FV3GFS C384 Sensitivity Experiments

1) Orographic Gravity Wave Drag and Mountain Blocking
2)Non-hydrostatic .vs. hydrostatic

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Acknowledgements:
Fanglin Yang et al.

Experiment Design

- FV3GFS trunk (r86557)
- C384 (~25km) 64 layers
- Non-Hydrostatic
- 32-bit precise
- Initialized with GFS production analysis
- 10 day forecasts
- 20161001-20170110 (00Z only)
- 16 nodes, about 60 mins for 10-day forecast
  (sometimes it is more than 70 mins)

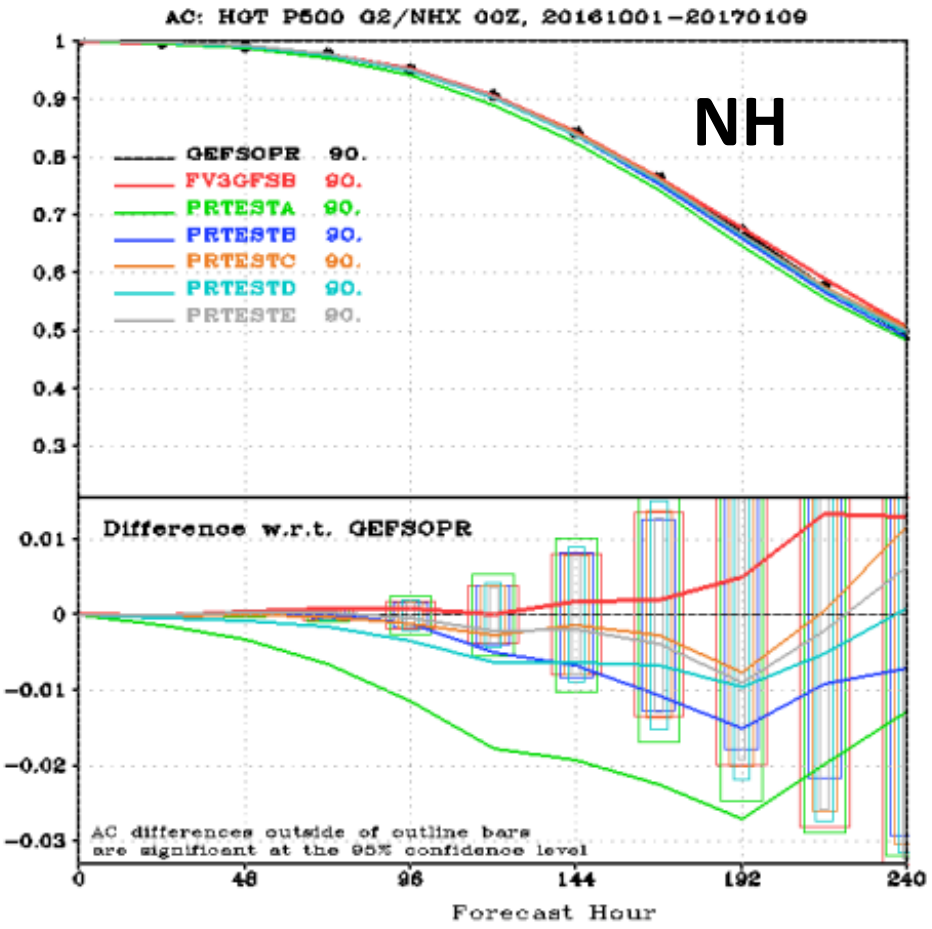
Experiments

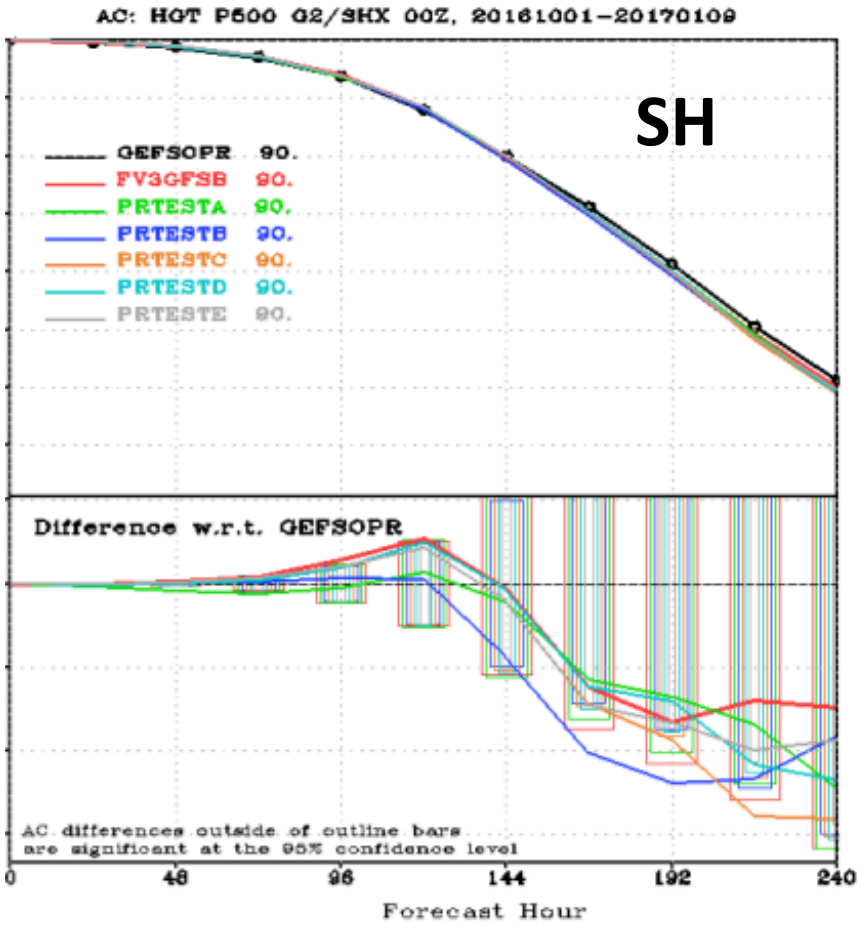
- **Exp A**: cdmbgwd=3.5,0.25 (13km setting)
- **Exp B:** cdmbgwd=0.25,2.0 (T574's setting)
- **Exp C:** cdmbgwd=1.0,1.2
- **Exp D:** cdmbgwd=1.5,0.8
- **EXP E:** cdmbgwd=0.8,1.5

