

National Hurricane Center Forecast Accuracy: Past and Present

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NHC Forecast Verification

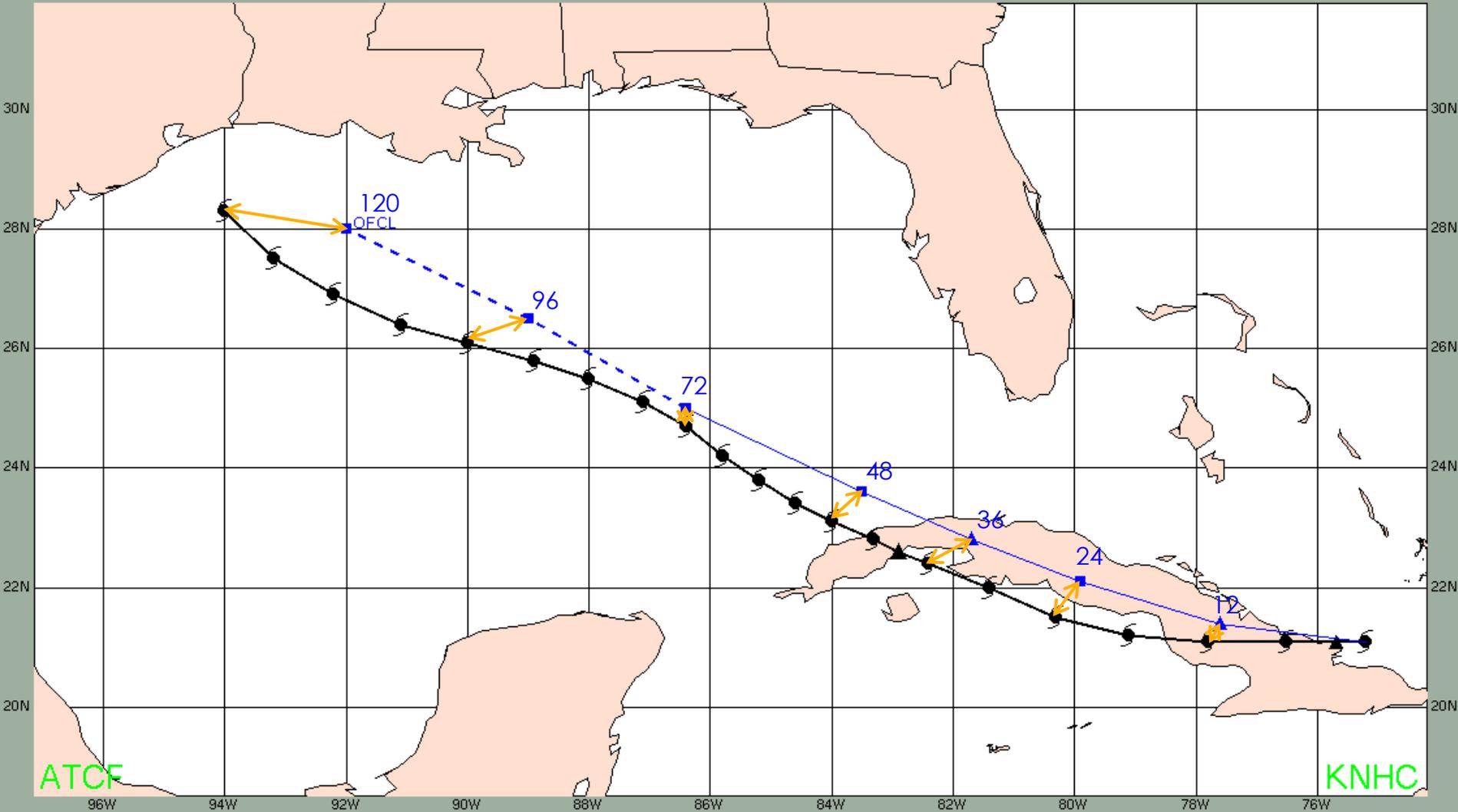
- * NHC verifies all its official tropical cyclone track and intensity forecasts each year.
- * Why do a forecast verification?
 - * We have to (Government Performance and Results Act [GPRA]). Monitor performance and progress.
 - * Understanding forecast errors help forecasters (and modelers) to reduce them.
 - * Identify critical issues for the research community.
 - * Basis for the development of certain products (e.g., the wind speed probabilities, storm surge probabilities).
 - * Helps decision makers use NHC products more effectively.

NHC Forecast Verification

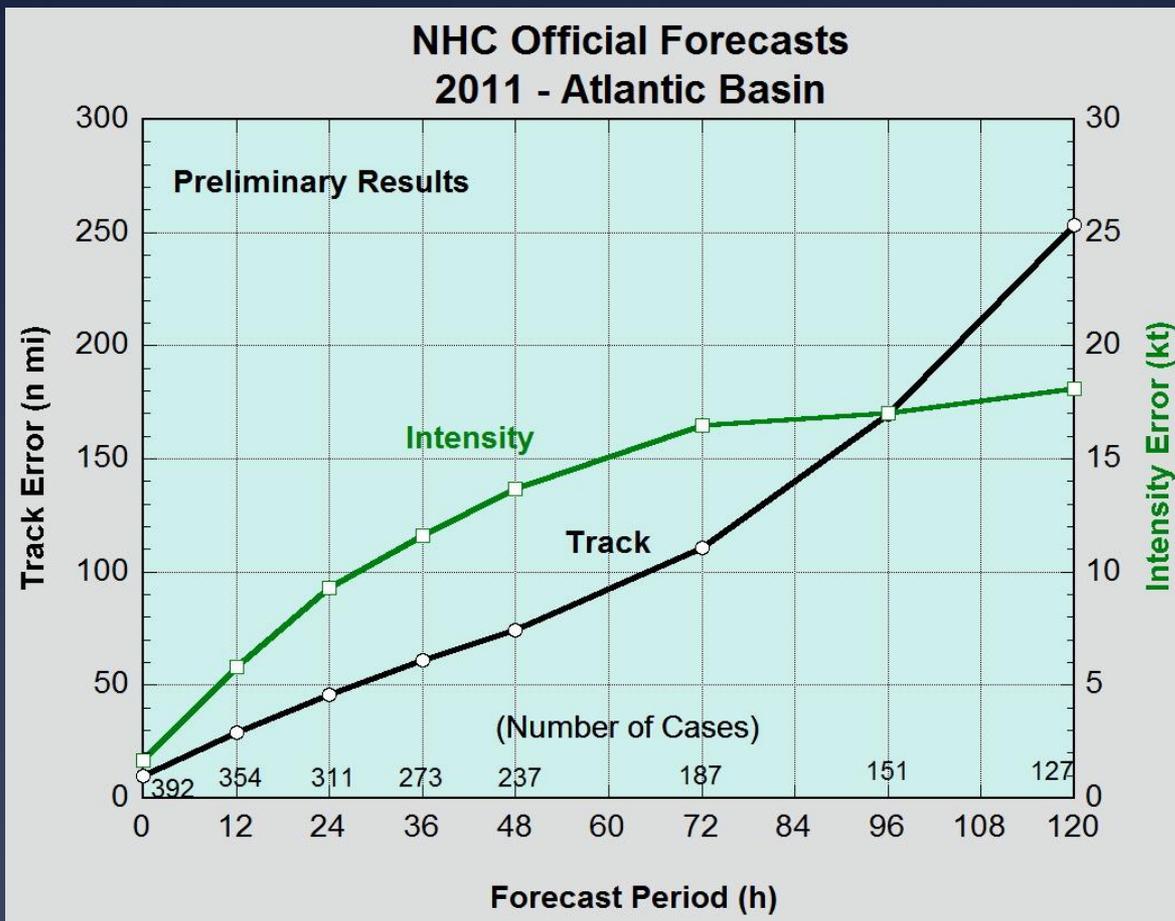
- * System must be a tropical or subtropical cyclone at both forecast initial time and verification time.
- * Special advisories ignored (original advisory is verified).
- * Definitions:
 - * Track error is the great-circle distance between the forecast location and the actual location of the storm center (n mi).
 - * Intensity error is the difference between the forecast and actual intensity (kt).
 - * Forecast SKILL is computed by comparing forecast error to the error from a Climatology-Persistence model (CLIPER, Decay-SHIFOR).

Track Error Definition

092008 - IKE 2008090800



2011 Atlantic Verification



VT (h)	NT	TRACK (n mi)	INT (kt)
000	392	9.7	1.7
012	354	29.3	5.8
024	311	45.7	9.3
036	273	61.2	11.6
048	237	74.2	13.7
072	187	110.6	16.5
096	151	169.5	17.0
120	127	253.1	18.1

Values in green exceed all-time records.

