Updates to the GFDL Vortex Tracker for 2016

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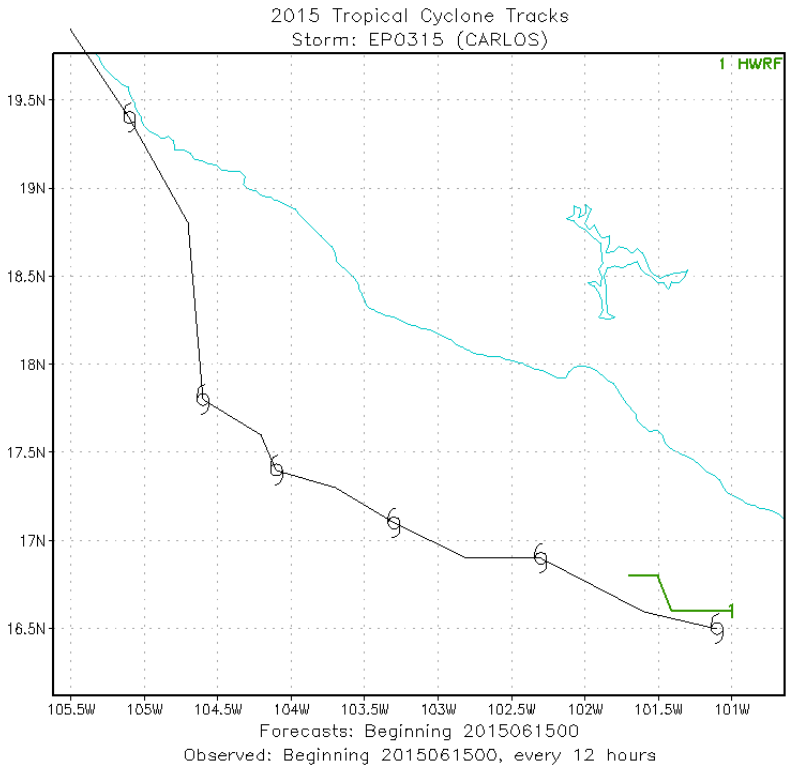
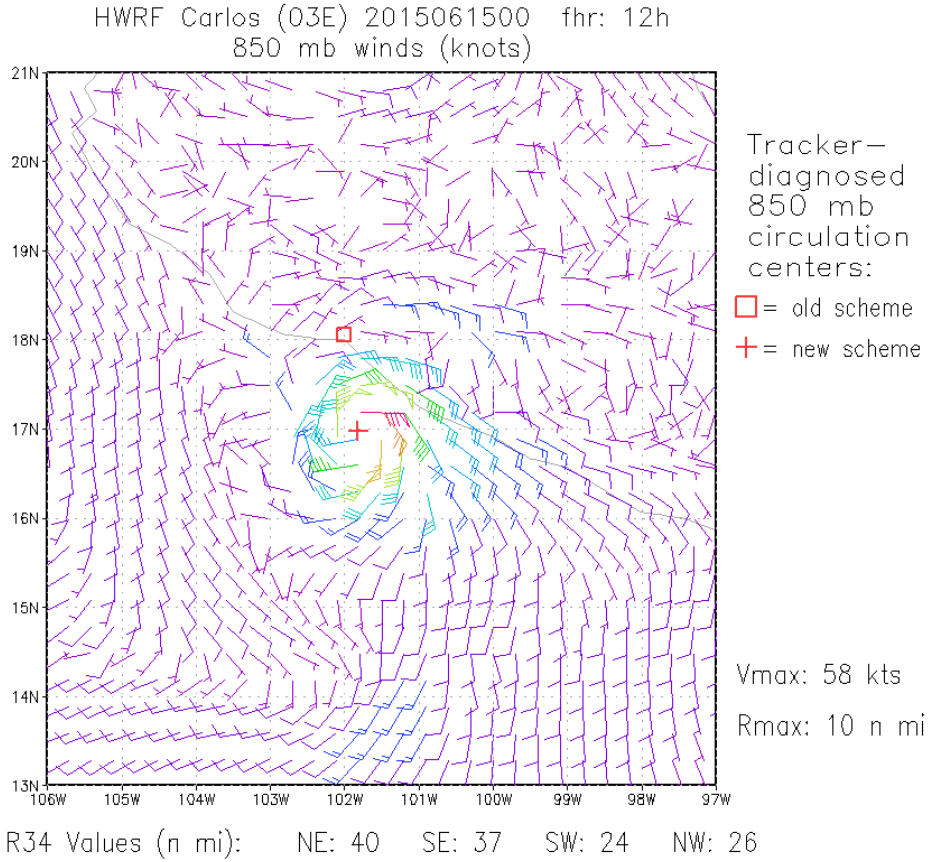
List of changes

