Enclosed is the JHT Semi-annual Report for:

A PROPOSAL FOR TRANSITION OF RESEARCH TO OPERATIONS:

Hurricane Model Transition to Operations at GFDL/NOAA

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Upgrades to the GFDL Hurricane Prediction System, developed through JHT funding during FY05, were successfully implemented into the operational version of the GFDL model before the start of the 2005 hurricane season. These included addition of a third nest resulting in a doubling of the highest resolution, implementation of a new vortex initialization, modification of the storm size and improved estimation of the 10m winds. Prior to implementation in May, 2005, these upgrades were extensively tested during the first part of the JHT funded period, using both the T254 and the new T384 GFS analysis as the initial condition. Tests were made for 130 forecasts in the Atlantic and 30 cases in the East Pacific. Using the upgraded modeling system, the track error was reduced 10% at 3-5 days in the Atlantic (*Figure 1*) with more skillful intensity forecasts particularly at the longer time periods in both basins (*Figure 2*).

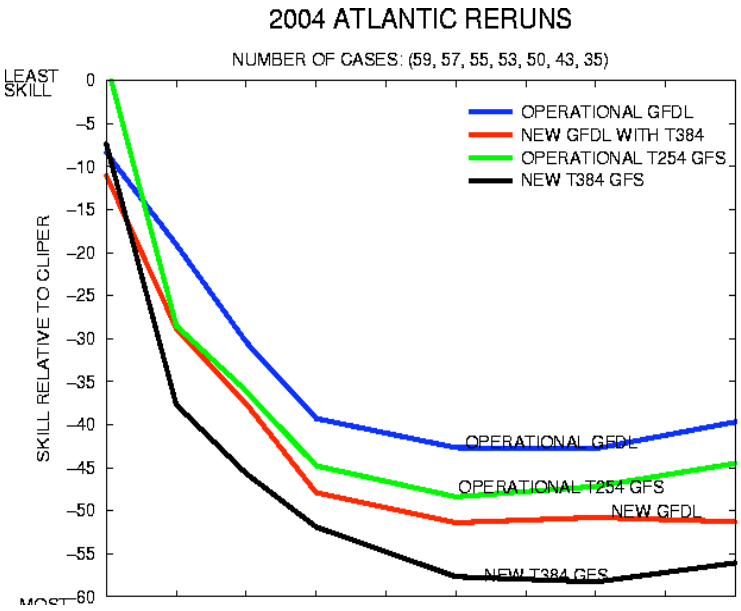

Figure 1 Track error, normalized with respect to CLIPER, for select cases during the 2004 hurricane season for the operational GFDL (blue line), the operational GFS (green), the upgraded GFDL run from the T384 GFS (red) and the T384 GFS.

