Introduction
Forecasting tropical cyclones is mostly based on numerical models, which are interpreted by forecasters at the National Hurricane Center (NHC). Forecasts of the track have steadily improved over the past 30 years, but forecasts for the storm size and intensity have not shown much improvement. This study focuses on analyzing errors in the forecast track, intensity (MWND) and wind radii (WRAD) errors of Hurricane Irene (2011) and Hurricane Sandy and Hurricane Isaac (2012). The purpose of this study is to analyze the track, intensity, and wind radii errors of operational and nonoperational (or research) guidance models compared to those of the NHC.

Methods
The model data and forecasts used in this study came from the NHC’s online database. The two files used contained the individual model forecasts and the NHC’s best track, respectively. The best track is a subjectively smoothed representation of a Tropical Cyclone’s (TC) location and intensity over its lifetime.

Verification
Alongside the best track, a MATLAB code was used that compares the NHC’s best track of each TC to each model output for every six-hour forecast interval the TC is classified as a tropical storm till it dissipates. The average errors over the entire lifetime of the storm are computed for each model, using the NHC best track as verification..

Models
Operational models used are: OFCL (NHC), AVNO (GFS), EMX (ECMWF), GFDT, and H213 (2013 updated HWRF). Nonoperational models used are: FIM9, COTC (Navy COAMPS model), AHW4 (NCAR Advanced Hurricane Research WRF). The statistical models used are: SHIPS (Statistical Hurricane Intensity Prediction Scheme), DRCL (DeMaria Climatology and Persistence Model), and MRCL (McCabe Climatology and Persistence Model).

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**Hurricane Lifecycles:** Hurricane Irene was from 21-28 August, 2011. Hurricane Isaac from 21-30 August, 2012, and Hurricane Sandy from 22-30 October, 2012.

**Track Error Plots**

**Intensity Error Plots**

**Wind Radii Error Plots**

Conclusions
- The models do relatively well in forecasting the track.
- The global models have skill in forecasting track over the regional models.
- The skill in forecasting intensity of the regional models surpasses those of the global models.
- The H213 is the most skillful of the regional models and is often equal to or better than the SHIPS.
- The GFDT and AHW4 at times have shown promise in forecasting intensity, though neither model is consistent in all the storms.

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