Friday 10 September 2010

TRI-AGENCY Weather Discussion

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Current Conditions/Review of Yesterday's Forecast:

Big Picture: The large-scale flow conditions in the middle and upper troposphere across the CONUS, Gulf of Mexico, Caribbean Sea, and North Atlantic at 1415 UTC 10 Sep are summarized by the high-resolution water vapor winds (**image 1**) and Atlantic scale IR image for 1652 UTC 10 Sep (**image 2**). Features of interest in **images 1 and 2** include the quasi-comatose remnants of Gaston (PGI38L) located Jamaica and Honduras/Nicaragua, a broad anticyclone over southern Texas, a southwest to northeast oriented deformation zone from the Yucatan Peninsula to Bermuda that lies to the southeast of this anticyclone, an area of convection broadly centered near 14 N and 60 W that marks PGI44L, a large area of dry air in the middle and upper troposphere over the central North Atlantic, weakening PGI39L near 27 N and 42 W, and TC Igor (PGI41L) near 17 N and 33 W, and PGI43L near 8 N and 12 W. The pouch locations that identify the rotating features described above are superimposed on a TPW image for 1200 UTC 10 Sep (**image 3**).

The remnants of Gaston continue to be very poorly organized. The ECMWF and GFS forecasts from 0000 UTC 10 Sep track a pouch associated with Gaston for 60 h and 96 h, respectively, after which the pouch dissipates and is no longer trackable.

At 1200 UTC 10 Sep, PGI44L was located near 12.7 N and 60.7 W based upon an analysis of available satellite imagery and the ECMWF forecast pouch position. A satellite analysis for 1645 UTC 10 Sep shows that PGI44L is associated with an organizing area of convection in the WV imagery that is mostly concentrated in the northern semicircle of a storm that features a quasi circular low-level vorticity maximum that is indicative of a developing vortex structure (**image 4**). At 1630 UTC the deep-layer shear over PGI44L is weak (5-10 kt), the developing storm is embedded in a region of very high maximum potential intensity (< 900 hPa) (**image 5**), high values of TPW (>55 mm) surround the low-level vorticity maximum, and a corridor of high SSTs (29-30 C) coincide with the track of the ECMWF forecast pouch (**image 6**).

The moist atmosphere in the vicinity of PGI44L is confirmed from the 3 h Barbados soundings from 0300-0900 UTC 10 Sep (available on the PREDICT field catalog) and the 72 h MIMIC-TPW loop (not shown). The existence of a developing low-level vortex is confirmed from a 925/850 hPa wind analysis garnered from dropsonde observations obtained by the NSF G-V research flight into PGI44L between 0900-1430 UTC 10 Sep (not shown), a composite analysis radar base reflectivity loop from Martinique that suggested the presence of a circulation center (not shown), and the Barbados (78954, TBPB) winds that veered from northeast to southeast

below 700 hPa between 0300-0900 UTC 10 Sep (soundings available on the PREDICT field catalog). All the environmental factors suggest that PGI44L should develop into a TC within 48 h, given the presence of an aircraft-indicated low-level vortex embedded in a very moist environment. The only significant rate-limiting step to TC development was the absence of widespread convection in the vicinity of the PGI44L pouch in the mid-morning satellite imagery.

An important forecast issue pertaining to the development of PGI44L is that the GFS analysis and short-term forecasts have consistently indicated that TPW values would be 5-10 mm lower than the corresponding TPW values in the ECWMF analyses and forecasts. Although reasons for this TPW analysis discrepancy between the ECMWF and GFS models is unknown and will require substantive post-storm analysis, an analysis of how the ITCZ and the associated monsoon trough along which PGI44L has been developing is represented in the models would probably be fruitful. As an example, an analysis of 144 h backward trajectories starting at 0600 UTC 10 Sep from 8.7 N and 60.7 W, 10.7 N and 60.7 W, and 12.7 N and 60.7 W from the NOAA HYSPLIT trajectory model shows the existence of converging and ascending airstreams into the PGI44L pouch region (**image 7**). The extent to which convergence and ascent in the vicinity of the ITCZ contributed to concentrating high TPW values along the ITCZ where PGI44L resides, and how the ECMWF and GFS models resolved this process, needs to be determined.

At 1800 UTC, TC Igor (PGI41L) was located over the eastern North Atlantic near 31 W and was a minimal tropical storm (**image 2**). PGI39L was stretched meridionally along a north-south axis west of Igor…with all of the convection being associated with the northern part of PGI39L. PGI43L was still located over western Africa and was associated with unorganized scattered convection. Both PGI39L and PGI43L are not coincident with NHC probabilities for genesis. Given the pathetic looking structure of PGI39L, and the rapid dissipation anticipated in the next 24-h, we will not discuss it beyond here. PGI43L will be briefly discussed in the extended forecast discussion.

Most of the convection associated with Igor was located west of the low-level circulation center at 1800 UTC (**image 8**; panel b). The apparent westward tilt in Igor was a result of increased deep-layer easterly wind shear on the equatorward flank of the upper-level subtropical anticyclone inferred in the upper-level satellite winds (**image 8**; panel a). At low levels, a well-defined cyclonic circulation was apparent on the eastern flank of the region of convection (**image 8**; panel b). The wind shear should decrease in the coming days as Igor moves westward away from the low-level monsoon southwesterlies that were contributing to increased deep-layer easterly shear. According to the 0000 UTC 10 Sep Reynolds SST analysis shows that the 1800 UTC position of Igor was located along an SST gradient (**image 8**; panel c)…with SSTs near 25 C (28 C) to the north (south) of Igor's circulation. As Igor moves westward, it should move over an environment with warmer SSTs. The warmer SSTs, combined with weaker deep-layer wind shear should contribute to further development.

The current NHC forecast as of 1500 UTC shows gradual westward movement and intensification to hurricane status at 1200 UTC Monday (**image 9**). The forecast positions and maximum winds are as follows:

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INITIAL      10/1500Z 16.4N  31.0W    35 KT
12HR VT     11/0000Z 16.6N  33.2W    40 KT
24HR VT     11/1200Z 16.8N  36.2W    45 KT
36HR VT     12/0000Z 17.0N  39.2W    50 KT
48HR VT     12/1200Z 17.1N  41.7W    60 KT
72HR VT     13/1200Z 17.3N  46.2W    70 KT
96HR VT     14/1200Z 18.2N  50.3W    85 KT
120HR VT     15/1200Z 19.5N  53.5W    95 KT

$$ FORECASTER STEWART
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Day 1 (Next 24 hours) Outlook:

PGI44L: The pouch analysis derived from the ECMWF forecast from 0000 UTC 10 Sep shows that PGI44L will move slowly to the northwest and be situated near 14.5 N and 64.5 W at 1200 UTC 11 Sep (**image 10**). The 700 hPa relative vorticity and OW parameter are forecast to increase significantly by 1200 UTC 11 Sep.

