islands there is up to 40-kts of easterly shear. There is a relative minimum of deep layer wind shear over western African continent itself (**C8**). Wind shear does decrease further westward though, and any AEWs that hold together will enter an increasingly favorable environment.

TPW analysis shows abundant moisture over the eastern Atlantic along a latitude line paralleling the Cape Verde islands and points south. To the north, TPW values drop off substantially (**S4**). Water vapor imagery also shows evidence of dry air to the north of the Cape Verdes (**C5**). The CIMSS SAL analysis shows some dry air to the north of these islands as well (**D1**). SSTs over the eastern Atlantic are presently quite warm and there exists a positive SST anomaly over much of the ocean to the east of Africa, except directly south of the Cape Verdes where there is a slight negative anomaly. The positive SST anomaly extends westward all the way to the Caribbean Islands.

In summary, conditions across the eastern Atlantic are presently only marginally conducive to tropical cyclone development. Although warm SSTs are present, any systems emerging off of the African coast have to contend with relatively strong deep layer shear. In Addition, some parts of the eastern Atlantic, especially to the north of the Cape Verde islands have dry air present.

Features of Interest:

PGI-44L:

The CIMSS analysis for pouch positions places PGI-L44 at 14.4° N and 63.6° W at 1100 UTC. The visible satellite imagery suggests the system is becoming much better

organized this morning with one main blow up of convection near the center of the pouch position (**44A**). The water vapor imagery shows that the pouch remains in an environment abundant in moisture with most of the evidence of dry air confined to the north (**44B**). MMIC TPW imagery confirms this as well (**44C**). The system remains over warm SSTs (**44D**) and high oceanic heat content (**44E**). There remains a little easterly shear on the southern edge of this storm (**C2**). Otherwise, PGI-44L appears to be in a favorable environment conducive for development into a tropical cyclone.
The 0600 UTC model guidance suggests that the system will begin to undergo intensification into a tropical cyclone over the next couple of days. In fact, most of the statistical models have it reaching tropical storm strength in about 24 hours (**44F**). Afterwards, hurricane strength appears possible over the next 2 to 3 days. The GFS and HWRF, however, do not do much with PGI44L. The 0000 UTC ECMWF has backed off from previous solutions and shows intensification much later in the forecast period as it approaches the Yucatán (**44G**). The 0600 UTC model guidance has the system generally tracking west-northwestward over the next several days (**44H**). Most of the models track the system near Jamaica in 72 hours, and then move it towards the Yucatan Peninsula. Despite the ECMWF backing off, all indications are that as the system pushes west-northwestward it will remain in a favorable environment with warm SSTs, high oceanic heat content, and decreasing wind shear.

PGI-42L/Tropical Storm Igor

Igor has continued to intensify over the past 24 hours, and is likely to become a hurricane within the next 24 hours. It is located at 17.4N/39.5W, and maximum sustained winds are now 60kts. A large convective burst was observed overnight, and the NHC noted that an eye-like feature was briefly evident. Convection has dissipated somewhat today and is mainly limited to the southern half of the storm, indicating that the system is still under the influence of some northeasterly wind shear (**I1**). The 1200 UTC SHIPS forecast, with the vortex removed, indicated that shear is presently around 15kts (**I2**). However, the environment should be vastly improving within the next day. Igor will be moving over warmer SSTs, and into lower environmental shear (**I3**). In fact, the GFS, as indicated by SHIPS, is forecasting shear values as low as 1kt in 60 hours. The system is in a pocket of very high TPW, and Water Vapor imagery also indicates a large amount of moisture available to the system aloft (**S4, S6**). The GEOS-5 0600 UTC analysis of Saharan Dust, along with AQUA and TERRA Aerosol Optical Depths, indicates the presence of dust to the north, east and west of Igor (**I4, S5**). AIRS soundings from a pass around 0430 UTC today indicate the presence of somewhat dry mid to upper level air along with the dust, however these soundings also indicate that the dry air is mostly displaced to outside the core of the system, and that it does not wrap all the way around (**I5)**. The GEOS-5 forecast, similar to yesterday, does not indicate that the dust or dry air will wrap all the way around the system, so it is not likely to be a major inhibiting factor for development. The 1200 UTC models indicate a general westward track for the next few days (**I6)**. After 72-96 hours, a mid latitude cyclone breaks down the subtropical ridge, allowing the system to turn towards the north for a period of time. However, recent runs of the GFS, HWRF, and GFDL indicate that the trough will lift away, allowing the ridge to build back south, turning the system back towards the west for a period of time. This could allow its position to move within range of FLL GRIP

operations in the 6-7 day timeframe. All intensity guidance suggests intensification of the system into a hurricane in the near future (**I7**). A model consensus forecast brings the intensity prediction close to a category 3 hurricane within 96 hours. While the recent fluctuations in convective activity may temporarily delay intensification, Igor is still likely to eventually evolve into a strong hurricane.

PGI-43L/AL-93L:

As of 1200 UTC PGI-43L is positioned at 12.0°N, 15.7°W just exiting Africa at the coast of Guinea. The system has a visible circulation in satellite imagery and vigorous convection located slightly west of the analyzed pouch location (**43A**). Low-level convergence is shifted slightly to the east of this location with upper divergence over the convective activity showing a westward-tilt of the system (**43B**). Dry air initially does not appear to be a problem for the system with the pouch becoming apparent in TPW as the system moves offshore (**S4**) in addition to a relatively moist area around the storm seen in water vapor (**43C**). At present, the system is embedded in a region of lower wind shear in between two higher shear areas to the north and south of the system (**43C**). SSTs offshore are marginal with values ranging from 25-28°C, however this layer is extremely shallow, as noted in the OHC analysis (**44E**).

The system is forecast to track west-northwest by the GFS (**43D**), ECMWF (**43D**), and UKMET global models. The GFS (**43D**) has vorticity and Okubo-Weiss values steadily increasing for the next 72 hours with moisture parameters roughly constant, while the ECMWF (**43D**) forecasts a sharp increase in vorticity and OW after 12 hours. Both models keep shear relatively low despite slowly increasing shear with time. The GEOS-5 model chemistry forecast keeps dust away from PGI-43L for the most part except for a small hint at the possibility of dust mixing into the pouch at 850 hPa near 0600 UTC Monday (**43E**). SHIPS develops the system into a Tropical Storm by 1800 UTC tomorrow, but since the system is not developed yet and this SHIPS is guided under that premise, this forecast should be taken cautiously. Officially, the NHC gives PGI-43L a 30% probability of development into a tropical cyclone within the next 48 hours.

Dust/SAL

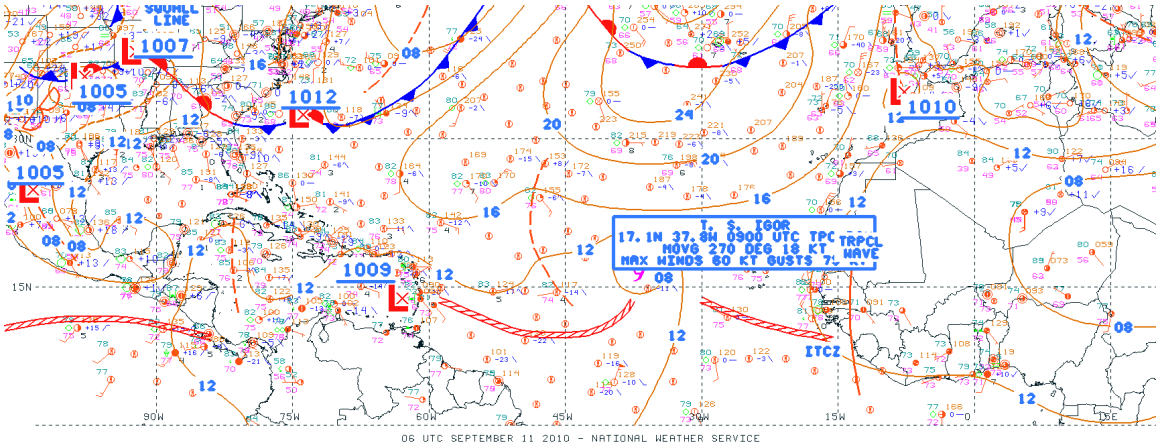
A new SAL outbreak is currently exiting the African Coast (**D1**) in addition to a separate large region of dry air persisting across the central Atlantic (**S6**), each of which are interacting primarily with Tropical Storm Igor. AIRS soundings from the Central Atlantic, in addition to PREDICT soundings to the northeast of PGI-44L (**D2**), depict a layer of extremely dry air extending up from 500 hPa. MODIS observations from late yesterday show high AOD values associated with the dust exiting the African coast and wrapping around to the west of Igor (**S5**). Little dust is seen exiting the African coast in MODIS true-color imagery from this morning, aside from some dust activity around 20°N (**D3**).

The GEOS-5 chemistry forecast has dust interacting with Igor and possibly PGI-43L/AL-93 in the coming days. At the upper levels little dust activity is seen until 0000 UTC Wednesday (**D4**), with low dust mass values otherwise extending from the African

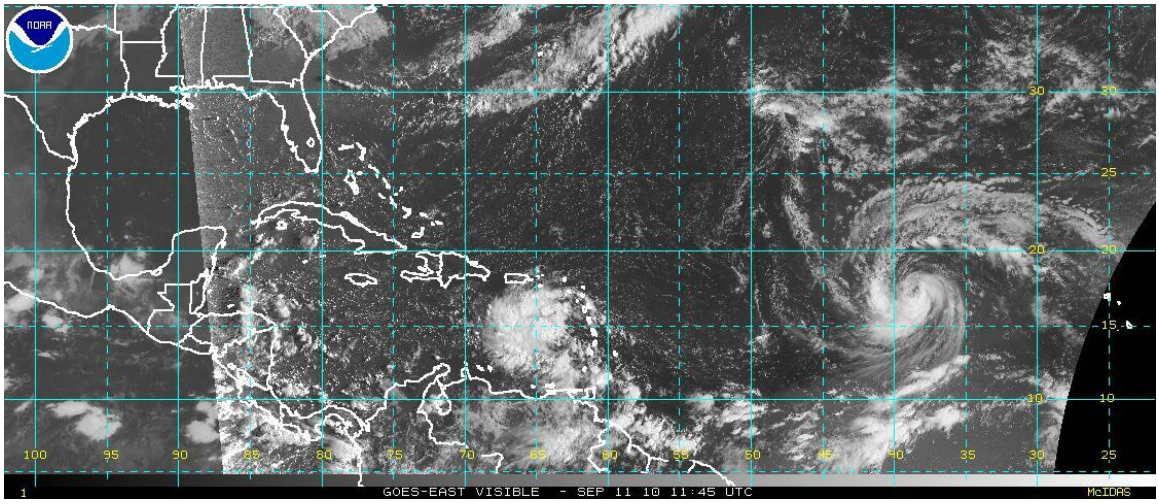
Coast through the Caribbean. At lower levels things are more active with constant shots of dust entering the Eastern Atlantic, and the most vigorous plume of dust expected to occur Monday into Tuesday (**D5**). One noteworthy observation is that dust activity remains primarily to the north of the AEJ throughout the period, and limited interaction with potential systems will be likely to occur unless the Atlantic High weakens.

Images used in discussion:

