High Temporal Frequency Diagnostics

HFIP Teleconference

Feb 15, 2012

Motivation and Goals

- Reasons to consider looking at high frequency data:
  - To determine the representativeness of the operational model output seen by forecasters
  - For use as a forecaster tool for identifying the temporal evolution of important storm characteristics, like RMW or the onset of RI, once forecasters gain confidence that a model correctly simulates such features
  - For use as a diagnostic tool to help explain, and eventually improve, model storm evolution

- Goals of this presentation:
  - Demonstrate capabilities of high-frequency tropical cyclone forecast (HTCF) output
  - Motivate modeling groups to provide data

HTCF Output

- Text output at every timestep of the model
  - Run on inner-most nest, lowest model level

Basin	Storm ID	Forecast	Model	Sub-model	Forecast Second	Min SLP	Lat/Lon of Min SLP	Max Wind	Lat/Lon of Max Wind	Lat/Lon of Nest Center
AL,	12,	201109020000,	H3GP,	HR43,	0.00,	983.344,	16.581N, 49.931W,	66.573,	16.827N, 50.260W,	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	5.00,	983.227,	16.581N, 49.931W,	66.573,	16.827N, 50.260W,	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	10.00,	983.115	16.541N, 49.931W,	66.573,	16.827N, 50.260W	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	15.00,	982.987	16.541N, 49.931W,	66.161,	16.827N, 50.260W	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	20.00,	982.846	16.560N, 49.910W,	66.161,	16.827N, 50.260W	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	25.00,	982.669	16.581N, 49.931W,	66.161,	16.827N, 50.260W	16.619N, 49.846W
AL,	12,	201109020000,	H3GP,	HR43,	30.00,	982.477	16.581N, 49.931W,	65.809,	16.827N, 50.260W	16.619N, 49.846W

Note:

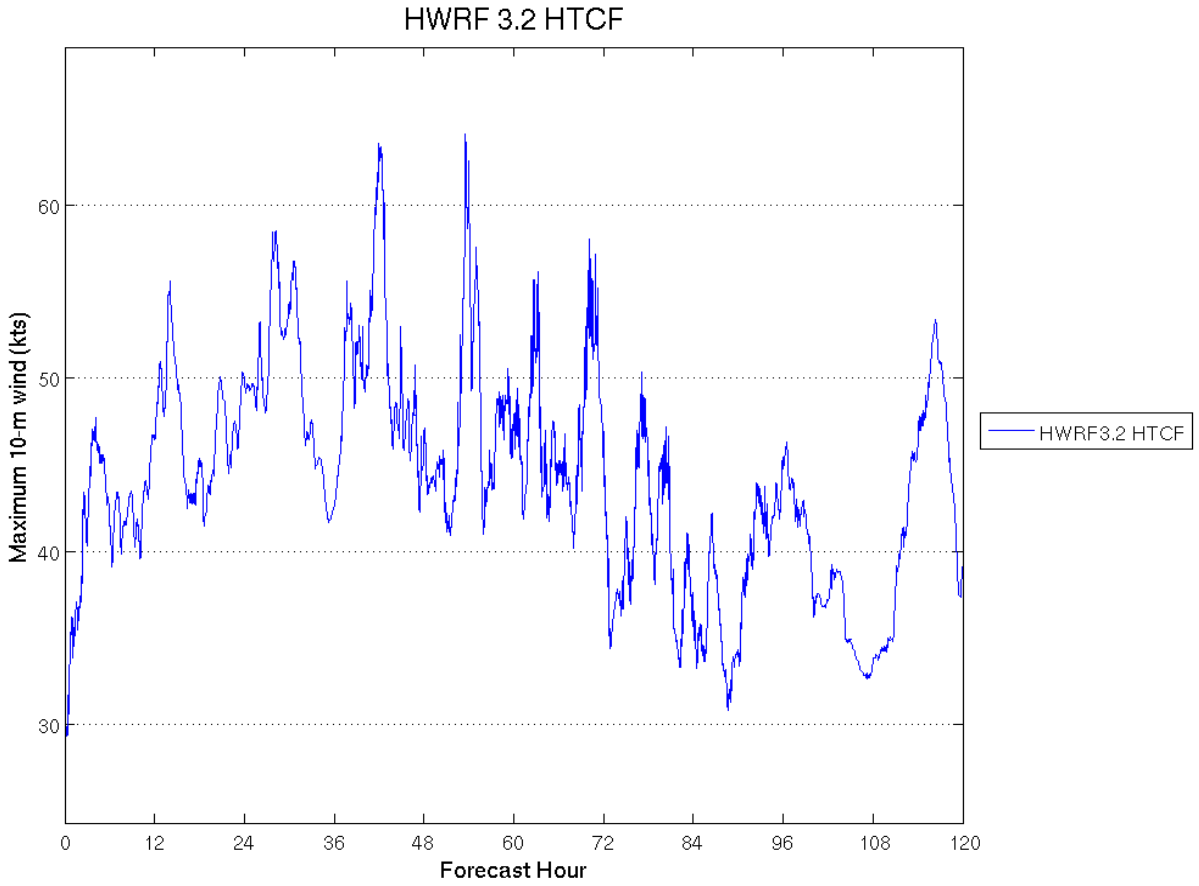
- Model: 2011 HFIP Stream 1.5 HWRF (27-9-3)

