Real time global GSI Hybrid/EnKF analysis system for 2011

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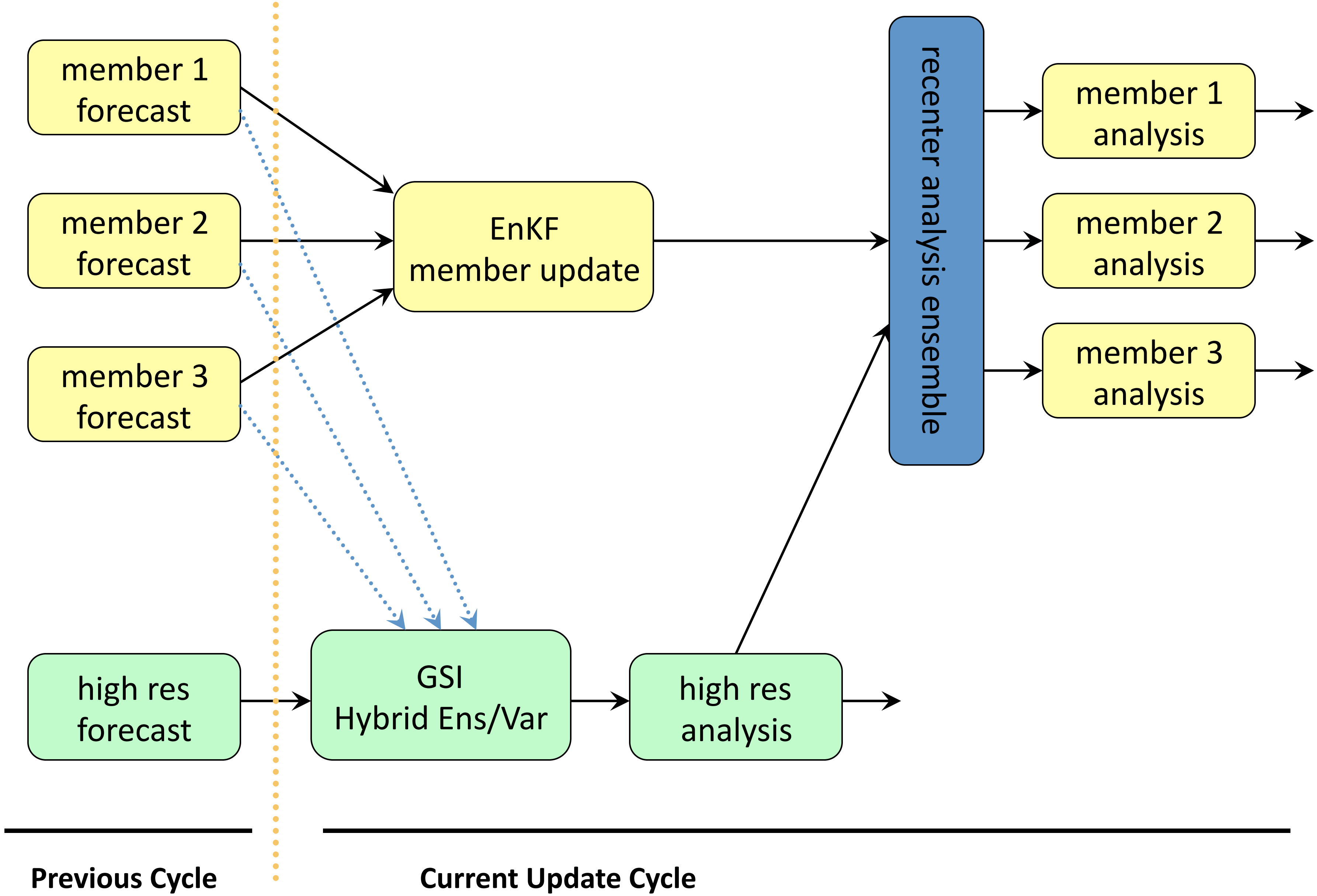
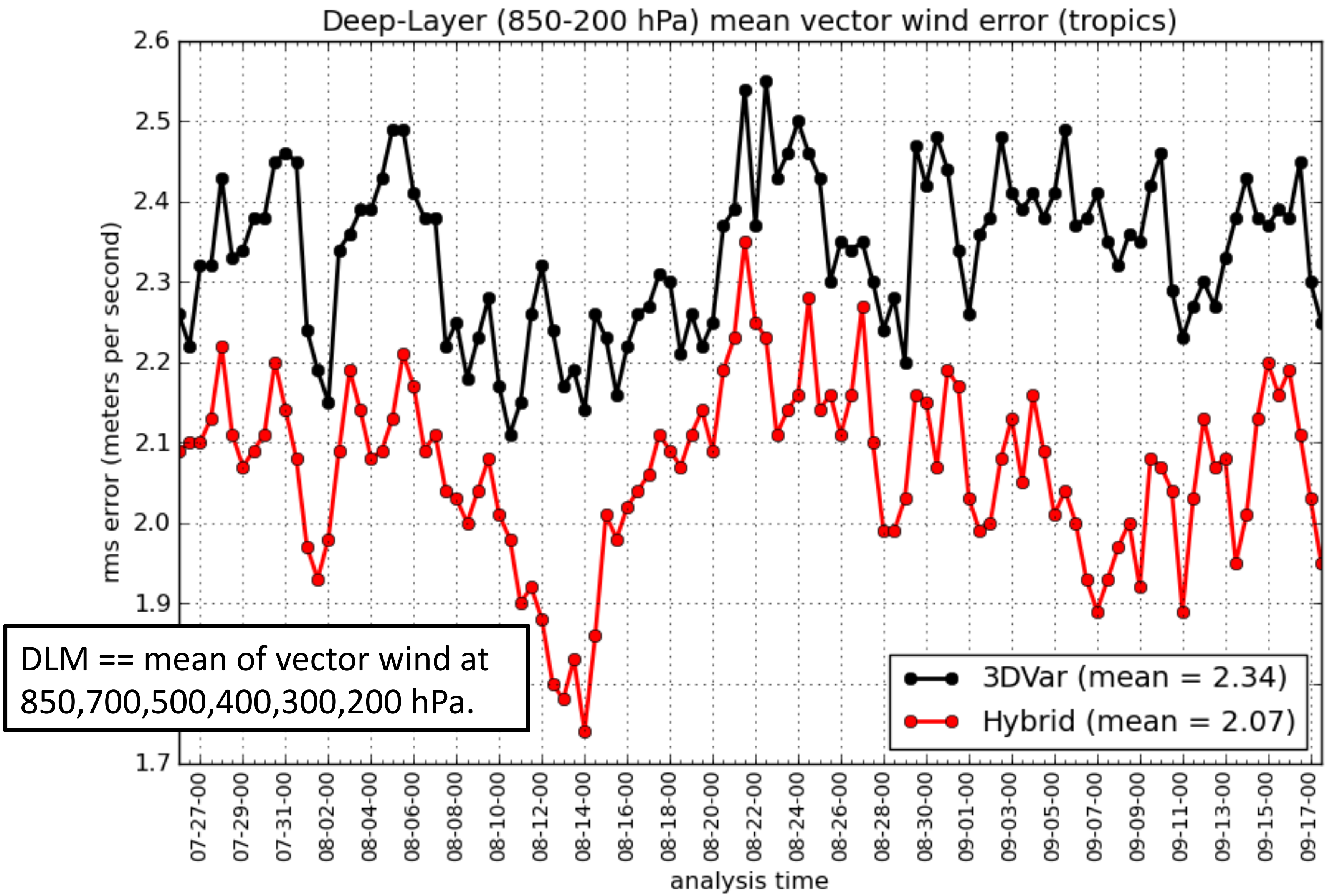
History