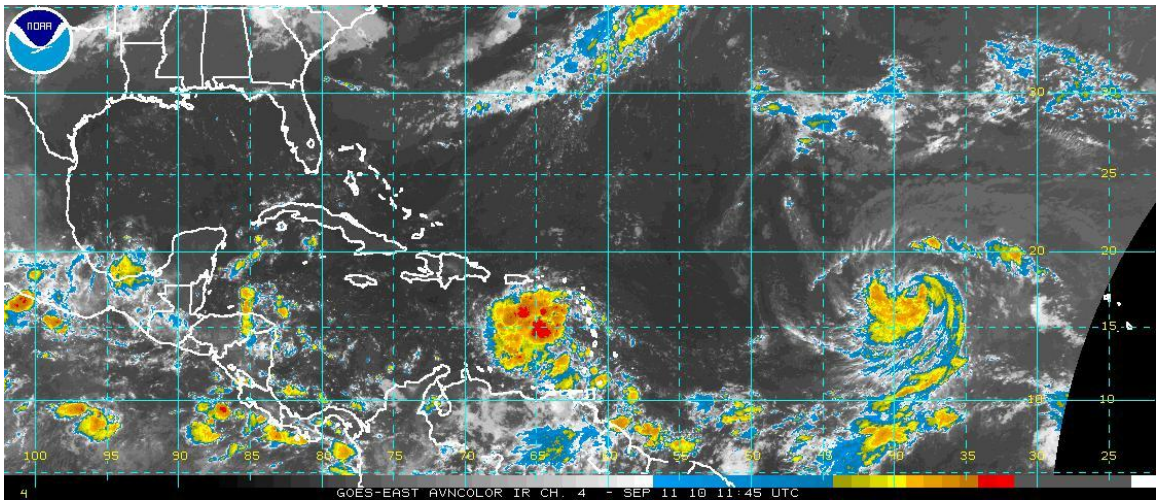
S1



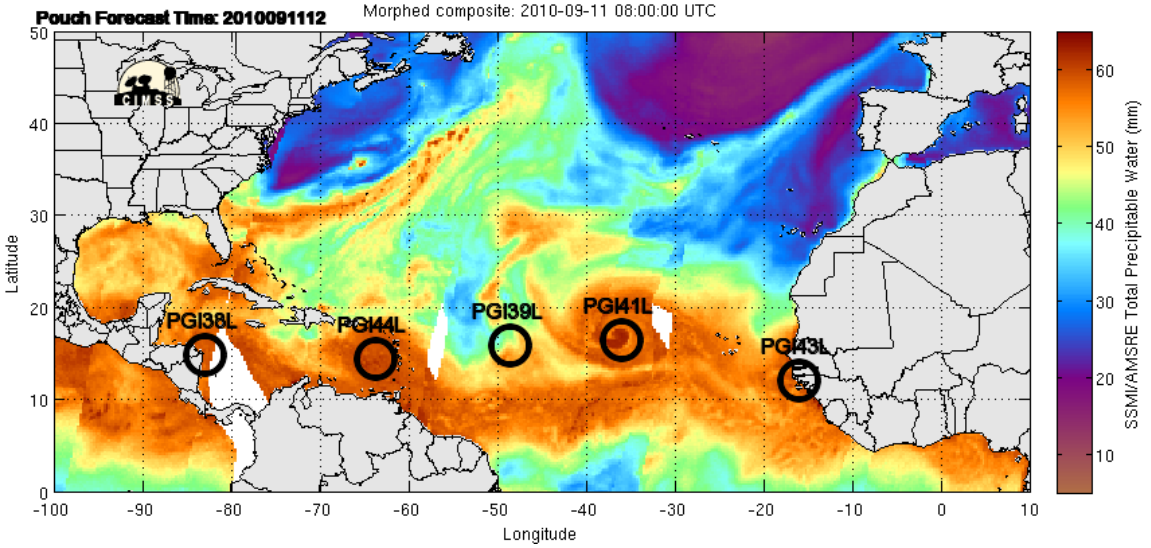
S2



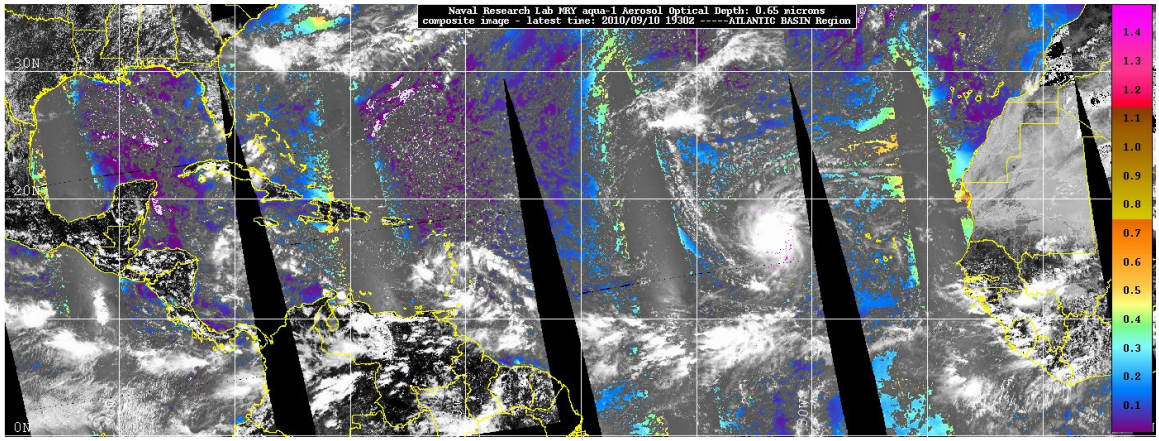
S3



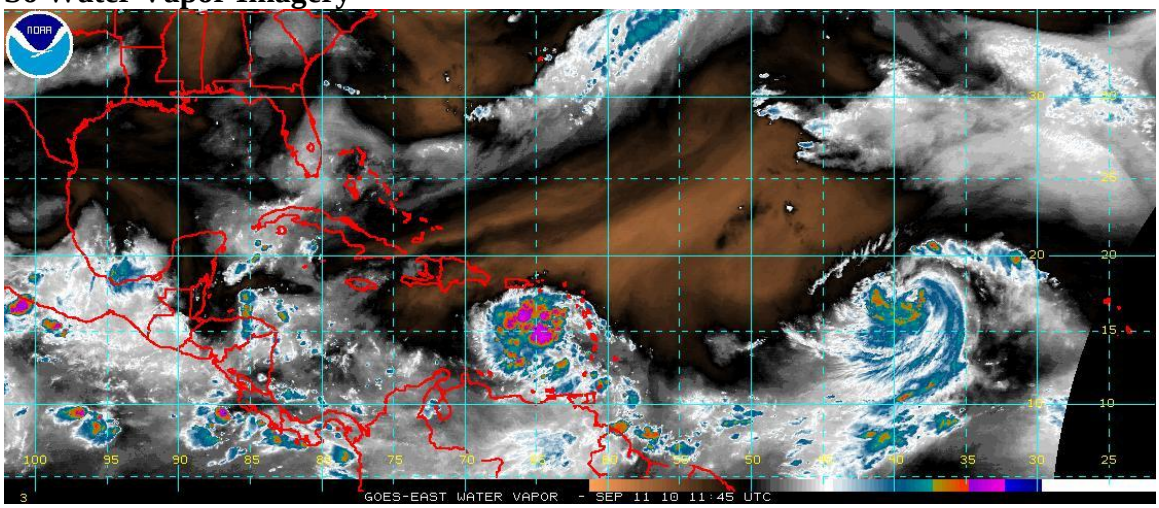
S4



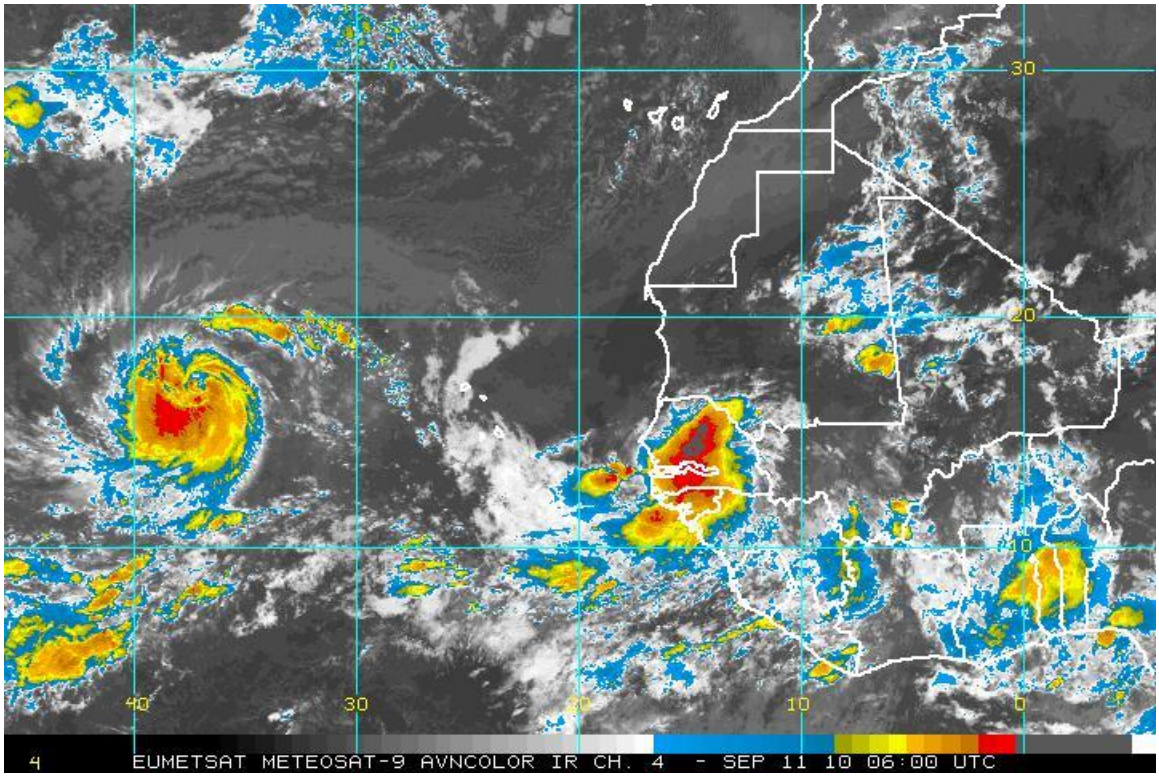
S5 AOT from MODIS via



S6 Water Vapor Imagery

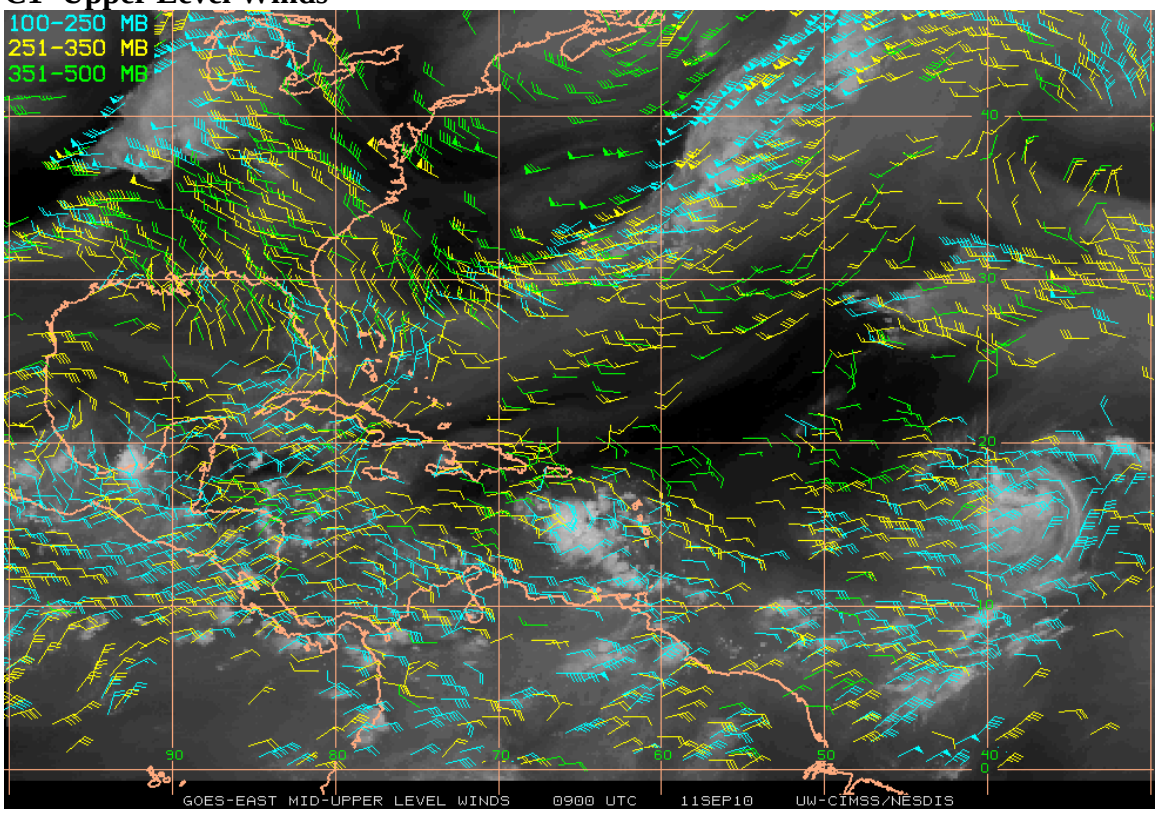


S7

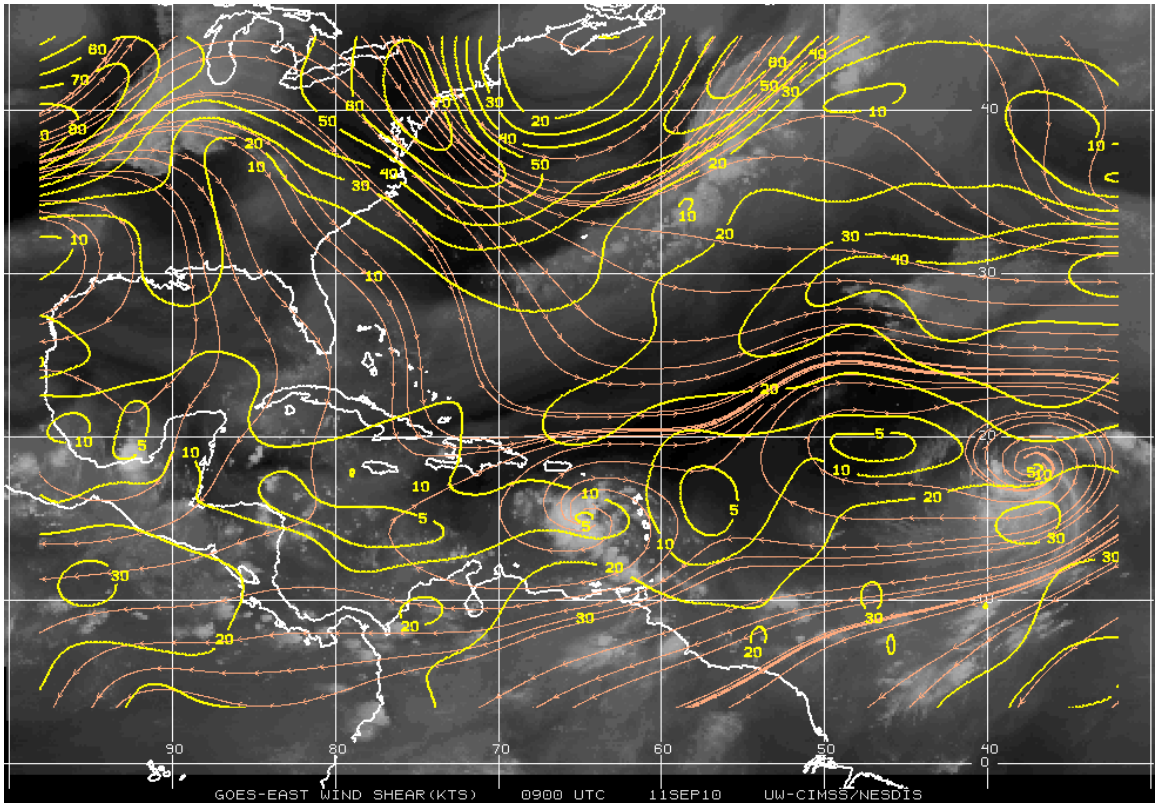


CIMSS Analyses:

