

NOAA Joint Hurricane Testbed (JHT) Mid-Year Progress Report, Year 1

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Project title: *Improvements in Statistical Tropical Cyclone Forecast Models*

Principal Investigators: Renate Brummer, Mark DeMaria

Affiliation: Brummer (CIRA/CSU), DeMaria (NOAA/NESDIS)

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1. Long-Term Objectives and Specific Plans to Achieve Them

Although considerable effort is being made to improve dynamical tropical cyclone forecast models, statistical-dynamical models have generally provided the most accurate intensity predictions over the last few years. Recent research has indicated that there is potential for further improvement of statistical-dynamical intensity forecasts. In this project, several improvements are proposed to the operational Statistical Hurricane Intensity Prediction Scheme (SHIPS) and the Logistic Growth Equation Model (LGEM). These improvements include the following: (1) Separating the persistence component of LGEM from the other inputs that are available throughout the forecast period, which allows the model to be run to any forecast length and the assimilation of the observed intensity up to the forecast time; (2) Developing versions of the SHIPS and LGEM models specifically for the Gulf of Mexico region; and (3) Improving the databases used to develop SHIPS and LGEM through use of the NCEP's new coupled reanalysis system. The project also includes a fourth task (4) to develop extended range versions of climatology and persistence models for track and intensity to be used as baselines for evaluation of other more general models beyond 5 days. A trajectory approach will be used for the new baseline models.

The timeline for Year 1 of this project is provided in the Appendix.

2. Accomplishments

The accomplishments on the four main project tasks are described below.

(1) A version of LGEM has been developed where all of the inputs that are only available at $t=0$ have been removed (persistence and GOES variables). This change greatly reduces the number of coefficients that need to be calculated for estimating the model growth rate, and allows the adjoint equation to be used to estimate the coefficients. This version can also be run to any forecast time, in preparation for developing a 7 day version of LGEM. The next step is to optimize the method for including the $t=0$ input into the adjoint version. This involves modifying the constant term in the equation for the growth rate. This can also be done using the adjoint version of LGEM applied to period from about 2 days before up to the start of the forecast.

(2) The development of versions of SHIPS and LGEM for the Gulf of Mexico will begin in the 2nd half of the project.

(3) The new NCEP climate reanalysis fields back to 1979 were obtained from NOAA/ESRL. The grib files have been converted to the form used by the SHIPS and LGEM diagnostic code. Although the grib files include 0.5 deg lat/lon resolution, the storage and processing requirements at that resolution are not currently feasible for SHIPS and LGEM. The new version will be developed with 1 deg lat/lon resolution, which is still a considerable improvement over the current version, which is developed from 2.5 deg lat/lon resolution reanalysis fields.

(4) Considerable progress has been made on the new baseline models. The climatological track model uses a trajectory approach (called T-CLIP), where the storm motion is determined from a time weighted average of the initial motion vector and the vertically averaged climatology flow. The weight on the initial motion vector decreases with time at a rate determined by a lag correlation analysis of a large sample of storms. The current version of T-CLIP uses a standard deep layer mean, but a version where the vertical weights depend on the intensity is being tested. The climatological intensity model also uses a trajectory type approach (called T-SHIF). The maximum wind trajectory (integration of dV/dt) is determined from the LGEM model with climatological input. If the version of T-CLIP with the variable vertical weights that are a function of intensity is successful, then T-CLIP and T-SHIF will be integrated together.

3. Plans for the remainder of Year 1

The development of the adjoint version of LGEM that runs to 7 days will continue in preparation for real time tests during the 2012 season. Preliminary work on the Gulf specific version of SHIPS and LGEM will begin. Versions of SHIPS and LGEM with the new reanalysis fields will be compared to those with the old reanalysis input. The new baseline models (T-CLIP and T-SHIF) will be finalized for testing during the 2012 season.

Appendix
Year 1 Project Timeline

Sep 2011	Begin collection of new NCEP reanalysis fields
Nov 2011	Collection of 0.5 deg lat/lon operational files for selected cases to test impact of GFS resolution
Dec 2011	Complete the development of extended range baseline models
Jan 2012	Complete the development of the adjoint version of LGEM
Feb 2012	Perform tests of adjoint LGEM and baseline models on 2011 cases
Feb 1, 2012	Mid-year progress report due
Mar 2012	Report preliminary results at the IHC
Apr 3, 2012	Renewal proposal due
Apr 2012	Begin development of Gulf-specific models
Jun 2012	Implement adjoint LGEM and baseline models for real-time testing
Sep 3, 2012	Annual report due