

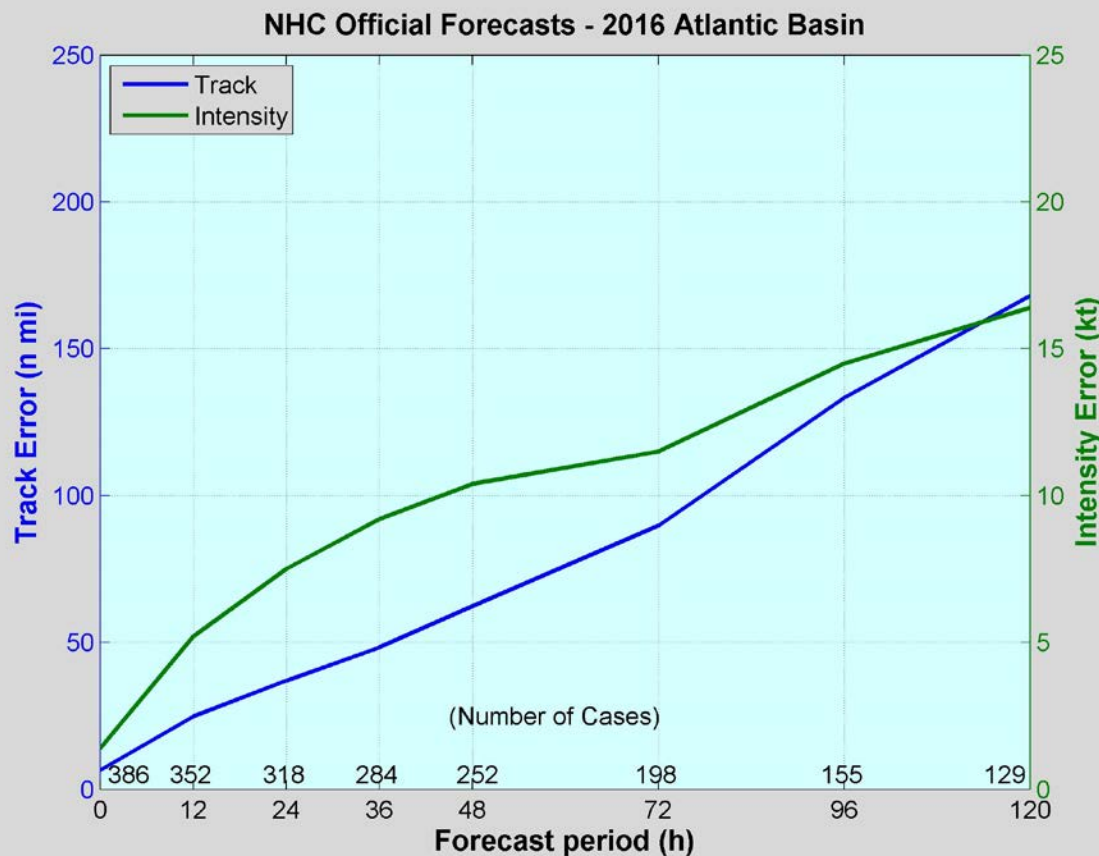
National Hurricane Center 2016 Forecast Verification (Preliminary)

John Cangialosi and James Franklin
Hurricane Specialist Unit
National Hurricane Center





2016 Atlantic Verification



| VT (h) | NT | TRACK (n mi) | INT (kt) |
|-----------|-----|-----------------|-------------|
| 000 | 386 | 6.5 | 1.4 |
| 012 | 352 | 24.8 | 5.2 |
| 024 | 318 | 37.0 | 7.5 |
| 036 | 284 | 48.3 | 9.2 |
| 048 | 252 | 62.3 | 10.4 |
| 072 | 198 | 89.7 | 11.5 |
| 096 | 155 | 133.3 | 14.5 |
| 120 | 129 | 168.0 | 16.4 |

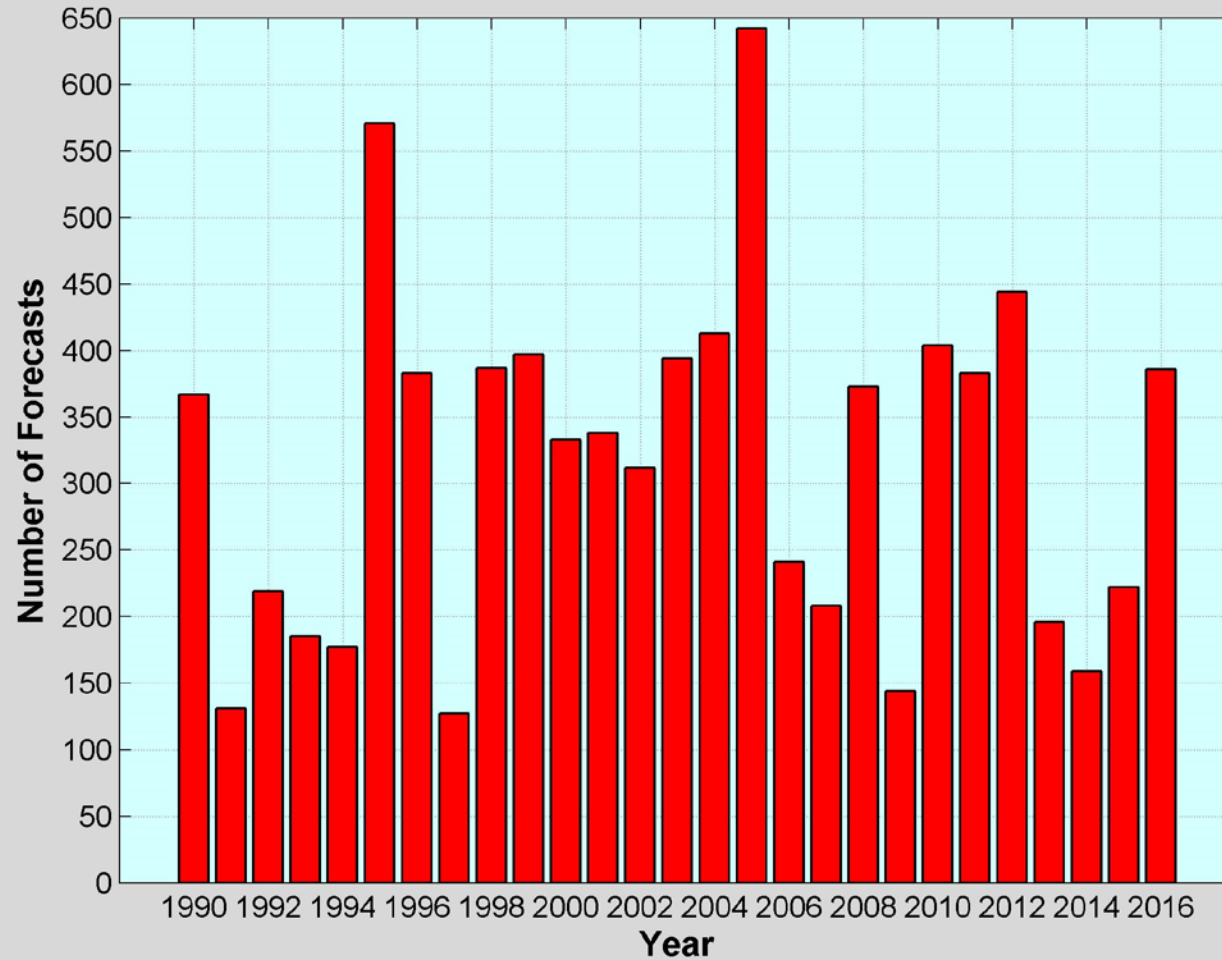
Values in green exceed all-time records.

GPRA 48-h track (71 n mi) and intensity (12 kt) goals were met.



Sample Size since 1990

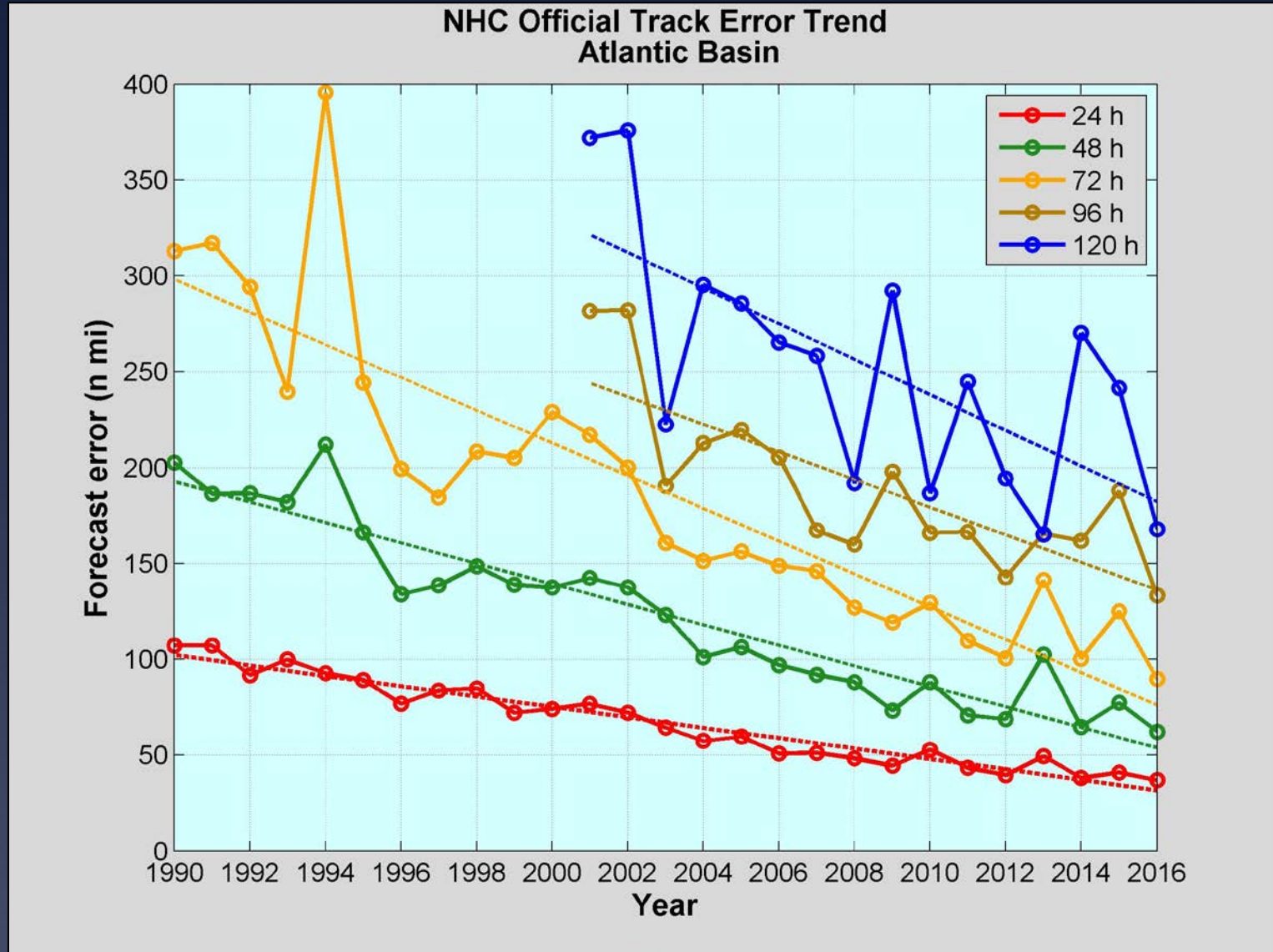
Number of NHC Official Forecasts By Year
Atlantic Basin