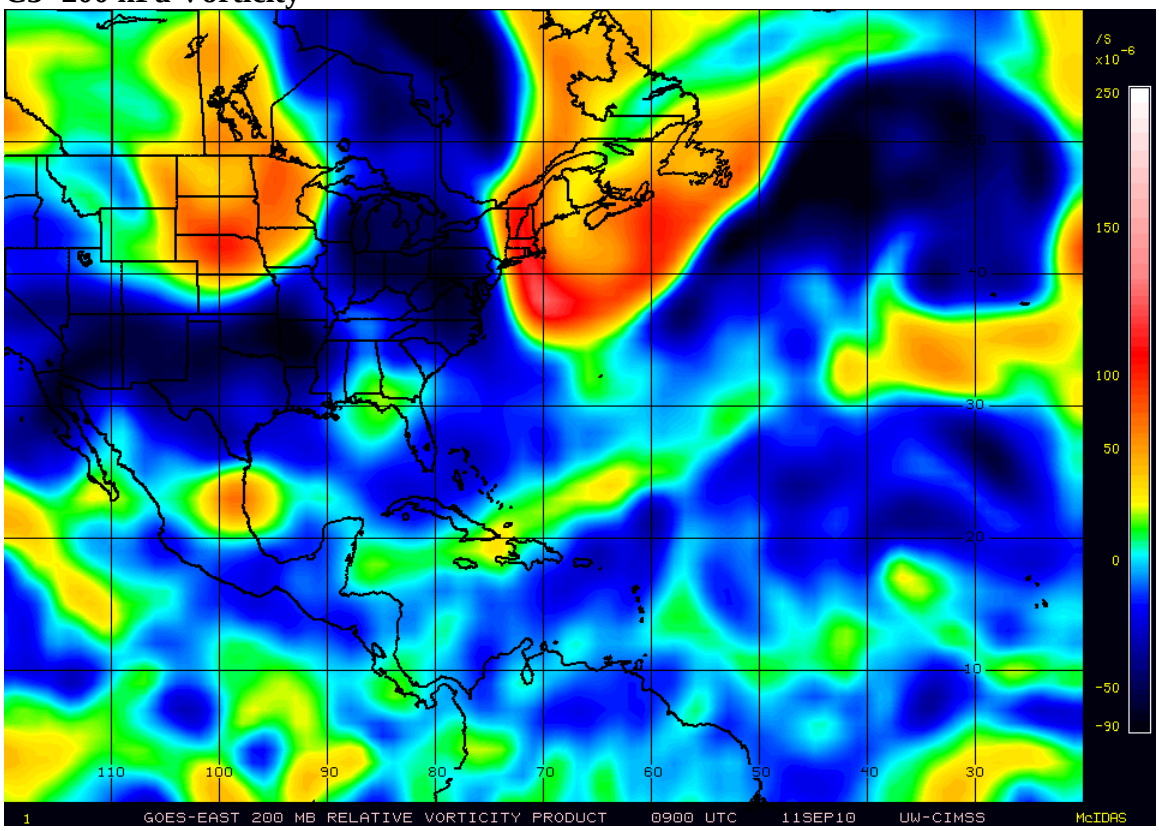
C1- Upper Level Winds



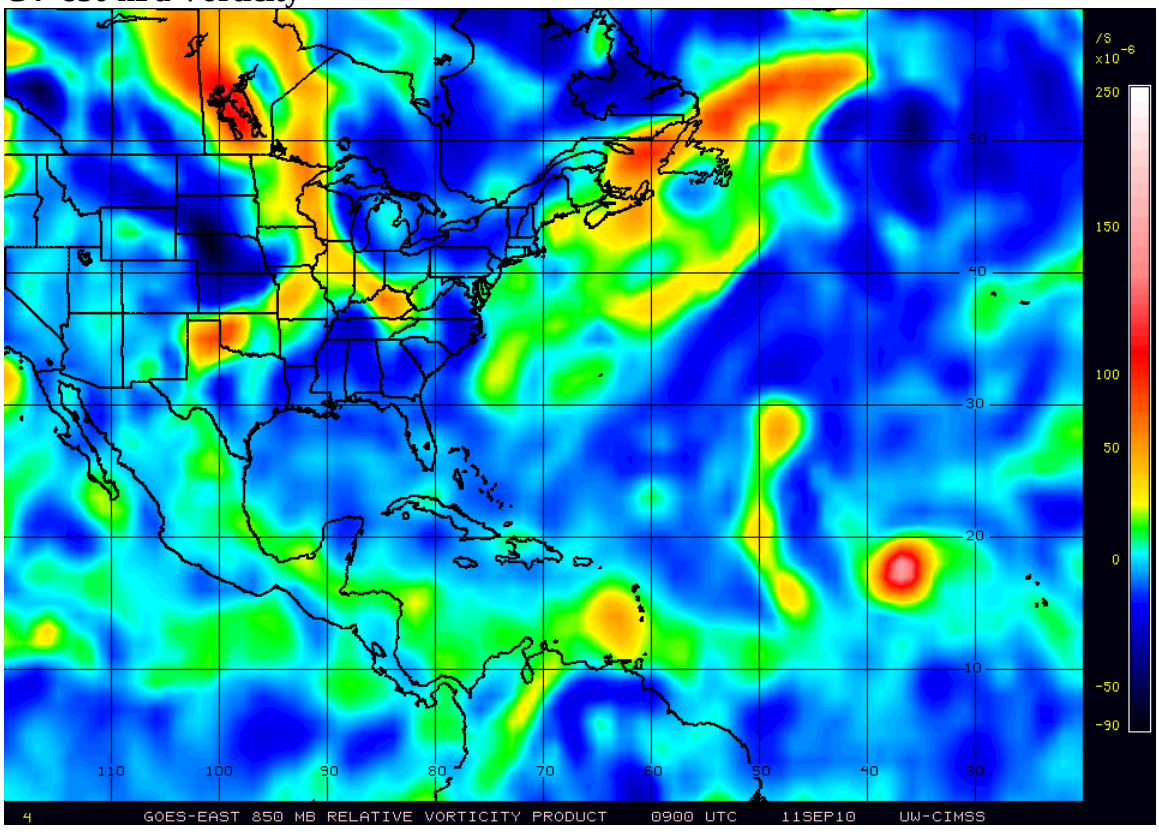
C2- Wind Shear



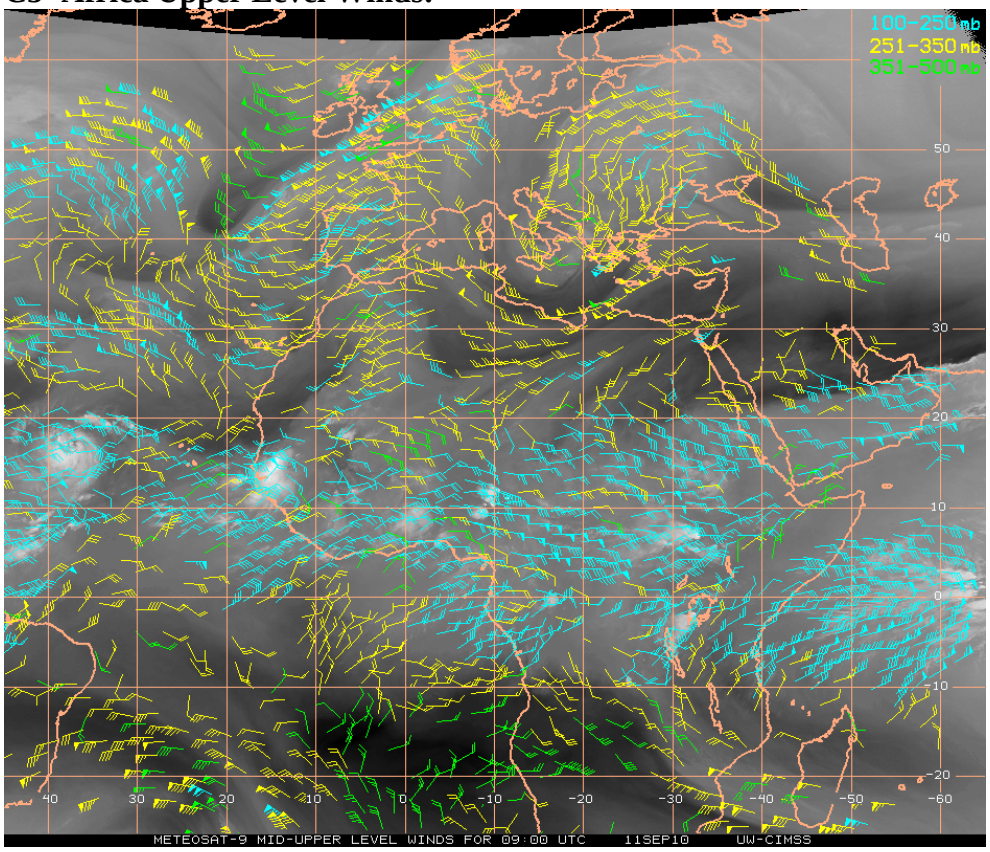
C3- 200 hPa Vorticity



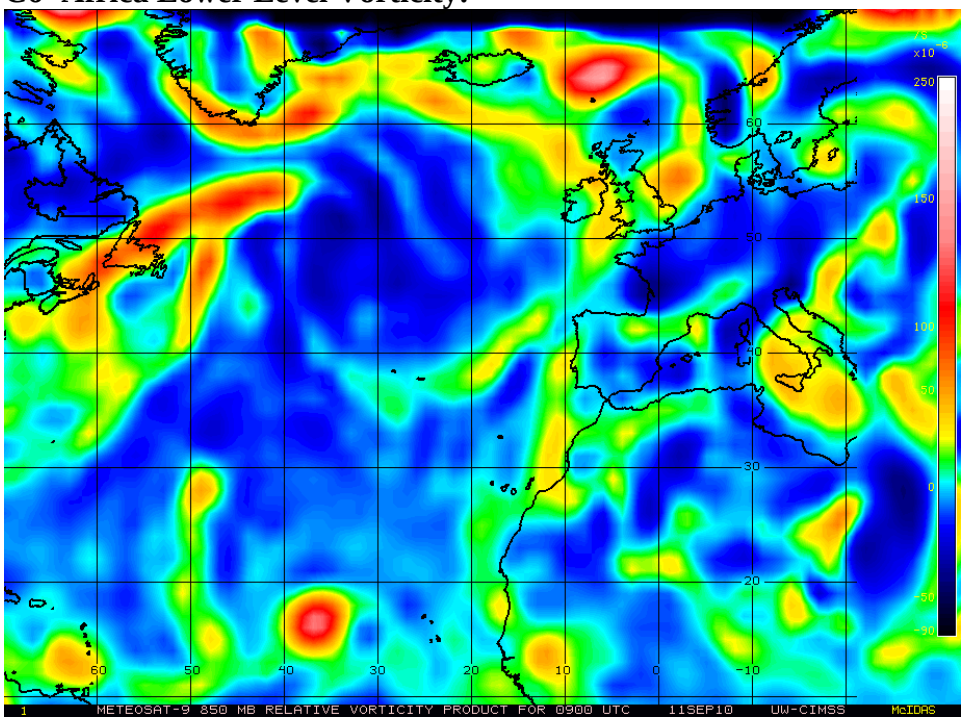
C4- 850 hPa Vorticity



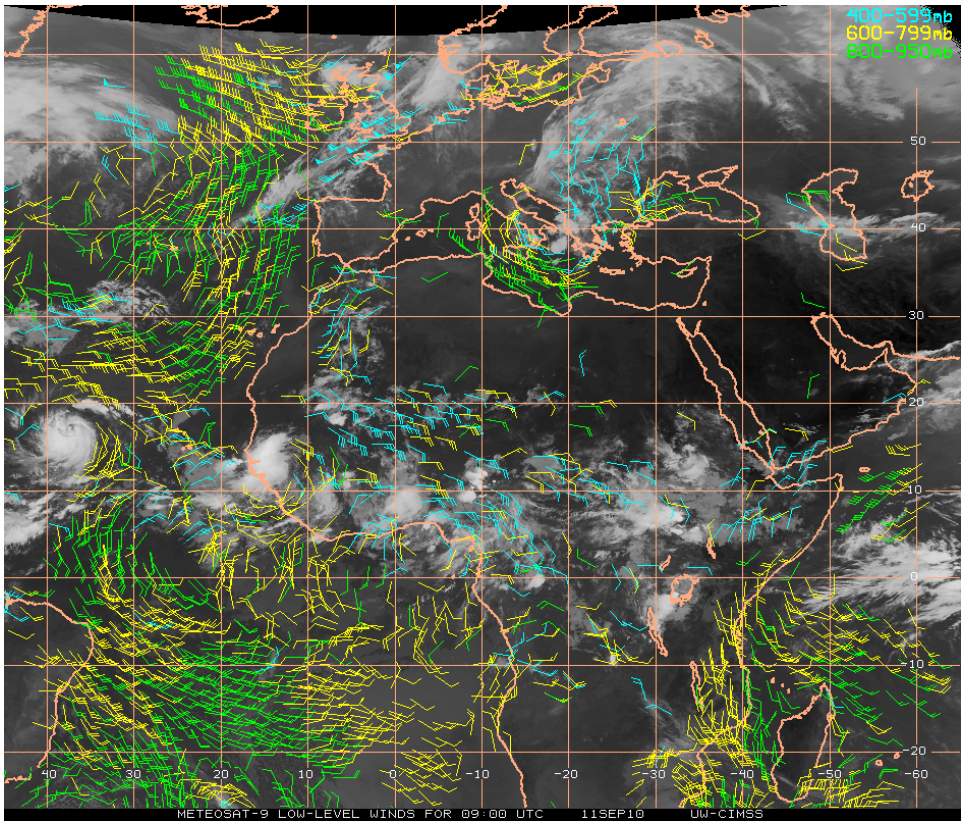
C5- Africa Upper Level Winds:



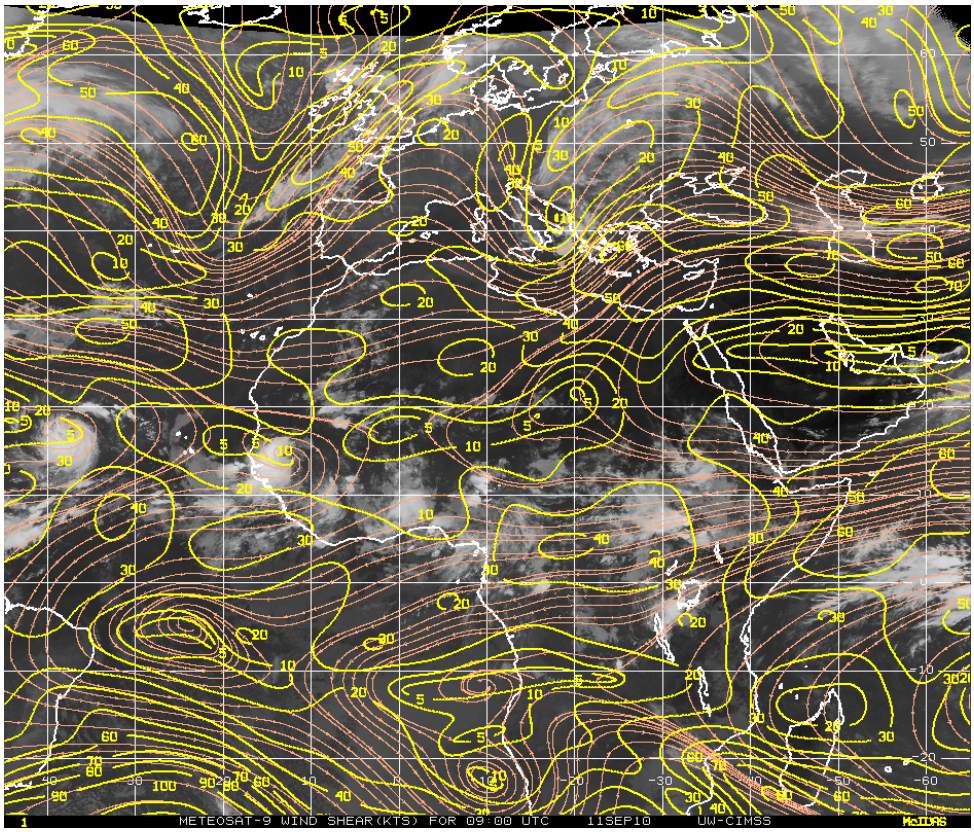
C6- Africa Lower Level Vorticity:



