

Improved Statistical Intensity Forecast Models: A Joint Hurricane Testbed Year 2 Project Update

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Outline

- Progress on JHT Project Goals
 1. New decay model in SHIPS
 2. Modified vertical shear calculation
 - * New problem in 2006 model
 3. Discriminant analysis version of the Rapid Intensity Index
- SHIPS and RII for the 2007 Season

2006 Operational Version of SHIPS

- Statistical-dynamical TC intensity prediction model
- 16 basic predictors
 - atmospheric from GFS forecast fields
 - oceanic from Reynold's weekly SST
 - climatology and persistence from ATCF input
- Correction for ocean heat content (Atlantic only) and GOES predictors
 - previous JHT project
- Adjusted SST from Joe Cione cooling algorithm
 - previous JHT project, Atlantic only
- Empirical decay equation over land

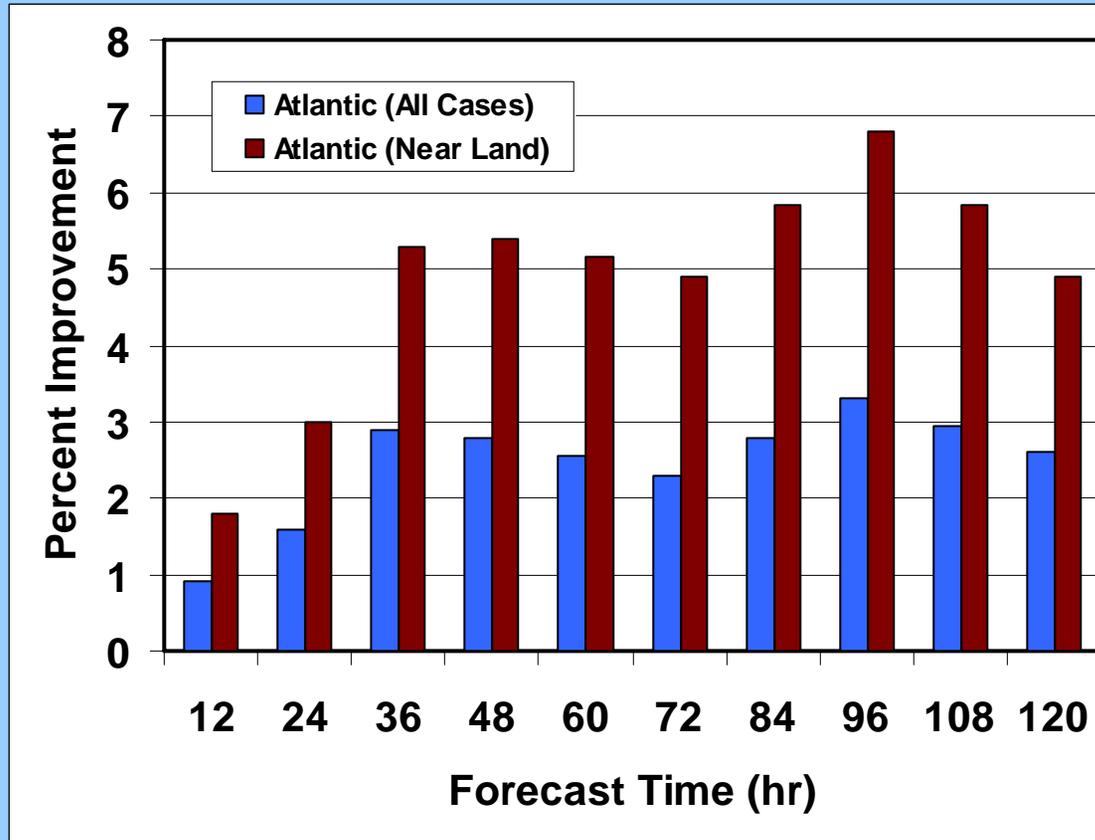
2006 Rapid Intensity Index

- Uses subset of SHIPS input most correlated with rapid intensity change
- Estimates probability of 25 kt increase in next 24 hours
 - Original version used 30 kt threshold
- Atlantic and east Pacific versions
- Results included on SHIPS text output

