

# Have We Reached the Limits of Predictability for Tropical Cyclone Track Forecasting?

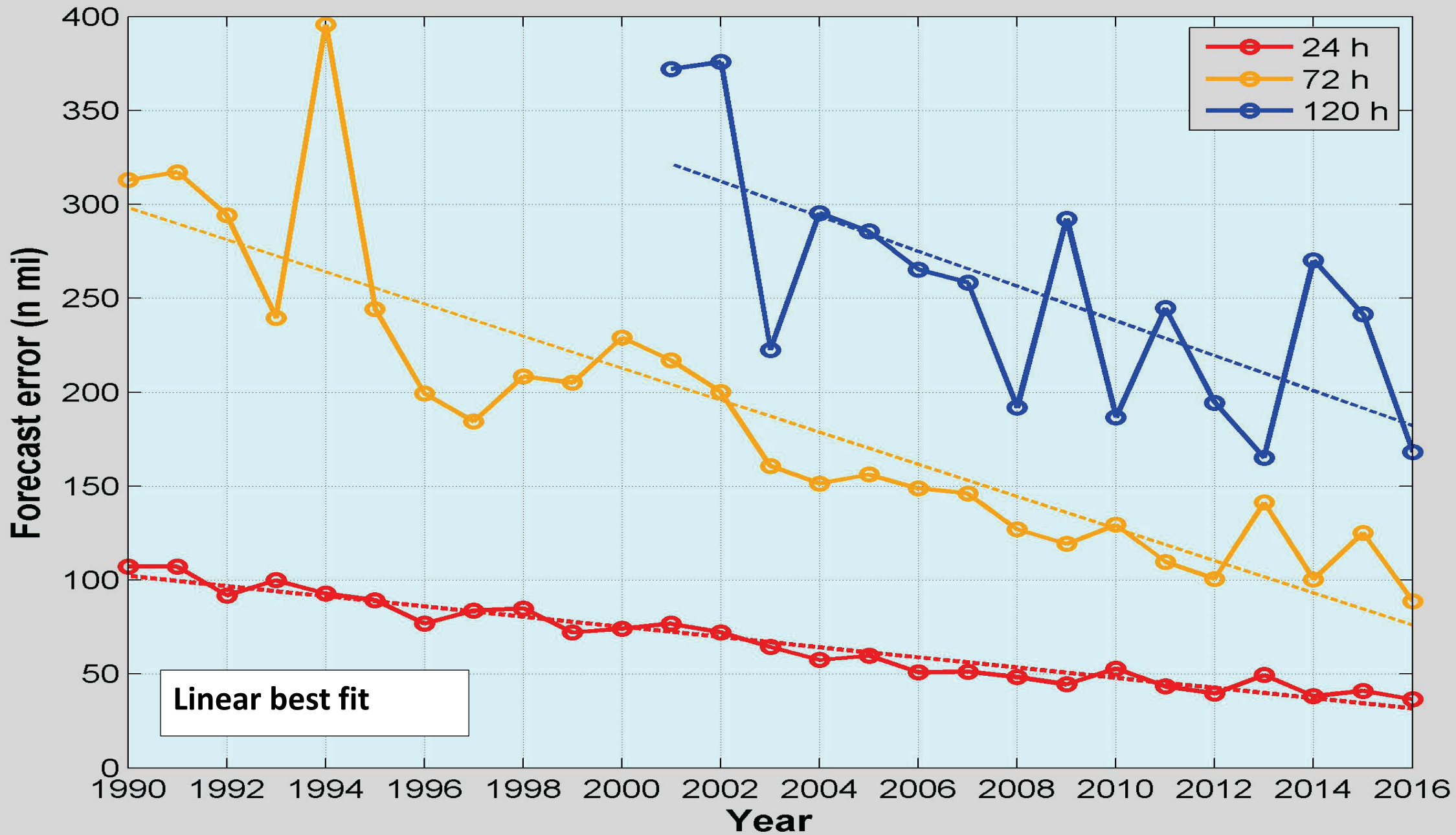
Christopher W. Landsea

and

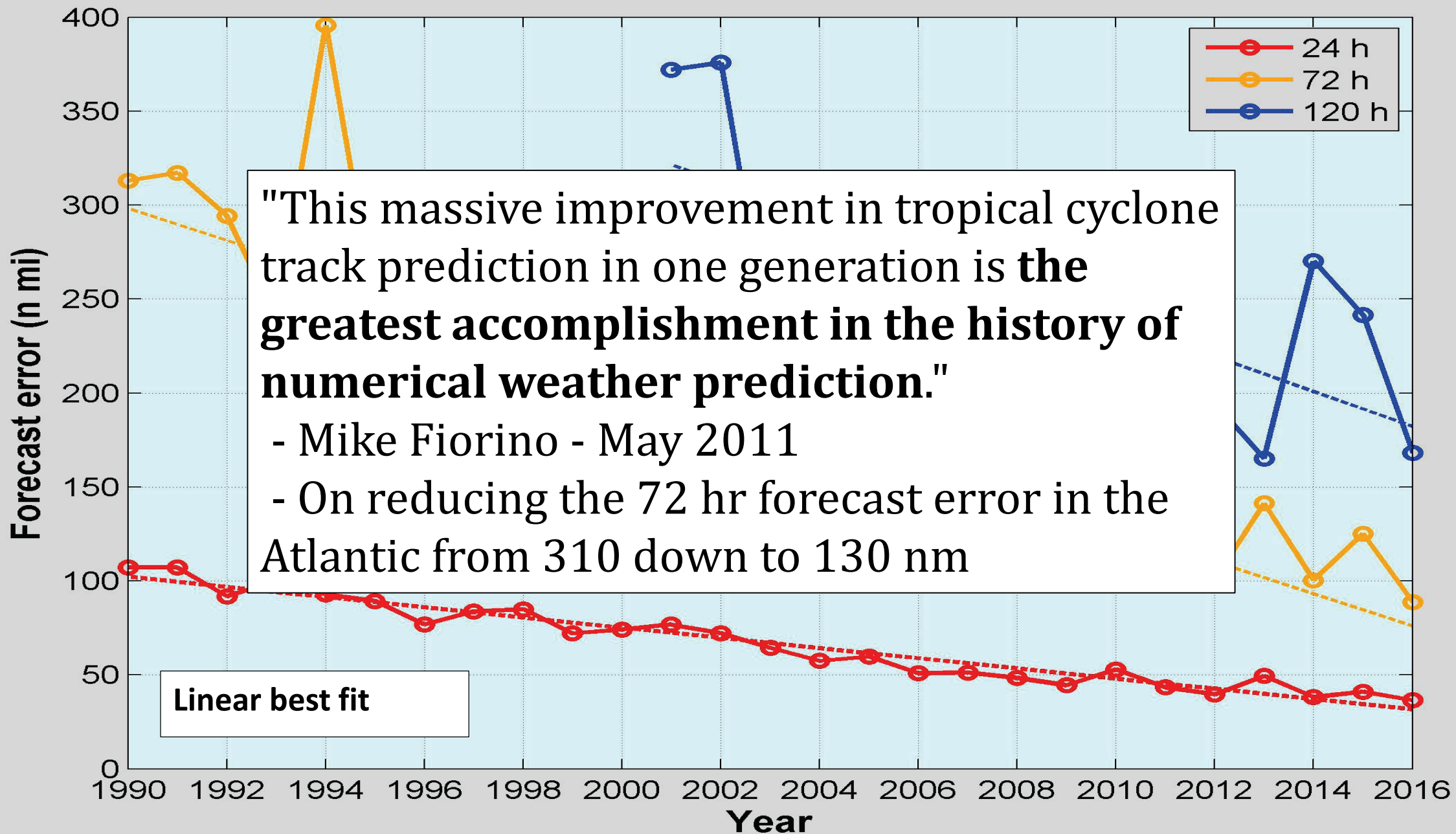
John P. Cangialosi

*NOAA/NWS/NCEP/National Hurricane Center, Miami, Florida, USA*

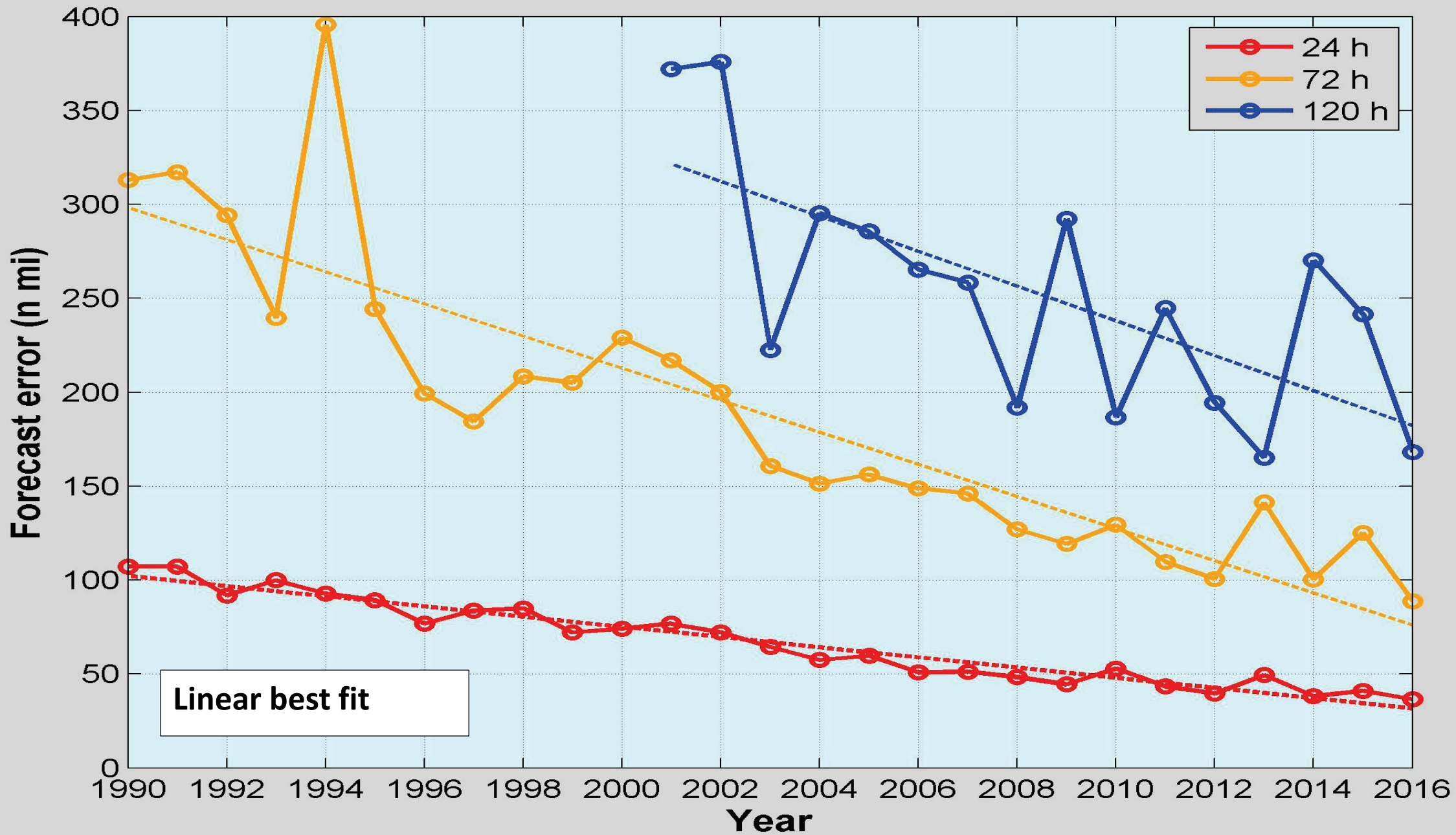
# NHC Official Track Error Trend Atlantic Basin