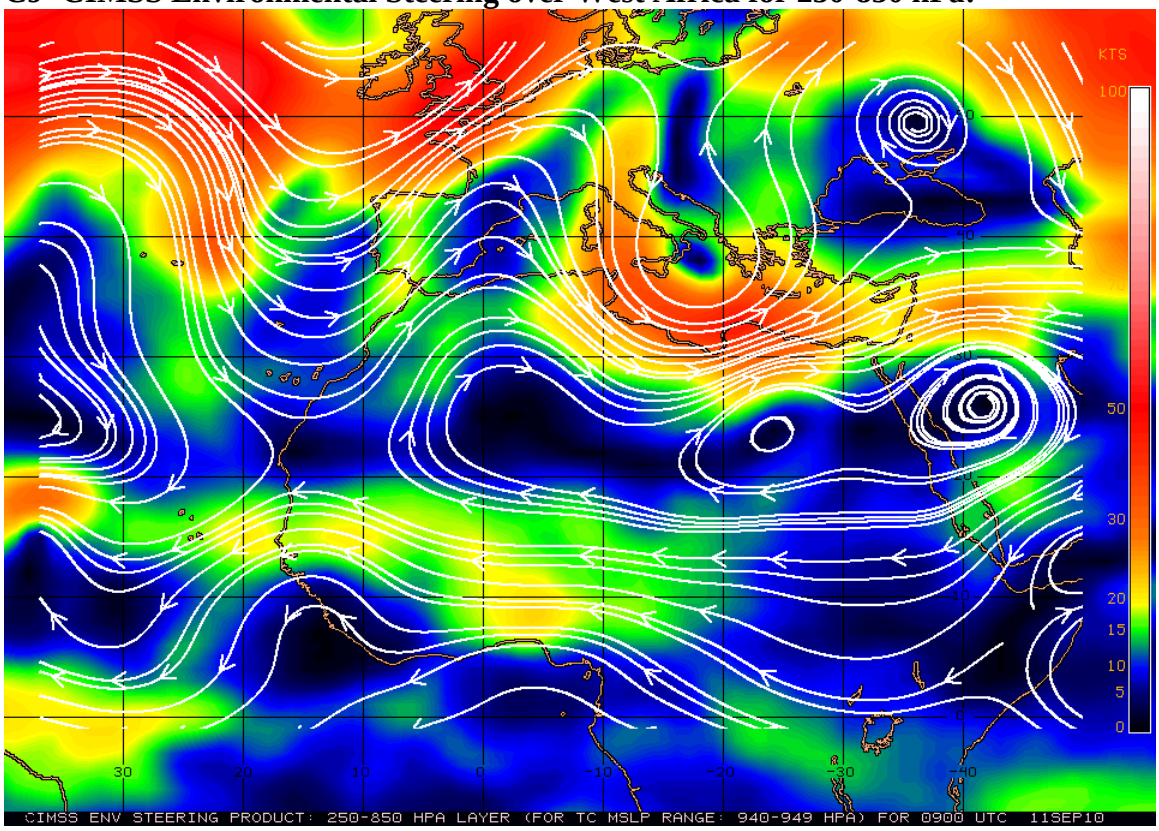
C7- Lower level winds over Africa:



C8- Wind Shear over West Africa:



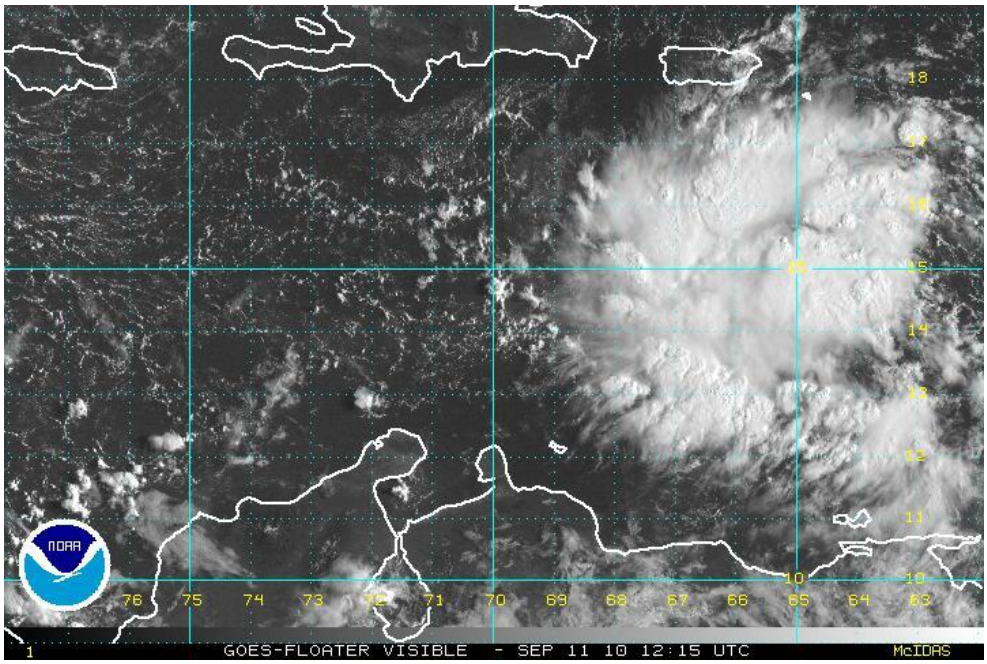
C9- CIMSS Environmental Steering over West Africa for 250-850 hPa:



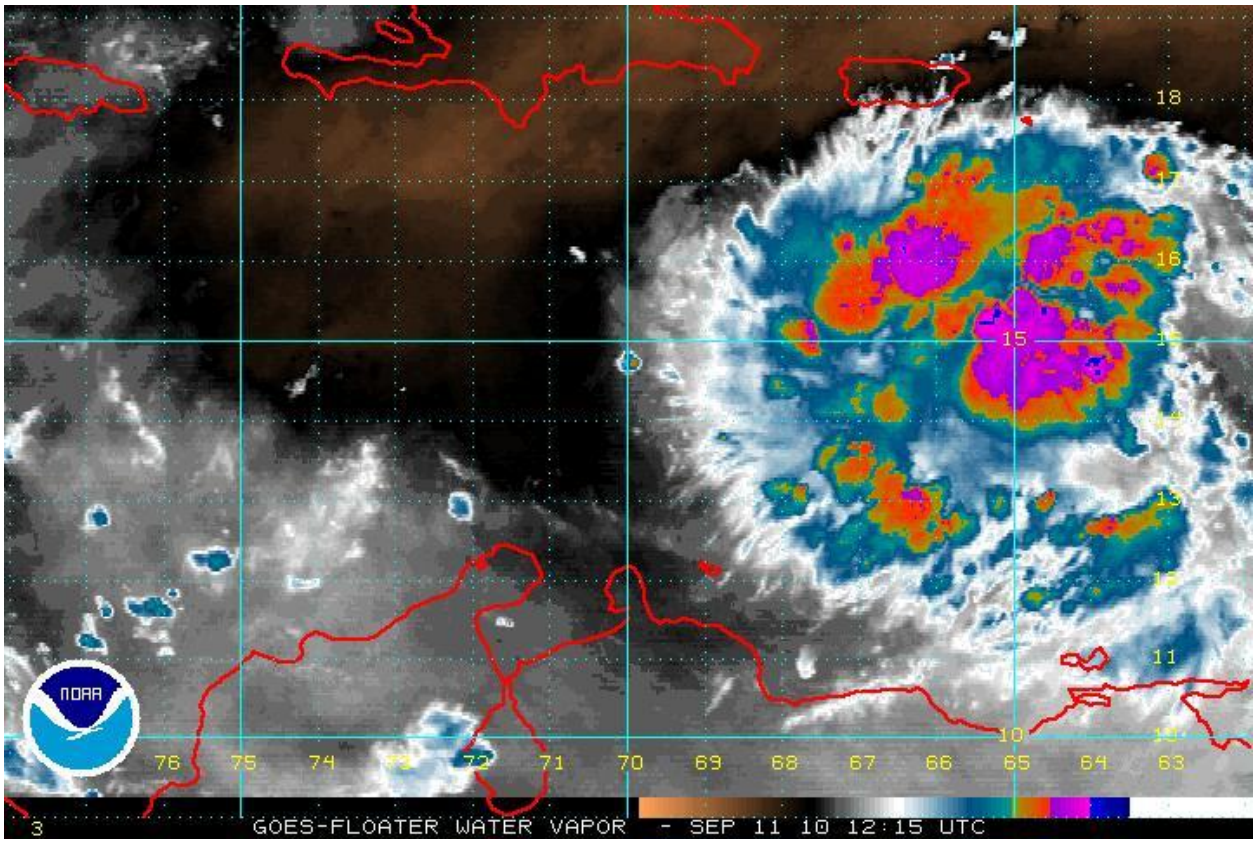
Features of Interest:

PGI-44L:

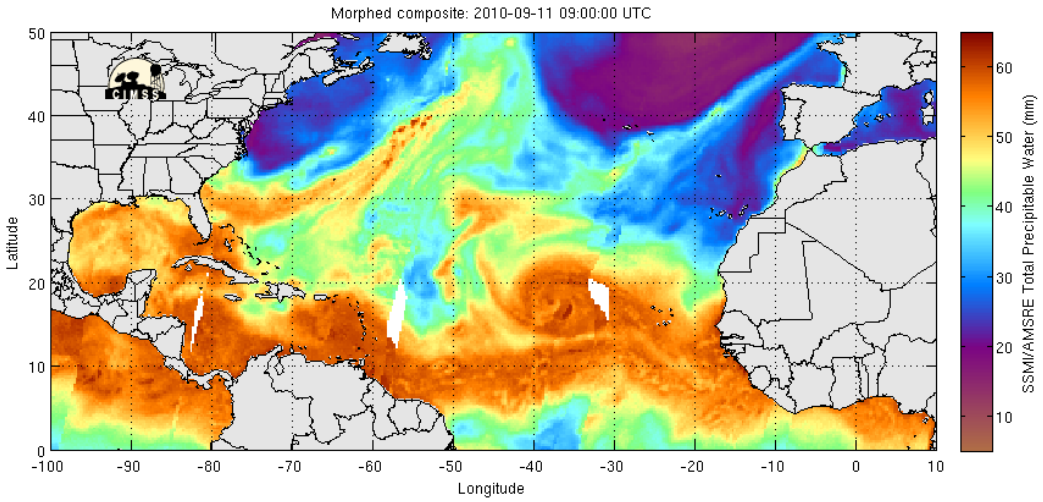
44A



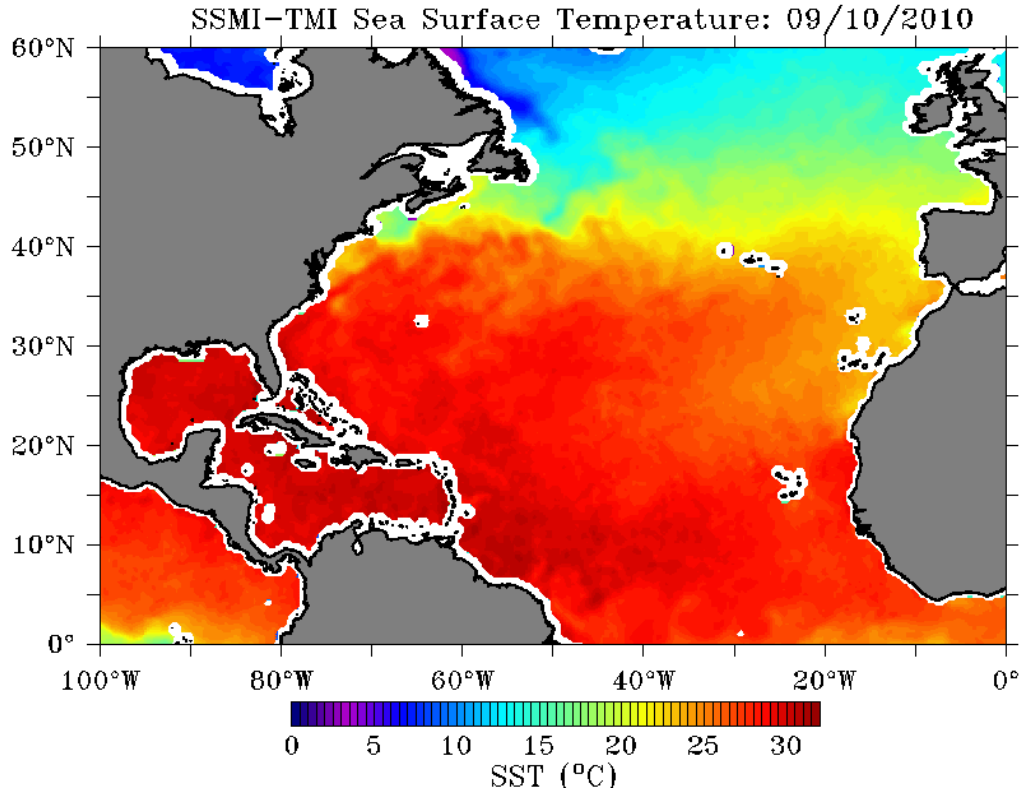
44B


18
17
16
15
14
13
12
11
10
9
76 75 74 73 72 71 70 69 68 67 66 65 64 63
3
GOES-FLOATER WATER VAPOR - SEP 11 10 12:15 UTC

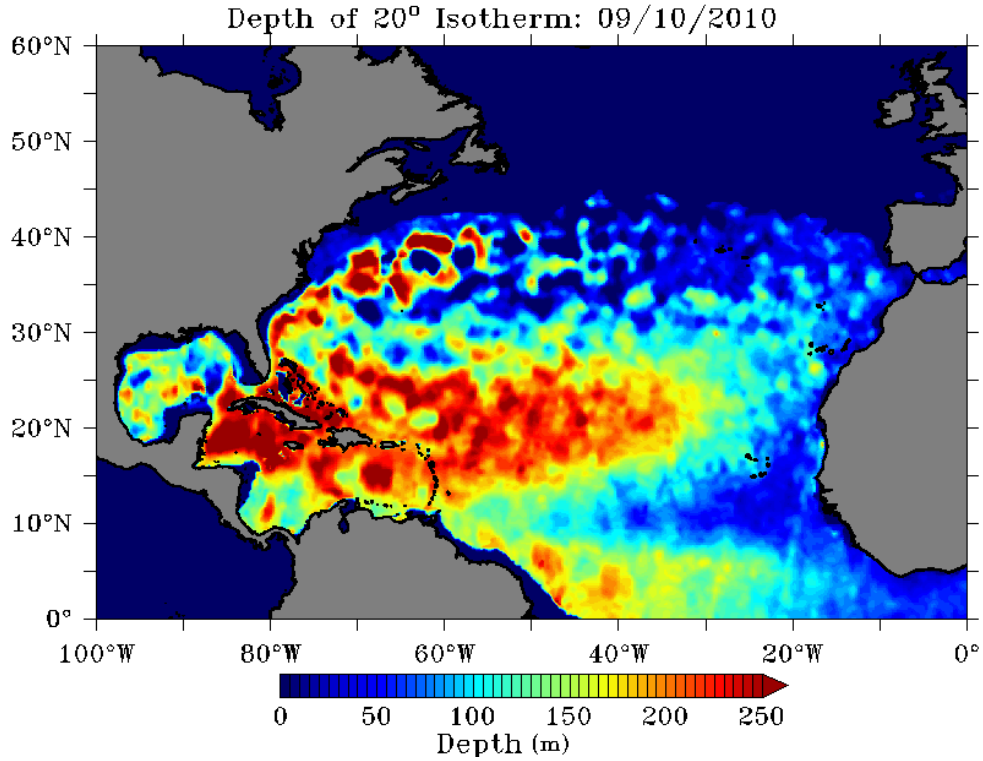
44C


Morphed composite: 2010-09-11 09:00:00 UTC
Latitude
Longitude
50
40
30
20
10
0
-100 -90 -80 -70 -60 -50 -40 -30 -20 -10 0 10
60
50
40
30
20
10
SSMI/AMSRE Total Precipitable Water (mm)

