Global HFIP demo results 2012/13

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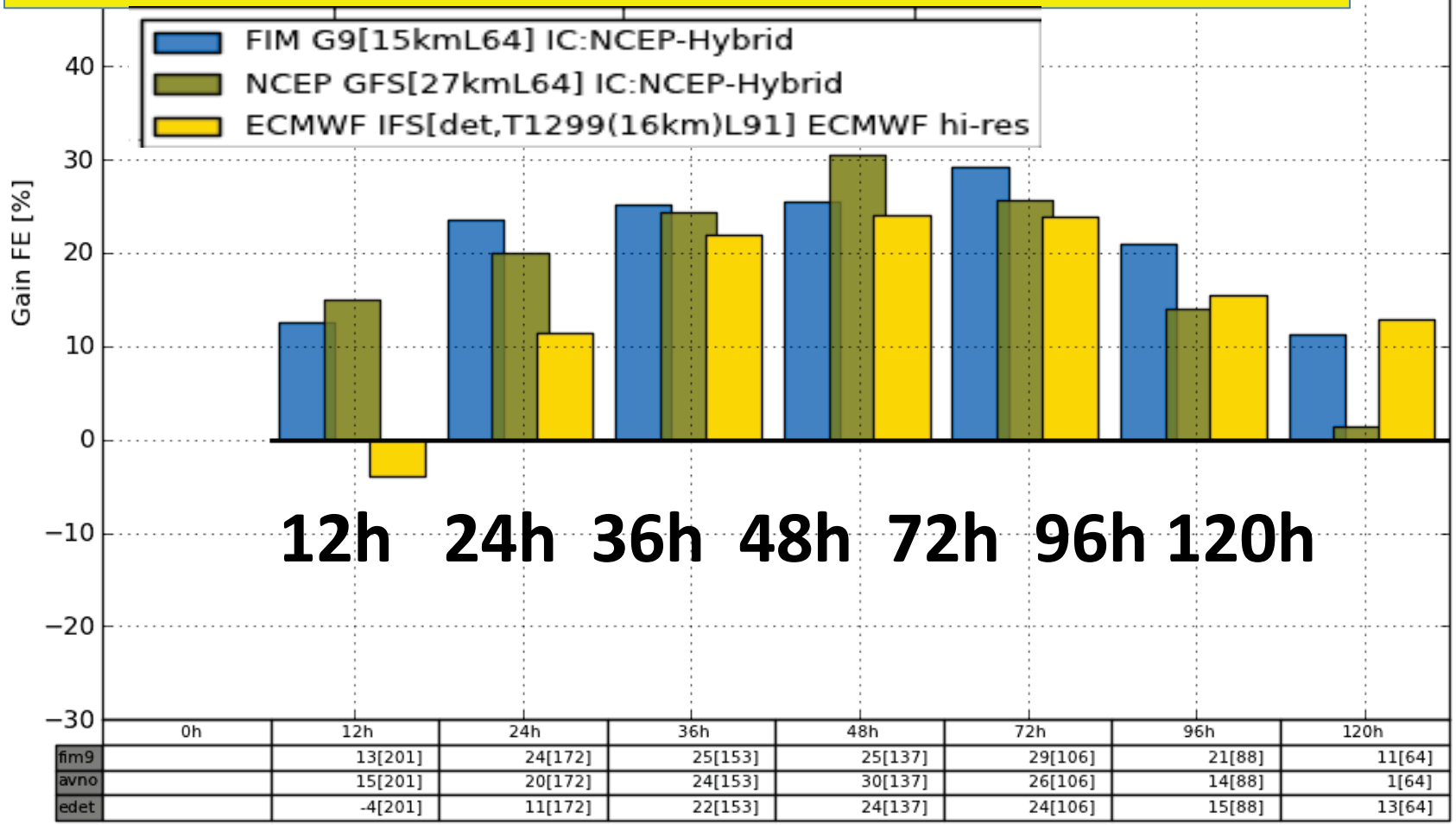
HFIP retrospective testing completed in April 2013