Goal 1. Modified Inland Wind Decay Algorithm

- Kaplan and DeMaria (1994) inland decay developed for continental U.S. landfalls
- Too much decay for storms over islands and peninsulas
- Modified version where decay rate depends on fraction of storm circulation over land
- Reduces decay rate over islands and narrow land masses

Atlantic SHIPS Improvements with New Decay Model (2001-2006)



Note: No significant impact on East Pacific SHIPS

Goal 1 completed and has been in SHIPS since 2005

Goal 2: Improved Shear Calculation

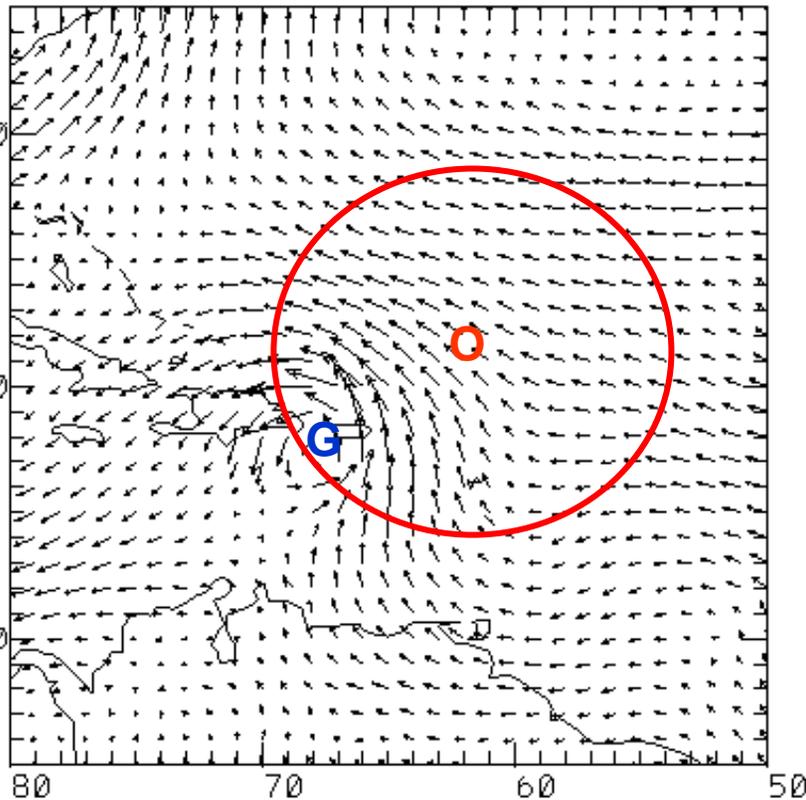
- SHIPS uses NHC official track for center of shear calculation
- GFS vortex track can differ from NHC track
- Shear calculation uses large annulus to compensate (200-800 km)