- **Verification web page:**

http://www.emc.ncep.noaa.gov/gmb/wx11wm/nems_gefs/fv3_1/

500 HGT AC



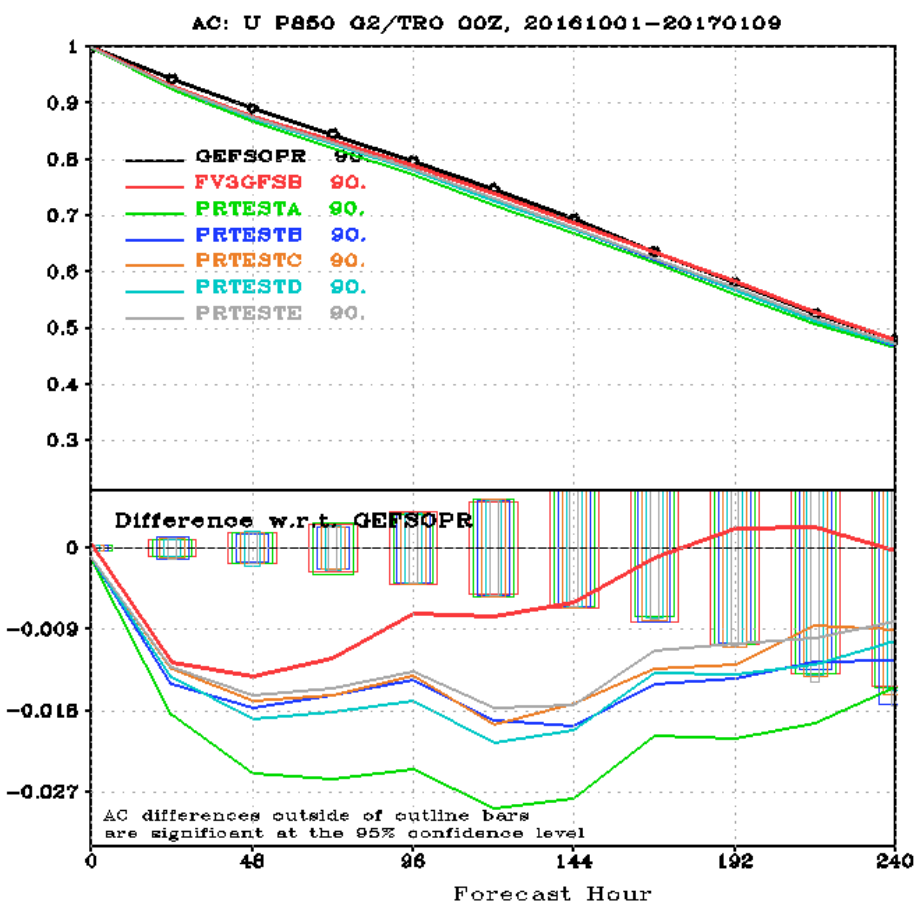