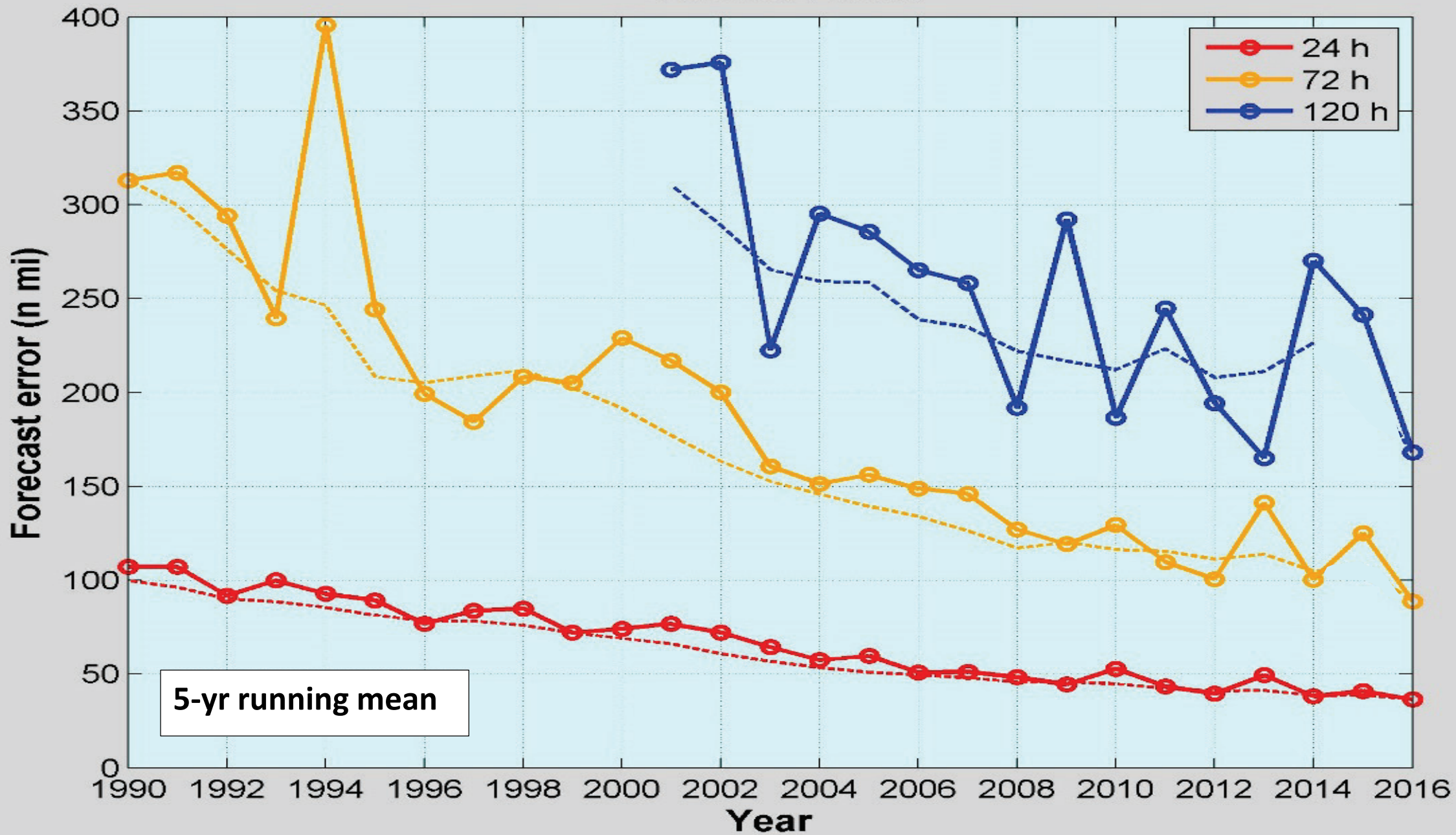
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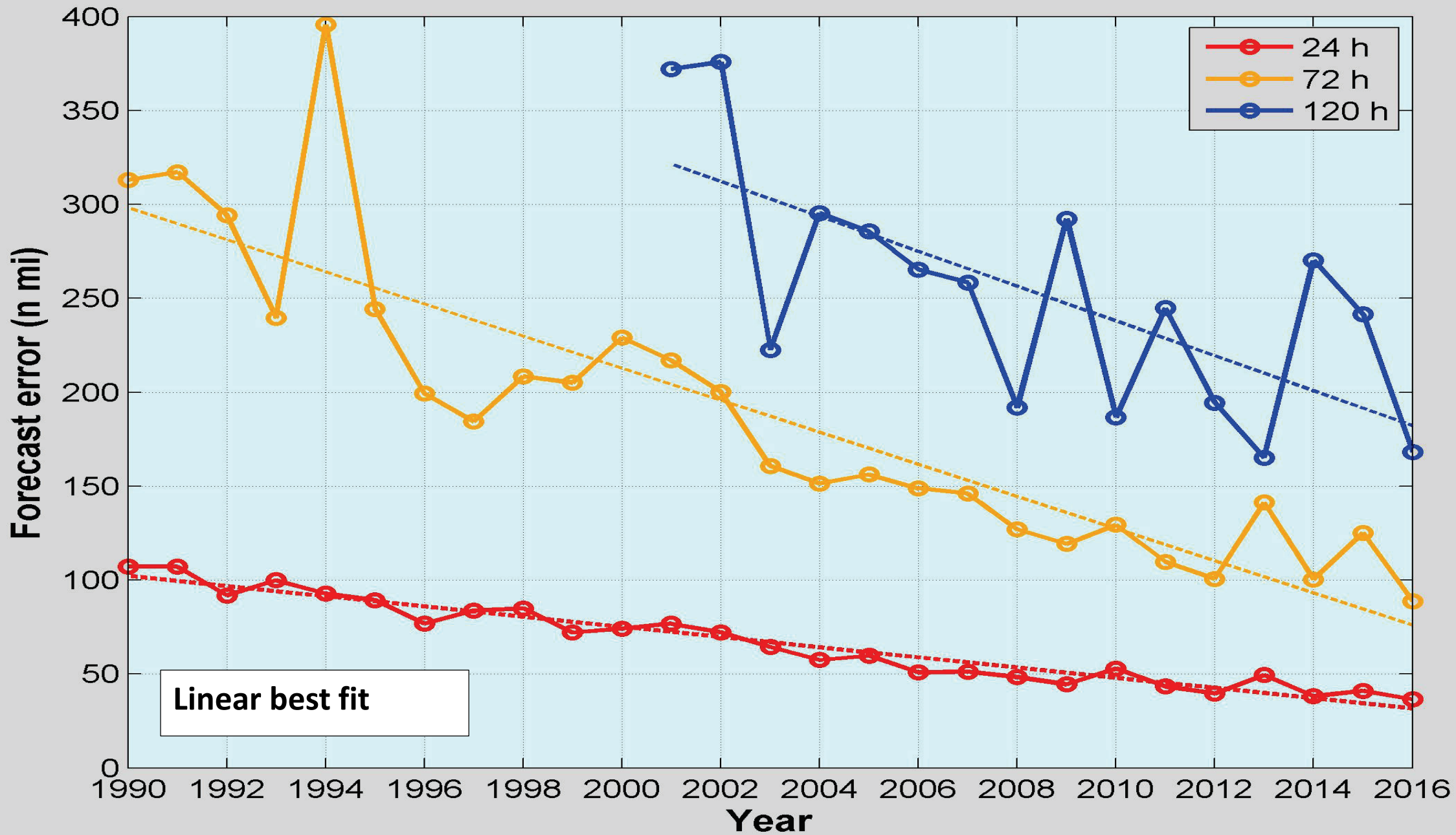
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