Tropical Cyclone Verification

"you're only as good as what you measure"

CAPT Vic Addison, USN; CO FNMOC will on active duty in 2006

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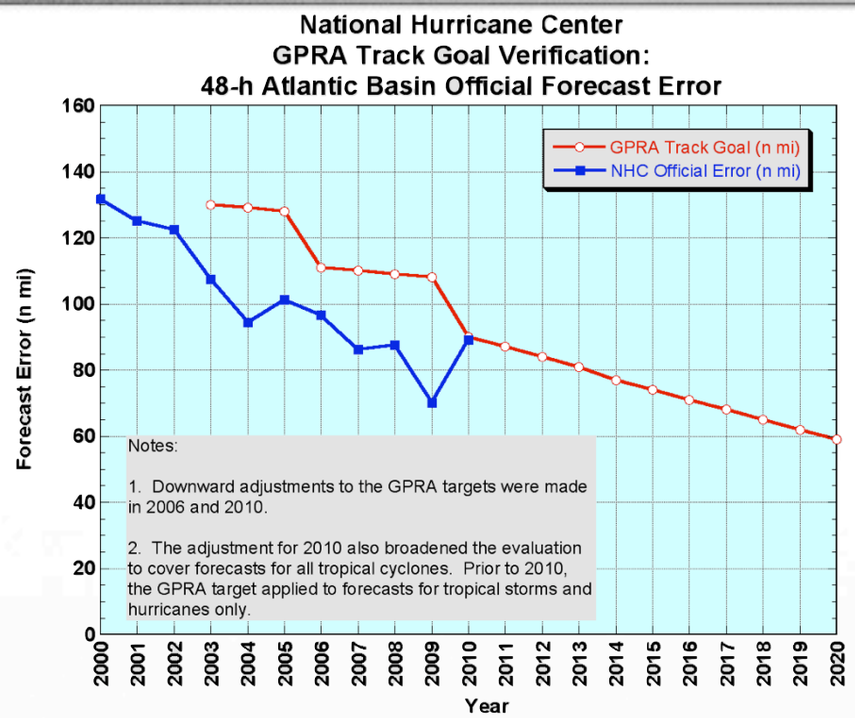
TCs: So What? Who cares?

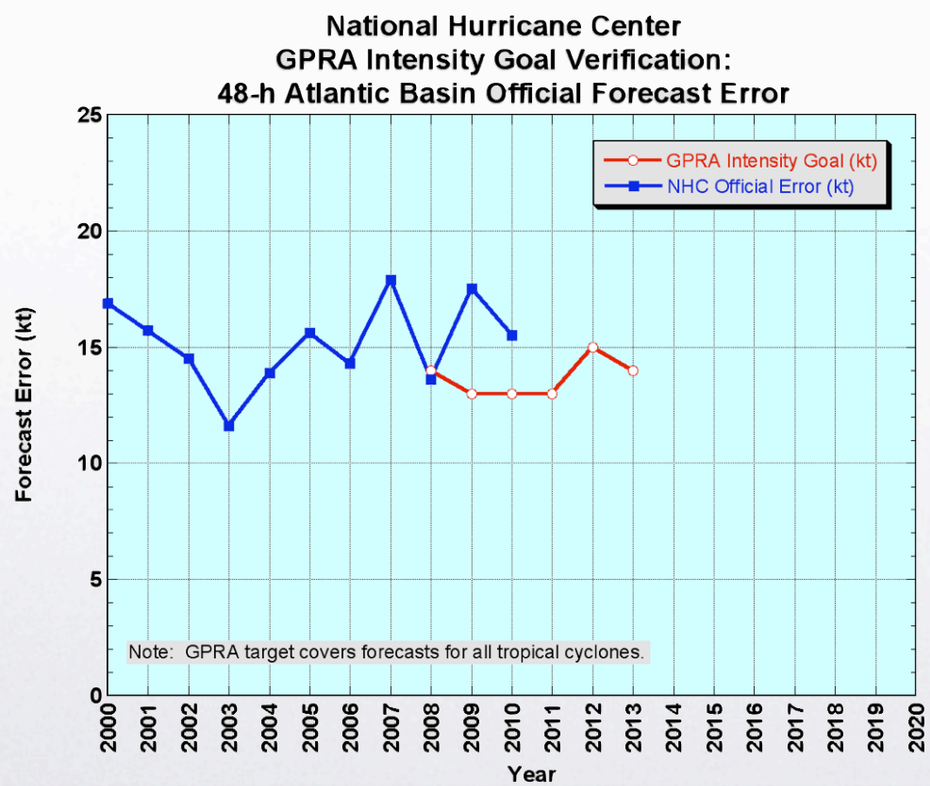
- TCs are ***multi-scale*** and both ***tropical*** and ***midlatitude***
  - track and intensity depends on all scales, global-mesosale
  - errors come from all scales as well...
- "Good" models make good TCs forecasts
  - ***good = meteorology***; != engineering
- TC model forecasts depend strongly on ***model physics***
  - convection, deep and shallow (intensity & tropical general circulation)
  - cloud-moisture-effected radiation (subtropical ridge, speed of motion)
- TC error is an ***integration of*** many (all?) ***model errors***