- Global EnKF system
  - Uses GFS model, GSI for forward operator.
  - Run in 2008 and 2009 at T382 resolution with 60 members (DOE Jaguar and TACC Ranger)
  - GSI now can use EnKF ensemble to define background error (Hybrid Var/EnKF)
- In 2010, ran on 1440 tjet cores from mid-June onward.
- Reran with GSI/Hybrid dual resolution T574/T254.
- Track skill in 2009/2010 on par with ECMWF (better in Atlantic, slightly worse in WPAC).

Dual-Res Coupled Hybrid

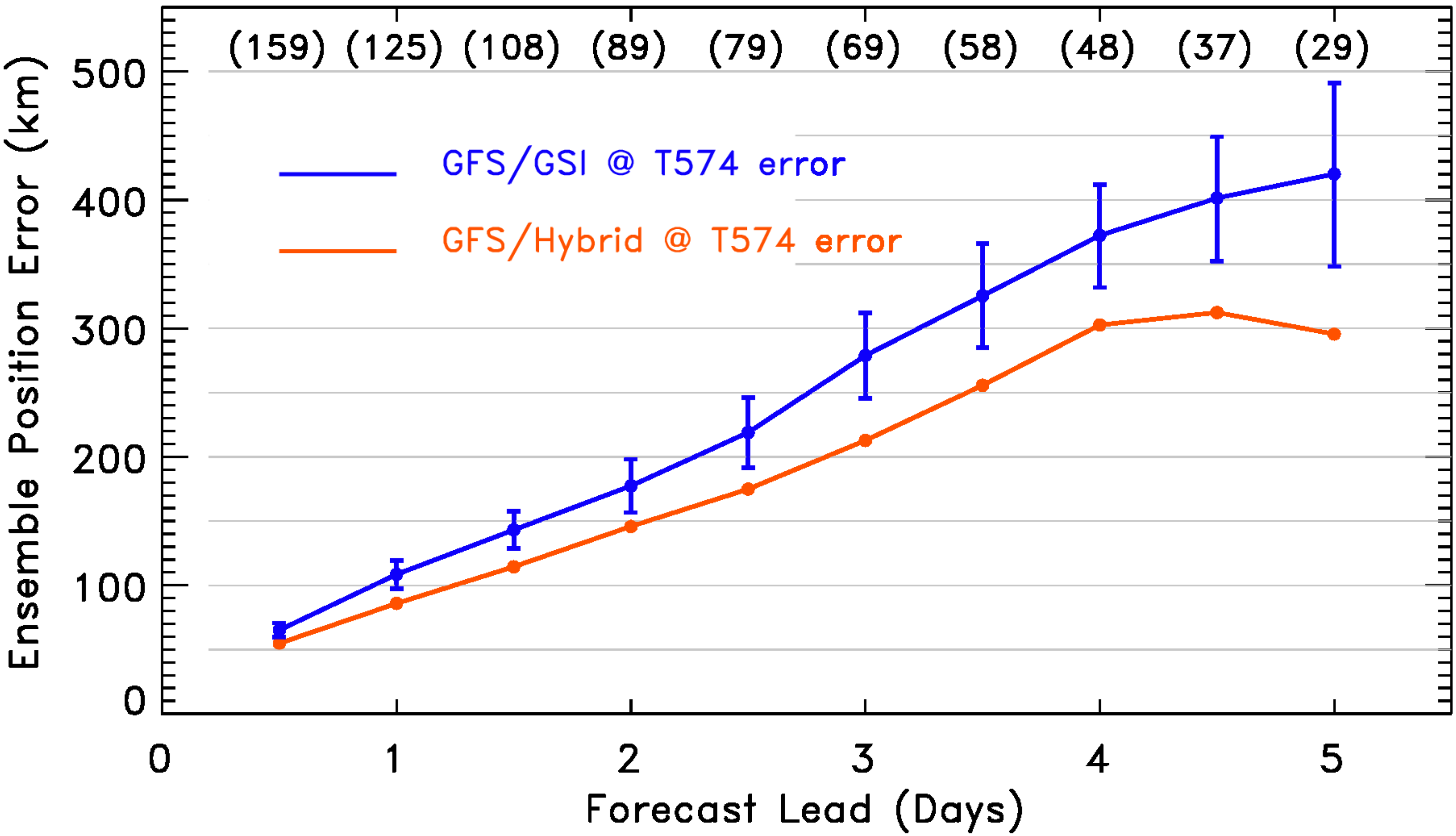


Tropical Wind Errors (72-h) vs ECMWF analysis



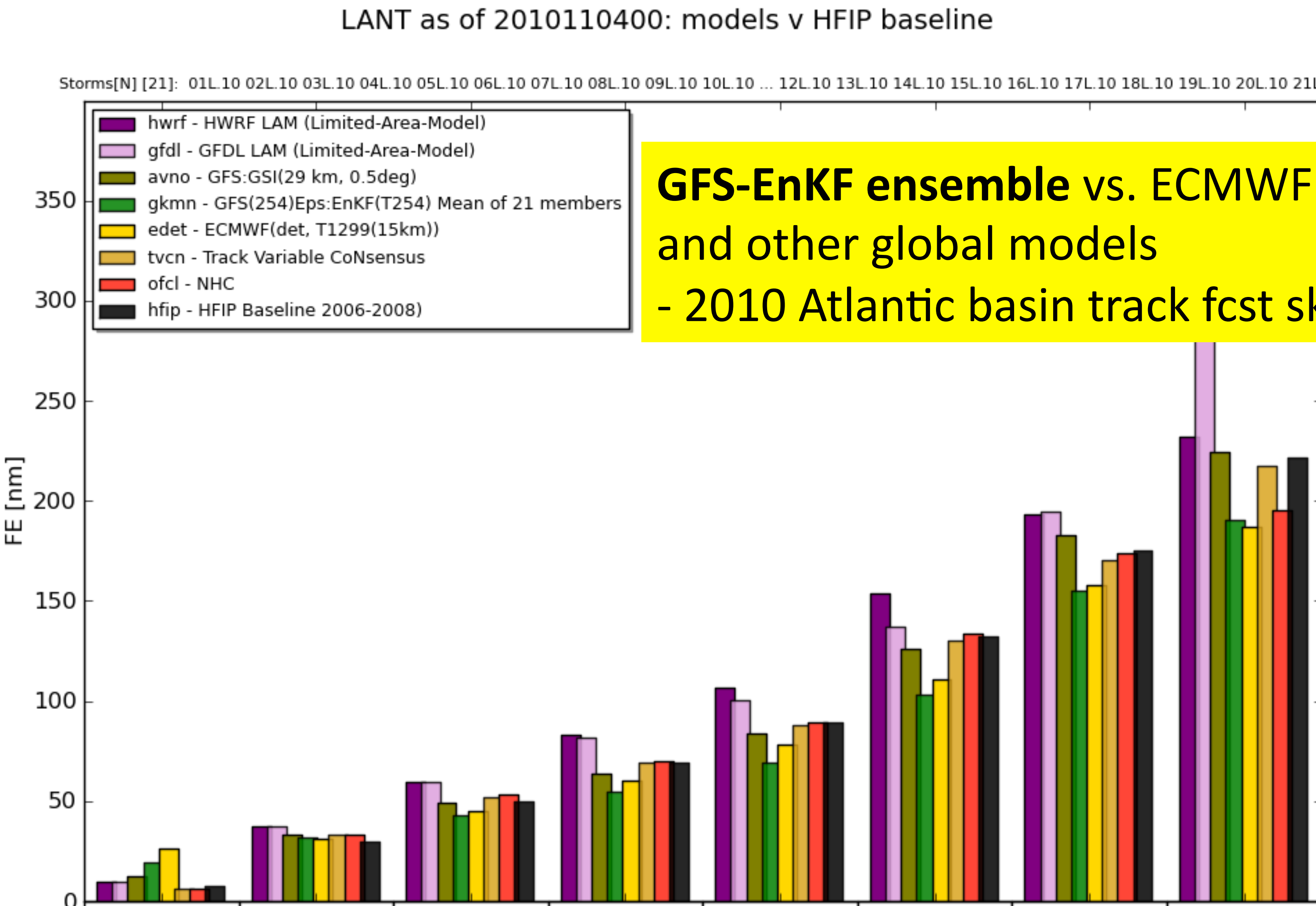
Hybrid steering flow forecasts are better than operational GSI, by a wide margin.
ECWMF produces best TC tracks, so steering flow analysis is probably better.

