Sensitivity of 63-Layer FV3GFS to Options of Vertical Coordinate

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- **ncep_plevels=T: run fv3gfs with the current NCEP GFS 64-layer model vertical coordinate.**

- **ncep_plevels=F: run fv3gfs with a coordinate coded within the model. It is slightly different from the GFS coordinate.**

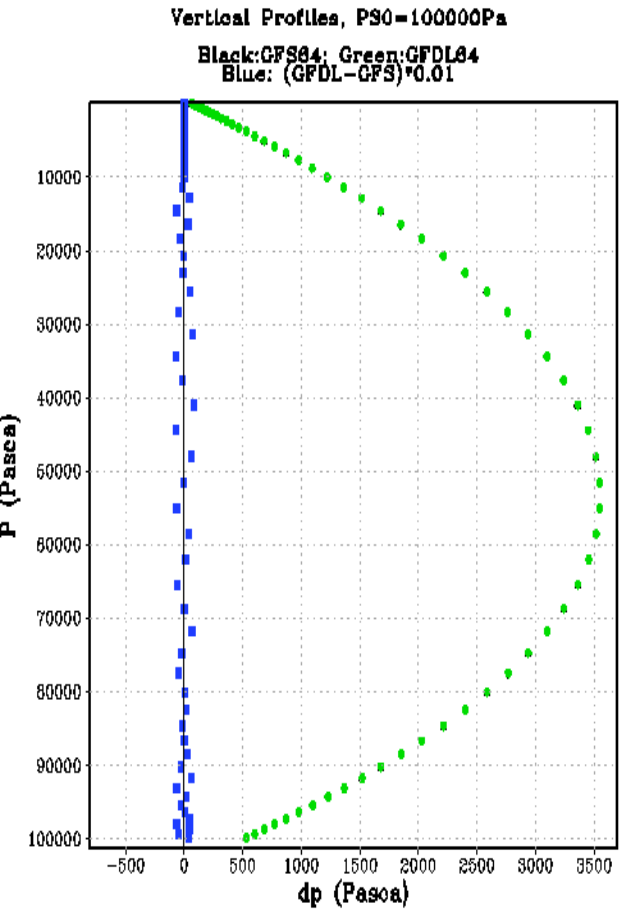
- **FV3GFS was run with ncep_plevels=F for the NGGPS Phase-II dycore comparison project.**

- **For consistency, data assimilation requires the use of current GFS coordinate. The purpose of this sensitivity test is to check if using current GFS coordinate will degrade the model forecast performance.**

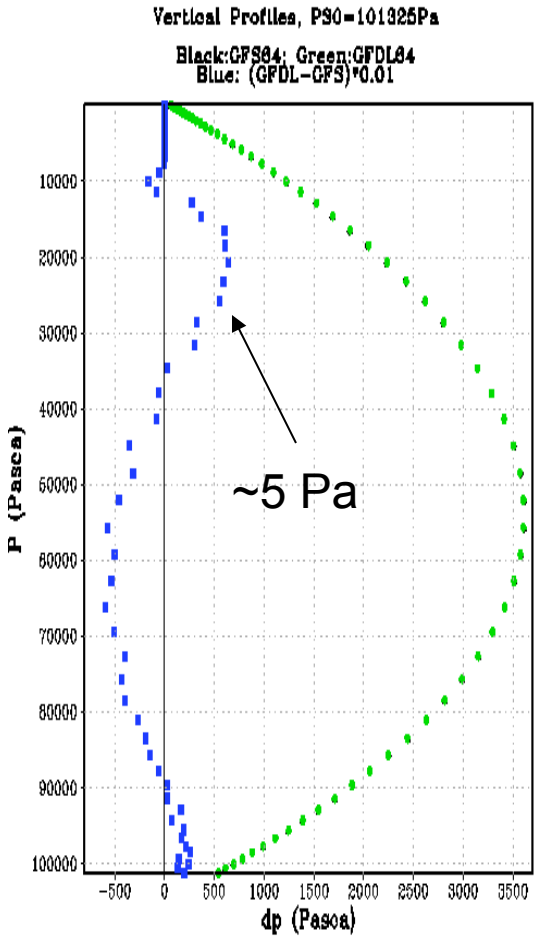
- **Two forecast experiments were carried out with ncep_plevels=T and F, respectively, for Aug-Sep-Oct 2016. Both were initialized with current operational GFS analyses.**

P(k)=A(k)+B(k)*Ps

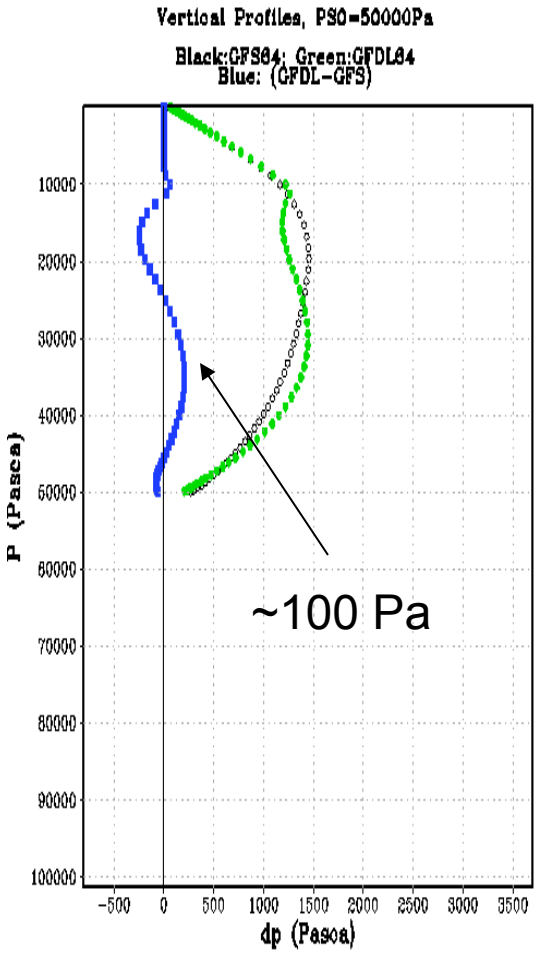
Black : GFS **Green: modified** **Blue: diff**



