Preliminary experiment with next implementation of GEFS

Current Operational GEFS:

- T190L28 up to 384hr, ETR, STTP
- Previous version of GFS model

Updated GFS model:

- Improved physics
- Significant improvements in fcst
- Implemented July 28, 2010
- Not used in operational GEFS

NEXT Implementation of GEFS

- Planned for Q4 2011
- Increase Resolution:

  T254L42 for 0-192hr, and the T190L42
- Improved ETR

  Changing value of rescaling parameter

  Allowing vertical variation of Parameter
- Improved STTP (formerly SPS)
- Other changes?

Yes! NEW GFS Model

and implicitly, analysis as initial conditions and as verification

Preliminary Tests

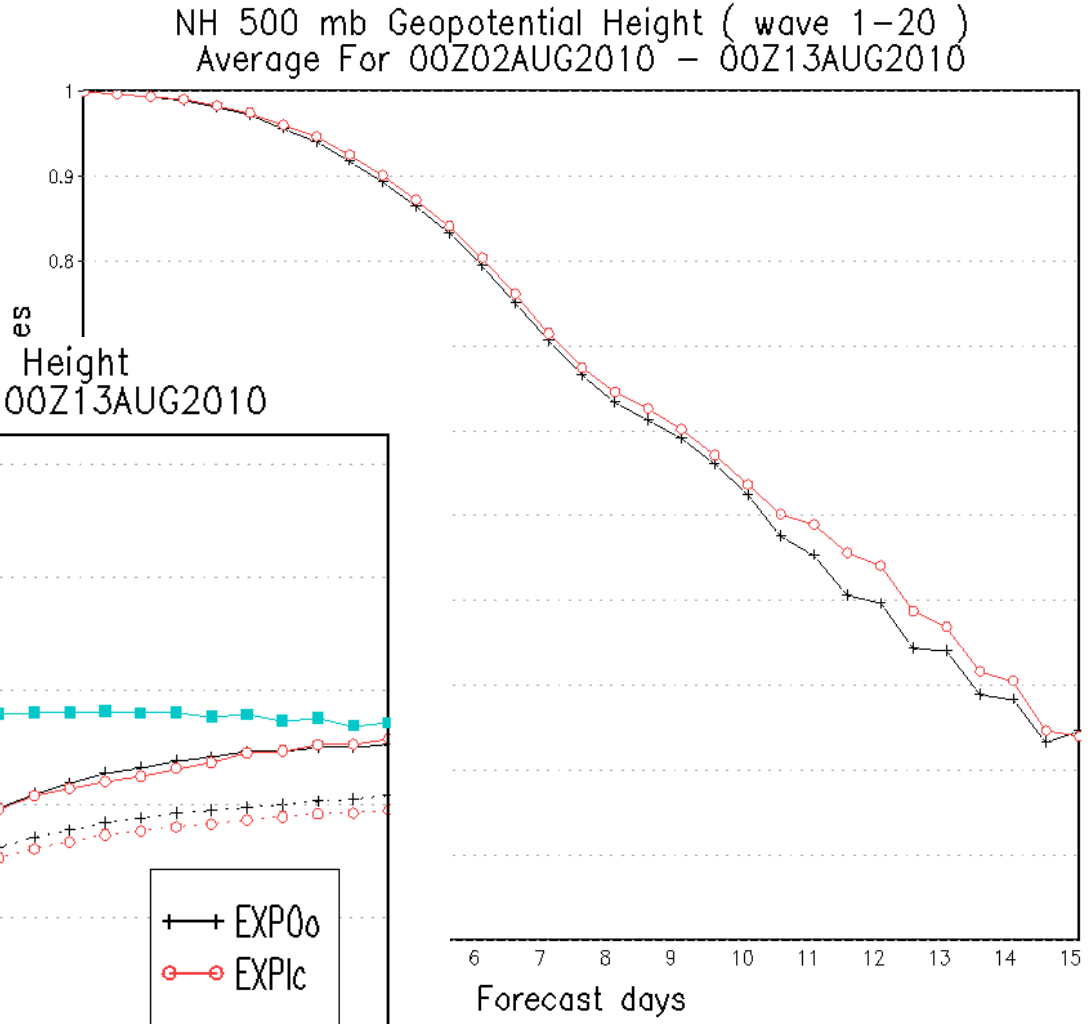
Control = T190L42, operational, old GFS

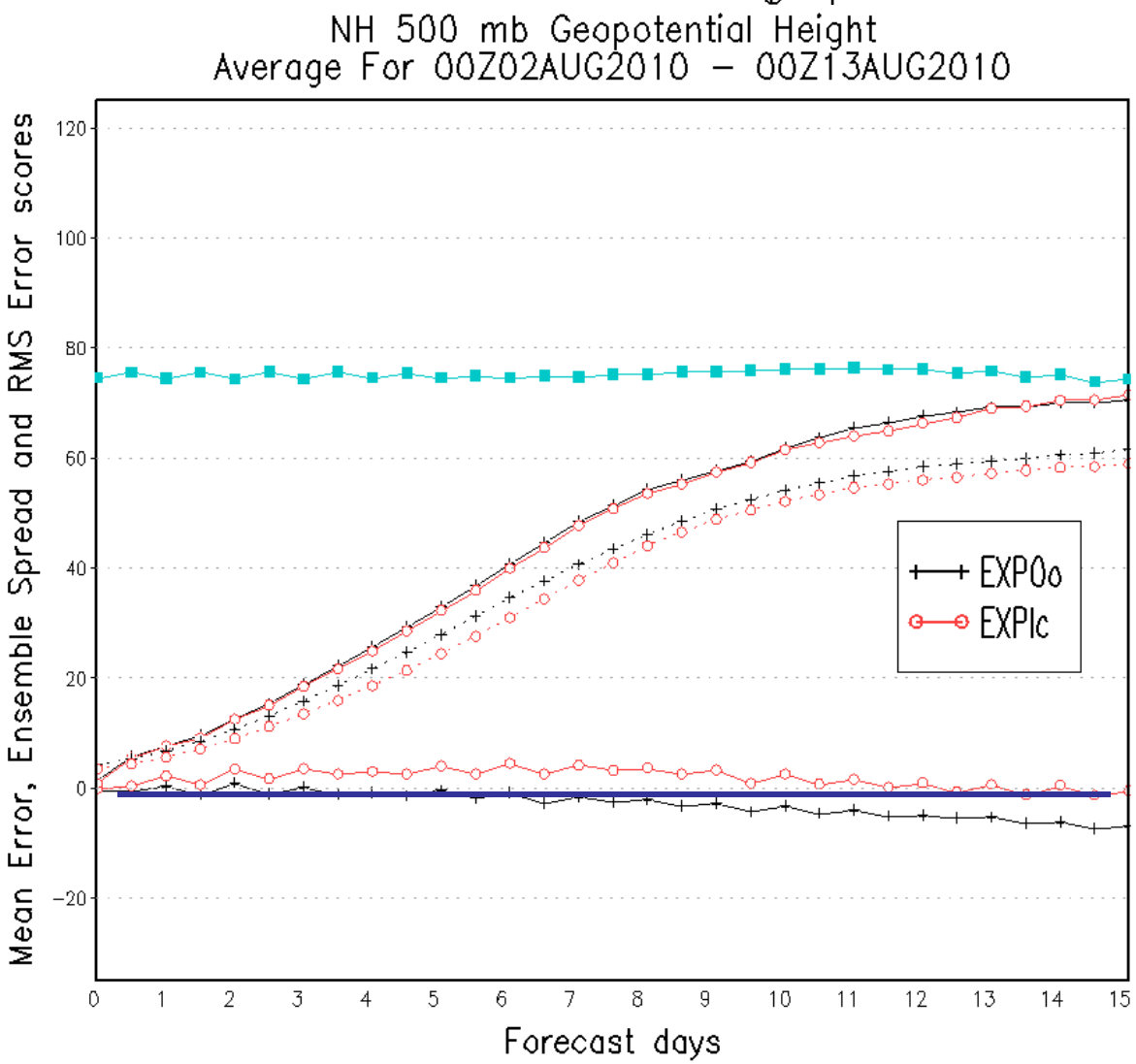
EXP = T254L42 up to 384hr, New GFS

ETR rescaling parameter

reduced so that initial spread is similar to the control.

NH 500Z



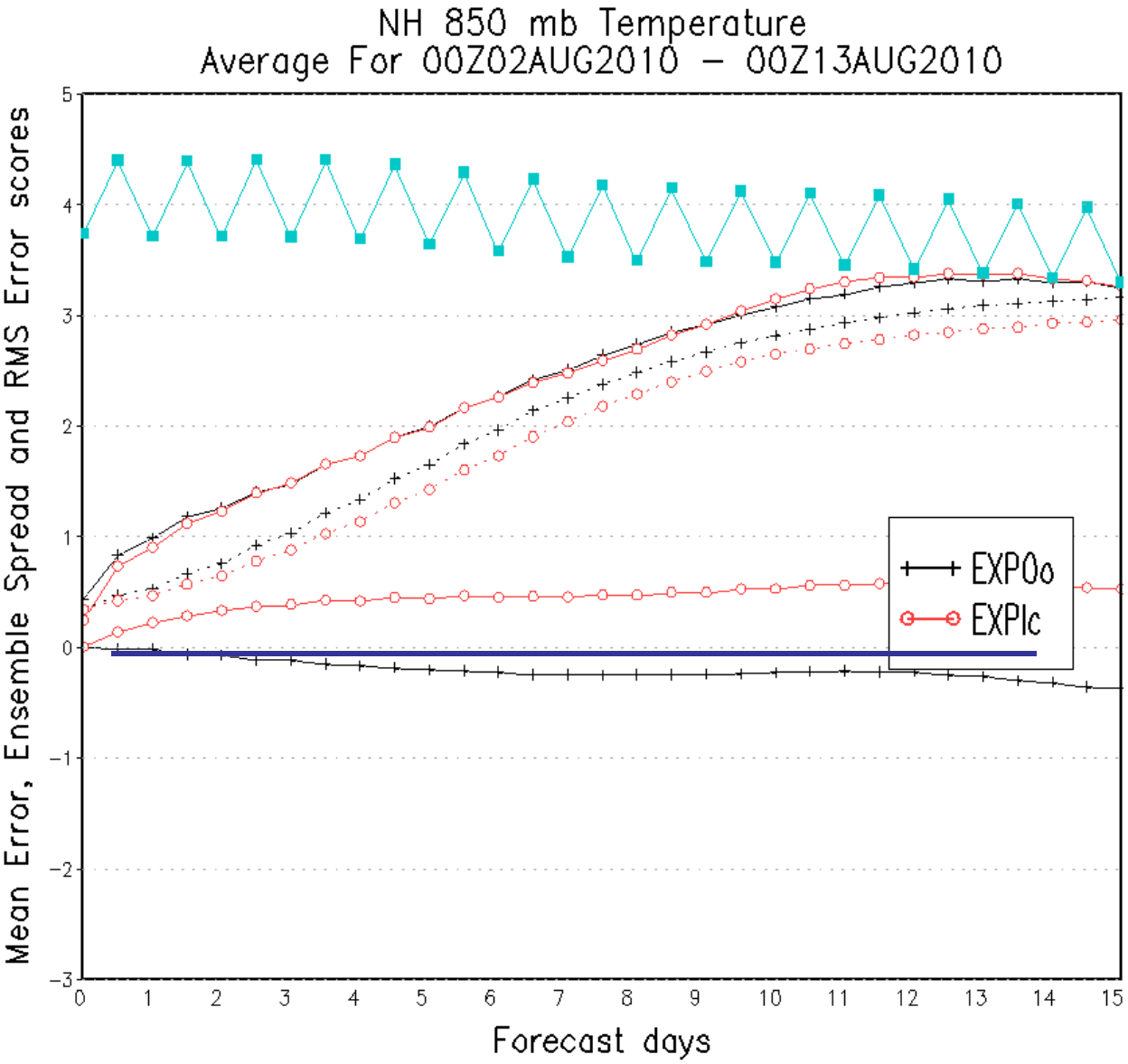


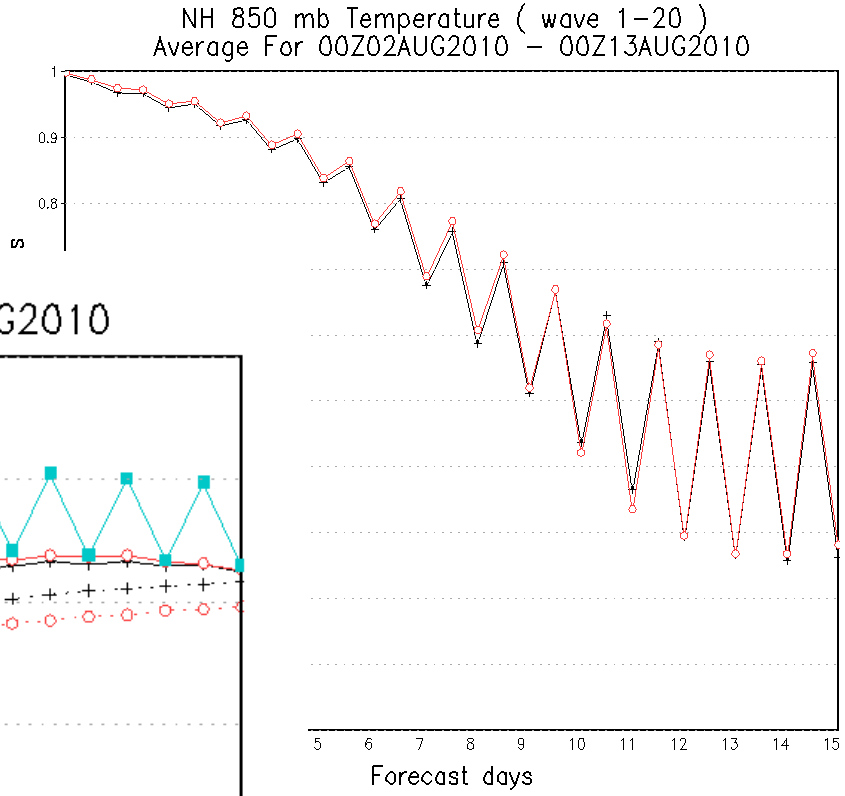
Improved AC

But

Positive Bias (day 1-8)