48 h error GPRA targets

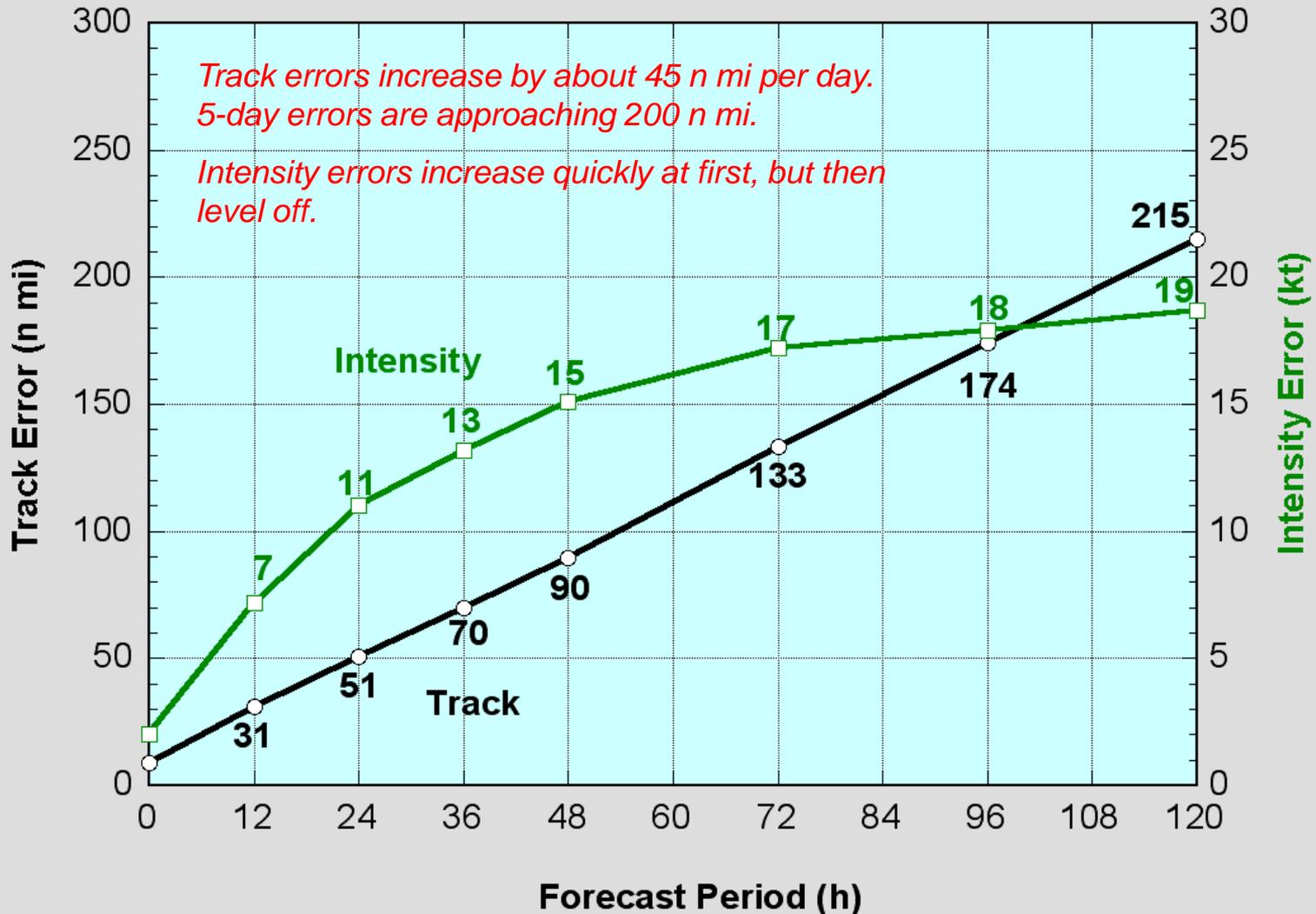
Track: 87 n mi (met)

Intensity: 13 kt (missed)

So what else is new?