Ps=100,000 Pa



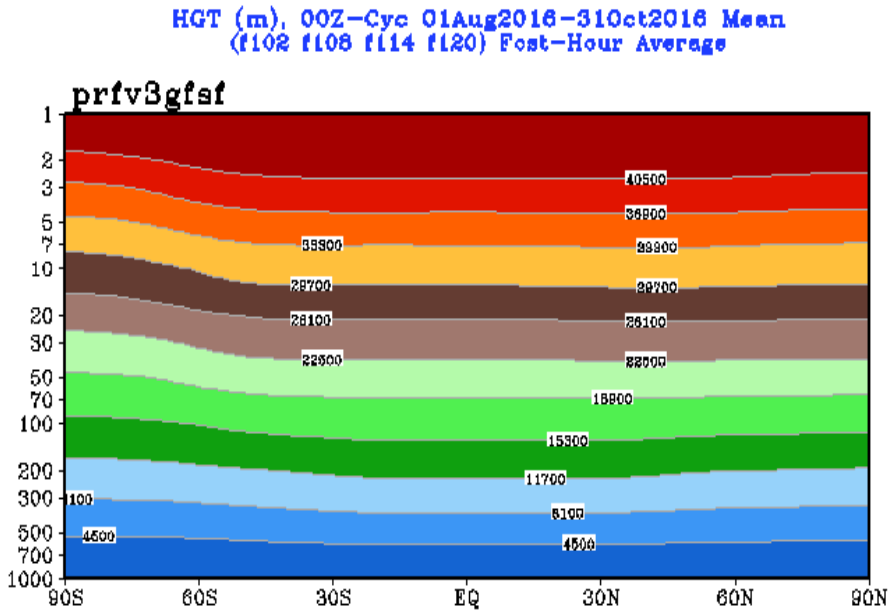
Ps=101,325 Pa

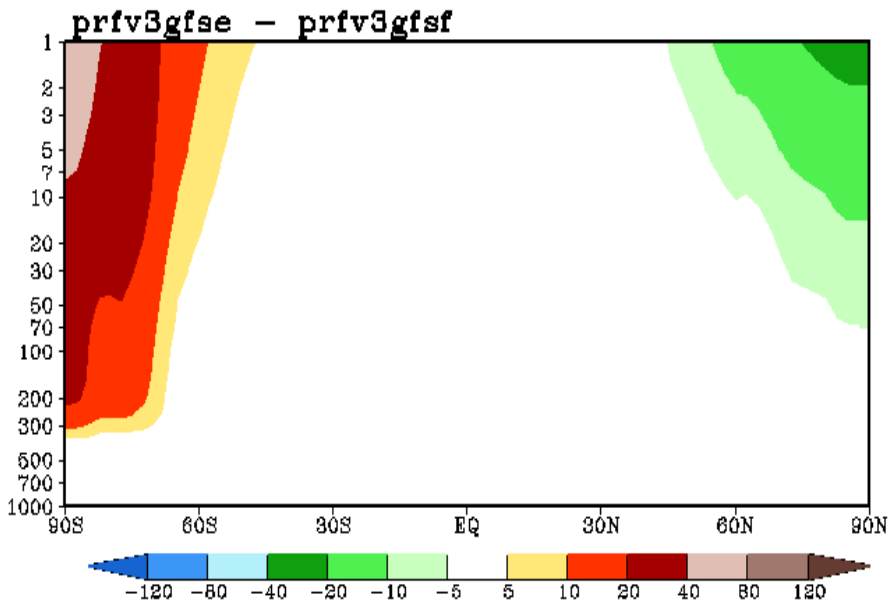


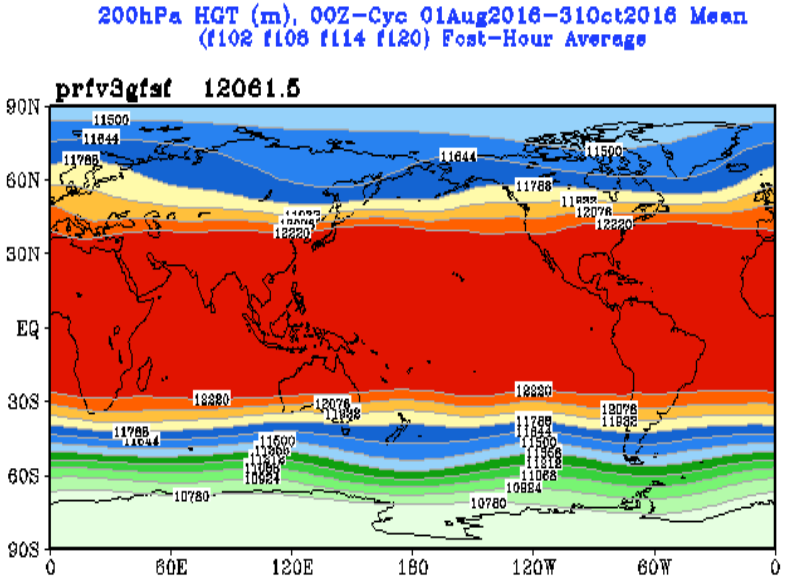
Ps=50,000 Pa

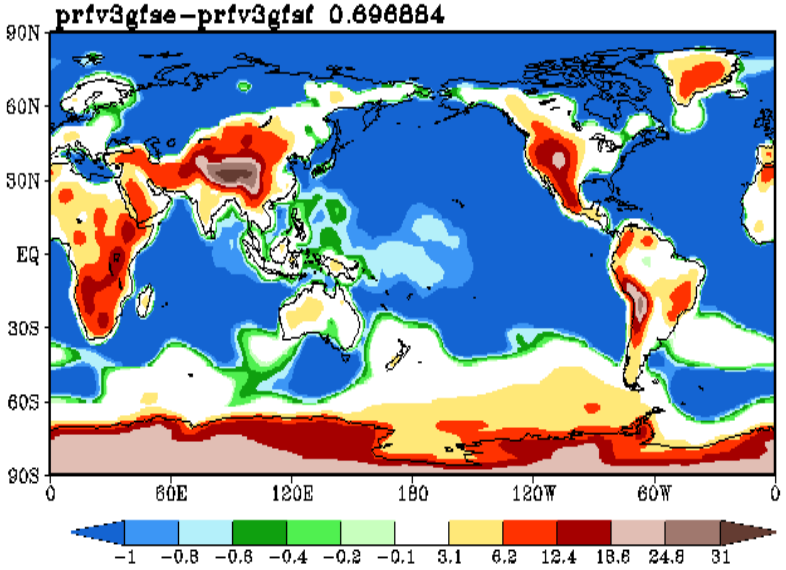
The difference between the two coordinates is small for Ps close to 1000 hPa, but increases over high terrains.

