Uncertainty of Tropical Cyclone Best-Track Information

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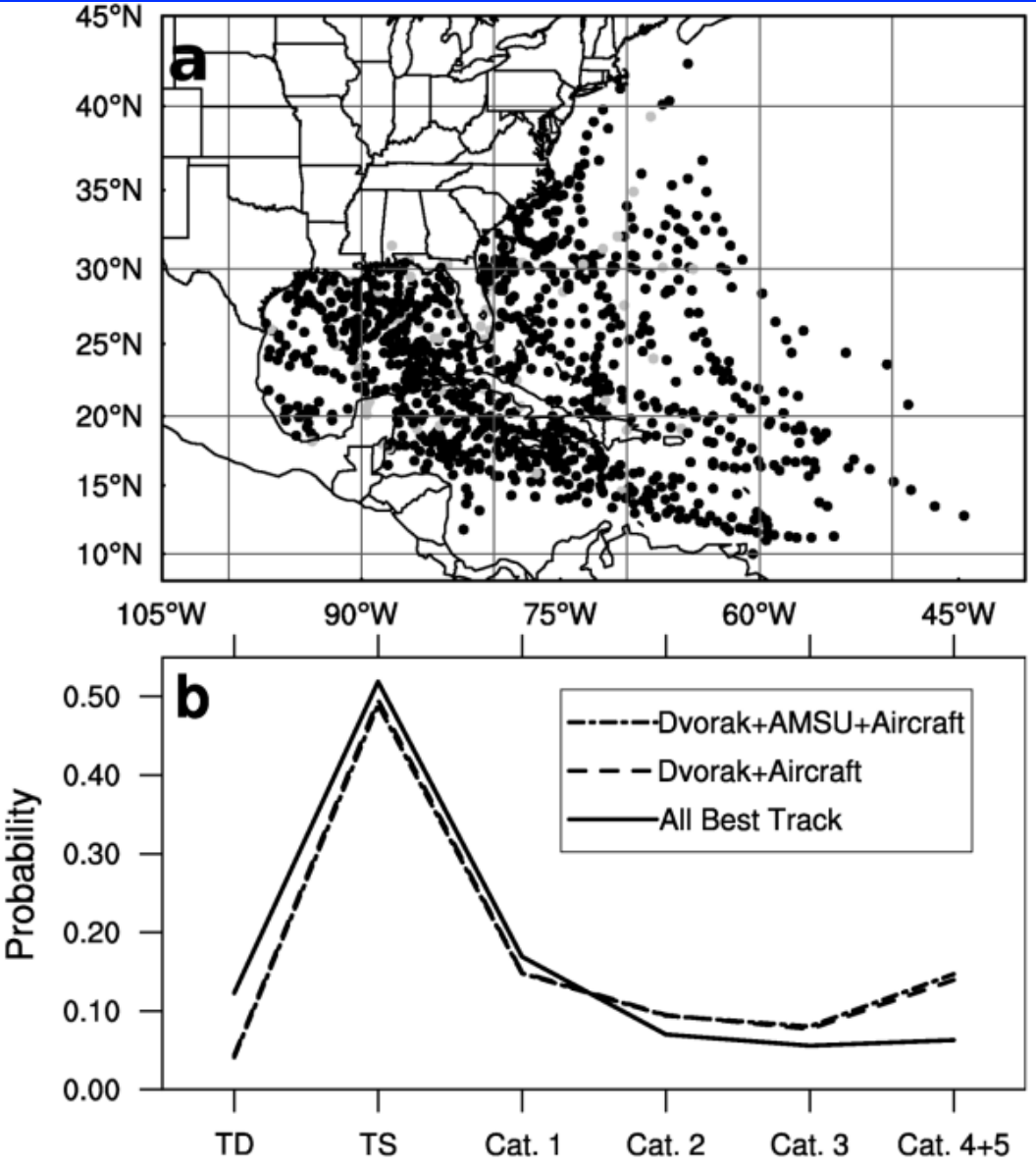
Motivation

- Many different applications of best track data from model forecasts to climate trends
- No estimates of what is the uncertainty in this data, especially given TCs are not often sampled by in situ observations
  - Knaff et al. (2010) has validation of Dvorak max. wind
- Knowing errors also important for data assimilation and initialization
- Goal of this study is to obtain quasi-objective estimates of position and intensity uncertainty

