

Tri-agency Weather Summary

27 September 2010

Heather Archambault, Clark Evans, and Brian Tang

Synoptic Overview/Current Conditions

The synoptic-scale flow pattern at upper levels is highlighted by the CIMSS analysis showing water vapor and upper-level cloud-tracks winds valid at 1015 UTC 27 Sep (**image 1**). Over the central U.S., a deep trough with an embedded closed low is advancing slowly eastward. Strong upper-level westerly winds along its base extend across much of the Gulf of Mexico (**image 2**). Over Central America and most of the Caribbean, broad diffluent upper-level outflow is associated with disorganized deep convection (**image 1**). Beneath the broad region of outflow, a west to east elongated monsoon gyre type system is evident by the broad cyclonically turning winds and cyclonic relative vorticity at 700 hPa (**image 2**). PGI50L is currently positioned at the center of this cyclonic gyre over extreme southeastern Mexico. Downstream of the deep trough over the central U.S, an upper-level ridge stretches from along the eastern coast of the U.S. eastward into the central Atlantic. Within this ridge at ~30 N, 58 W, the remnant circulation associated with Julia is still evident in visible satellite imagery, with deep convection continuing to fire near its low-level center (not shown). East of the ridge, a broad, positively tilted trough with two embedded vortices extends southwestward toward the Lesser Antilles. PGI48L is located in a region of convection within a midlevel warm core low (low-to-midlevel cyclonic flow beneath upper-level anticyclonic flow) to the east of the positively tilted trough. PGI49L, just off the west coast of Africa, is tracking westward on the southern periphery of a midlevel anticyclone (**image 2**).

The tropical pouches being followed today are (from west to east): PGI50L over Central America, PGI48L over the central tropical North Atlantic, and PGI49L emerging off the coast of western Africa. Discussion of each of these pouches follows below:

PGI50L: As of 1700 UTC, PGI50L was located at 17.9 N, 89.8 W. Note, however, that extreme caution should be exercised when considering the location of this pouch today. At the initialization time of 0000 UTC, the pouch that is being tracked as PGI50L was still south of the Bay of Campeche in association with the remnants of Matthew. A more representative analysis of the location of PGI50L, including the uncertainty therein, encompasses the area bounded by 11-21 N and 80-95 W amidst the larger-scale monsoon gyre feature across the region (**image 3**). A synthesis of available surface observations and across the northwestern Caribbean today suggest that maximum sustained surface winds are near 25 kt and that the minimum sea level pressure is approximately 1004 hPa (**image 3**).

Three areas of deep convection are noted in association with PGI50L: that associated with the remnant mid-tropospheric circulation of Matthew between the Bay of Campeche and the Gulf of Tehuantepec, a localized area of deep convection near 19 N, 84.5 W, and a widespread area of intense organized convection along 81 W between 13-19 N. NCAR/NSF G-V dropsondes

from a survey of this region indicate the presence of a 700 hPa convergence axis/trough along 18 N between the latter two areas of convection (not shown). At the surface, both an ASCAT overpass analysis from approx. 0320 UTC (**image 4**) and available surface observations (**image 3**) indicate the presence of broad cyclonic curvature to the near-surface wind field associated with PGI50L somewhat to the southwest of that analyzed by the G-V dropsondes. PGI50L is located underneath an east-west elongated subtropical ridge centered near the southern Bay of Campeche. Aloft, substantial upper tropospheric diffluence is noted along with deep layer vertical wind shear of approximately 15-20 kt out of the north/northwest on the eastern periphery of the upper anticyclone (not shown).

PGI48L: As of 2000 UTC, PGI48L was positioned at 12.1 N, 37.6 W, with some north-south spread noted in the initial position among the individual dynamical models (**image 5**). The initial position of the pouch is collocated with scattered convection and a local maximum in cyclonic relative vorticity at 850 hPa (top panel in **image 5**). This disturbance is in a very moist environment (TPW >55 mm, not shown) in a region of low (~10 kt) deep-layer vertical wind shear (bottom panel in Image 5). Little upper-level divergence is apparent directly over the pouch, with enhanced divergence displaced to the southwest of PGI48L over a larger area of deep convection (top panel in **image 5**).

PGI49L: As of 1700 UTC, PGI49L was located at 10.2 N, 19.2 W. Currently, there exists substantial east-west spread in the position of PGI49L among the available model guidance (**image 6**), likely arising due to differences in how the models represent the focal point of the disturbance along an elongated east-west lower tropospheric vorticity sheet/convergence axis between 16-26 W (**image 7**). Deep convection is almost non-existent with PGI49L at this time. PGI49L is moving fairly rapidly (~8 m/s) to the west as steered by fast lower to middle tropospheric easterly steering flow across the eastern Atlantic (not shown). The environment of the disturbance is characterized by relatively high total precipitable water values near 55-60 mm, weak vertical wind shear of 5-10 kt, and marginal upper tropospheric forcing (not shown).

0-24 hr Forecast

PGI50L: Model guidance consensus suggests that a new disturbance - what truly can be referred to as PGI50L - will develop across the northwestern Caribbean sometime within 12 hr of F024/0000 UTC 28 September (**image 8**). This occurs in response to persistent vorticity stretching (associated with deep convection) and advection (associated with the westerly monsoonal flow) across the region and may well be tied to the persistent organized deep convection ongoing across the region at this time (e.g. **image 3**). Of the individual model consensus members, the GFS and NOGAPS are faster in showing this occurring while the ECMWF and UKMET are somewhat slower with this evolution (**image 9**). Both the dynamic and thermodynamic environments across the northwestern Caribbean Sea - as characterized by vertical wind shear, upper tropospheric diffluence, total precipitable water, and SSTs/MPI - are expected to remain favorable through F024.