NH 850T



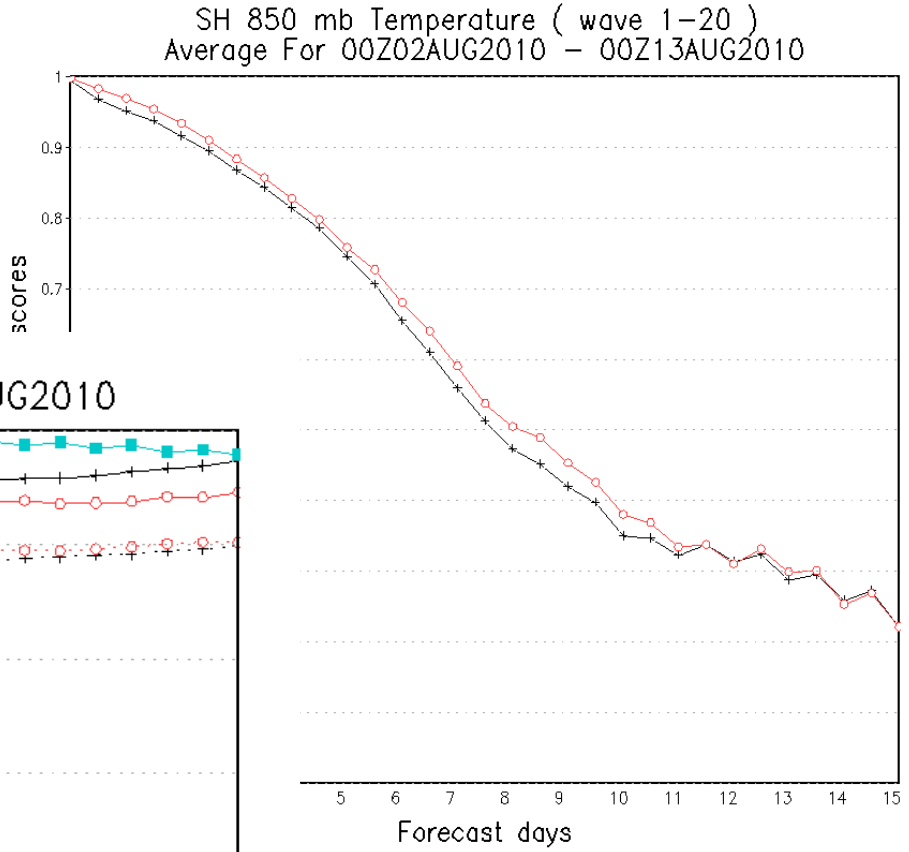


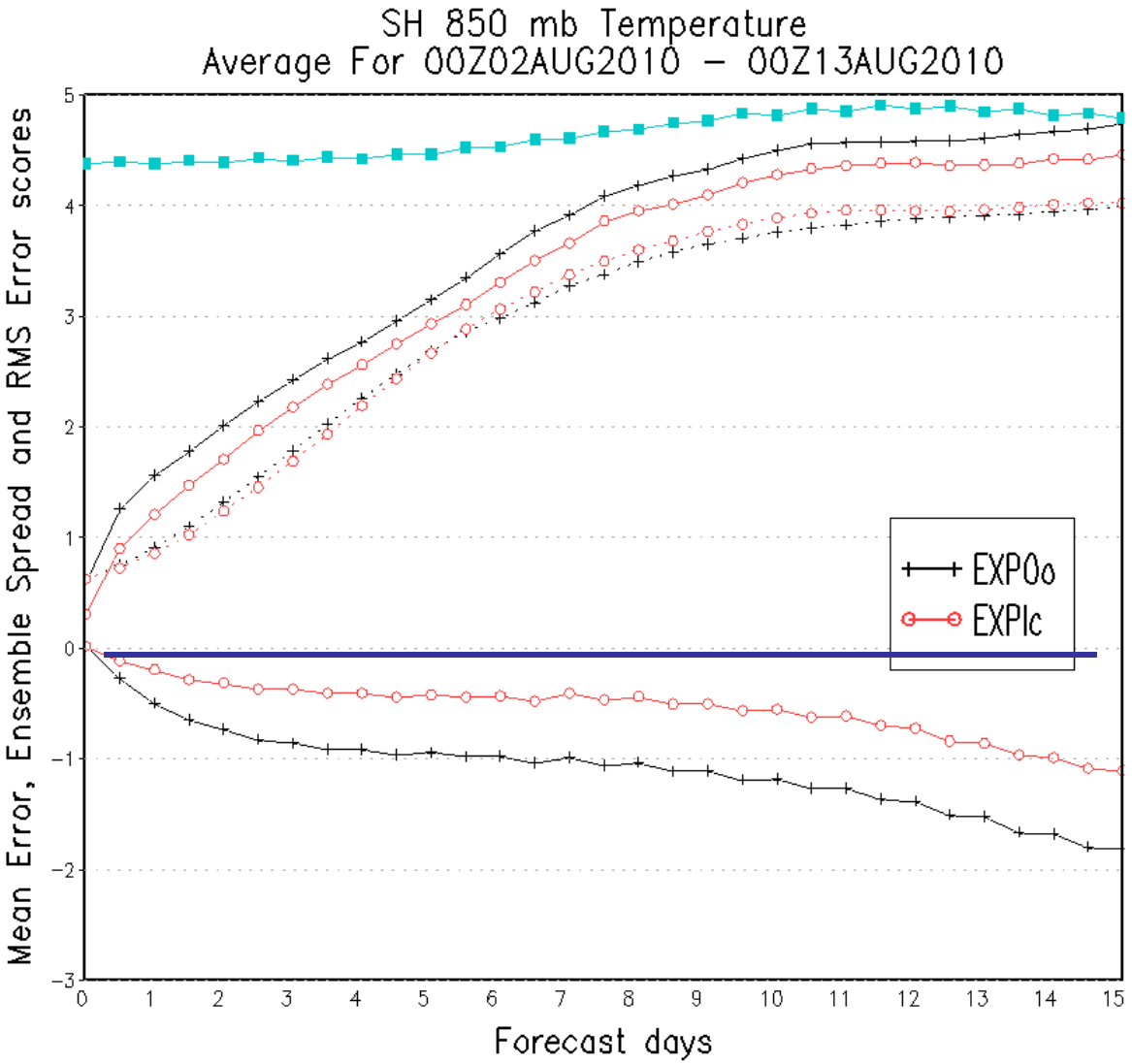
Slightly Improved AC

But

Large, warm bias build up rapidly

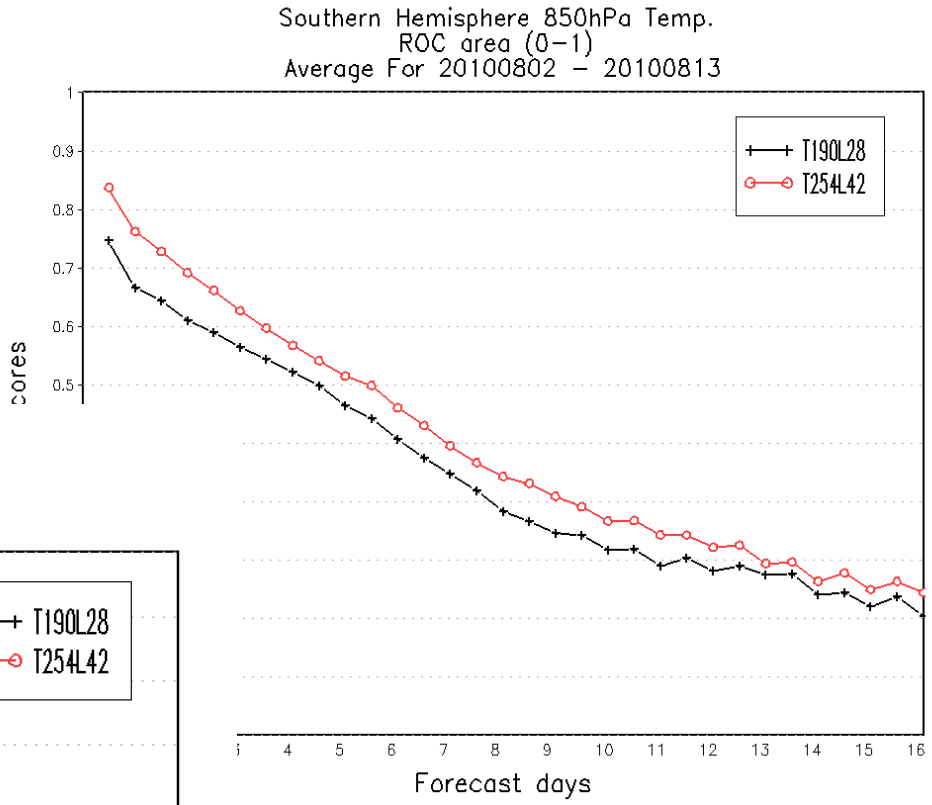
SH 850T

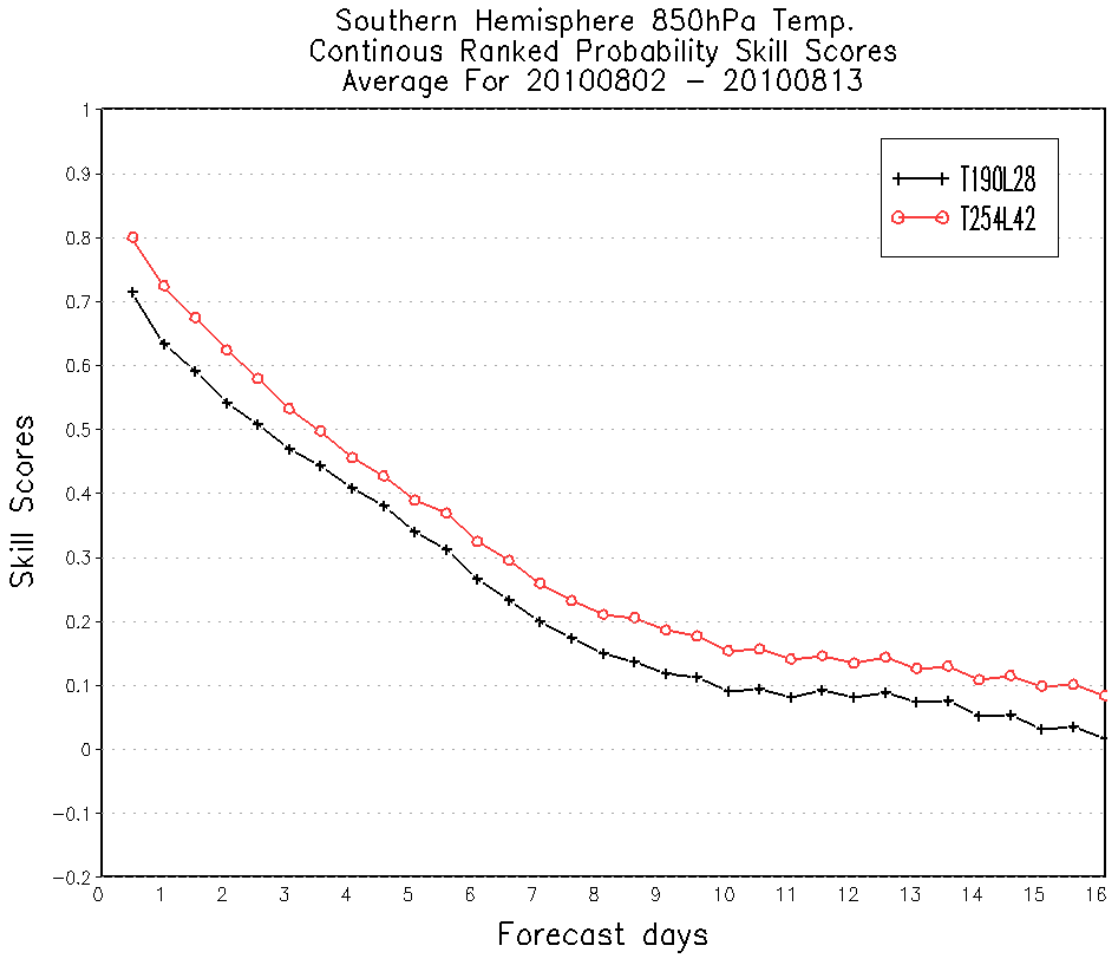




Improved AC
And
Reduced cold bias

SH 850T

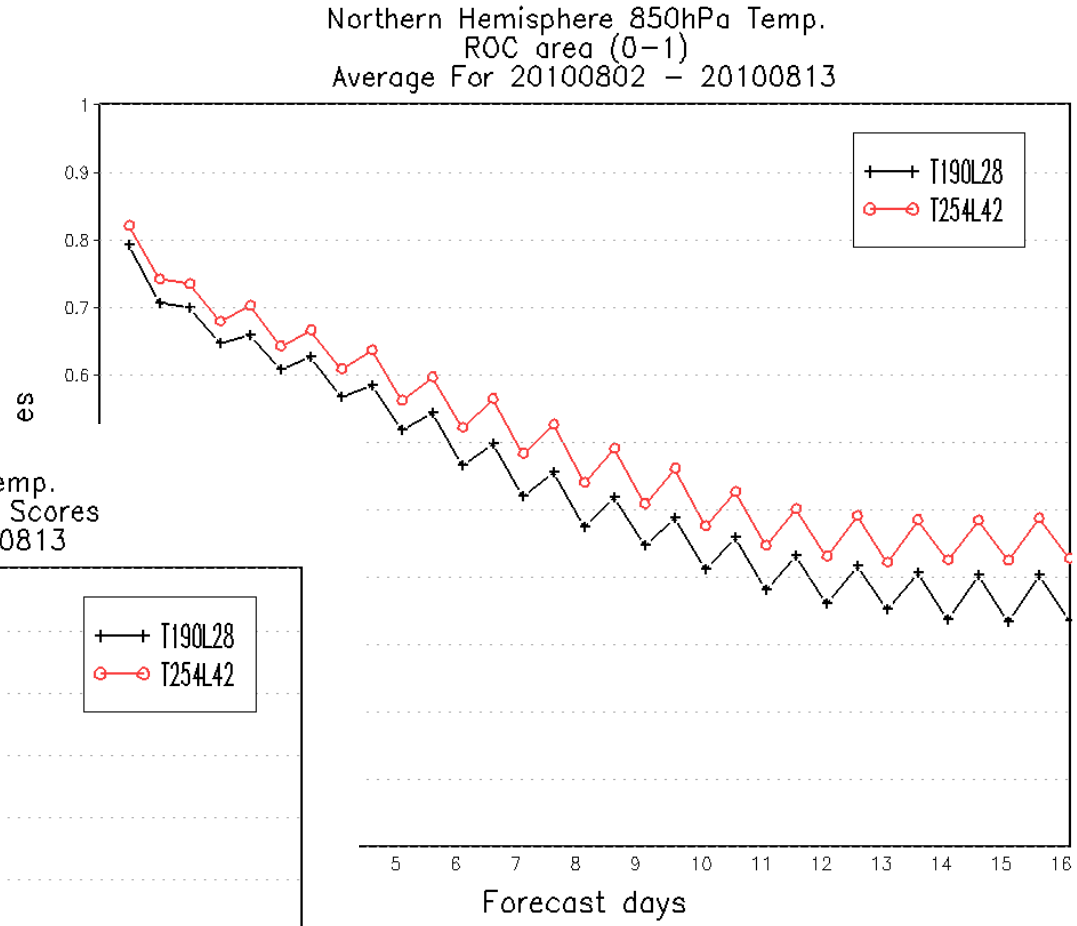


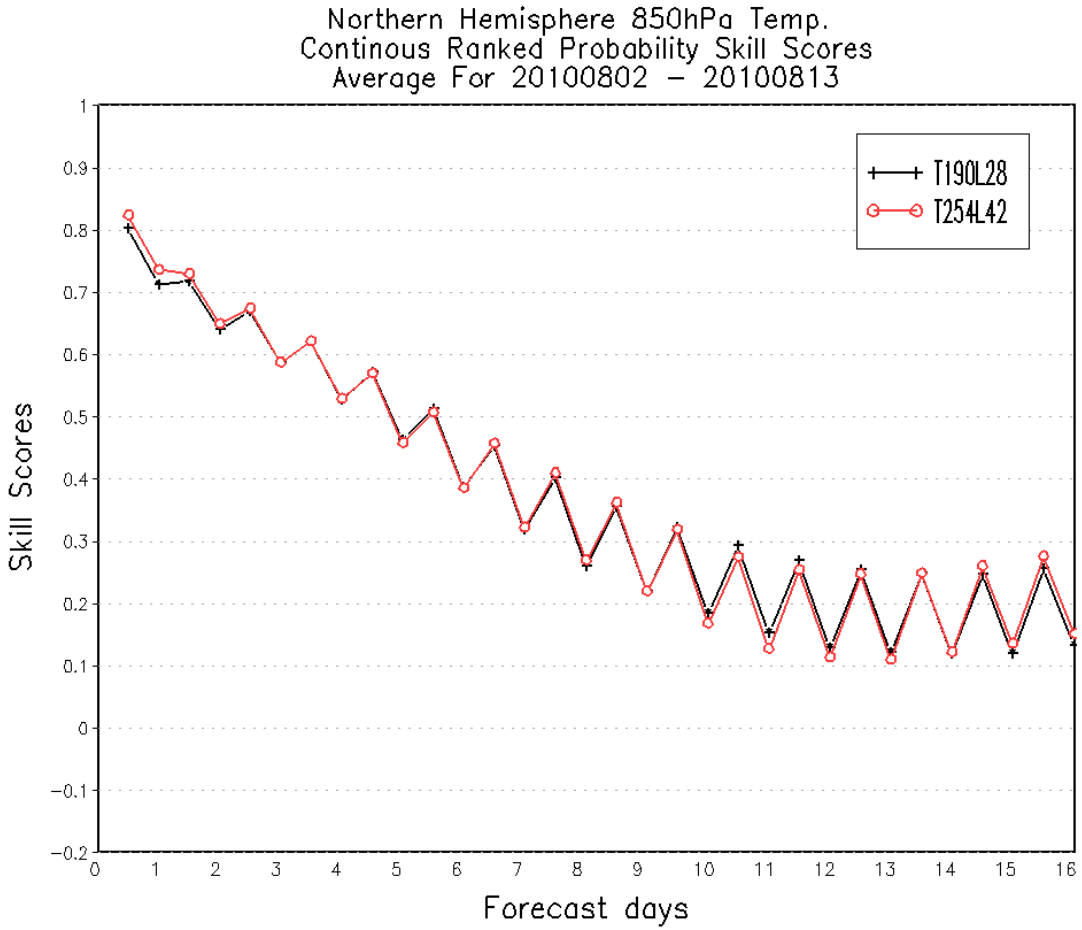


Probabilistic Fcst Scores
Improvement in both
ROC and CRPSS
(and others as well)

This is also true for TR

NH 850T