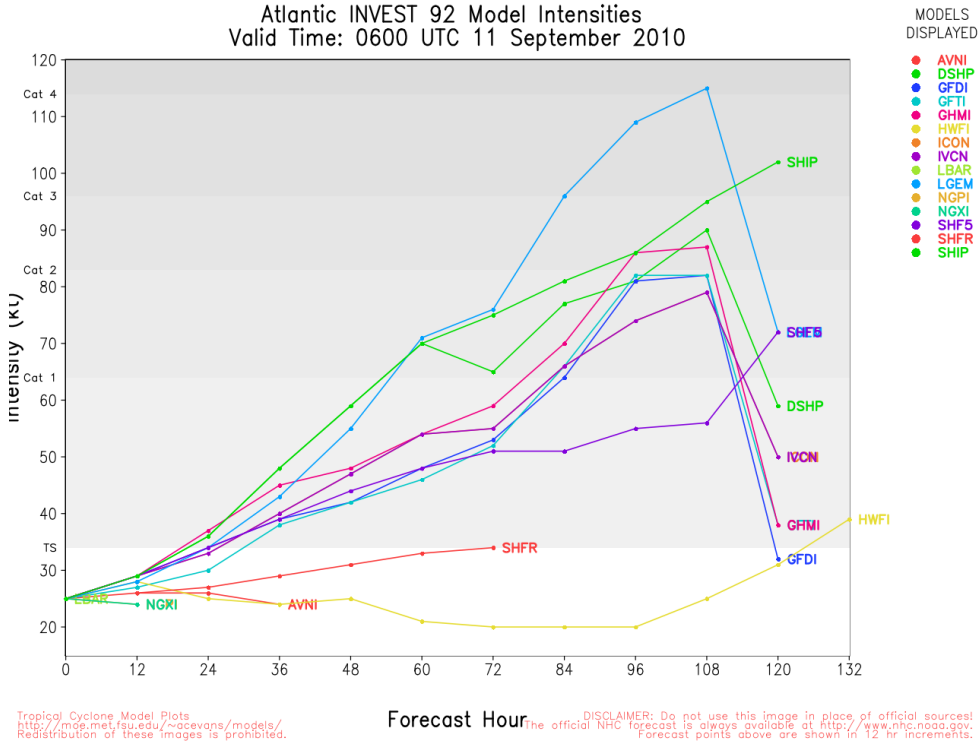
44D


SSMI-TMI Sea Surface Temperature: 09/10/2010
60°N
50°N
40°N
30°N
20°N
10°N
0°
100°W
80°W
60°W
40°W
20°W
0°
0
5
10
15
20
25
30
SST (°C)

44E


Depth of 20° Isotherm: 09/10/2010
60°N
50°N
40°N
30°N
20°N
10°N
0°
100°W
80°W
60°W
40°W
20°W
0°
0
50
100
150
200
250
Depth (m)

44F


Atlantic INVEST 92 Model Intensities
Valid Time: 0600 UTC 11 September 2010
MODELS DISPLAYED
AVNI
DSHP
GFDI
GFTI
GHMI
HWFI
ICON
IVCN
LBAR
LGEM
NGPI
NGXI
SHF5
SHFR
SHIP
Intensity (kt)
Forecast Hour
Cat 4
Cat 3
Cat 2
Cat 1
TS
SHIP
DSHP
IVCN
GHMI
HWFI
GFDI
SHFR
NGXI
AVNI
LBAR
Tropical Cyclone Model Plots
http://moe.met.fsu.edu/~acevans/models/
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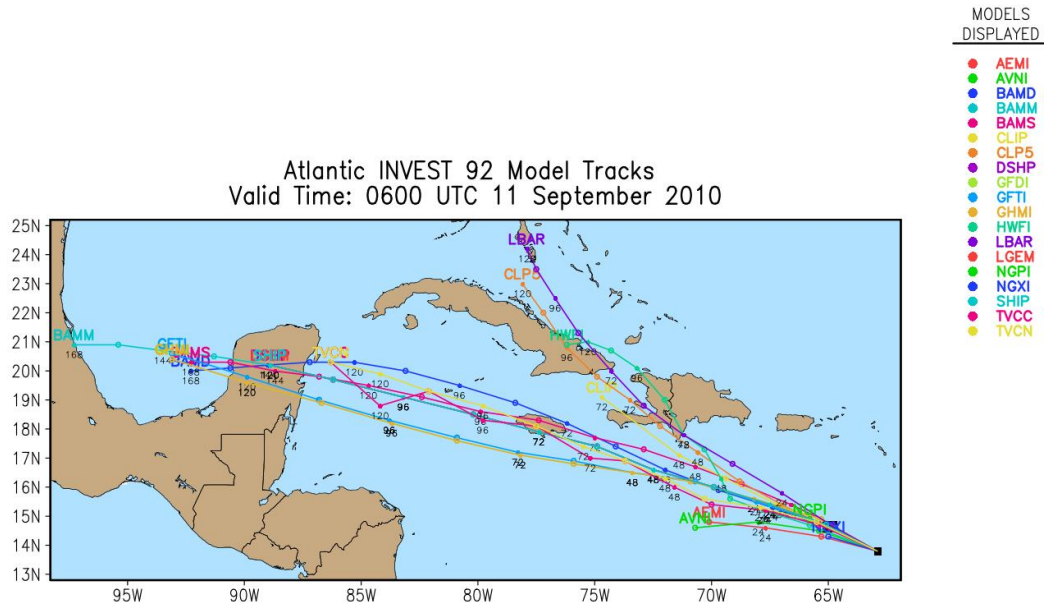
The official NHC forecast is always available at http://www.nhc.noaa.gov.
Forecast points above are shown in 12 hr increments.

44G


Atlantic INVEST 92 Model Tracks
Valid Time: 0600 UTC 11 September 2010
MODELS DISPLAYED
AEMI
AVNI
BAMD
BAMM
BAMS
CLIP
CLP5
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GFDI
GFTI
GHMI
HWFI
LBAR
LGEM
NGPI
NGXI
SHIP
TVCC
TVCN
LBAR
CLP5
BAMM
GFTI
BAMS
BAMD
DSHP
TVCC
HWFI
CLIP
AEMI
AVNI
NGPI
NGXI
Tropical Cyclone Model Plots
http://moe.met.fsu.edu/~acevans/models/
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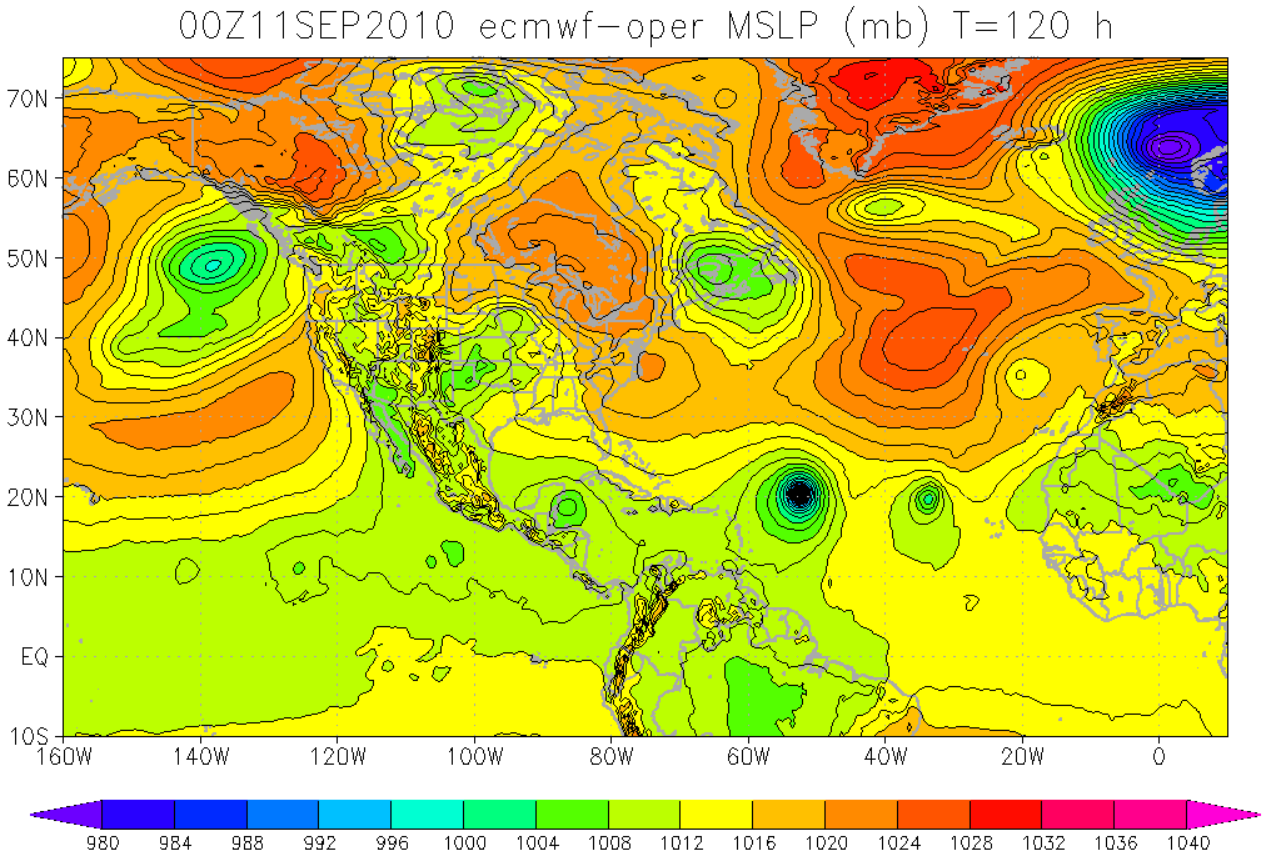
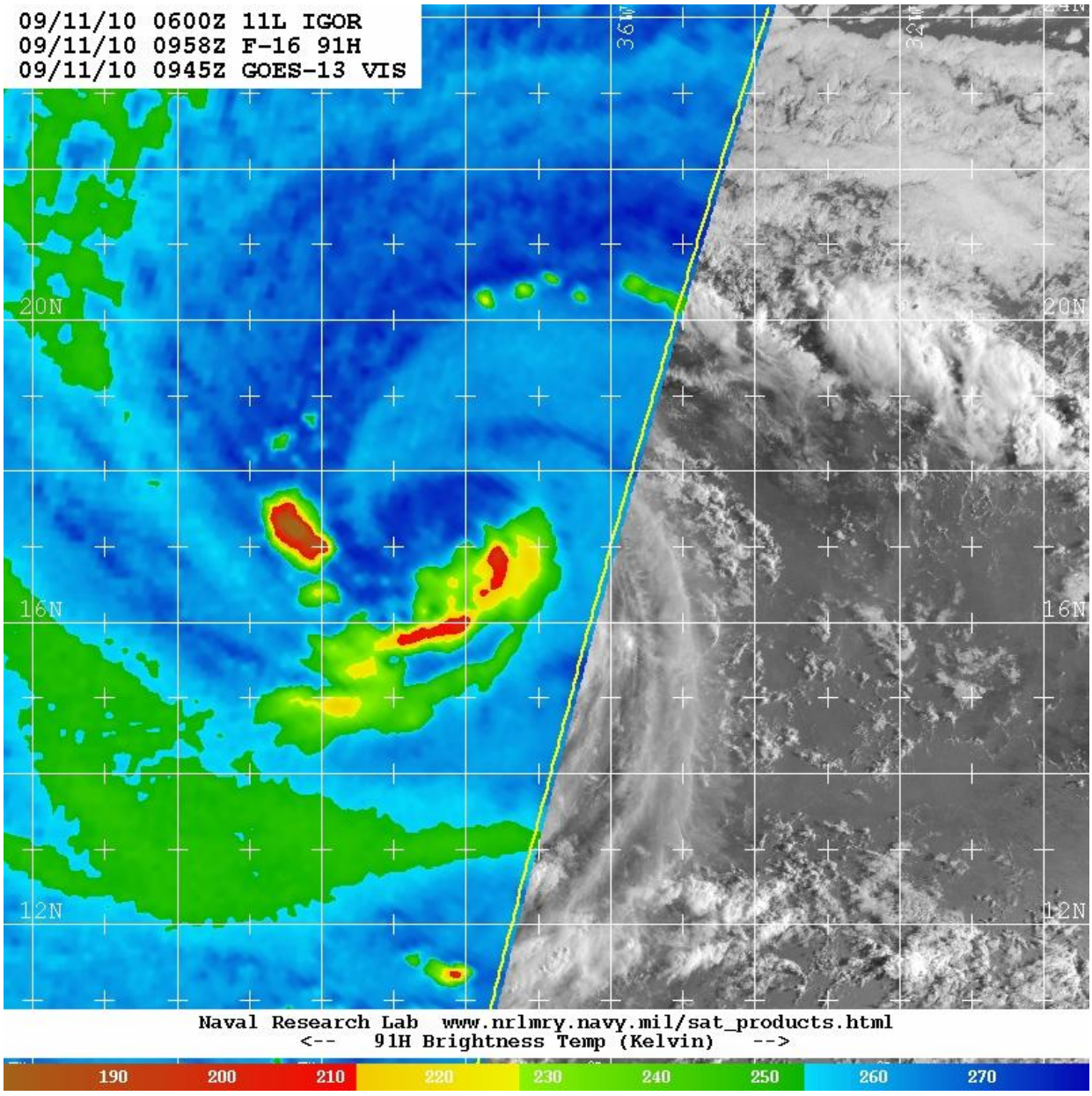
Forecast points above are shown in 12 hr increments. Initial points denoted by black squares.