These characteristics suggest that the development of PGI50L through F024 is likely to be determined primarily by how quickly the lower tropospheric vorticity maxima within the broader-scale monsoon gyre-like disturbance congeal into a coherent disturbance. We feel that model predictability of such an evolution/process is likely to be relatively low.

PGI48: PGI48L will move steadily toward the west (**image 10**). The GFS and ECMWF both show slight weakening of the OW and relative vorticity, despite keeping the vertical wind shear low and the lower levels moist. In particular, the pouch signature is strongest at 925 mb and weakens aloft where it becomes barely distinguishable at 700 mb. The NOGAPS is the strongest model with OW values above $2 \times 10^{-9} \text{ s}^{-2}$, but it appears to be far too strong initially. Despite the models insisting the vertical wind shear will remain low, westerly vertical wind shear appears to be increasing over PGI48L. Additionally, it is moving toward a region of stronger westerly shear, so it is possible the models are not handling the vertical shear correctly in the short term.

PGI49L: During the 0-24 hr period, PGI49L is expected to continue to move rapidly to the west. The disturbance is expected to remain very weak with little change in strength amidst a fairly moist, low vertical wind shear environment (**image 6**).

24-48 hr Forecast

PGI50L: Differences between the available model guidance products appear during the 24-48 hr period. The majority of the model guidance - including the ECMWF, UKMET, and NOGAPS - suggest that PGI50L will move slowly across the northwestern Caribbean Sea during this period with only a modest increase in strength (**image 9**). The GFS, however, depicts rapid organization of PGI50L during this period, ultimately resulting into an intense disturbance racing north-northeastward across Cuba into the Florida Straits by F048 (**image 9**). Careful examination of the Okubo-Weiss (**image 11**) and relative vorticity (not shown) fields valid at F048 from each model suggests that these differences result from differences in how each model consolidates individual relative vorticity/Okubo-Weiss parameter maxima associated with PGI50L. The GFS is very quick in developing a single coherent disturbance whereas the remainder of the model guidance maintains a broad, somewhat disorganized disturbance through F048. It is unclear as to whether this rapid organization of the disturbance within the GFS is based in reality or owes a significant contribution to its convective parameterization scheme.

As before, the development of PGI50L through F048 is likely to be determined primarily by how quickly a coherent disturbance can develop amidst the broader-scale monsoon gyre-like disturbance across the region. Model predictability is likely to remain low through this period given these considerations. As of 1800 UTC, the NHC gives this area a 40% chance of development during the next 48 hr.

PGI48: PGI48L is forecasted to continue moving toward the west or west-northwest on day 2 (**image 10**). The GFS and ECMWF have trouble tracking a coherent pouch through the period,

whereas the UKMET and NOGAPS have a more coherent feature. OW values in the GFS and ECMWF fall to near zero. The NOGAPS remains the strongest of the models with OW values hovering around $2 \times 10^{-9} \text{ s}^{-2}$. The models all indicate that the environment around PGI48L should remain fairly moist.

PGI49L: The forecast evolution of PGI49L during the 24-48 hr period is essentially a continuation of the 0-24 hr forecast. Little change in strength is forecast as the disturbance moves rapidly westward in a fairly moist, low vertical wind shear environment (**image 6**).

Extended Forecast

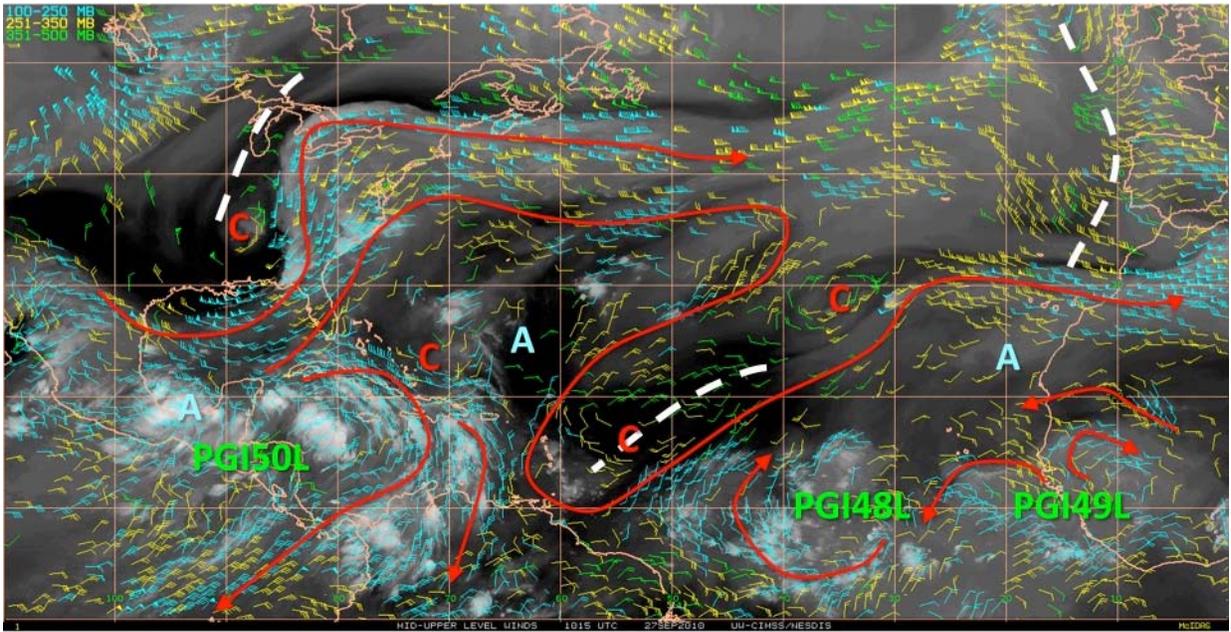
PGI50L: Apart from the GFS, which shows a quickly developing disturbance race northward across Cuba and South Florida through F072, the model guidance is in fair agreement with regards to the evolution of a slowly developing disturbance in the northwestern Caribbean Sea that gradually accelerates northeastward through F096-F120 (**image 9**). Even the GFS (0000 UTC run) shows two additional separate disturbances across the region after F072 (not shown). The first new disturbance rapidly develops and moves rapidly northeast over Cuba in a manner similar to its predecessor while the second new disturbance slowly intensifies while remaining nearly stationary over the northwestern Caribbean at and beyond F120. We suspect that the GFS is a bit overdone with this forecast evolution and thus lean our forecast in the direction of the consensus of the remaining forecast guidance.