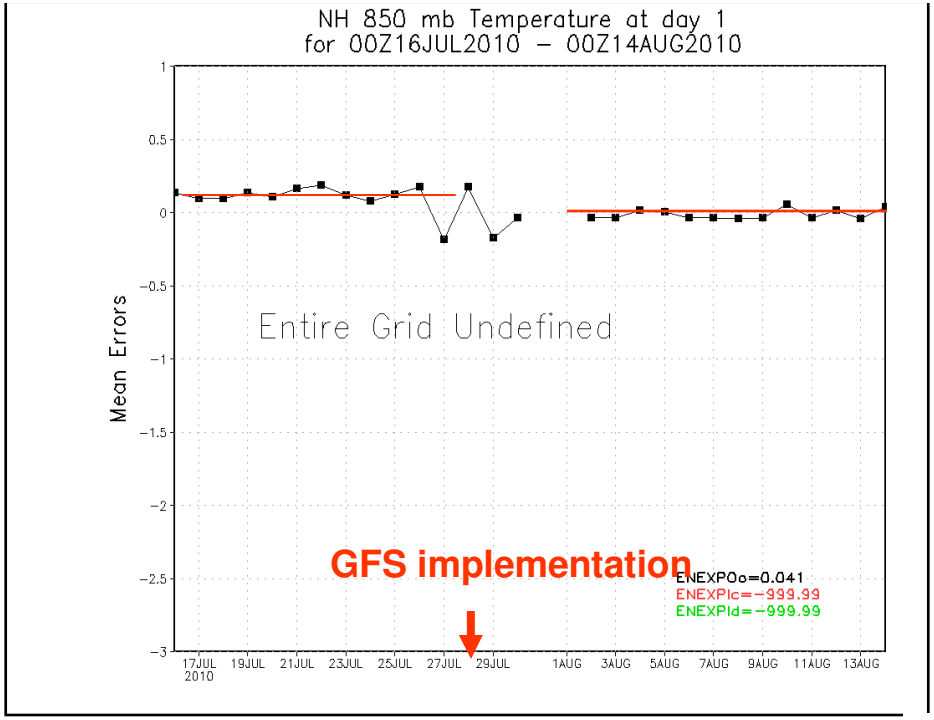
However, in NH
Improved ROC
But
Not clear in CRPSS

Summary of summer tests

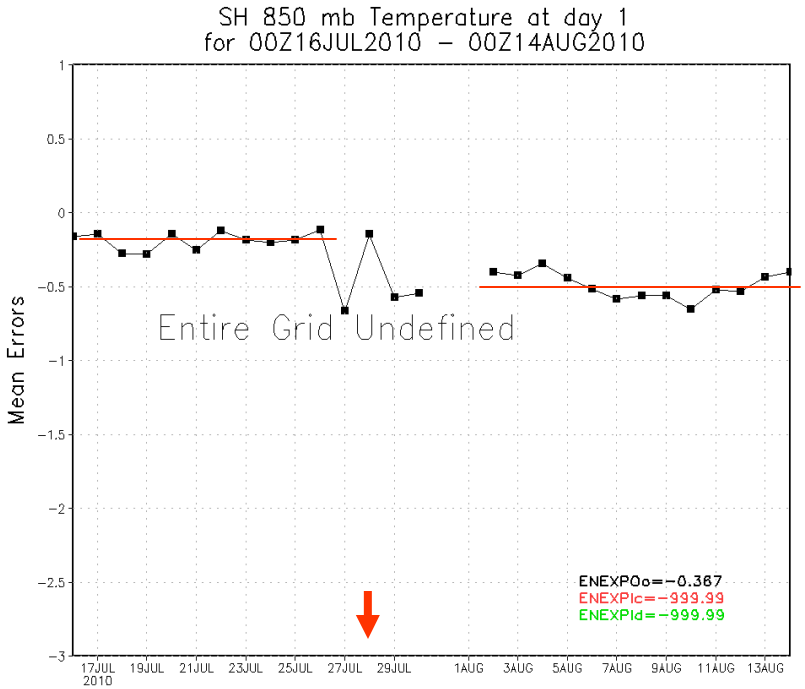
- Significant improvement in general but …
- Less improvement or negative impact in NH, especially in CRPSS and BSS reliability.
- Improvement is due to the increased AC and reduced negative bias.
- Negative impact is mainly due to building up of positive bias over NH, especially in T850.
- Positive bias is introduced by the new GFS model.