Current/Planned Availability

- Output from 2011 HFIP HWRF is available

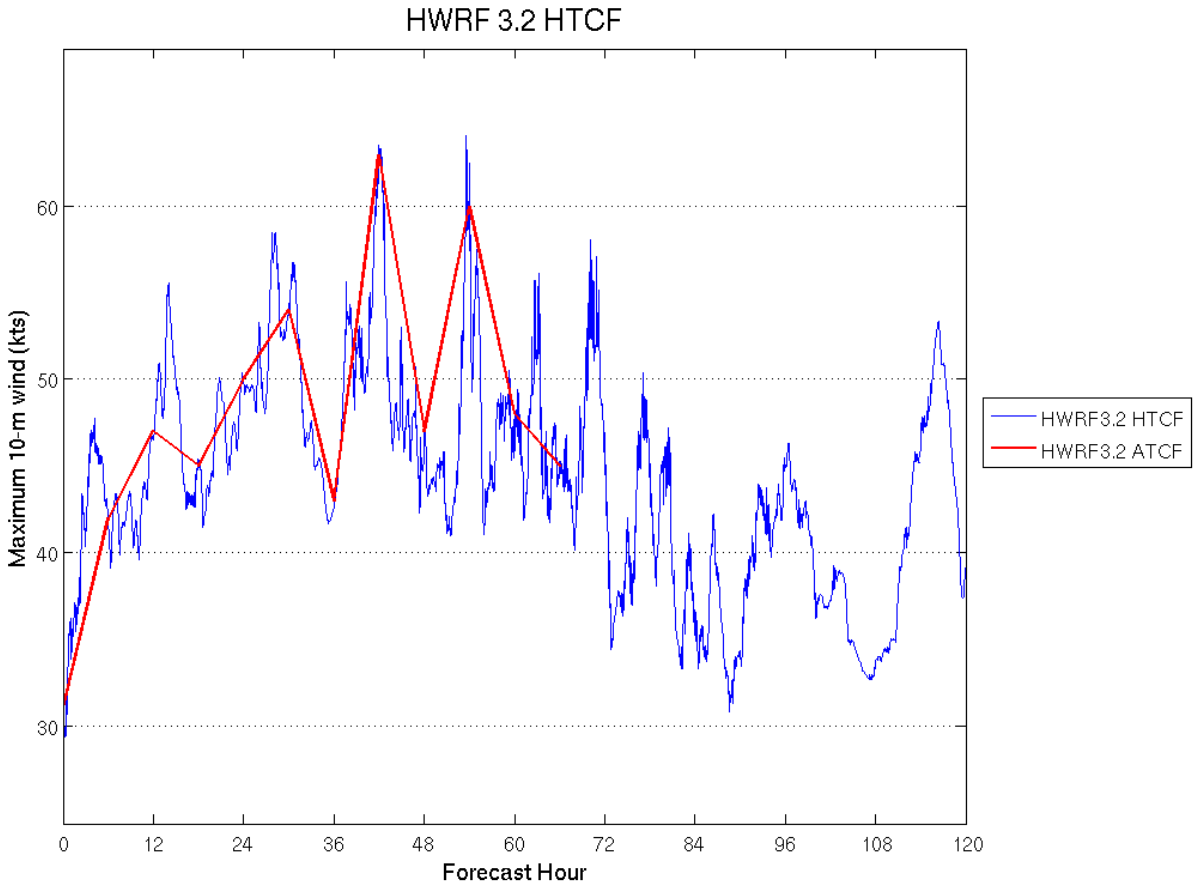
- The HWRF team is producing HTCF files during pre-implementation testing, and will be providing them for the operational model in real time during the 2012 season.