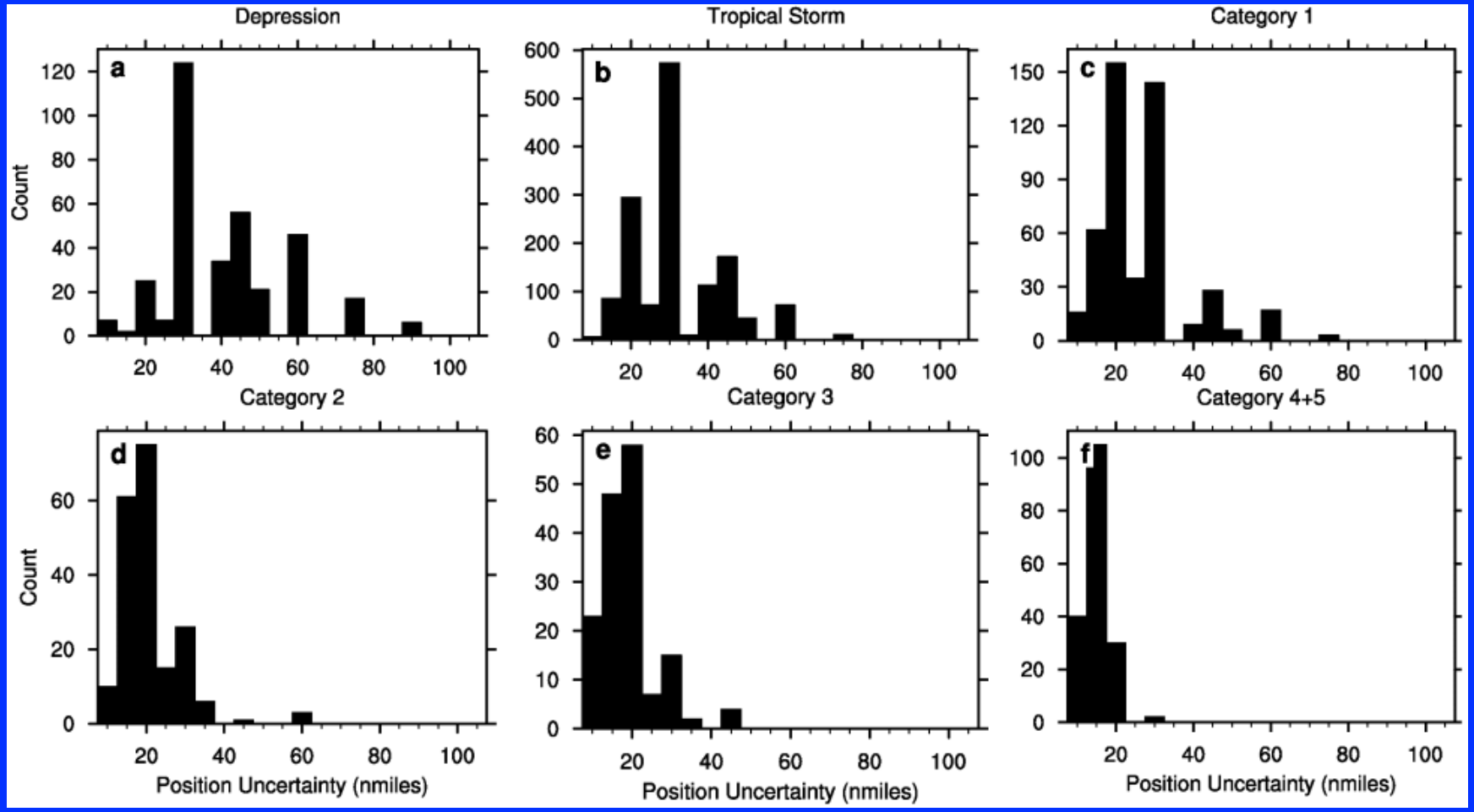
Methods

- All data obtained from NHC ftp server for 2000-2009 TCs
- Position uncertainty taken from “Position accurate within” value in NHC advisories
- No comparable intensity uncertainty in advisories, thus need to compute errors and define uncertainty as the E[error] in estimates
- Most times only have satellite estimates (mainly Dvorak), thus compute error in Dvorak-derived max. wind and MSLP at times with aircraft data within +/- 2 hours of synoptic time