More forecasts were issued in 2016 than the past few years. The number of forecasts was above average.

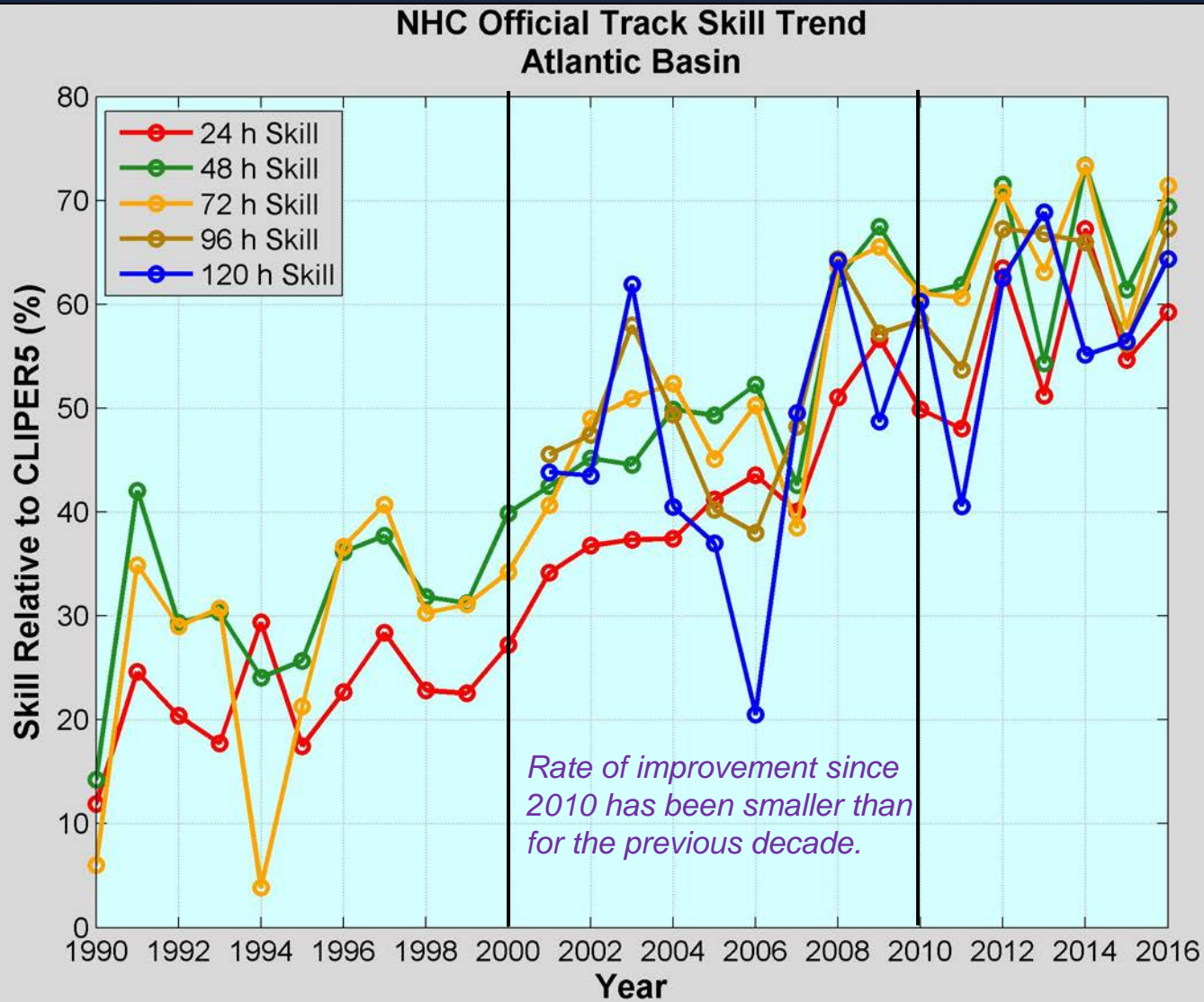


Atlantic Track Error Trends



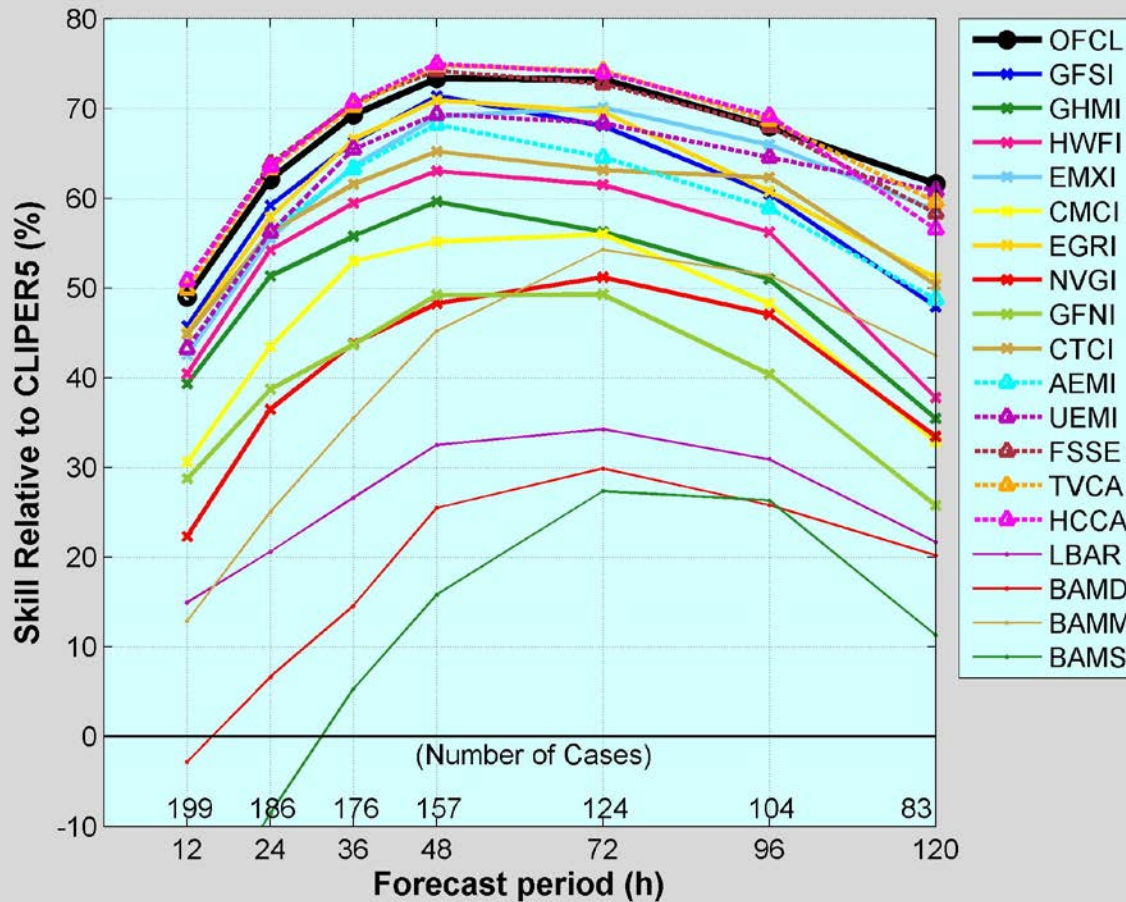
Track errors decreased at all times in 2016 compared to 2015, and although many accuracy records were set in 2016, it does appear as though the rate of improvement is slowing.

Atlantic Track Skill Trends



2016 Track Guidance

Track Forecast Skill (Early Models)
2016 - Atlantic Basin



Official forecasts were very skillful, near the best-performing models (consensus aids).

Among the consensus aids, *HCCA*, *TVCA*, and *FSSE* were very close to one another.

GFSI and *EGRI* were the best individual models in the short range, *EMXI* best at longer leads.

UK Met ensemble mean (*UEMI*) was very skillful and as good as or better than *GFSI*, *EMXI*, and *EGRI*.