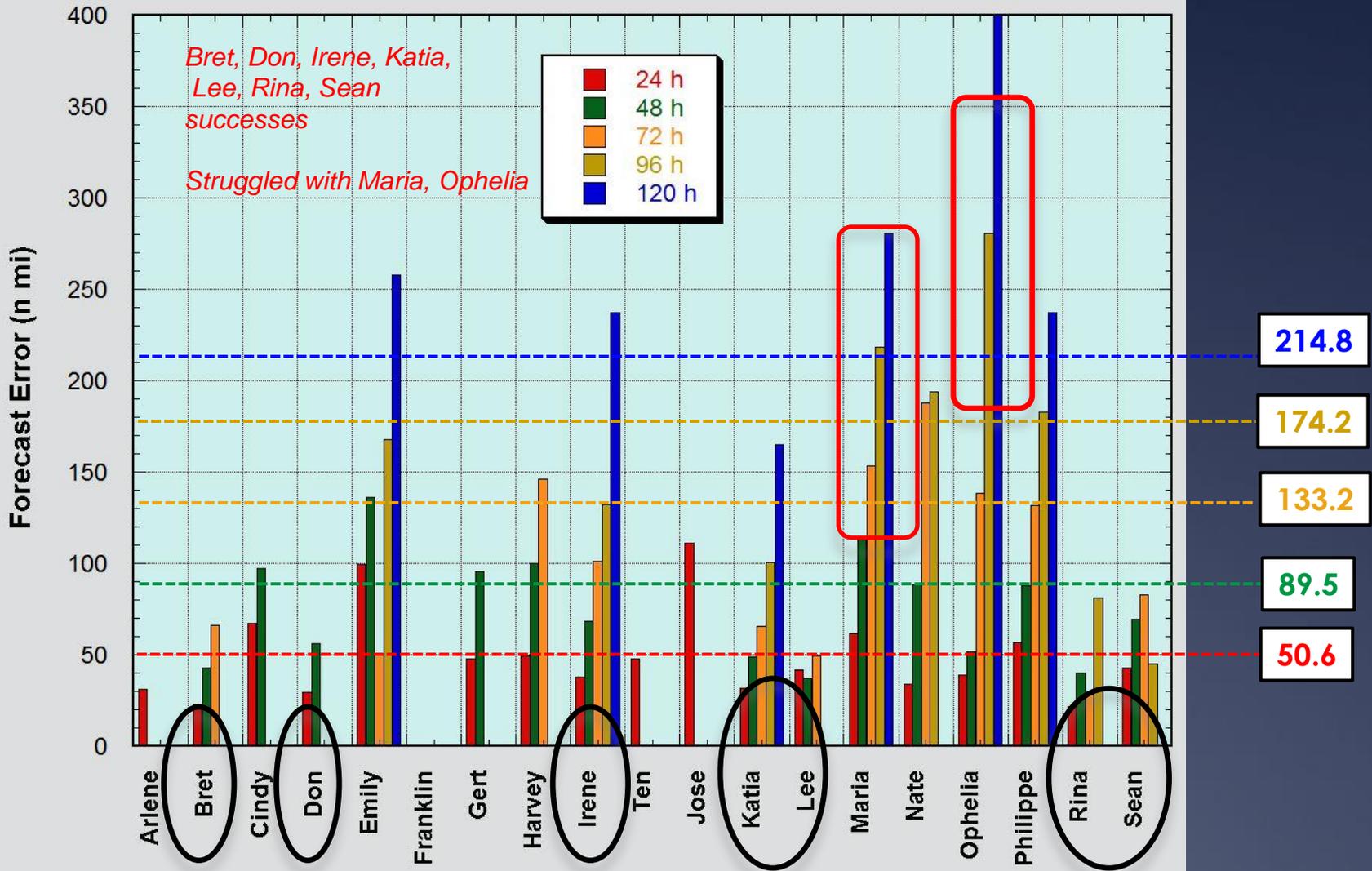
Atlantic 5-Year Mean Errors

**NHC Official Five-Year (2006-10)
Mean Errors - Atlantic Basin**



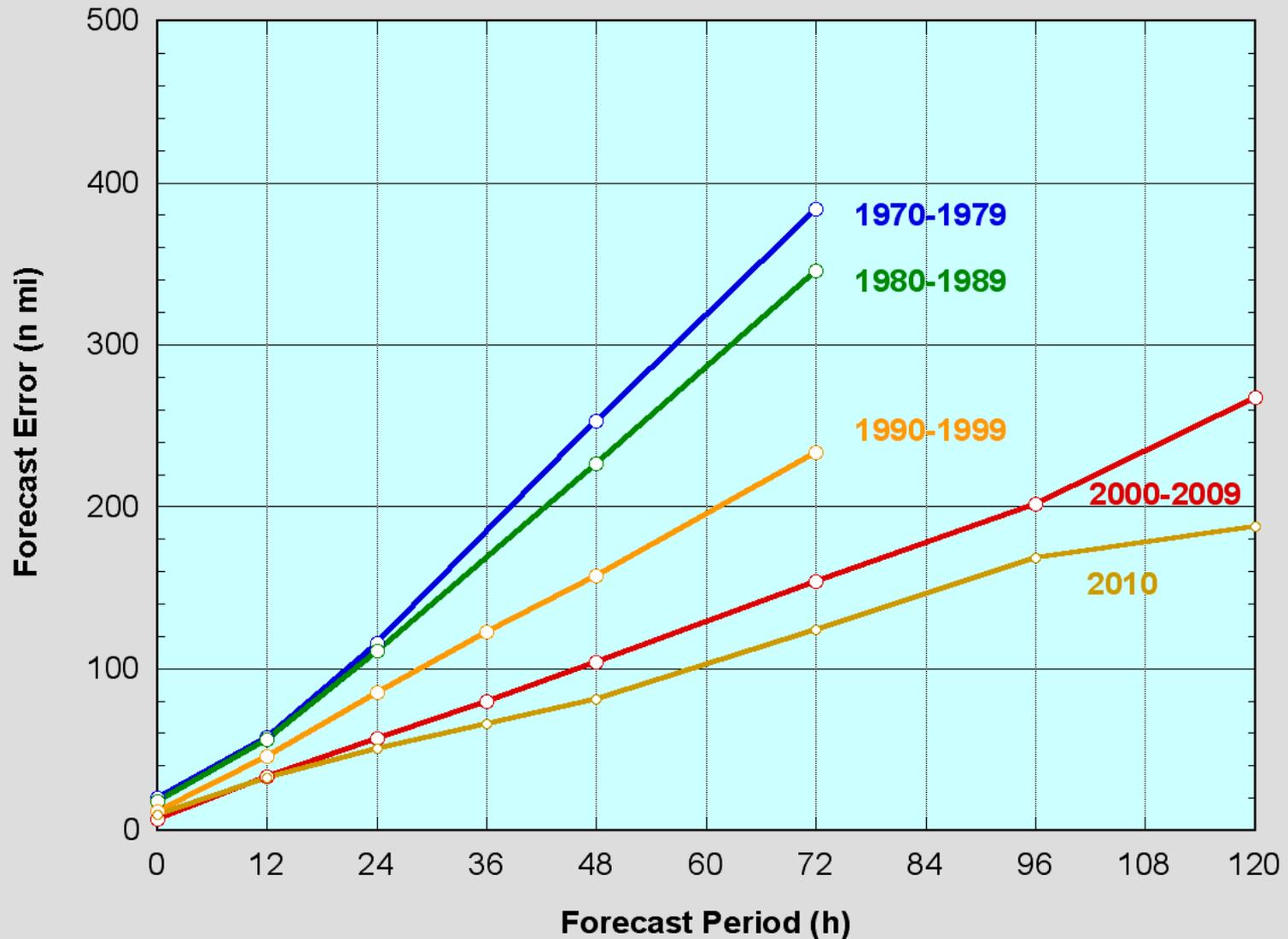
Atlantic Track Errors by Storm

2011 Official Track Errors By Storm - Atlantic

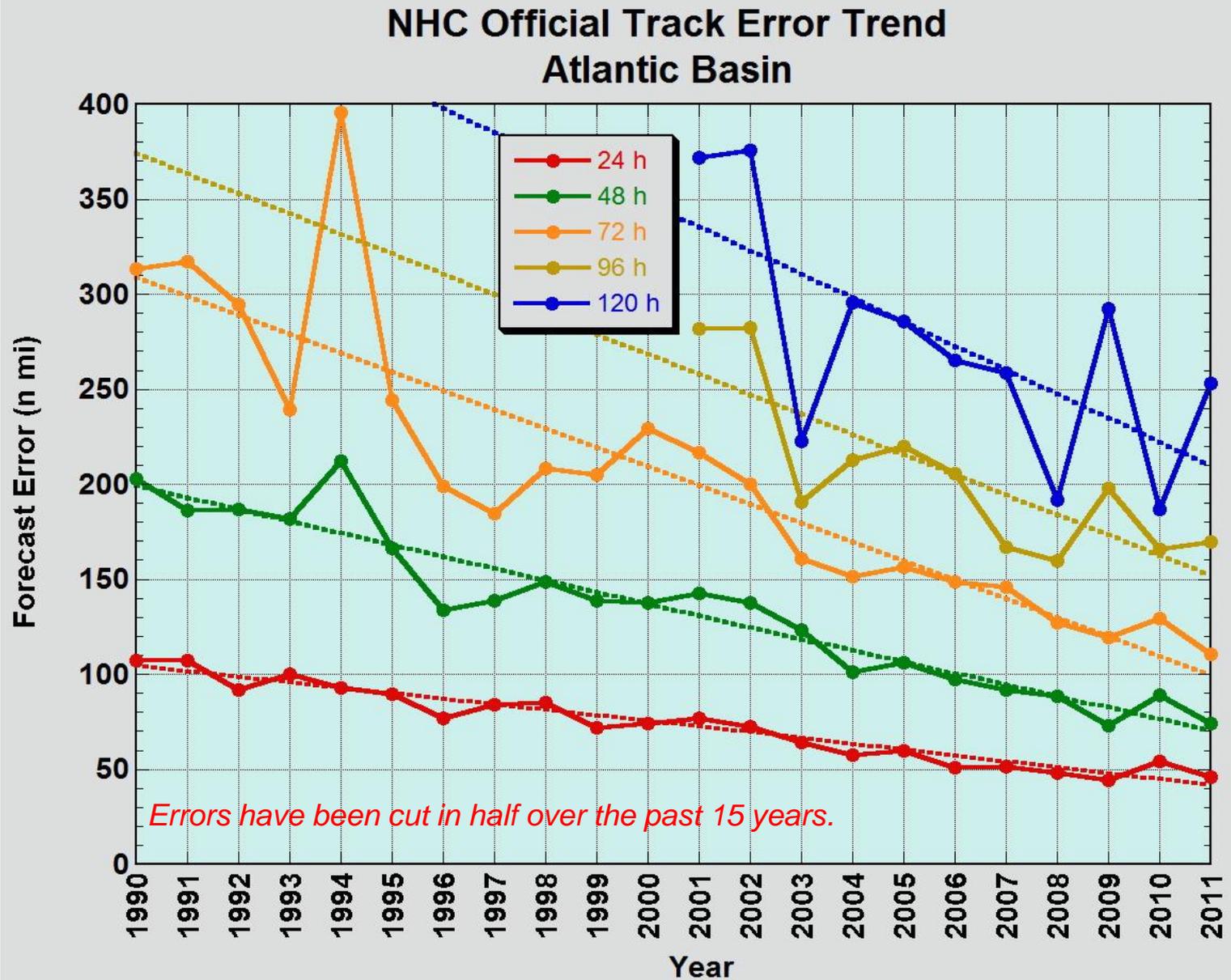


Atlantic Track Error Trends

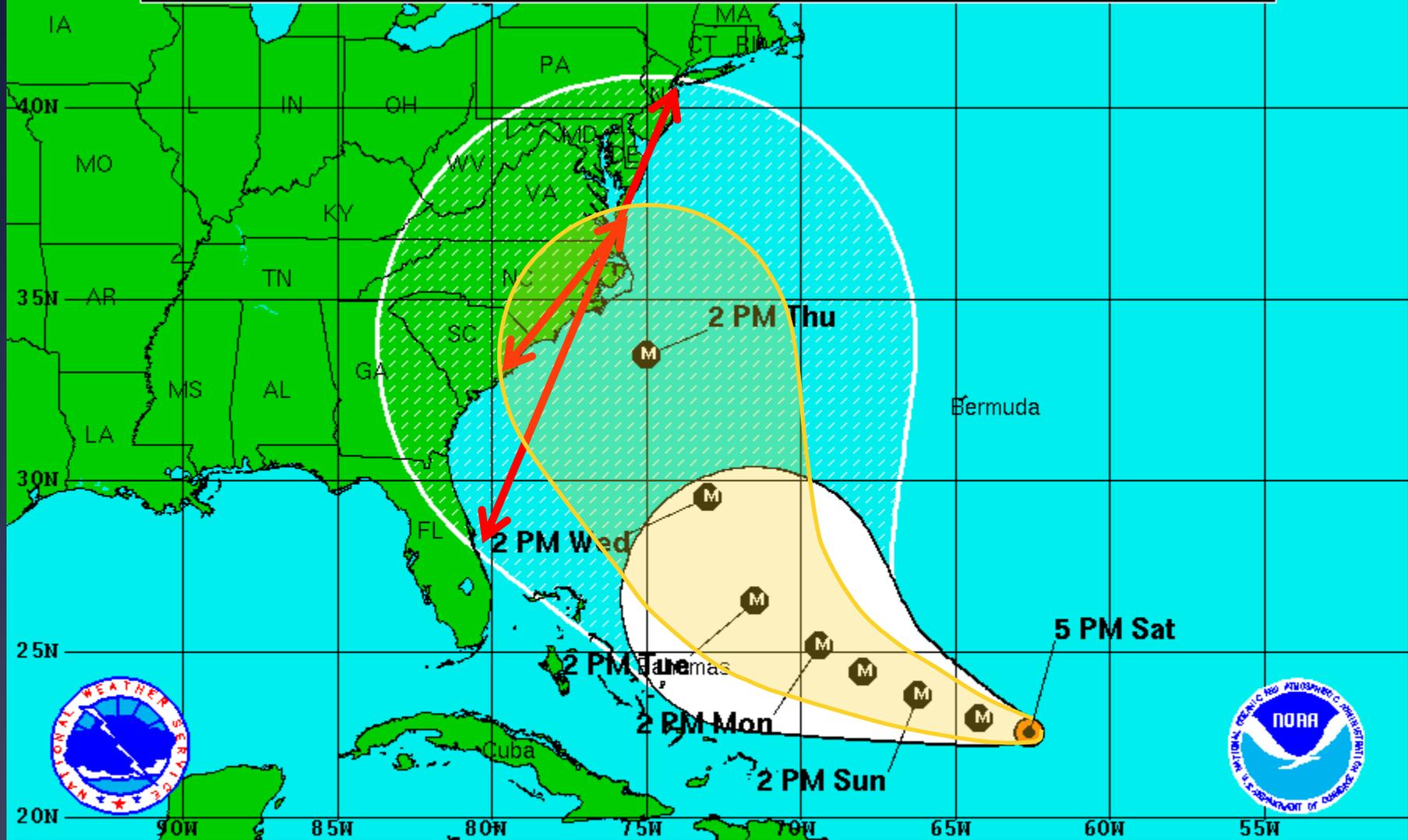
**NHC Official Average Track Errors
Atlantic Basin Tropical Storms and Hurricanes**



Atlantic Track Error Trends



Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.