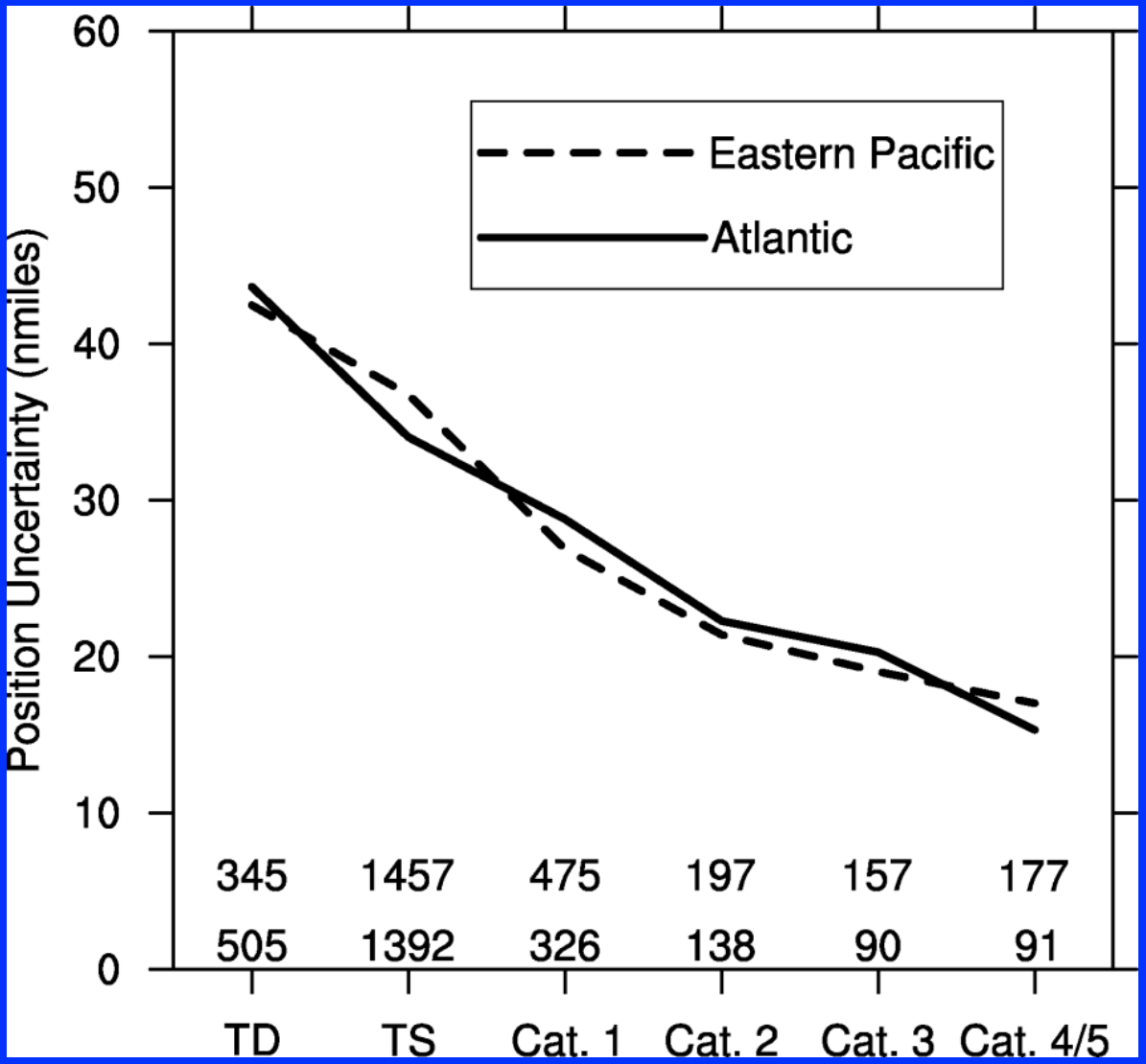
Recon Data/Times



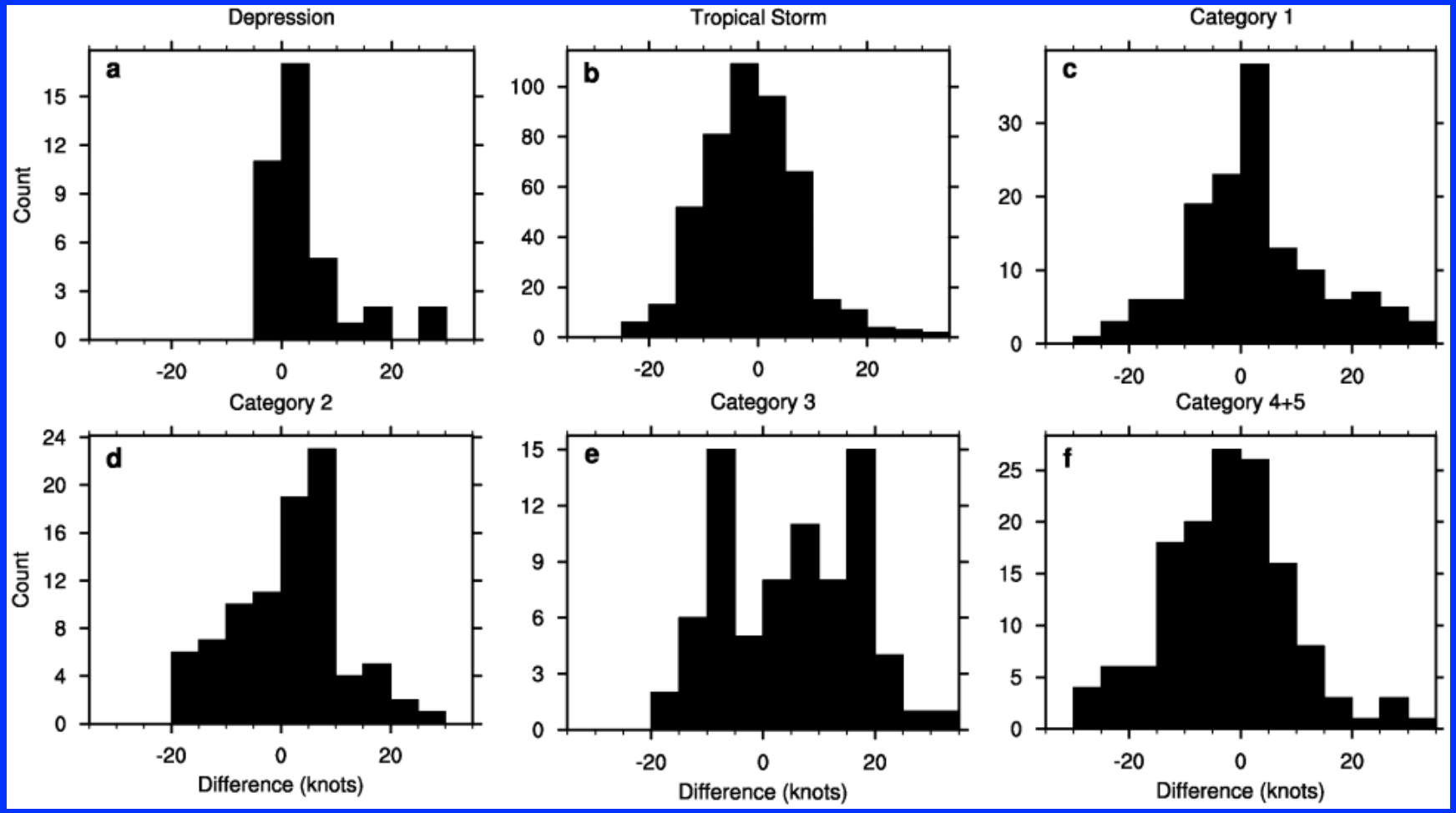
Position Uncertainty