Intensity Considerations



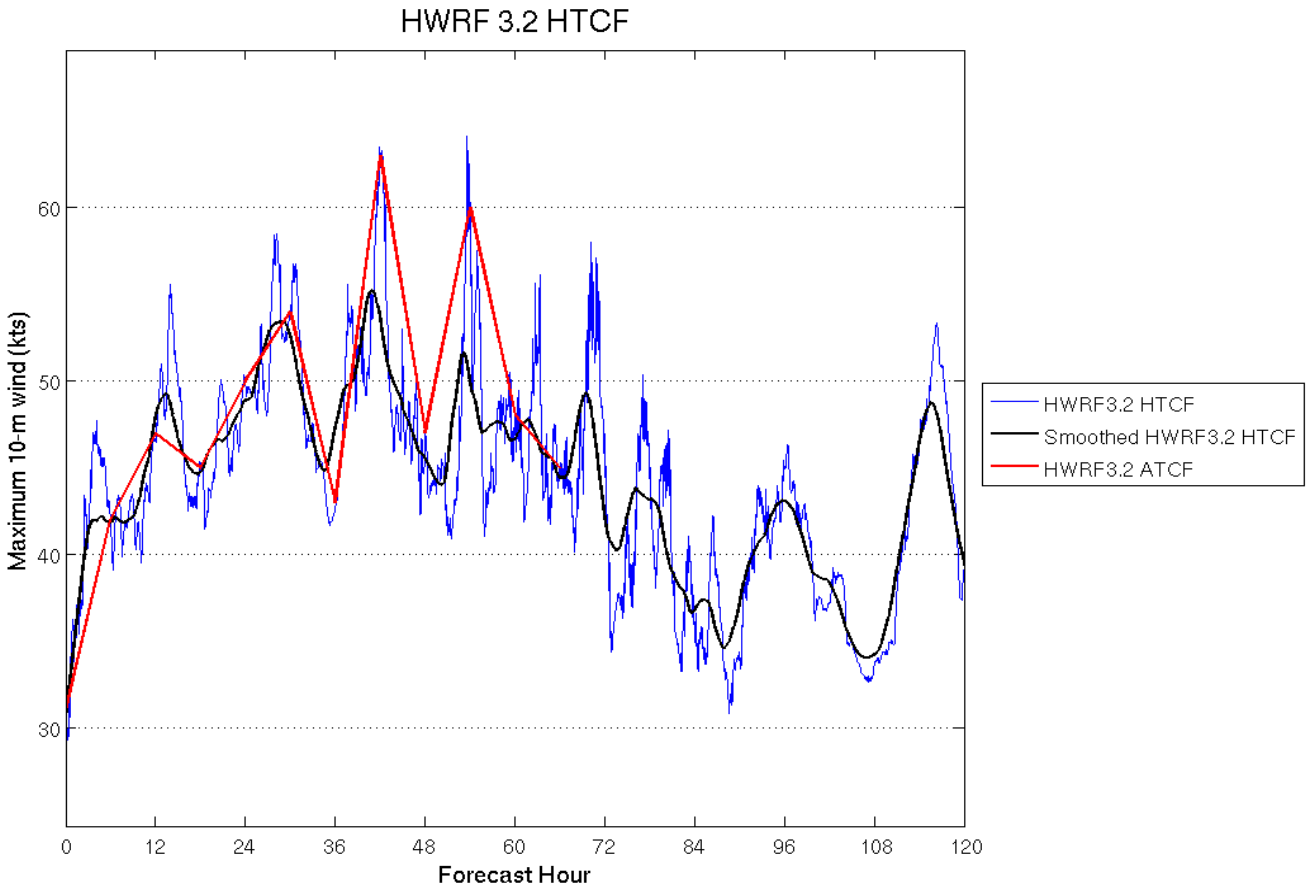
- Raw HTCF Intensity output
  - Shows large variability over short periods of time
  - Many sources of variability