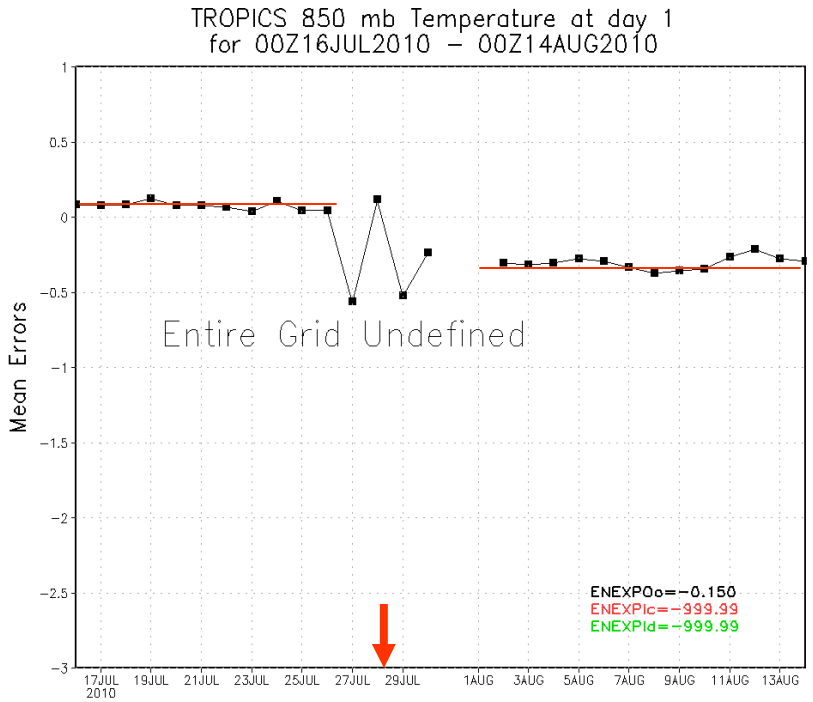
Challenges in the implementation

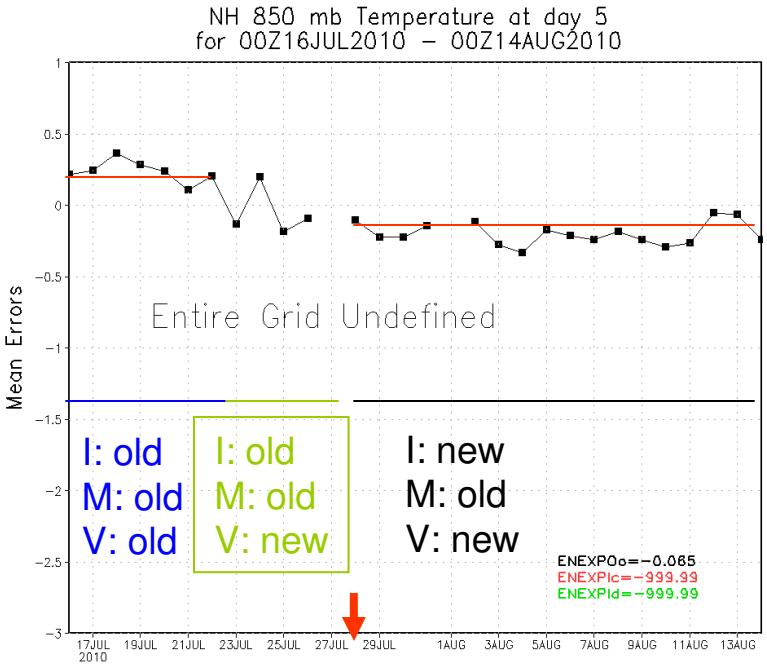
- Adopt the new GFS: The positive Bias
  - The winter month test showed more alarming results: positive bias even for SH and TR.
  - Need to do a concrete test for winter cases: requires gfs analysis (using new gfs model) in historical parallel runs.
  - Support the plan for gfs minor implementation to reduce the positive bias.
- ETR
  - Global tuning is straightforward and effective
  - Vary the rescaling parameter in vertical?
- STTP
  - Current parameters works fine but tuning may be beneficial.
  - modify the gfs code to input the parameters from outside for easy tuning. (include this into the gfs minor implementation, if any)



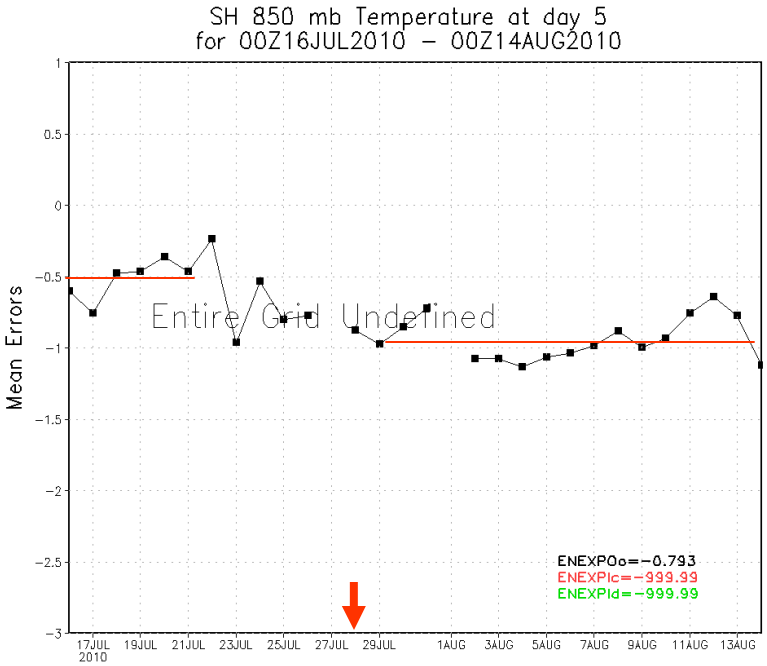
Bias of Operational ens mean, T850
20100716-20100814, day 1 fcst
Shift in bias after GFS implementation is the effect of the change in analysis used for initial conditions and verification

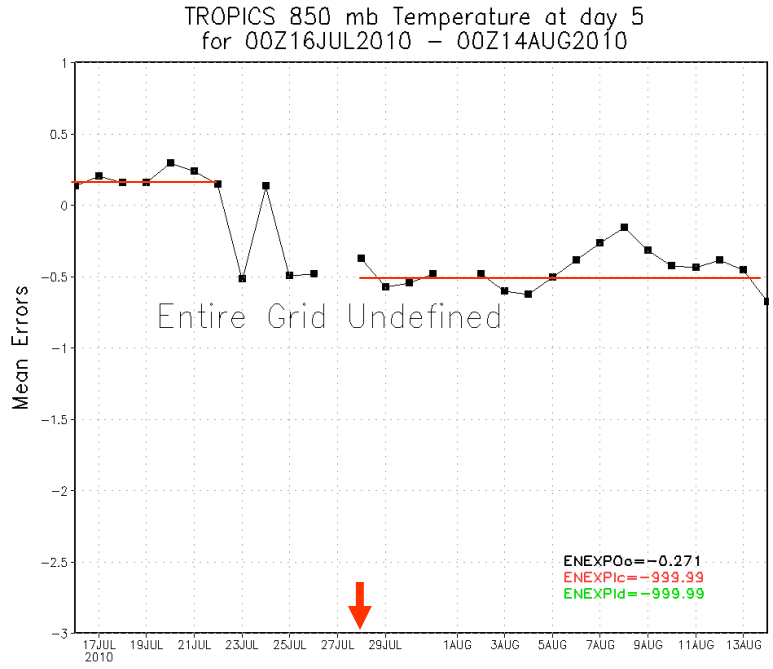


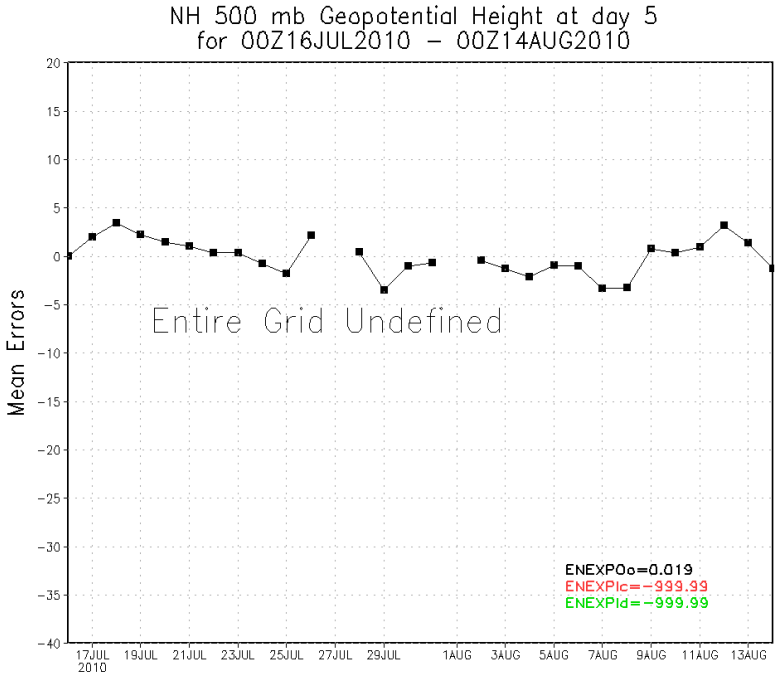




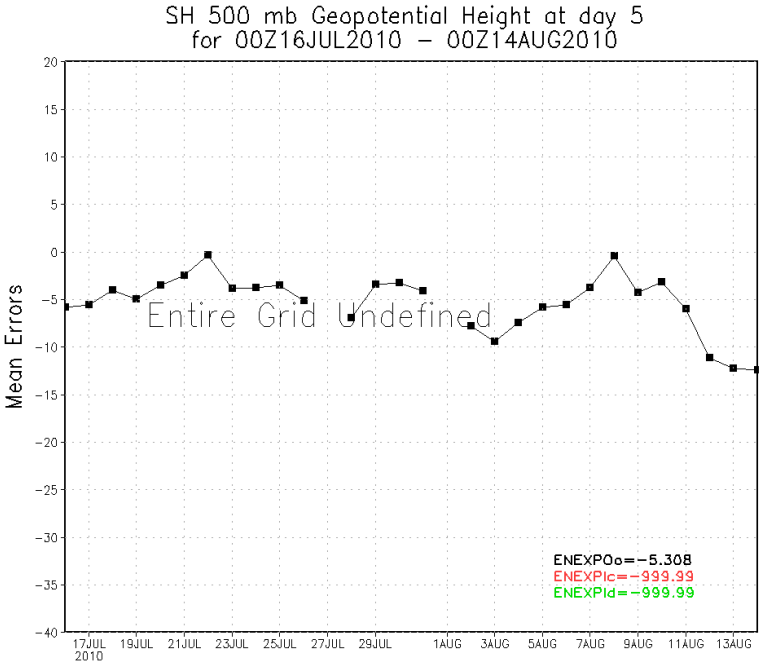
Bias of Operational ens mean, T850
20100716-20100814, day 5 fcst
Shift in bias after GFS implementation grows larger

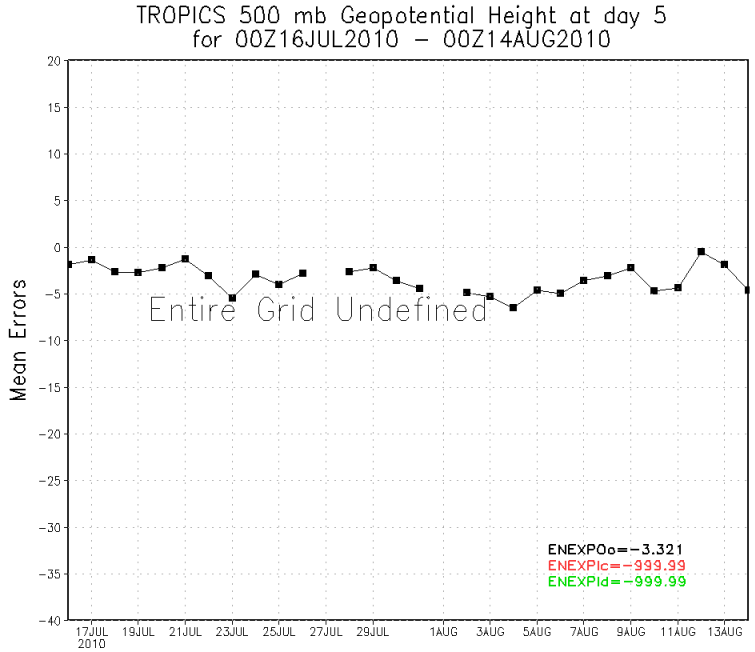






Bias of operational ens mean, Z500 20100716-20100814, day 5 fcst shift in in bias after GFS implementation is not as clear as in T850