- Replacement of scheme to track the near-core circulation
- Tracking of 200-850 mb thickness
- Expansion of domain for tracker files for moveable grids from limited-area models.
- Option to use land-sea mask for genesis detection
- Use of azimuthally averaged values for surface wind structure diagnostics
- GRIB2 issues…

Near-core circulation issue

Operational tracker for HWRF dropped Carlos (2015061500) at 12h, even while it was a 58-kt storm in HWRF and the 850 mb winds clearly showed a coherent, albeit very small, circulation:





Near-core circulation issue

One of the criteria used for determining whether to continue or stop tracking is based on computation of mean V_T surrounding the found circulation center. Therefore, diagnosing an accurate fix for that circulation center is critical.

Old scheme:

Interpolate data to fine scale, then find the minimum in wind speed.

This is okay for coarse grid models with broad vortex structures.

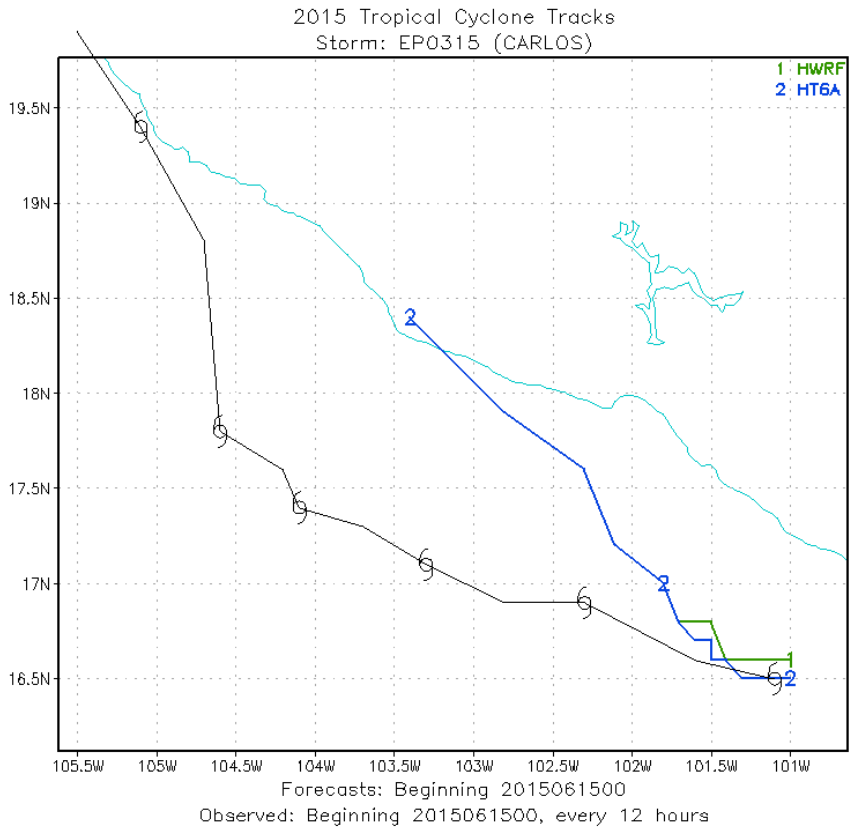
New scheme:

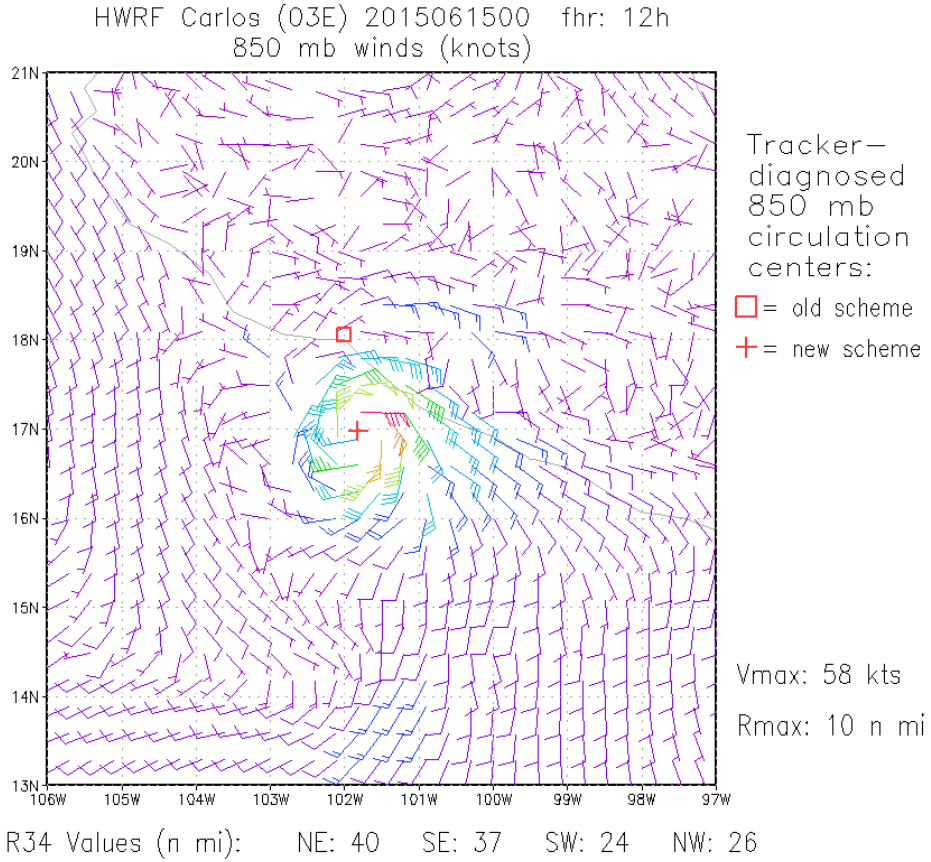
Compute circulation difference (Circulation minus Vmax at center) at six radii within a specified distance of center. Circulation center fix exists where this function is maximized.

Subtracting the Vmax at the center helps to more accurately refine the center fix.

Near-core circulation issue

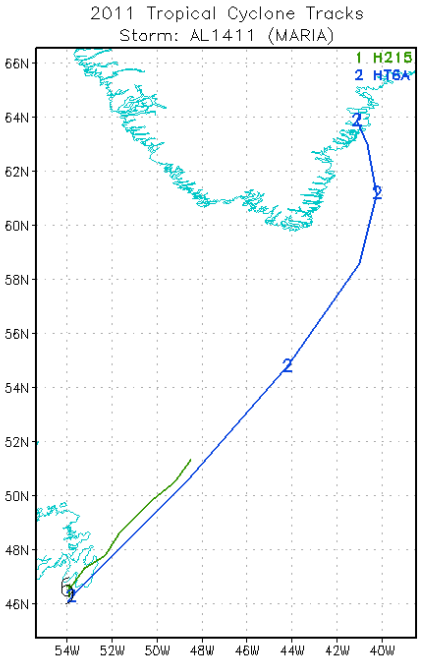
Updated tracker for HWRF more accurately fixes the circulation center and allows tracking of Carlos through landfall (HT6A in left figure).