http://www.emc.ncep.noaa.gov/gmb/wx24fy/NGGPS/vcoord_test/

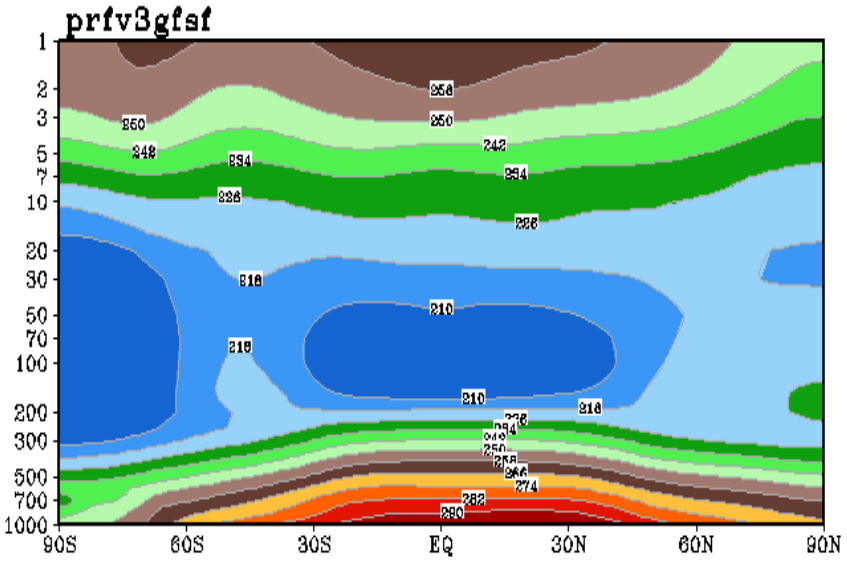


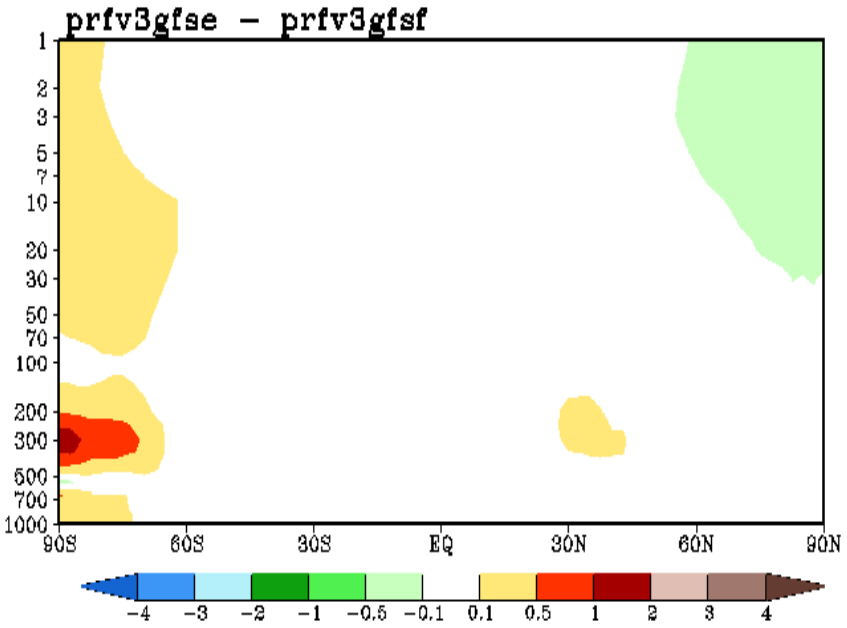




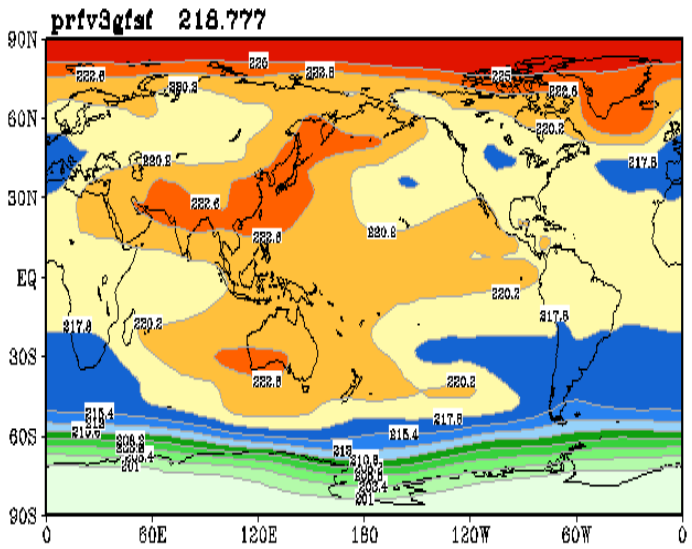


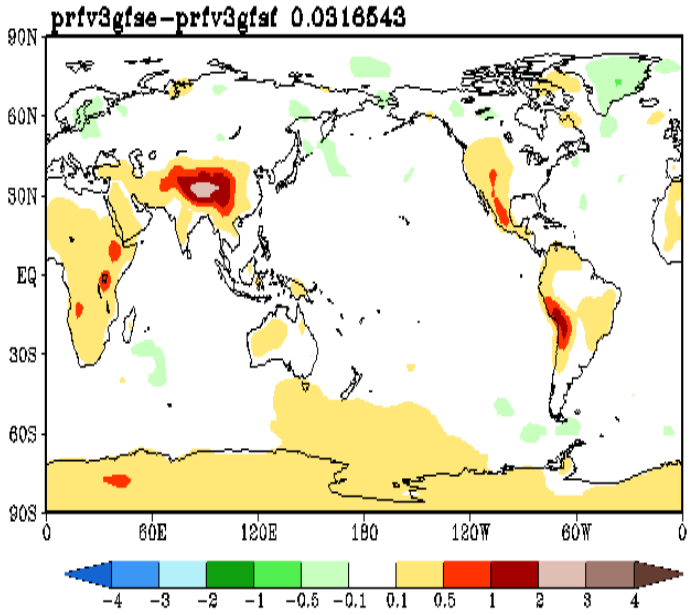
