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TRIAGENCY Weather Discussion

Lance Bosart and Tom Galarneau

*The images referenced below can be found in the 1400 UTC PREDICT weather discussion summary from 11 Sep 2010 [http://catalog.eol.ucar.edu/cgi-bin/predict/report/index]

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 11 Sep are summarized by the high-resolution water vapor winds (**image 1**) and Atlantic scale IR image for 1652 UTC 11 Sep (**image 2**). Features of interest in **images 1 and 2** include the remnants of Gaston (PGI38L) making landfall along the Central American coastline, a broad anticyclone over the southeast U.S., a southwest to northeast oriented deformation zone from the eastern tip of Cuba to well east of Bermuda that lies to the east of this anticyclone, an area of convection broadly centered near 14 N and 64 W that marks PGI44L, a large area of dry air in the middle and upper troposphere over the central North Atlantic, TC Igor (PGI41L) near 17 N and 38 W, and PGI43L near 12 N and 18 W. The pouch locations that identify the rotating features described above are superimposed on a TPW image for 1200 UTC 11 Sep (**image 3**). The current NHC graphical weather outlook indicates a 60% chance of tropical cyclogenesis for PGI44L over the next 48 hours, and a 50% chance for PGI43L over the next 48 hours (**image 2**).

The remnants of Gaston (PGI38L) remain very weak and disorganized near 15 N 82 W at 1200 UTC 11 Sep. Gaston is progged to make landfall along the Central American coastline today and move into the eastern North Pacific….and will no longer be discussed here.

At 1200 UTC 11 Sep, PGI44L was located near 14.2 N and 64.2 W based upon an analysis of available satellite imagery and the ECMWF forecast pouch position (**image 4**). A loop of satellite WV imagery ending 1645 UTC 11 Sep shows that PGI44L is associated with a large area (~500 x 300 km) of convective and stratiform precipitation. Although this precipitation was most extensive in the northern and western quadrants of the storm, small clusters of precipitation (convective and stratiform) were also evident in the eastern and southern quadrants of the storm as well (**image 5**). Numerous overshooting convective tops, indicative of fairly widespread convection, were identified during the late morning by a CIMSS-PREDICT product designed to provide guidance to pilots on the locations of potentially dangerous vigorous convective elements (not shown; see URL http://cimss.ssec.wisc.edu/tropic2/predict/overshooting_tops/).

Radar loops from San Juan, St. Maarten, and Martinique indicated the presence of widespread showers and thunderstorms, some with banded structures, over the northern half of PGI44L (not shown). Clear indications of rotation in the radar imagery characteristic of a TD-level disturbance were not found. Three hourly soundings from Barbados (78954, TBPB) confirmed the moist environment of the southeasterly inflow toward the pouch center.

The "vitals" of PGI44L were identified from the CIMSS-PREDICT "invest" page, As of 1630 UTC 11 Sep, these vitals were as follows: the deep-layer shear was weak (5-10 kt), the developing storm was embedded in a region of very high maximum potential intensity (< 900 hPa) (**image 6**), the TPW values were high (>55 mm), the low-level vorticity/OW maximum was embedded in high TPW values, and the corridor of high SSTs (29-30 C) coincided with the track of the ECMWF forecast pouch from 0000 UTC 11 Sep (**image 7**). All the available environmental factors suggest that PGI44L should develop into a TC within 24-48 h, given the presence of an aircraft-indicated low-level vortex embedded in a very moist environment from yesterday and more widespread satellite- and radar-indicated convection today.

An important science and forecasting question to ask is what are we "buying" from the expenditure of boatloads of dollars to obtain high quality meteorological datasets from research aircraft data in developing TDs and TSs. To help answer this question we note that dropsonde data obtained from two research flights by the G-V into PGI44L on 10 Sep were successfully assimilated into the ECMWF operational prediction model as evidenced by the green and red dots denoting the location of assimilated (research) dropsonde and (operational) soundings for 1200 and 1800 UTC 10 Sep (**image 8**). The impact of these special research aircraft dropsonde observations on the operational ECMWF forecast model can be appreciated by calculating the layer-mean 800-600 hPa circulation (computed by line integral methods) inside a circle of radius of 200 km that is centered on the PGI44L pouch for each of the 96 members of Ryan Torn's WRF ensemble and displaying the results as a pdf.