Intensity Considerations



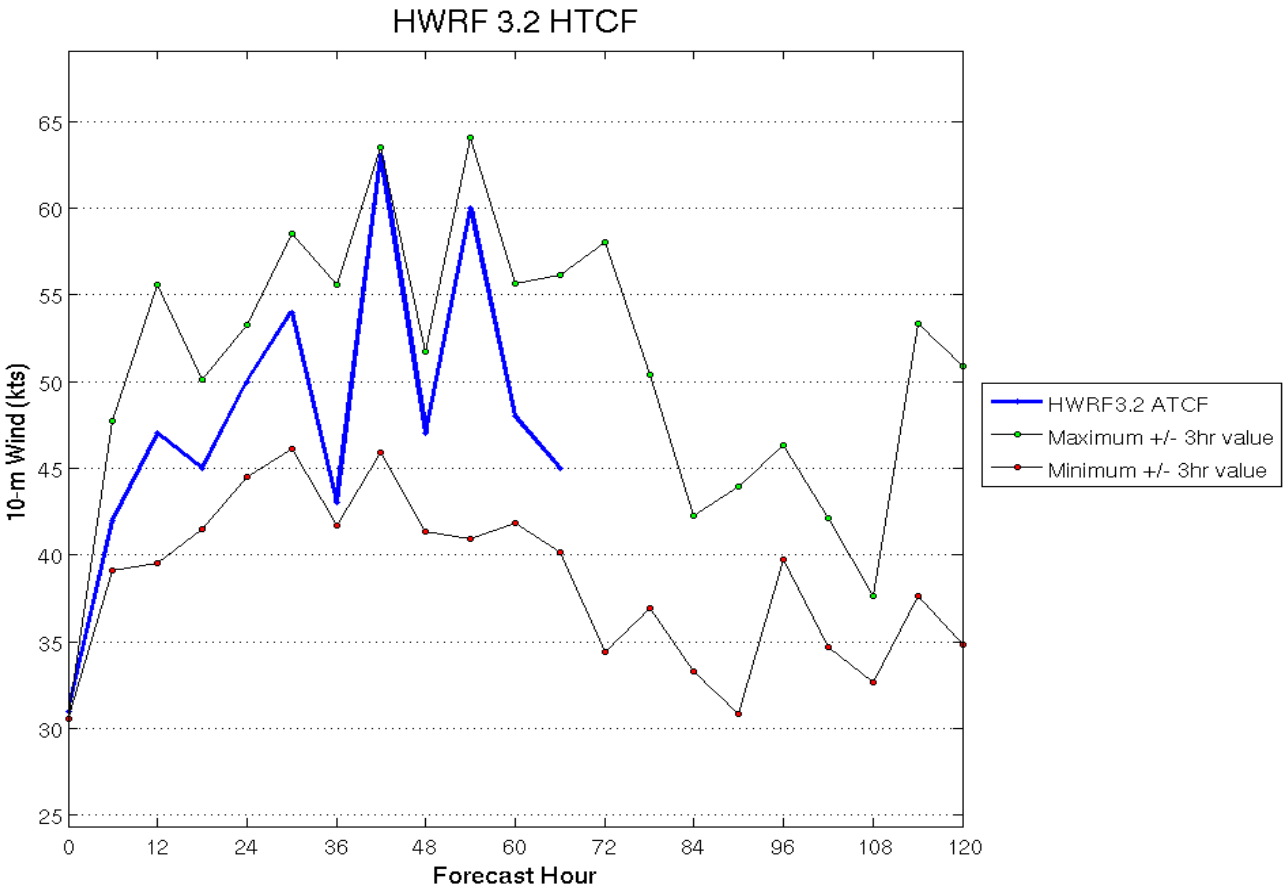
- Raw HTCF output plus ATCF output
  - HWRF ATCF tracker uses instantaneous values of intensity, resulting in unrepresentative values

Intensity Products



- Smoothed Intensity forecast
  - Will produce an experimental smoothed HWRF forecast during the upcoming season
  - Not anticipated to improve skill, but it will provide more “representative” values
  - Provides some insight when the tracker quits