Black: GEFSOPR- T574L64, GEFS operational control

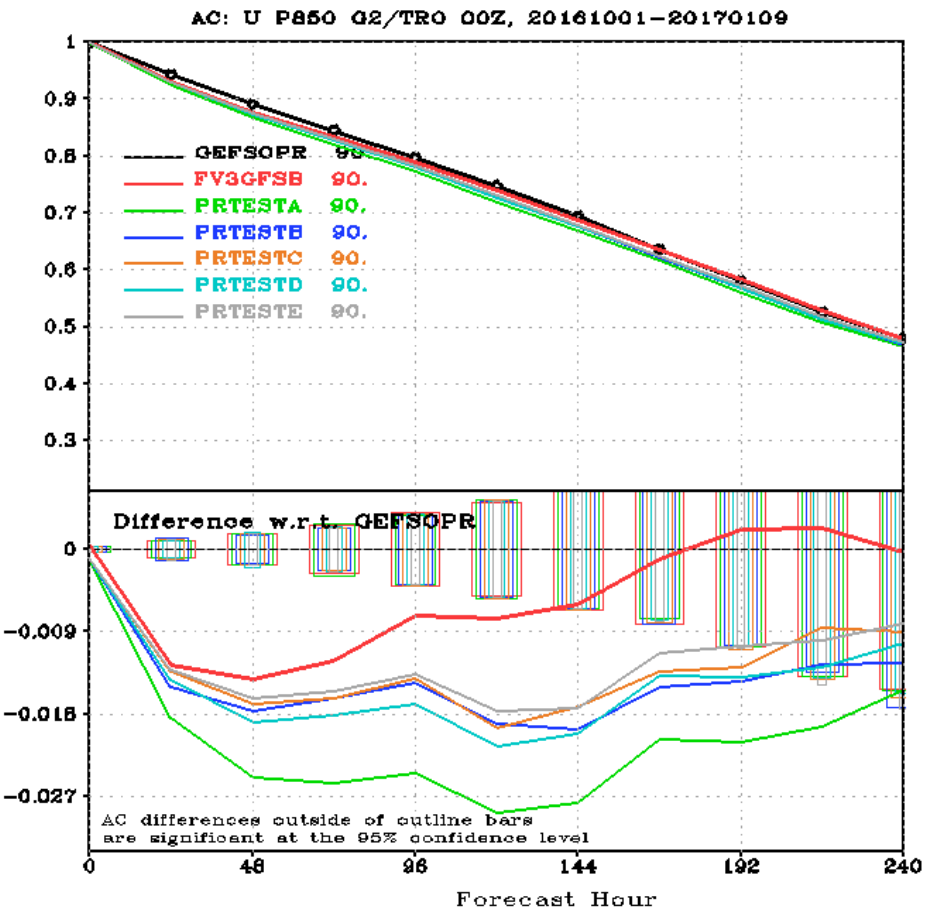
Red: FV3GFSB- C768, from Fanglin

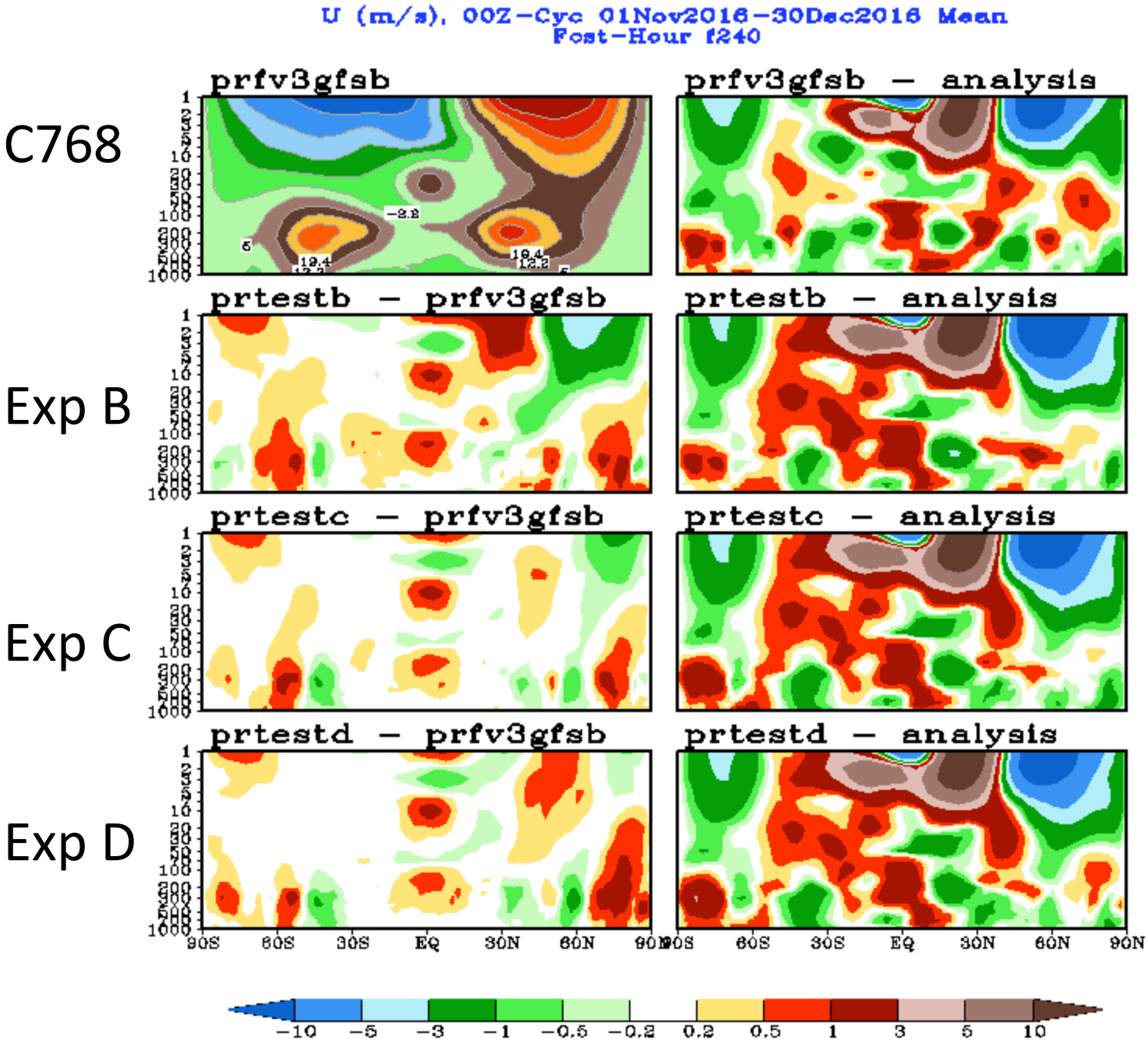