Hurricane Isabel
 Saturday September 13, 2003
 5 PM EDT Advisory 31
 NWS TPC/National Hurricane Center

Current Information: ●
 Center Location 22.6 N 62.6 W
 Max Sustained Wind 160 mph
 Movement WNW at 12 mph

Forecast Positions:
 ● Tropical Cyclone ○ Post-Tropical
 Sustained Winds: D < 39 mph
 S 39-73 mph H 74-110 mph M > 110mph

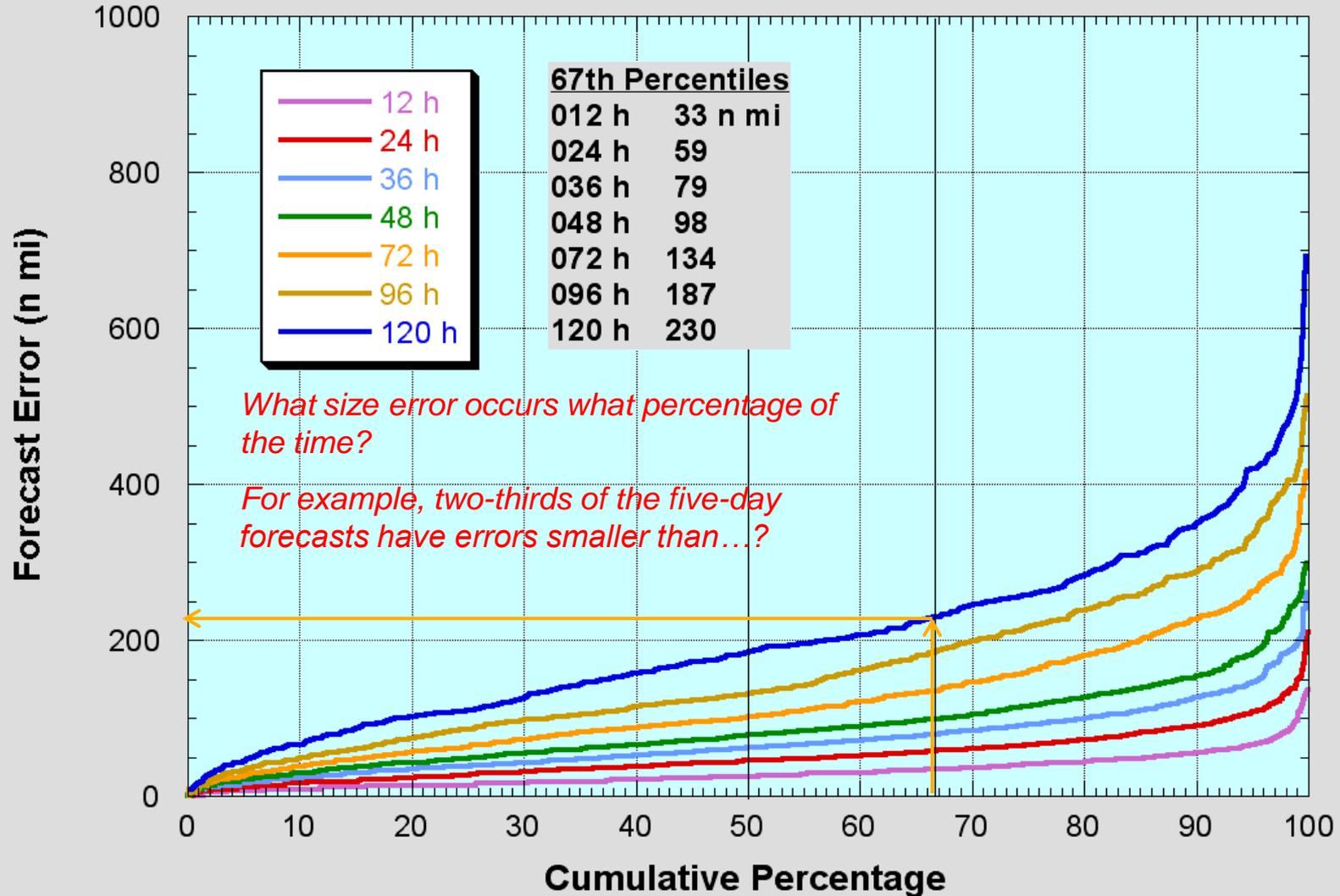
Potential Track Area:
 ▽ Day 1-3 ▽ Day 4-5

Watches:
 ■ Hurricane ■ Trop.Storm

Warnings:
 ■ Hurricane ■ Trop.Storm

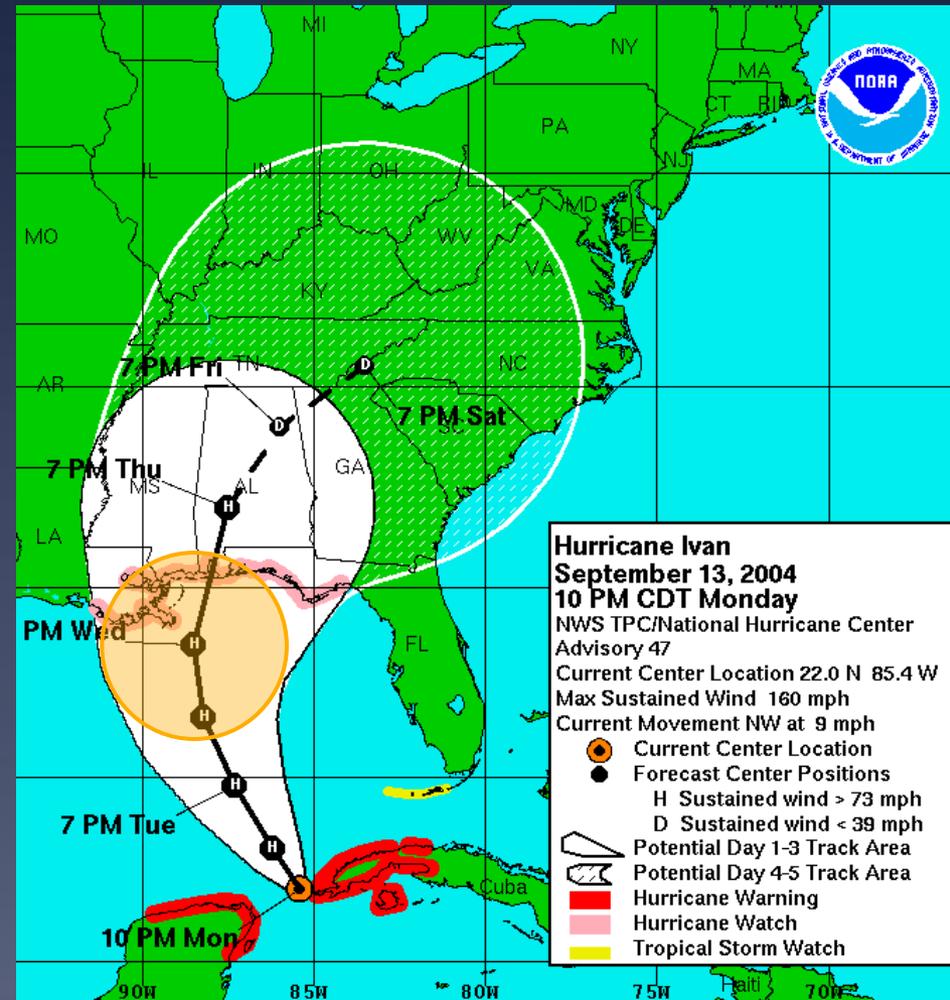
OFCL Error Distributions and Cone Radii

NHC Official Track Error Cumulative Distribution Eastern North Pacific Basin Tropical Cyclones 2006-10