The timing of this disturbance being accelerated northeastward by the seasonably deep eastern United States trough will depend in part upon how it evolves in response to the continued Rossby wave dispersion event associated with the recurvature of former western North Pacific TY Malakas. In and of itself, when and how strong this disturbance is as it recurves into the mid-latitudes will have significant impacts upon the downstream pattern across the Atlantic, including that ahead of PGI48L. Given these considerations and uncertainty with respect to tropical cyclone development in the Caribbean, model predictability throughout the western northern hemisphere is expected to be low through the next five or more days.

PGI48L: PGI48L is forecasted to move toward the west day 3 with a possible bend toward the northwest day 4 through 5 (**image 10**). The ECMWF and its ensembles have an uptick in PGI48L's circulation strength on day 4. The GFS is a bit delayed, but still shows development on day 5, possibly due to interaction with PGI49L, as it appears to catch up with PGI48L leading to an increase in vorticity by superposition of wave energy. The UKMET remains weak through the extended period, while the NOGAPS shows a subtle increase in OW and relative vorticity. The vertical wind shear in the ECMWF, UKMET, and NOGAPS increases to moderate to high values toward the end of the extended range, which may limit development. The GFS doesn't increase the shear as much, but this is possibly due to its more southerly position with PGI48L.

PGI49L: The majority of the available model guidance, including the ECMWF, GFS, and UKMET, indicate that PGI49L will cease to be a trackable feature beyond F072-F096 (**image 6**). Model-based 850 hPa relative vorticity fields (not shown) indicate that the remnant vorticity associated with PGI49L may become entrained into PGI48L or, beyond F096, begin to re-develop into a coherent disturbance approx. 8 deg to the east of PGI48L as it nears the Lesser Antilles. Any potential feature of interest for flight operations in association with PGI49L is at least five days out, however.

Figures



1015 UTC 27 Sep

A = Upper-level anticyclone
C = Upper-level cyclone

 Representative streamline
 Upper-level trough axis

Image 1.

700 hPa Wind, Relative Vorticity, and Streamfunction

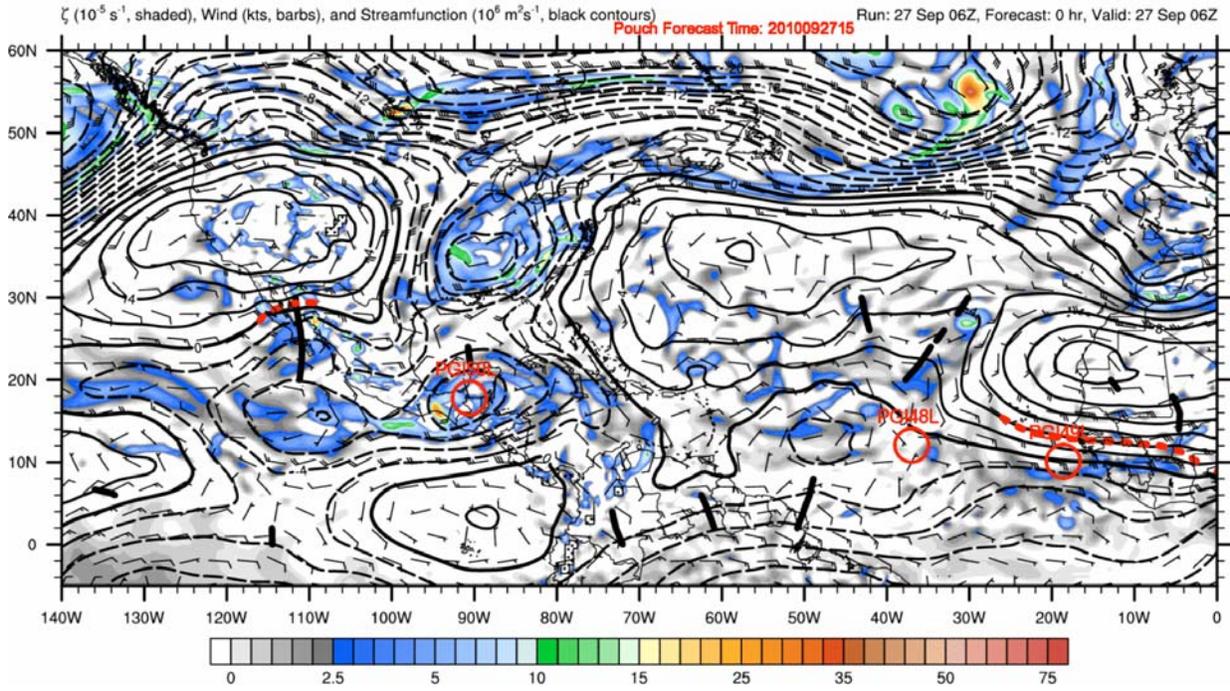


Image 2.