TC Verification: standard metrics

track/intensity (errors) – this stuff matters – NHC GPRA goals



- ***TRACK*** - great circle distance between forecast (from human/model ***tracker***) and verifying position (postseason "best" track)



- ***INTENSITY*** - difference between forecast max 1-min sustained surface wind speed Vmax (from human/ model tracker) and verifying Vmax (postseason "best" track)

TC Verification: INPUT

it's (all about) the tracker...locates TC center...and a lot more...

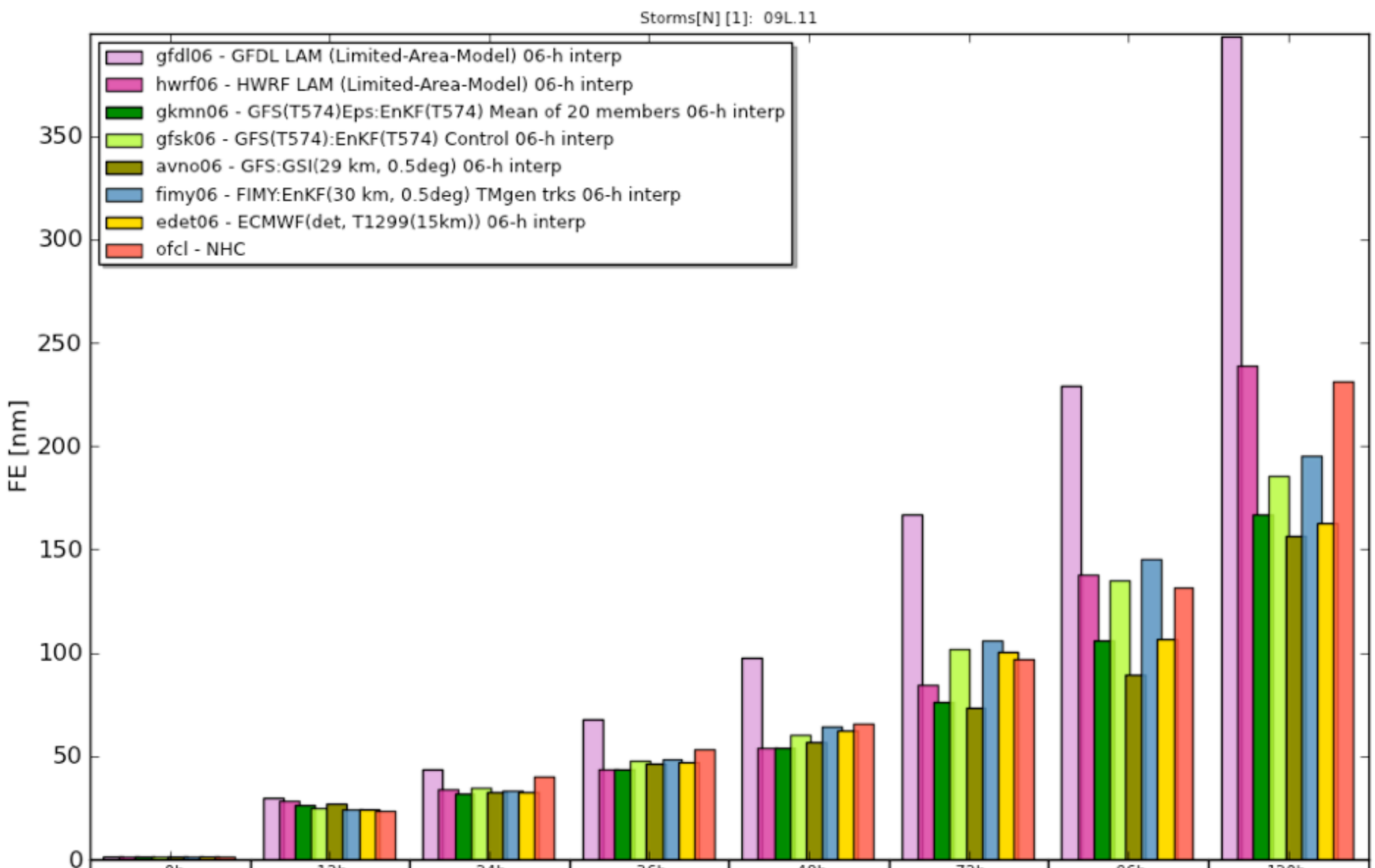
- human/best tracking (the 'truth')
  - operational: TC structure needed for the warning/advisory
    - track: center of 'TC-dominated' sfc wind circulation
    - intensity: max 1-min sfc wind speed in TC-dominated
    - wind fields: radius of 34/50/64 kt winds in 4 quadrants
    - final best track: blending 'fixes' from multiple sources of TC location/structure
  - ***ESRL capabilities***
    - ***complete set of best tracks both real-time and an archive extending back to...***
- model/data (the 'forecast')
  - consistent with operational definitions...answers the "a TC, or not a TC, that is the question"
  - ***ESRL capabilities***
    - ***global model field archive 1996-2011***
    - ***run various NCEP and locally developed model trackers***
    - ***complete set of model/aid tracks globally***