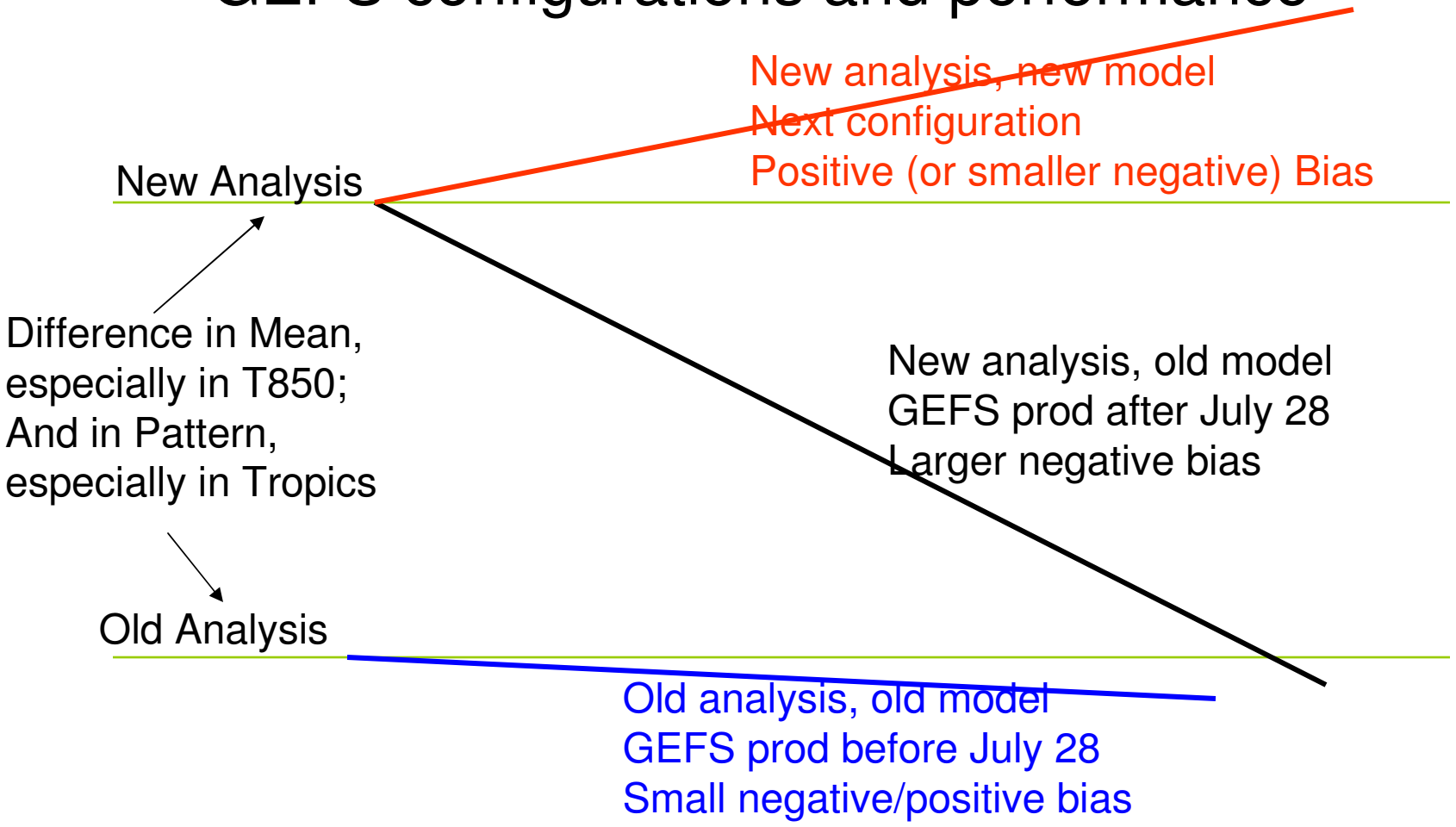




Impact of July 28 GFS Implementation on GEFS Performance

- The new gfs model is significantly different from the old model.
- As a result, the new GDAS analysis also experienced significant change.
- The difference between the two analysis is very clear in T850, but not in Z500.
- The difference is clear in mean (the new analysis is higher in T850) and pattern (especially in Tropics).
- Using the old gfs for integration, but the new analysis as initial condition and verification, GEFS performance (at least for some scores) is underestimated after July 28. This is because GEFS forecasts shift to the old analysis although it starts from the new analysis.

Schematic showing the past, current and future GEFS configurations and performance



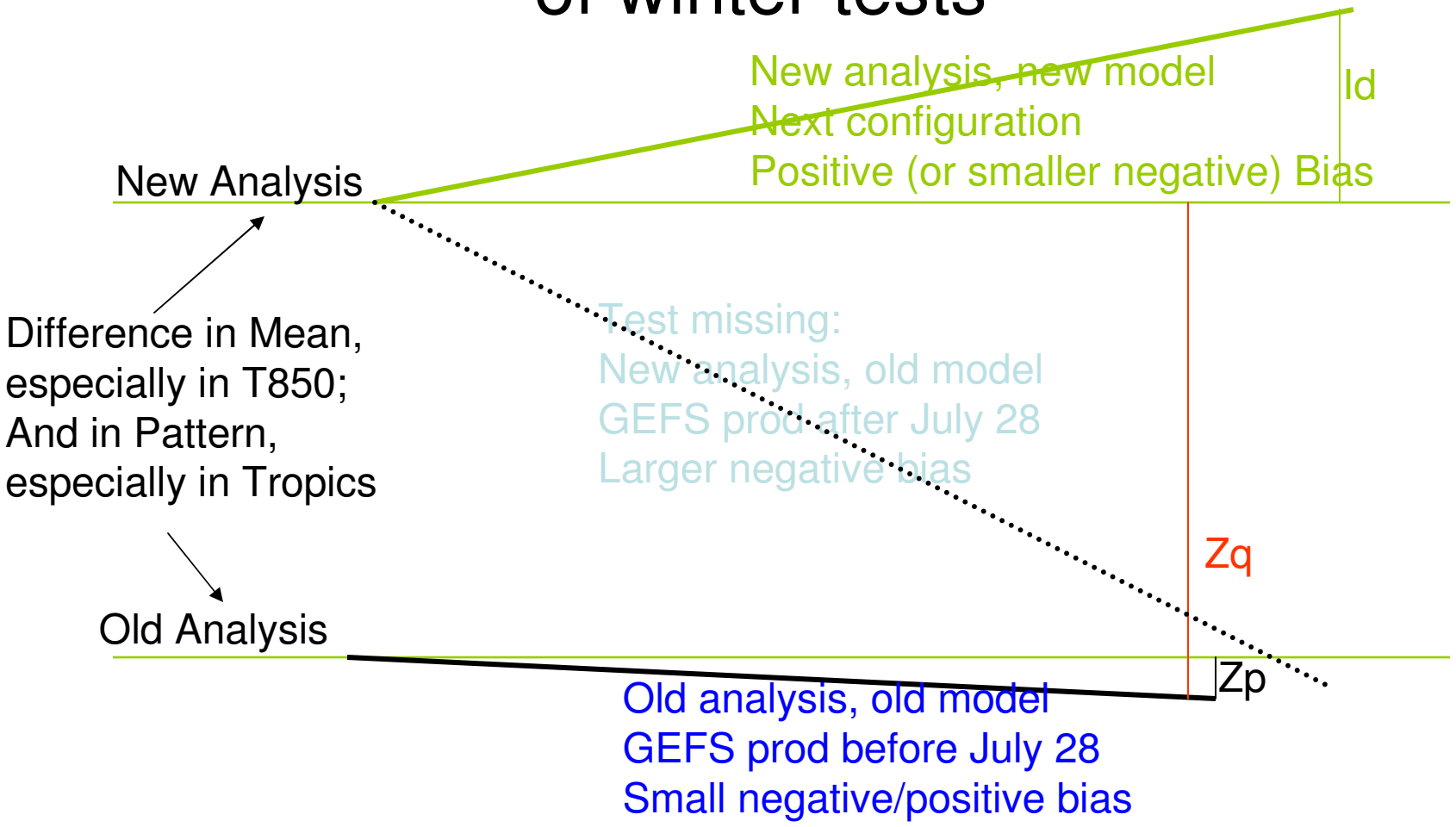
Winter Tests

- Three Experiments

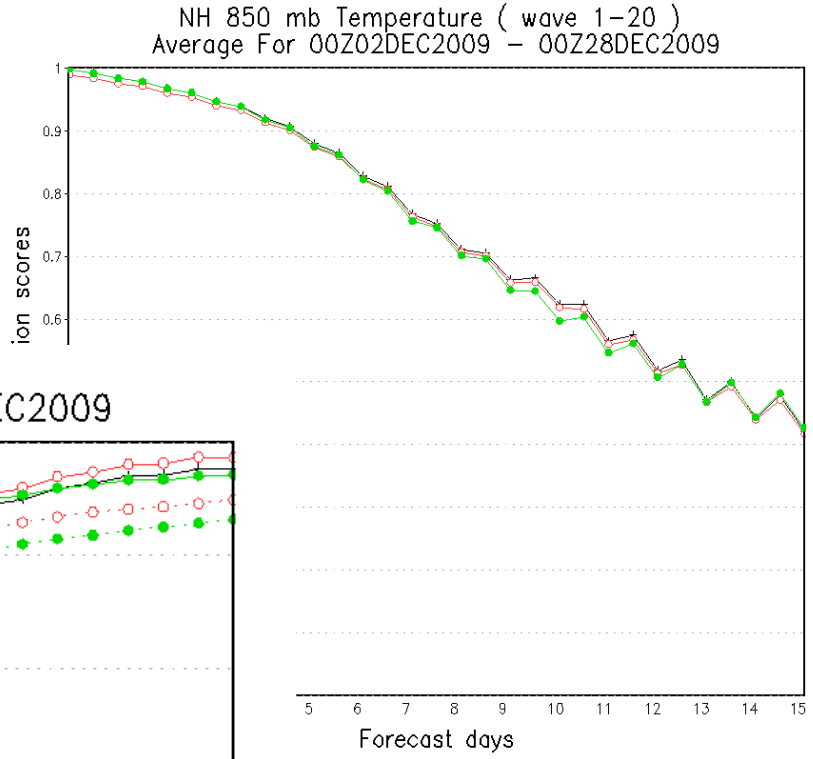
	Init.	Model	Res.	Verf. Anl	(comments)
(parallel run Dec 2009=Prod between 20100223 to 20100727)					
Zp,	Old	Old	T190L28	Old	(prod, Feb-Jul)
(re-evaluation of Zp, with new analysis as verification)					
Zq	Old	Old	T190L28	New	
(Experiments missing)					
(X1)	New	Old	T190L28		(Prod, impact of Init Anl)
(X2)	New	New	T190L28		(impact of model lag)
(Recent test, the new configuration)					
Id	New	New	T254L42	New	(prod in plan)
			(T190L42 after 192h)		