Example of NHC and GFS Track Mismatch

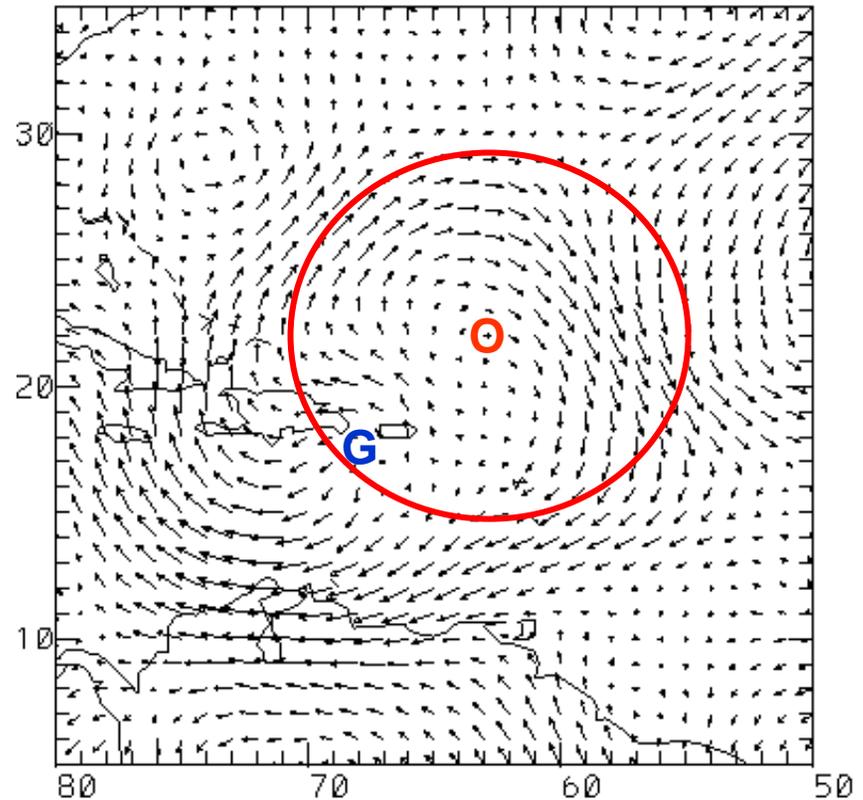
96 h Forecast for Frances from 27 Aug 2004 12 UTC

850 hPa

200 hPa



0.000E+00
MAXIMUM VECTOR



0.000E+00
MAXIMUM VECTOR

G = GFS position **O = NHC Position**

New Shear Algorithm

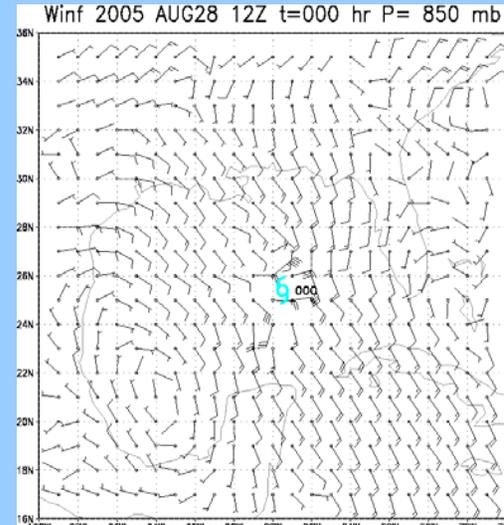
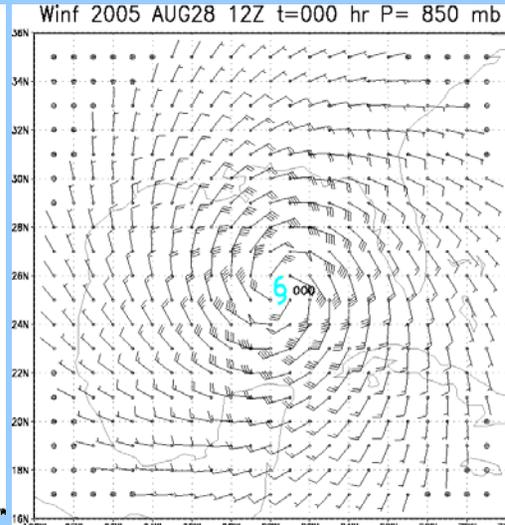
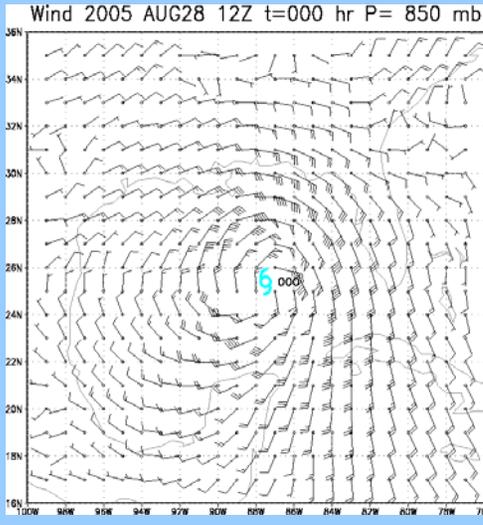
- Track location of GFS vortex at 850 hPa
 - Tracker finds location that maximizes 0 to 600 km symmetric tangential wind
 - Checks for reasonable translational speeds
 - Requires minimum cyclonic wind
- Symmetric circulation subtracted
 - Starts from outer radius where symmetric circulation is cyclonic
 - Subtraction radius decreases with height
- Shear calculation at NHC track position after vortex removed
- 0-500 km radius rather than 200-800 km annulus