TC Verification: PROCESSING/OUTPUT

display, verification and statistical analysis

- ATCF - Automated Tropical Cyclone Forecast system
  - display of model and best track
  - calculate errors and analyze statistically (.f)
  - used at all US TC forecast centers: NHC, CPHC, JTWC,(HPC,FNMOC)
- ***ESRL atcf.py – python version of ATCF(++)***
  - handles **same data files as ATCF**; **QC** of forecast and best tracks
  - more **advanced** tracker **post processing** for verification and forecasting
  - .py shelves for database, **interactive** vice batch (ATCF) **data access**
  - unique **diagnostic** applications (**web**):
    - TCgen: display & verification of genesis trackers
    - TCdiag: display & analysis of TC environment
    - TCeps: display of ensemble prediction system trackers and products
  - outputs: wxmaps, stats...

track errors of IRENE



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ofcl	2[12]	24[12]	40[12]	53[12]	66[12]	97[10]	132[8]	231[6]

WxMAP2

- http://ruc.noaa.gov/wxmap2/
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TC Verification: ***ESRL Inventory***

input, output and next step

- Most comprehensive set of TC (and model) data in the world
  - global TC best tracks extending back to 1945
  - global model field archive (development of TC general tracker)
  - complete set of TC forecast tracks
- TC tracker and cyclone diagnostics
  - merging and development of various codes (.f & .f90)
    - my tracker + NCEP tracker + CSU/CIRA diagnostics
    - remove data format dependencies
- .py & .f (.c) management using sourceforge
  - global model field archive (development of TC general tracker)
  - complete set of TC forecast tracks

outtakes

- **`http://sourceforge.net/projects/wxmap2/`**
  - all code/scripts; not just TCs...weather maps...model diagnosis...WMO verification...
- **`http://ruc.noaa.gov/hfip/wxmap2`**
  - weather maps of the US models + access to TC webs
- **`http://ruc.noaa.gov/hfip/tcdiag`**
  - TC genesis tracker display for 6 global models including FIM
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