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Poster: 65

Tropical Cyclone Intensity Model Improvement: Better Models or Easier Forecasts?

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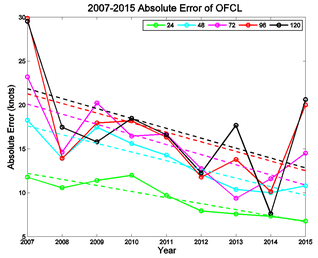
Although National Hurricane Center (NHC) Official (OFCL) forecast errors have remained constant, DeMaria et al. (2014) showed a long-term (1989-2012) decrease in the absolute error (AE) of intensity forecast guidance. A variety of verification tools are used to determine whether the lower observed OFCL errors from 2007 to 2015 in the Eastern Pacific and Atlantic basins are due to "better " guidance or "easier" forecasts .

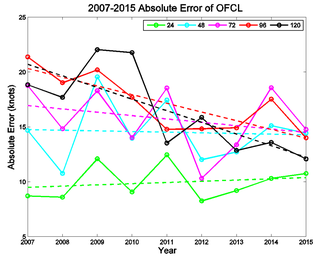
Background

- The recent introduction of four 'early' hurricane models to the operational community has resulted in an unprecedented period of model guidance for forecasters and end users of tropical cyclone intensity forecasts:
  - Decay-Statistical Hurricane Intensity Prediction Scheme (DSHP) – Operational in 2000
  - Logistic Growth Equation Model (LGEM) – Operational in 2006
  - Interpolated Geophysical Fluid Dynamics Laboratory (interpolated GFDL : GHMI) Hurricane Model – Operational in 2006
  - Interpolated Hurricane Weather Research and Forecasting Model (interpolated HWRF: HWFI) – Operational in 2007
- Traditionally, the time series of the yearly mean OFCL AE is used as the main metric to determine whether intensity forecasts have improved.

Atlantic



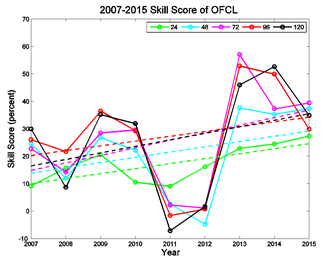
Eastern Pacific



Unconventional OFCL Verification

- A more appropriate performance metric is skill score (SS) because it normalizes forecast performance against a benchmark model (OCD5). In theory, if forecasts are "easier" during a hurricane season, then OCD5's forecast will record lower AE, thereby making it more difficult for the OFCL forecast to achieve a positive SS.

Atlantic



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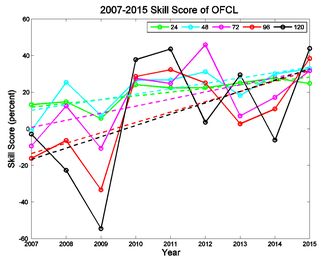
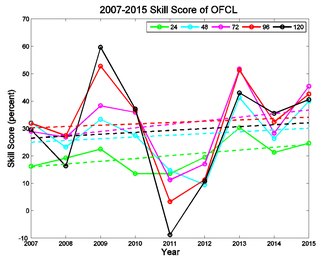


- The sample size was then augmented by including:
  - Forecasts that were issued when no corresponding best track verification existed. The forecast was verified as 20 knots.
  - "LO" (lows) and "EX" (extratropical) storms.
  - Cases where verification was available, a corresponding forecast was not issued, but shorter forecasts were issued. These missing forecasts were listed as 20 knots.

Atlantic



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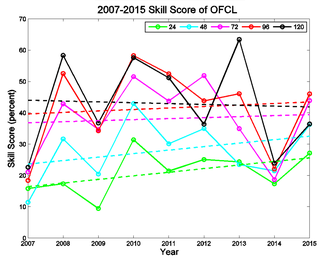
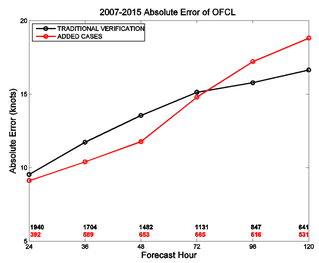


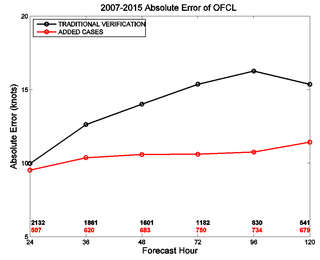
Augmented Sample

- The 2007-2015 average AE of the original and added cases is plotted as well as the number of forecasts in each sample.

Atlantic



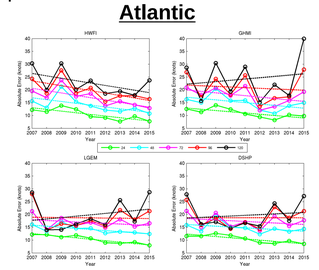
Eastern Pacific



Improved Guidance?

- DSHP, LGEM, GHMI, and HWFI are the four best early models that are used by NHC forecasters. For each model, the 2007-2015 AE of the augmented sample is plotted.