GSI/EnKF Hybrid vs GSI opnl track errors



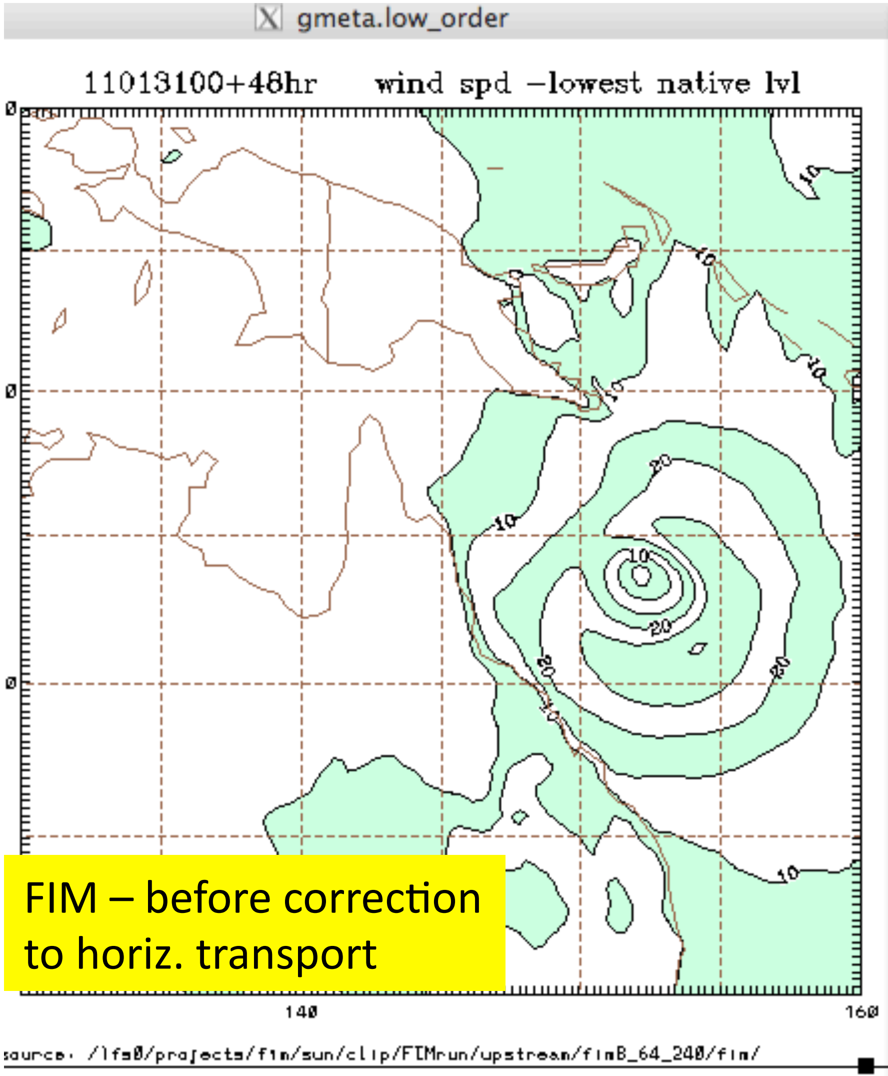
Hybrid has significantly lower track errors than operational GSI (using static covariance)