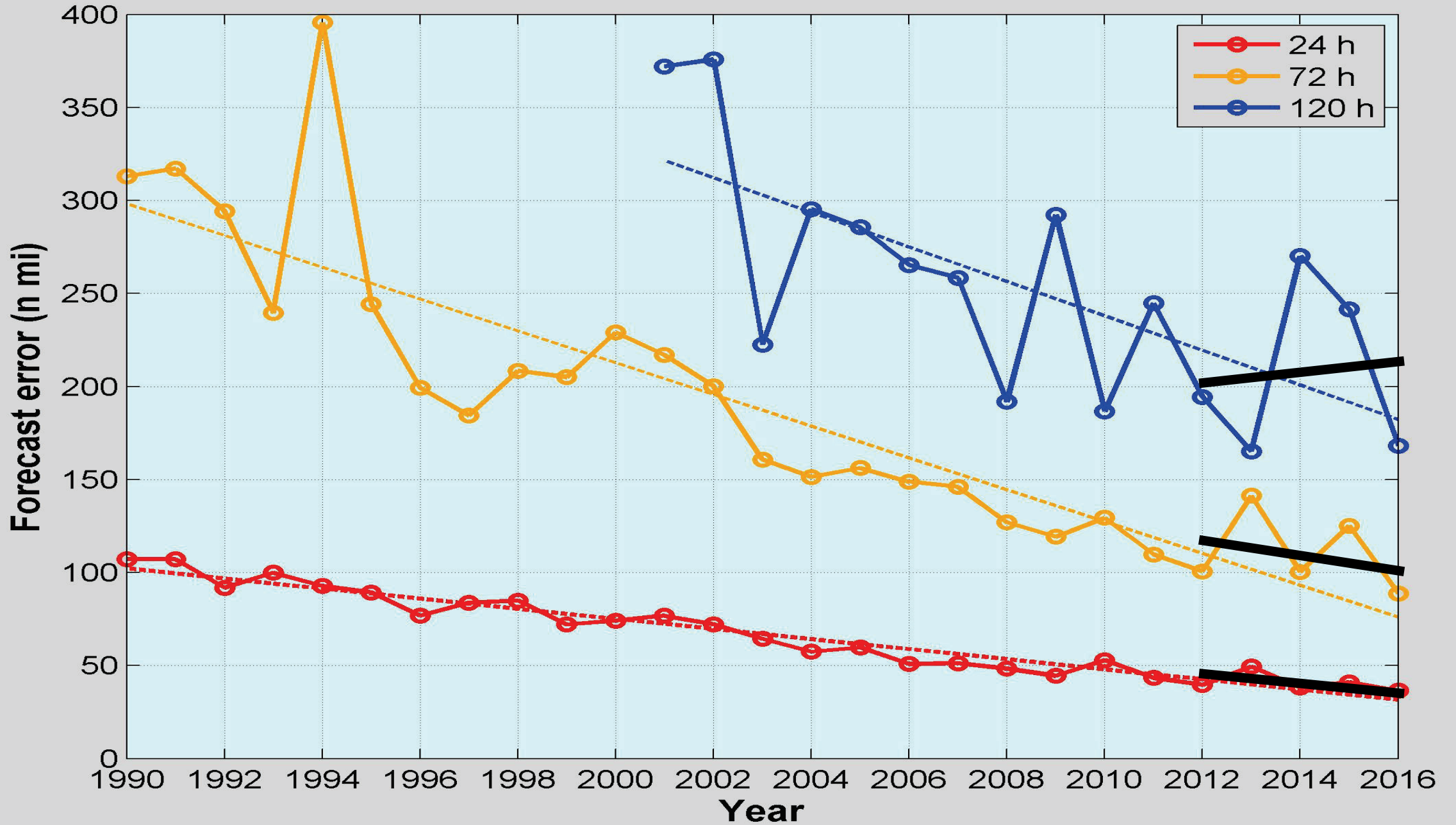
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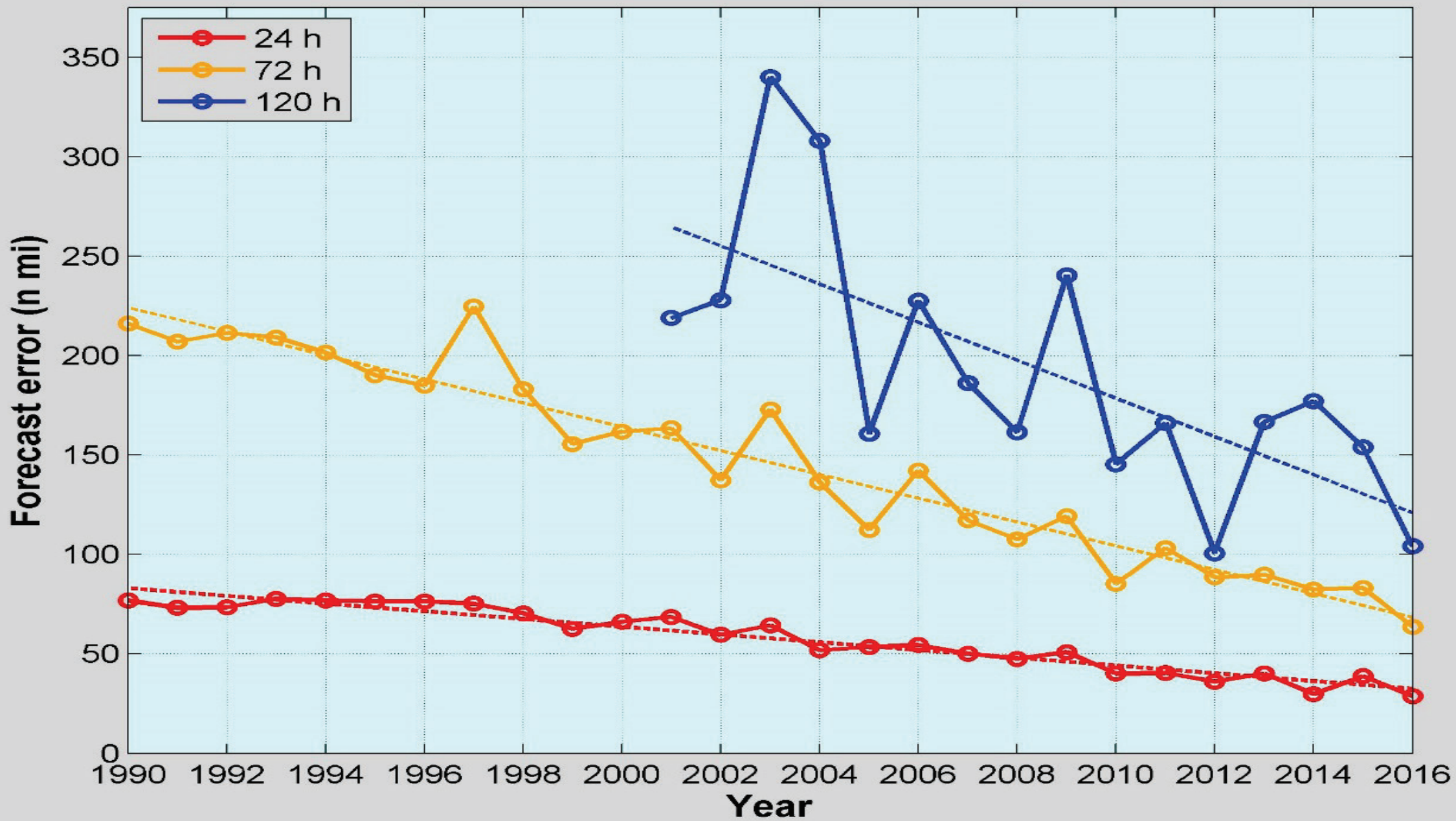
# Latest five year (2012-2016) trends – Atlantic Basin