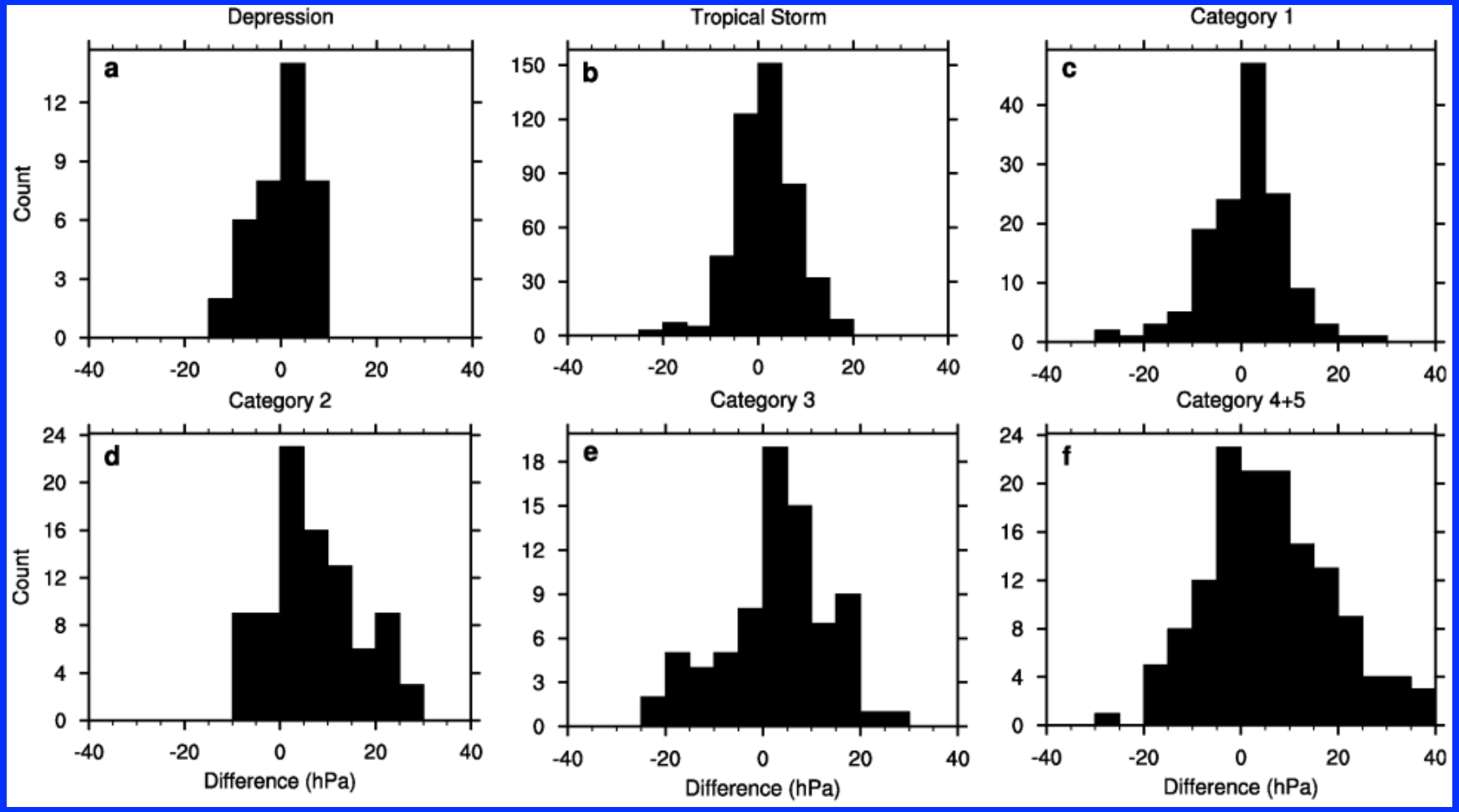
Position Uncertainty



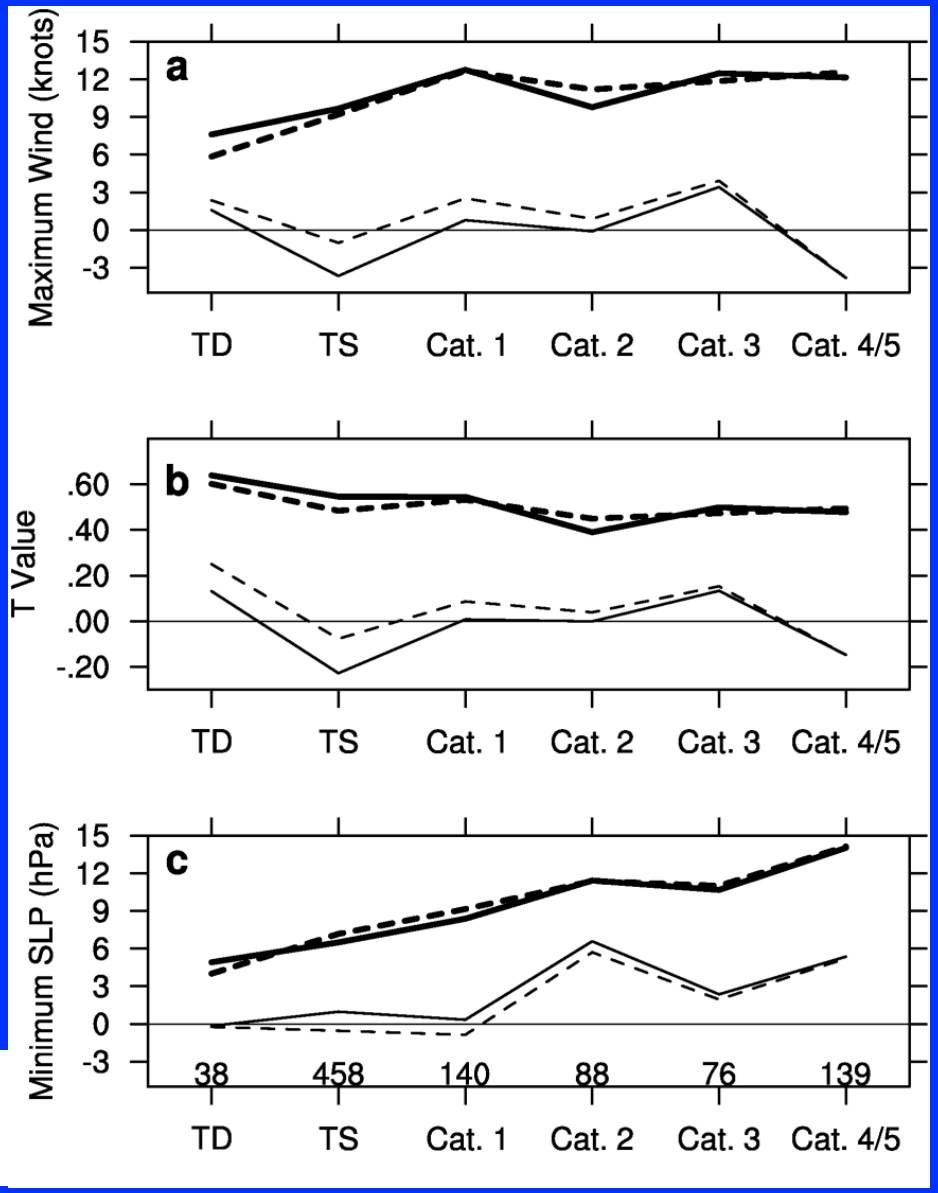
Max. Wind Uncertainty



Minimum SLP


Depression
Tropical Storm
Category 1
Category 2
Category 3
Category 4+5
a
b
c
d
e
f
Count
Count
Difference (hPa)
Difference (hPa)
Difference (hPa)