3-year (2010-2012) Atlantic hurricane track error results

% forecast error (FE) improvement over HFIP baseline

(HFIP goal – 20% improvement over baseline

- Both FIM and GFS used the same hybrid initial conditions
- FIM9 = 2013 version for 2013 HFIP real-time runs

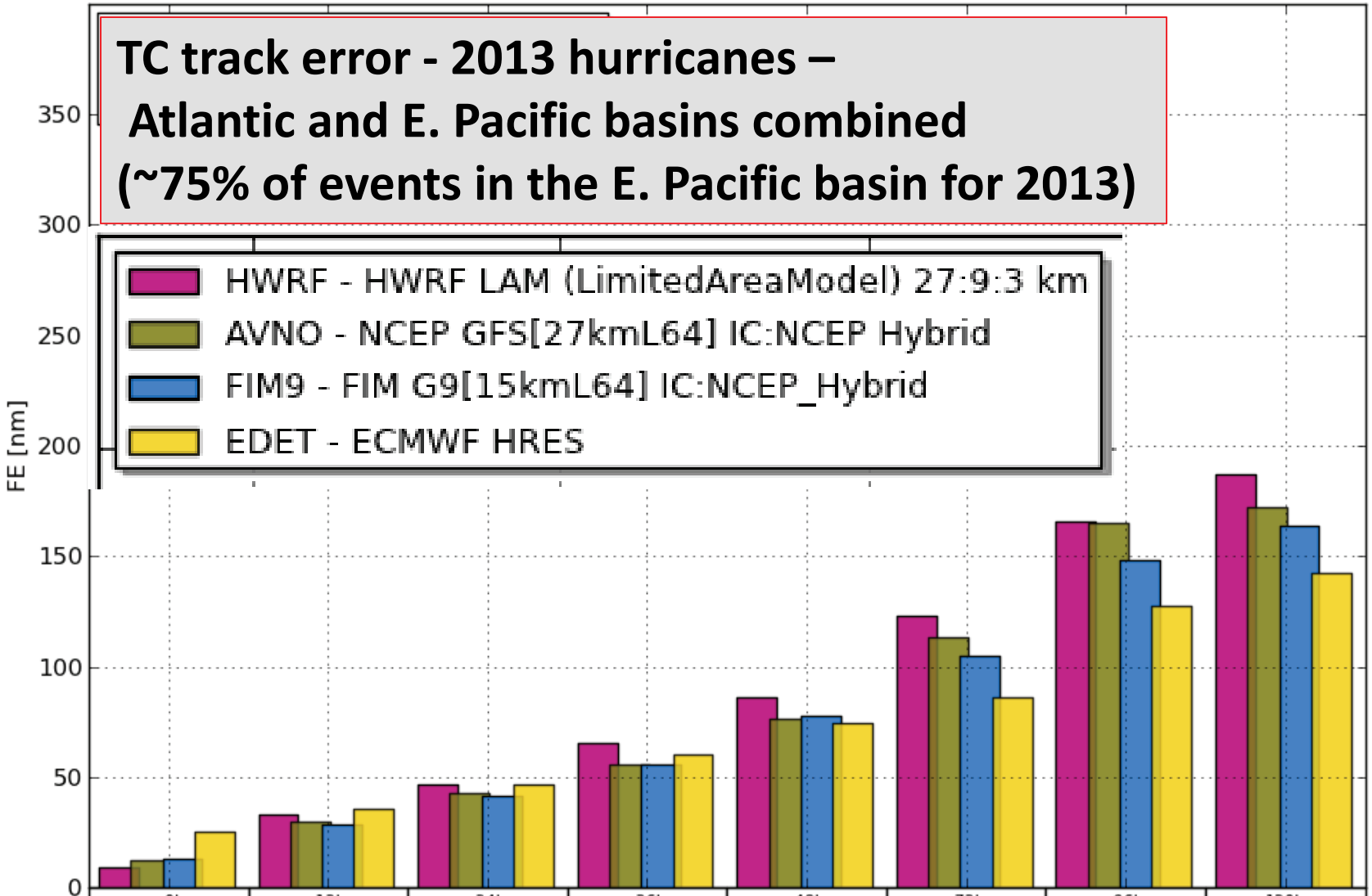


	0h	12h	24h	36h	48h	72h	96h	120h
fim9		13[201]	24[172]	25[153]	25[137]	29[106]	21[88]	11[64]
avno		15[201]	20[172]	24[153]	30[137]	26[106]	14[88]	1[64]
edet		-4[201]	11[172]	22[153]	24[137]	24[106]	15[88]	13[64]

EPAC/LANT 2013 HWRF v GFS v FIM9 v ECMWF