Atlantic



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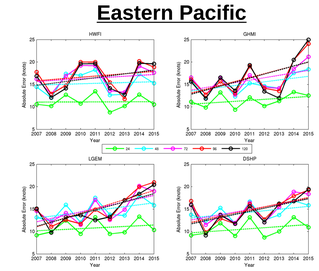
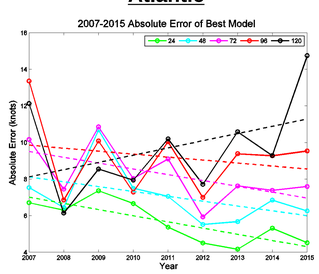
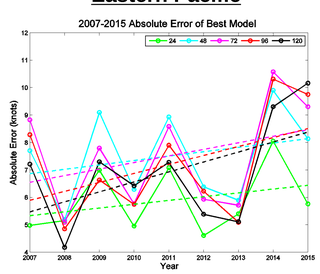


- An idealized "best model" scenario is also considered. In this theoretical scenario, *a priori* information is available to select the model with the lowest AE for every individual forecast. These augmented sample plots address whether the best available intensity guidance at each forecast time has improved annually.

Atlantic

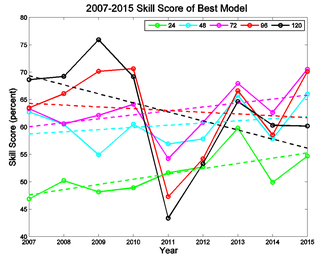


Eastern Pacific

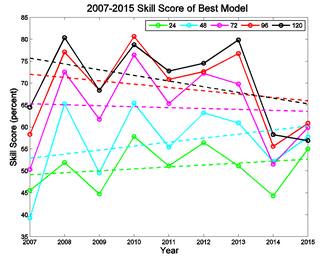


- The AE of the best model is decreasing for 24-96 hour forecasts in the Atlantic and increasing for 120 hour forecasts. All forecast hours show increasing AE for the Eastern Pacific. SS is plotted below and exhibits very different trends.

Atlantic



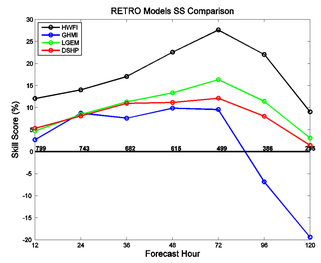
Eastern Pacific



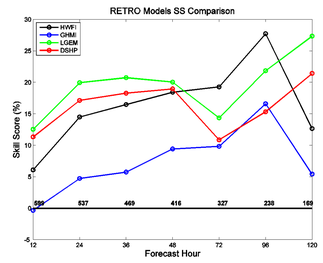
Retrospective Forecasts

- Retrospective forecasts were generated by applying the 2015 version of each model to select storms during the 2011-2014 seasons. SS is plotted for a homogeneous sample (including 2015) of the four models along with the number of forecasts at each forecast hour.

Atlantic

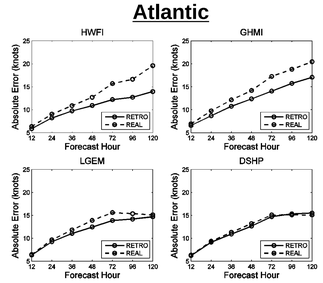


Eastern Pacific

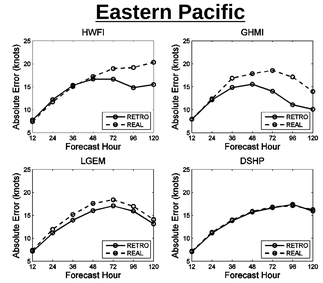


- The performance of the 2015 version ("RETRO") of each model can be compared to previous versions ("REAL") of the model by examining pre-2015 cases where both a retrospective and real-time forecast were created. The average AE for each forecast hour is plotted for the four models (not a homogeneous sample size among the models).

Atlantic

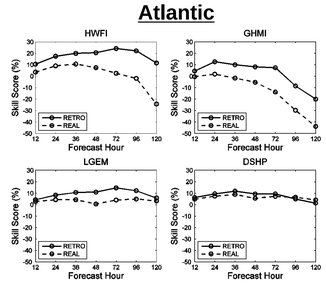


Eastern Pacific

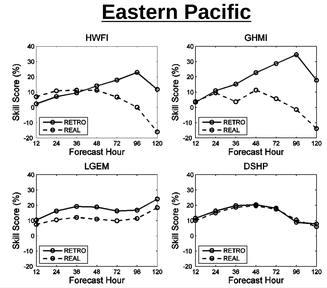


- The retrospective forecasts show the most improvement compared to the real-time forecasts for the dynamical models. The performance of the 2015 version of DSHP is almost exactly the same as the real-time version of DSHP in the Atlantic and Eastern Pacific. Similar plots were created to display SS.

Atlantic



Eastern Pacific



Conclusions

- A trend analysis of the augmented sample of verified OFCL forecasts shows the SS of OFCL forecasts is slightly increasing in the Atlantic and Eastern Pacific (except 120-hour forecasts in the Eastern Pacific).
- In general, the AE in the Atlantic models available for OFCL guidance have substantially decreased from 2007-2015 while the AE in Eastern Pacific models have either remained constant or increased. For both basins, the most significant improvement is observed for shorter forecast hours.
- For a homogeneous sample, the 2015 version of each model outperforms the real-time version of the model at almost all forecast hours. The retrospective forecasts of the dynamical models showed the largest improvement.