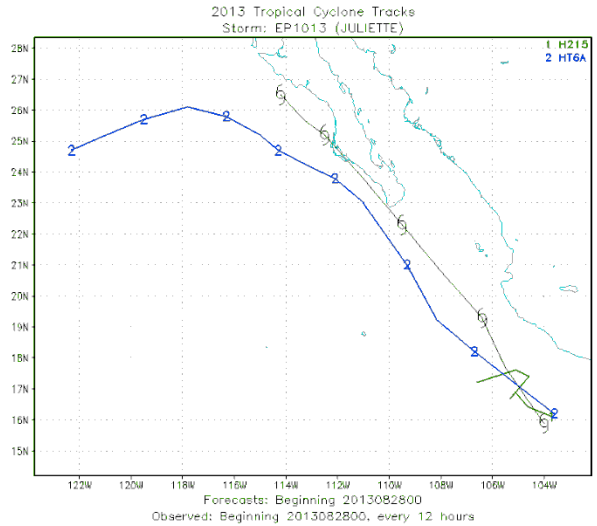


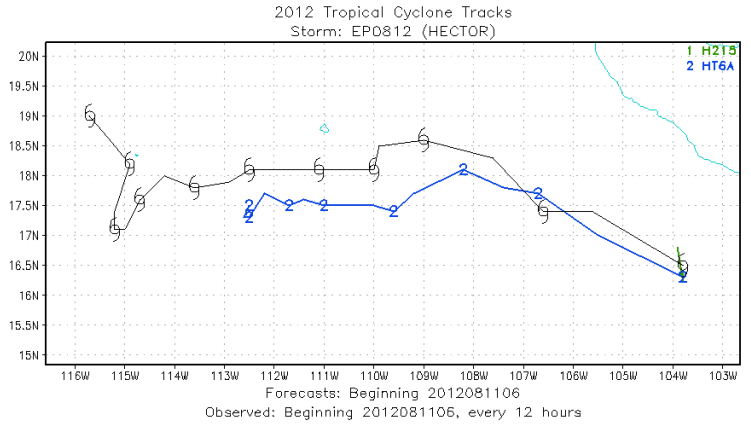


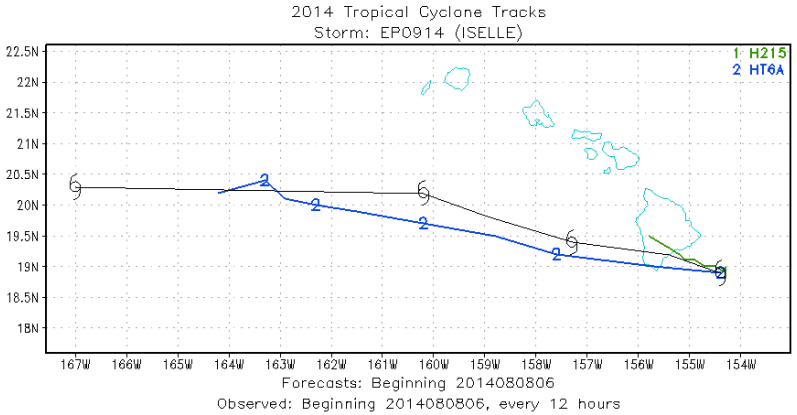
Near-core circulation issue

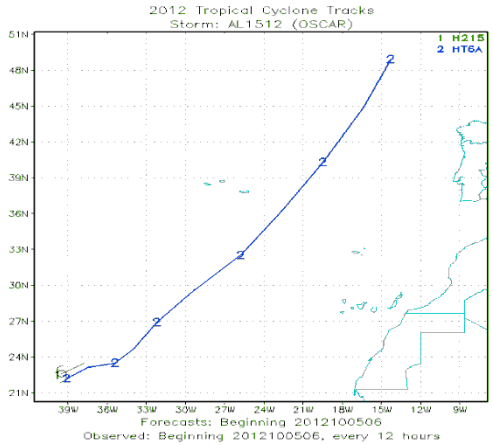
Improvements to select HWRF cases from the H215 testing

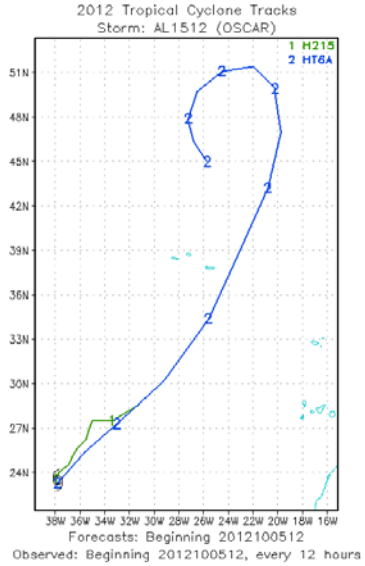












Near-core circulation issue

Comparison of stats with current tracker for the GFS

average track errors (NM) FOR HOMOGENEOUS SAMPLE

	00	12	24	36	48	72	96	120
GV16	9.8	27.0	38.8	51.3	68.6	103.2	144.1	174.1
GFSO	9.7	27.0	38.8	51.0	68.4	103.3	143.9	174.6
#CASES	251	234	210	190	166	128	93	66

Comparison of stats for select 2015 GFS cases reveals almost identical results.

The differences are seen in the extension of tracks beyond early dissipation.