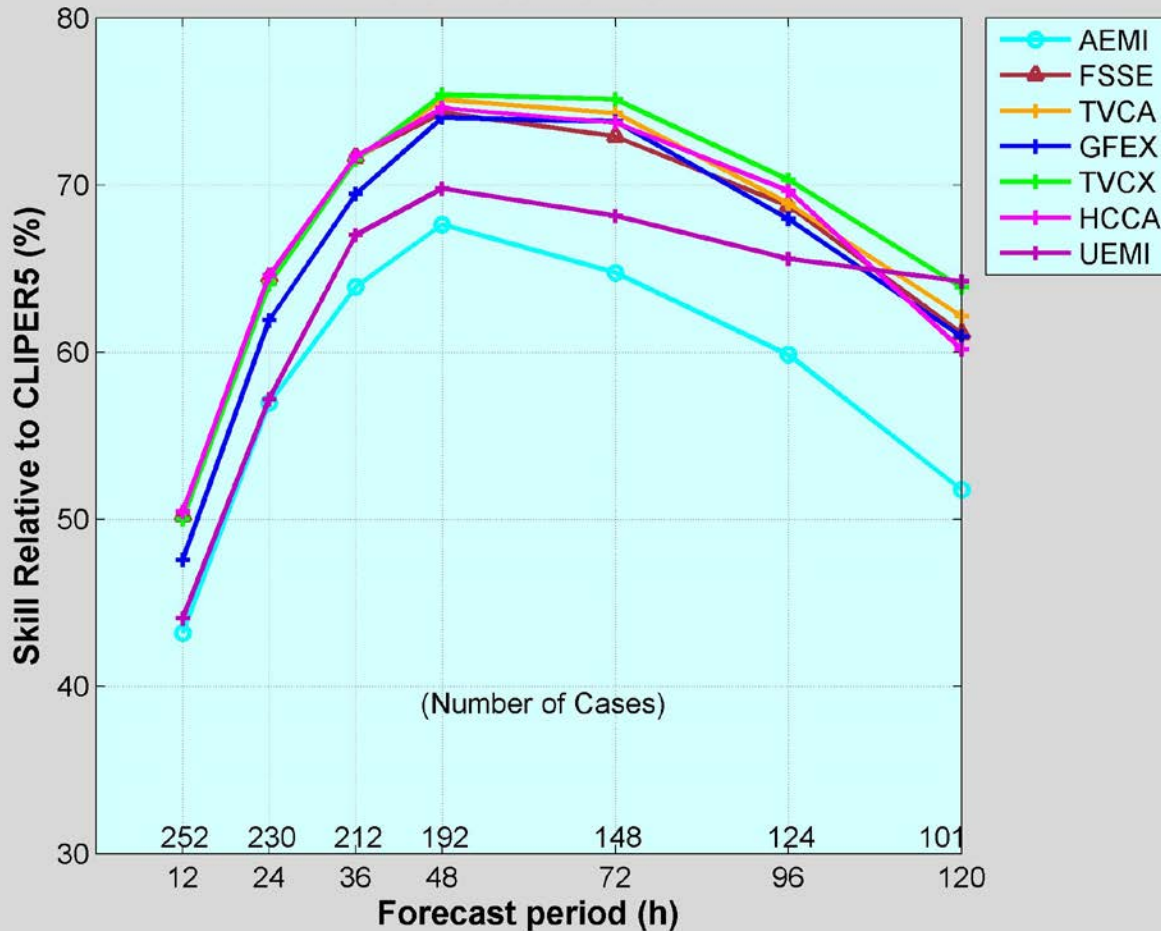
AEMI, *CTCI*, and *HWFI* were the next best models.

GHMI, *CMCI*, *NVGI*, *GFNI* trailed again in 2016.



2016 Consensus Guidance

Track Forecast Skill (Consensus Models)
2016 - Atlantic Basin



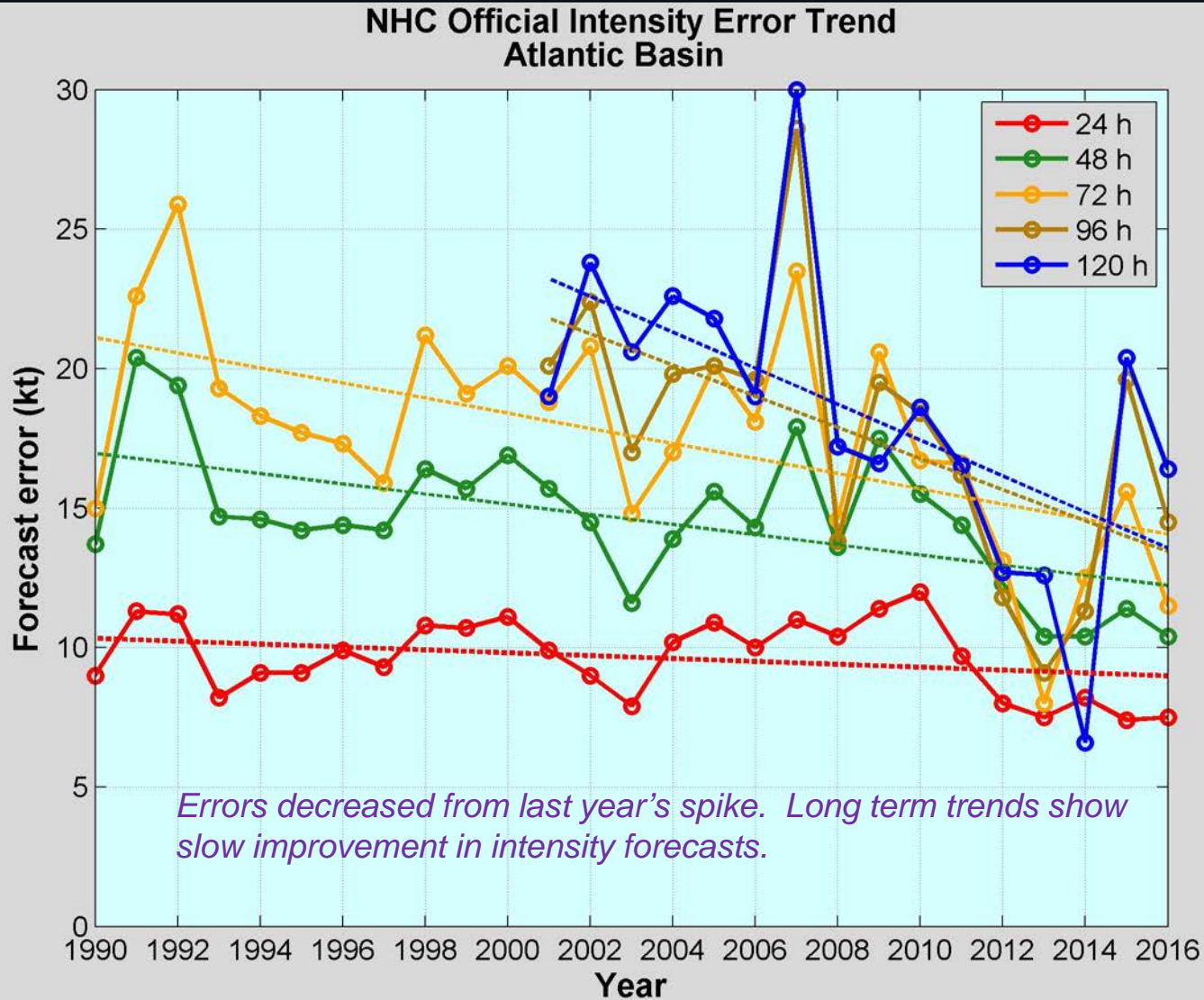
TVCX slightly better than *HCCA*, *TVCA*, *GFEX*, and *FSSE*.

Good first year for *HCCA*.

UEMI not as good except at 120 h.

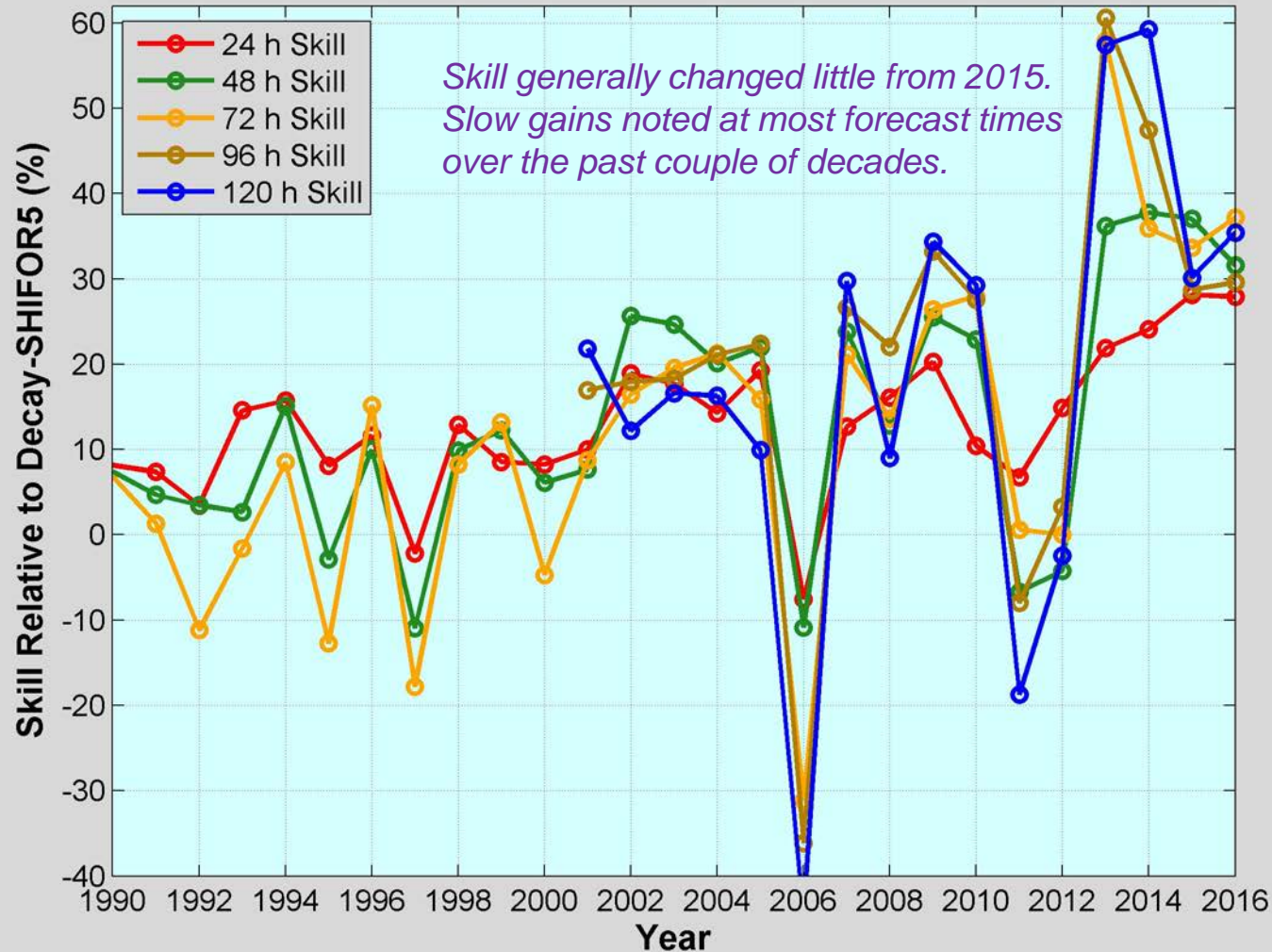
AEMI not competitive with the multi-model consensus aids. In fact, you're far better off having one GFS and one ECMWF than a whole bunch of GFSs.