## *Atlantic Errors*

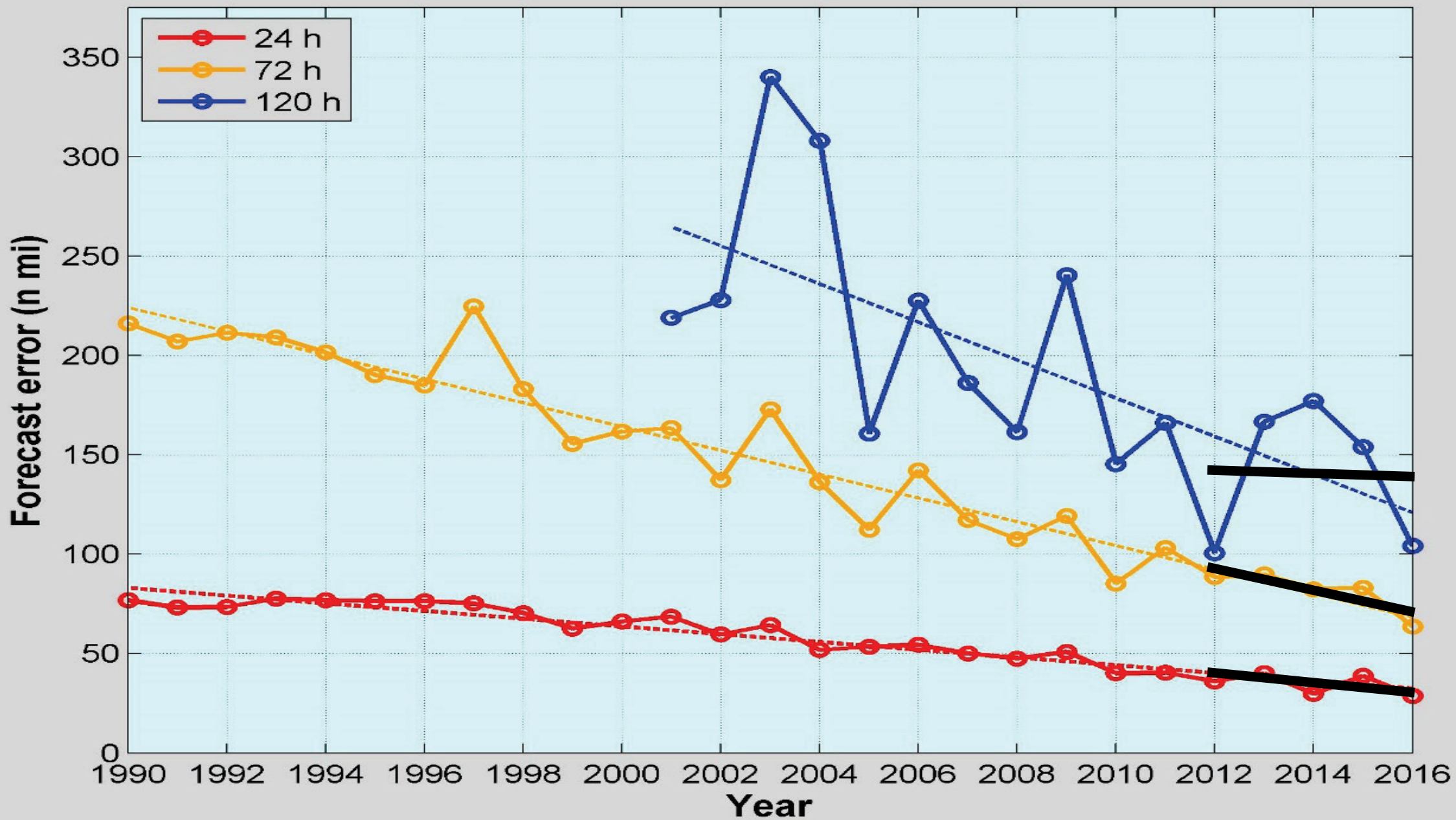
- 24 hr – Flatter than 19 of previous 23 5-yr periods
- 72 hr – Flatter than 16 of 23
- 120 hr – Flatter than 9 of 12



# NHC Official Track Error Trend Eastern North Pacific Basin Tropical Cyclones



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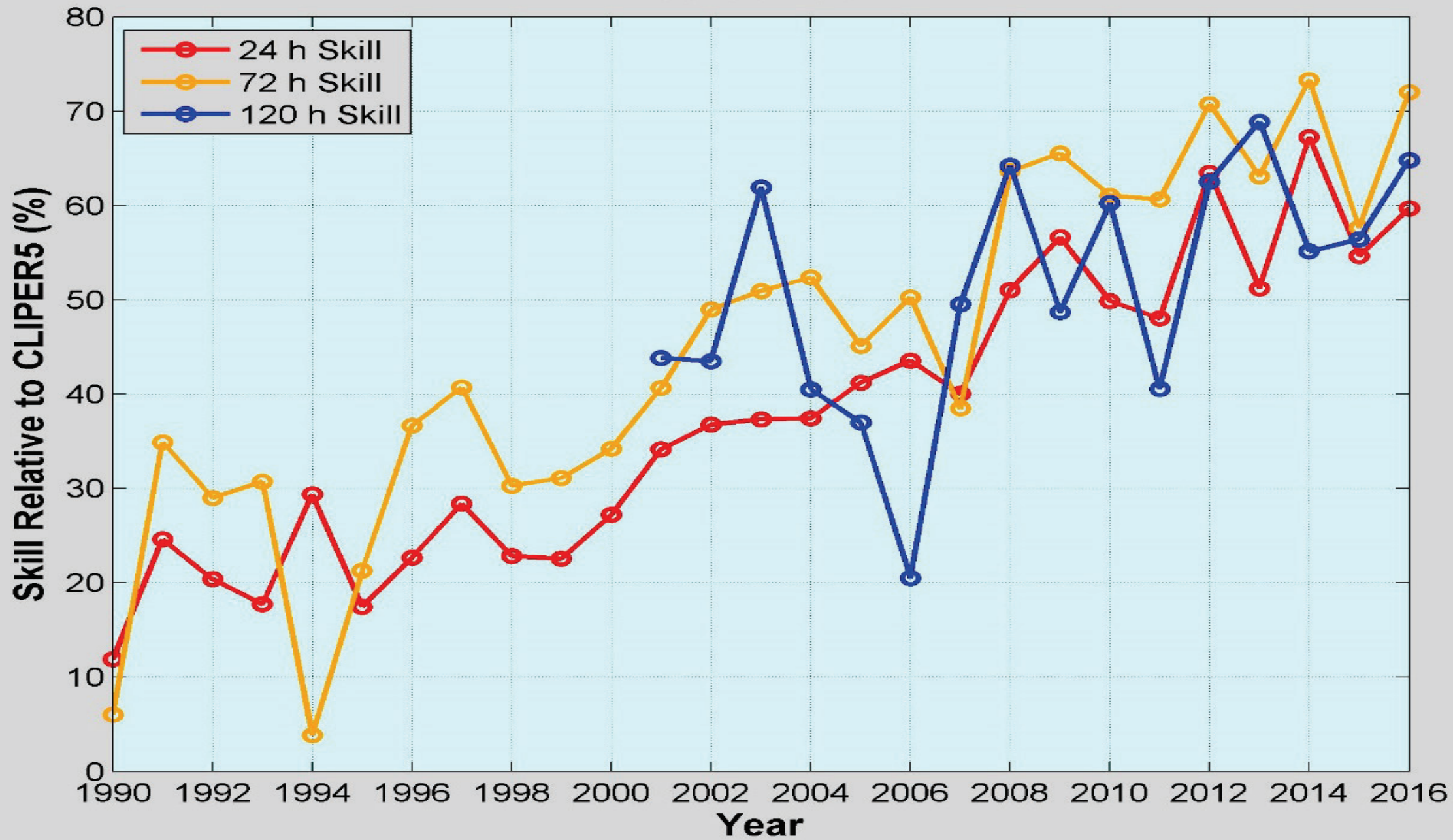