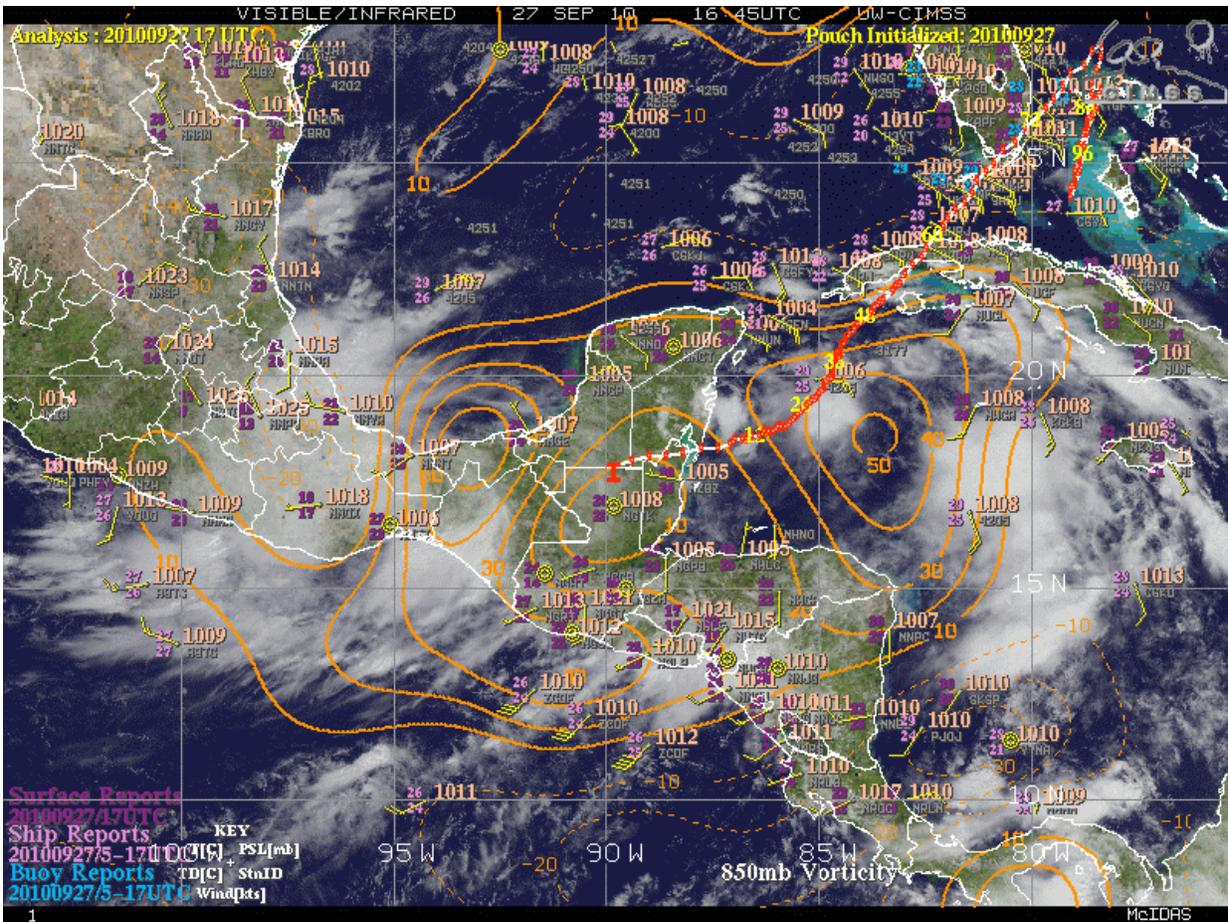


Image 3.