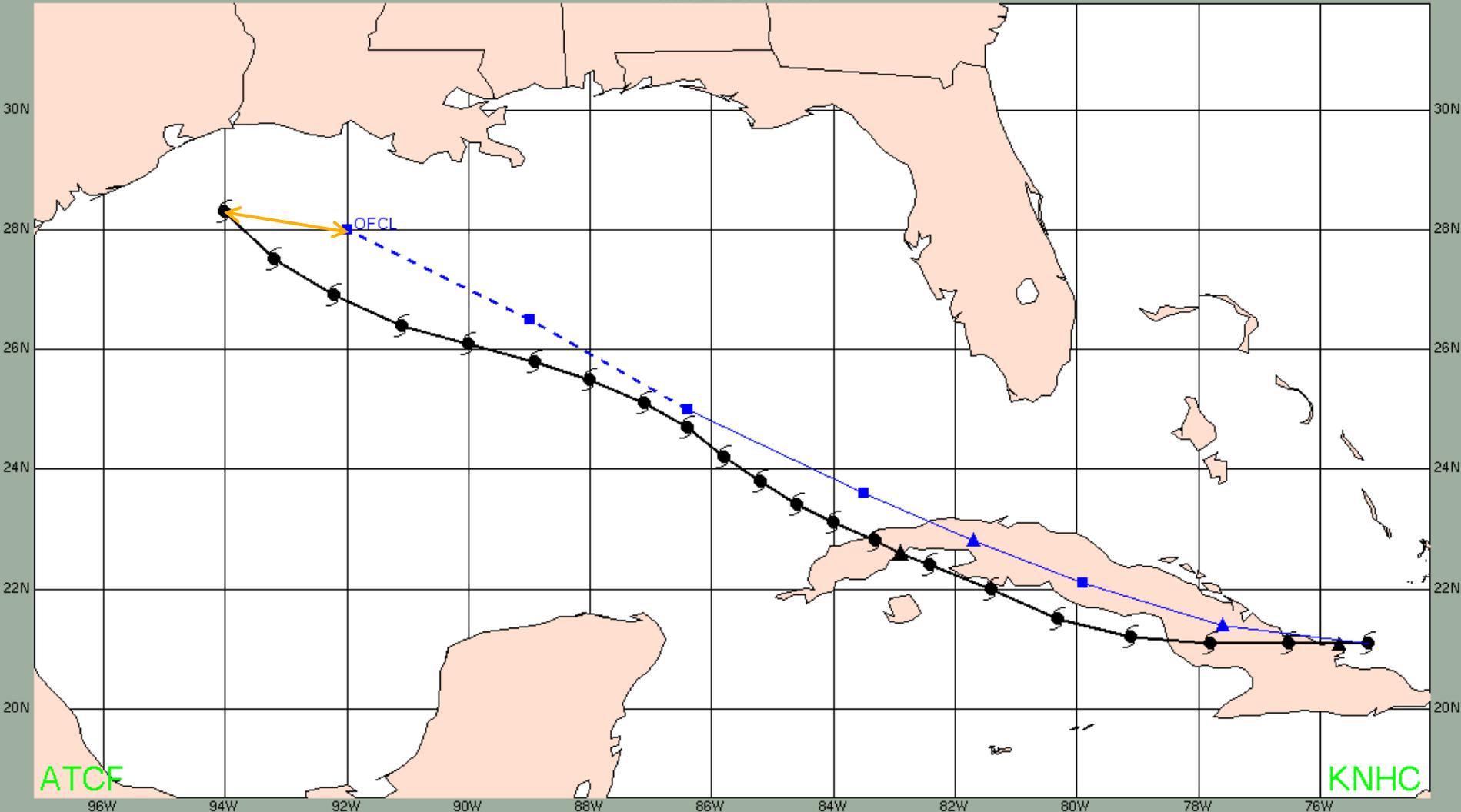
NHC Forecast Cone

- * Represents the probable track of the center of the tropical cyclone.
- * Formed by connecting circles centered on each forecast point (at 12, 24, 36 h, etc.)
- * Size of the circles determined so that, say, the actual storm position at 48 h will be within the 48-h circle 67% of the time.

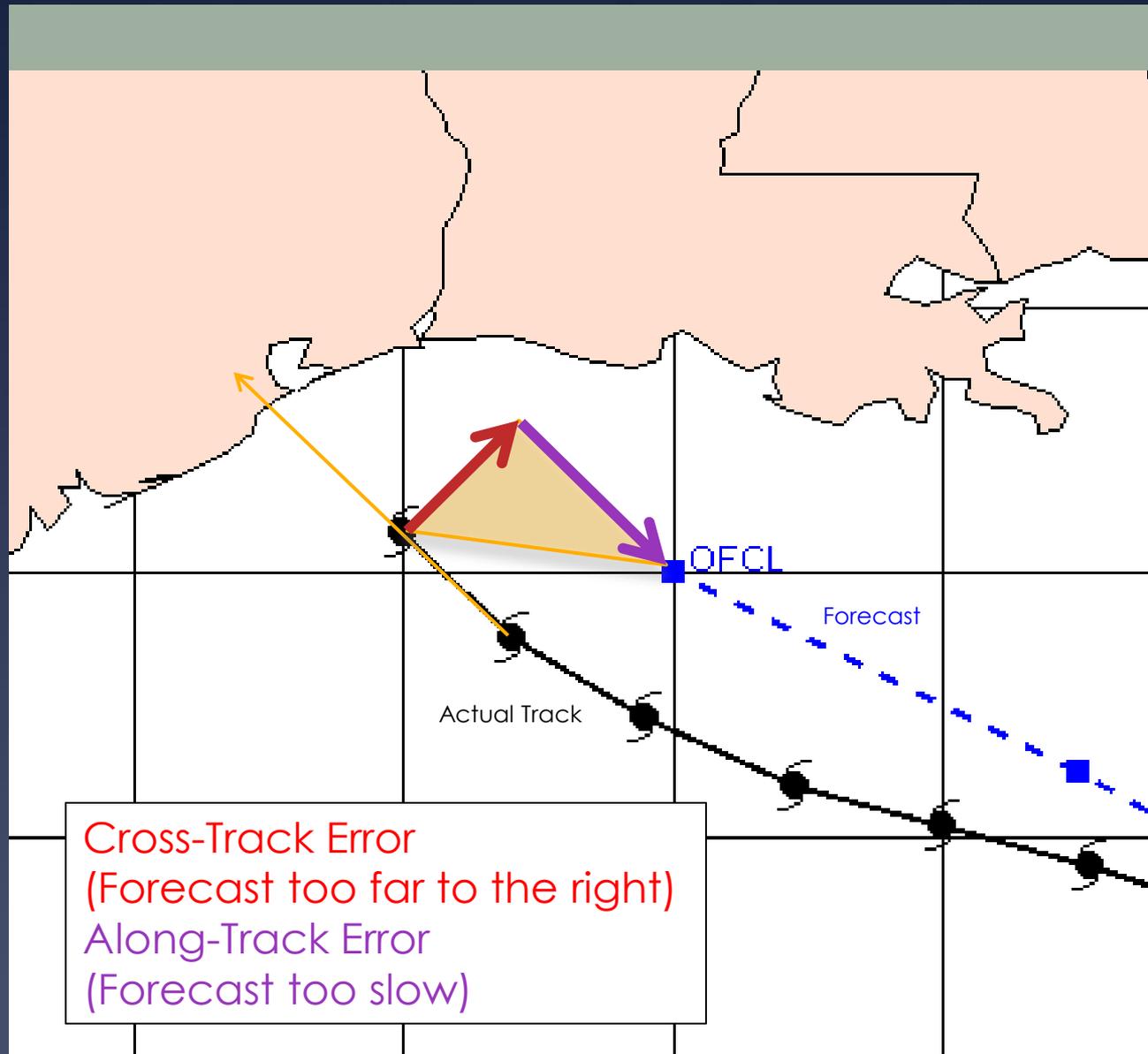


Along- and Cross-Track Errors (Timing vs. Location)