Igor/PGI43L: By 1200 UTC 11 Sep, Igor is progged by both the GFS (not shown) and ECMWF (**image 11**; top panel) to be continue to move westward along the southern flank of the subtropical anticyclone and be near 16 N 37 W. The ensembles from Jonathon Vigh's page also show the westward progression to near 35-37 W (**image 12**), slightly intensifying to a moderate tropical storm (**image 13**). Ryan Torn's 96 member WRF/EnKF ensemble (**image 14**; left panel) shows slower strengthening of Igor through 1200 UTC 11 Sep…with most members indicating strength below tropical storm status. Recall however that this forecast is from 0000 UTC 10 Sep, and appears to be slower than the current evolution of Igor. Note that the SHIPS from 1200 UTC 10 Sep also shows weakening deep-layer wind shear through 1200 UTC 11 Sep with gradual intensification to a moderate tropical storm [ftp://ftp.nhc.noaa.gov/atcf/stext/10091012AL1110_ships.txt].

Note that PGI43L is progged to emerge from western Africa by 1200 UTC 11 Sep (**image 11**).

Day 2 (24-48 h) Outlook:

PGI44l: The pouch analysis from the 0000 UTC 10 Sep ECMWF 60-h forecast from 0000 UTC 9 Sep suggests that PGI44L will be located near 15.5 N and 69.5 W at 1200 UTC 12 Sep (**image 10**). At this time, the values of 925-hPa vorticity and the OW parameter are forecast to be "pegged" as PGI44L continues to intensify. A majority of members of Ryan Torn's 48 h WRF-model ensemble forecast (96 members) verifying 0000 UTC 12 Sep predict that PGI44L will be a TC by this time (**image 15**). Likewise, a corresponding 48-h ECMWF ensemble analysis (Sharan

Majumdar) verifying 0000 UTC 12 Sep shows that many ensemble members have 700-hPa vorticity/OW maxima that exceed pouch circulation thresholds (**image 16**). Considerable model forecast uncertainty in the location and strength of PGI44L is apparent in the 60 h ECMWF and GFS forecasts verifying 1200 UTC 12 (not shown).

Igor/PGI43L: By 1200 UTC 12 Sep, Igor is progged by the GFS (not shown) and ECMWF (**image 11**; bottom panel) to be near 42 W as it continues to move westward on the southern flank of the subtropical ridge. The ensemble forecasts from Jonathon Vigh's page shows a similar longitude compared to the GFS and ECMWF solution…except that the envelope extends five degrees of latitude from 15-20 N (**image 12**). The corresponding intensity forecast shows strengthening in all of the members, with intensities ranging from a weak tropical storm to a Cat 1 hurricane (**image 13**). The SHIPS forecast doesn't show much change in the environment between Day 1 and Day 2, with gradual strengthening to a minimal hurricane. Ryan Torn's WRF ensemble suggests that the farthest west members at 1200 UTC 12 Sep intensify to a weak tropical storm, while the eastward members continue to indicate no strengthening (**image 14**; middle panel)…which goes against the operational model forecasts.

PGI43L is progged by the ECMWF (**image 11**) to be near 13 N 24 W by 1200 UTC 12 Sep…with the vorticity field showing better organization and a more circular shape.

Extended Outlook:

PGI44L: The ECMWF, GFS, and UKMET models all continue to move PGI44L westward with varying intensities and propagation speeds. The ECMWF 120 h forecast verifying 0000 UTC 15 Sep brings PGI44L to near 18.5 N and 80.5 W. The GFS forecast initiated at 0000 UTC 10 Sep dissipates PGI44L after 0000 UTC 12 Sep. The UKMET forecast from 0000 10 Sep was only available through 1200 UTC 11 Sep, but showed an intensifying disturbance through that time period. Ryan Torn's 96-member WRF ensemble forecast verifying 0000 UTC 13 Sep indicates that every ensemble member makes PGI44L a TC and more than half of the ensemble members make PGI44L a Cat 1 (or greater) TC (**image 17**). Sharanya Majumdar's corresponding 72 h ECMWF ensemble forecast is also bullish on the development of PGI44L.

Igor/PGI43L: In the extended range through 120-h, the ensembles show that Igor should continue westward, and begin to recurve northwestward after 72-h…near 45 W (**image 12**)…with continued intensification until around 108-h with most of the members producing a Cat 1-3 storm (**image 13**). The SHIPS model indicates that Igor will continue to gradually strengthen through 120-h as the deep-layer vertical wind shear remains low and the SSTs and OHC increase smartly.

The 72-h forecast from the WRF ensemble shows some strengthening by 1200 UTC 12 Sep, with most of the members indicating at least a tropical storm (**image 14**;

right panel)…again, however, it appears that the WRF ensemble is slow in its development of Igor based on current observations.

In the extended range through 144-h, the GFS and ECMWF (**image 18**) begin to significantly diverge in their solutions for both Igor and PGI43L. In the GFS, Igor is progged to be near 20 N 58 W as it recurves into a seam in the subtropical ridge. In the ECMWF, Igor is progged to be near 20 N 50 W…farther east than in the GFS…as it interacts with an upper-level low and attendant trough near 25 N 60 W. For PGI43L, the GFS progs it to turn northwestward and transition to a subtropical storm as it interacts with an upper-level PV hook near 22 N 34 W (**image 18**). Meanwhile, the ECMWF keeps PGI43L on a more southerly track…likely because the weak trough extending southwestward from the deep low near 29 N 22 W is located farther north relative to the GFS solution.