Example of Vortex Removal

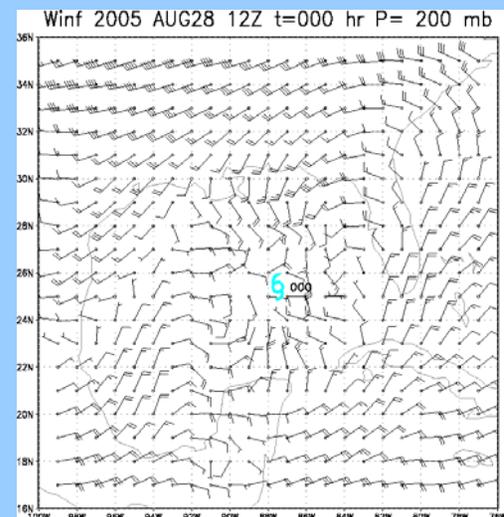
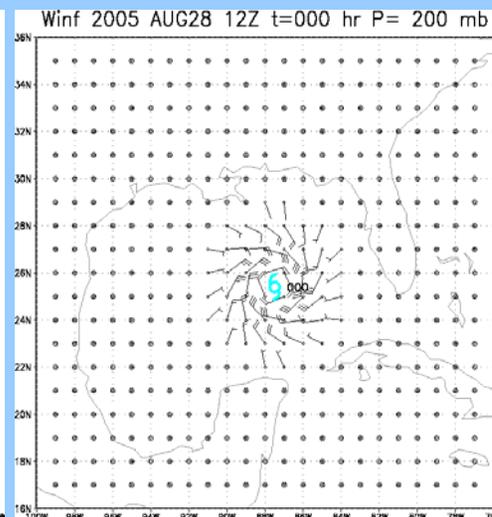
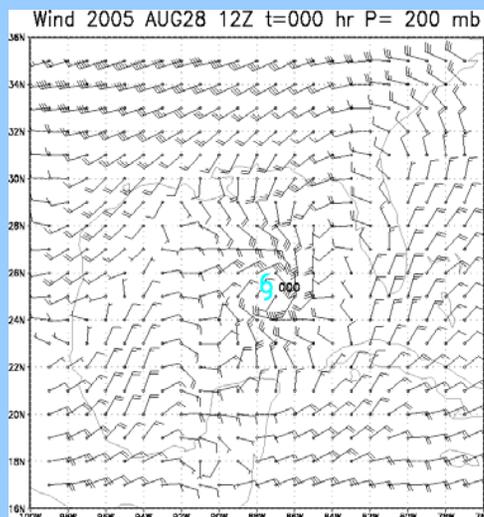
Total Wind

