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**Title: Introducting Diagnostic Variables towards extending the
SHIPS Algorithm for Hurricane Intensity Forecasts**

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1. Project Goals:

The primary goal of this proposed study is to develop a real time, statistically based, forecast capability for hurricane intensity forecast for the NOAA Hurricane Test Bed. This is to be developed as an extension of the current SHIPS model developed by DeMaria (2005, 2009). The extension includes a number of dynamical/thermodynamical parameters derived from the HWRF forecast data base. The SHIPS inventory includes parameters such as observed maximum intensity, persistence, the observed 12 hour intensity change, 850mb-200mb vertical wind shear etc. The FSU diagnostic parameters include the vertical distribution of heating (in the context of the potential vorticity equation), the transformation of shear vorticity into curvature vorticity, the transformation of divergent kinetic energy into rotational kinetic energy and the advection of angular momentum into the inner core of a hurricane. The procedure for the statistical forecasts is to be based on the multiple regression method for the above parameters where the tendencies of hurricane intensity based on NHC's best observed estimates with respect to SHIPS and the FSU parameter based tendencies.

An added goal has been to include the forecasts from SPICE (another new operational product from DeMaria, 2009) within the above framework.

2. Work Completed:

Period for regression: For deriving the aforementioned tendencies we have included 2008 and 2009 Atlantic hurricane seasons. This period covers the following hurricanes.

Table1: Selected Atlantic Hurricane Cases in 2008 and 2009 season for this study:

2008	2009
Bertha (03-20 July)	ANA (11-16Aug)
Dolly (20-25 July)	Bill (15-24 Aug)
Gustav (25 Aug-04 Sep)	Danny (26-29 Aug)
Hanna (28 Aug-07 Sep)	Erika (01-03 Sep)
IKE (01-14 Sep)	
Omar (13-18 Oct)	

We have used all the above hurricanes of the 2008 season and an additional two hurricane cases from 2009 as listed in the above table for the training phase to extract the regression weights. The weights so obtained are applied for forecast to Danny and Erika forecast cases from the 2009 year. This entire problem was subdivided into hurricane intensity forecast skills from DeMaria's SHIPS alone, from the FSU diagnostic parameters alone, from the combined use of SHIPS plus FSU parameters. Our study includes a training phase that covers the hurricane forecasts for two years. This carries more than 170 HWRF forecasts of past hurricanes which are used for computation of four FSU diagnostic parameters. Here, we have selected 154 cases for regression weights and weights so obtained are applied to the remaining 16 forecasts for every 6 hour between 6 to 120 hours.

The results are being prepared for the following categories:
  i)   Forecasts of hurricane intensity from the use of the Ships algorithm alone
  ii)   Forecasts of hurricane intensity from the use of the FSU parameters alone
  iii)   Forecasts of hurricane intensity from the use of the SPICE algorithm alone
  iv)   Results based on combining SHIPS and FSU parameters
  v)   Results bases on combining SHIPS, FSU parameters and SPICE.

In addition to the above we shall also be examining the relative standing of hurricane intensity forecasts (with respect to the above) from the HWRF model.

3. Results: We shall be presenting the results for the above categories at the 66th Interdepartmental Hurricane Conference (IHC) in Charleston, South Carolina during March 5-8, 2012. We will have our first results, for practical applications, by the end of March. Our results look very promising at this stage.

DeMaria, M. et al., 2005: Further improvements to the Statistical Hurricane Intensity Prediction Scheme (SHIPS). *Wea. Forecasting*, **20**, 531-543.

DeMaria, M., 2009: A simplified dynamical system for tropical cyclone intensity prediction. *Mon. Wea. Rev.,* **137**, 68-82.