Storms[N] [26]: 01L.13 02E.13 02L.13 03E.13 03L.13 04E.13 04L.13 05E.13 05L.13 06E.13 ... 10L.13 11E.13 11L.13 12L.13 13E.13 13L.13 14E.13 15E.13 16E.13 17E.13

TC track error - 2013 hurricanes – Atlantic and E. Pacific basins combined (~75% of events in the E. Pacific basin for 2013)



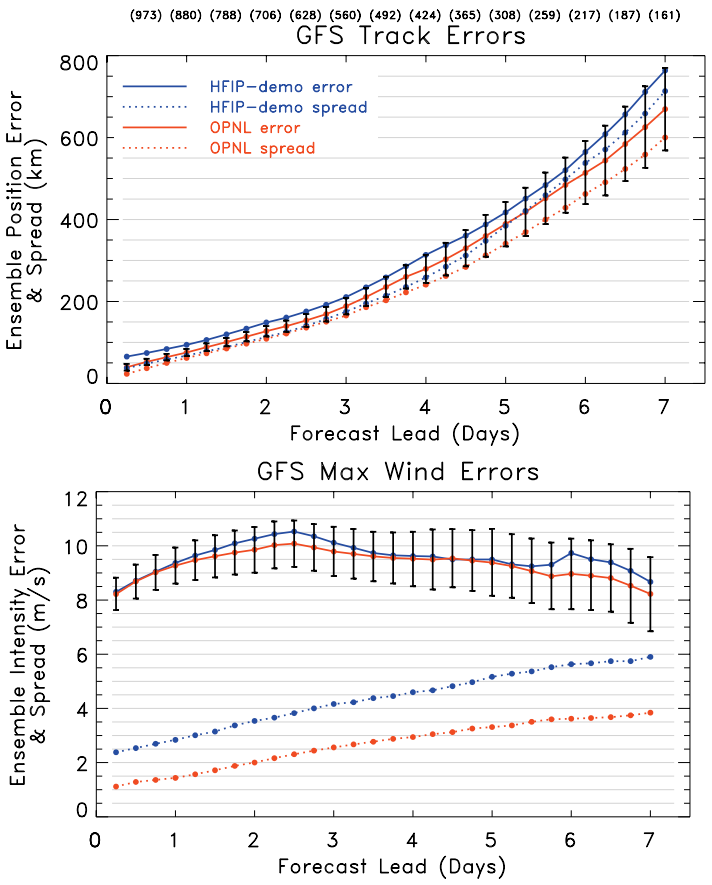
	0h	12h	24h	36h	48h	72h	96h	120h
hwrf	9[196]	33[159]	47[137]	65[117]	86[96]	123[59]	166[42]	187[28]
avno	12[196]	30[159]	43[137]	56[117]	76[96]	113[59]	165[42]	172[28]
fim9	13[196]	28[159]	42[137]	56[117]	78[96]	105[59]	148[42]	164[28]
edet	25[196]	36[159]	47[137]	60[117]	74[96]	86[59]	127[42]	143[28]