Symmetric Flow

Residual



850 hPa



200 hPa

A New Predictor and Bad Old One

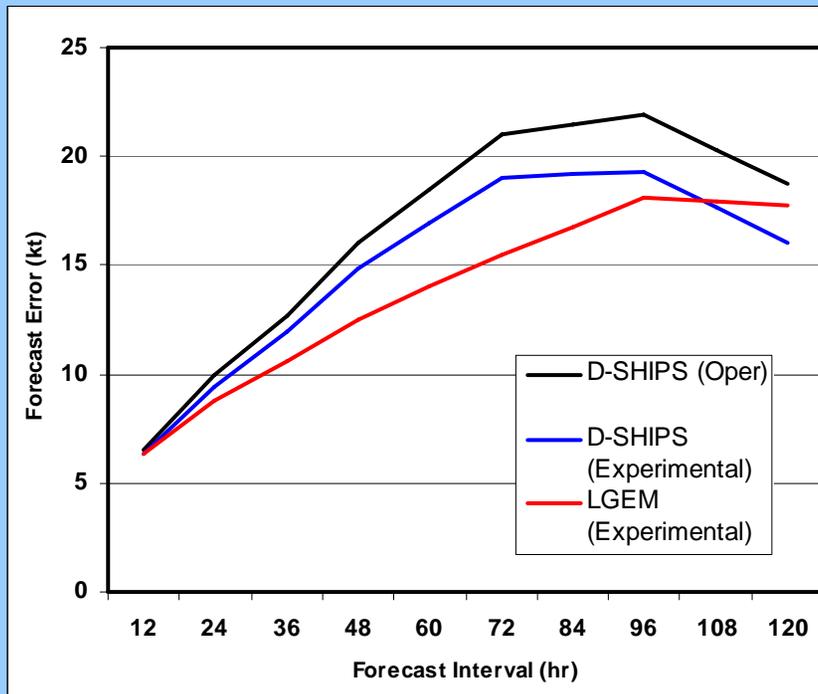
- *New*: Time tendency of GFS mean 850 hPa tangential circulation
 - 0 to 600 km average
- *Old*: 850 hPa environmental vorticity
 - 0 to 1000 km average
 - Measures environment for small storms
 - Measures storm circulation for large storm
 - Inconsistent predictor with higher resolution GFS

SHIPS With New Shear

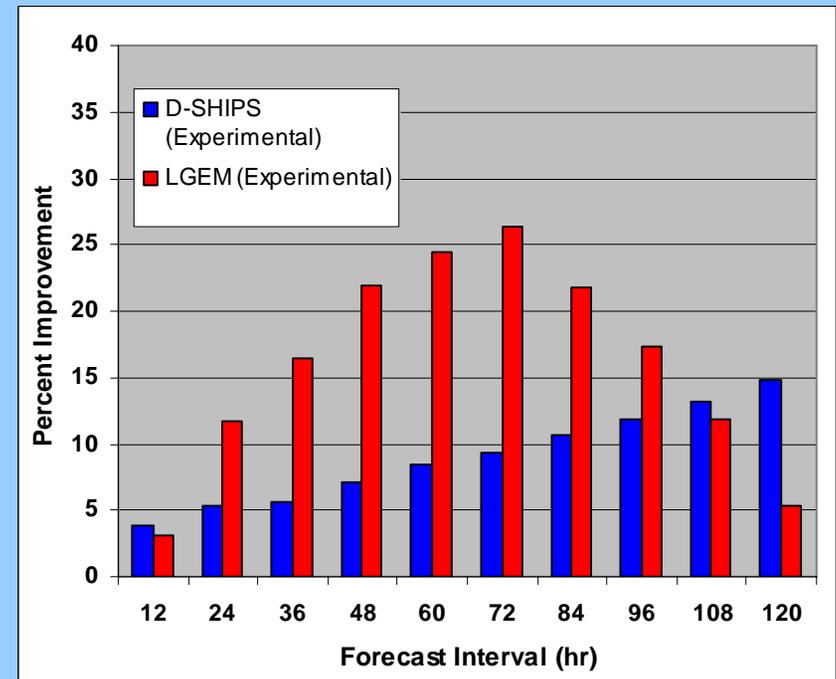
- Replace 200-800 km shear with 0-500 km shear (after vortex removal)
- Replace 850 hPa environmental vorticity with GFS vortex time tendency
- All 2006 cases re-run with operational input
- Logistic Growth Equation Model (LGEM) also tested with new shear
 - Uses time stepping procedure instead of time averaging of predictors