A comparison of the initially analyzed layer-mean 800-600 hPa circulation for 1200 UTC 10 Sep after assimilation of our research dropsonde observations into the ECMWF forecast model with the 12 h ECMWF forecast verifying 1200 UTC 10 Sep that did not assimilate our special research aircraft datasets shows that the forecast mean circulation of 4.3 s-1 (standard deviation of 0.78 s-1) was reduced to 2.81 s-1 (standard deviation 0.53 s-1) after the dropsonde data was assimilated into the ECMWF model (**image 9**).

A similar trend is evident from comparing the 24 h forecast 800-600 hPa circulation distribution pdf verifying 0000 UTC 12 Sep for PGI44L (initiated prior to dropsonde data assimilation) with the corresponding 12 h 800-600 hPa circulation forecast verifying the same time that was initialized with our research aircraft dropsonde observations (**image 10**). In both cases, the assimilation of the dropsonde data into the ECMWF model weakened the strength of the analyzed and forecast cyclonic

circulation and reduced the standard deviation between the 96 members of the ensemble. In effect, the additional dropsonde data forced the ECMWF model initial analysis to better reflect atmospheric "reality" and resulted in a delayed forecast of PGI44L reaching TC status by 12-18 h in forecasts generated subsequent to 1200 UTC 10 Sep.

Igor (PGI41L): At 1500 UTC, NHC has TC Igor positioned near 17 N 41 W with an intensity of 60 kt. The upper-level winds over Igor continue to be easterly at approximately 30 kt (**image 11**; panel a) as Igor moves westward on the southern flank of the subtropical anticyclone in the deep easterly steering flow (**image 11**; panel b). Unlike yesterday, the most intense convection is located along the southern flank of the circulation and is showing indication of developing over and east of the center. This change in the Igor-relative position of the strongest convection (it was on the western flank of the circulation yesterday) suggests that the deep-layer easterly wind shear on the southern flank of the subtropical ridge may be relaxing as Igor moves westward. The current SST analysis (**image 11**; panel c) shows that Igor is located on an SST gradient…with SSTs ranging from 25-26 C on the north side and 28-29 C on the south side of the circulation. As Igor moves westward it will encounter warmer SSTs in the 28-29 C range and weaker shear…hence, intensification is expected.

The 1500 UTC NHC track forecast for Igor (**image 12**) indicates a continued westward course through 1200 UTC 13 Sep…followed by a gradual recurvature to the northwest. The forecast positions and intensity from NHC are as follows:

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FORECAST POSITIONS AND MAX WINDS
INITIAL      11/1500Z 17.4N  39.5W    60 KT
12HR VT     12/0000Z 17.5N  42.0W    65 KT
24HR VT     12/1200Z 17.6N  44.9W    70 KT
36HR VT     13/0000Z 17.7N  47.5W    80 KT
48HR VT     13/1200Z 17.7N  49.7W    90 KT
72HR VT     14/1200Z 18.0N  53.5W   105 KT
96HR VT     15/1200Z 19.5N  56.5W   110 KT
120HR VT     16/1200Z 21.0N  59.5W   110 KT
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The biggest issue in the forecast for Igor is the time of recurvature, which will be determined by the evolution of the upper-level trough over the western North Atlantic and weakening on the subtropical ridge near 50-60 W.

PGI43L: The 0600 UTC 11 Sep METEOSAT infrared image shows that PGI43L was located over extreme western Africa and was associated with an organized region of convection (**image 13**). AT 1800 UTC, NHC increased their TC genesis potential to 50% for PGI43L within the next 48 hours (**image 2**) that is consistent with the well-defined anticyclonic outflow that has organized over the low-level disturbance (**image 1**). The positively-tilted upper-level trough along 30 N stretching from 40 W to 10 W will dig south and quickly pick up this developing TC within the next few days.

Day 1 (Next 24 hours) Outlook:

PGI44L: The pouch analysis derived from the ECMWF forecast from 0000 UTC 11 Sep shows that PGI44L will move slowly to the west-northwest and be situated near 16.5 N and 69.5 W at 1200 UTC 12 Sep (**image 4**). The magnitude of the 700 hPa relative vorticity and OW parameter are forecast to remain unchanged through 1200 UTC 11 Sep.