44H


00Z11SEP2010 ecmwf-oper MSLP (mb) T=120 h
70N
60N
50N
40N
30N
20N
10N
EQ
10S
160W
140W
120W
100W
80W
60W
40W
20W
0
980
984
988
992
996
1000
1004
1008
1012
1016
1020
1024
1028
1032
1036
1040

Tropical Storm Igor/PGI-41L:

I1 – 1000 UTC SSMIS 85-GHz Microwave

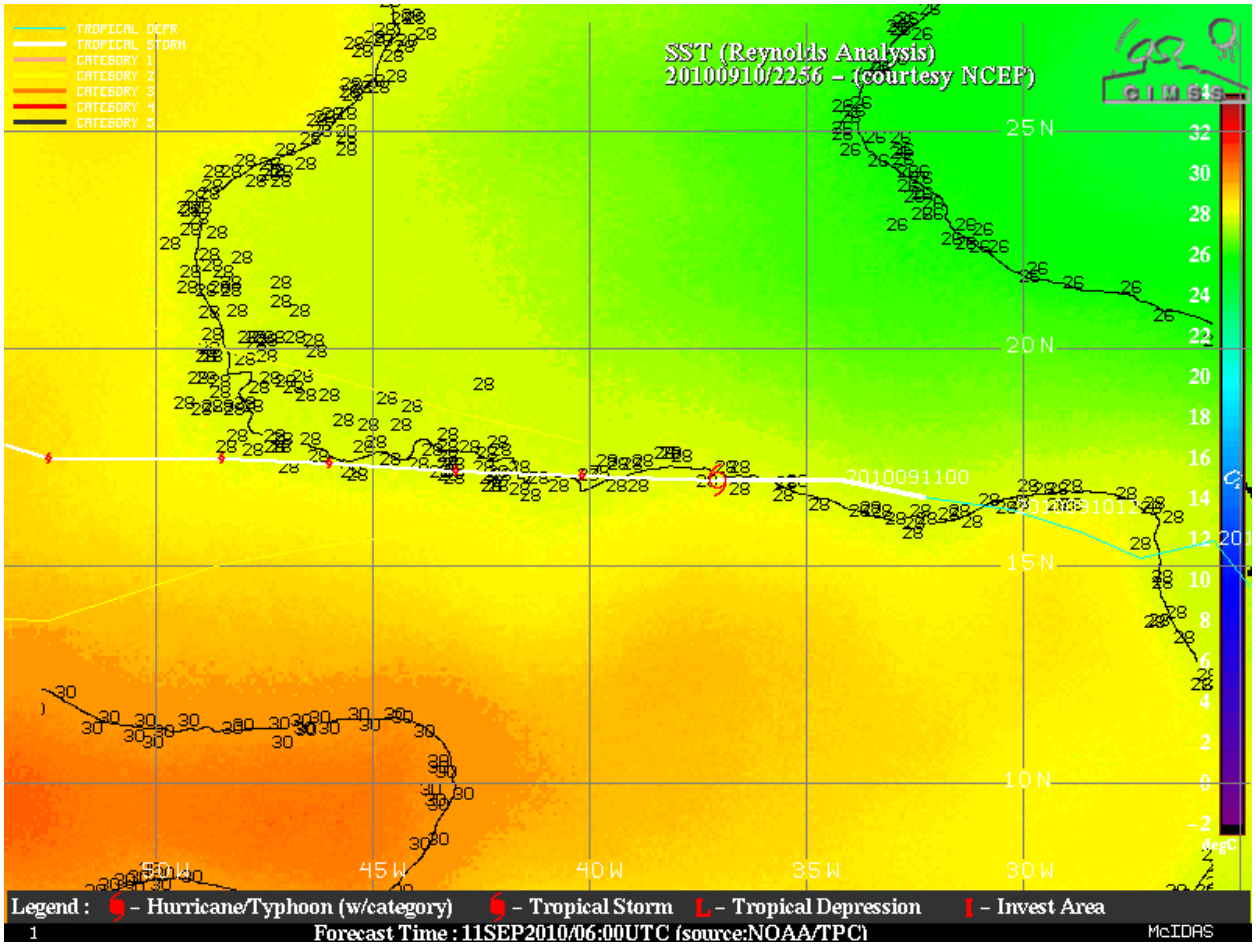


I2- 1200 UTC SHIPS Text Forecast

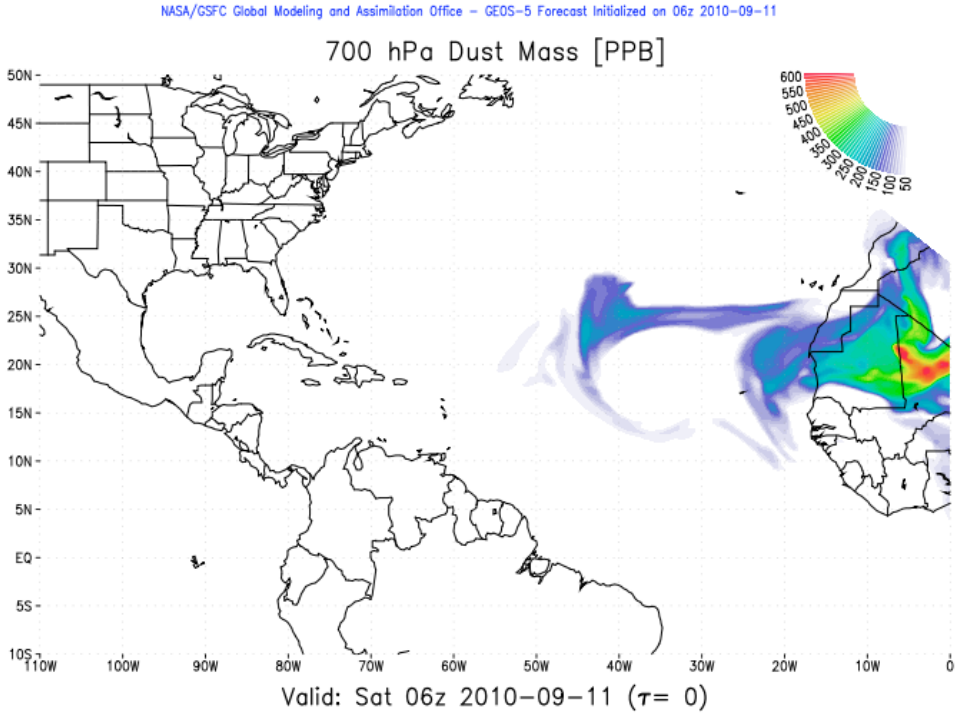
```
                    *   ATLANTIC SHIPS INTENSITY FORECAST       *
                    *      GOES DATA AVAILABLE                  *
                    *      OHC  DATA AVAILABLE                  *
                    *        IGOR  AL112010  09/11/10  12 UTC    *
```

TIME (HR)	0	6	12	18	24	36	48	60	72	84	96	108	120
V (KT) NO LAND	60	63	66	70	75	83	92	101	108	111	114	117	113
V (KT) LAND	60	63	66	70	75	83	92	101	108	111	114	117	113
V (KT) LGE mod	60	65	69	74	78	87	96	103	109	113	114	116	116
SHEAR (KT)	13	15	13	11	10	5	6	1	7	3	3	4	1
SHEAR ADJ (KT)	2	1	0	0	0	0	1	3	3	1	4	2	0
SHEAR DIR	62	54	58	43	37	13	17	360	355	39	355	231	126
SST (C)	27.1	27.3	27.5	27.7	27.9	28.2	28.4	28.6	28.8	29.0	29.1	29.1	29.0
POT. INT. (KT)	127	129	132	134	137	140	143	145	148	151	153	154	152
ADJ. POT. INT.	125	125	127	130	132	134	135	136	138	140	142	144	141
200 MB T (C)	-52.5	-52.1	-52.3	-52.4	-52.4	-51.5	-51.3	-50.8	-50.7	-50.1	-50.2	-49.4	-49.7
TH_E DEV (C)	7	8	8	9	9	10	11	11	11	11	10	11	11
700-500 MB RH	64	66	64	59	62	61	59	55	60	60	62	60	57
GFS VTEX (KT)	19	18	19	20	21	21	23	27	30	28	33	39	36
850 MB ENV VOR	79	89	91	87	77	62	52	50	55	55	67	92	126
200 MB DIV	14	35	38	44	49	40	21	22	35	63	45	63	51
LAND (KM)	2013	1911	1815	1724	1642	1517	1420	1269	1136	1067	1015	845	677
LAT (DEG N)	17.3	17.3	17.3	17.4	17.5	17.7	17.7	17.7	17.8	18.3	19.2	20.2	21.2
LONG(DEG W)	38.7	40.2	41.6	43.1	44.5	47.3	49.5	51.6	53.3	54.8	56.1	57.9	60.0
STM SPEED (KT)	16	14	14	14	13	12	10	9	8	7	8	11	11
HEAT CONTENT	13	16	28	33	36	45	52	64	75	74	82	79	66

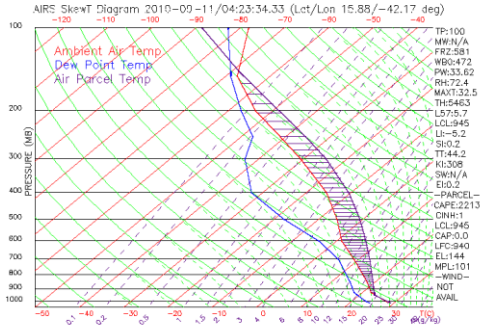
I3-CIMSS Reynolds Averaged SSTs and NHC forecast track

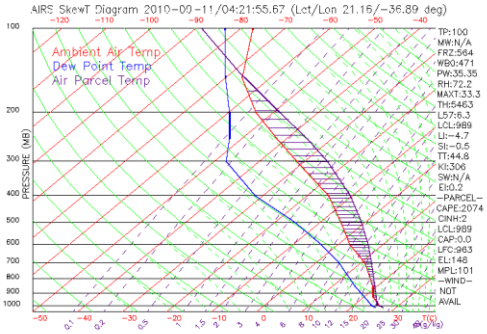


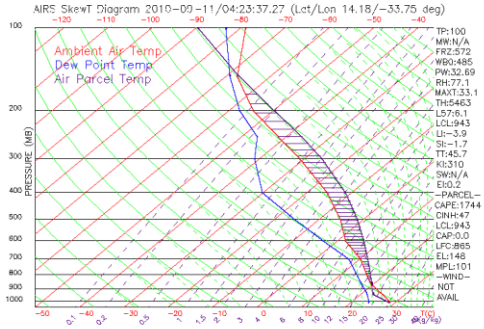
I4-0600 UTC GEOS-5 700hPa Dust Mass Analysis

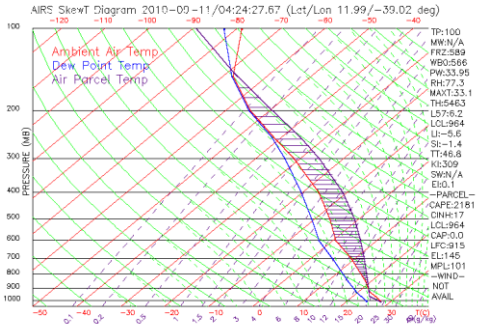


I5- 0430UTC Airs Soundings to the West (top left), North (top right), East (bottom left), South (bottom right) of Igor.