Intensity Products



- Intensity bounds product
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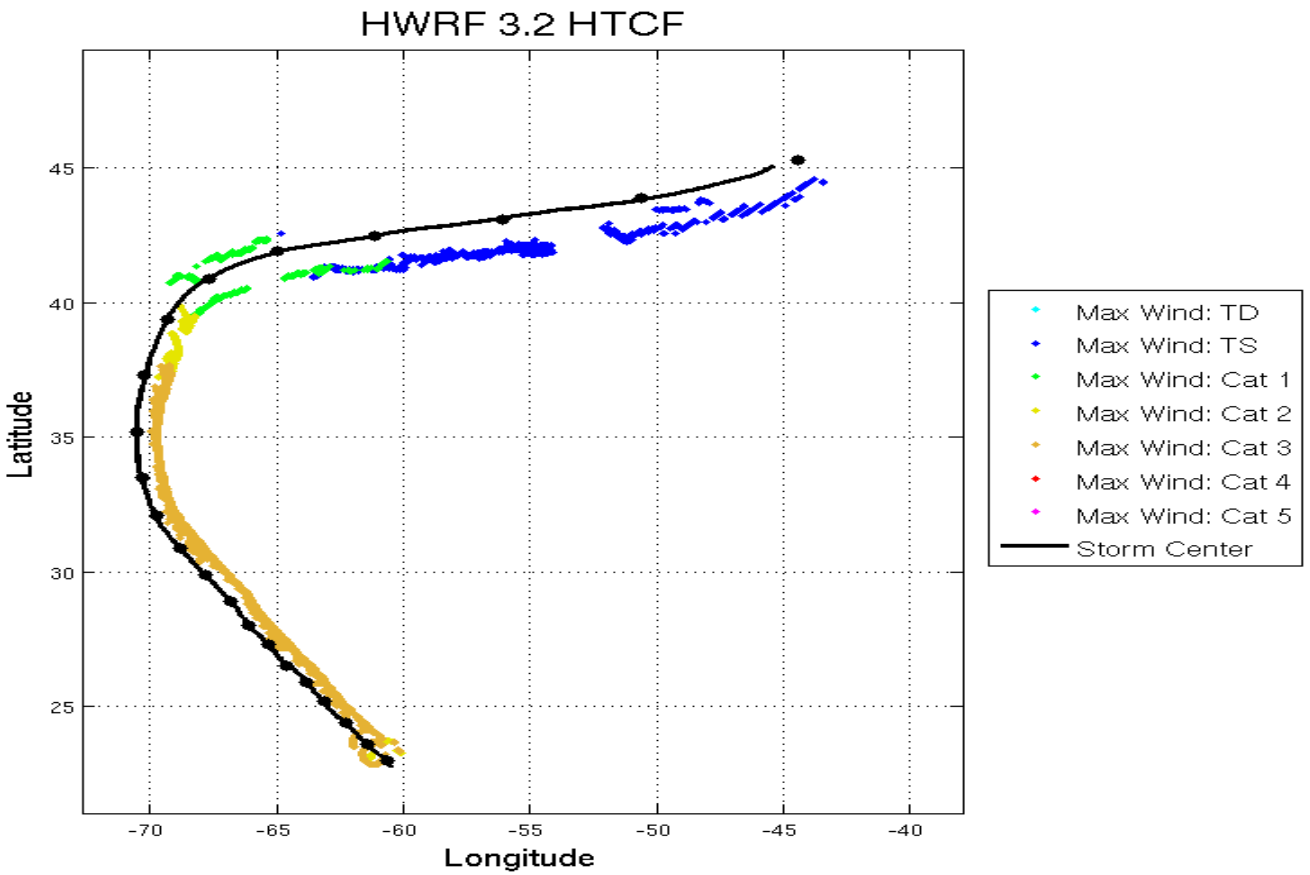
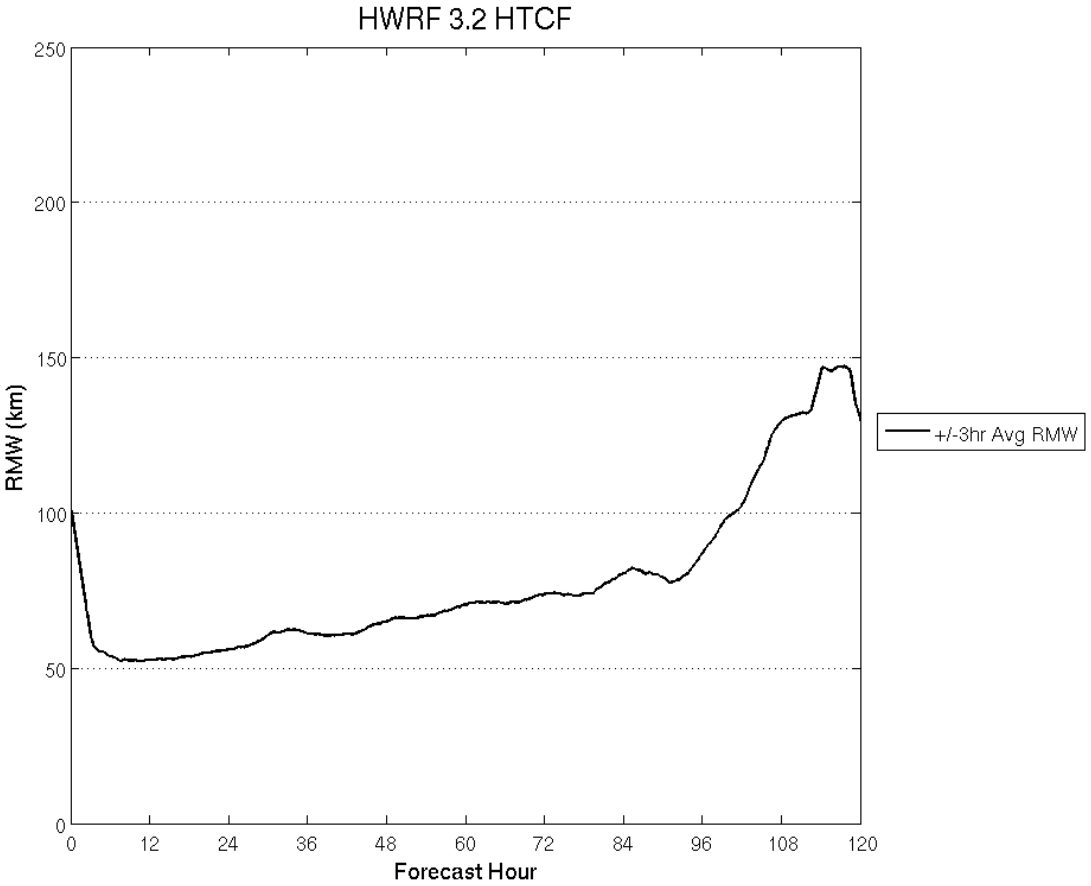
Structure Products/Diagnostics