GFS DA/Ensemble Configuration

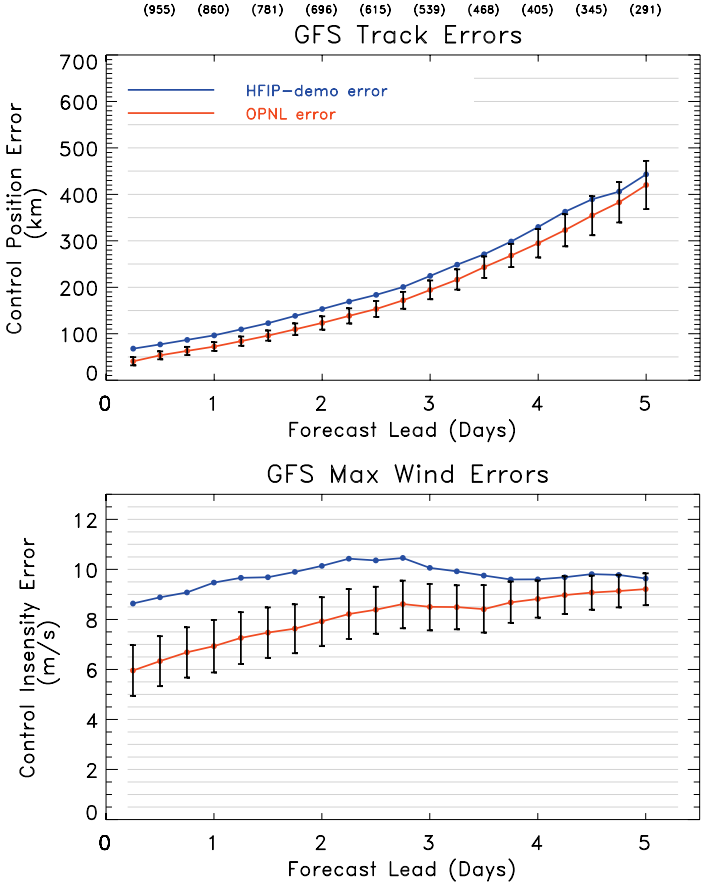
- In 2012, we (ESRL/PSD) ran a hybrid ensemble-3DVar analysis system with an 80 member T382 (~40 km) ensemble and a T878 (~20 km) control forecast. The Eulerian version of the GFS dynamic core was used, with the same physics settings used in operations (which was T574/T254 for the control and ensemble for both 2012 and 2013). No TC relocation was done. 7-day 20 member ensembles and a high resolution control forecast were run out to 5 days. Stochastic physics was active in the 7-d forecast ensemble, but not in the data assimilation cycle.
- In 2013, we ran a hybrid ensemble-3DVar analysis system with an 80 member T574 (~30 km) ensemble and a T1148 (~17 km) control forecast. The semi-lagrangian version of the GFS dynamic core was used, with physics settings as recommended by NCEP. TC relocation was done for both the ensemble and the control forecast. 7-day 20 member ensembles and a high resolution control forecast were run out to 7 days. Stochastic physics was active in the both the 7-d forecast ensemble and the data assimilation cycle.