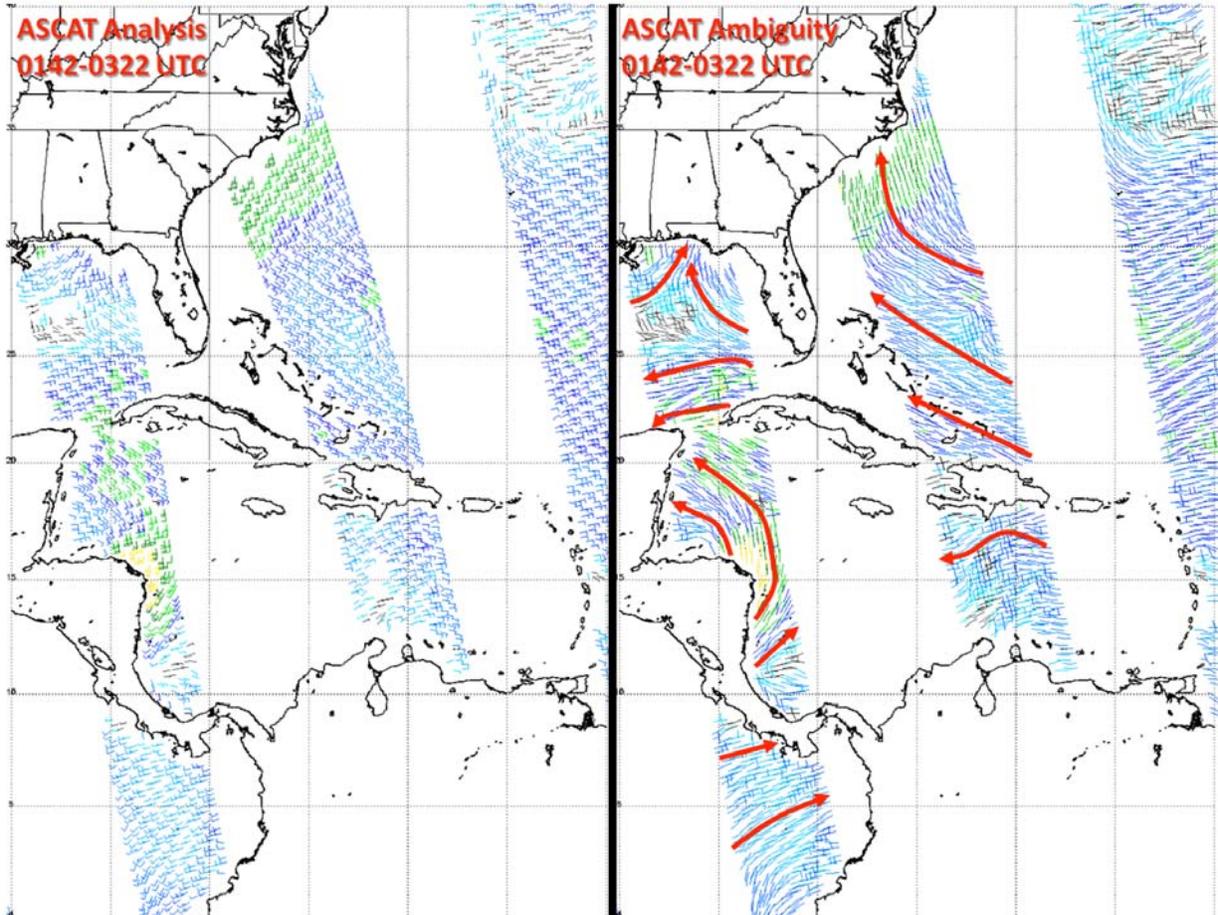


Image 4.

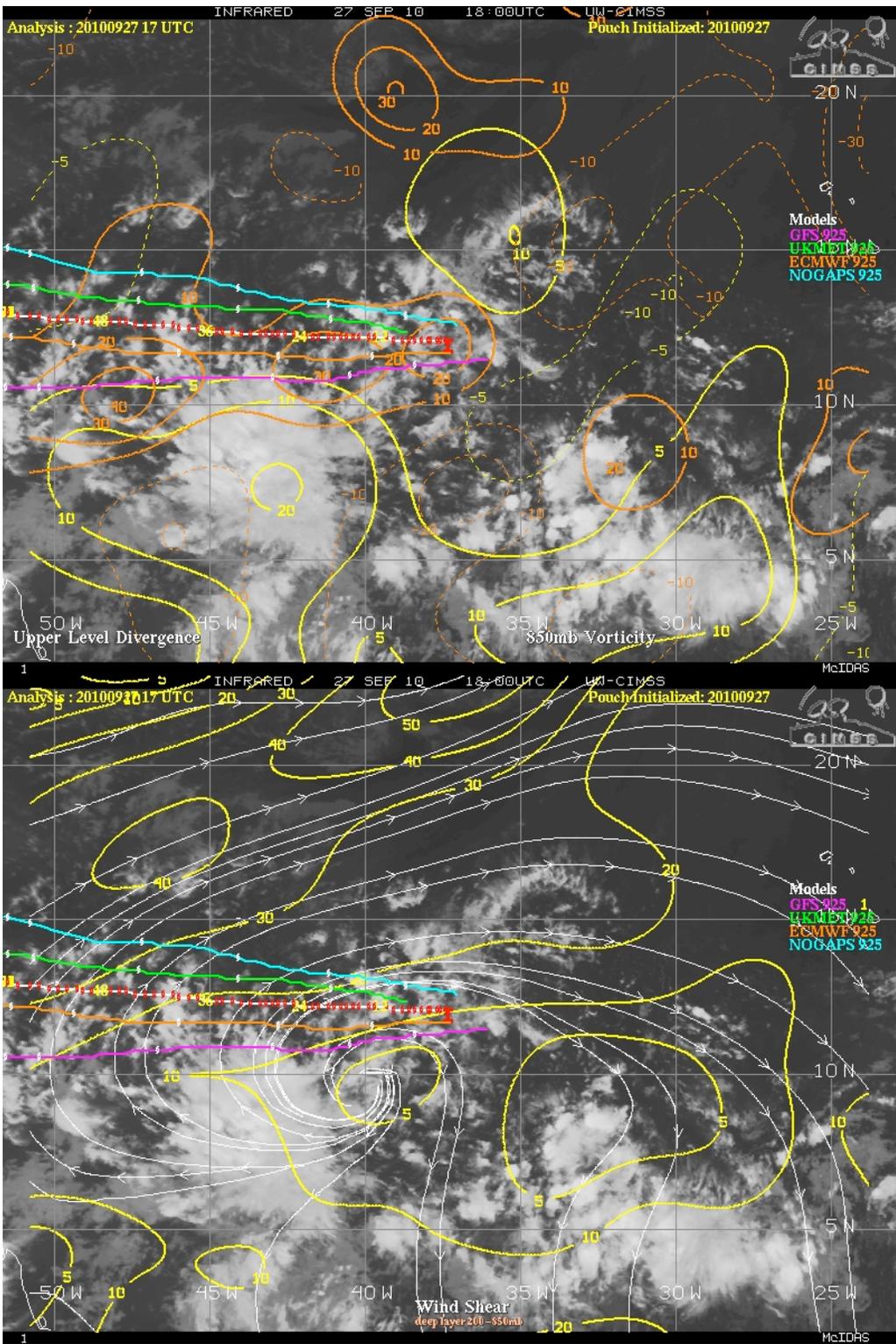


Image 5.