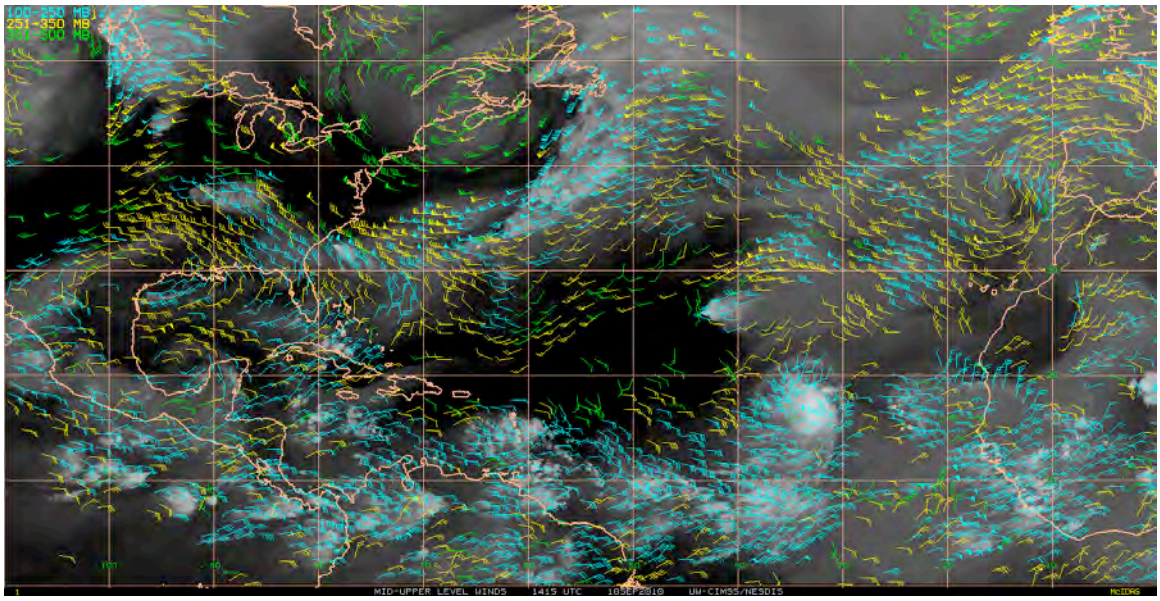


Image 1

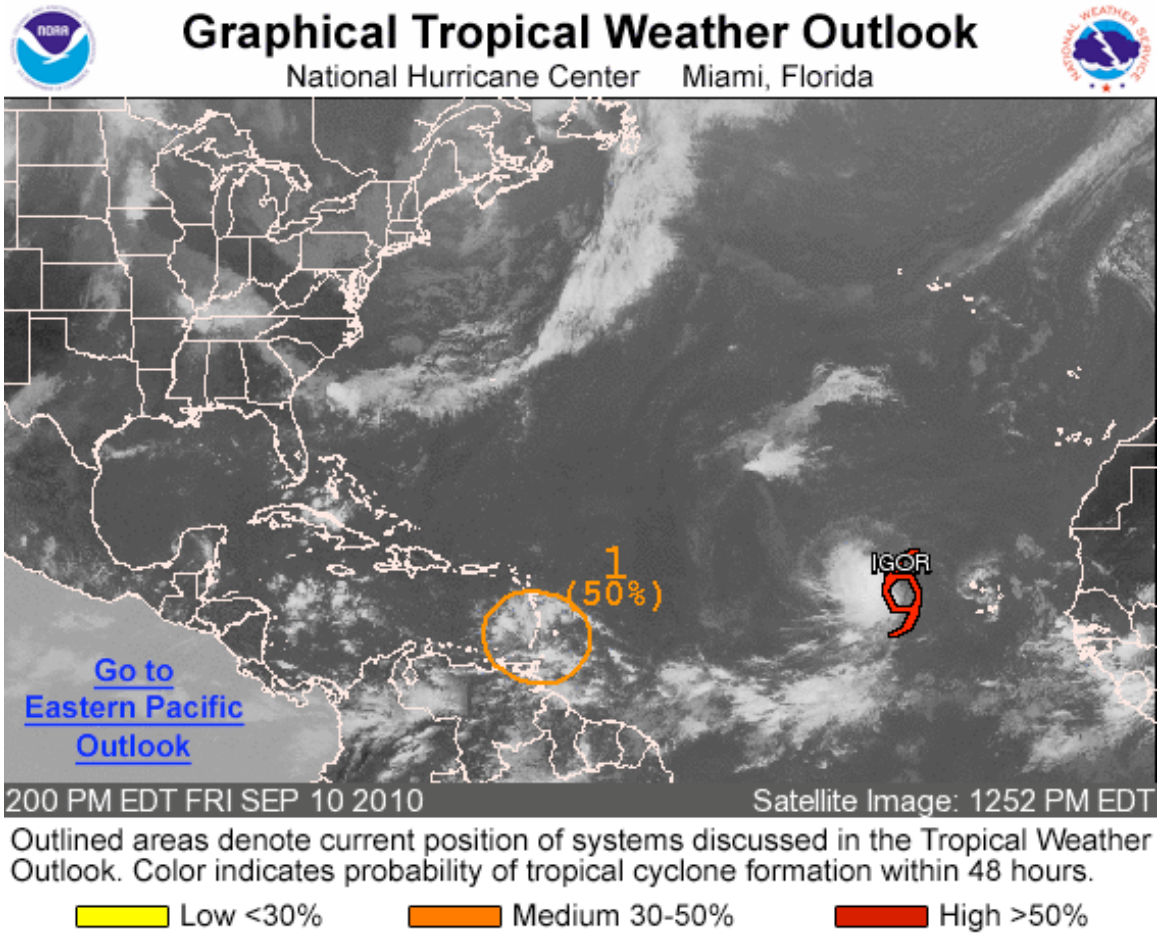


Image 2

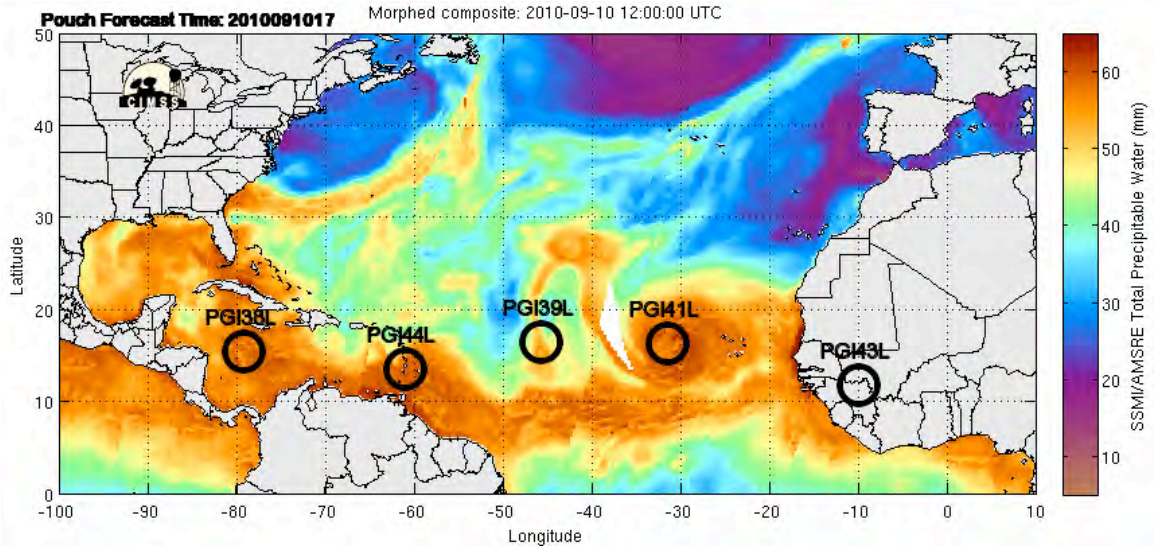
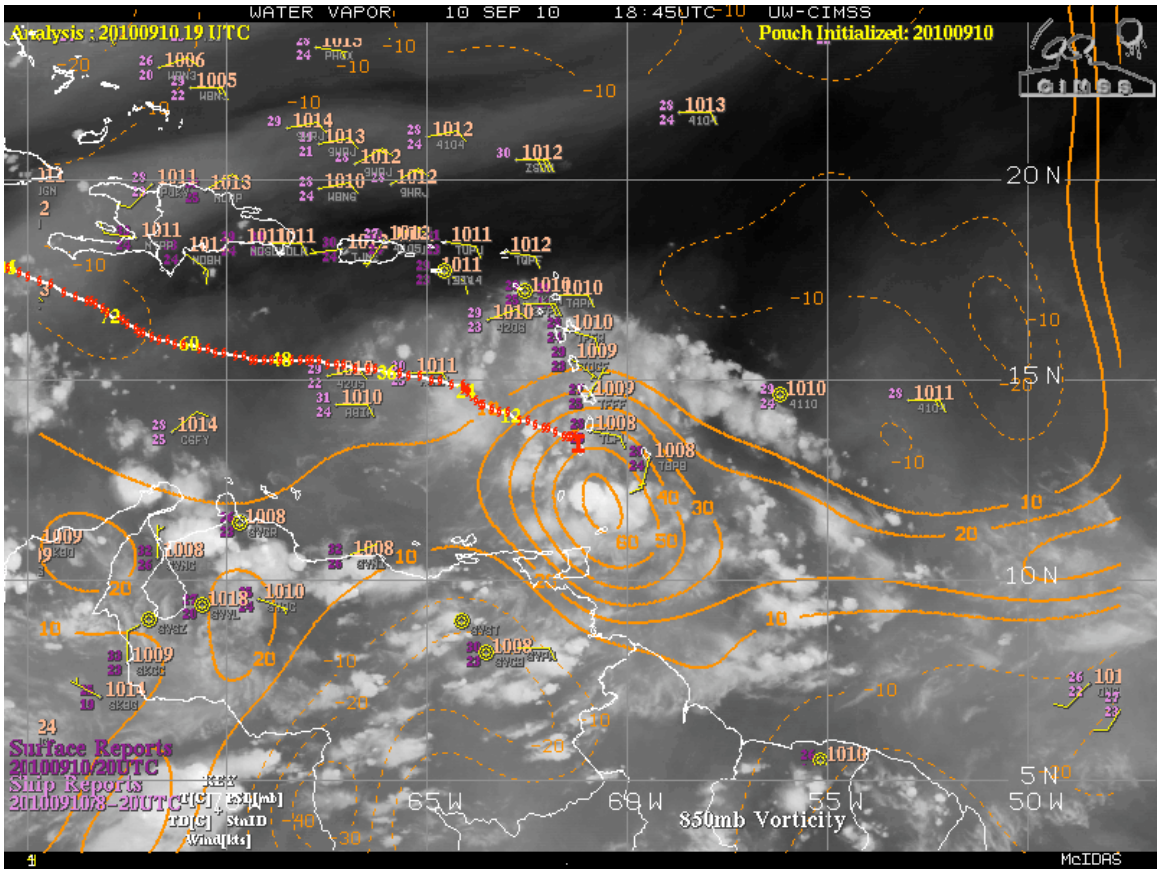