Atlantic Intensity Error Trends



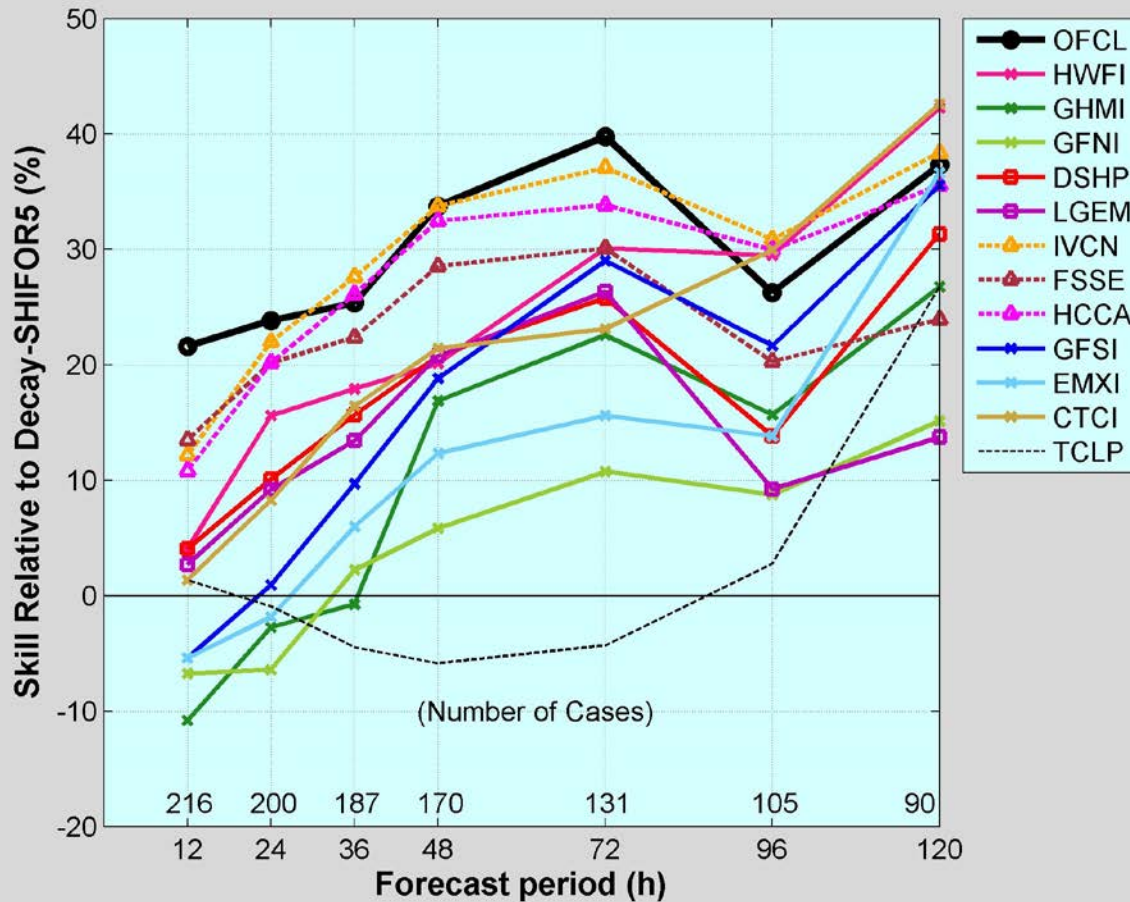
Atlantic Intensity Skill Trends

NHC Official Intensity Skill Trend
Atlantic Basin



2016 Intensity Guidance

Intensity Forecast Skill (Early Models)
2016 - Atlantic Basin



Official forecasts skillful at all times, near or better than the top models (consensus aids).

Among the consensus aids, IVCN was a little better than HCCA and FSSE.

HWFI and CTCI showed increased skill with forecast time and were the best models at days 4 and 5.

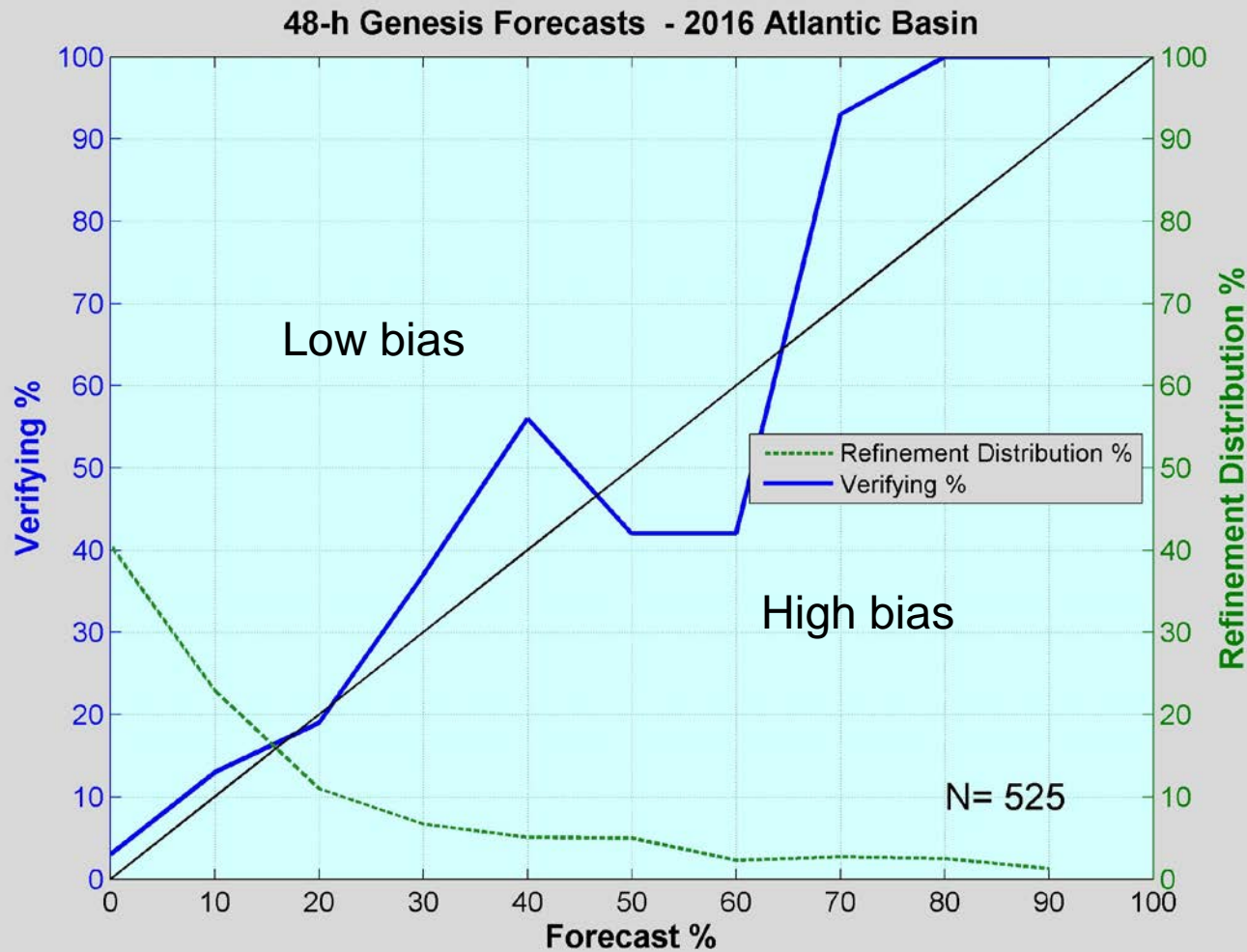
DSHP and LGEM were skillful but not as good as consensus aids or HWFI, CTCI.

GFSI was competitive at 48 h and beyond.

GFNI, GHMI, and EMXI trailed.