Temp (K), 00Z-Cyc 01Aug2016-31Oct2016 Mean
(f102 f108 f114 f120) Fost-Hour Average



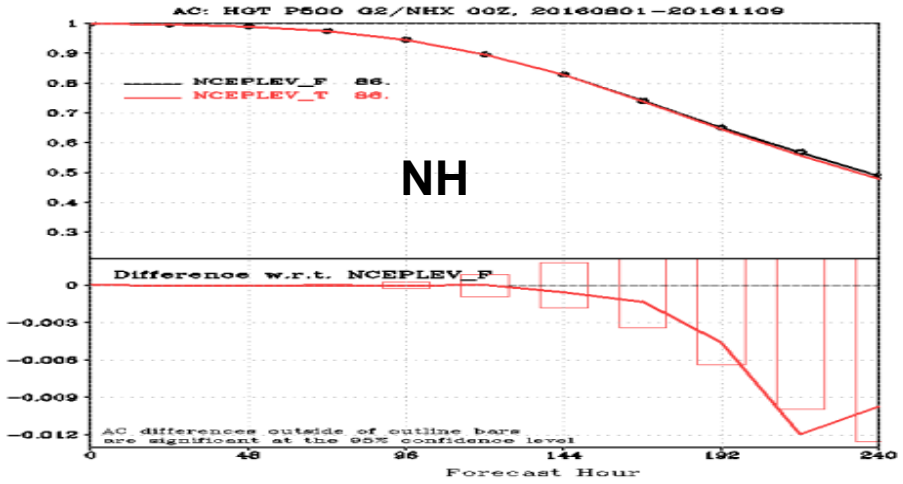


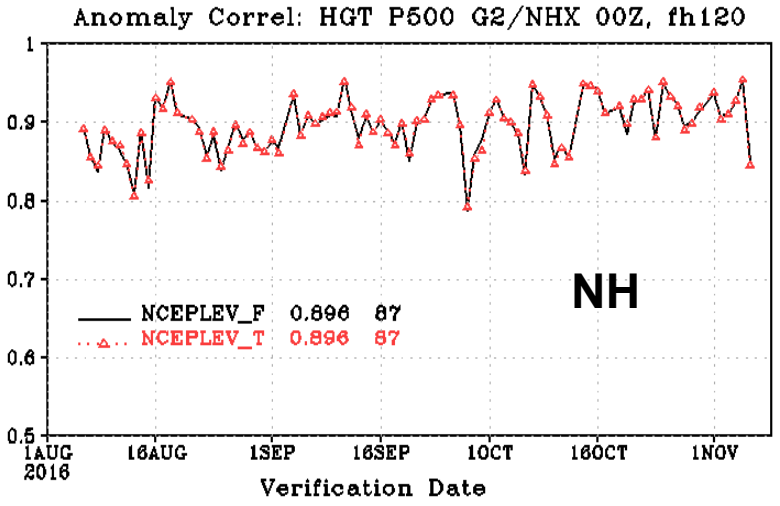
200hPa Temp (K), 00Z-Cyc 01Aug2016-31Oct2016 Mean
(f102 f108 f114 f120) Fost-Hour Average