Image 3



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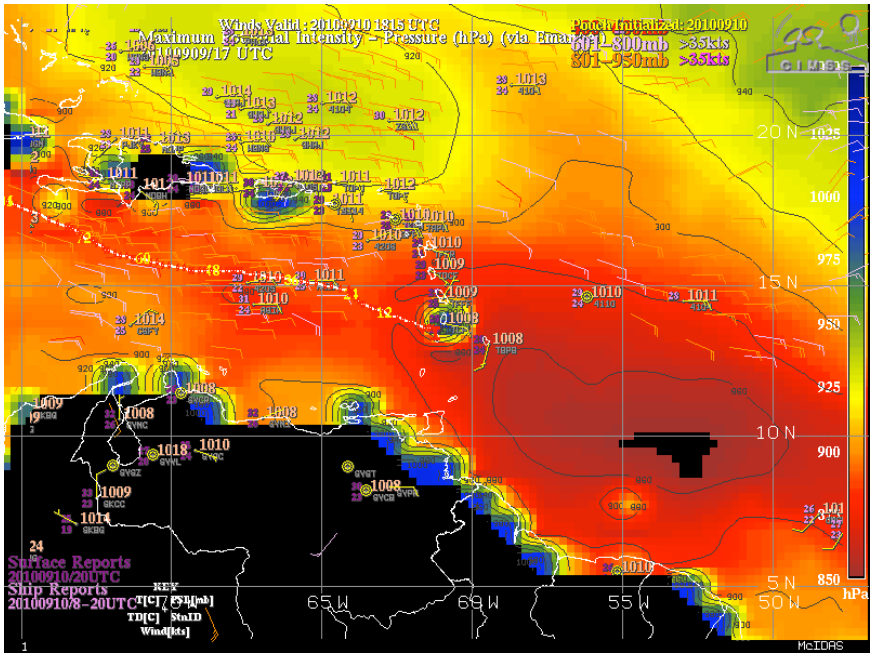

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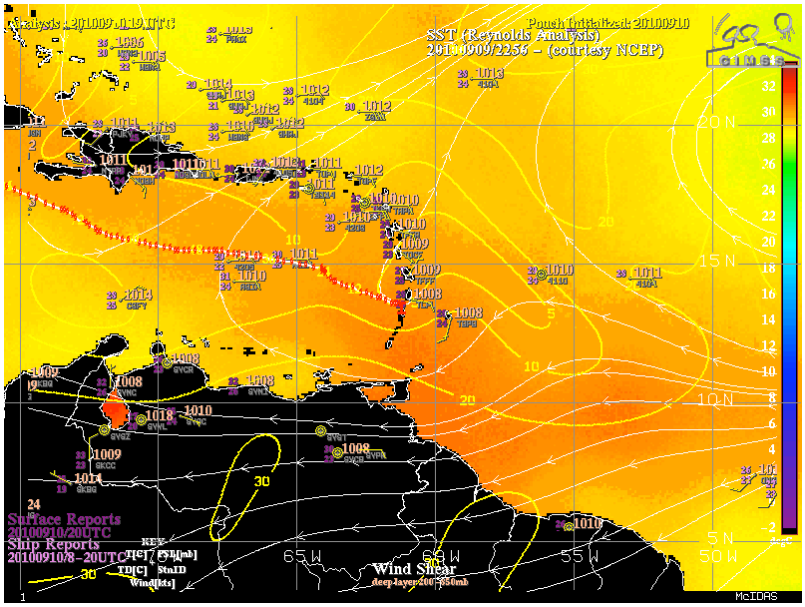

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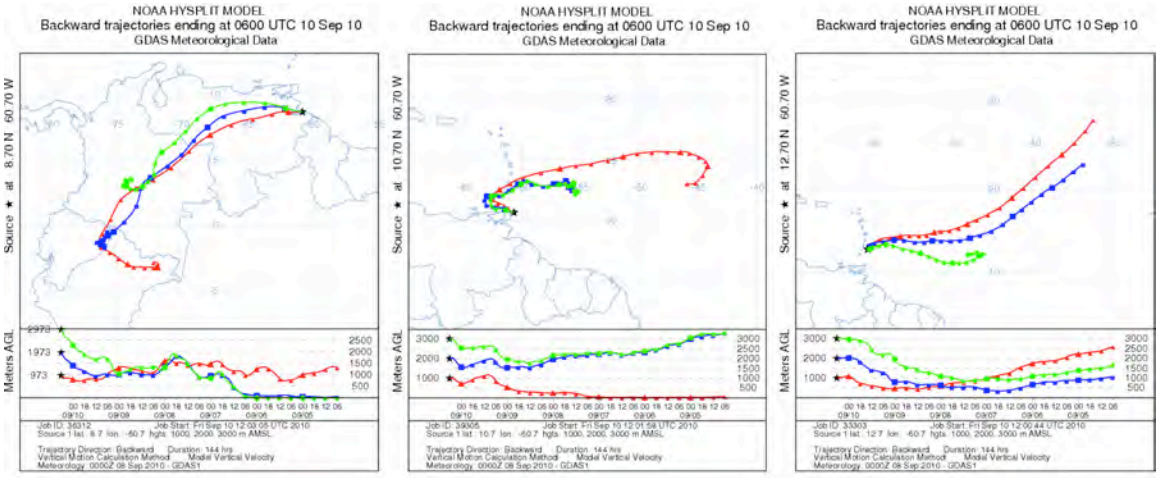