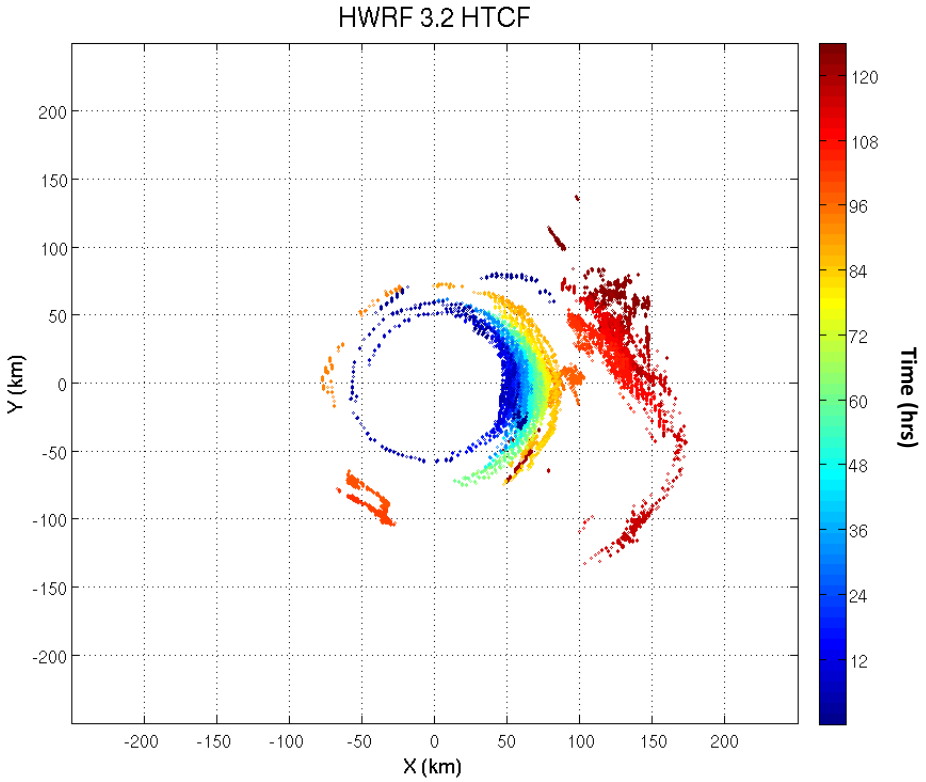
- Track and Intensity Graphic
  - Similar to current wind swath product, but it only plots the RMW
  - Track derived from minimum pressure and the nest center (agrees well with ATCF track)

Structure Products/Diagnostics



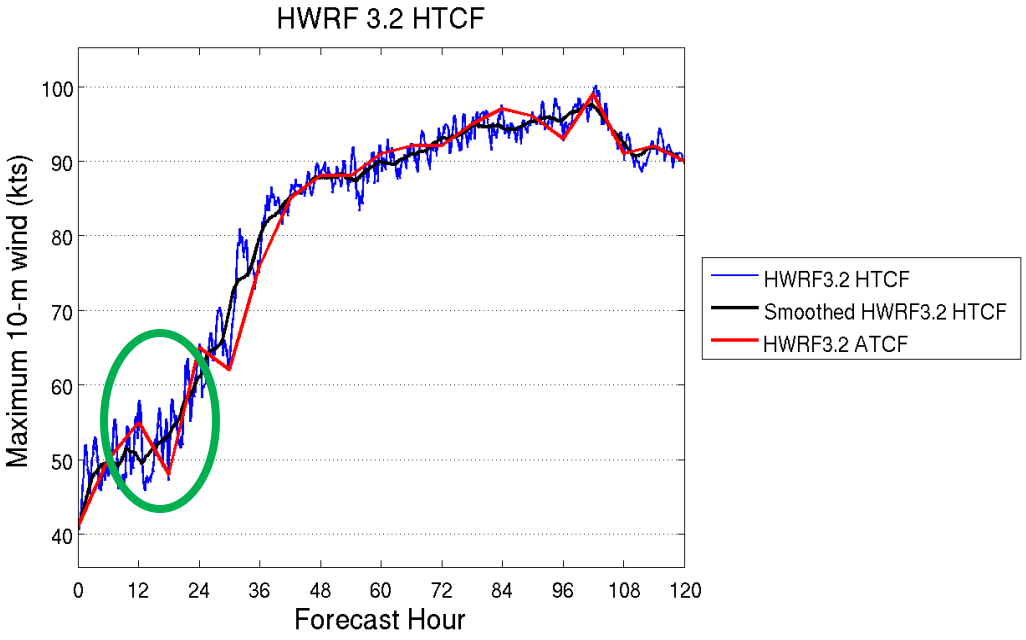
- RMW Evolution over time
  - Derived from smoothed storm center and the position of the maximum wind
  - If data from multiple models were available, this could be used as a tool for quick inter-model structure comparisons