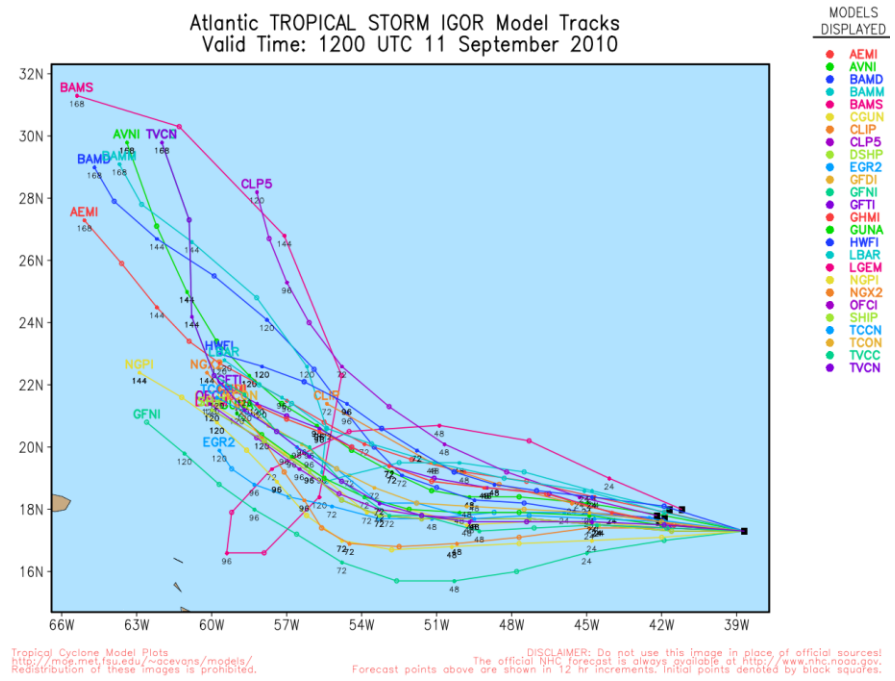




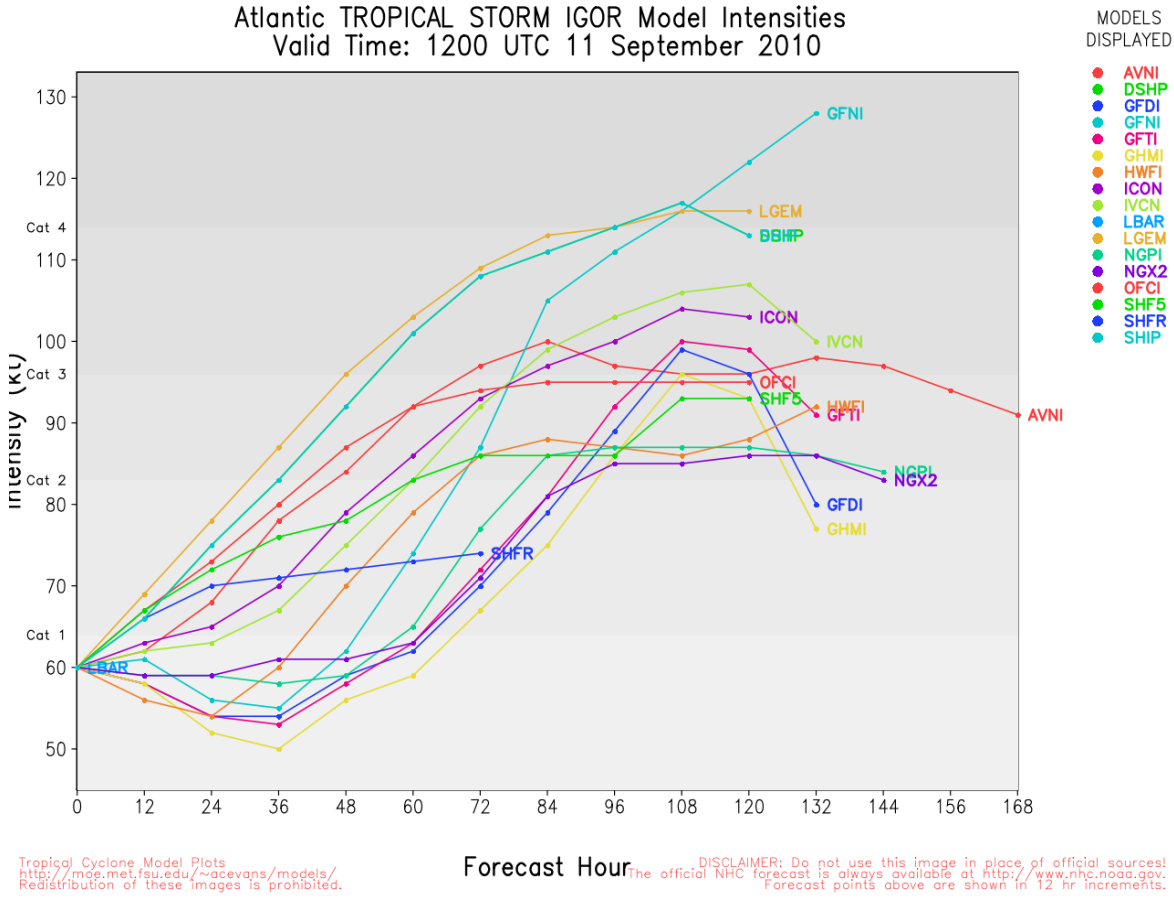




I6


Atlantic TROPICAL STORM IGOR Model Tracks
Valid Time: 1200 UTC 11 September 2010
MODELS DISPLAYED
AEMI
AVNI
BAMD
BAMM
BAMS
CGUN
CLIP
CLP5
DSHP
EGR2
GFDI
GFNI
GFTI
GHMI
GUNA
HWFI
LBAR
LGEM
NGPI
NGX2
OFCI
SHIP
TCCN
TCON
TVCC
TVCN
32N
30N
28N
26N
24N
22N
20N
18N
16N
66W
63W
60W
57W
54W
51W
48W
45W
42W
39W
Tropical Cyclone Model Plots
http://moe.met.fsu.edu/~acevans/models/
Redistribution of these images is prohibited.
DISCLAIMER: Do not use this image in place of official sources!
The official NHC forecast is always available at http://www.nhc.noaa.gov.
Forecast points above are shown in 12 hr increments. Initial points denoted by black squares.

I7


Atlantic TROPICAL STORM IGOR Model Intensities
Valid Time: 1200 UTC 11 September 2010
MODELS DISPLAYED
AVNI
DSHP
GFDI
GFNI
GFTI
GHMI
HWFI
ICON
IVCN
LBAR
LGEM
NGPI
NGX2
OFCI
SHF5
SHFR
SHIP
Intensity (kt)
130
120
110
100
90
80
70
60
50
Cat 4
Cat 3
Cat 2
Cat 1
0
12
24
36
48
60
72
84
96
108
120
132
144
156
168
Forecast Hour
Tropical Cyclone Model Plots
http://moe.met.fsu.edu/~acevans/models/
Redistribution of these images is prohibited.
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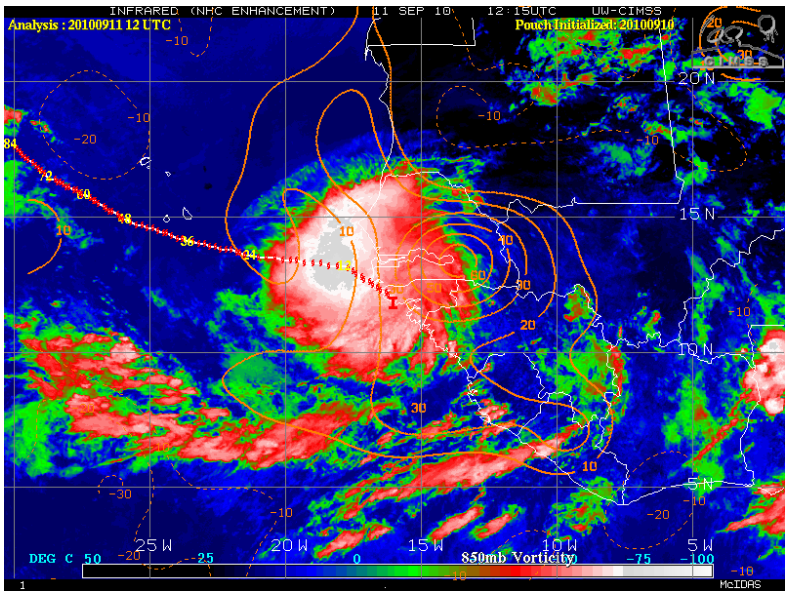
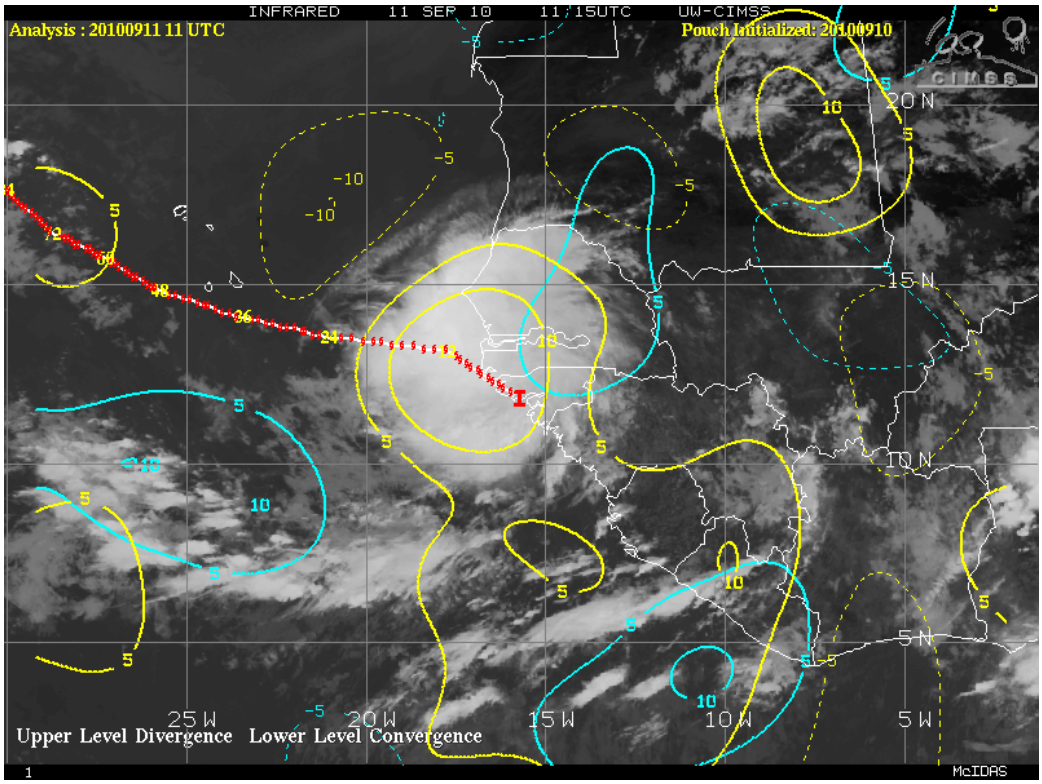
The official NHC forecast is always available at http://www.nhc.noaa.gov.
Forecast points above are shown in 12 hr increments.

PGI-43L:

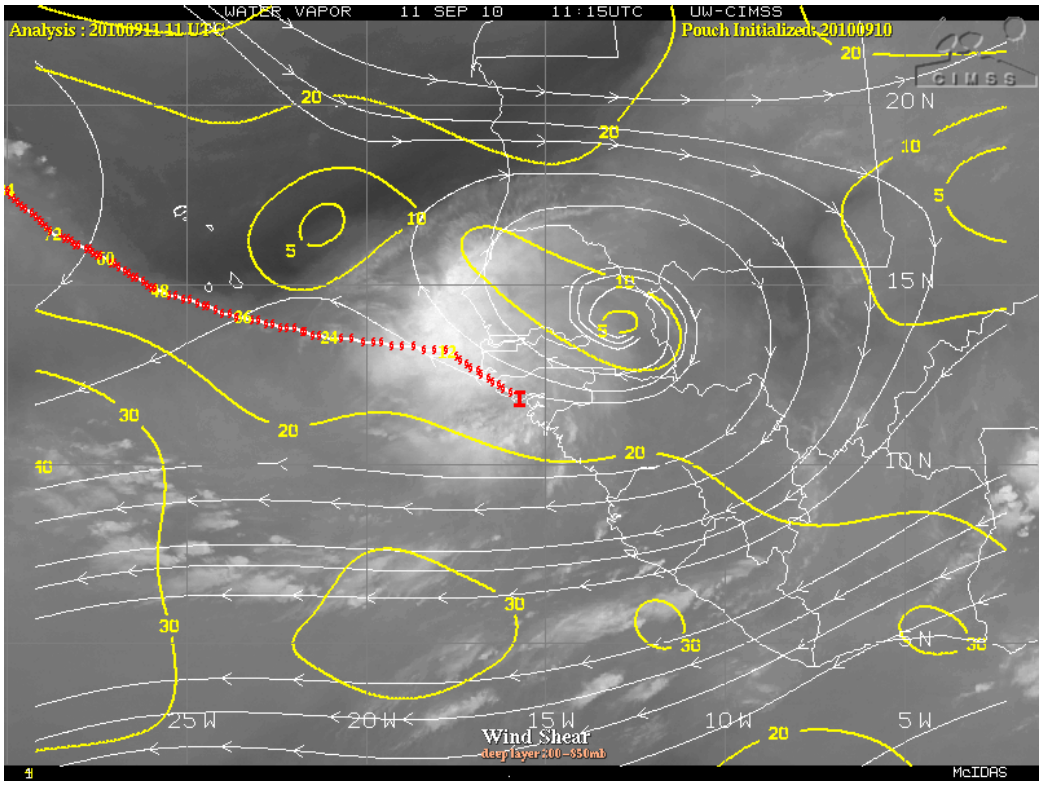
43A



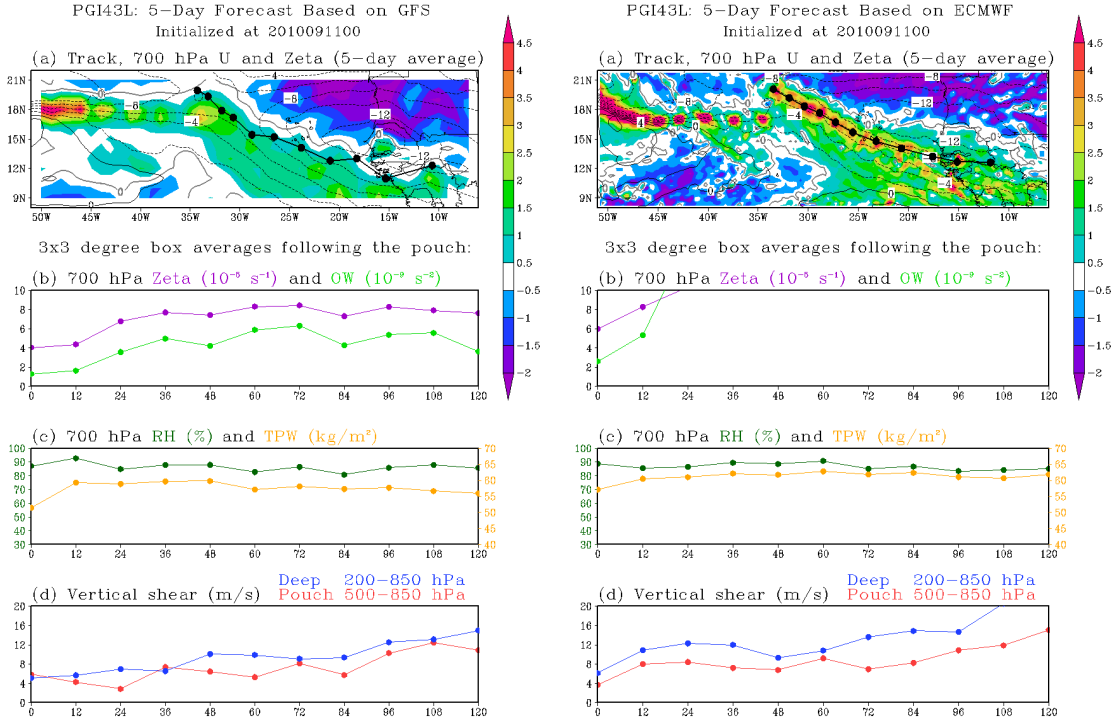
43B



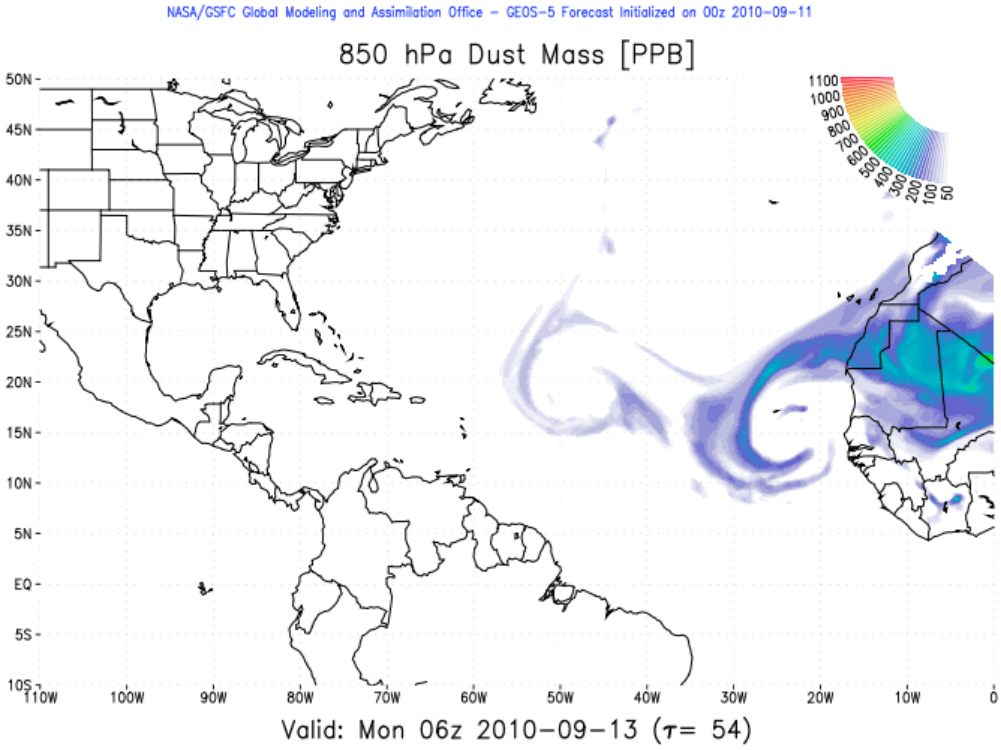
43C


WATER VAPOR 11 SEP 10 11:15UTC UW-CIMSS
Analysis : 20100911.11 UTC
Pouch Initialized: 20100910
CIMSS
20 N
15 N
10 N
5 N
25 W
20 W
15 W
10 W
5 W
Wind Shear
deep layer 200-850mb
McIDAS