# Latest five year (2012-2016) trends – Northeast Pacific Basin

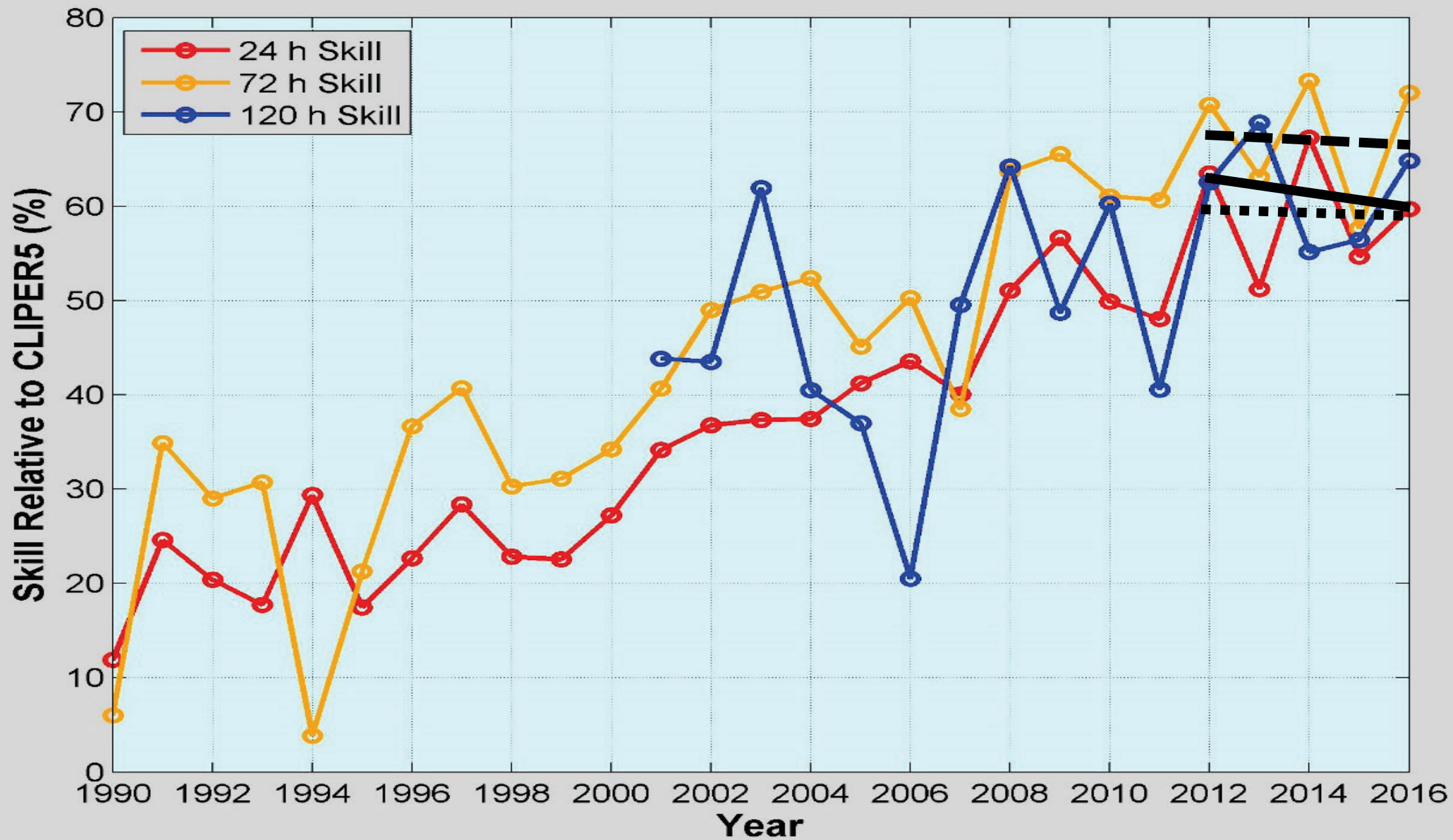
## *Northeast Pacific Errors*

- 24 hr – Flatter than 13 of previous 23 5-yr periods
- 72 hr – Flatter than 9 of 23
- 120 hr – Flatter than 9 of 12

# NHC Official Track Skill Trend Atlantic Basin



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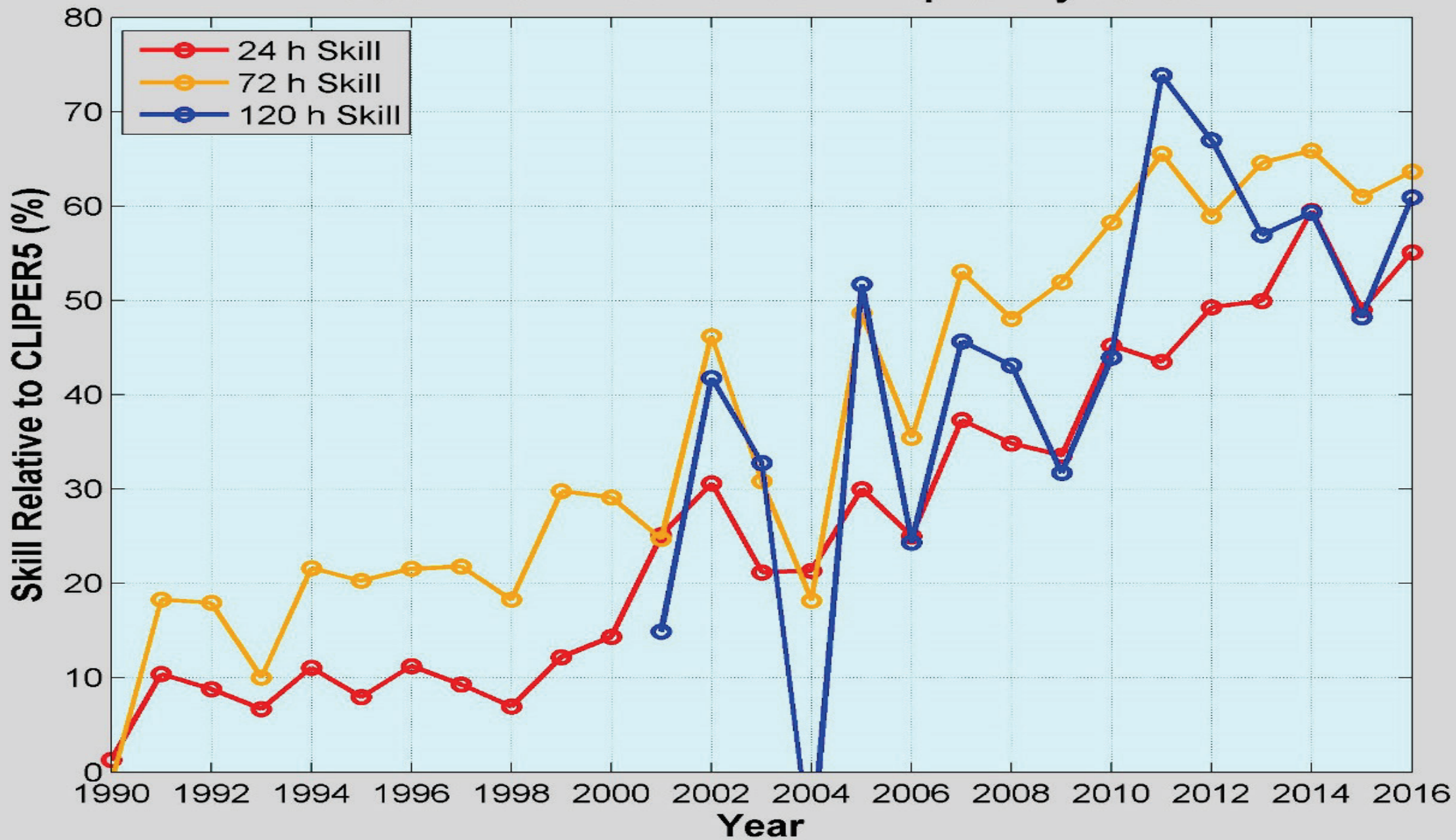