Error by Category

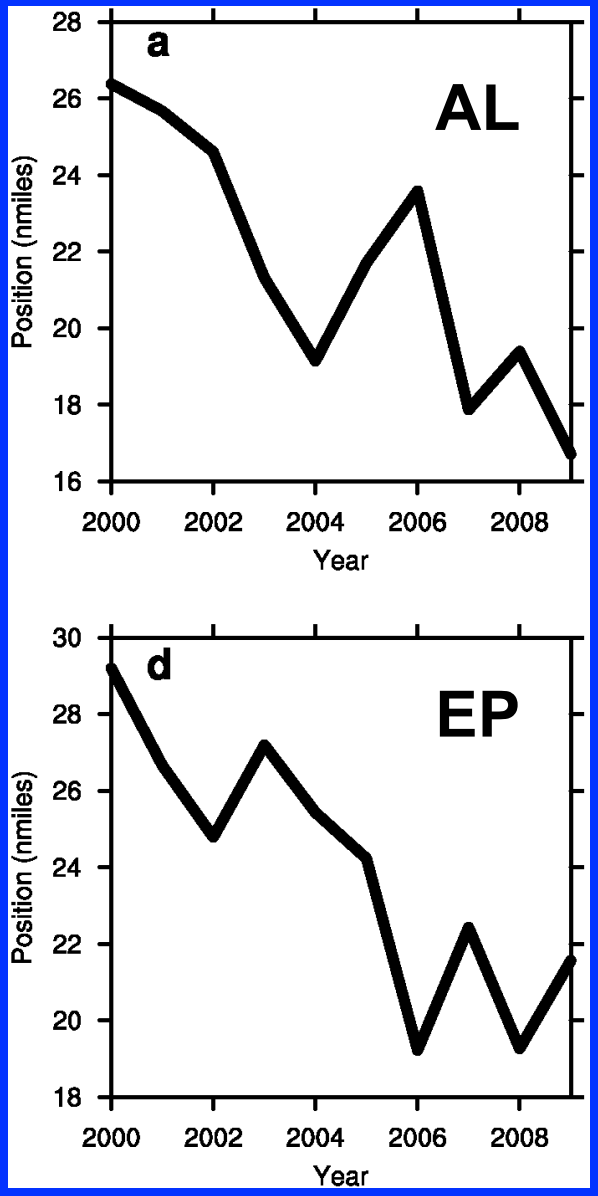


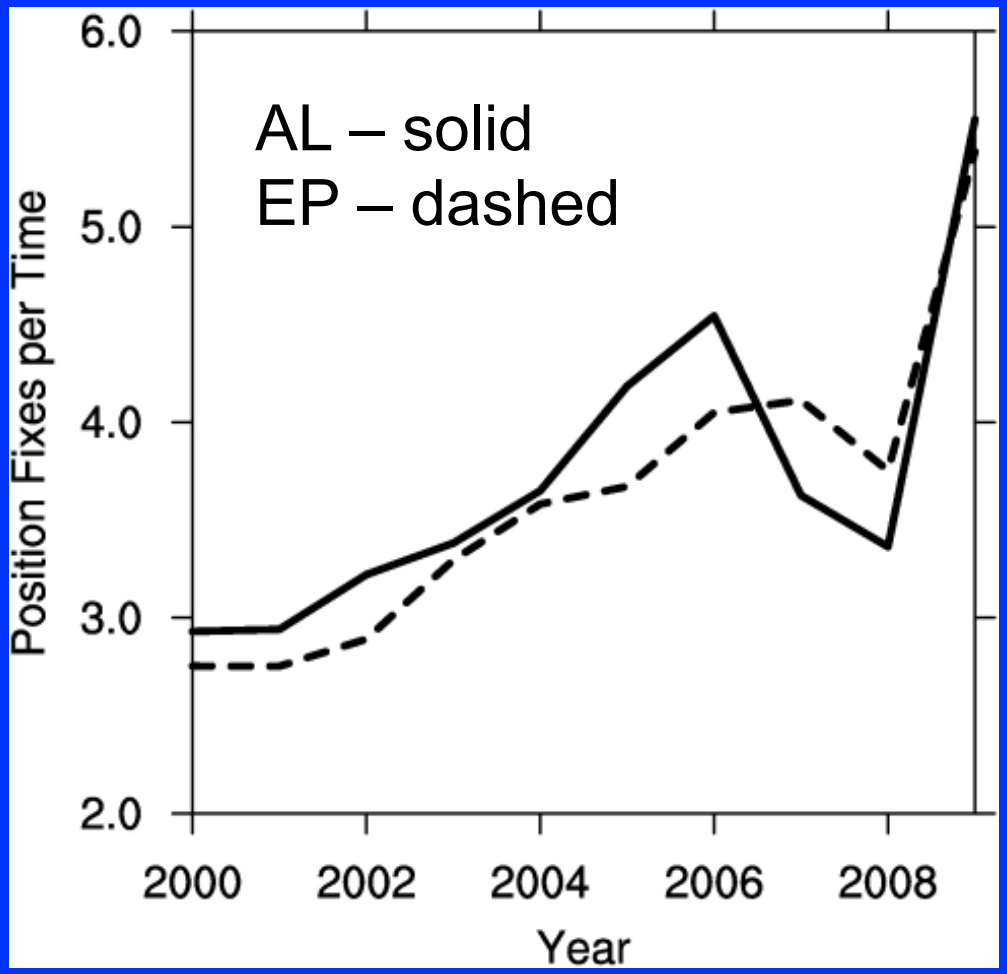
SAB – Solid
TAFB - Dashed

Uncertainty Assignments

- Want to develop algorithm for assigning uncertainty at any single time, can be used to determine interannual variability
- Estimate position uncertainty by taking NHC advisory value
- Estimate intensity uncertainty for each time based on aircraft availability
  - If aircraft data within +/- 2 h, assume 2 hPa MSLP and 9 knots intensity uncertainty
  - If no aircraft data, take Dvorak intensity error as a function of intensity