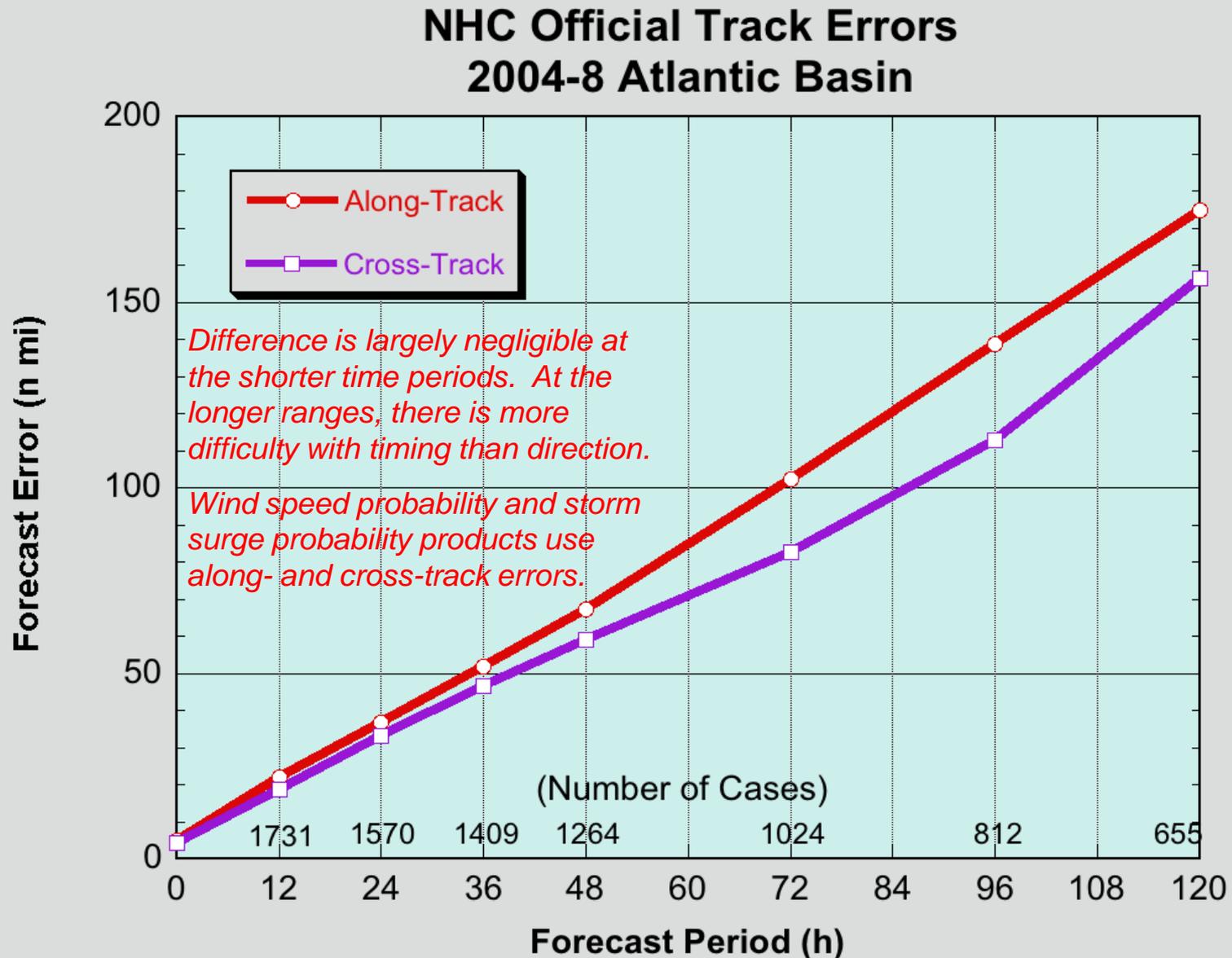
092008 - IKE 2008090800



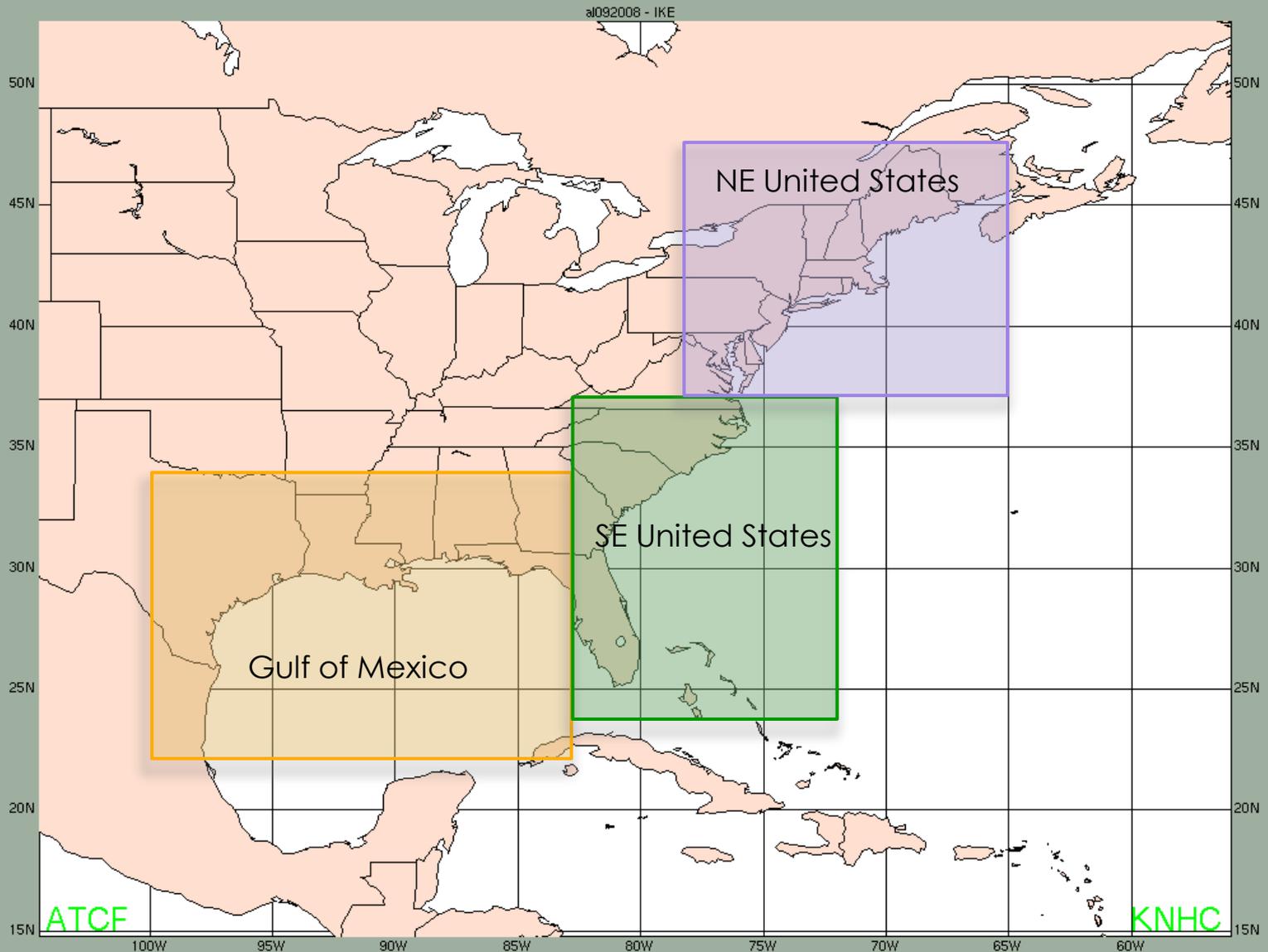
Along- and Cross-Track Errors



Along- and Cross-Track Errors



Geographical Domains

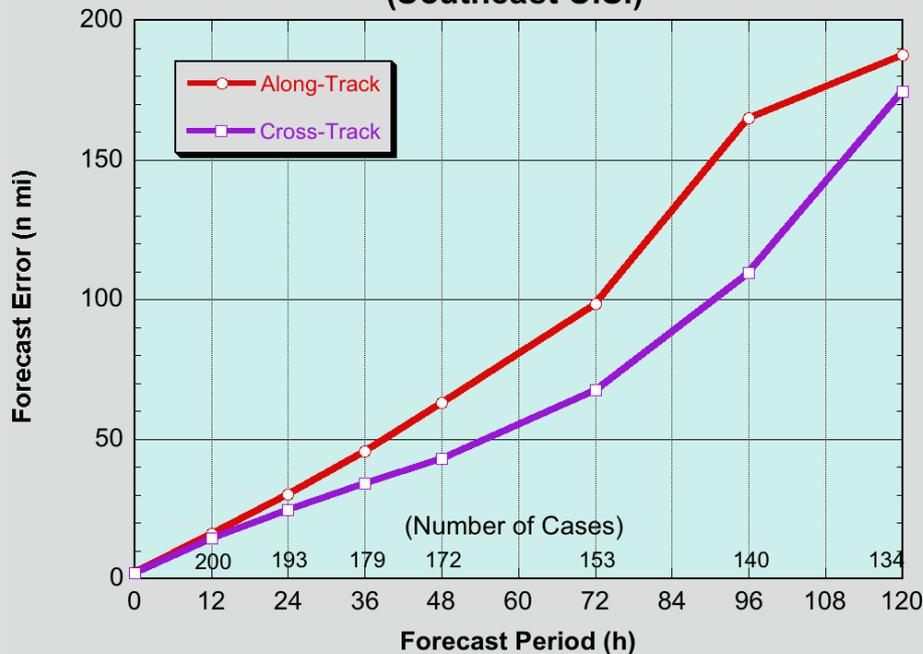


Southeast United States

Along/Cross Errors

Along/Cross Biases

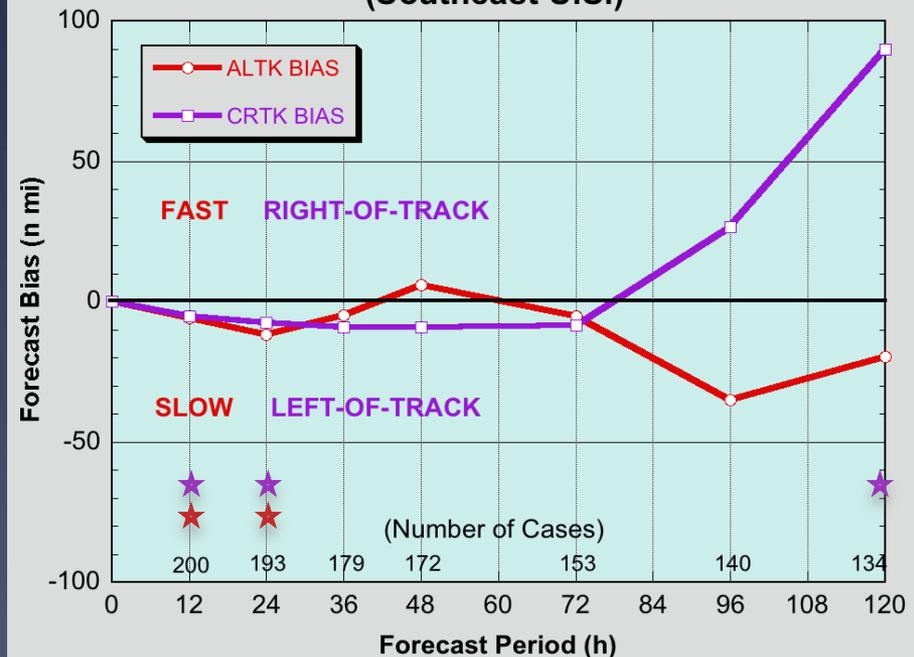
NHC Official Track Errors 2004-8
Forecasts Verifying from 24-37N, 72-83W
(Southeast U.S.)



In this region, cross-track errors are significantly smaller than the along-track errors.

Mean forward speed = 9 kt.

NHC Official Track Errors 2004-8
Forecasts Verifying from 24-37N, 72-83W
(Southeast U.S.)