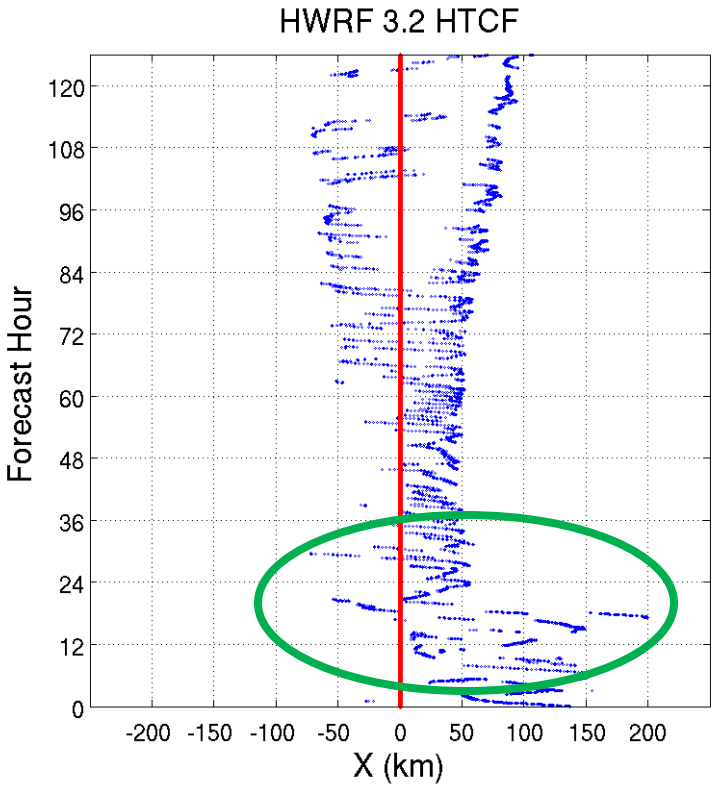
Structure Products/Diagnostics



- Storm-relative position of the maximum wind relative to the center, with respect to time
  - Also derived from smoothed storm center and the position of the maximum wind
  - Another way to quickly diagnose structure

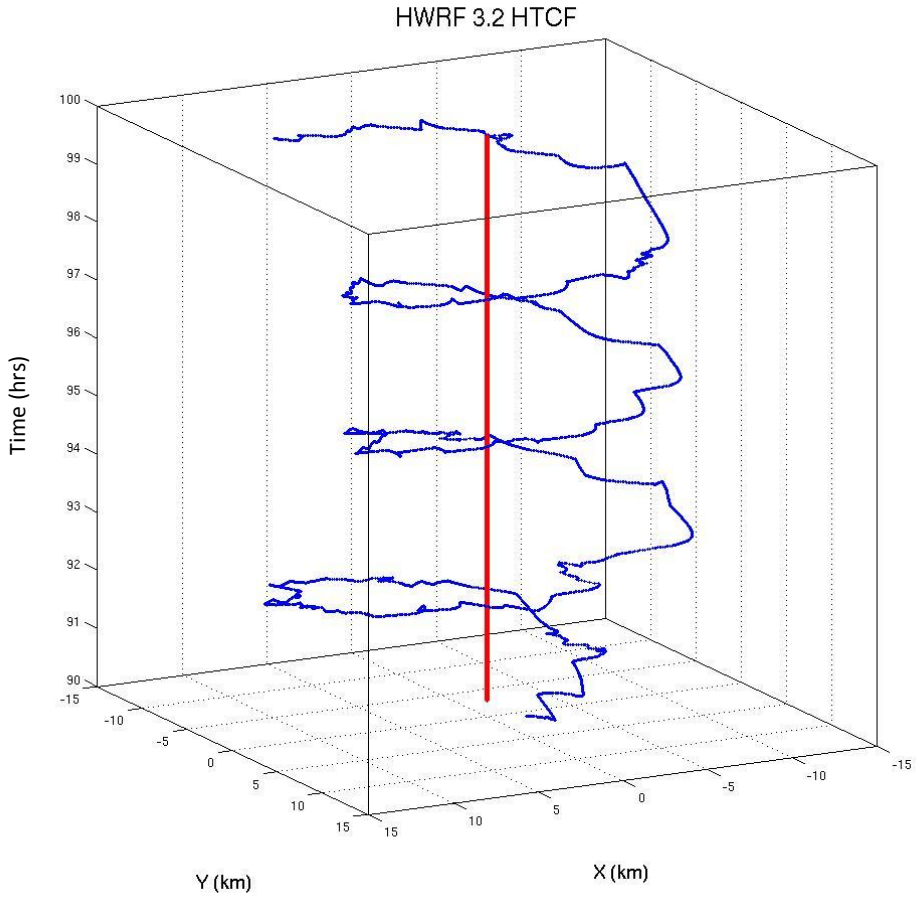
Additional Diagnostics





- HTCF can also be used to identify periods within a forecast that are most critical to the evolution of the modeled storm
  - Indicates what time a forecaster should examine most closely when making a forecast, and what times should be closely studied for research purposes