Position Uncertainty Trends

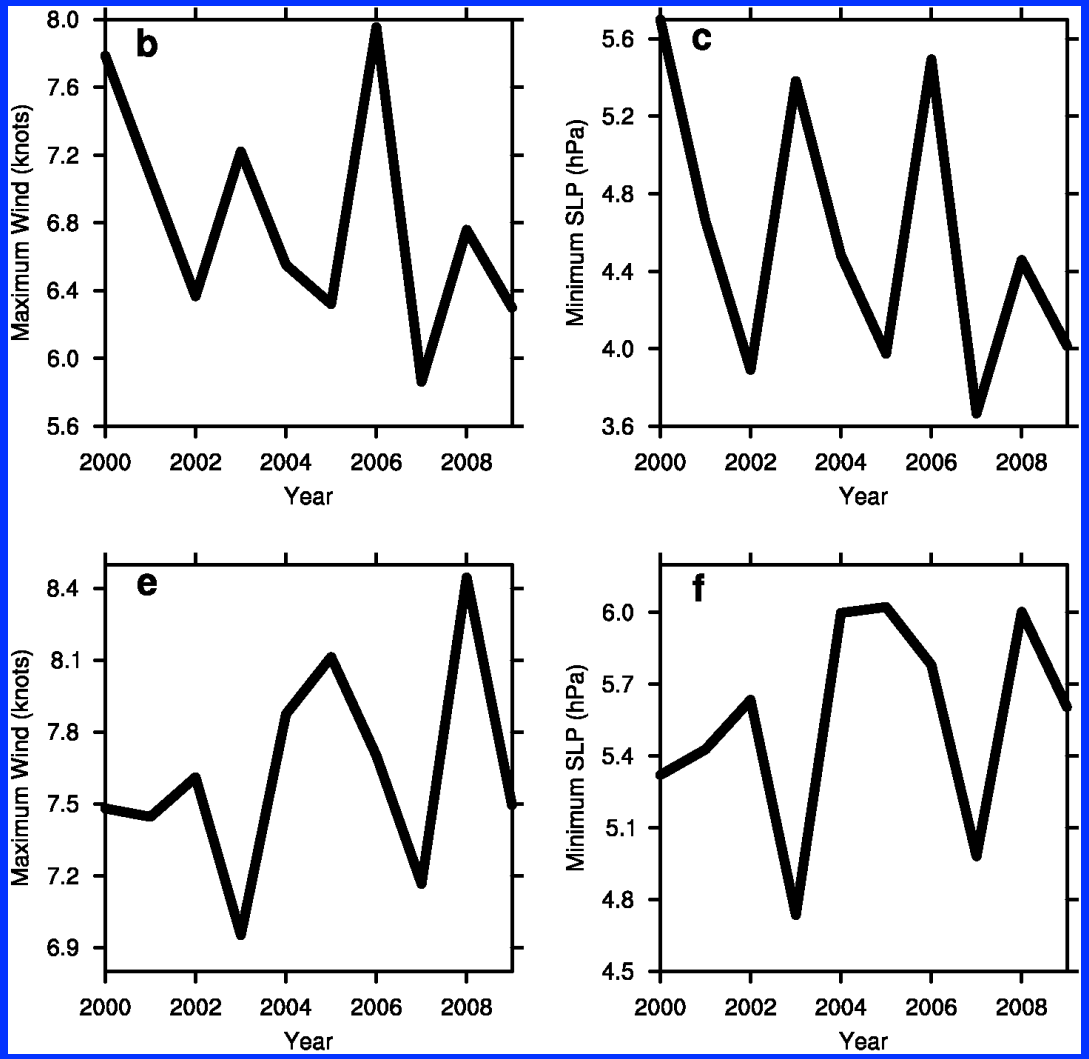


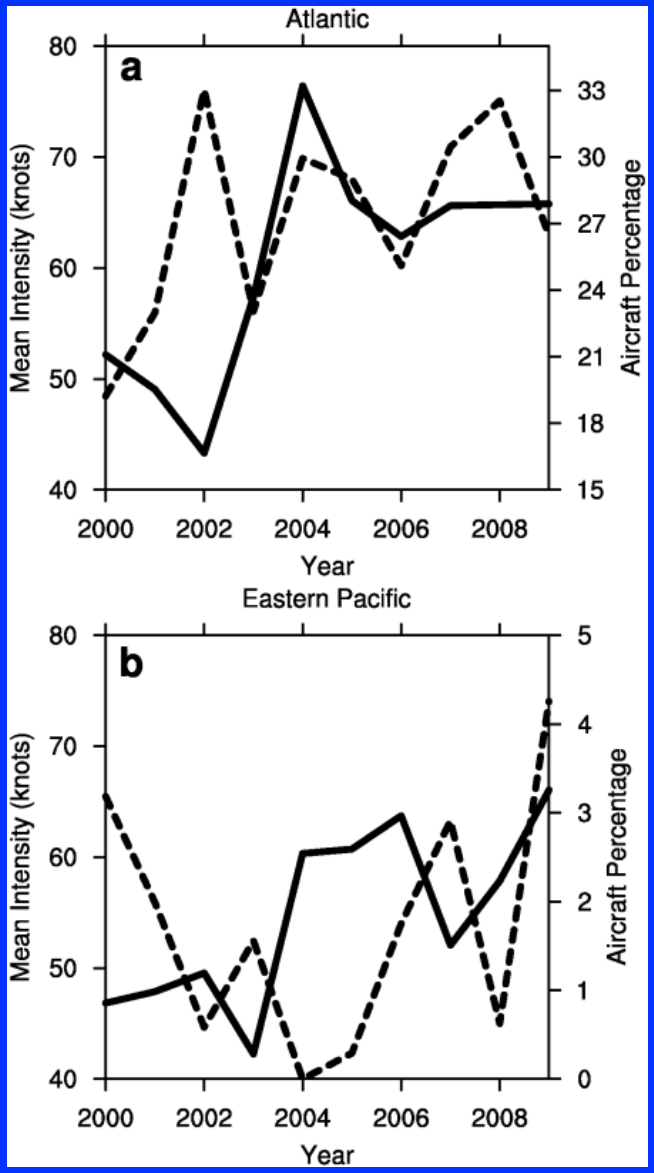


Intensity Uncertainty

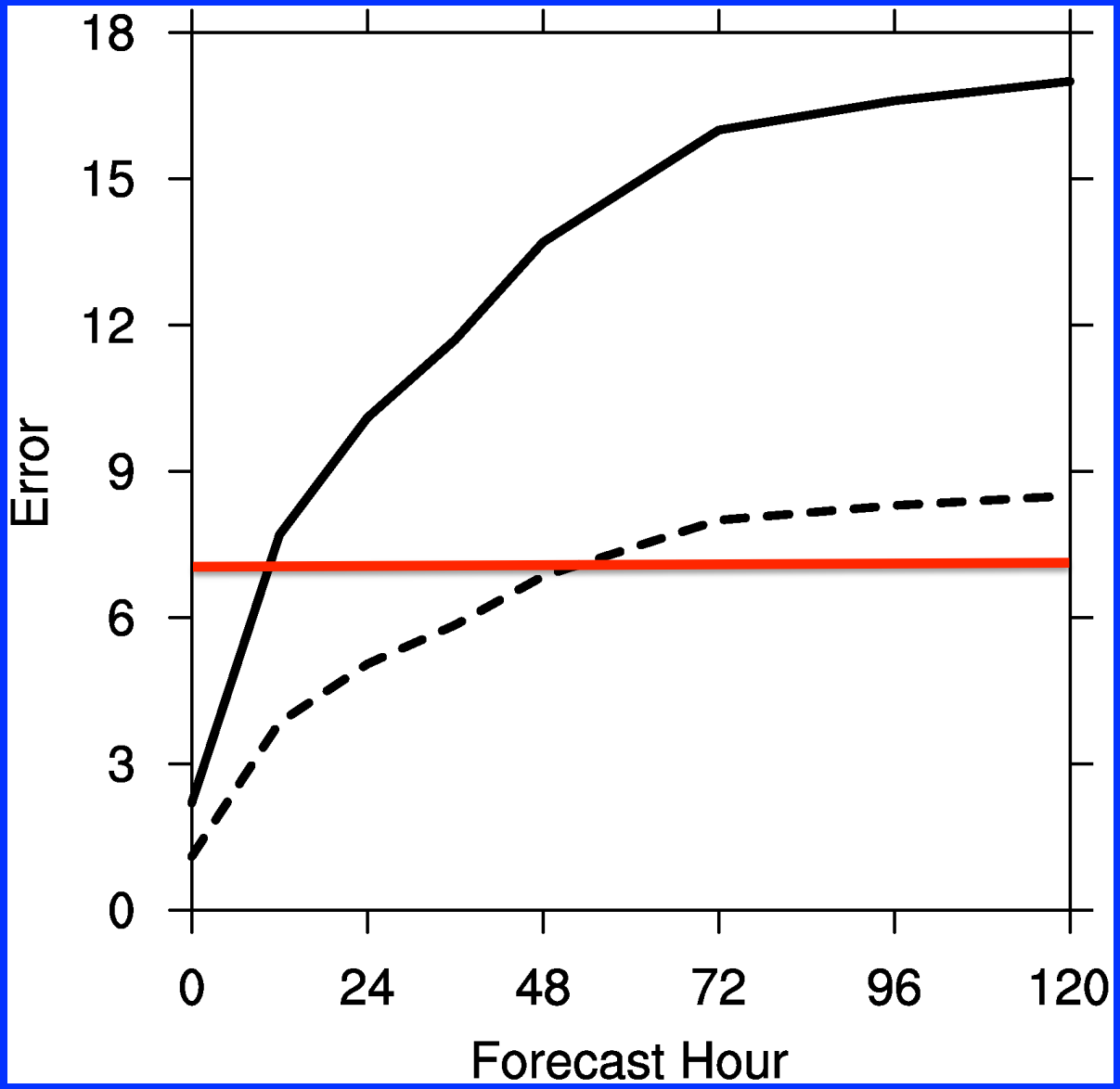
Atlantic

Eastern Pacific





HFIP Goal Implications



Summary

- Position uncertainty, measured through NHC estimates, has been declining steady due to more data
- Maximum wind speed uncertainty is roughly 7 knots, roughly constant with time, compares to 10 knots from Landsea et. al study
- Given current algorithms and observations, it is difficult to determine whether a 50% improvement has been obtained
- Might also be possible to use variance in various satellite estimates to determine uncertainty (not discussed here, though it is in paper)