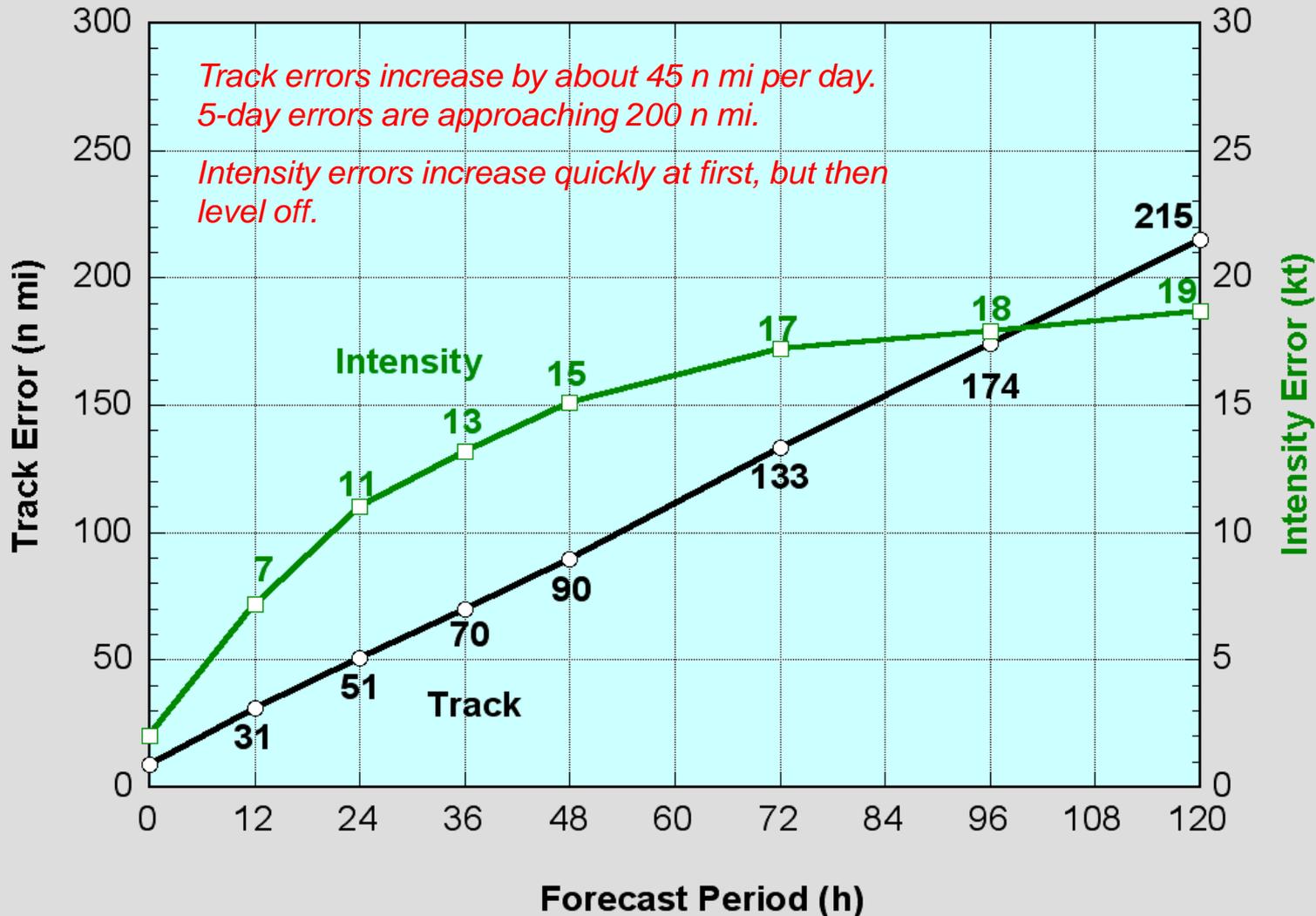


Biases are minimal through Day 3. Interesting rightward bias develops by Day 5.

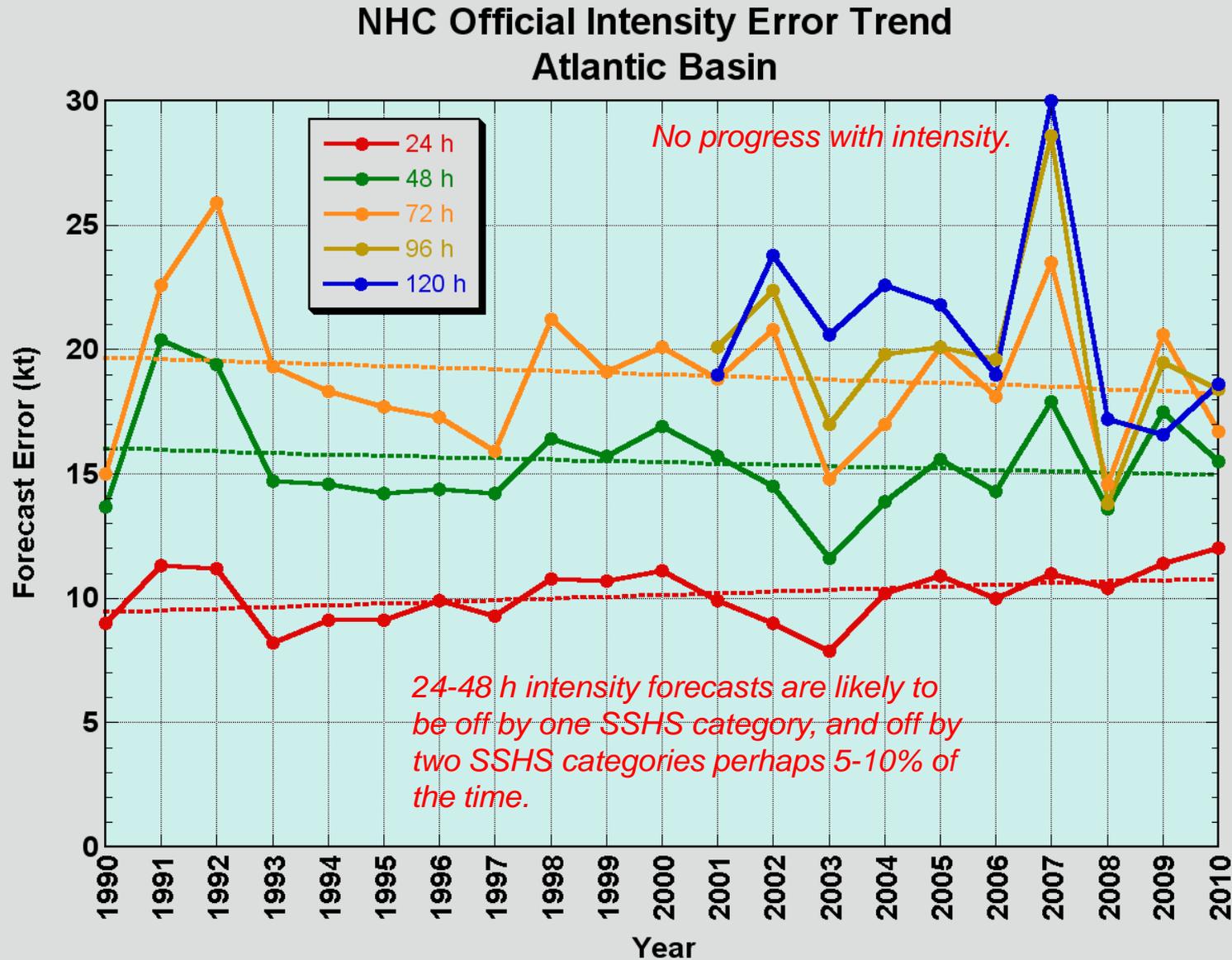
★ = Statistically significant biases (95%)