Image 7

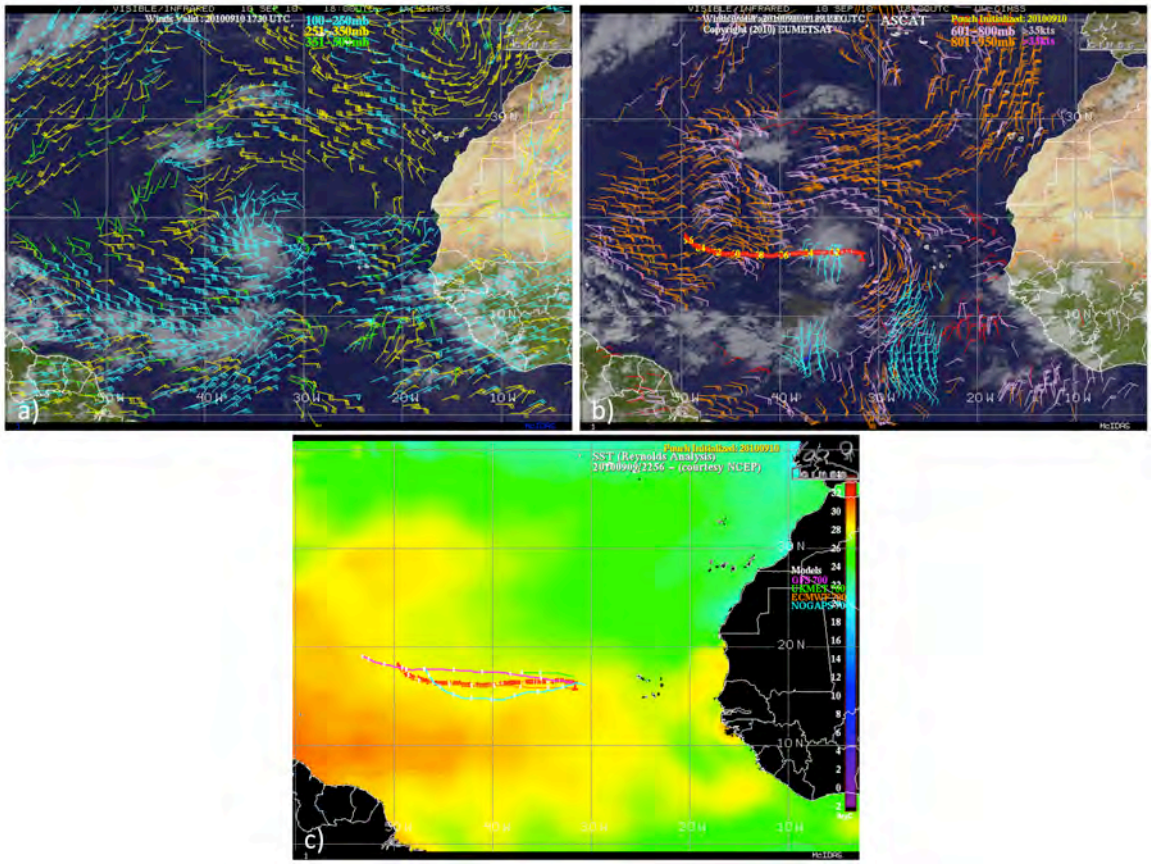


Image 8

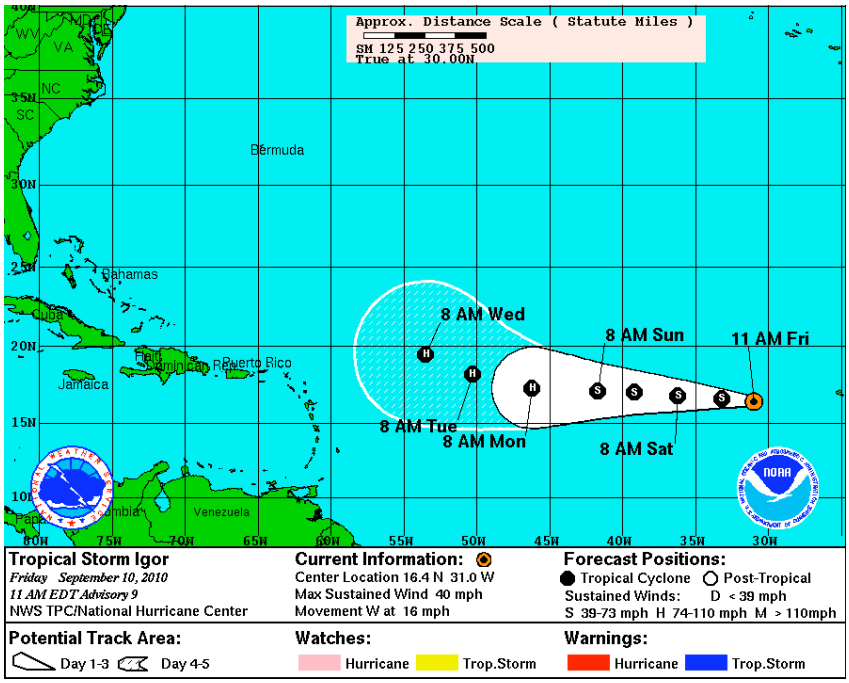


Image 9

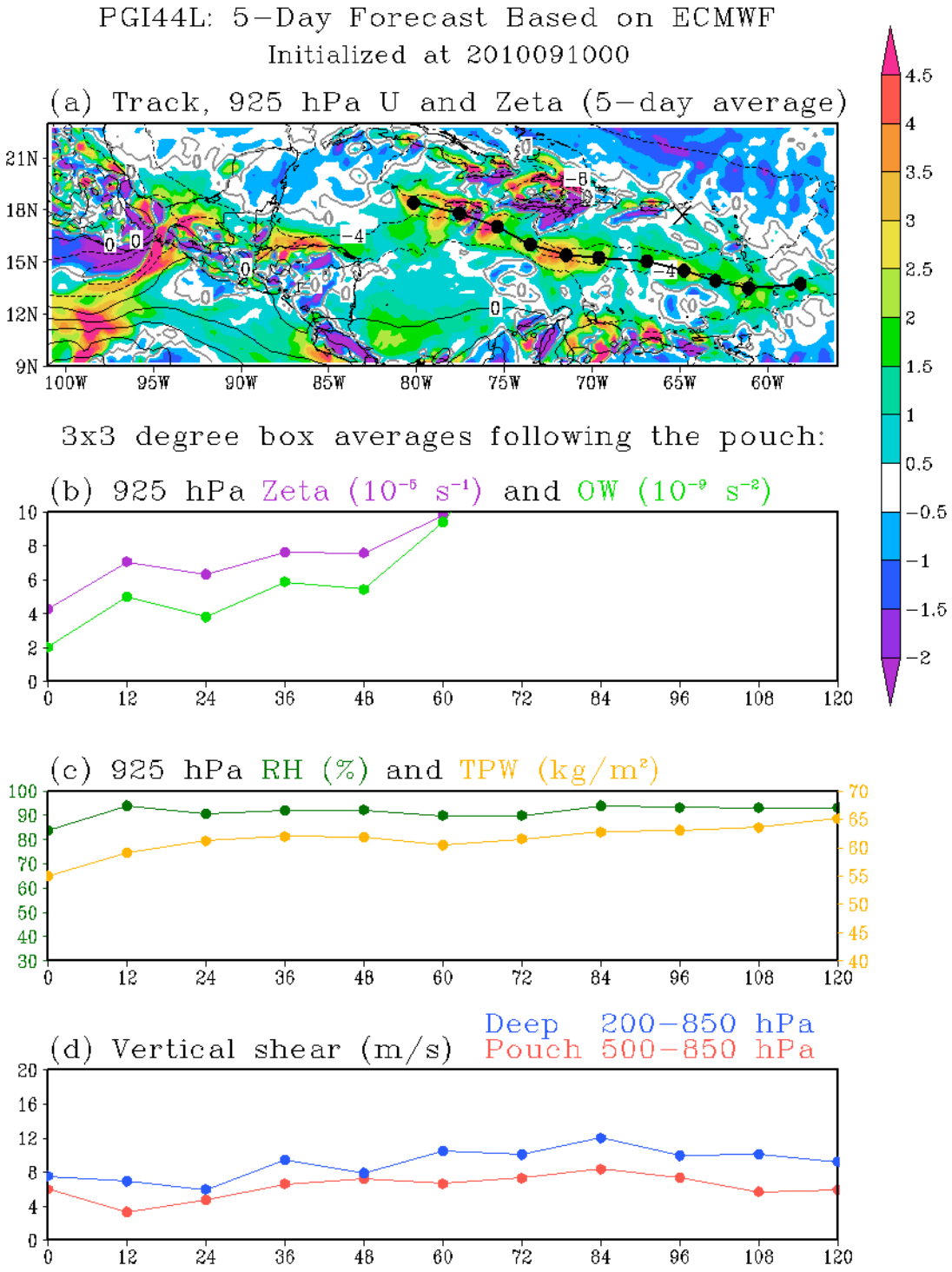

PGI44L: 5-Day Forecast Based on ECMWF
Initialized at 2010091000
(a) Track, 925 hPa U and Zeta (5-day average)
21N
18N
15N
12N
9N
100W
95W
90W
85W
80W
75W
70W
65W
60W
4.5
4
3.5
3
2.5
2
1.5
1
0.5
-0.5
-1
-1.5
-2