43D

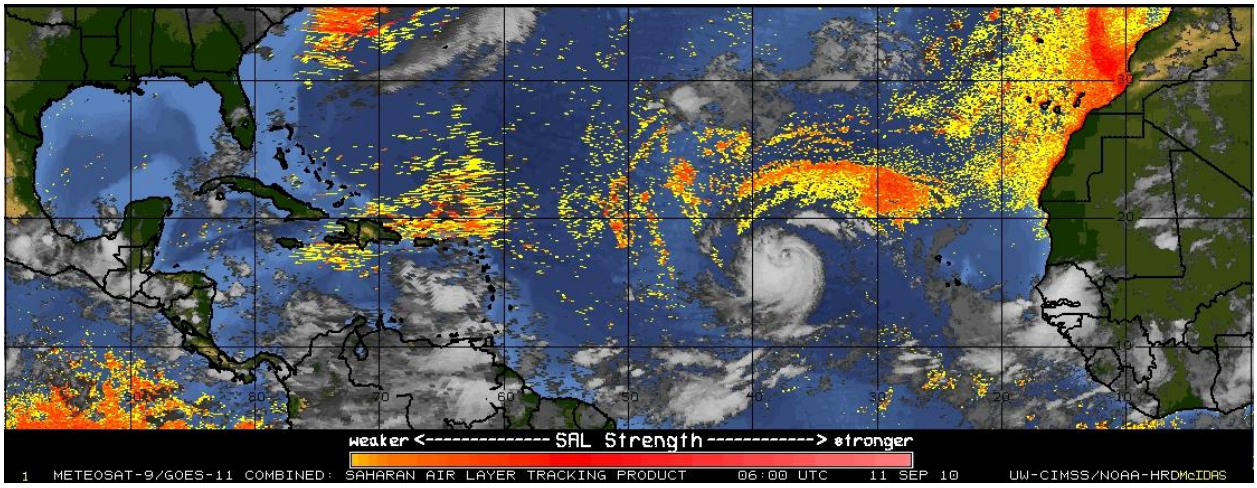

PGI43L: 5-Day Forecast Based on GFS
Initialized at 2010091100
(a) Track, 700 hPa U and Zeta (5-day average)
3x3 degree box averages following the pouch:
(b) 700 hPa Zeta (10^{-5} s^{-1}) and OW (10^{-9} s^{-2})
(c) 700 hPa RH (%) and TPW (kg/m²)
(d) Vertical shear (m/s) Deep 200-850 hPa Pouch 500-850 hPa
PGI43L: 5-Day Forecast Based on ECMWF
Initialized at 2010091100
(a) Track, 700 hPa U and Zeta (5-day average)
3x3 degree box averages following the pouch:
(b) 700 hPa Zeta (10^{-5} s^{-1}) and OW (10^{-9} s^{-2})
(c) 700 hPa RH (%) and TPW (kg/m²)
(d) Vertical shear (m/s) Deep 200-850 hPa Pouch 500-850 hPa

43E

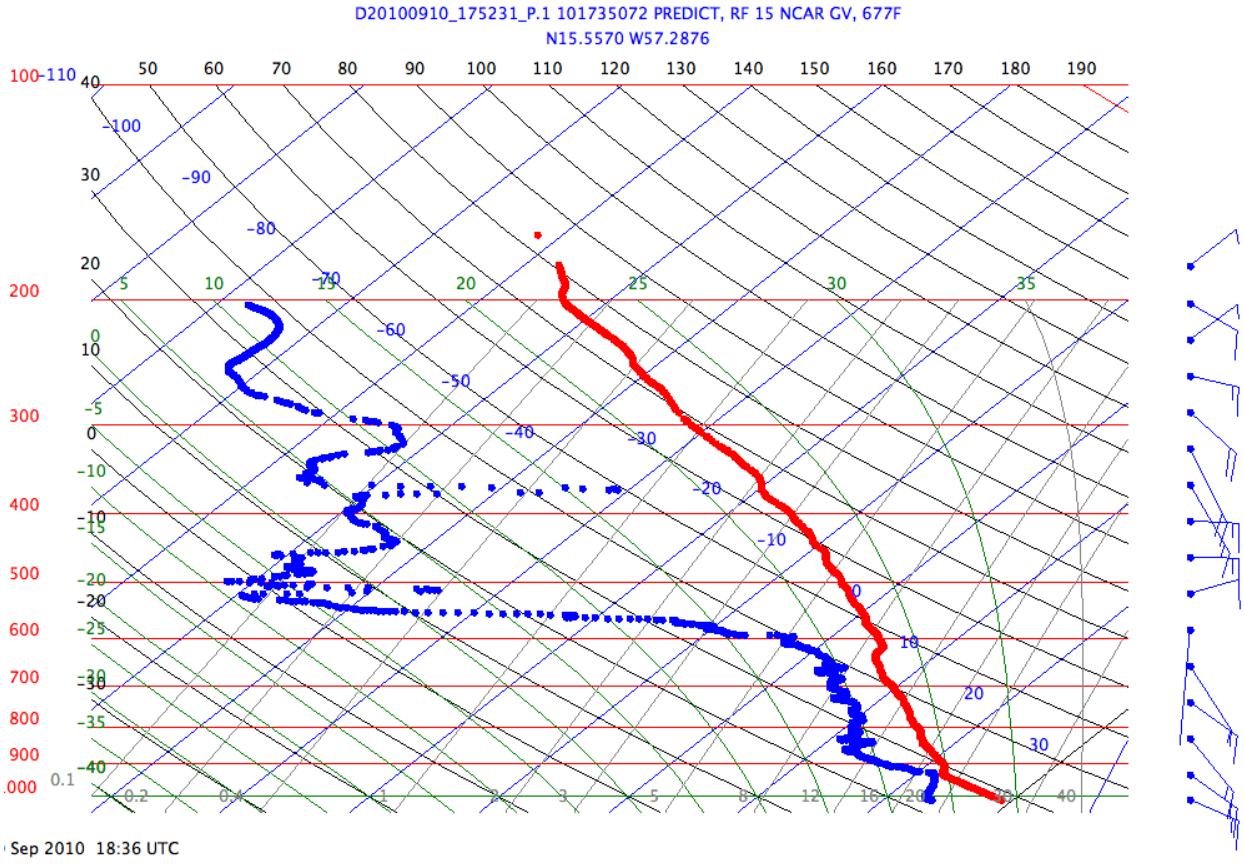


<u>Dust/SAL:</u>

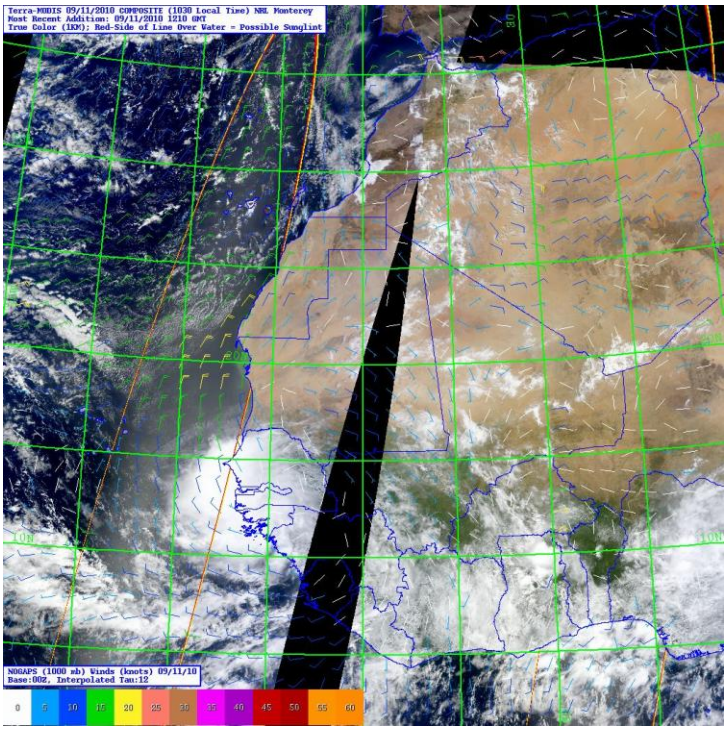
D1



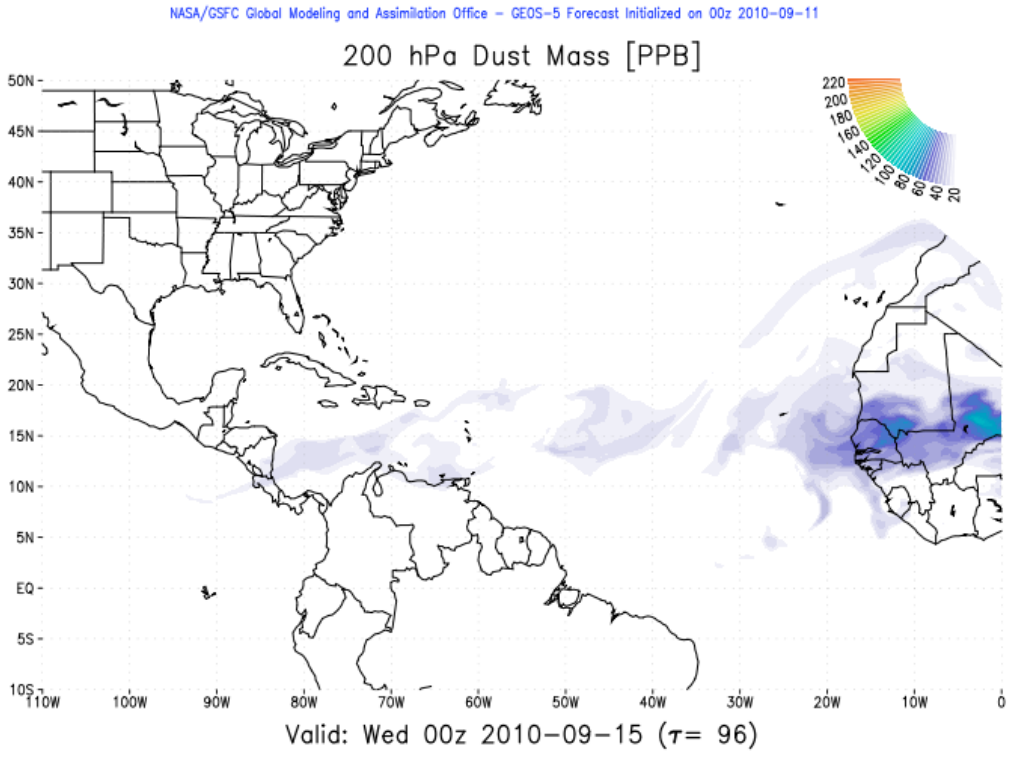
D2


D20100910_175231_P.1 101735072 PREDICT, RF 15 NCAR GV, 677F
N15.5570 W57.2876
Sep 2010 18:36 UTC

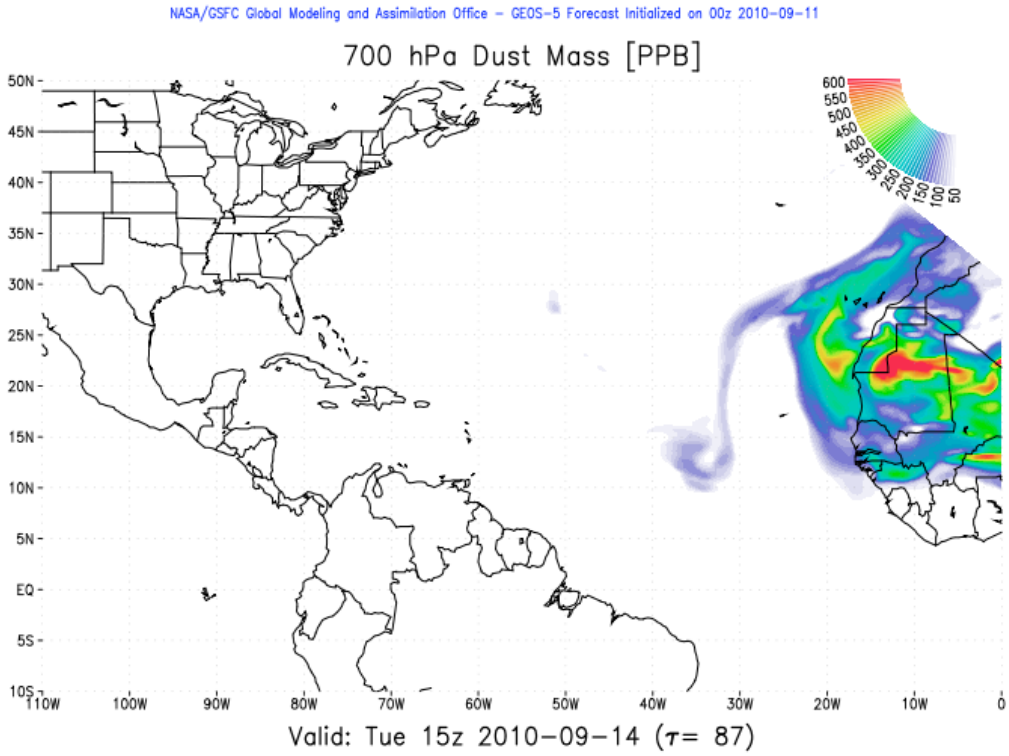
D3


Terra-MODIS 09/11/2010 COMPOSITE (1030 Local Time) NRL Monterey
Most Recent Addition: 09/11/2010 1210 GMT
True Color (1KM); Red-Side of Line Over Water = Possible Sunglint
NOGAPS (1000 mb) Winds (knots) 09/11/10
Base:00Z, Interpolated Tau:12

D4


NASA/GSFC Global Modeling and Assimilation Office – GEOS-5 Forecast Initialized on 00z 2010-09-11
200 hPa Dust Mass [PPB]
220
200
180
160
140
120
100
80
60
40
20
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
110W
100W
90W
80W
70W
60W
50W
40W
30W
20W
10W
0
Valid: Wed 00z 2010-09-15 (τ= 96)

D5


NASA/GSFC Global Modeling and Assimilation Office – GEOS-5 Forecast Initialized on 00z 2010-09-11
700 hPa Dust Mass [PPB]
600
550
500
450
400
350
300
250
200
150
100
50
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
110W
100W
90W
80W
70W
60W
50W
40W
30W
20W
10W
0
Valid: Tue 15z 2010-09-14 (τ= 87)