2-day Genesis Forecast Verification

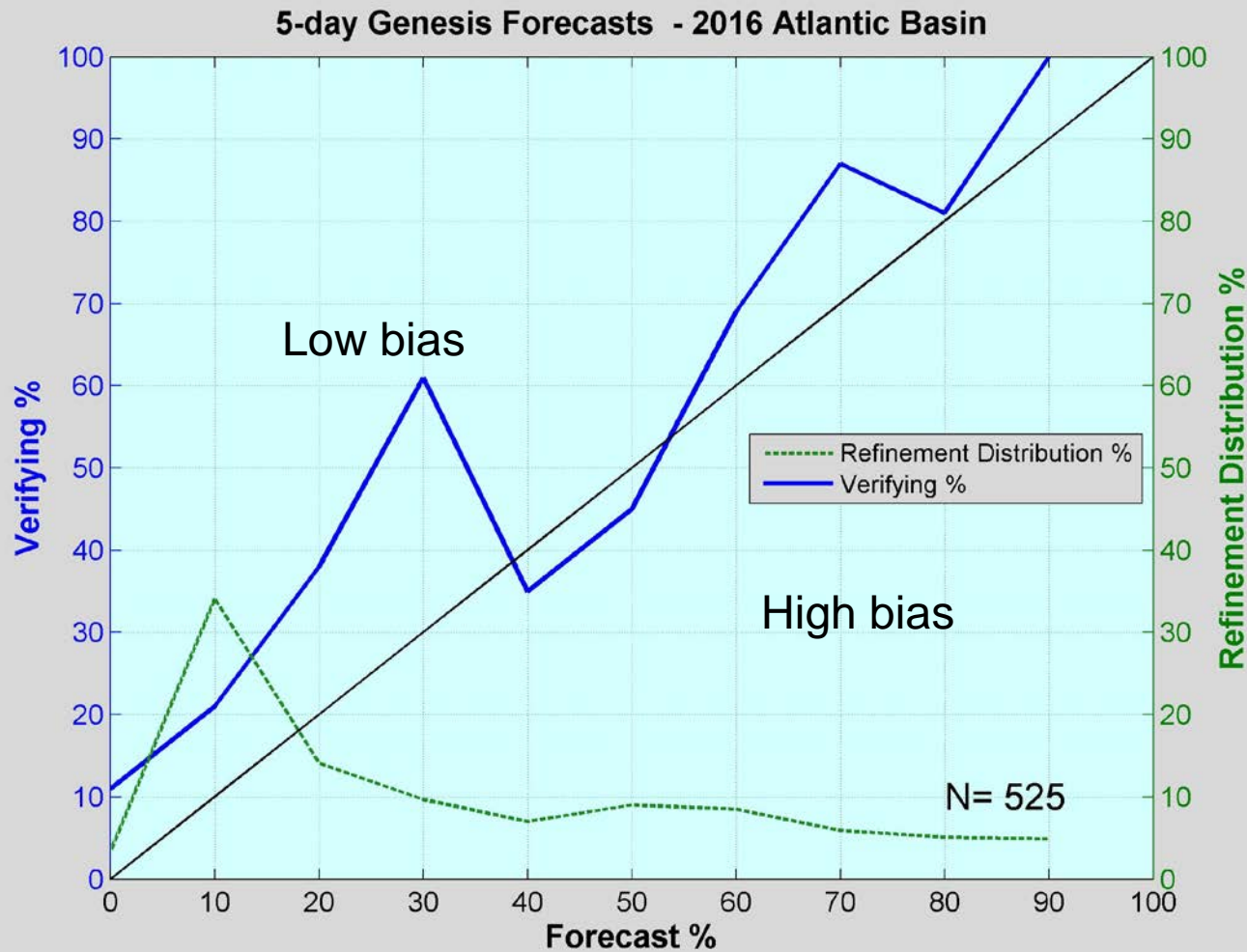


** Fairly well calibrated at the low and medium probabilities.*

** Low bias for a small sample at high probabilities.*



5-day Genesis Forecast Verification



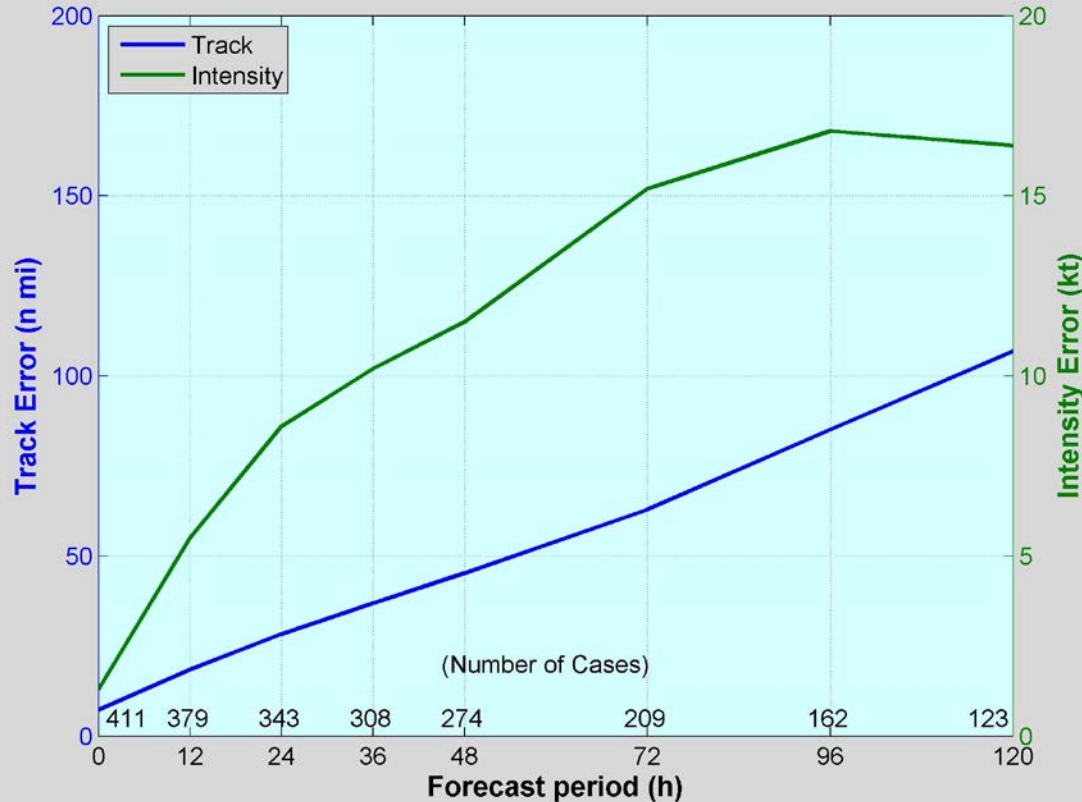
Slight low bias at most probabilities.



2016 East Pacific Verification



NHC Official Forecasts - 2016 East Pacific Basin

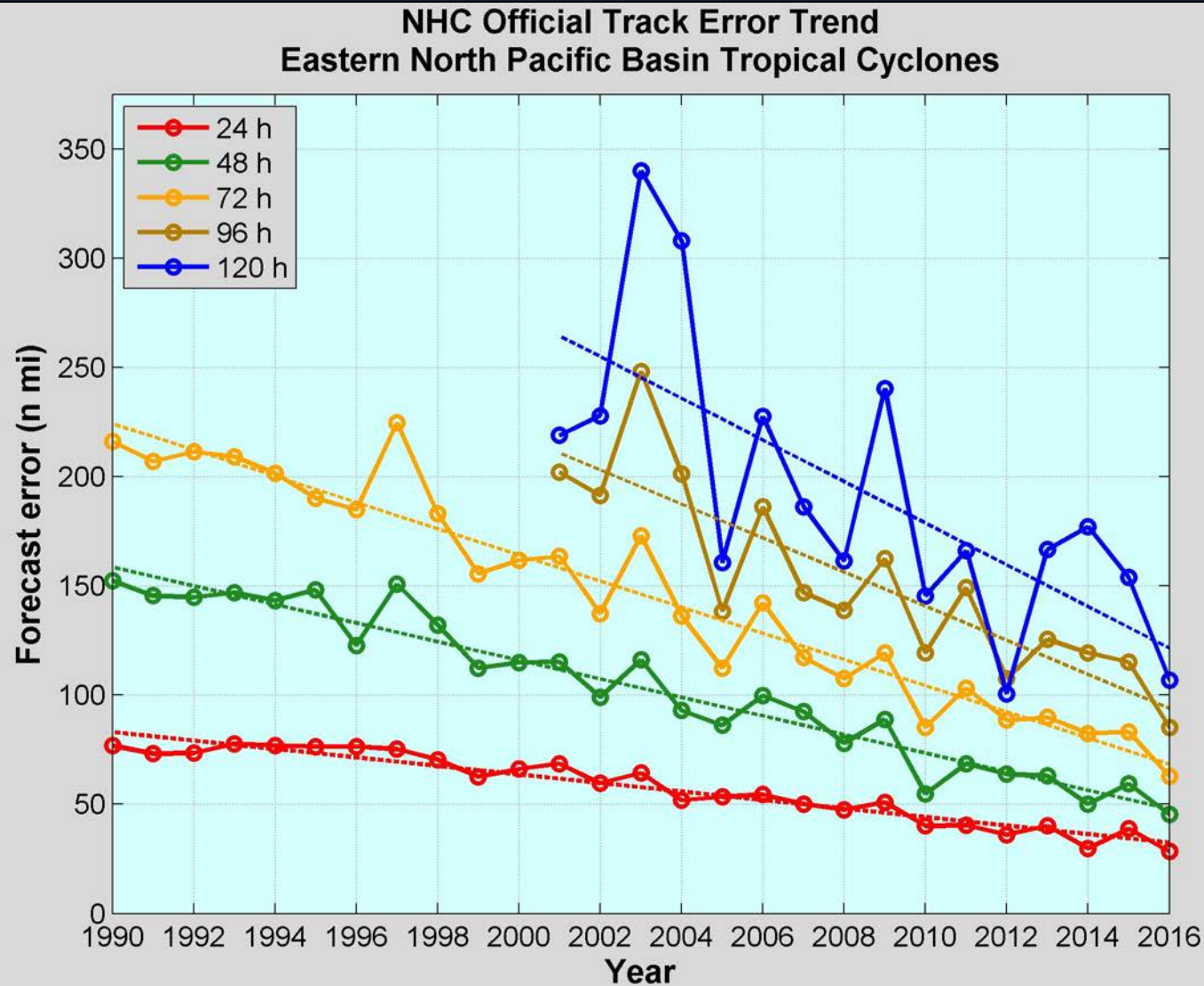


| VT (h) | NT | TRACK (n mi) | IN (kt) |
|-----------|-----|-----------------|------------|
| 000 | 411 | 7.3 | 1.3 |
| 012 | 379 | 18.5 | 5.5 |
| 024 | 343 | 28.4 | 8.6 |
| 036 | 308 | 36.9 | 10.2 |
| 048 | 274 | 45.3 | 11.5 |
| 072 | 209 | 62.9 | 15.2 |
| 096 | 162 | 85.1 | 16.8 |
| 120 | 123 | 106.8 | 16.4 |