3x3 degree box averages following the pouch:
(b) 925 hPa Zeta (10^{-5} s^{-1}) and OW (10^{-9} s^{-2})
(c) 925 hPa RH (%) and TPW (kg/m^2)
(d) Vertical shear (m/s)
Deep 200-850 hPa
Pouch 500-850 hPa

Image 10

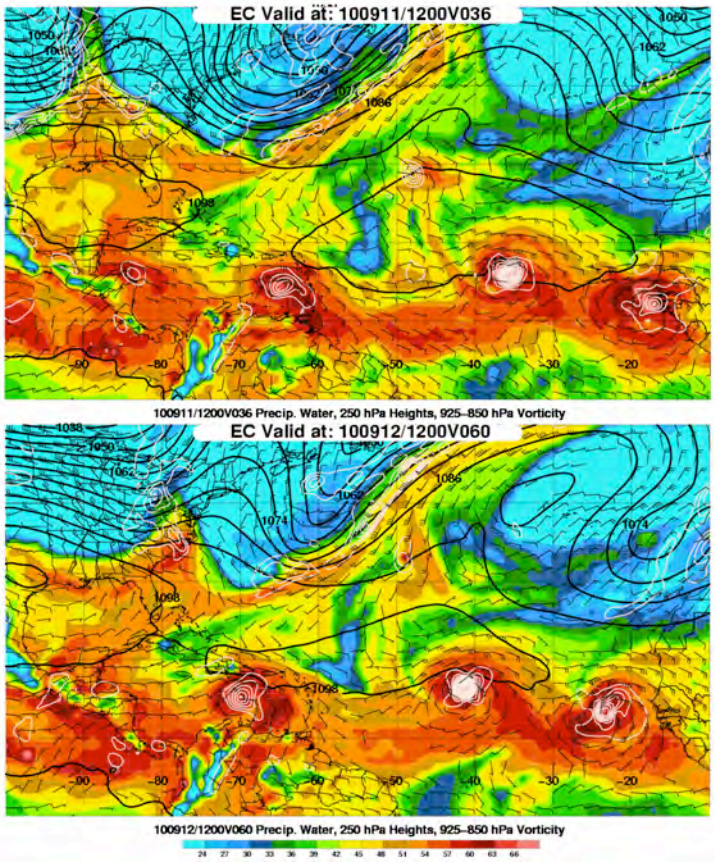
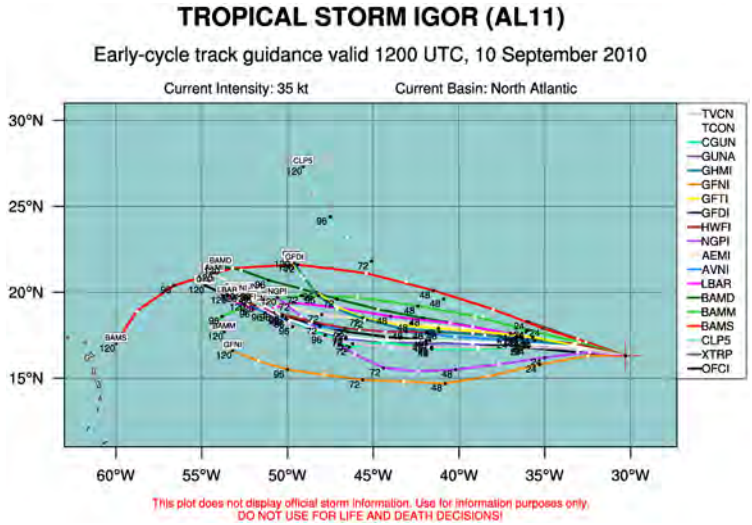


Image 11



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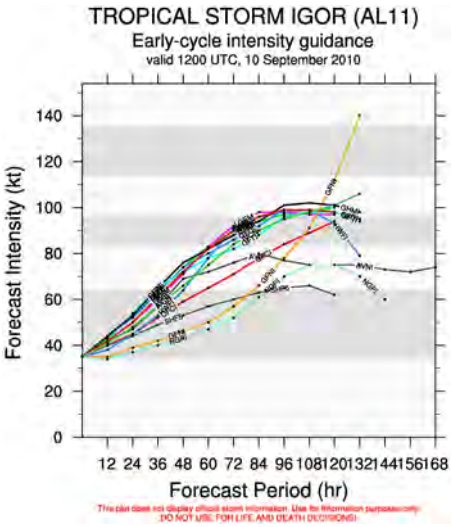