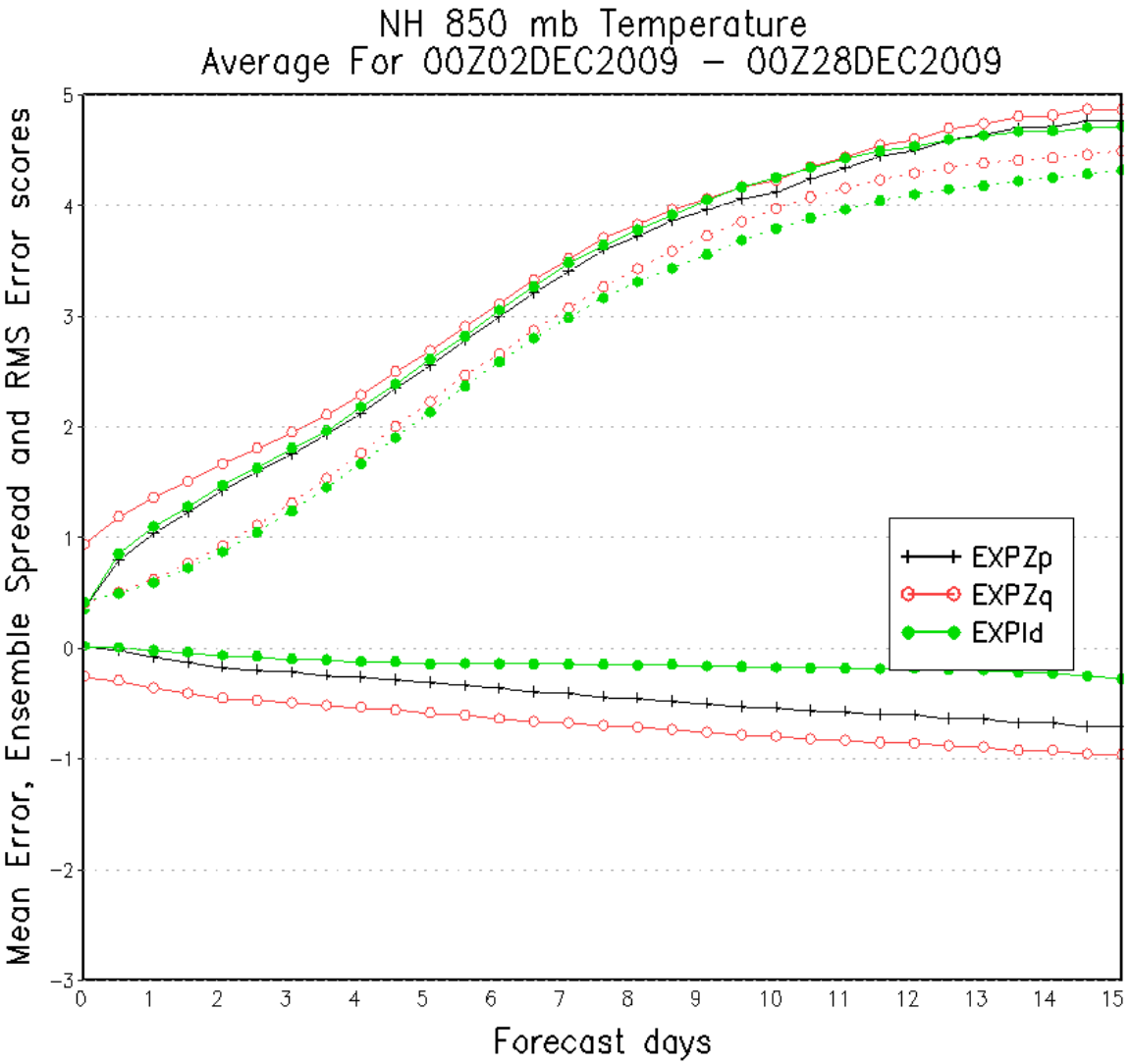
An experiment with the current configuration (X1) is missing

Schematic showing the GEFS configurations of winter tests



NH 850T

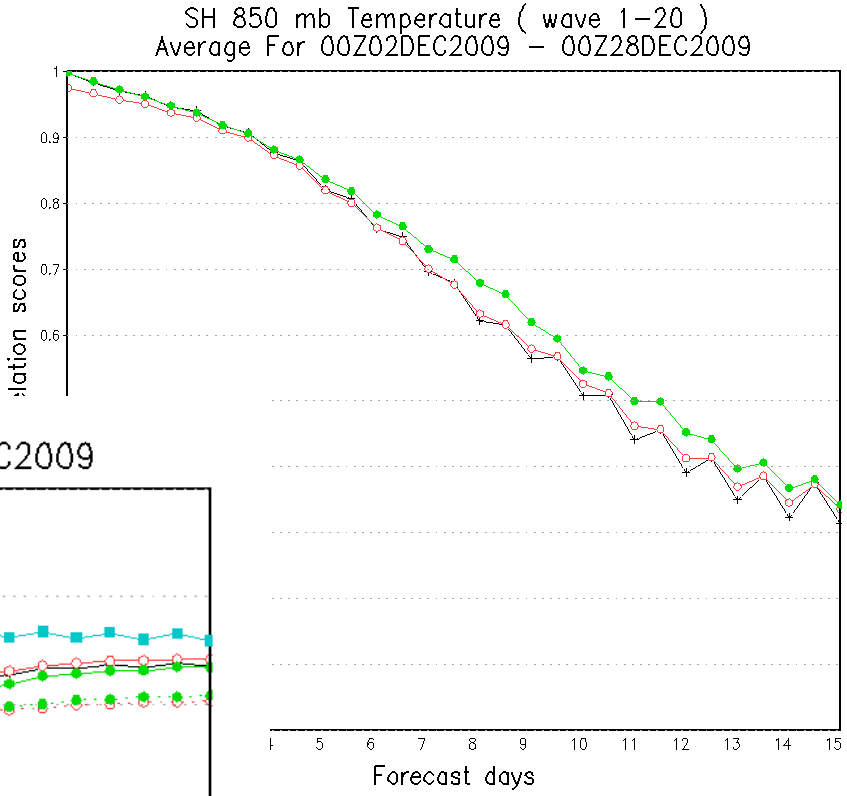


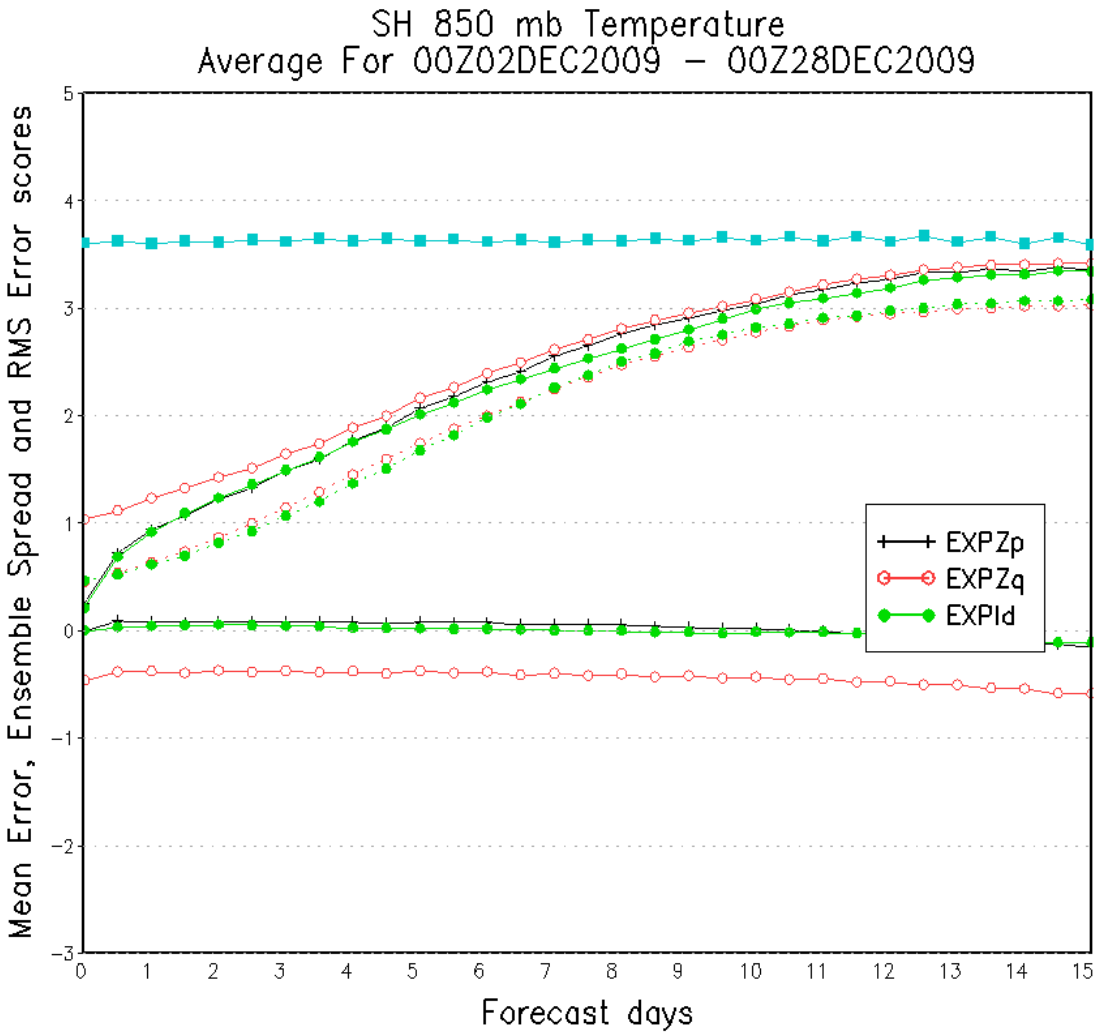


AC: Slight degradation (day 7-11 days)

Difference between the two analyses (Pattern and Bias)

SH 850T

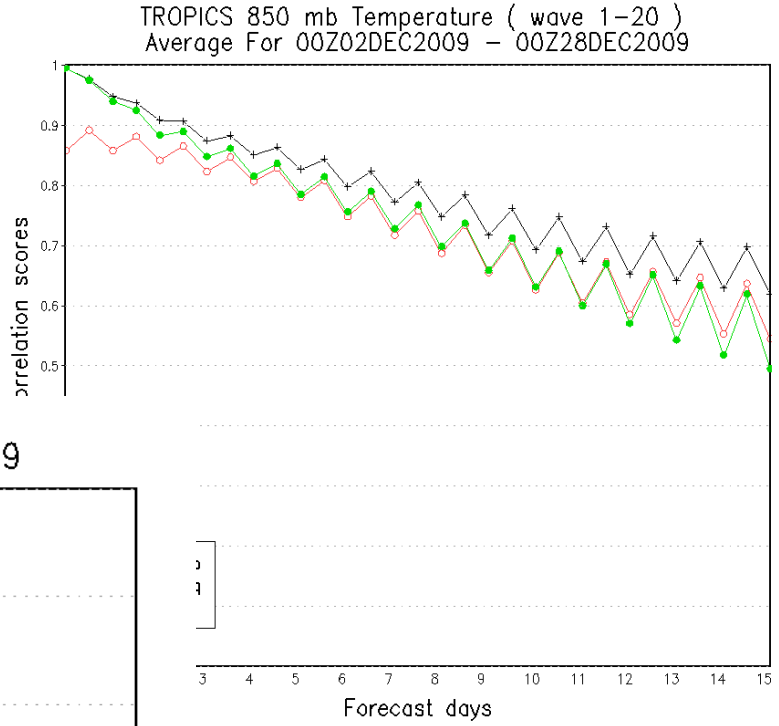


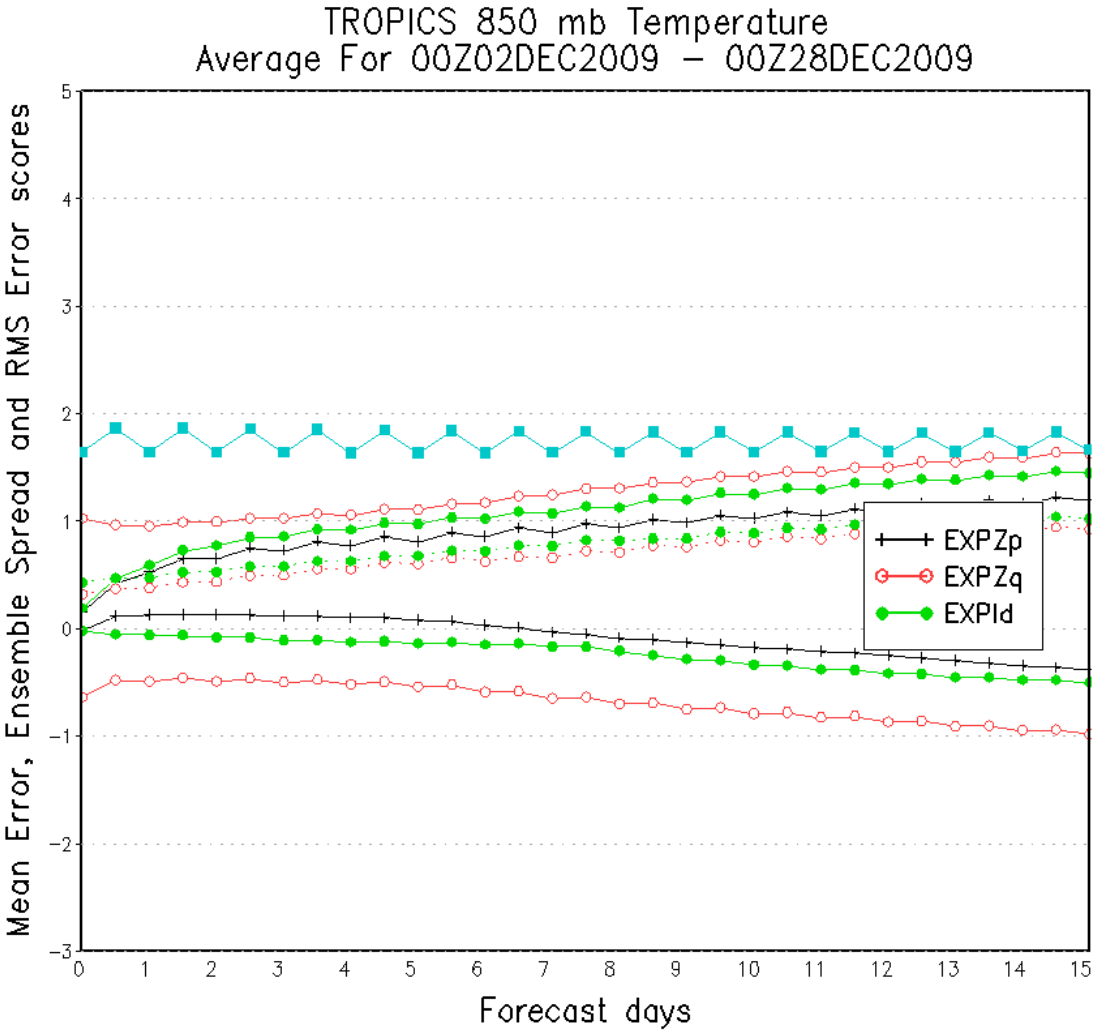


AC: Improvement (also in 500Z)