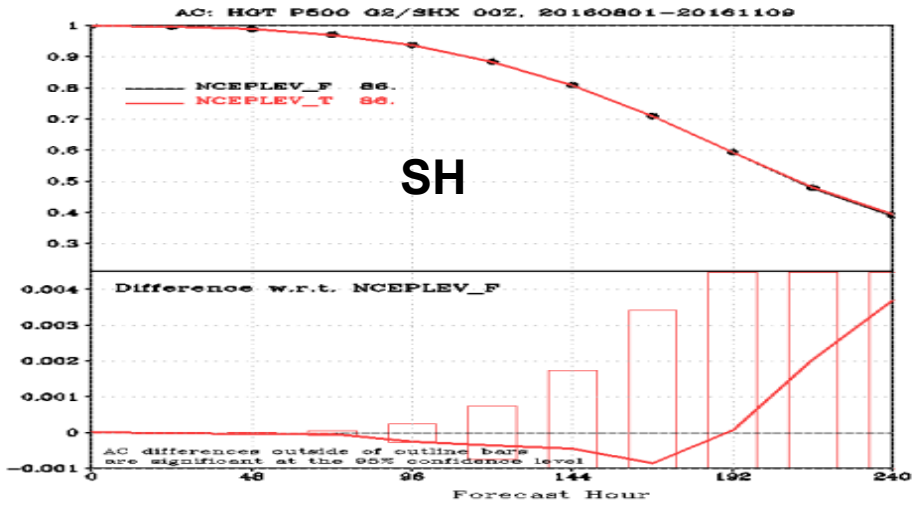


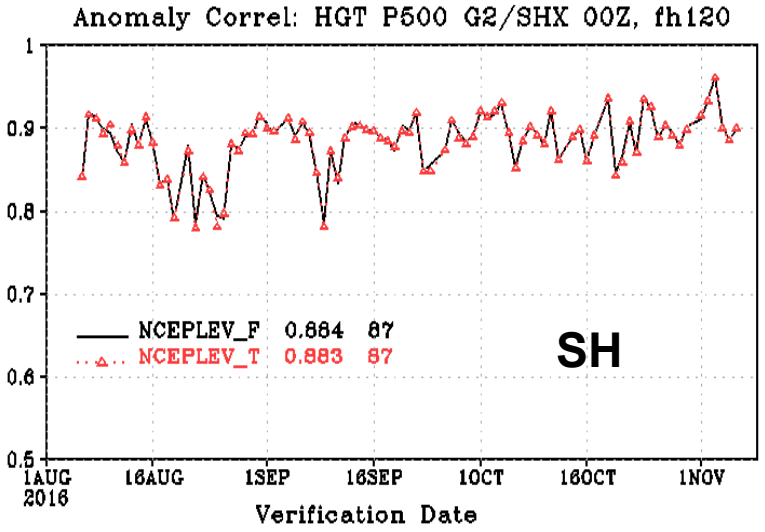


500-hPa HGT AC

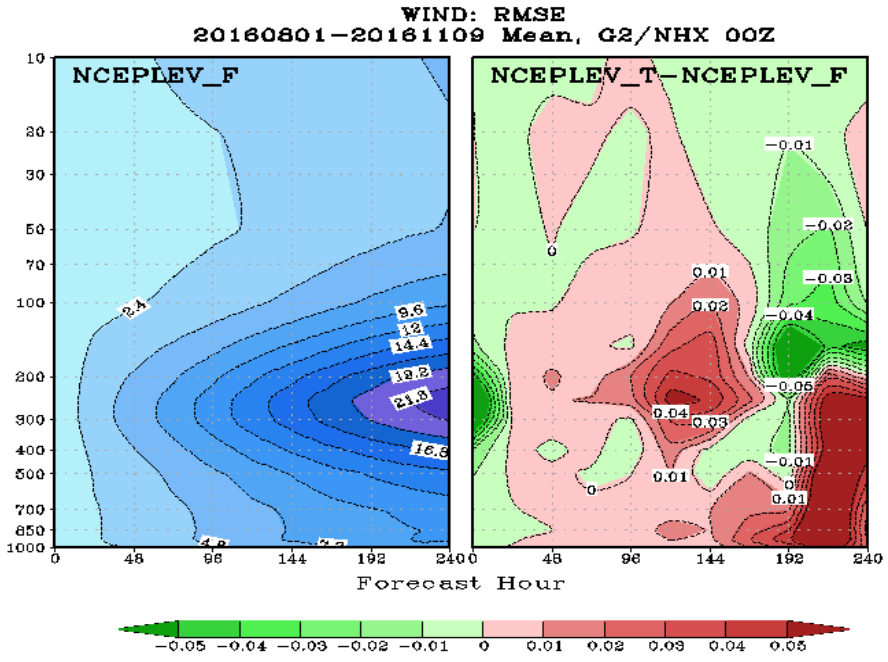


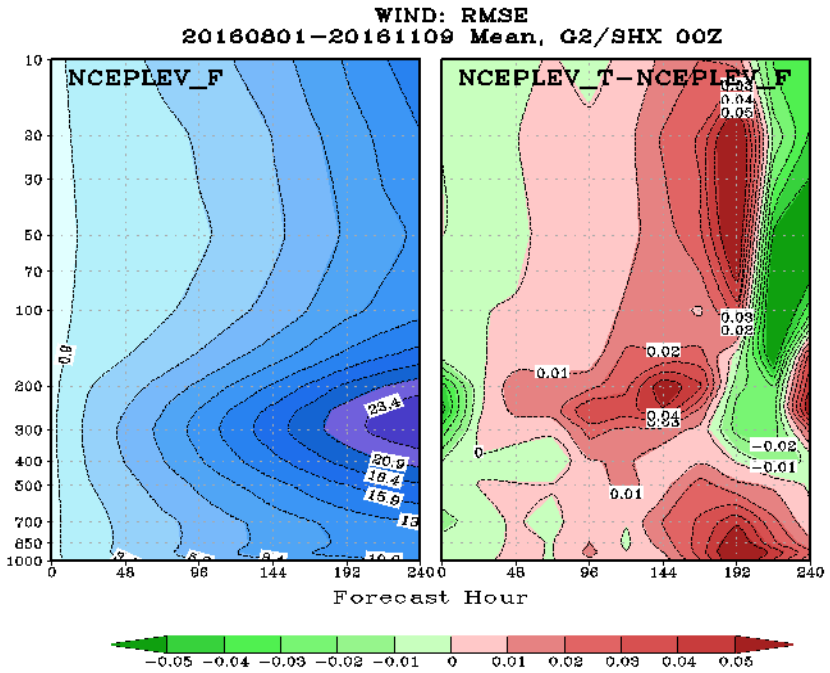


