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:

<table>
<thead>
<tr>
<th>Time</th>
<th>Position</th>
<th>Maximum Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>INITIAL</td>
<td>10/1500Z</td>
<td>16.4N 31.0W</td>
</tr>
<tr>
<td>12HR VT</td>
<td>11/0000Z</td>
<td>16.6N 33.2W</td>
</tr>
<tr>
<td>24HR VT</td>
<td>11/1200Z</td>
<td>16.8N 36.2W</td>
</tr>
<tr>
<td>36HR VT</td>
<td>12/0000Z</td>
<td>17.0N 39.2W</td>
</tr>
<tr>
<td>48HR VT</td>
<td>12/1200Z</td>
<td>17.1N 41.7W</td>
</tr>
<tr>
<td>72HR VT</td>
<td>13/1200Z</td>
<td>17.3N 46.2W</td>
</tr>
<tr>
<td>96HR VT</td>
<td>14/1200Z</td>
<td>18.2N 50.3W</td>
</tr>
<tr>
<td>120HR VT</td>
<td>15/1200Z</td>
<td>19.5N 53.5W</td>
</tr>
</tbody>
</table>

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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 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 proged to be near 20 N 58 W as it recurves into a seam in the subtropical ridge. In the ECMWF, Igor is proged 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.
Graphical Tropical Weather Outlook
National Hurricane Center  Miami, Florida

200 PM EDT FRI SEP 10 2010
Satellite Image: 1252 PM EDT

Outlined areas denote current position of systems discussed in the Tropical Weather Outlook. Color indicates probability of tropical cyclone formation within 48 hours.

- Yellow: Low <30%
- Orange: Medium 30-50%
- Red: High >50%

Image 2

Pouch Forecast Time: 2010091017
Morphed composite: 2010-09-10 12:00:00 UTC

Image 3
PGI44L: 5-Day Forecast Based on ECMWF
Initialized at 2010091000

(a) Track, 925 hPa U and Zeta (5-day average)

3x3 degree box averages following the pouch:

(b) 925 hPa Zeta ($10^{-3} \text{s}^{-1}$) and OW ($10^{-6} \text{s}^{-2}$)

(c) 925 hPa RH (%) and TPW (kg/m$^2$)

(d) Vertical shear (m/s)

Deep 200–850 hPa
Pouch 500–850 hPa

Image 10
TROPICAL STORM IGOR (AL11)
Early-cycle track guidance valid 1200 UTC, 10 September 2010

This plot does not depict official storm forecasts. Use for informational purposes only.
DO NOT USE FOR LIFE AND DEATH DECISIONS!
INVEST92 F048 valid 2010091200

MSLP Count (hPa)

WMAX Count (knots)

Image 15
Gray: NCEP 48-hour CTRL streamlines at 700 hPa. Init. 20100000, Valid 2010001200.
Color: Spaghetti contours of ZETA x 5e-5 s−1 and GW x 2e-9 s−2. 20 members.