Image 13

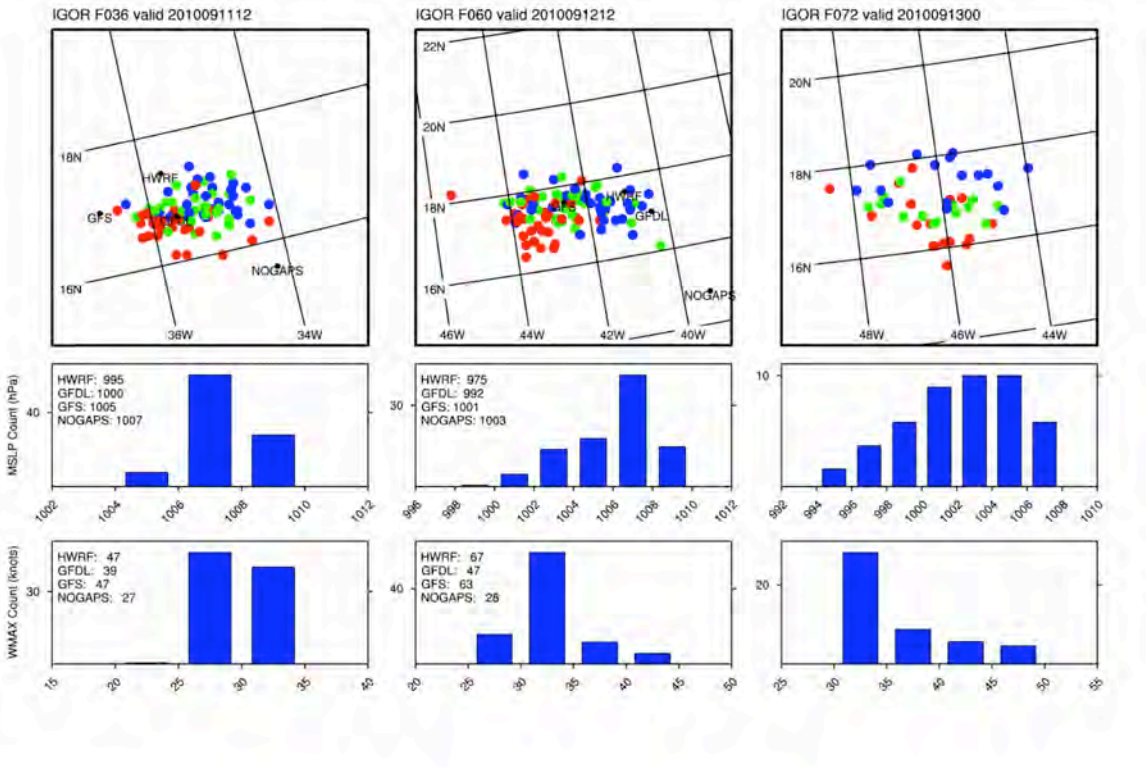
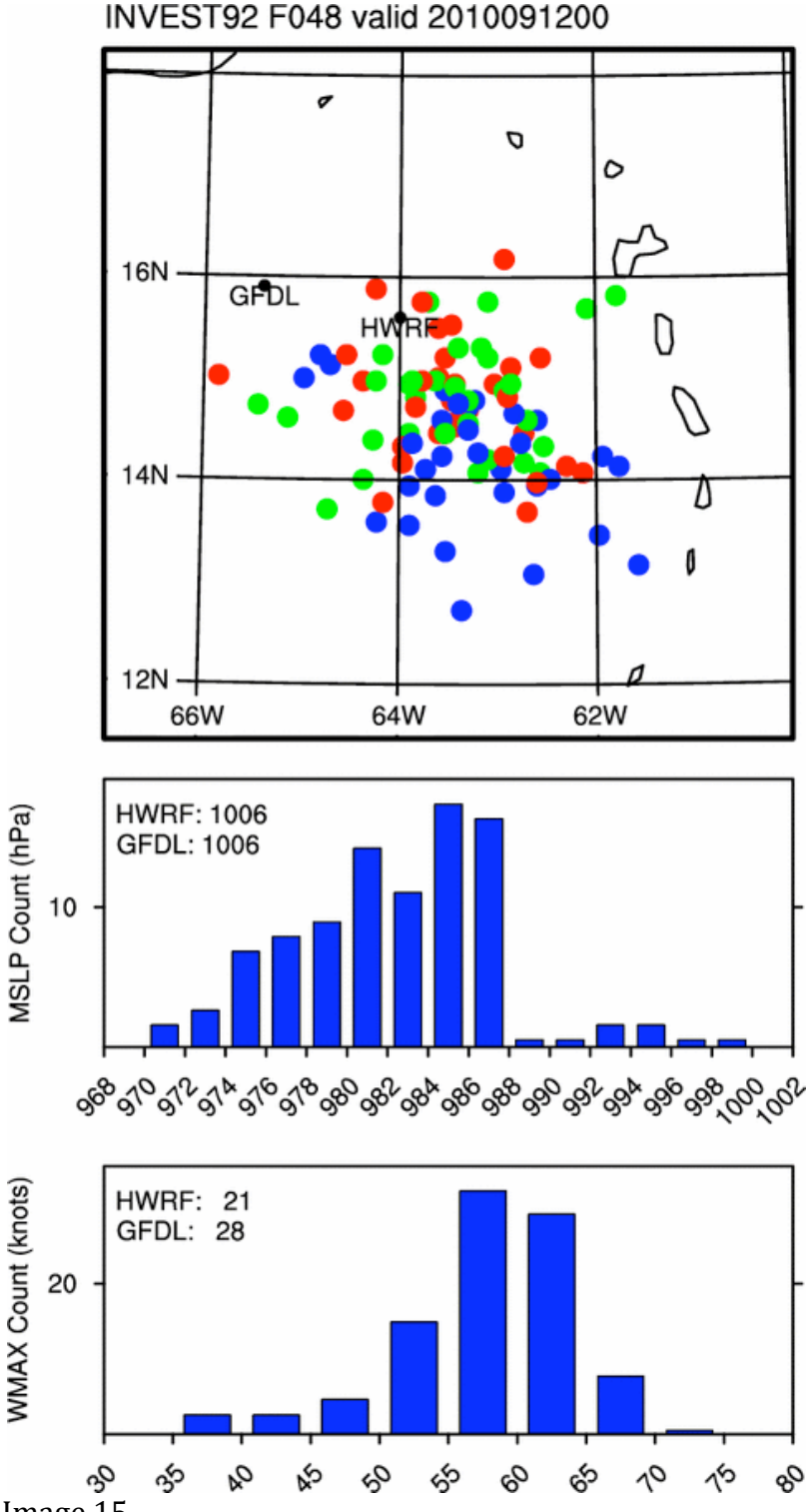
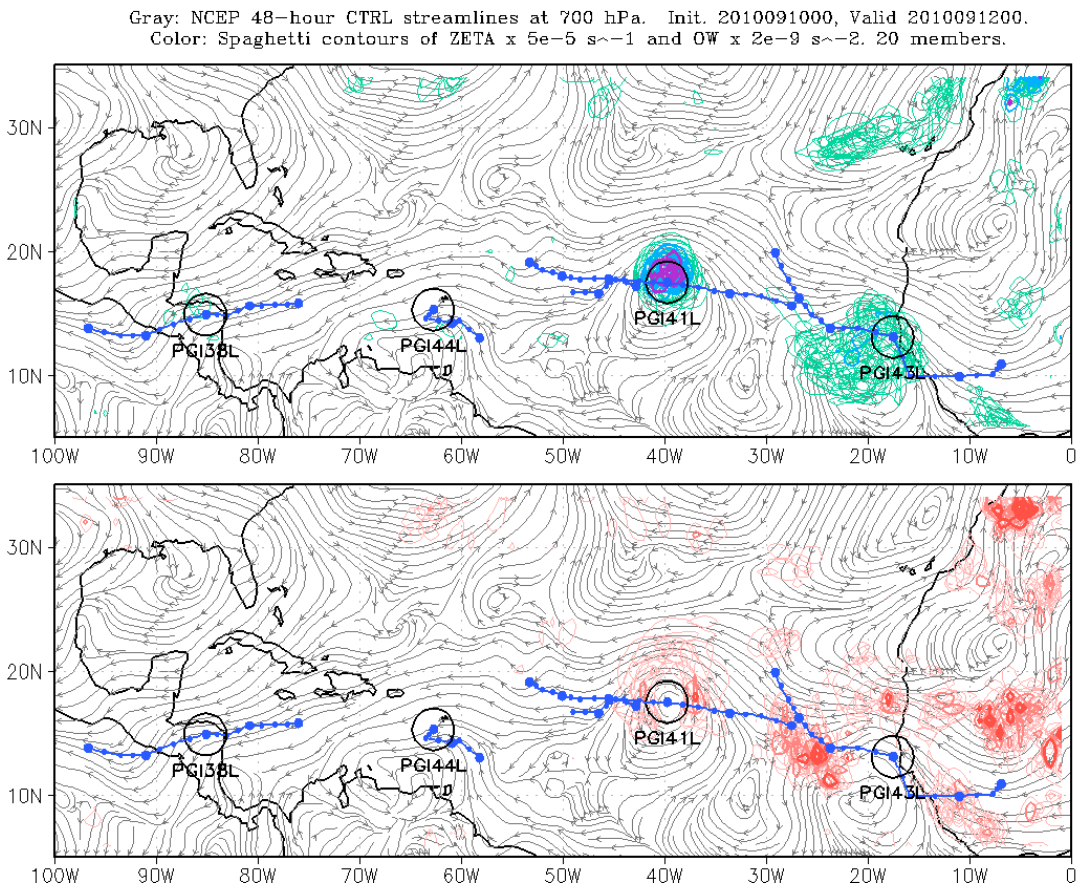
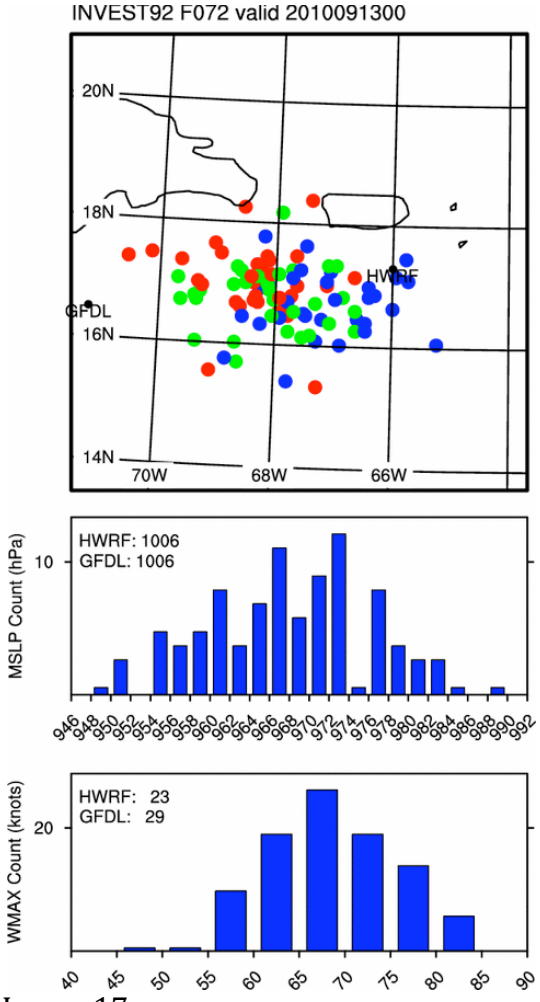