# Latest five year (2012-2016) trends – Atlantic Basin

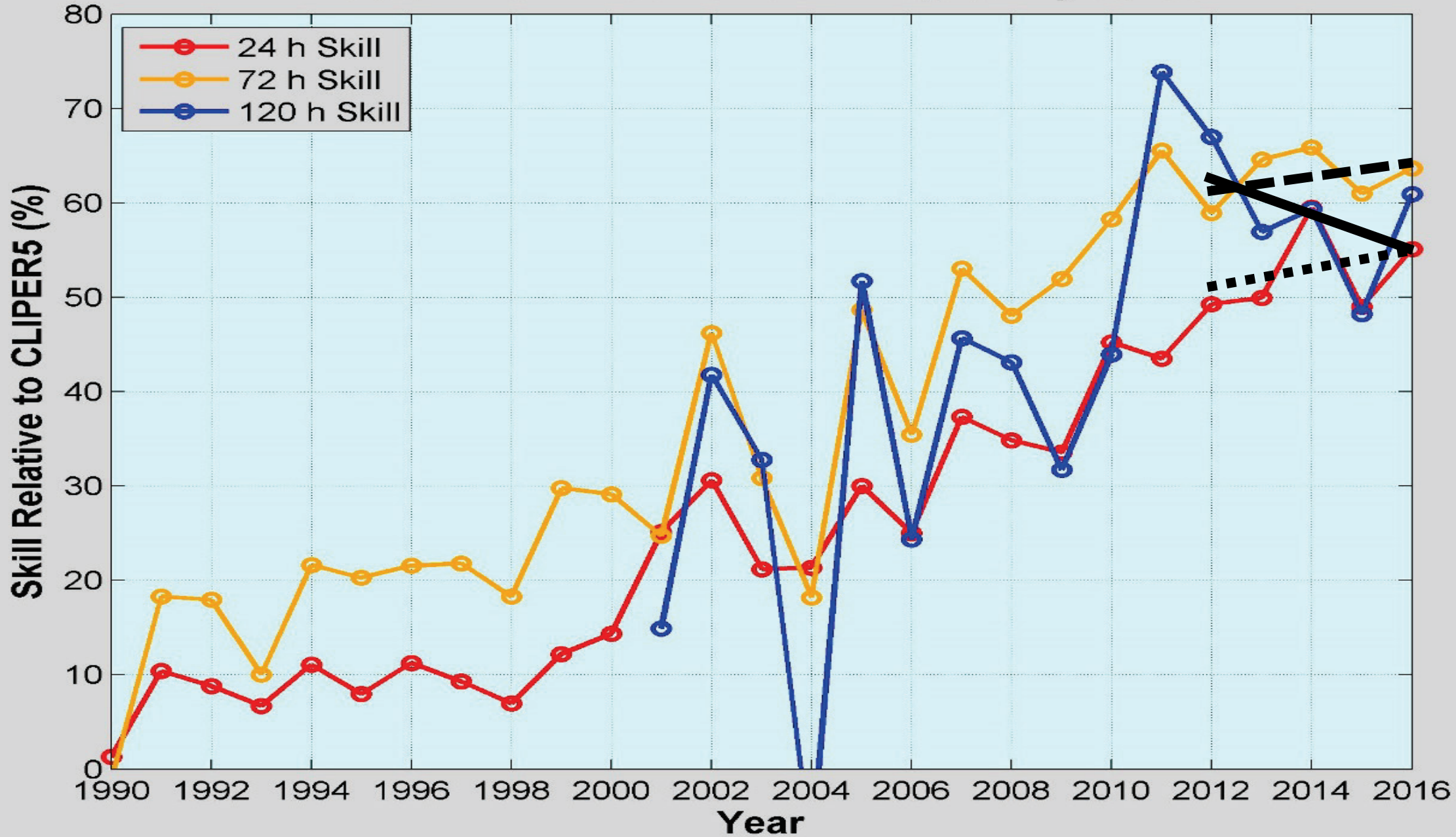
## *Atlantic Skill*

- 24 hr – Flatter than 22 of previous 23 5-yr periods
- 72 hr – Flatter than 17 of 23
- 120 hr – Flatter than 7 of 12

# NHC Official Track Skill Trend Eastern North Pacific Basin Tropical Cyclones



# NHC Official Track Skill Trend Eastern North Pacific Basin Tropical Cyclones





# Latest five year (2012-2016) trends – Northeast Pacific Basin

## *Northeast Pacific Skill*

- 24 hr – Flatter than 14 of previous 23 5-yr periods
- 72 hr – Flatter than 19 of 23
- 120 hr – Flatter than 10 of 12

# Theoretical Limits of Predictability

2.5 Day Timescale  
for Doubling of  
Errors  
- Aberson (1998)

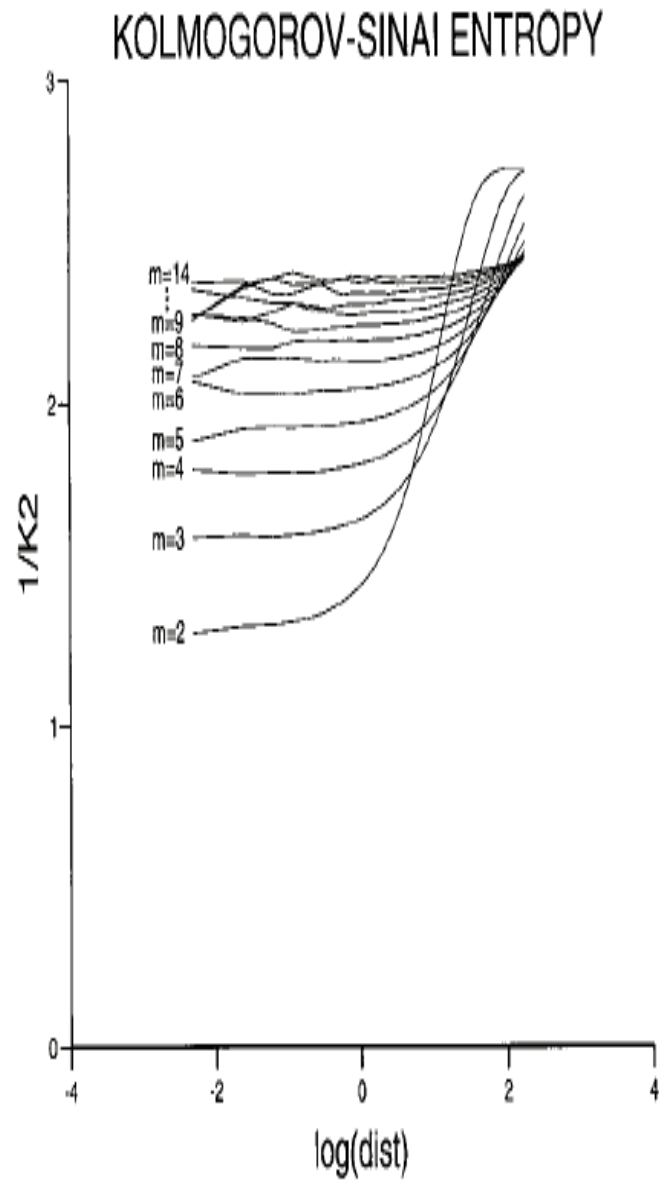


FIG. 5. The predictability timescale for tropical cyclone tracks in the North Atlantic ( $m = 2$  to 14). The values of  $1/K$  do not change as  $m$  increases, giving the value of the timescale of about 2.5 days.