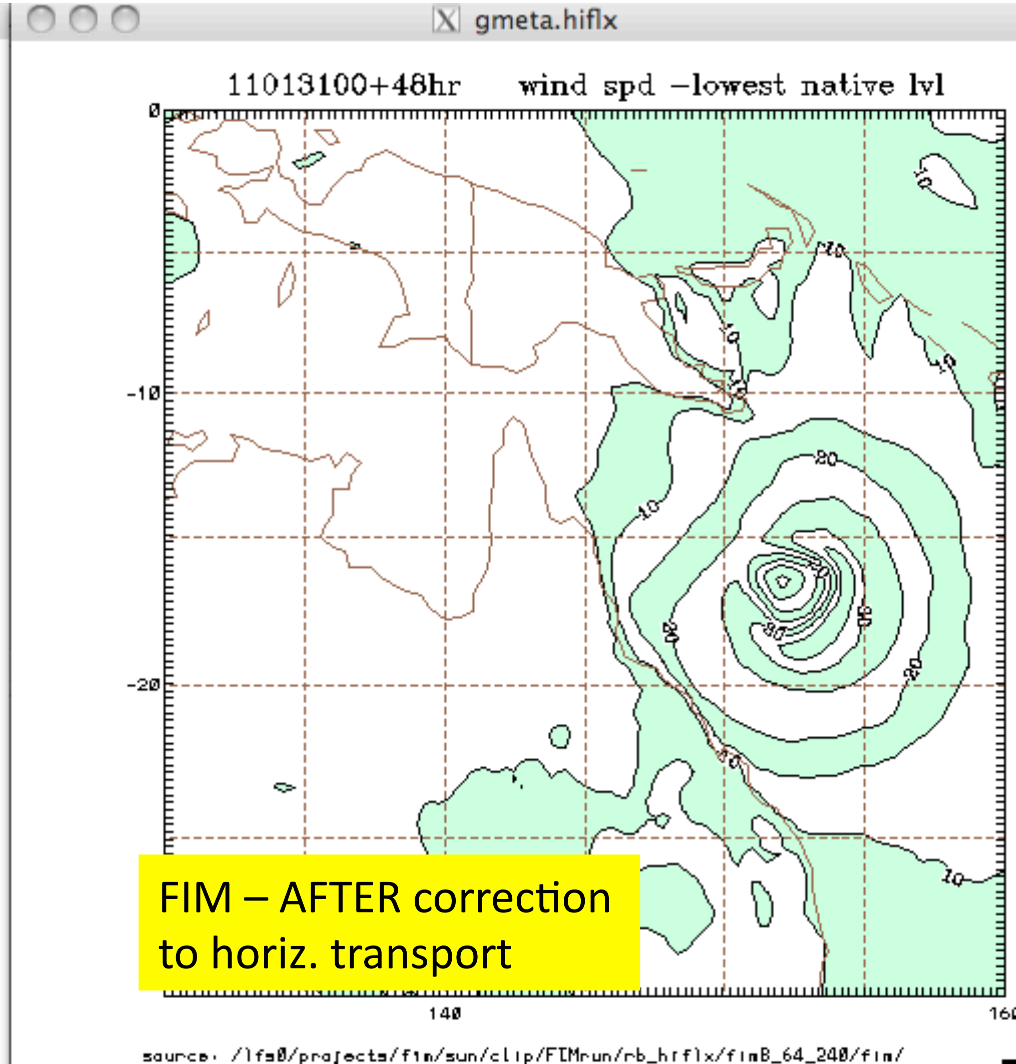
GFS-EnKF ensemble vs. ECMWF and other global models
- 2010 Atlantic basin track fcst skill