Igor: By 1200 UTC 12 Sep, TC Igor is progged to be located near 17-18 N and 43-45 W (**image 14**). Note that the GFS is a little faster with the westward movement of the system already. The ensembles are more in line with the GFS solution, with westward movement to near 45 W through 1200 UTC 12 Sep (**image 15**; left panel). There is some uncertainty in the intensity of Igor through 24-h…with the statistical models spinning up the system to a Cat 1 hurricane and the dynamical members keeping the system in the TS range (**image 15**; right panel). Based on the current satellite imagery, it would seem that intensification to a Cat 1 storm would be the most likely scenario.

PGI43L: The GFS and ECMWF both track PGI43L to near 20 W by 1200 UTC 12 Sep…with the GFS having the position slightly more south of the ECMWF (**image 14**).

Day 2 (24-48 h) Outlook:

PGI44l: The pouch analysis from the 0000 UTC 11 Sep ECMWF 60-h forecast verifying 1200 UTC 13 Sep indicates that PGI44L will be located near 16.5 N and 74.5 W (image). Approximately 40%, 65% and 80% of the 96 members of Ryan Torn's WRF ensemble produce sustained 35 kt winds (TC status) in the 30-h, 36-h, and 42-h forecasts verifying 0600, 1200, and 1800 UTC 12 Sep (**image 16**). Forecast position uncertainty is greater in longitude (~5 deg) than in latitude (~2 deg) at these times and the ensemble WRF track is farther south than the consensus track of the ECMWF, GFS, and UKMET models and the track of the forecast pouch based on the operational ECMWF model. Another unknown forecast issue is to what extent PGI44l as it continues to develop and move slowly west-northwestward will interact with the Hispaniola landmass and what the potential impact of this storm-land interaction will be on the expected intensification of the storm.

Igor: Much like the 24-h forecast, the 48-h forecast continues the westward movement of Igor…with the GFS moving the system a little faster compared to the ECMWF (**image 17**). The ensembles are a little faster than the deterministic GFS and ECMWF, placing the system near 50 W through 48-h with all members intensifying the system…ranging from a strong tropical storm to a strong Cat 2 (**image 15**).

PGI43L: Both the GFS and ECMWF track PGI43L westward to near 25 W through 48-h…with the ECMWF hinting at a slightly stronger system (**image 17**).

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 16 Sep brings PGI44L to near 19.0 N and 86.0 W from the previously discussed pouch tracks (not shown) and subsequently brings the storm onshore over the Yucatan peninsula in the following 24 h. The GFS forecast initiated at 0000 UTC 10 Sep dissipates PGI44L after 1800 UTC 15 Sep near 17.5 N and 84.5 W (not shown). The UKMET forecast from 0000 11 Sep places PGI44L near 18.5 N and 84.5 W at 120 h (not shown). Only the ECMWF forecast from 0000 UTC 11 Sep intensifies PGI44L into a TC. Almost 100% of the 96 members of Ryan Torn's 96 member ensemble have PGI44L as a TC in the 72 h forecast verifying 0000 UTC 14 Sep (**image 18**). The SHIPS model slowly and steadily intensifies PGI44L into a major hurricane by 120 h under very favorable environmental conditions of low shear, high SSTs, and significant ocean heat content (not shown)

Igor: In the extended range, the GFS and ECMWF continue to track Igor westward. The GFS forecast verifying 0000 UTC 16 Sep places the system near 22 N 58 W (**image 19**)…with recurvature to the northwest commencing in response to the approach of an upper-level trough over the western North Atlantic and a corresponding weakness in the subtropical ridge. The ECMWF forecast also verifying at 0000 UTC 16 Sep shows a slower westward progression of Igor…and hence recurvature has not started yet…with the system located near 20 N 52 W (**image 19**). The ensembles are much faster than both the GFS and ECMWF, putting the system near 60 W and beginning to recurve through 120-h (**image 15**). The ensembles suggest that continued gradual intensification will occur through 108-h (**image 15**)…until trough interaction occurs and the vertical wind shear likely increases.

PGI43L: Both the GFS and ECMWF prog PGI43L to be a tropical cyclone, and be located near 20-22 N and 34 W (**image 19**). PGI43L will undergo a trough interaction with the southern end of an upper-level trough extending southwestward from the cutoff low near 28 N and 20W at 0000 UTC 16 Sep. It is likely that if this interaction verifies, that PGI43L will become more subtropical in nature…rather than shear out and weaken.