

**JHT Mid-term Report**  
**July 7, 2003 –January 31, 2004**

Development of a Rapid Intensification Index for the Eastern Pacific Basin

Principle Investigator: John Kaplan  
Hurricane Research Division  
NOAA/AOML

Co-Investigator: Mark DeMaria  
NOAA/NESDIS/RAMMT

Additional project personnel: Joseph Griffin  
Hurricane Research Division  
NOAA/AOML

**Mid-term progress report:**

**Funded accomplishments:**

The software that was previously employed to derive a rapid intensification (RI) index for the Atlantic basin was modified so that it could be utilized for the same purpose in the Eastern Pacific basin. This software was then used to derive an RI index for the Eastern Pacific basin by employing the 1989-2002 SHIPS (DeMaria and Kaplan 1999) and TPC/NHC best track databases. Following the methodology that was utilized for the Atlantic basin (Kaplan and DeMaria 2003), RI was defined as the 95<sup>th</sup> percentile of all of the over-water 24-h intensity changes for the tropical and sub-tropical cyclones that comprised the database. For the Eastern Pacific basin, this corresponded to a 24 h intensity change of  $\sim 19 \text{ ms}^{-1}$ . However, RI was defined as a 24 h intensity change of  $\geq 18 \text{ ms}^{-1}$  (35 kt) for the purpose of this study. The Eastern Pacific sample was divided into RI and non-RI cases to choose the predictors for which statistically significant differences existed between the RI and non-RI samples at the 99.9% level following the methodology described in Kaplan and DeMaria (2003). The RI thresholds were then defined as the mean values of all of the RI cases for each of the statistically significant predictors. Sensitivity tests were performed to determine which sets of predictors should be included in the final version of the Eastern Pacific version of the RI index. This was done objectively by choosing the predictors that yielded probability of RI estimates that produced the highest Brier Skill Score (Wilks 1995) for a homogenous set of cases that comprised the dependent sample.

The Brier Skill Score was evaluated by comparing the probability of RI estimates of the various versions of the RI index to the climatological probability of RI to assess which method more accurately reflected whether or not RI occurred during any given 24-h period. These tests showed that combining the five predictors that were employed previously to obtain the standard version of the Atlantic RI index (previous 12-h intensity change, 850-700 hPa relative humidity, 850-200 hPa vertical shear, sea-surface temperature, potential intensity) and two inner-core GOES predictors (area-averaged

infrared brightness temperature and the standard deviation of the GOES infrared brightness temperature) produced the most skillful version of the RI index for the Eastern Pacific basin. Both of the GOES predictors and the previous 12-h intensity change were evaluated at  $t=0$  h, while the remaining four predictors were averaged for 24 hours. Interestingly, it was found that the Eastern Pacific version of the RI index had a higher Brier skill score than did the Atlantic RI index when both indices were tested on their respective dependent basin samples.

In preparation for real-time testing during the upcoming 2004 Eastern Pacific Hurricane season, the subroutine that is currently used to compute the RI index operationally in the SHIPS model was modified so that it can be used to compute the probability of RI for both the Eastern Pacific and Atlantic basins. Prior to the start of the 2004 season, the probabilities of RI and RI thresholds will be updated by including data from the 2003 Eastern Pacific Hurricane season. These values will then be included in the subroutine that will be employed by the SHIPS model to estimate the RI probabilities operationally during the 2004 Eastern Pacific Hurricane Season.

#### **Additional accomplishments:**

To enable comparisons to be made between the Atlantic and Eastern Pacific versions of the RI index, a series of versions of the Atlantic RI index were assessed using the 1989-2002 dependent Atlantic hurricane database. These assessments showed that a slightly different version of the RI index than was used operationally during the 2003 Atlantic hurricane season yielded the highest Brier skill score. Interestingly, the predictors in this version of the Atlantic RI index were identical to those that were utilized in the recently developed Eastern Pacific version of the index save for a slight difference in the area over which the standard deviation of the brightness temperature was computed. If TPC/NHC desires, the RI probabilities and thresholds for this version of the RI index will be updated using data from the 2003 season and this version will be used operationally at the start of the upcoming 2004 Atlantic hurricane season. The upcoming Interdepartmental Hurricane Conference (IHC) would seem to be a suitable forum at which this issue could be discussed in more detail.

#### **References:**

- DeMaria, M., and J. Kaplan, 1999: An updated statistical Hurricane Intensity Prediction Scheme (SHIPS) for the Atlantic and eastern North Pacific basins. *Wea. Forecasting*, **14**, 326-337.
- Kaplan, J. and M. DeMaria, 2003: Large-scale characteristics of rapidly intensifying tropical cyclones in the North Atlantic basin. *Wea Forecasting*, **18**, 1093-1108.
- Wilks, S.D., 1995: *Statistical methods in the atmospheric sciences*. Academic Press, 467 pp.