JHT Mid-term Report
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Improvement in the rapid intensity index by incorporation of inner-core information

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Accomplishments:

Rapid intensification (RI) predictors from three new sources of inner-core information were developed for testing in a revised version of the operational Atlantic basin SHIPS RI index (RII) (Kaplan et al. 2010). These three sources are the time evolution of inner-core structure as deduced from GOES infra-red (IR) imagery, total precipitable water (TPW) derived from microwave SSM/I imagery and boundary-layer temperature and moisture differences and sensible and latent heat fluxes derived from GFS analyses. The activities related to the development of the predictors from each of these areas are discussed below.

Time evolution of GOES IR imagery:

- The CIRA Tropical cyclone IR image archive has been updated to include more imagery from the 1995 Atlantic hurricane season. Complete storm histories were added for Allison, Barry, Gabrielle,TD14, Noel, Pablo Sebastien, and Tanya. The imagery histories for Humberto, Iris, Jerry, Karen, Luis, Marilyn, Opal, and Roxanne were also improved.

- Using these improved records Empirical Orthogonal Function/Principle Component Analysis was performed on storm relative, motion rotated imagery. Using the first 9 EOFs, predictors for the SHIPS database were created. These include the six-hour averages of the first nine EOFs, the standard deviations, and the regression coefficients associated with the six-hour periods. These predictors were added to the database for testing with respect to rapid intensification.

- The generation of IR imagery for the Eastern Pacific 1996 season, which previously did not exist has begun. This complete image records for TD01, TD02, Alma, Boris, Christina, Douglas, TD06, and Elida have been created. Partial records for Genevieve have also been created.

Total Precipitable water:

- Using the 1995-2008 TPW data supplied by our partners at the NRL, several storm relative predictors were created and added to the SHIPS database for testing. These include: TPW azimuthally averaged from r=0 to r=100 km, TPW azimuthally averaged from r=100 to r=200 km, %TPW less than 45 mm in radii r=0 to r=200 km and r=400 to r=600 km in the N, W, S and E quadrants, the %TPW less than 45 mm, r=0 to r= 200 km and r=400 to r=600 km, front, left, back, right quadrants (storm motion relative quadrants), the %TPW less than 45 mm, r=0 to r=500 km, 90 deg. quadrant centered upshear, TPW averaged r=0 to r=500 km, 90 deg. quadrant centered upshear, and TPW averaged r=0 to r=500 km.

- Software has been written to read the HDF4 TPW files generated by NESDIS/OSDPD and convert them to a simple ASCII-formatted lat./lon. grid. Readers for this file format have also been created.

Boundary-layer predictors:

- GFS atmospheric temperature and moisture data and sea-surface temperature (SST) estimates obtained from objectively analyzed SST fields and an inner-core cooling algorithm were used to compute air-sea temperature and moisture differences and to estimate surface sensible and latent heat fluxes within the storm's inner-core region. A total of 15 such boundary-layer predictors that were computed directly from the GFS data for both the Atlantic and eastern North Pacific basins were added to the SHIPS database. An additional thirty-five Atlantic basin boundary-layer predictors were also computed by applying empirical relationships that were previously developed from buoy data (Cione et al. 2000; Cione and Uhlhorn 2003) to the GFS and SST fields.

Current/Future year 1 efforts:

Significant tests have been performed on all of the aforementioned new Atlantic basin predictors to help identify those that exhibit the strongest correlation with RI. These predictors will be subsequently tested for potential inclusion into a revised version of the Atlantic RII. Once the revised Atlantic version of the RII has been derived, its skill will be compared to that of the current operational version. Also, the CIRA GOES IR image archive will continue to be updated to include 1995 and 1996 East Pacific tropical cyclones and the TPW database for the East Pacific will be completed. Finally, our

current efforts to install the TPW data ingest on the JHT server at NHC will continue in preparation for testing of the new revised Atlantic RII during the 2010 Hurricane season.

References:

Cione, J.J., and E.W. Uhlhorn, 2003: Sea Surface temperature variability in hurricanes: Implications with respect to intensity change. *Mon. Wea. Rev.,* **131**, 1783-1796.

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Kaplan, J, M. DeMaria and J. A. Knaff, 2010: A revised tropical cyclone rapid intensification index for the Atlantic and eastern North Pacific basins, *Wea. Forecasting*, **25,** 220-241.