2012 high-res GFS results

20-member ensemble



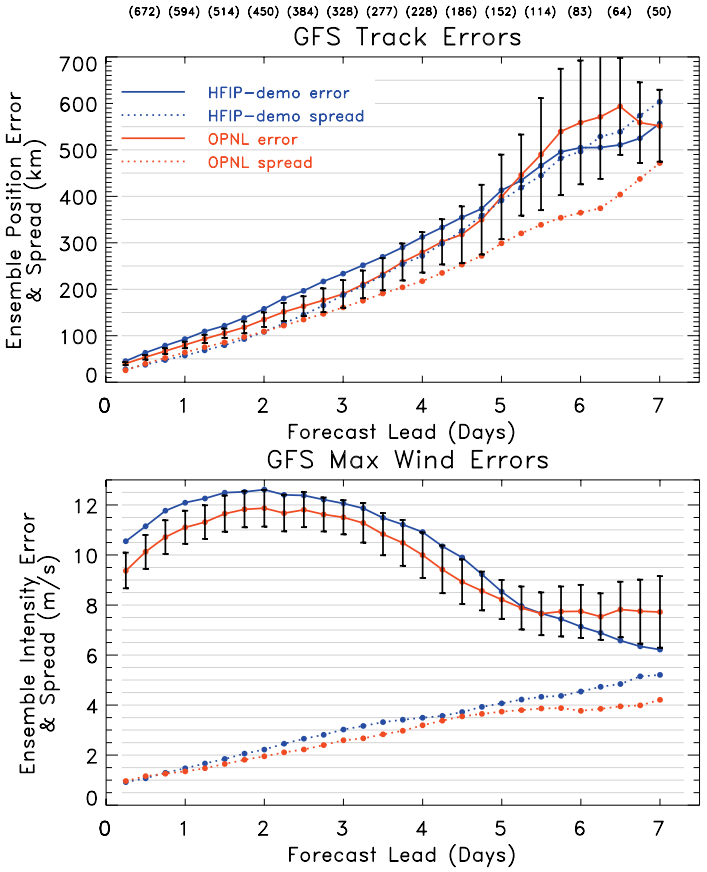
deterministic forecast



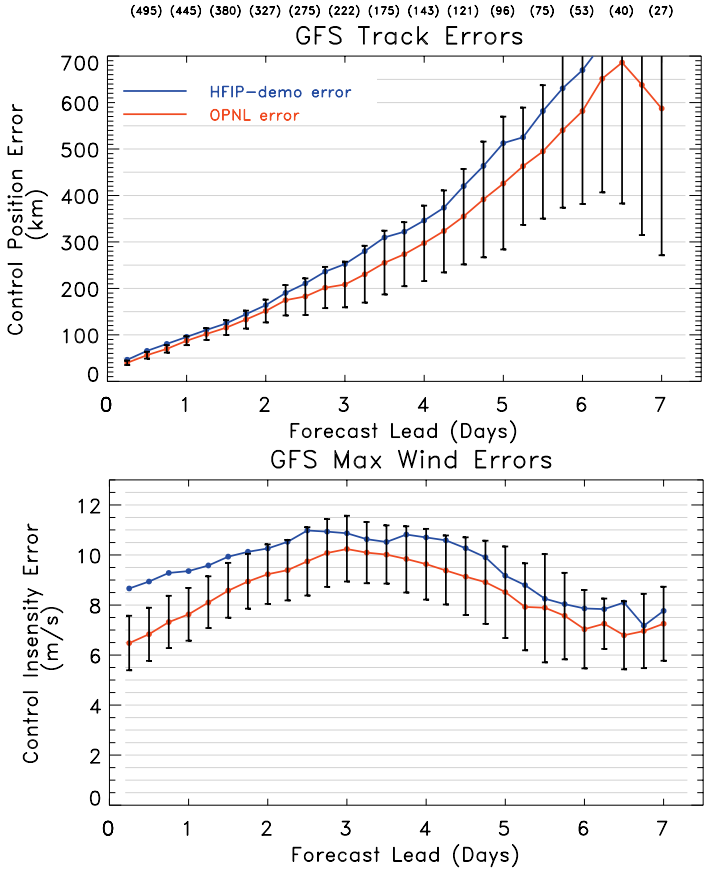
Larger Initial position error in HFIP-demo was due to not relocating first guess.
Stochastic physics in HFIP-demo produce larger ensemble spread.