Image 14


INVEST92 F048 valid 2010091200
16N
14N
12N
66W
64W
62W
GFDL
HWRF
HWRF: 1006
GFDL: 1006
MSLP Count (hPa)
10
968
970
972
974
976
978
980
982
984
986
988
990
992
994
996
998
1000
1002
HWRF: 21
GFDL: 28
WMAX Count (knots)
20
30
35
40
45
50
55
60
65
70
75
80
Image 15


Gray: NCEP 48-hour CTRL streamlines at 700 hPa. Init. 2010091000, Valid 2010091200.
Color: Spaghetti contours of ZETA x 5e-5 s^-1 and OW x 2e-9 s^-2. 20 members.
30N
20N
10N
100W
90W
80W
70W
60W
50W
40W
30W
20W
10W
0
PGI41L
PGI43L
PGI44L
PGI38L
Image 16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20N
18N
16N
14N
70W
68W
66W
HWRF
GFDL
HWRF: 1006
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MSLP Count (hPa)
10
946 948 950 952 954 956 958 960 962 964 966 968 970 972 974 976 978 980 982 984 986 988 990 992
HWRF: 23
GFDL: 29
WMAX Count (knots)
20
40 45 50 55 60 65 70 75 80 85 90
Image 17

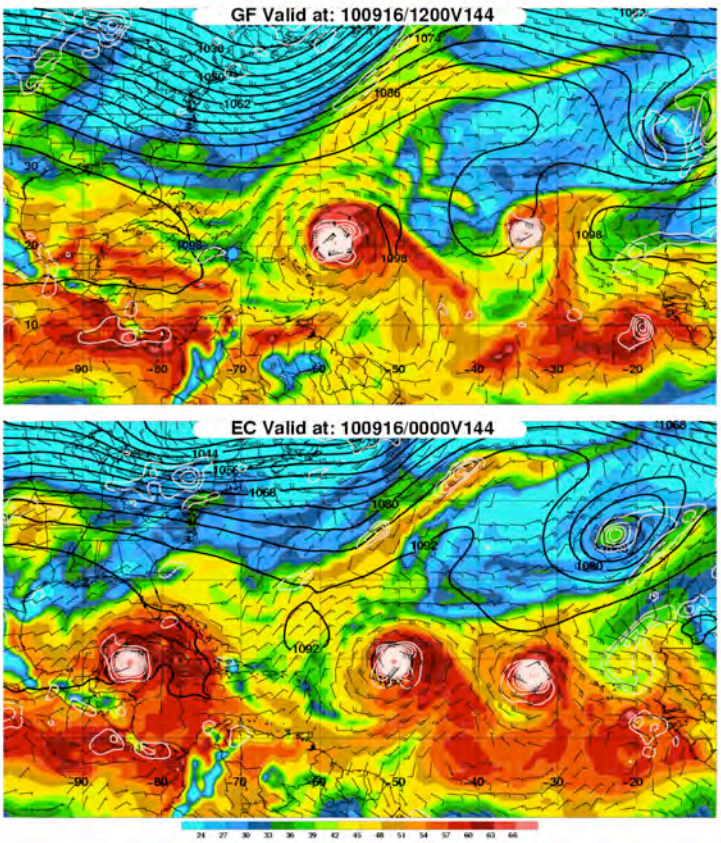

Image 18