*Value in green exceeded
all-time record.*



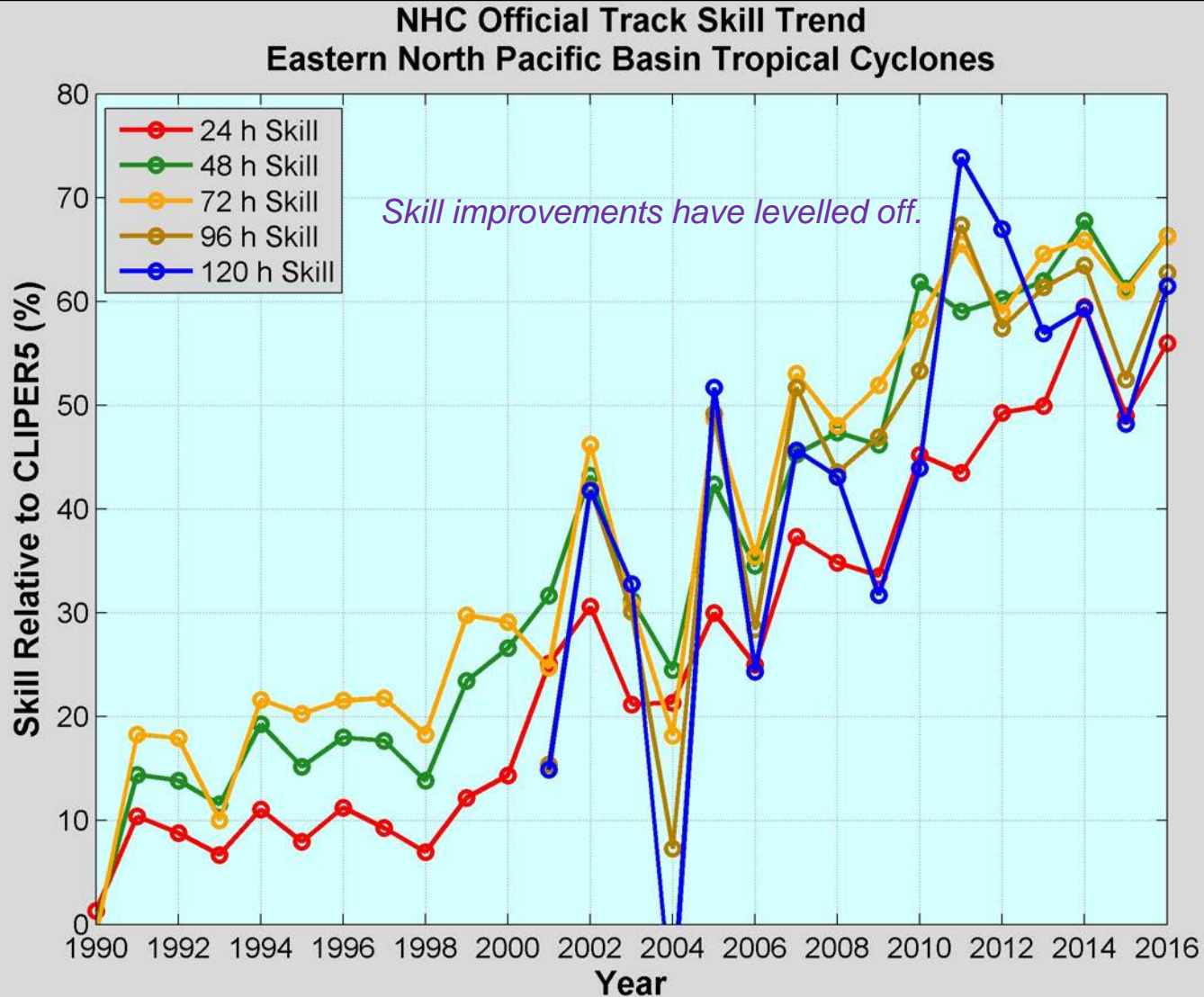
EPAC Track Error Trends



Track errors decreased at all forecast times from 2015. Since 1990, track errors have decreased substantially.