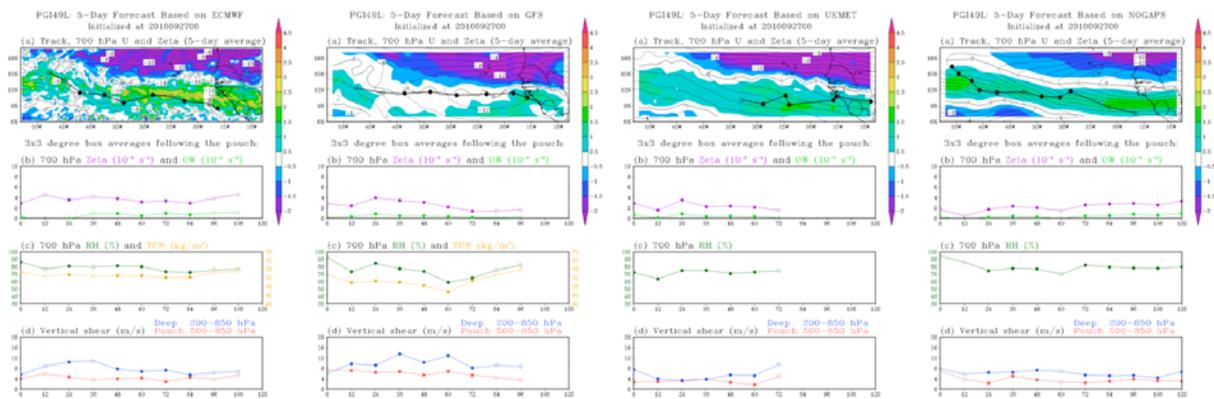


Image 6.

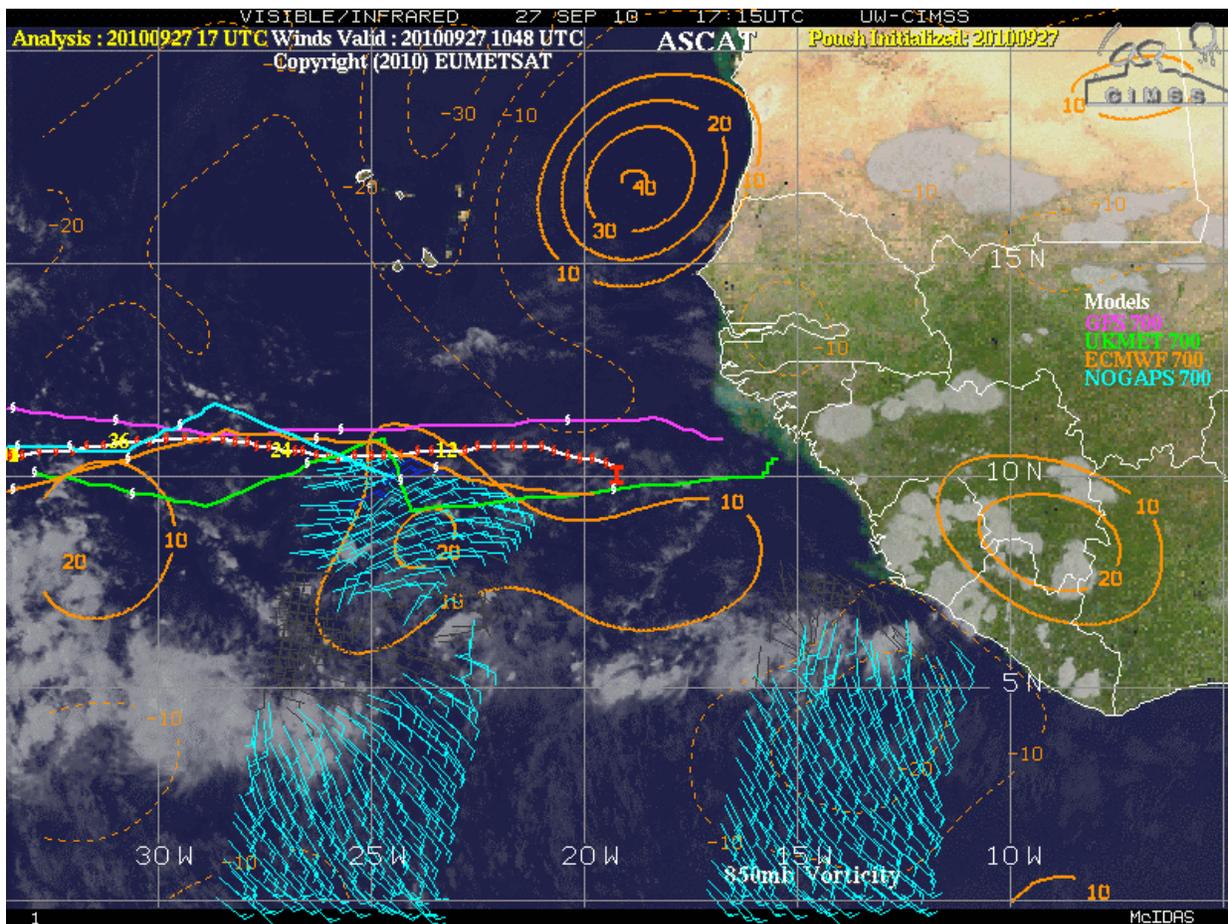


Image 7.