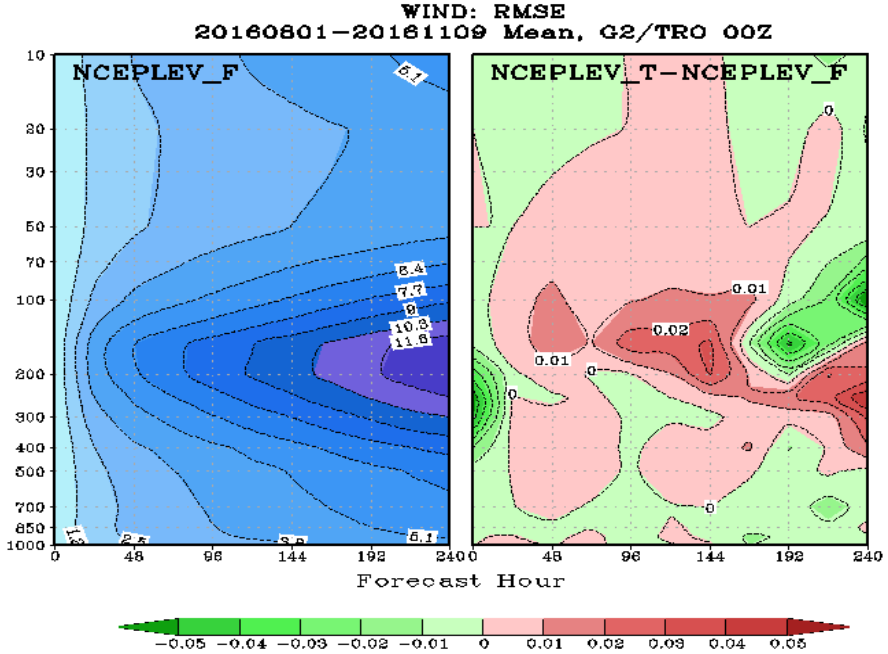




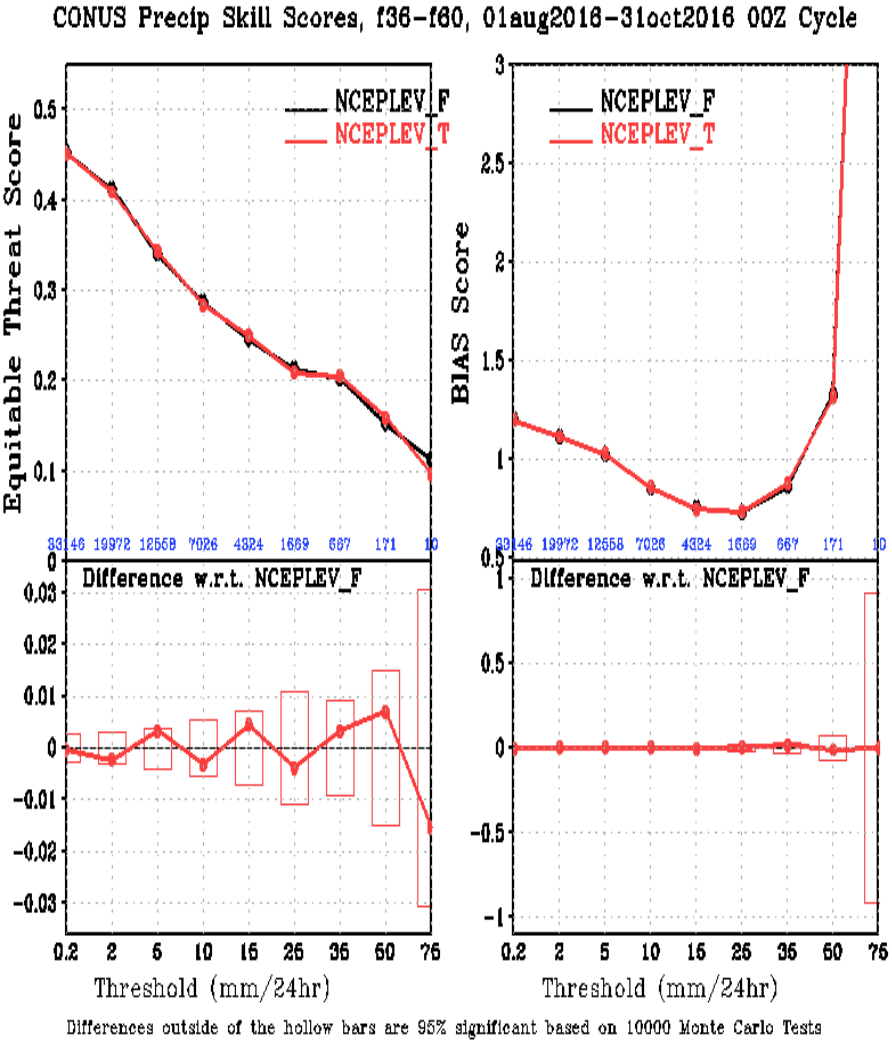
ncep_plevels=T is slightly worse than ncep_plevles=F in both NH and SH.