Significant difference between the two analyses (Pattern and Mean)

TR 850T



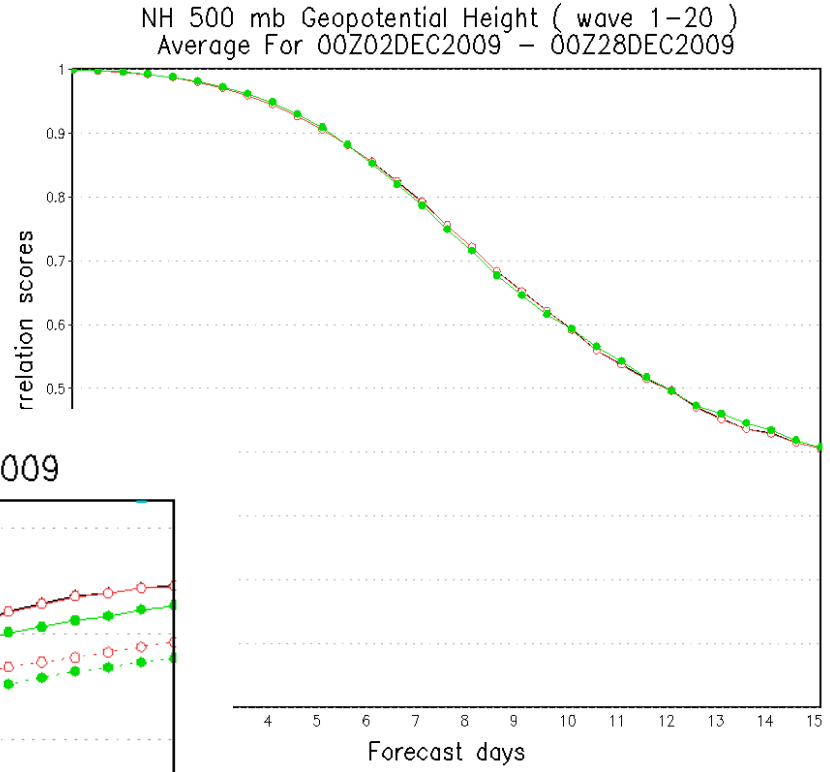


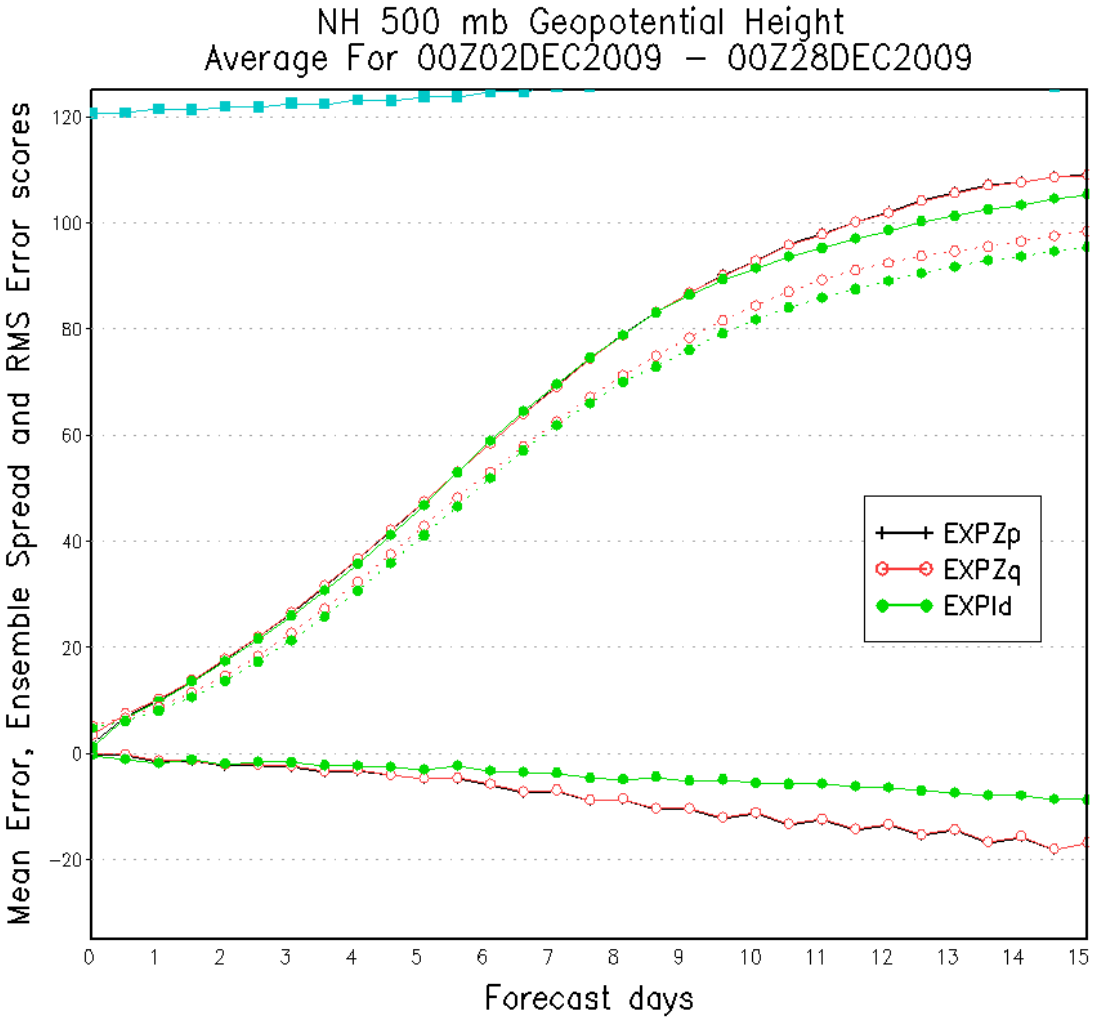
AC: Degradation
Spread: larger from beginning (but AC for the current prod may be not as good as in Zp)

(ET different with new gfs)

Large difference between the two analyses (Pattern and Mean)