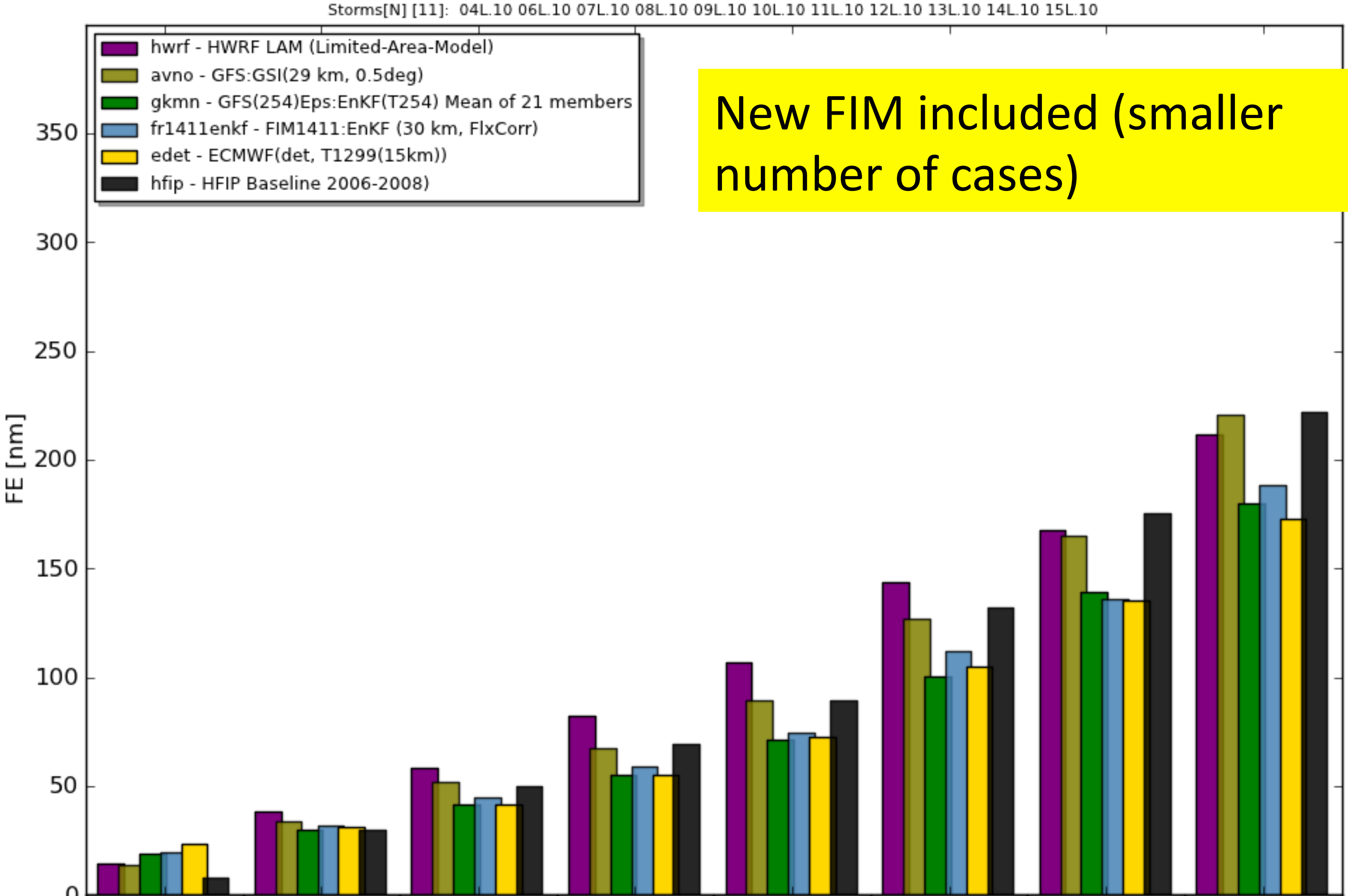
	0h	12h	24h	36h	48h	72h	96h	120h
hwrf	10[162]	38[147]	59[128]	83[111]	106[99]	154[75]	193[60]	232[43]
gfdl	10[162]	37[147]	59[128]	81[111]	100[99]	137[75]	195[60]	282[43]
avno	12[162]	33[147]	49[128]	63[111]	84[99]	126[75]	183[60]	224[43]
gkmn	19[162]	32[147]	43[128]	55[111]	69[99]	103[75]	155[60]	190[43]
edet	26[162]	31[147]	45[128]	60[111]	78[99]	111[75]	158[60]	187[43]
tvcn	6[162]	33[147]	52[128]	69[111]	88[99]	130[75]	171[60]	218[43]
ofcl	6[162]	33[147]	53[128]	70[111]	90[99]	133[75]	174[60]	195[43]
hfip	8[818]	30[741]	50[663]	70[586]	90[518]	132[411]	175[313]	222[247]