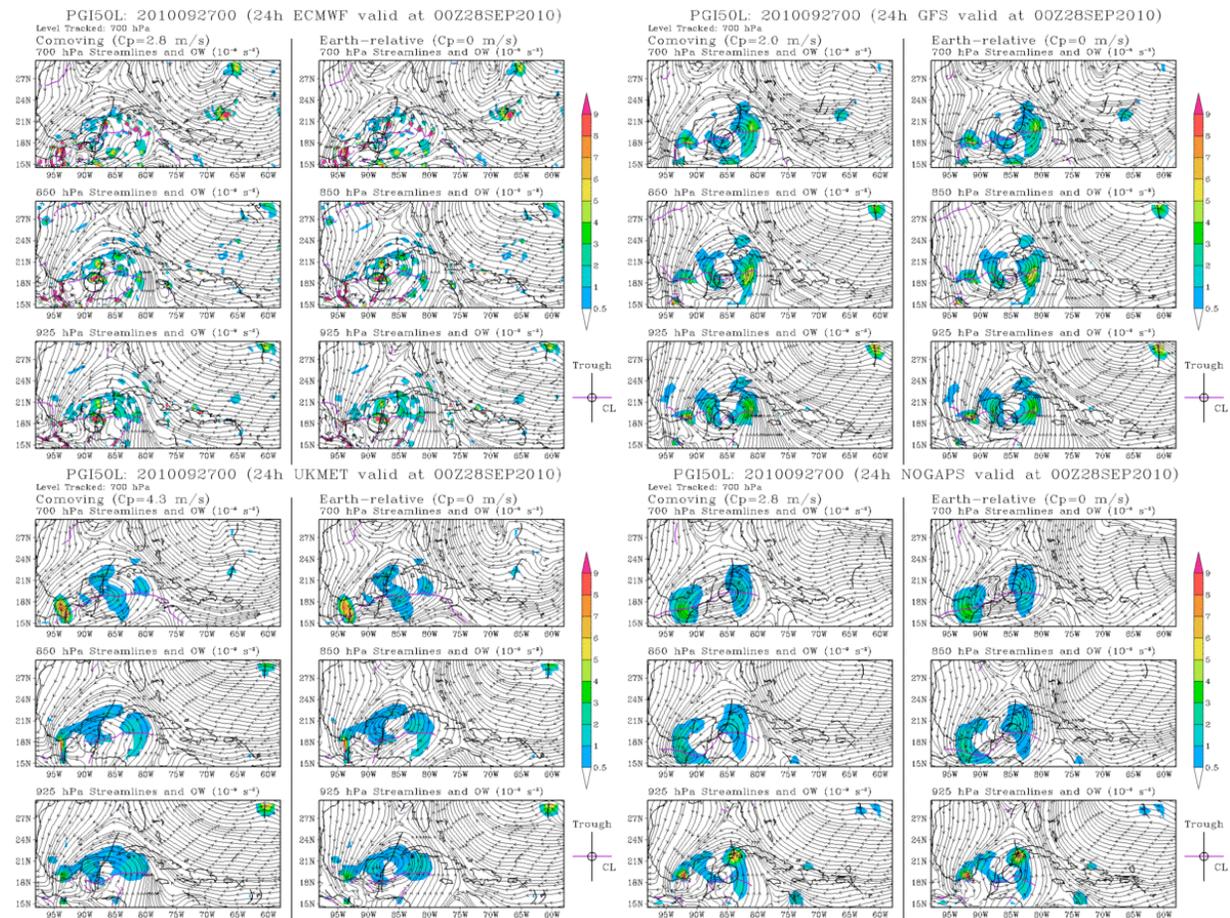


Image 8.

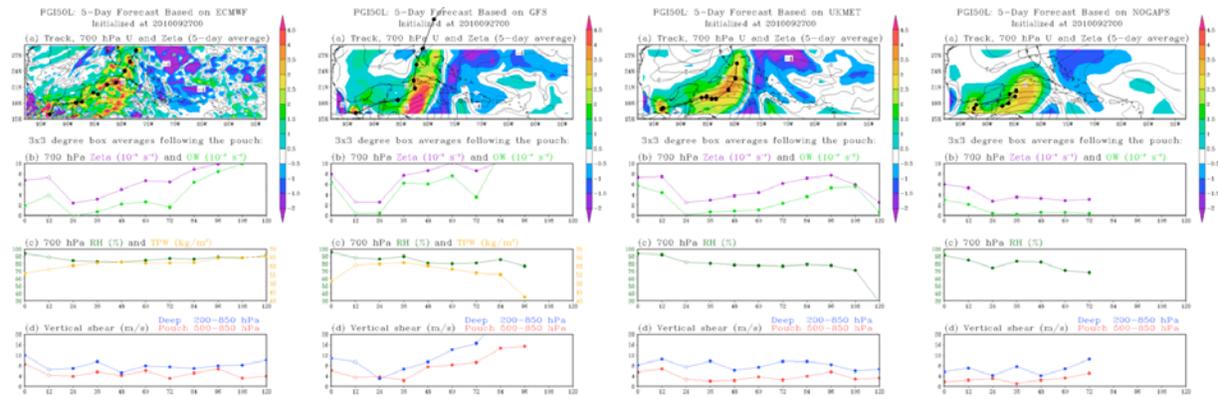


Image 9.