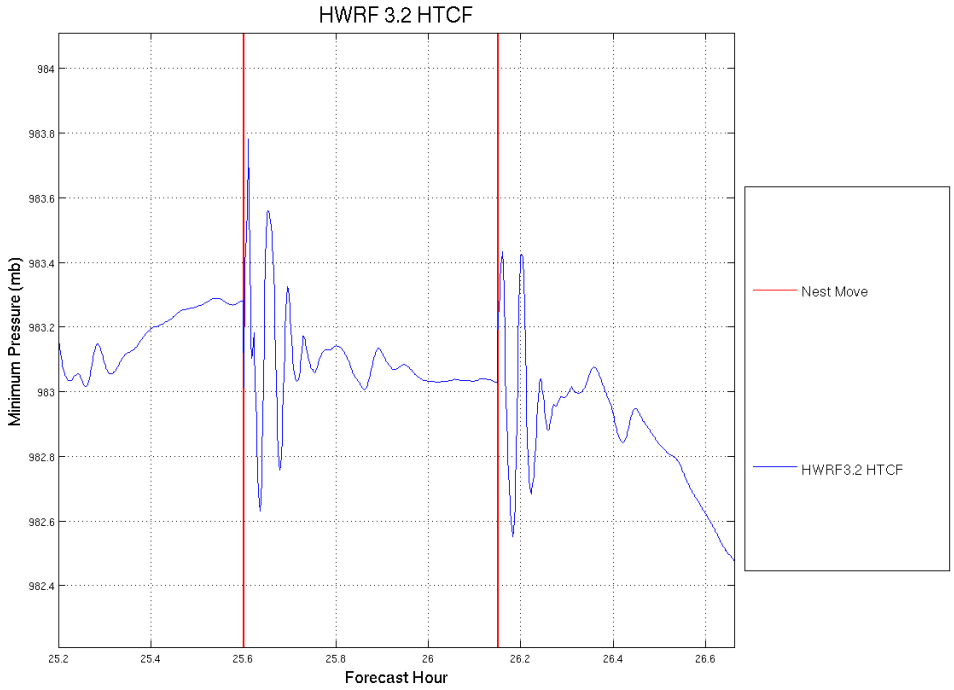
Additional Diagnostics

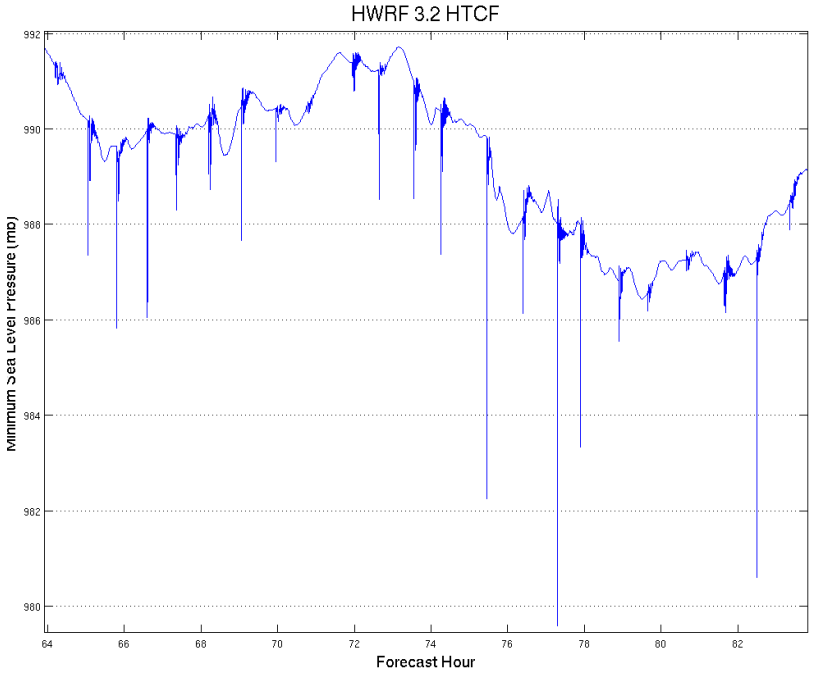


(Graphic depicts position of minimum pressure, relative to the center of the storm)

- Trochoidal Oscillations (as in Marks et al, 2008 and Nolan et al, 2001)
  - Frequency and spatial scale of oscillations are consistent with observations in Hugo by NOAA aircraft

Additional Diagnostics





- HTCF can identify features that may not be seen in regular output
  - Every time the nest moves, the pressure oscillates, indicating the presence of gravity waves

NHC goals for output

- Model to model comparisons
  - Variability of structure and intensity
- Examine the “representativeness” of regular ATCF output for a variety of models/trackers
- Identify forecast hours that are most critical to the evolution of a given forecast
- Produce products for use by forecasters
  - RMW suite
  - Smoothed intensity (depending on tracker)