FIM 48h forecasts – 8m wind speed (m/s) – Cyclone Yasi - Valid 00z 2 Feb 2011





LANT 2010 ESRL GFSEnKF ensemble v ECMWF deterministic v HFIP baseline



New FIM included (smaller number of cases)

	0h	12h	24h	36h	48h	72h	96h	120h
hwrf	14[115]	38[103]	58[90]	82[79]	107[72]	144[51]	168[40]	211[31]
avno	14[115]	34[103]	52[90]	67[79]	89[72]	127[51]	165[40]	221[31]
gkmn	19[115]	30[103]	41[90]	55[79]	71[72]	100[51]	139[40]	180[31]
fr1411enkf	19[115]	32[103]	45[90]	59[79]	74[72]	112[51]	136[40]	188[31]
edet	24[115]	31[103]	41[90]	55[79]	72[72]	105[51]	135[40]	173[31]
hfip	8[818]	30[741]	50[663]	70[586]	90[518]	132[411]	175[313]	222[247]

Proposed 2011 configuration

- 6-h cycle starting June 1, 2011 running through October.
- Projected operational resolution April, 2012 hybrid Var/EnKF implementation – T254 for ensemble, T574 for high-res control.
- Options for 2011 demo (to get analysis done by data cutoff +1 hour).
  - Same as above (1440 tjet cores)
  - T382 for ensemble (2880 tjet cores)
  - T574 for everything (5760 tjet cores) *
- Ensemble forecast: 11 each (10 + 1 control) for FIM (27-30 km) and GFS (T574) out to 7 days.

Schedule (T=00,06,12 and 18UTC)

- **T+3:30**: get GFS cutoff BUFR data from NCEP
- **T+3:30-T+4:30**: T574 EnKF Analysis (5760 cores)
- **T+4:30-T+8:00**: 22 member ensemble to day 7 (11 GFS T574 members, 11 FIM 27 km members). 6-hrly output (additional 6336 cores)
- **T+4:30**: get GDAS cutoff BUFR data from NCEP.
- **T+4:30-T+5:30**: run EnKF analysis again from GDAS data.
- **T+5:30-T+8:00**: run 80 member GFS forecasts from GDAS cutoff EnKF analysis, with hourly output to provide first guess fields for next analysis, and lateral BCs for regional models (5760 cores). Need to be 9-h duration for global EnKF, perhaps longer for regional models.

Total Core Usage

- **T+3:30-T+4:30**: 5760 cores (EnKF)
- **T+4:30-T+8:00**: 12096 cores (5760 cores for EnKF analysis and first guess forecasts, 6336 cores for 22 member longer GFS+FIM ensemble)
- **T+8:00-T+9:30**: idle

Something to think about (but won't be ready in time for start of demo)

- Run continuously cycling EnKF WRF domain (ARW + HWRF?) over Atlantic at ~10 km resolution, using all data (including satellite)
  - Same EnKF code and observations as global EnKF
  - Uses boundary conditions from global EnKF.
  - Use as outer domain for high-res nests including inner-core data assimilation when there are flights.
  - Could provide framework for investigating regional model predictability issues discussed by Tom on last HFIP call.
  - Demonstrate unified global-regional Var/EnKF hybrid system, facilitate transition to this system at PSU, AOML, U. of Albany, NCEP.