These statistics also include tracking for 200-850 mb thickness

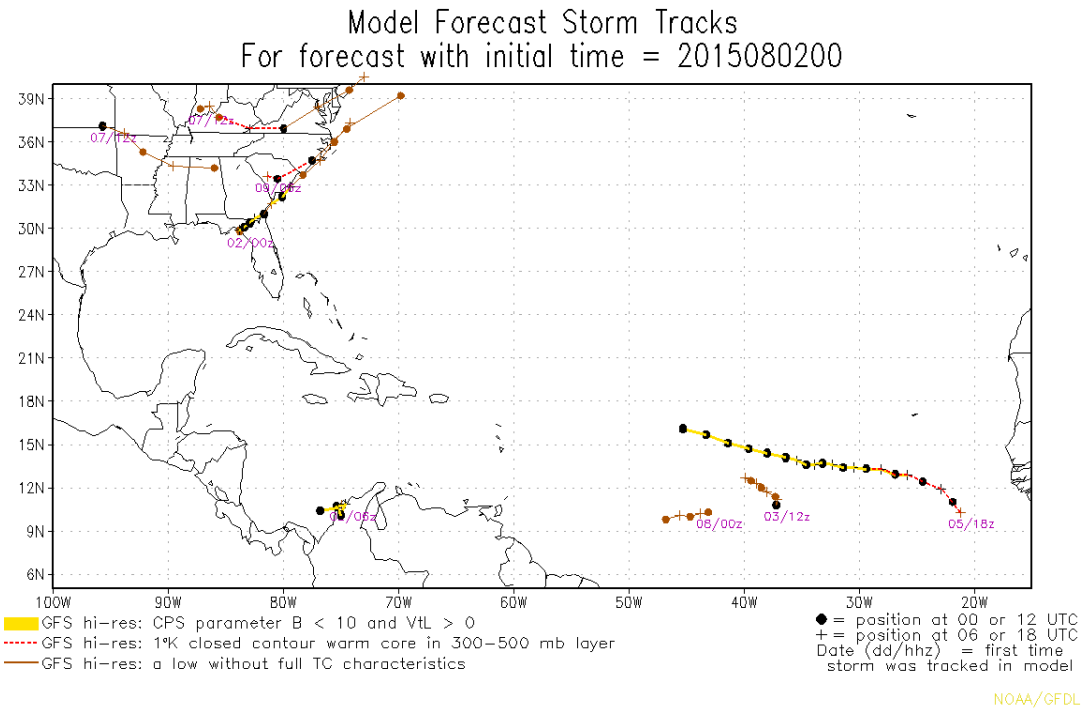
Other changes…

- Tracking of 200-850 mb thickness – Results do not indicate a significant benefit.

- Expansion of domain for tracker files – Expand from 20x20 to 25x25 degree grid to diagnose R34 for very large storms.

Other changes…

- Option to use land-sea mask for genesis detection



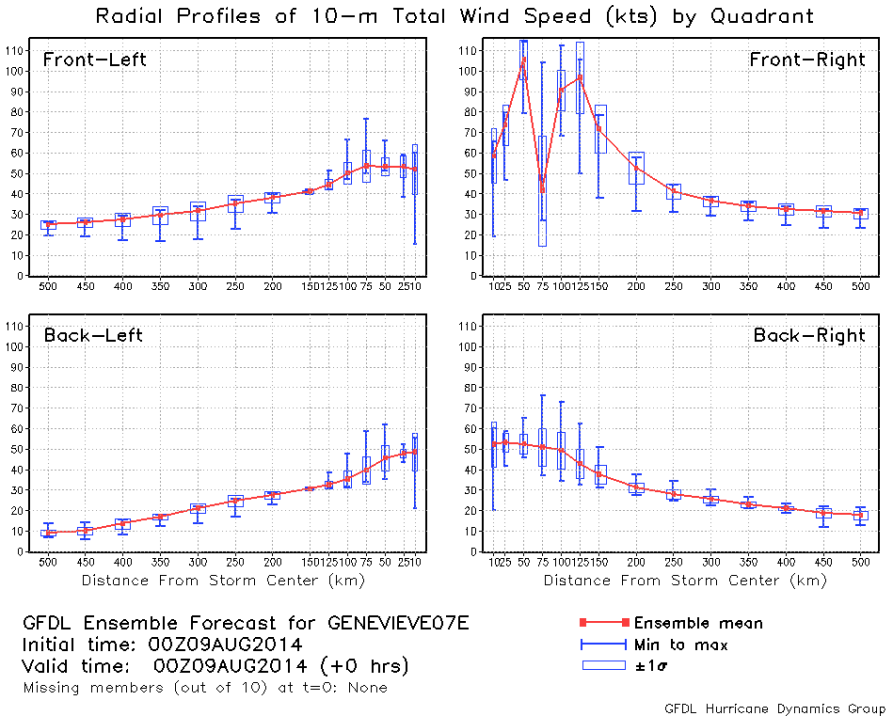
Namelist option allows user to turn on/off the use of a land-sea mask.

Candidate lows that are located in areas with a land fraction >50% will be filtered out.

Only applied at formation time.

Other changes…

- Use of azimuthally averaged values for surface wind structure diagnostics



Current method of computing the diagnostics along one 45° azimuth in each quadrant can lead to noisy and unrepresentative plots.

Other changes…

- GRIB2 issues…

  - Coding for GRIB2 compatibility is complete. In fact, the tracker running operationally for the GFS has been using GRIB2 files since the 2015 season.

  - GRIB2 compatibility for models with moving grids will not work until an upgrade is implemented for NCEP's g2lib.

Summary

- The most significant upgrade included here is the use of a new algorithm to diagnose the center of circulation.

- This new code is being transitioned to the HWRF group and to DTC for public release.