Atlantic 5-Year Mean Errors

NHC Official Five-Year (2006-10)
Mean Errors - Atlantic Basin

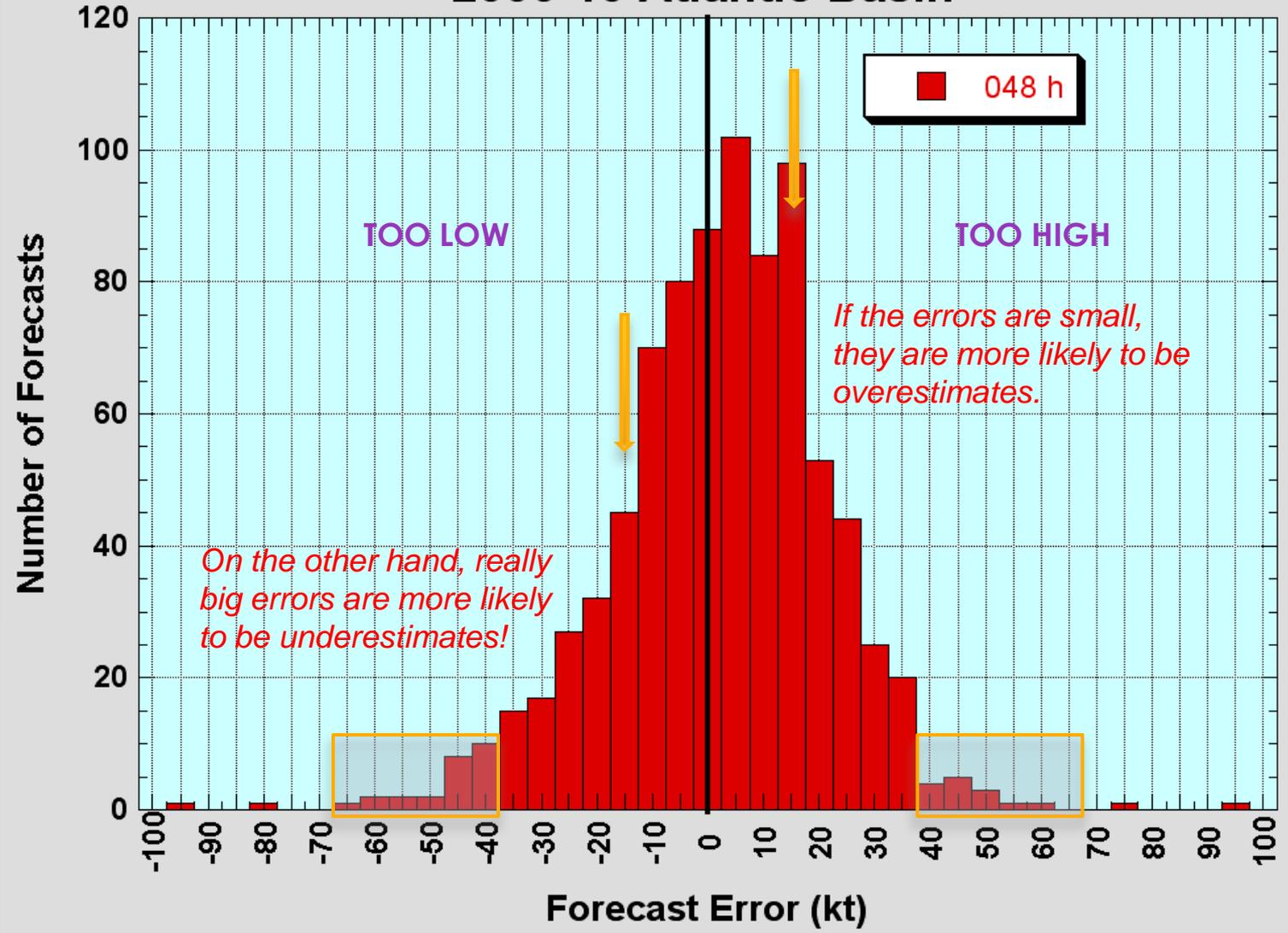


Atlantic Intensity Error Trends



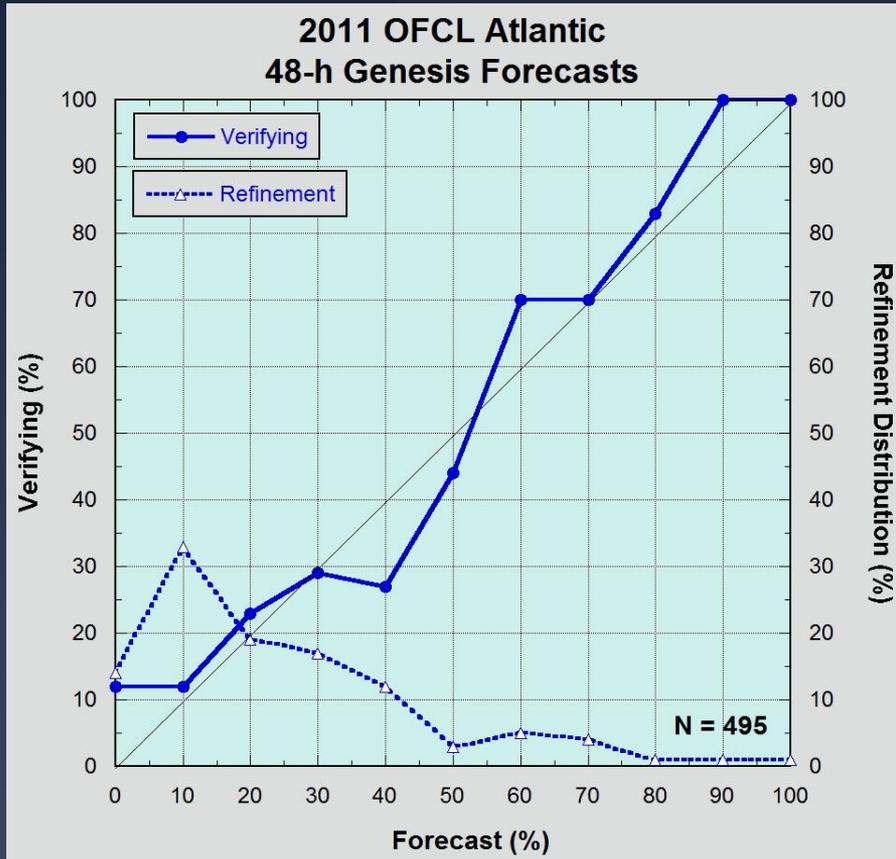
Intensity Error Distribution

NHC Official Intensity Forecasts 2006-10 Atlantic Basin

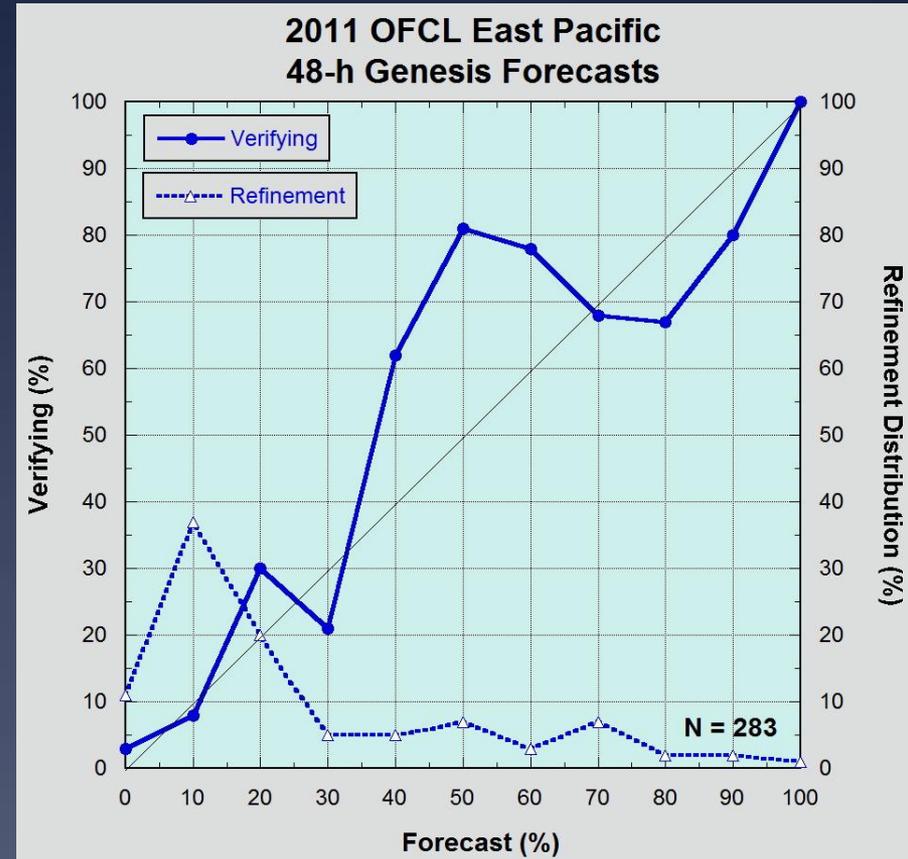


2011 Genesis Forecast Verification

Atlantic



East Pacific



Atlantic forecasts well calibrated throughout. Much improved this year.

Some progress made in reducing the east Pacific under-forecast bias.

Verification Web Page

National Hurricane Center Forecast Verification

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National Hurricane Center Forecast Verification

Updated 21 May 2008

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1. Introduction

NHC receives frequent inquiries on the accuracy and skill of its forecasts and of the computer models available to it. To help answer these questions, these verification web pages were established in March 2005. The development of this resource will be completed in stages; ultimately all available records dating back to the earliest NHC forecasts in 1954 will be included. A digital database of NHC official track forecast errors has been constructed for the period 1970 to the present, and it is this period that is presented initially here. A digital database of intensity errors has been constructed dating back to 1990. These pages will be updated as extensions to the database are completed. Questions on NHC forecast verifications may be directed to James.Franklin@noaa.gov.

Note: A number of the documents included here are in PDF format. You may need to install the free [Acrobat® Reader](#) to view and print these documents.

Next: [Forecast verification procedures](#)

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National Hurricane Center
Tropical Prediction Center
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Summary

- * Atlantic basin track errors increase at a rate of 45 n mi per day of forecast. Forecasts have been steadily getting better over the past two decades (and longer). Track errors have been cut in half over the past 15 years, and are likely to continue to decrease.
- * NHC uncertainty cone is made up of circles that enclose the actual storm position about two-thirds of the time.
- * Actual errors aren't quite circular about the forecast point. Along-track (timing) errors tend to be larger than the cross-track (directional) errors, especially along the U.S. east coast.

Summary

- * Near the coast during the watch/warning phase, official forecasts biases are generally small through 72 h
- * Significant rightward (northward) bias on days 4-5, however.
- * Intensity errors 24-48 h in advance will regularly be in error by one Saffir-Simpson category. Intensity errors begin to level off around 72 h. There has been no appreciable change in intensity forecast error over the past two decades.
- * There are some promising new models and approaches (HFIP) that we hope will improve intensity forecasts over the next 5 years.