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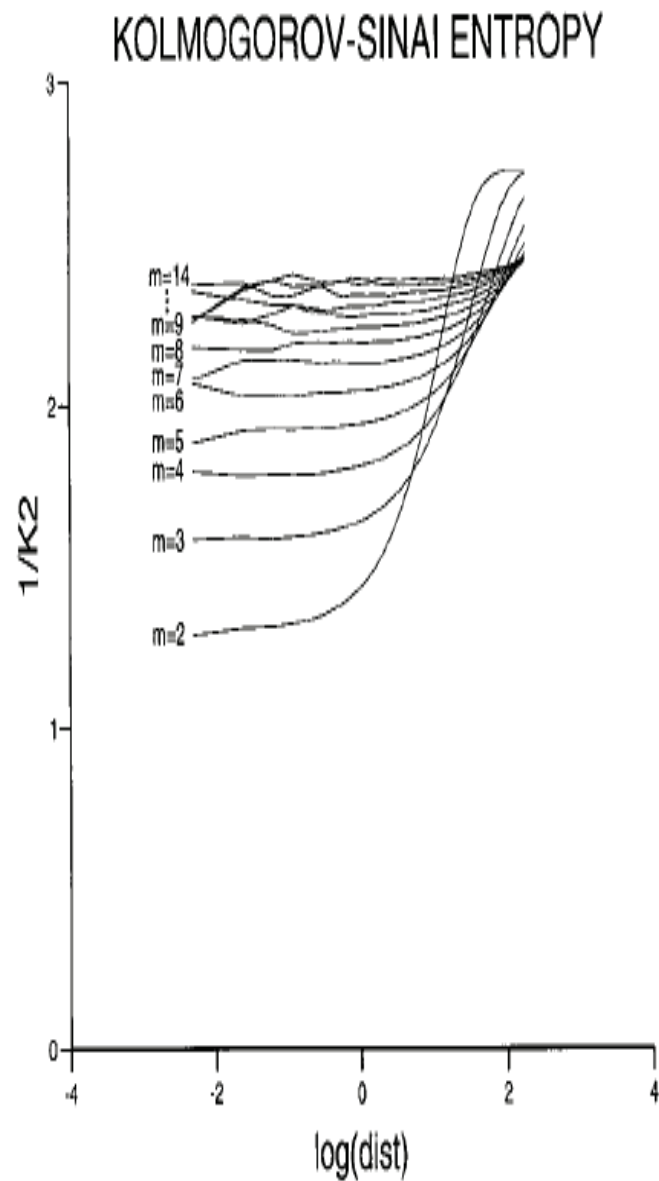
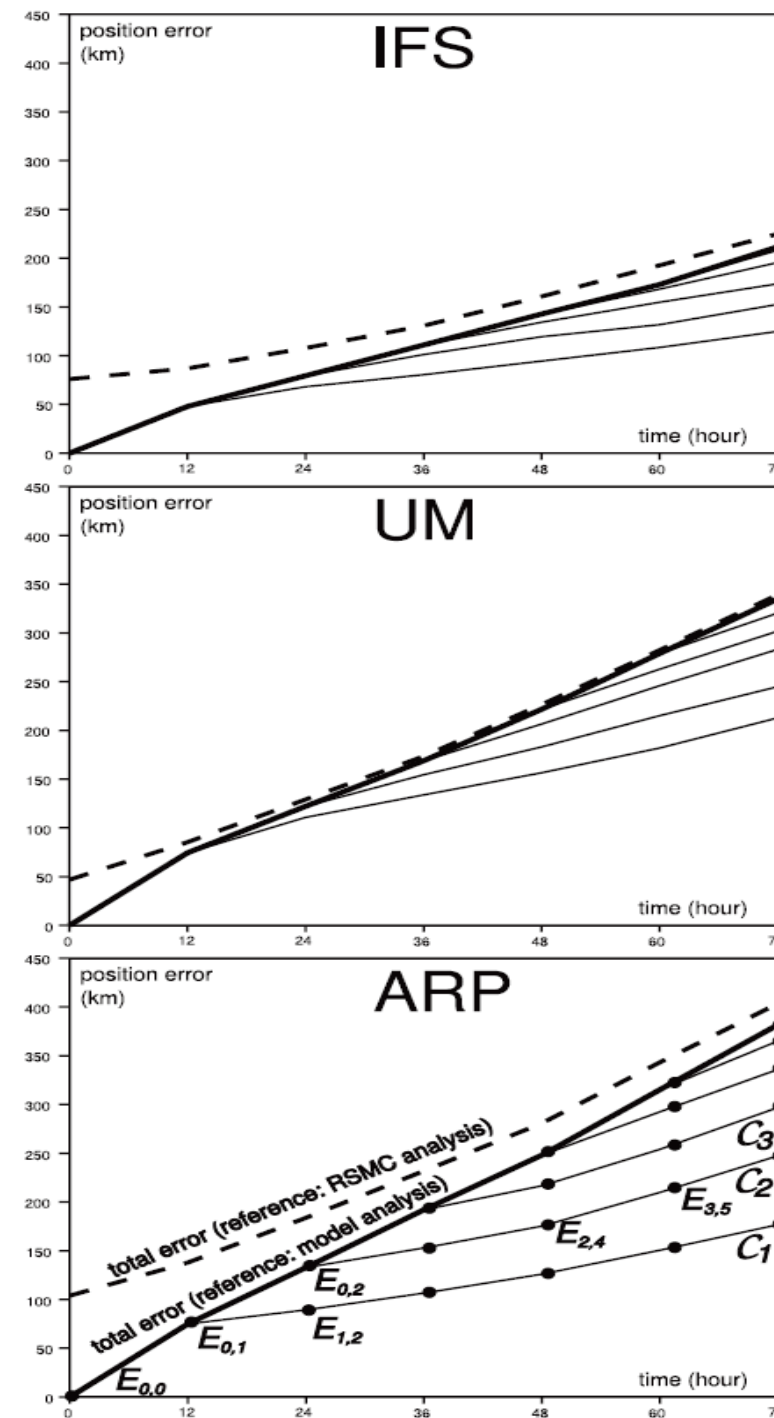
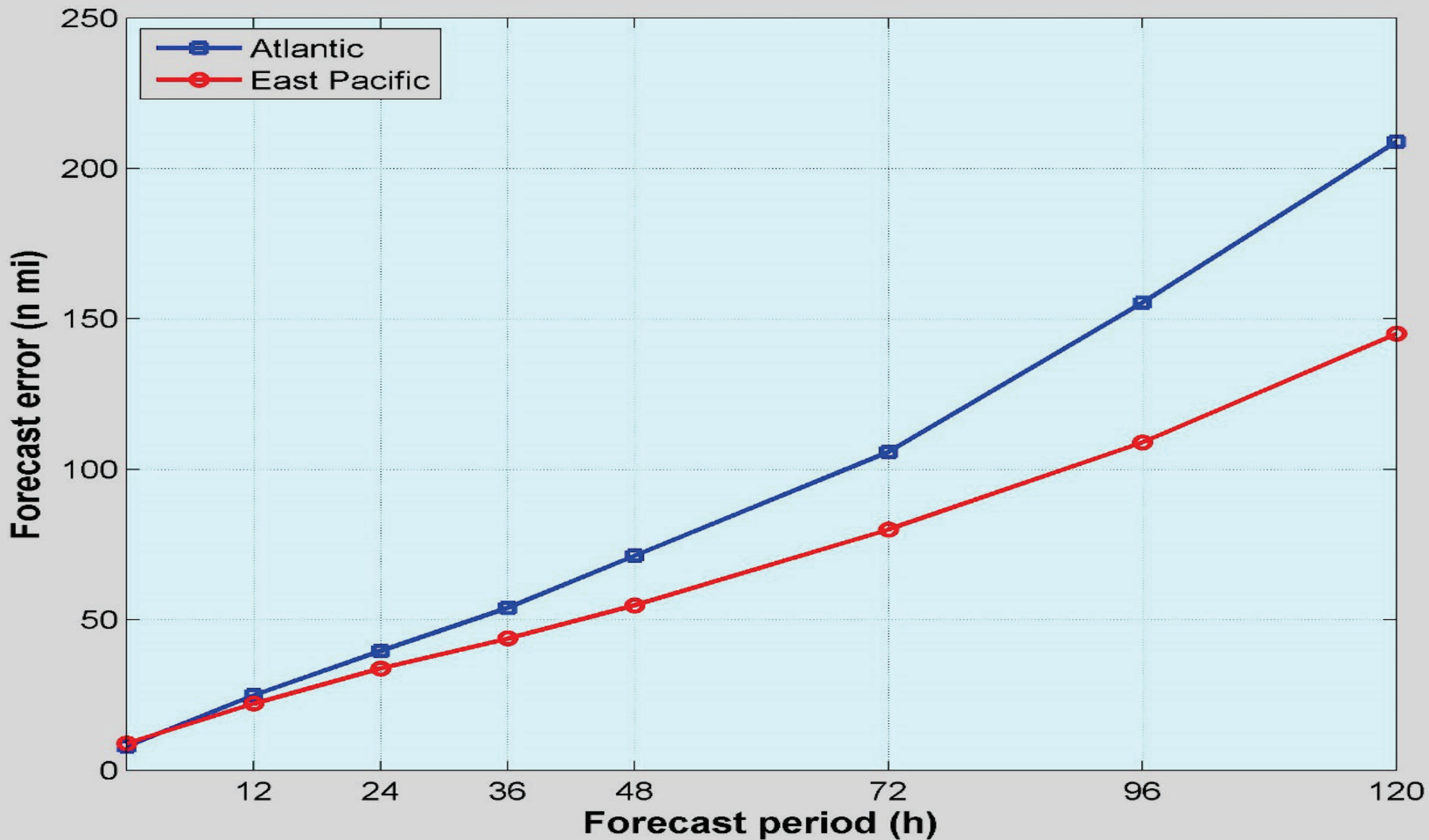


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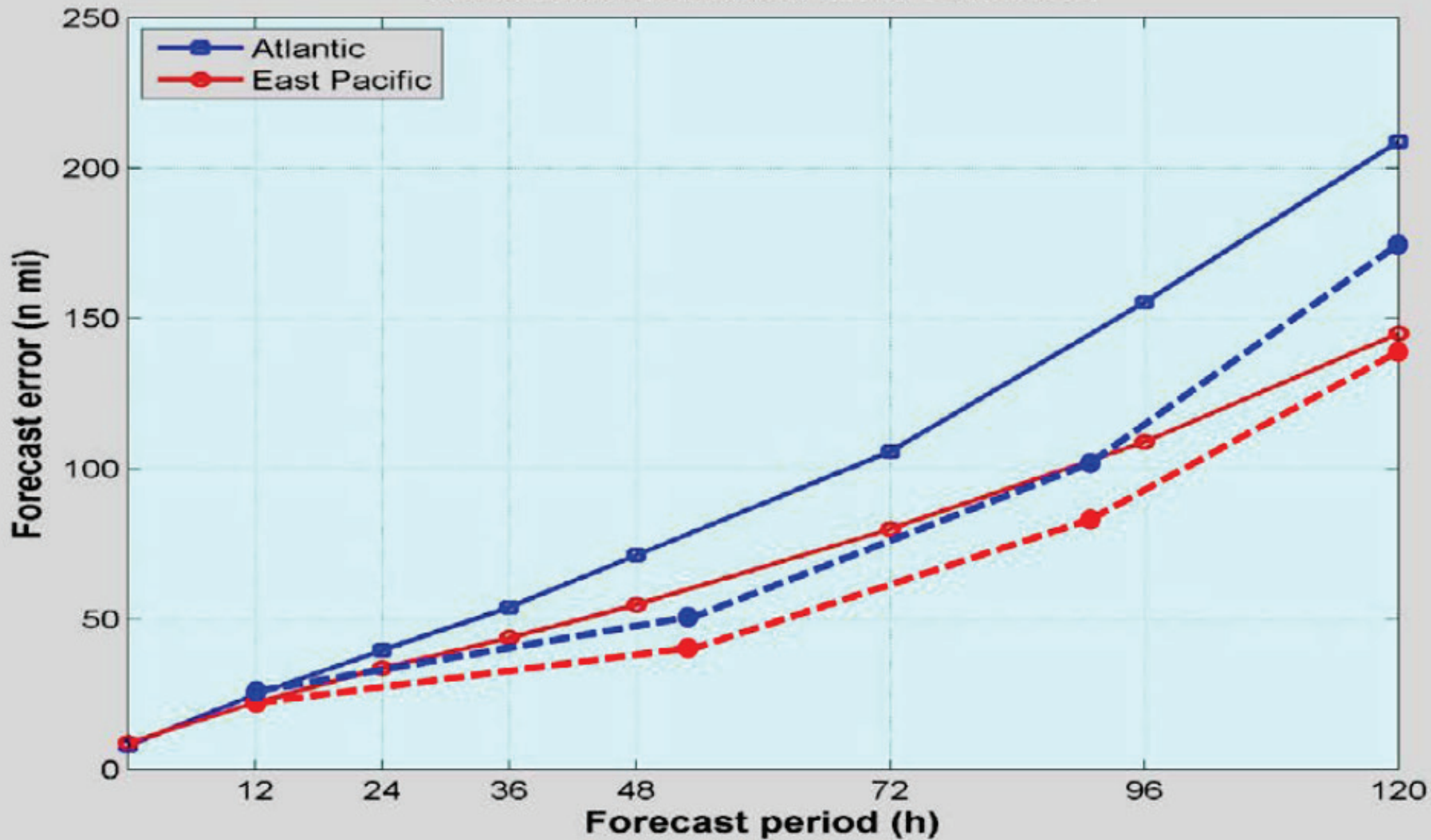