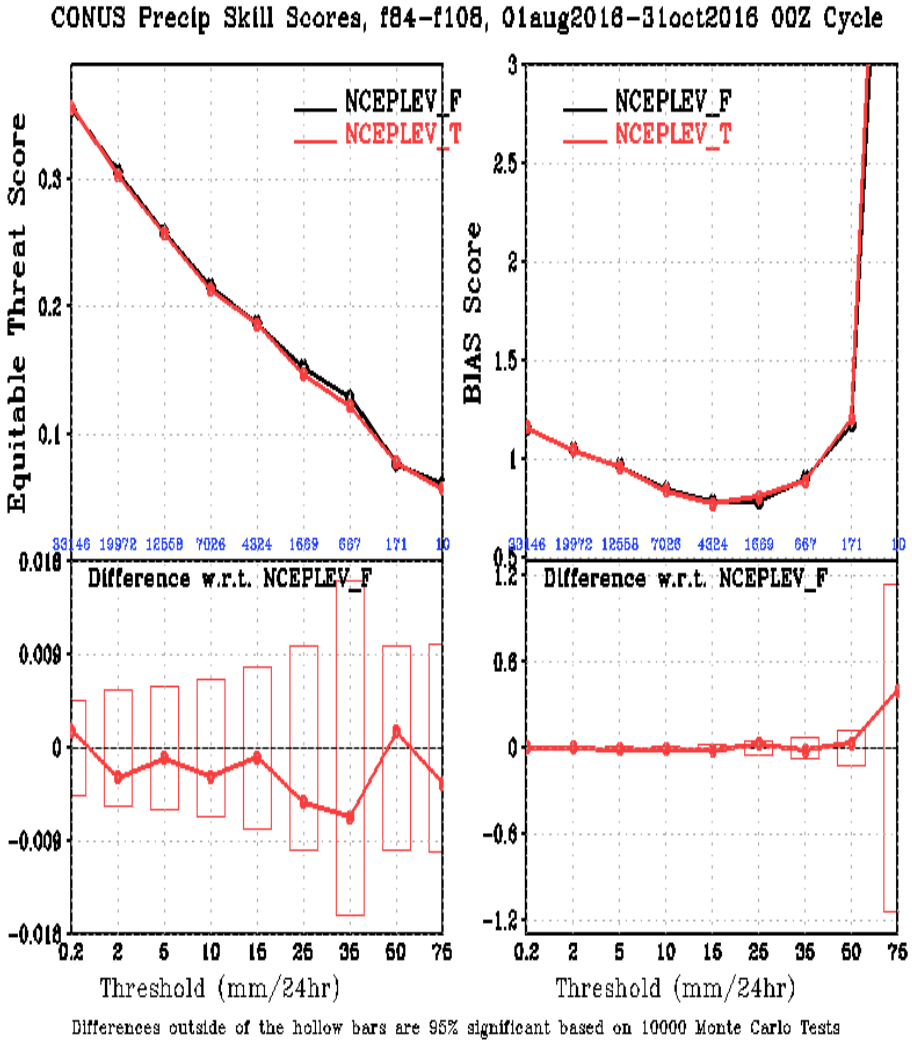




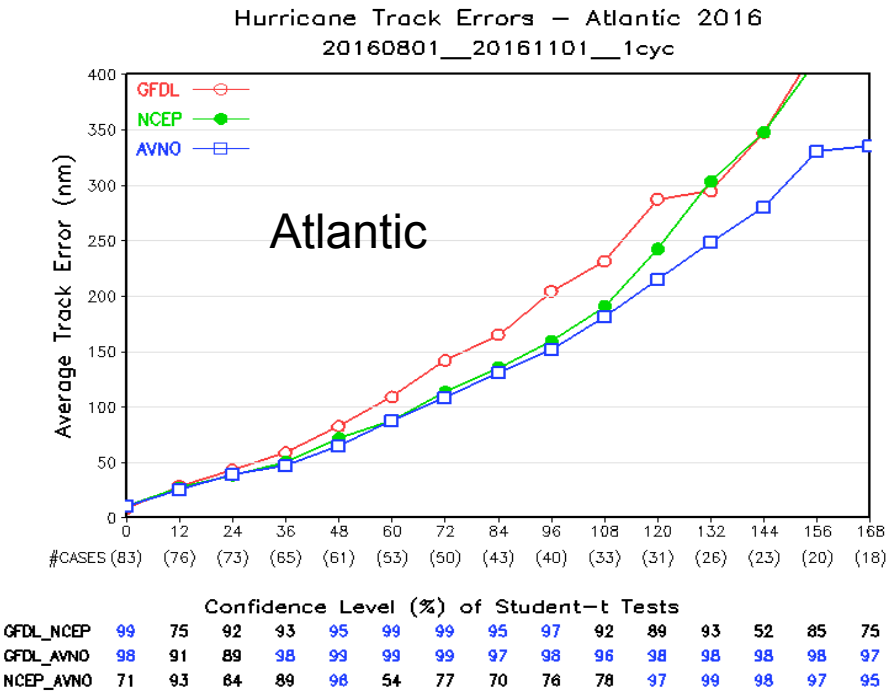


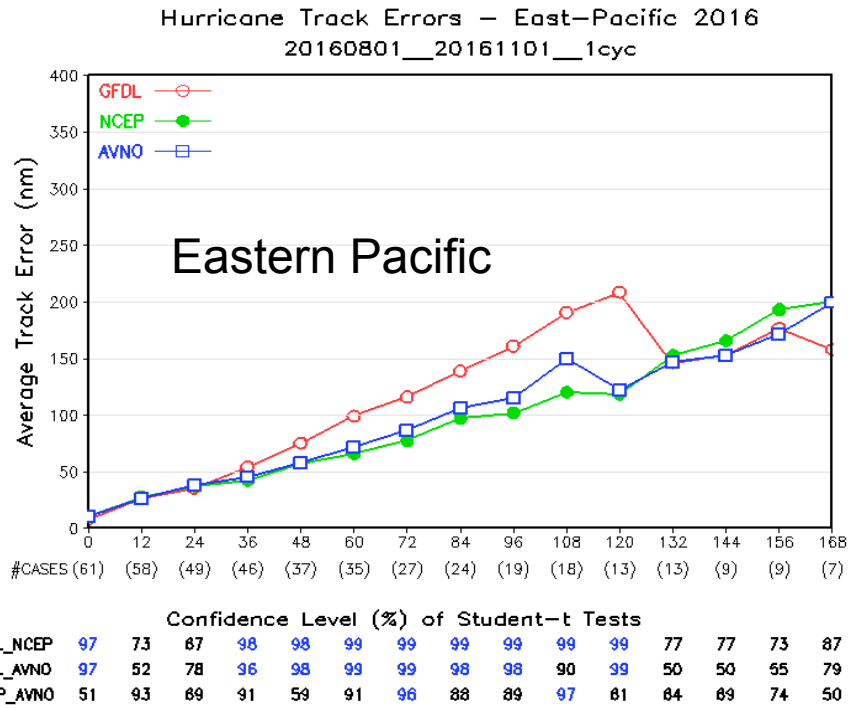
For wind RMSE, ncep_plevels=T is slightly worse than ncep_plevles=F in all regions (NH, SH and Tropics).