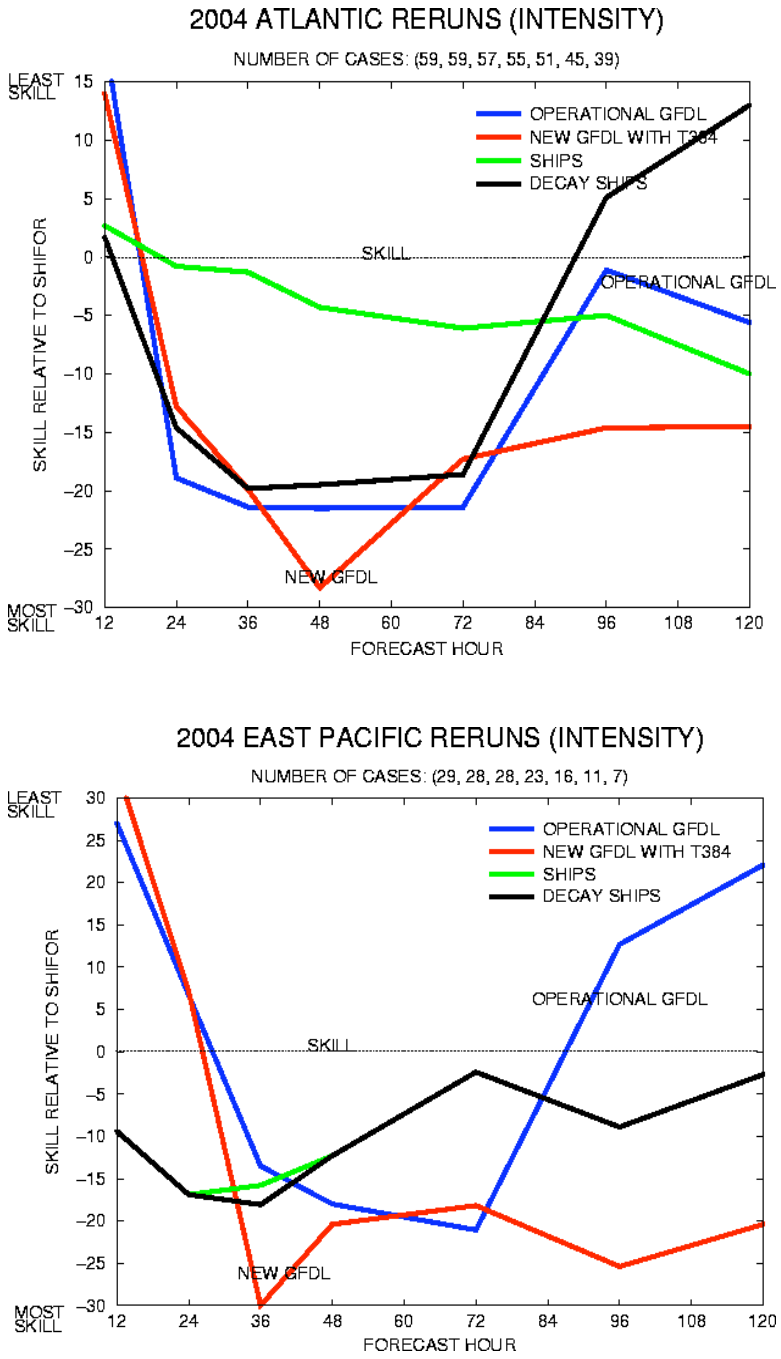

Figure 2 Intensity error, normalized with respect to SHIFOR, for selected cases during the 2004 Atlantic (top) and East Pacific (bottom) hurricane season for the operational GFDL (blue line), the upgraded GFDL run from the T384 GFS (red) and the SHIPS and DECAY SHIPS statistical models.

In the original *Statement of Work*, the proposed project plan was to focus on several specific tasks during year one, after the extensive testing of the 2005 upgrades was completed. The first proposed task was to transfer the new high resolution version of the GFDL model to FLEET for testing and possible implementation in GFDN (the Navy's version of the GFDL model). The transfer of the software was done in the early summer, and GFDL scientists have been collaborating extensively during the past several months with FLEET personal, to get this version working in the GFDN system. Due to differences in the computer code that have evolved between the two modeling systems, this has involved a significantly larger amount of time then originally anticipated. However the work is proceeding and it is hoped that tests of the high-resolution GFDN model will begin later this fall.

The second proposed task was to improve the current GFDL bogus technique for possible implementation in 2006. However, after consultation with Naomi Surgi at NCEP who oversees the NWS hurricane modeling effort, it was decided to modify the original JHT work plan and not to peruse this project. Instead, the plan was modified to concentrate on the implementation of the Ferrier micro-physics package into the GFDL forecast system. Although this physics package was successfully transferred into a version of the GFDL model in the previous year, testing of the new physics package during the past several months in the new high-resolution GFDL model, revealed several problems that need to be resolved. First, although the micro-physics packages has significantly reduced the model's positive intensity bias in sheared situations, such as the Florida landfall of Katrina (*Figure 3*), it was found that the new model under-predicted some of the rapidly intensifying systems that were properly handled in the current model. Collaboration with NCEP scientists indicated that this new physics packages was giving unrealistically small concentrations of ice and snow in the upper levels in the eyewall, which had a negative impact on the storm structure and intensity. Other problems involved too small values of the total condensate. It is clear that these problems have to be resolved before the package can be considered for operational implementation in 2006. This is requiring a continued extensive focus for the next 6 months. These problems are currently being addressed and will hopefully be resolved in time for the implementation in 2006.

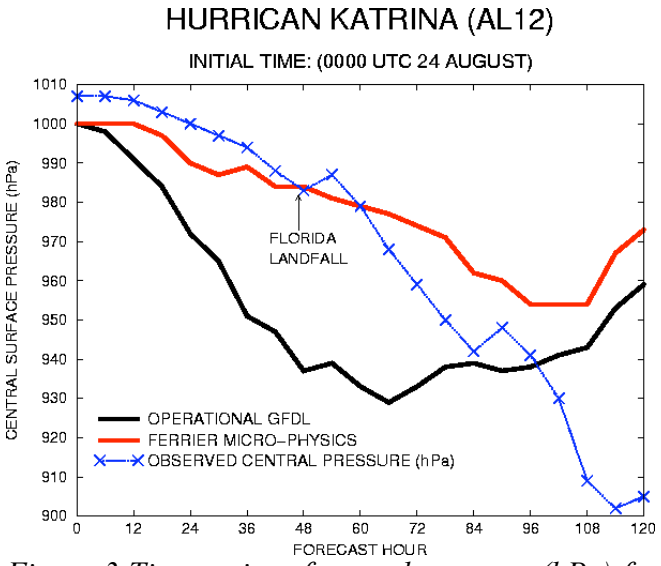

Figure 3 Time series of central pressure (hPa) for the forecast of Hurricane Katrina 48h before landfall on Florida, for the operational GFDL (black line) and the GFDL model with the new Ferrier micro-physics (red line), compared to the observed central pressure (dotted blue line)

Finally, collaboration between GFDL and NCEP/EMC scientists is continuing to aid in the development of HWRF. For example, some of the algorithms and software coding used to move the inner nests in the GFDL model are being tested in HWRF. GFDL scientists are also involved in the comparisons of the heat and momentum flux parameterizations in the two models. These collaborations will become increasing more important in the coming year as the HWRF model is further developed and more parallel tests are made comparing HWRF with the new GFDL model that will be implemented next season.