40 hr Timescale for Doubling of Errors  
- Plu (2011)

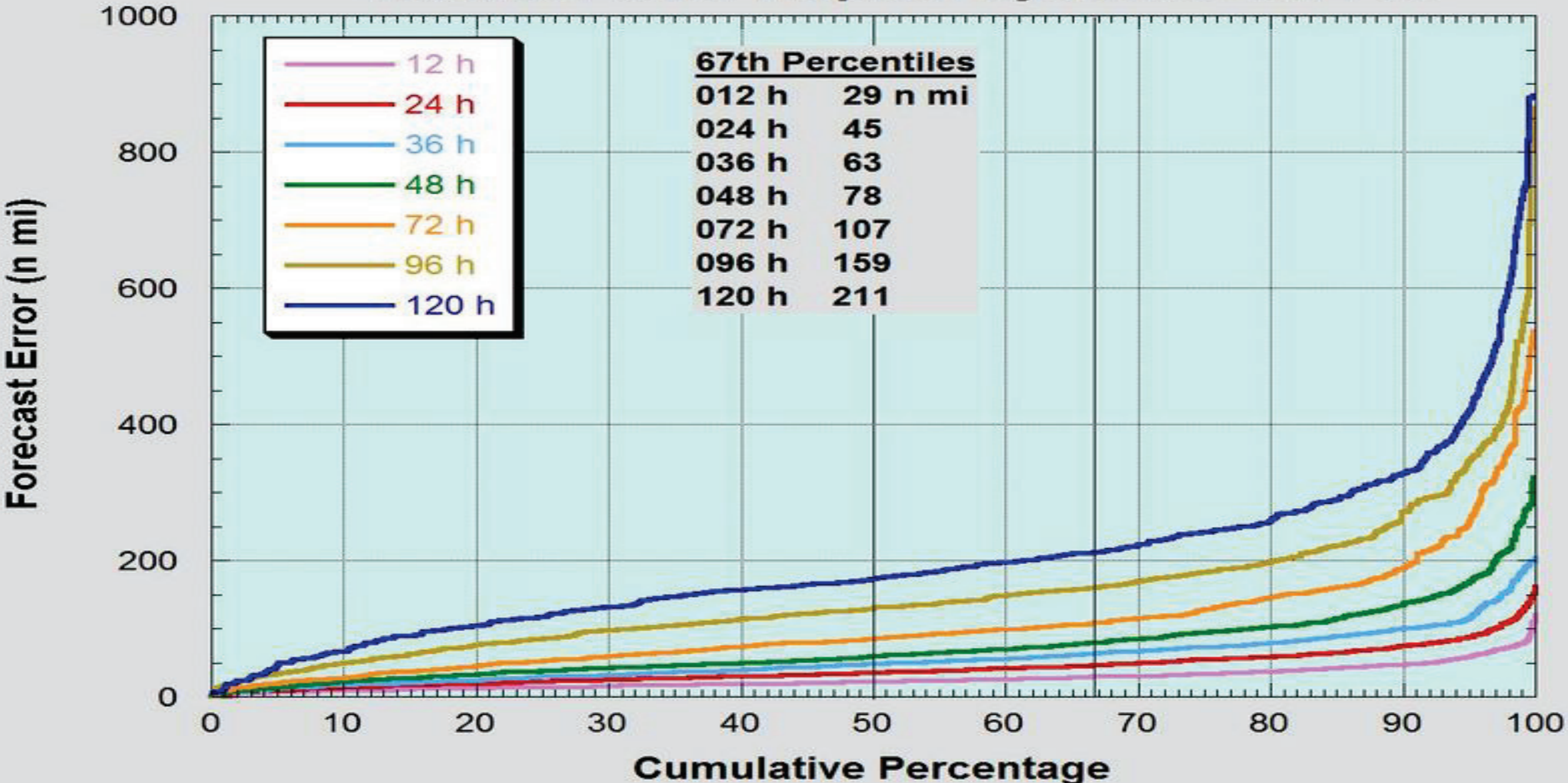
# NHC Track Forecast Error - 2012-16

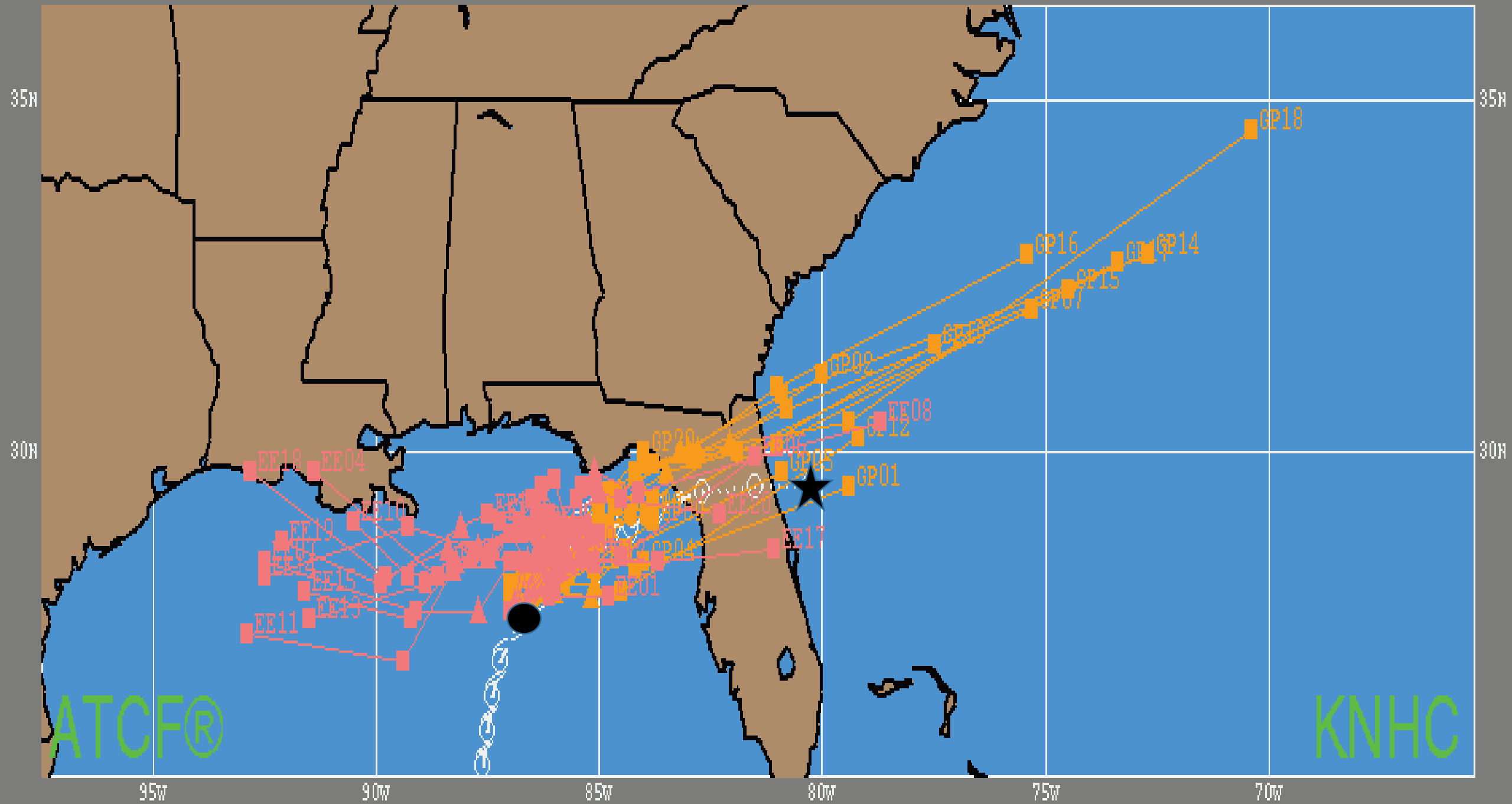


### NHC Track Forecast Error - 2012-16



# NHC Official Track Error Cumulative Distribution Atlantic Basin Tropical Cyclones 2012-16





# Have We Reached the Limits of Predictability for Tropical Cyclone Track Forecasting?

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- Using theoretical and empirical evidence, it appears that we may soon be reaching the limits of predictability
- If so, important to convey this expectation to tropical cyclone forecast users
- Going forward, research focus should be on improving forecasts of intensity, structure, and impacts (wind, flooding rain, surge, tornadoes) presented primarily probabilistically