2013 results

20-member ensemble

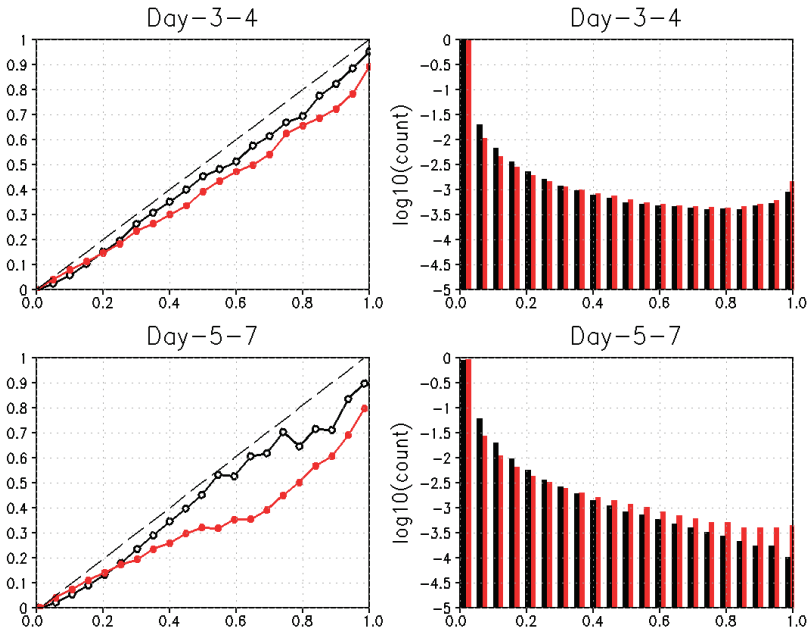


deterministic forecast

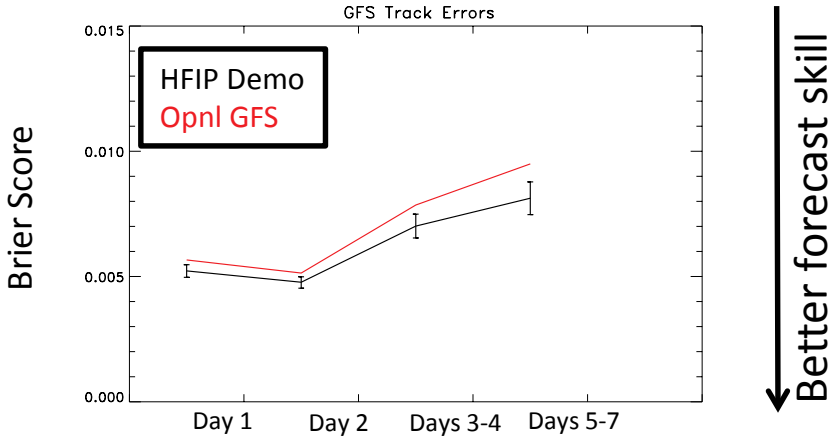


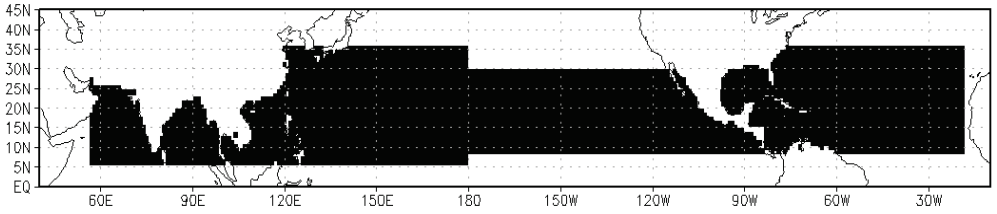
Relocation in HFIP-demo fixed the initial position error.
Stochastic physics in HFIP-demo produce larger ensemble spread.