Forecast Impact 2006 Atlantic Re-runs

Forecast Errors

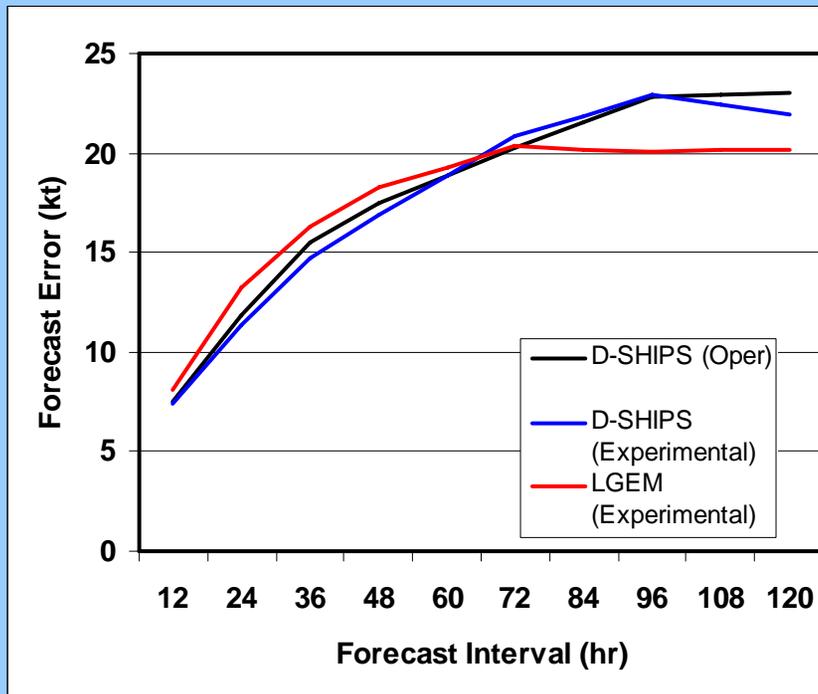


Percent Improvement over Operational D-SHIPS

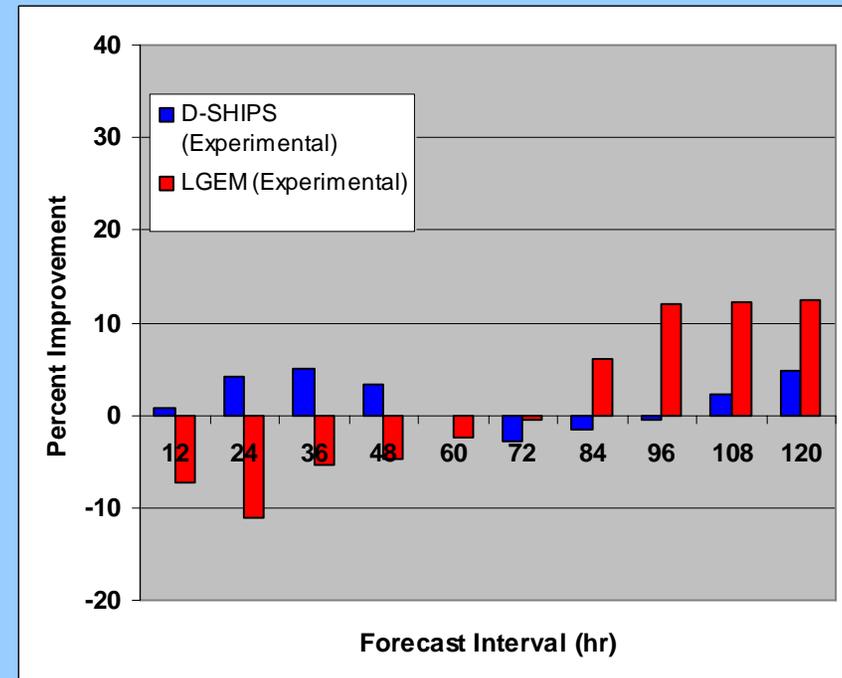


Forecast Impact 2006 East Pacific Re-runs

Forecast Errors



Percent Improvement over Operational D-SHIPS



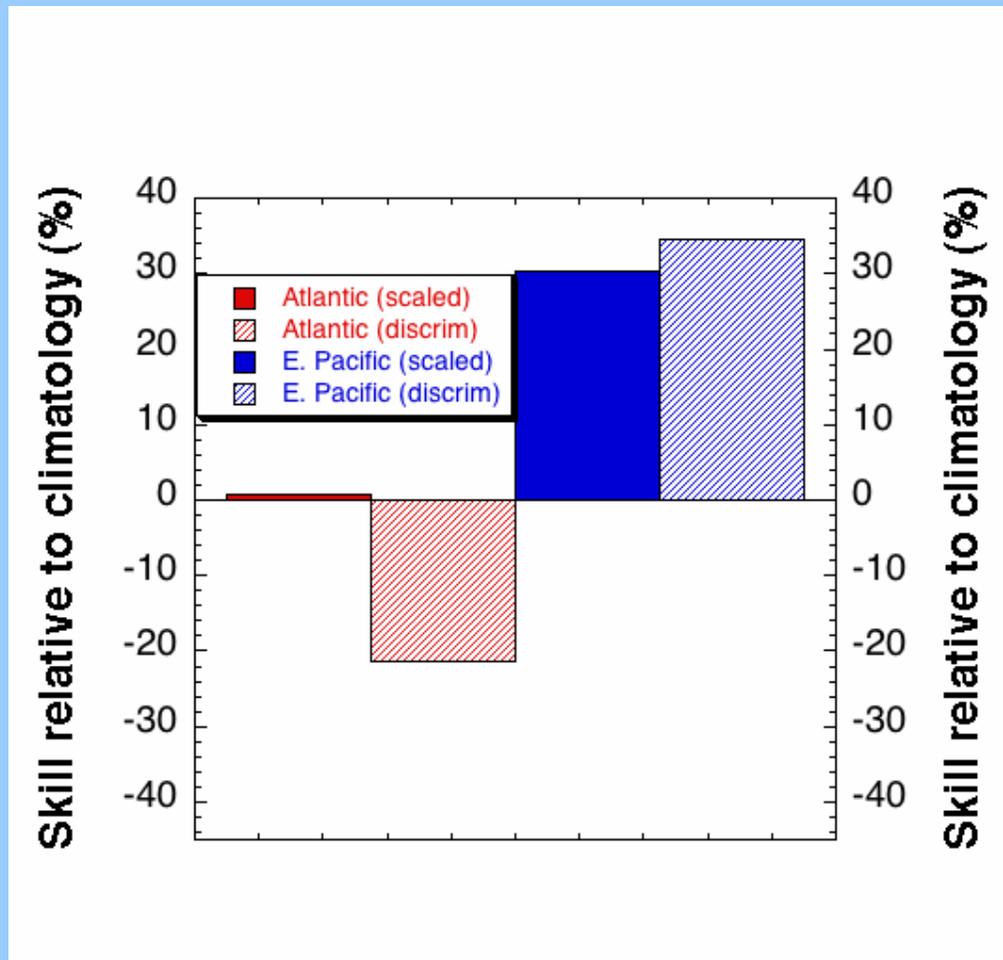
Goal 3: Improve the Rapid Intensity Index

- Operational version uses 6 scaled input parameters to estimate the probability of rapid intensification in the next 24 hours
- Improved version
 - Use discriminant analysis to determine optimal weights for combining predictors
 - Run in real time during 2006 season
 - Also tested on larger sample in dependent mode
- RII Probabilities evaluated using Brier Skill Score

2006 RII skill

Atlantic N=175 Nri=11 Probri = 6.3% (climo=12%)