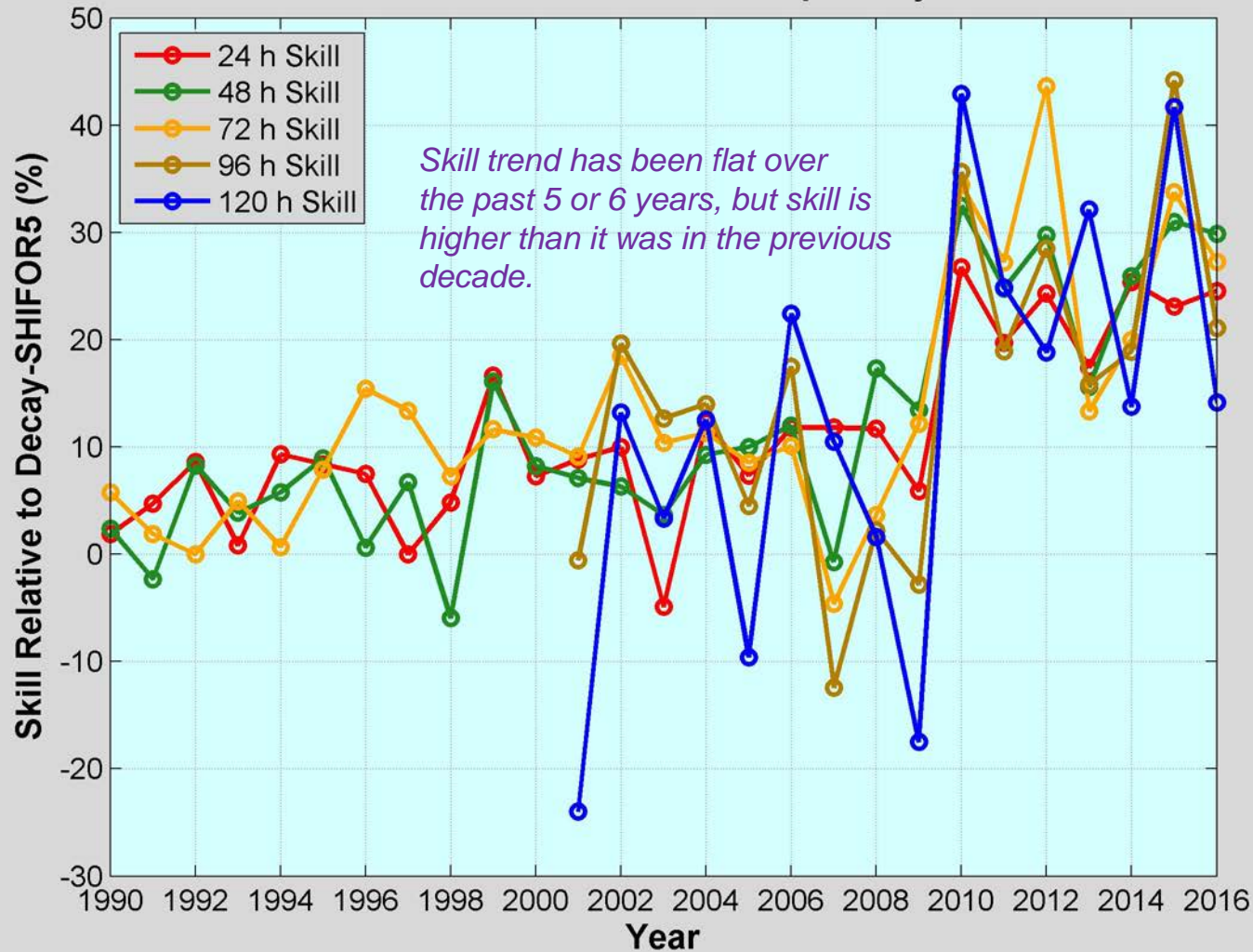


EPAC Track Skill Trends



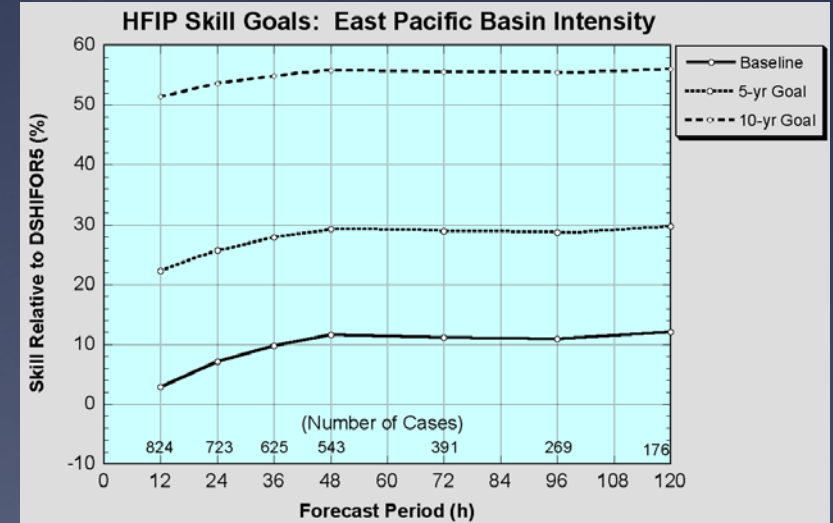
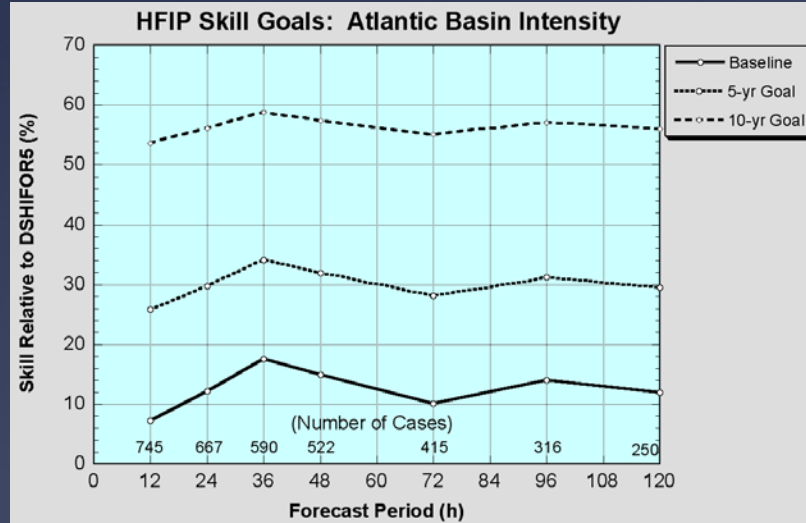
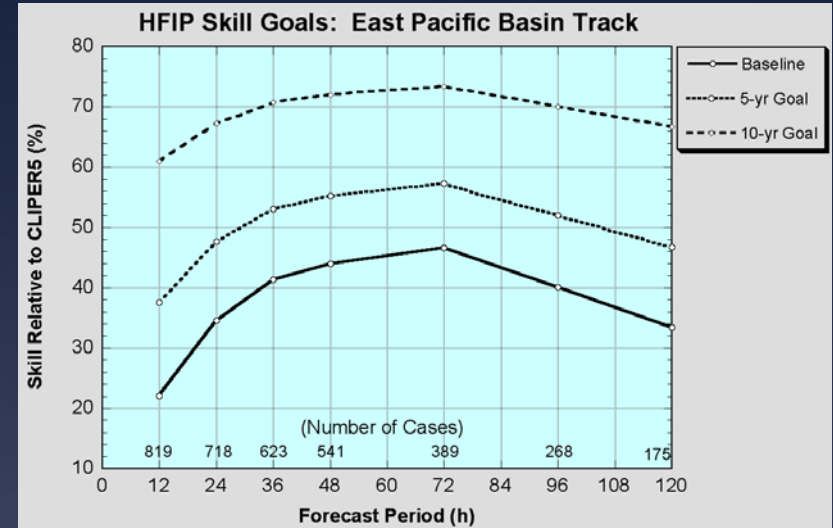
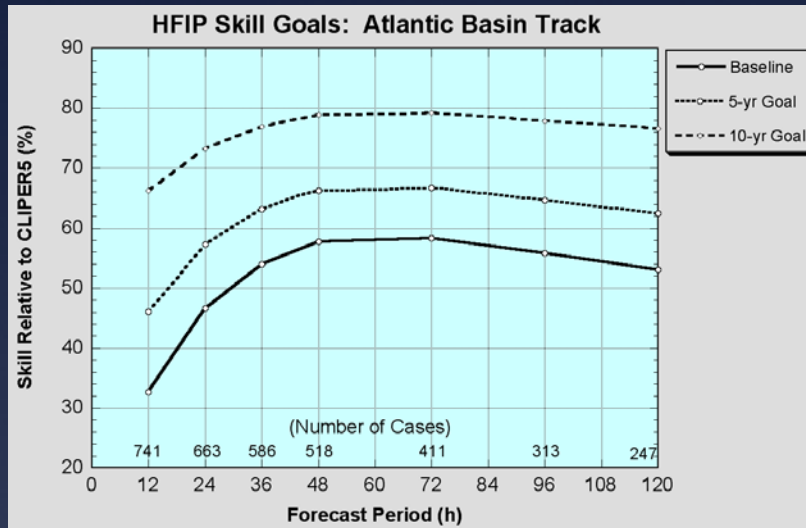
EPAC Intensity Skill Trends

**NHC Official Intensity Skill Trend
Eastern North Pacific Basin Tropical Cyclones**





HFIP Progress Assessment

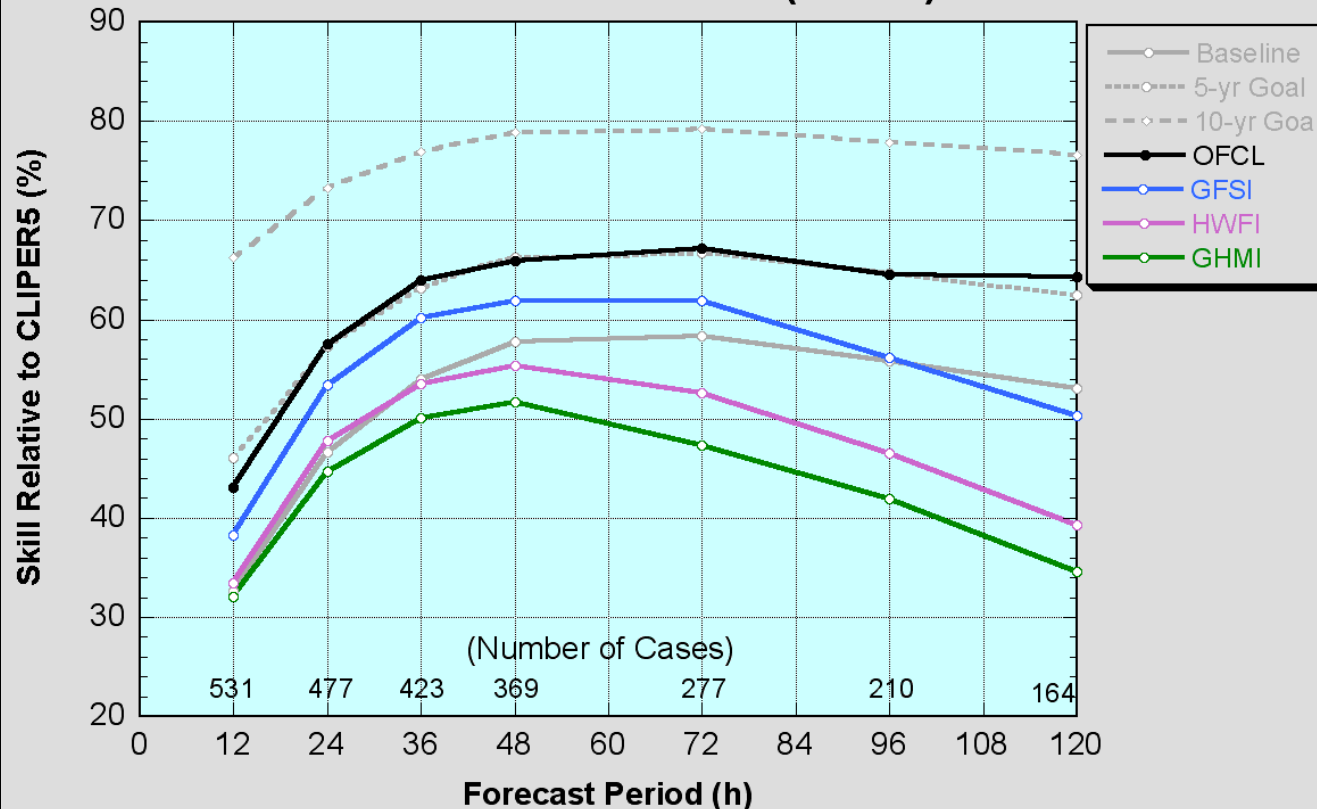


Baseline error was determined from a consensus of operational models evaluated for the period 2006-8. Reducing the baseline error by 20% (50%) and normalizing by CLIPER/SHIFOR yielded the 5-yr (10-yr) HFIP skill goals.



HFIP Progress Assessment

Atlantic Basin Track Skill (2015-6)



Will use OFCL as a measure of the state of the science (could have used model consensus), for a two-year sample to improve representativeness. Also will show the operationally accessible models HFIP is contributing to.

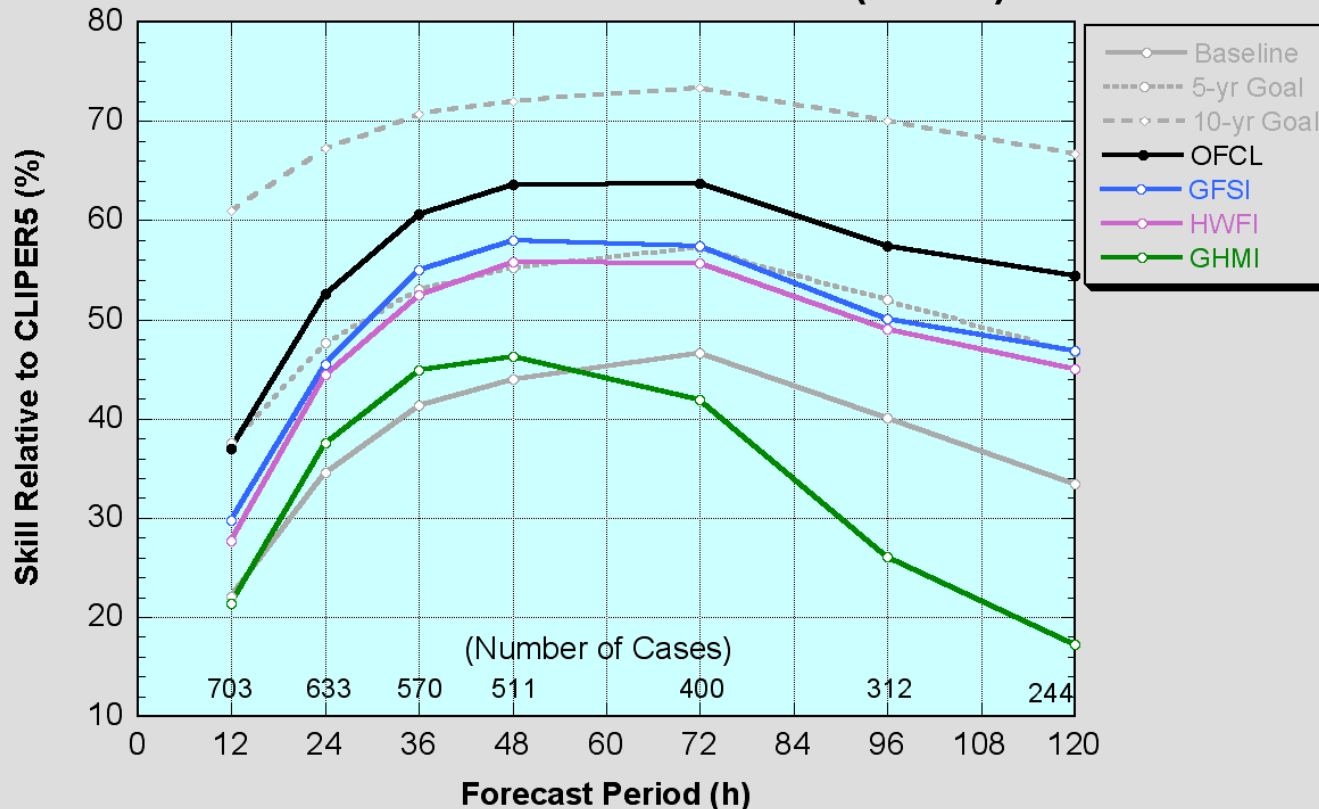
Atlantic Basin Track:

OFCL is virtually on top of the 5-yr HFIP goal.



HFIP Progress Assessment

Eastern Pacific Basin Track Skill (2015-6)



East Pacific Basin Track:

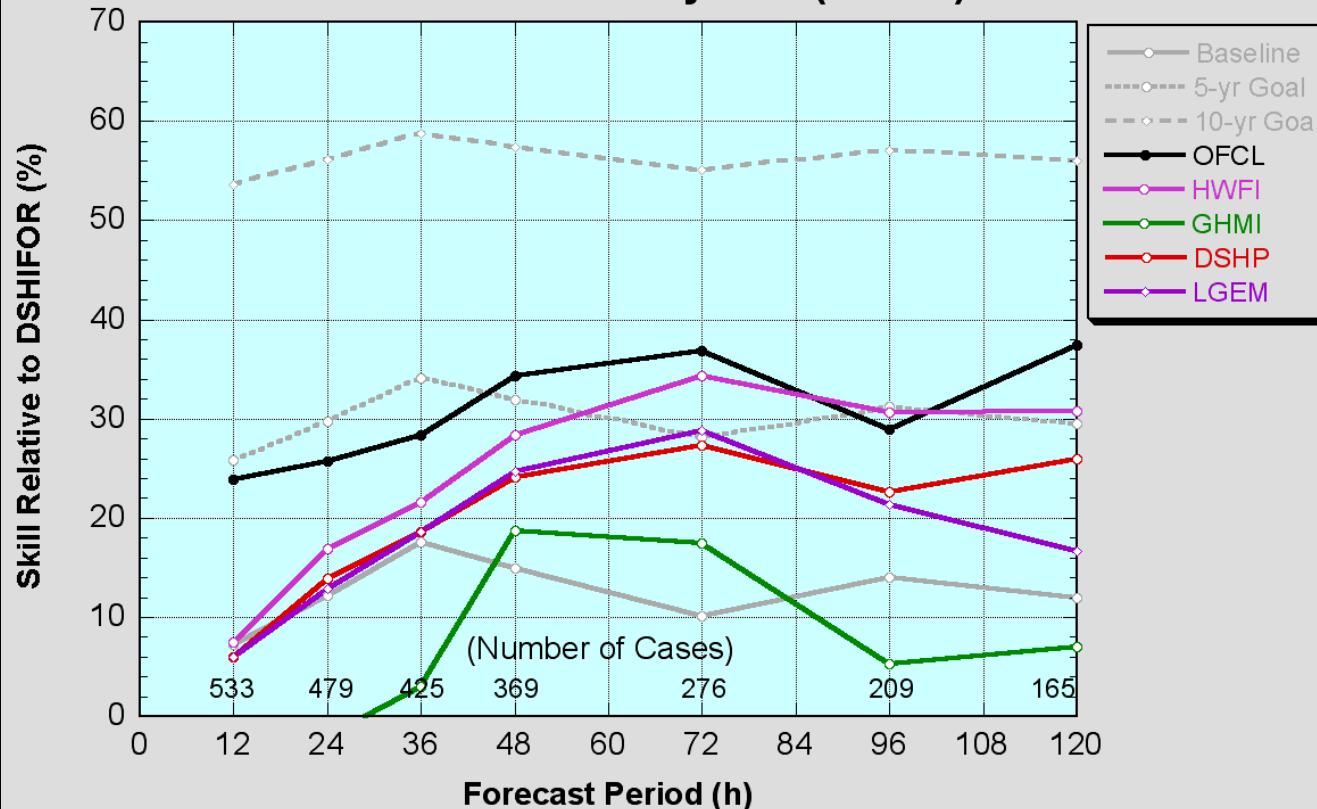
For the 2-yr sample, OFCL is well above the 5-yr goal and seemingly within reach of the 10-yr goal.

HWRF and GFS neck and neck, and individually have reached the 5-yr goal.



HFIP Progress Assessment

Atlantic Basin Intensity Skill (2015-6)



Atlantic Basin Intensity:

For the 2-yr sample, OFCL was near or above the 5-yr goal.

HWRF skill above the skill of DSHP and LGEM.

Caution advised due to the relative lack of RI events in recent years. RI events were 40% more common during the baseline period than during the last two years.

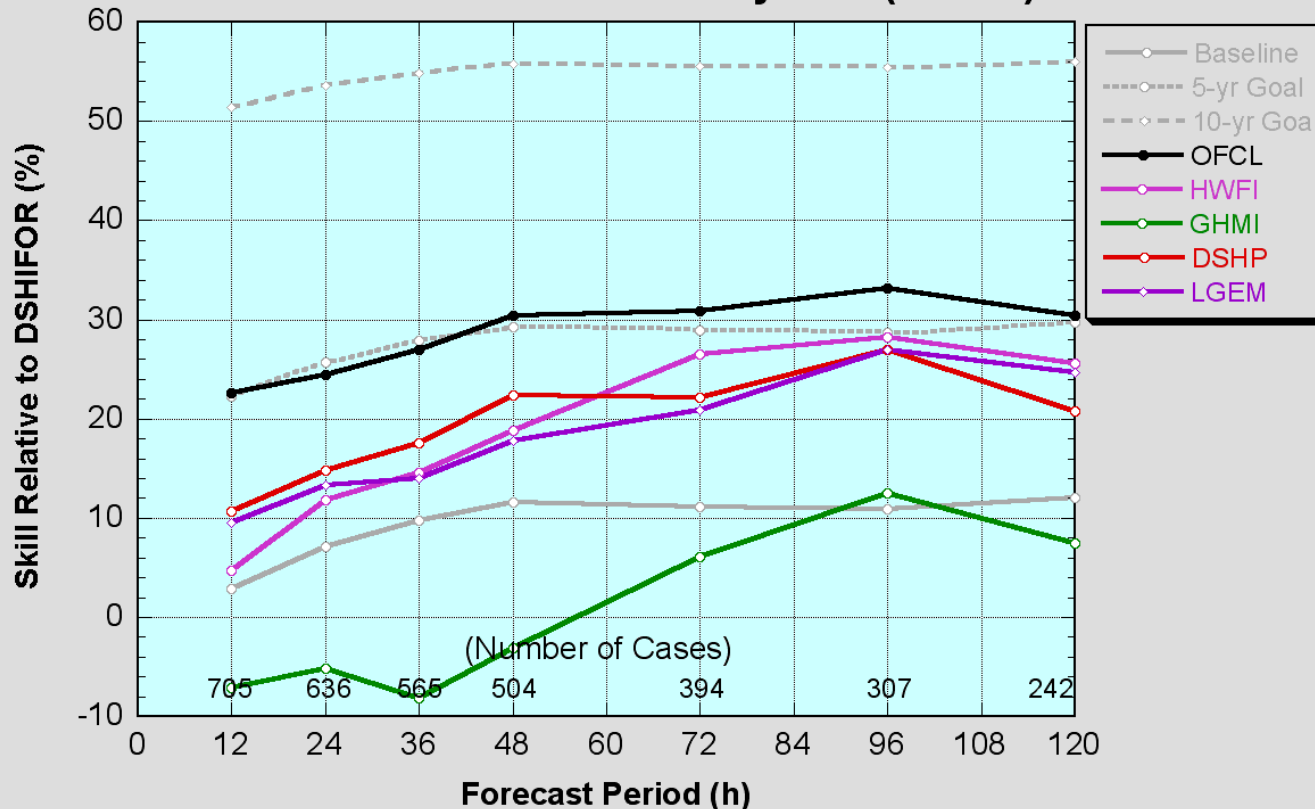
During the baseline period, the ratio of RI events to total forecasts was $54:705 = 7.7\%$. Same ratio for 2015-16 was $29:536 = 5.4\%$.

When there are few RI events, OFCL errors go down. When storms are unusually weak, SHIFOR errors can actually go up.



HFIP Progress Assessment

Eastern Pacific Basin Intensity Skill (2015-6)



East Pacific Basin Intensity:

For the 2-yr sample, OFCL was right at the 5-yr goal (and well above the individual guidance).

HWRF competitive with DSHP.

RI event ratio for baseline period was $54:700 = 7.7\%$.

RI event ratio for 2015-16 was $84:680 = 12.4\%$



Summary

- * While it appears that we have reached our 5-year goals, improvements seem to be leveling off.
- * Given the funding cuts to HFIP, and the NWS' seeming desire to simplify the operational production suite, it's not clear where future improvements in tropical cyclone guidance are going to come from.