PGI48L

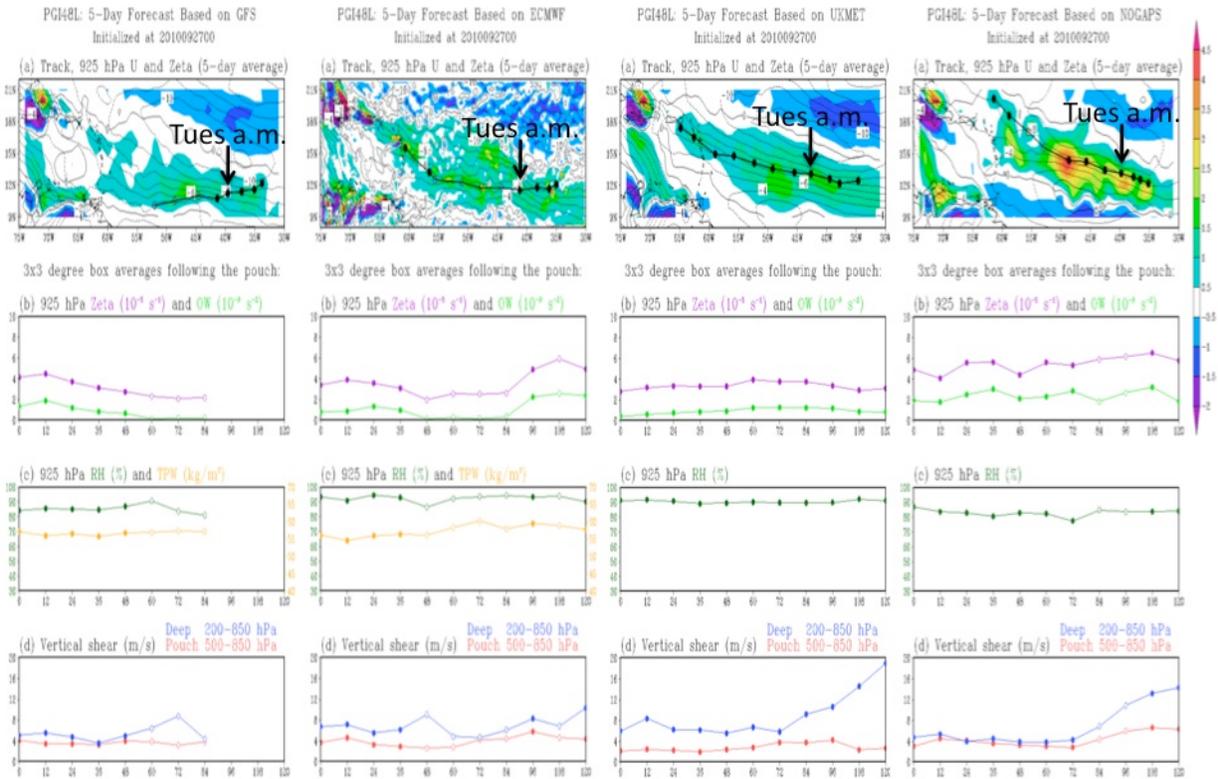


Image 10.

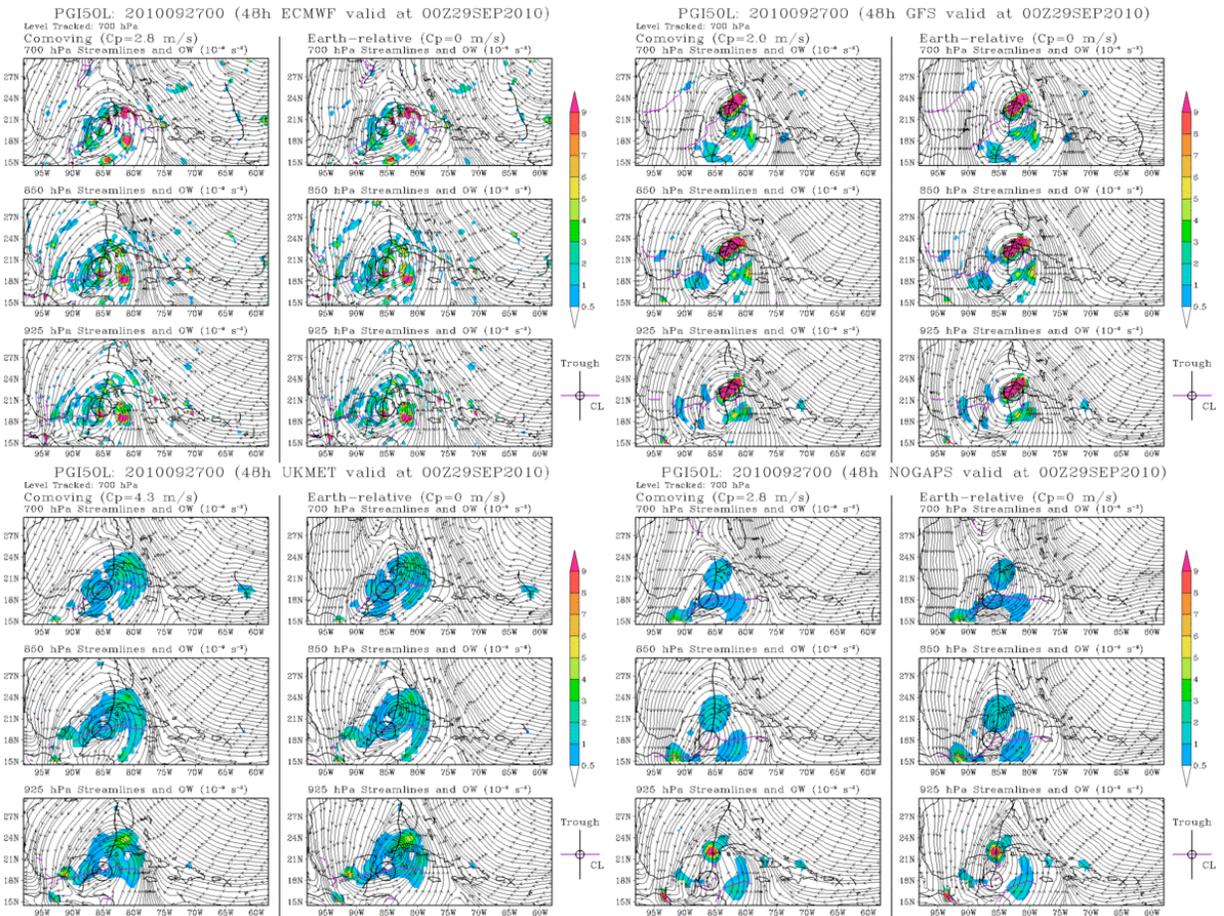


Image 11.