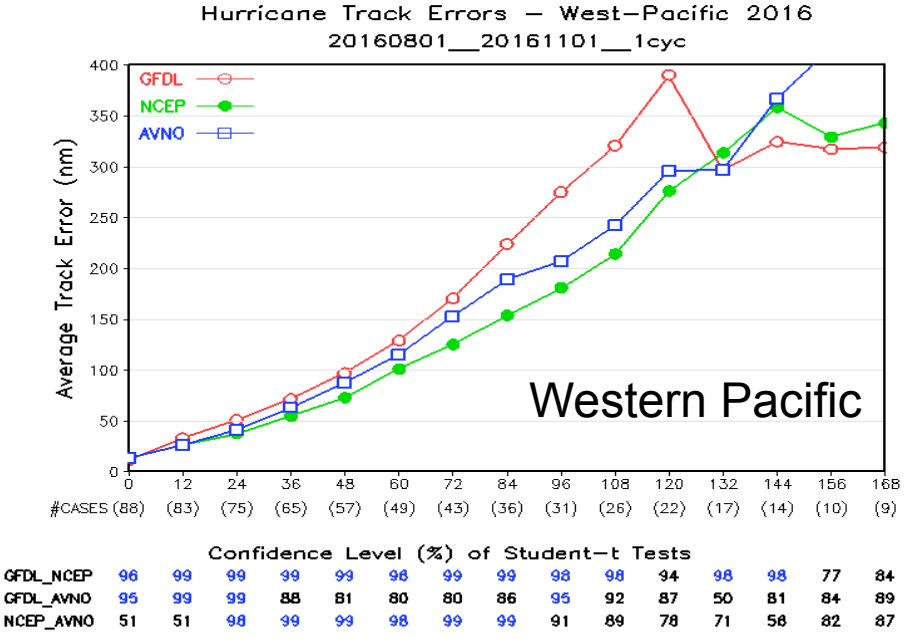




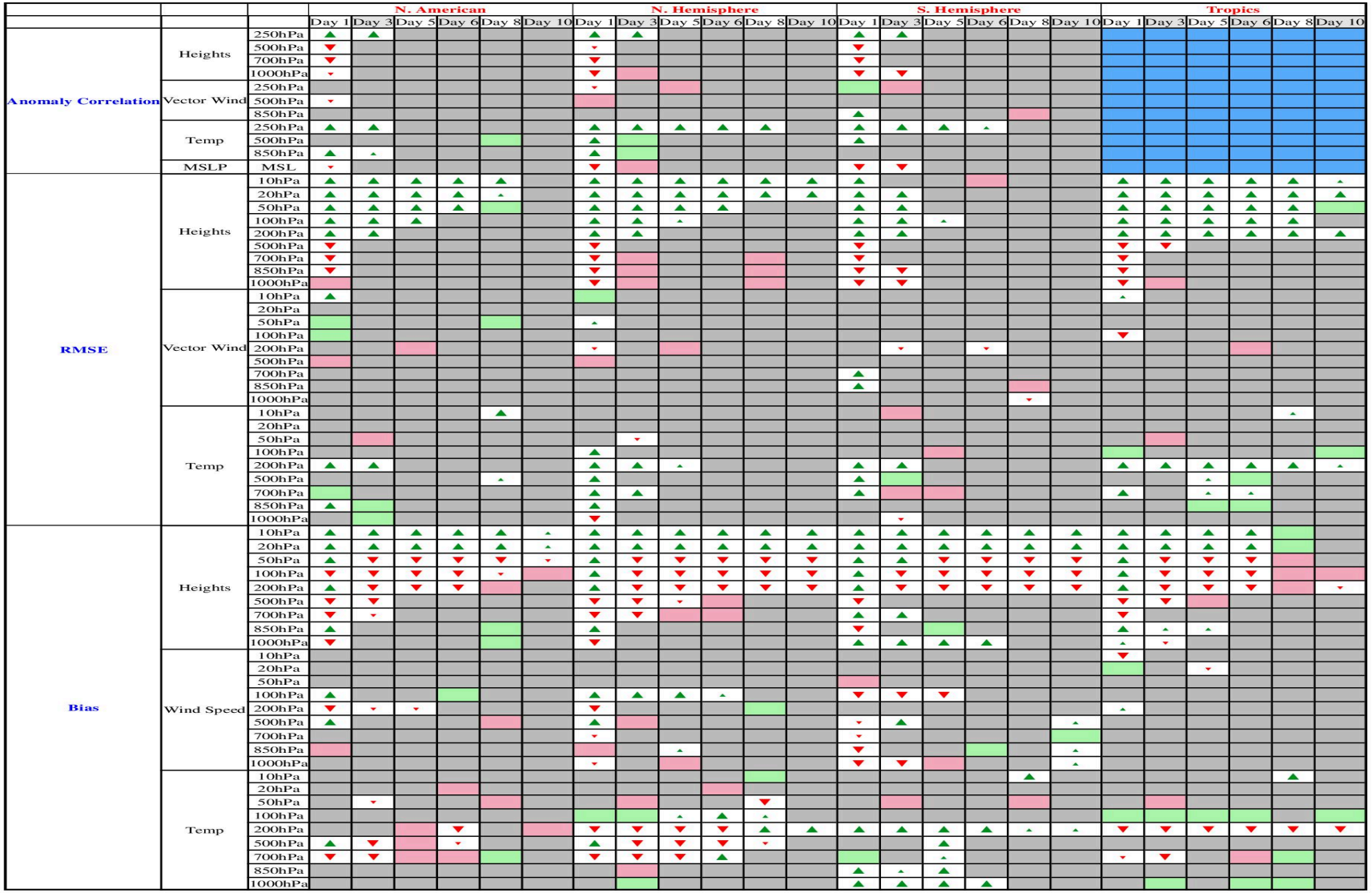
No significant difference in precipitation ETS and Bias scores







Running with ncep_plevels=T improves hurricane track forecast in all three basins.



Scorecard: overall difference is small

Conclusion

- Using ncep_plevels=T slightly degrades AC and RMSE scores, but improves hurricane track forecasts. The overall differences are small between the two runs.

- It is recommend to use ncep_plevles=T to facilitate data assimilation applications.