NH 500Z

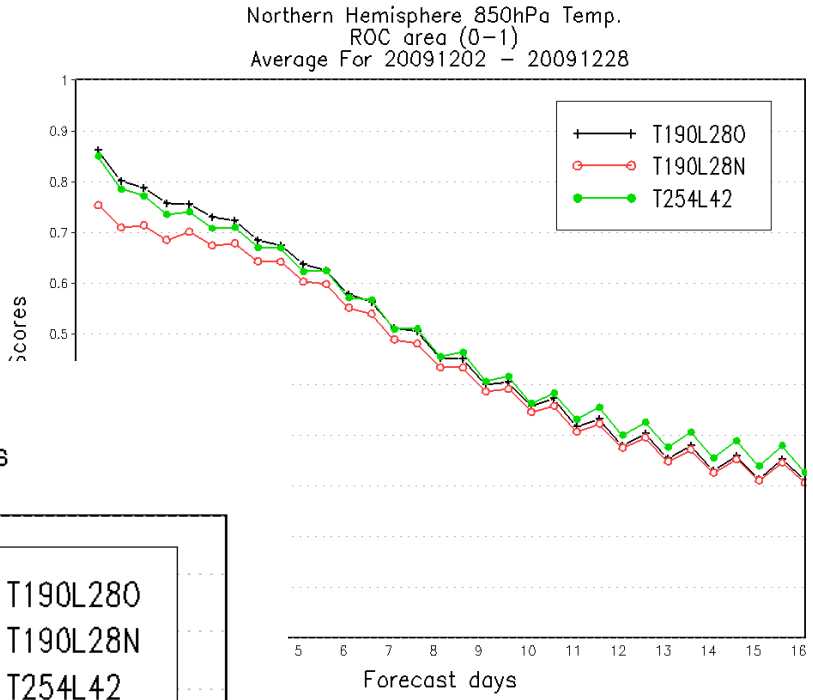


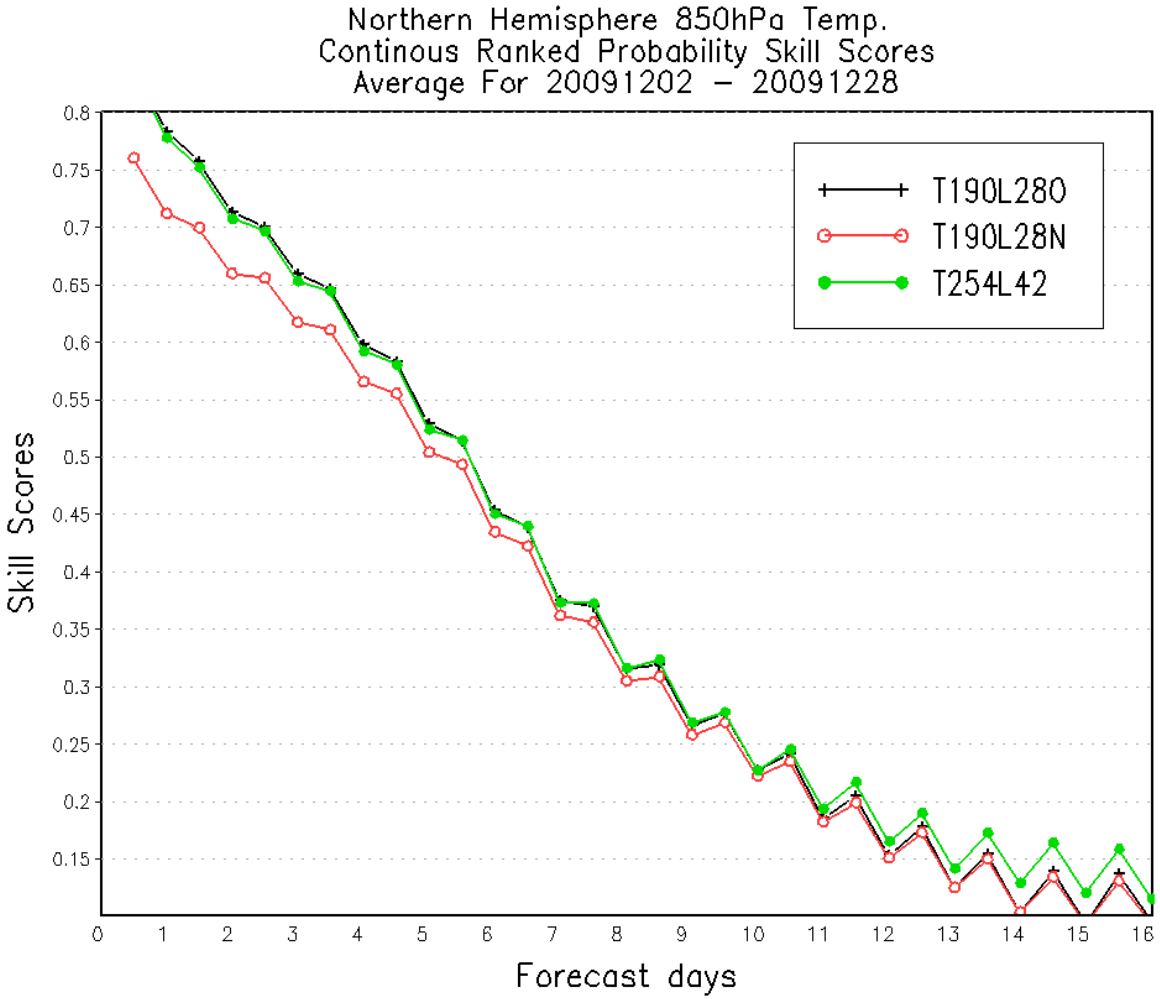


AC: little change
BIAS: Reduced negative

little difference between the two analyses

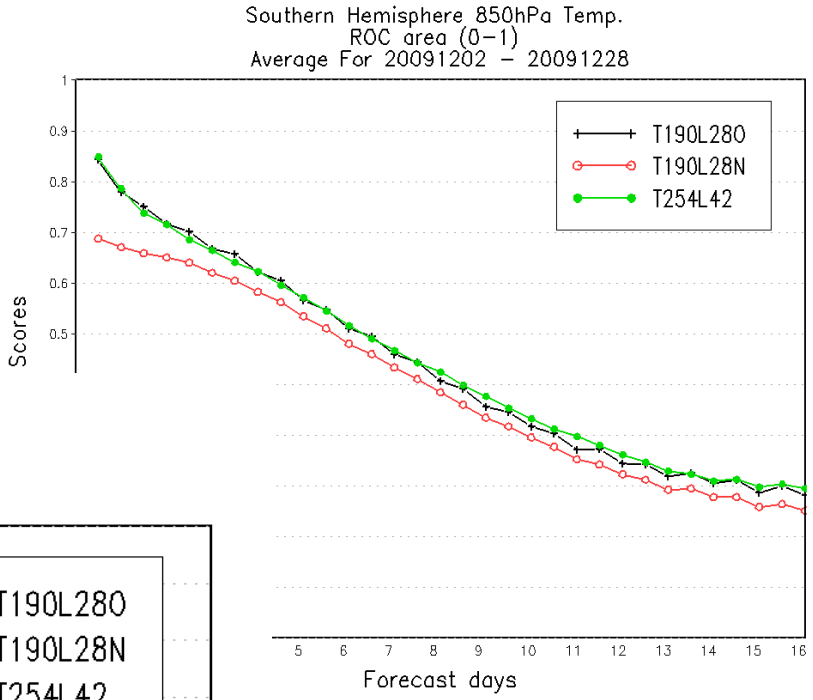
NH 850T

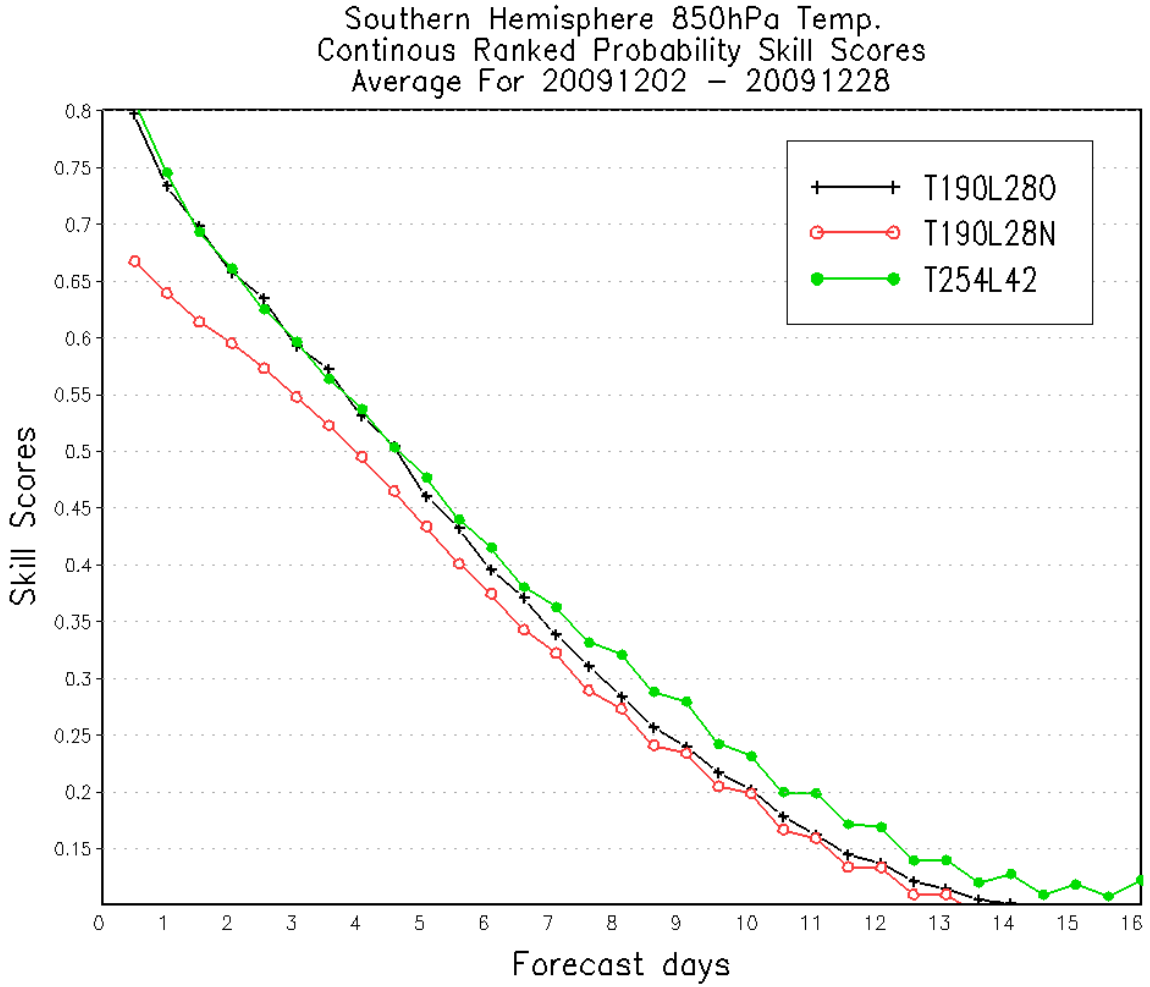




ROC and CRPS: Some improvement in week two, but not clear in week 1.

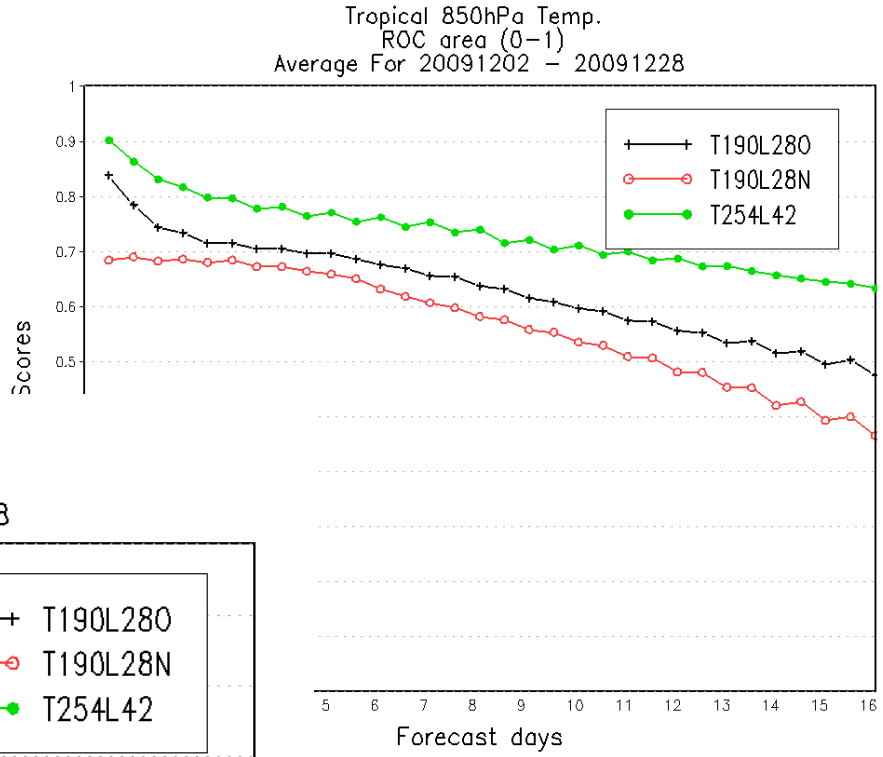
SH 850T

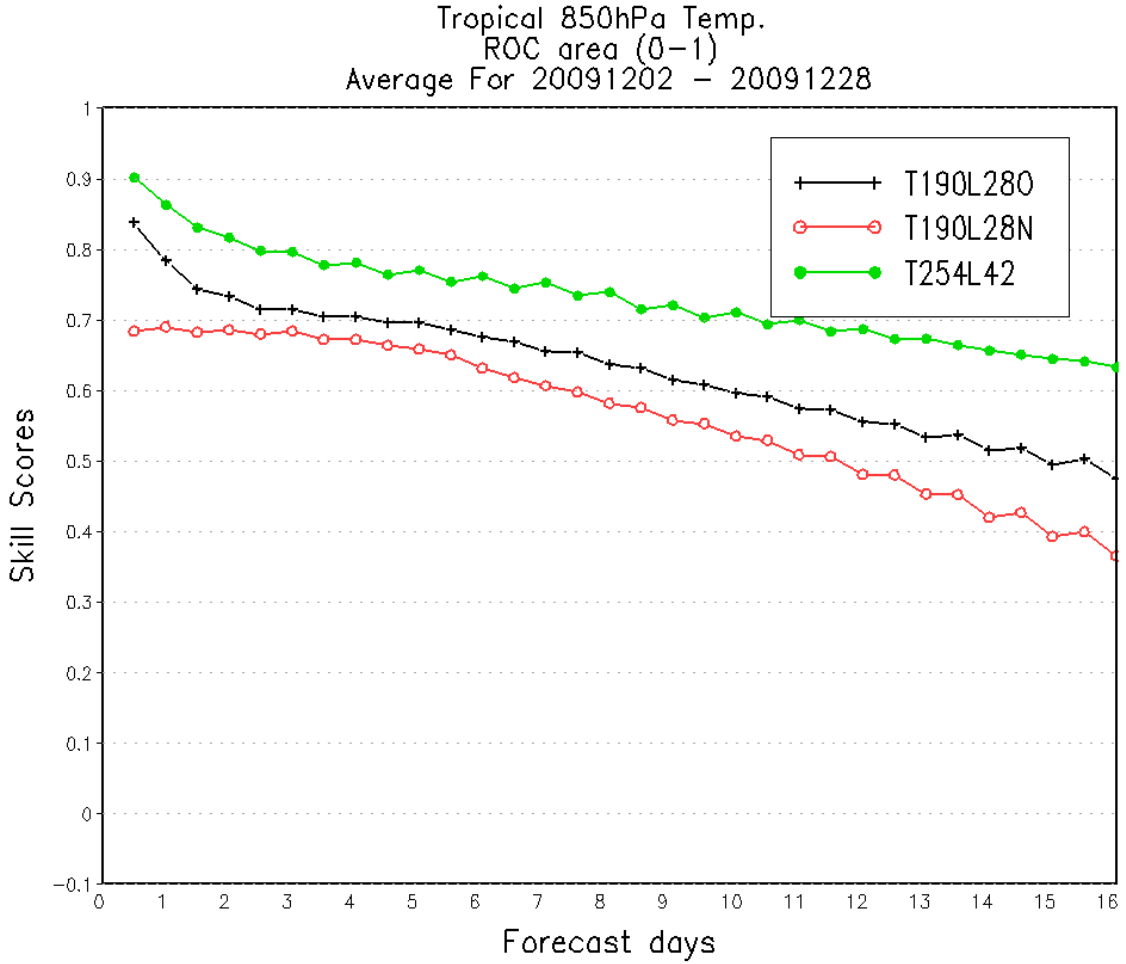




ROC and CRPS: Clear improvement in week 2 but mixed results in week 1.

TR 850T





ROC and CRPS:
Significant improvements

Summary

- Winter Cases
  - –Similar to the summer tests, some improvement, especially in SH and TR.
  - –Less improvement compared with the summer cases, possibly because the control ensemble has higher score than the current prod, especially in week1.
  - –Need to fill the gap by an experiment equivalent to the current prod, for a solid conclusion.
  - –For more plots, see

    http://www.emc.ncep.noaa.gov/gmb/yzhu/Jessie/RESOLUTION_cyc_WIN.HTML
- General
  - –Similar results in both seasons, improvement more likely in SH and TR.
  - –A significant change in gfs model and in the corresponding analysis (used as initial condition and verification) is a major issue in this implementation.
  - –This configuration can be used as the bench mark for the next implementation and THORPEX funded research

Next Step

- ETR
  - Vertical variation of rescaling factor
    - Test started
  - Variation in latitude (?)
- STTP
  - Works well but tuning needed
  - A little more aggressive (?)
  - Especially in week 2 (after truncation)
- Longer Period?
- Plan for minor implementation of GFS?
  - STTP parameters