Enhancements to the SHIPS Rapid Intensification Index

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1. Background

SHIPS RI index (SHIPS-RI) is a statistically-based tool that was developed to aid in forecasting RI events which remains a top forecasting priority of the NHC.

SHIPS-RI uses mainly environmental and a few GOES inner-core SHIPS model predictions to estimate the probability of RI from 0 to 12-h using linear discriminant analysis. (Kaplan et al. 2010).

2. Project Goals

Develop new multi-lead time (12-h, 24-h, 36-h, and 48-h) consensus RI models (Rozoff and Kossin 2011).

Utilize new multi-lead time consensus RI models to develop new versions of the deterministic rapid intensity aid guidance (Sampson et al. 2011).

Derive new microwave-based RI models (see previously presented conference poster by Rozoff et al. 2014).

3. Methodology

Multi-lead time (12-h, 24-h, 36-h, and 48-h) RI models were derived using 1995-2012 SHIPS developmental data for both the Atlantic and E. Pacific basins.

Consensus RI model is the average of RI probabilities from SHIPS, Bayesian, and Logistics-regression versions of the RI model.

Multi-lead time RI model was run in real-time at CIRES/CU from August 1 to Nov 30 of the 2013 Hurricane Season (see sample output in Fig. 1).

4. Results

Multi-lead time independent consensus of the RI models were derived for each year between 2004-2013 by first removing all cases from that year and then re-deriving those models using the remaining 9-year sample.

RI re-run forecasts were performed using operational GFS forecast fields and NHC storm data archived from 2004-2013 using the independent models derived for the 10-year sample.

All over-water tropical and subtropical forecasts from 2004-2013 verified against climatology based upon a Brier skill score (see Kaplan et al. 2010).

Deterministic Rapid Aid guidance

RAPID aids provide deterministic RI intensity forecasts by combining consensus IVCN model (e.g., HWRT, LUGEM, SHIPS, GDP), and probabilistic SHIPS-RII forecasts (Sampson et al. 2011).

RAPID aids assign intensification rate when ensemble RI forecasted probability > 40% for a given RI threshold.

Assign intensification rate added to existing IVCN model forecasts to obtain deterministic IRI intensity forecasts for the 2008-2013 independent samples.

Skill of 2008-2013 independent Rapid Aid RI re-run forecasts

Skill of 2004-2013 independent RI re-run model forecasts

Operational SHIPS-RII model (with enhancements)

Reliability of 2004-2013 independent consensus RI re-run model forecasts

Verification of the 2004-2013 independent RI re-run forecasts showed that the individual multi-lead time RI models (SHIPS, Bayesian, Logistic-regression) were generally skillful at each lead-time in both basins with the consensus version proving to be the most skillful overall.

New versions of the rapid intensification aid (IRI) that employs both the probabilistic RI guidance and operational intensity model consensus (IVCN) were developed using the ensemble-based multi-lead RI models for the Atlantic and E. Pacific basins.

An evaluation of the independent 2008-2013 IRI re-run forecasts demonstrated that the IRI forecasts generally had smaller mean absolute errors and biases than did IVCN in both forecast basins.

5. Summary

New multi-lead time models for estimating the probability of RI at lead times of 12-h, 24-h, 36-h and 48-h were developed (and tested in real-time during the 2013 Hurricane Season) for both the Atlantic and E. Pacific basins.

Verification of the 2004-2013 independent RI re-run forecasts showed that the individual multi-lead time RI models (SHIPS, Bayesian, Logistic-regression) were generally skillful at each lead-time in both basins with the consensus version proving to be the most skillful overall.

New versions of the rapid intensification aid (IRI) that employs both the probabilistic RI guidance and operational intensity model consensus (IVCN) were developed using the ensemble-based multi-lead RI models for the Atlantic and E. Pacific basins.

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