Hurricane Transition to Operations at NOAA/GFDL

1.) As noted in previous reports, through collobaration with URI a 1/12 degree high-resolution version of the GFDL model was developed and tested with various cumulus paramaterizations. Even at these resolutions the paramterizations performed quite favorably in regards to both track and intensity. As discussed in 2.) this new high-resolution model will be tested more extensively with the Lin micro-physics scheme that has successfully been imported into the GFDL hurricane model.

2.) A new version of the GFDL model was implemented operationally in May of 2003. This upgrade represented the largest improvements in the GFDL system since the model became operationlly in 1995. Each of these model and initialization upgrades were caerfully evaluated and tuned during the first part of the funding period. These changes included replacing the model's cumulus and boundary layer physics packages with those used in NCEP's GFS model, an improved mass initialization, and further refinements to the model initialization (e.g., vortex specification and filtering). This upgraded system was then thoroughly tested for cases from both the 2001 and 2002 East Pacific and Atlantic hurricane season. These tests were made during the first 3 months of 2003 and involved 3 day (2001) and 5 day (2002) forecasts for nearly 200 cases. The results showed consistent improvements in the track particularly during the 3-5 day period where the average track error was reduced from 8% to nearly 35% in the Atlantic. A detailed outline all of these changes and a summary of the test results can be seen in the following WEB site:

http://www.emc.ncep.noaa.gov/gfdl_2003_upgrades.pdf

It is becoming increasingly evident that for skillful intensity prediction to be achieved using dynamical models, particularly in a sheared environment, convection and moist processes need to be resolved explicitly. To address this problem, the Lin micro-physics package was imported to the GFDL model. This involved an extensive coding change, to enable the variables of liquid and cloud water, snow, graupel and ice to be computed as prognostic variables. Recently this package was added to the new 42 level GFDL model with the 2003 physics upgrades. As already mentioned, this model can run with higher resolution of 1/12 and even 1/18 degree. However, at the coarser resolution of 1/6 degree the improvements to the intensity and track prdiction were quite signficant for the forecasts of Hurricane Debby (2000) with the Lin physics. In these forecasts, the previous (GFDL) and new operational GFDL model(203E) greatly over predicted the storm while the inclusion of the bulk micro-physics (BULK) resulted in a much better forecast:

During the 2003 season this model will continue to be run on more cases both at 1/6 and 1/12 degree resolution. The NCEP Ferrier micro-pysics package will also be imported to this model so that comparison will be able to be easily made between both packages. With the proposed computer upgrade at NCEP in the fall 2004, it is anticipated that one of these packages will be made operational in the GFDL model for the 2005 hurricane season at the highest resolution that will be operationally feasible.

3.) Precipitation verification of the GFDL model was done for many cases from the 2001 and 2002 hurricane seasons, through the efforts of Mark Demaria and Bob Tuleya. As JHT funding becomes available, plans are underway to extend this work to the 2003 hurricane season,

using the new operational GFDL model with the upgraded physics.

4.) Collaboration with Qing Fu Liu at NCEP continued, to help in developing a new 3 dimensional hurricane bogus technique. This work will continue this coming year, through close colloboration with GFDL scientists.