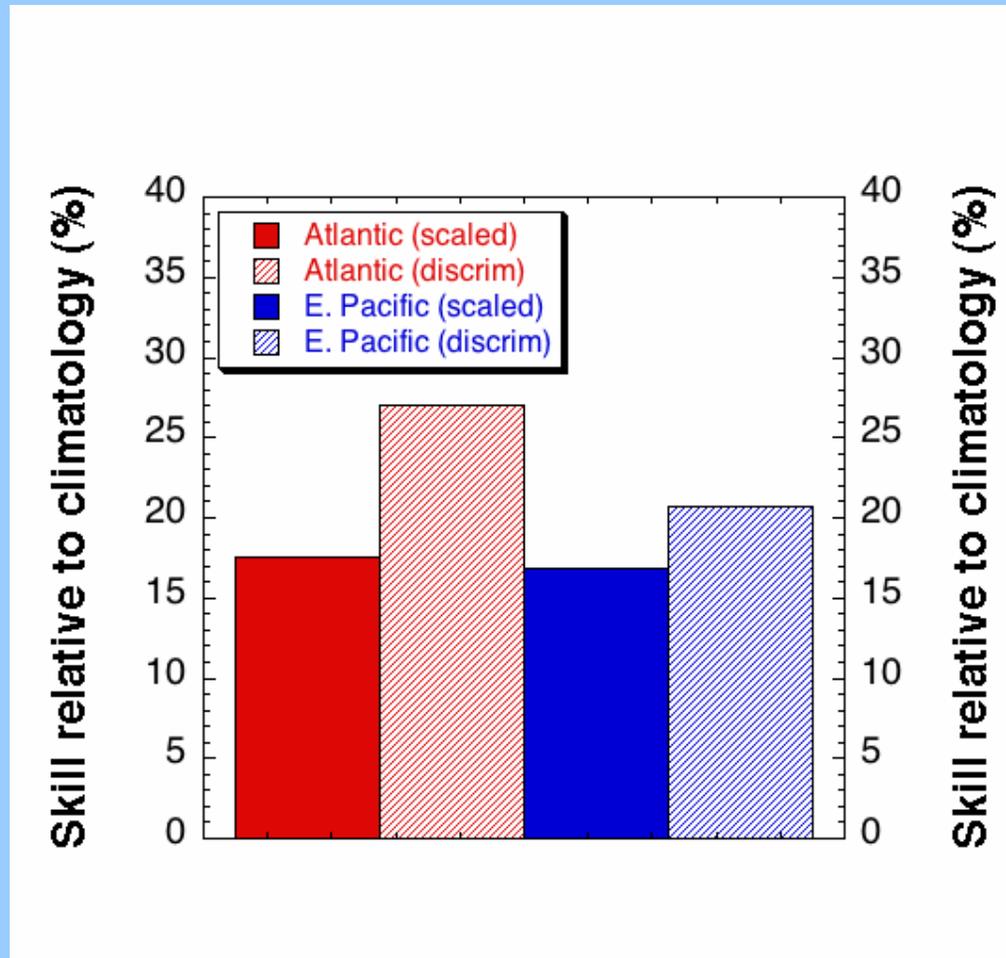
E. Pacific N=284 Nri=45 probri= 15.8% (climo=11%)



RII Skill for the 2003-2005 developmental sample

Atlantic N=846 Nri=115 Probri=13.6% (climo=12%)

E. Pacific N=521 Nri=59 Probri=11.3% (climo=11%)



Proposed Form of 2007 SHIPS and RII

- SHIPS

- Include new decay model
- Replace old shear with new one
- Replace 850 hPa environmental vorticity with 850 hPa GFS vortex circulation predictor
- Run LGEM version with new SHIPS predictors
- Additional changes
 - Fix Central Pacific domain problem
 - Additional GOES data quality control

- RII

- Re-develop discriminant analysis weights with 2006 case
- Run equal weights and DA version in 2007