Probability of winds of tropical storm strength or greater



Brier Skill of Probabilistic Wind forecast >34kts

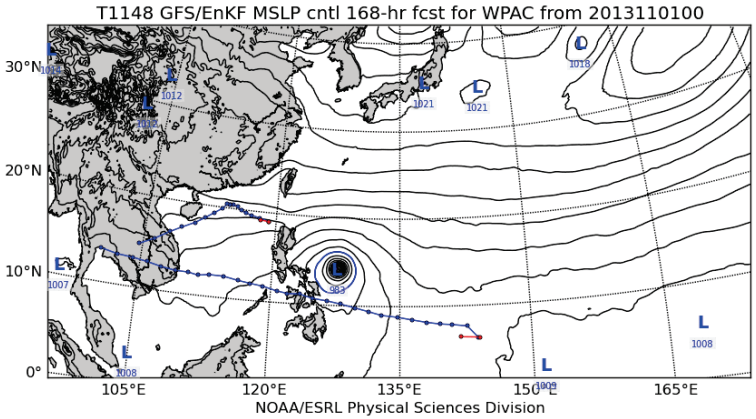


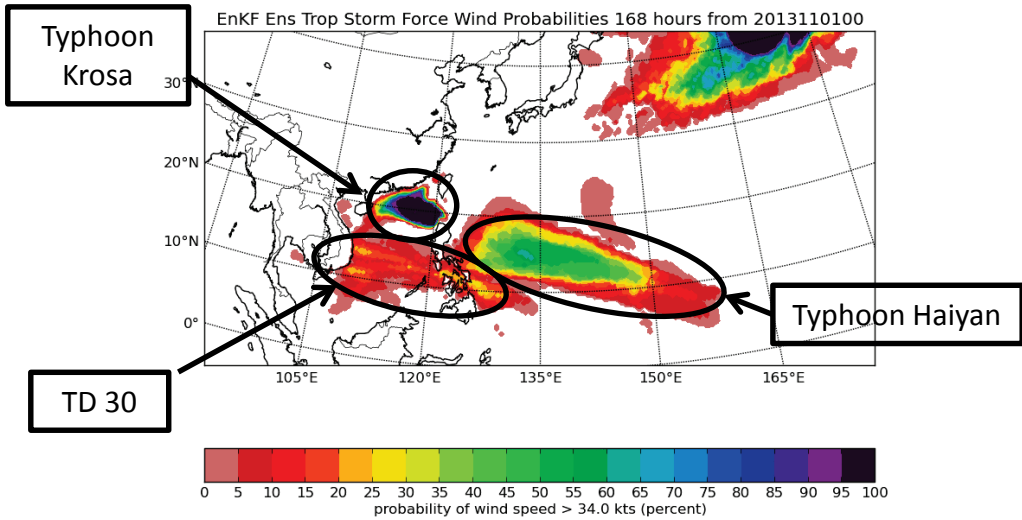


Probabilities are computed on a 1x1-degree. Reliability and Brier Scores are aggregated over domain shown on left

7-Forecast of Typhoon Haiyan

Haiyan at validation time:
Position: 8.6ºN 132.8ºE
minp: 911 mb
maxw: 150 kts





This forecast was initialized 18 hours before Haiyan was classified as an invest, and 48 hours before it was classified as a depression.

Operational Transitions

- Stochastic physics (tested in 2012 and 2013)
  - Improves reliability of ens forecasts
  - Improves background-error covariance in DA
  - On track for opnl implementation in next GFS upgrade (in DA cycle).
- TC relocation in EnKF ensemble (algorithm suggested by Y. Ota, tested in 2013)
  - Better accounts for uncertainty in TC position, while preventing mean TC position from drifting.
  - Also on track for opnl implementation in next GFS upgrade.

What next?

- Test 4D-EnVar DA (in collaboration with OAR/NWS Sandy Supplemental project, ahead of possible implementation in FY15).
- Continue stream 1.5 FIM, with updated physics in FIM, higher-res (1/8 deg) output for tracker.
- Emphasis on probabilistic products from global (multi-model) ensemble, particularly for days 5-7.
- Physics development for global models?