Year One Report / Renewal Proposal for JHT Project entitled:
Prediction of Consensus TC Track Forecast Error and
Correctors to Improve Consensus TC Track Forecasts
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Background

Funded by my previous JHT Project, a new consensus forecast model (CONU) and a
Predicted Consensus Error (PCE) product for the Atlantic and eastern North Pacific
basins were installed on the ATCF for use by the NHC forecasters during the 2004
season. A PCE product for the western North Pacific basin was also installed on the
ATCF for use by the JTWC forecasters.

Summary of Work / Year One

Prediction of Consensus TC Track Forecast Error

The PCE product was verified for 2004 for the consensus models (CONU and GUNA for
NHC and CONW for JTWC) for each forecast length for the Atlantic, eastern North
Pacific, and western North Pacific basins by determining the percent of verifying TC
positions contained within the circular areas depicted by the product. The PCE product
was found to meet or exceed expectations (approximately 70-75 percent of verifying TC
positions contained within the circular areas) for all basins and forecast lengths except for
the Atlantic basin at 120 h. The sub par performance of the PCE product in the Atlantic
at 120 h was found to be due to consistently large consensus model errors for Ivan despite
better than normal agreement of the individual model forecasts. The performance of the
PCE product in the Atlantic at 120 h for all other storms met expectations.

Using the PCE product's pool of predictors for the 2001-2004 seasons, revised regression
models to be used by the PCE product for the 2005 season for all combinations of
forecast length and basin were derived. In addition to the aforementioned basins,
regression models were derived for the Southern Hemisphere basins within JTWC's area
of responsibility. The revised PCE products for 2005 were installed on the ATCF's at
NHC and JTWC for CONU for the Atlantic and eastern North Pacific and for CONW for
the western North Pacific and Southern Hemisphere.

Using the procedures described previously, the PCE product was verified for 2005 for the
consensus models (CONU for NHC and CONW for JTWC) for each forecast length for
the Atlantic, eastern North Pacific, and western North Pacific basins. The PCE product
was found to meet or exceed expectations (approximately 70-75 percent of verifying TC
positions contained within the circular areas) for all basins and forecast lengths. For the
Atlantic, the circular areas displayed by the PCE product drawn around the CONU
forecast positions contained the verifying TC position between 75-77 percent of the time.
For the eastern (western) North Pacific, the circular areas drawn around the consensus
model forecast positions contained the verifying TC position between 76-94 percent (77-
85 percent) of the time. For the Atlantic, the performance of the PCE product was very

close to what was expected. Except at 24 h, the performance of the PCE product for the eastern North Pacific greatly exceeded expectations. This result was consistent with the exceptionally small CONU forecast errors for that basin in 2005 (80 nm at 48 h, 111 nm at 72 h, 136 nm at 96 h, and 161 nm at 120 h).

A manuscript entitled "Prediction of Consensus Tropical Cyclone Track Forecast Error" was prepared and submitted to *Monthly Weather Review*.

Correctors to Improve Consensus TC Track Forecasts

Regression models to predict CONU and GUNA east-west and north-south forecast error for all forecast lengths in the Atlantic were derived using the PCE product's pool of predictors for the 2001-2002, 2001-2003, and 2001-2004 seasons. These predicted errors were used as correctors to be applied to the consensus models for the 2003, 2004, and 2005 seasons, respectively. The means of the CONU and GUNA east-west and north-south forecast errors for all forecast lengths in the Atlantic were also found for the 2001-2002, 2001-2003, and 2001-2004 seasons to be used as bias correctors for the consensus models for the 2003, 2004, and 2005 seasons, respectively. For both CONU and GUNA, it was found that these bias correctors were more effective than the statistical correctors derived using the regression models for forecast lengths less than or equal to 72 h. For CONU, the application of only the statistical corrector for the north-south error was most effective at 96 h and 120 h. For GUNA, the application of the statistical corrector for the north-south error and the bias corrector for the east-west error was most effective at 96 h and 120 h.   Using these strategies, corrected consensus forecasts (CCON and CGUN) were produced for the 2003, 2004, and 2005 seasons. For the 2003-2005 seasons, the CCON errors were 54 nm, 94 nm, 143 nm, 204 nm, and 268 nm at 24 h, 48 h, 72 h, 96 h, and 120 h, respectively. The respective errors for CONU were 56 nm, 97 nm, 145 nm, 211 nm, and 280 nm. The CCON improvements were significant at the 99% level at 24 h, 48 h, and 72 h, the 90% level at 96 h, and the 97% level at 120 h. For the 2003-2005 seasons, the CGUN errors were 50 nm, 88 nm, 135 nm, 191 nm, and 251 nm at 24 h, 48 h, 72 h, 96 h, and 120 h, respectively. The respective errors for GUNA were 52 nm, 91 nm, 137 nm, 194 nm, and 257 nm. The CGUN improvements were significant at the 99% level at 24 h, 48 h, and 72 h, the 80% level at 96 h, and the 85% level at 120 h. For both CCON and CGUN, the performance for the individual years was consistent with that displayed for the 2003-2005 seasons.

The progress of the project was presented at the Interdepartmental Hurricane Conference in Mobile, Alabama, March 20-24, 2006.

Proposed Work / Year Two

The goals of the second year of this project are to extend the corrected consensus methodology demonstrated for the Atlantic to the other basins and to bring closure to this research effort by providing NHC and JTWC with a software system that can be run at the end of each season to derive the regression models for the PCE product and the corrected consensus models to be used for the next season.

Using the PCE product's pool of predictors for the 2001-2005 seasons, derive revised regression models to be used by the PCE product for the 2006 season for all combinations of forecast length and basin. Install the revised PCE products on the ATCF's at NHC and JTWC for CONU for the Atlantic and eastern North Pacific and for CONW for the western North Pacific and Southern Hemisphere.

Using the PCE product's pool of predictors for the 2001-2005 seasons, derive regression models and bias correctors for the Atlantic and install experimental corrected consensus forecast models (CCON and CGUN) on the ATCF for use by the NHC forecasters for the 2006 season.

As was done for the Atlantic during the first year of this project, determine and evaluate corrected consensus forecast models for the eastern and western North Pacific and the Southern Hemisphere basins. Install experimental corrected consensus forecast models on the ATCF for use by the NHC and JTWC forecasters for the basins where their evaluation shows improvement over the consensus forecast models.

Combine the research software developed during this project to derive the regression models for the PCE product and the corrected consensus models into a software system that can be run at the end of each season on the ATCF (or any Unix box for that matter) by NHC and JTWC personnel to derive the regression models to be used for the next season. Test the software system on past seasons to ensure its robustness for future use by the centers. Install the software system at NHC and JTWC and provide any training required for its use.

Present progress of the project at the Interdepartmental Hurricane Conference.

Prepare documentation of the software and the final report for the project.