Tropical zonal wind AC

850 hPa



200 hPa





C768

Exp B

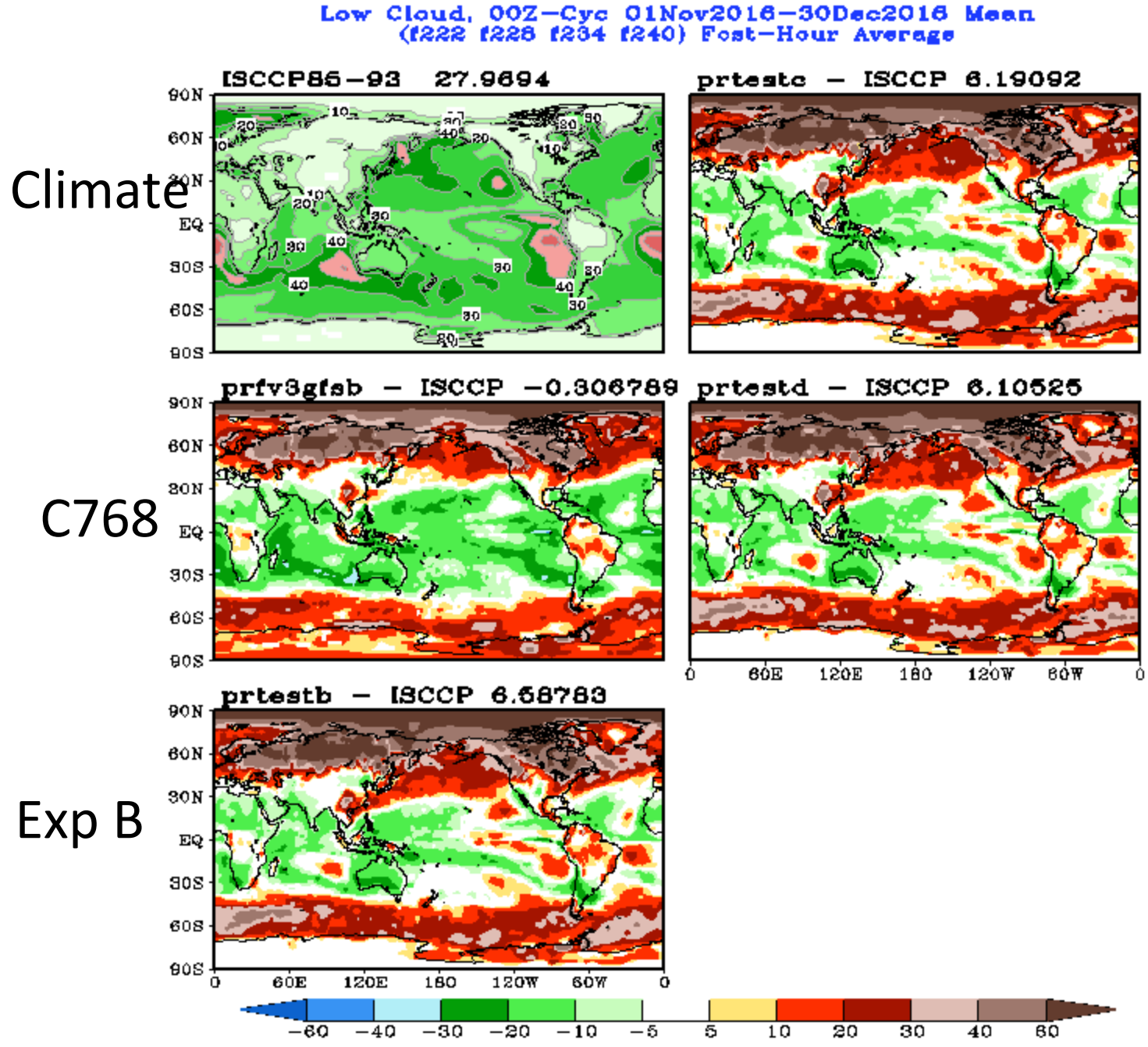
Exp C

Exp D

Zonal mean

U

F240 hr



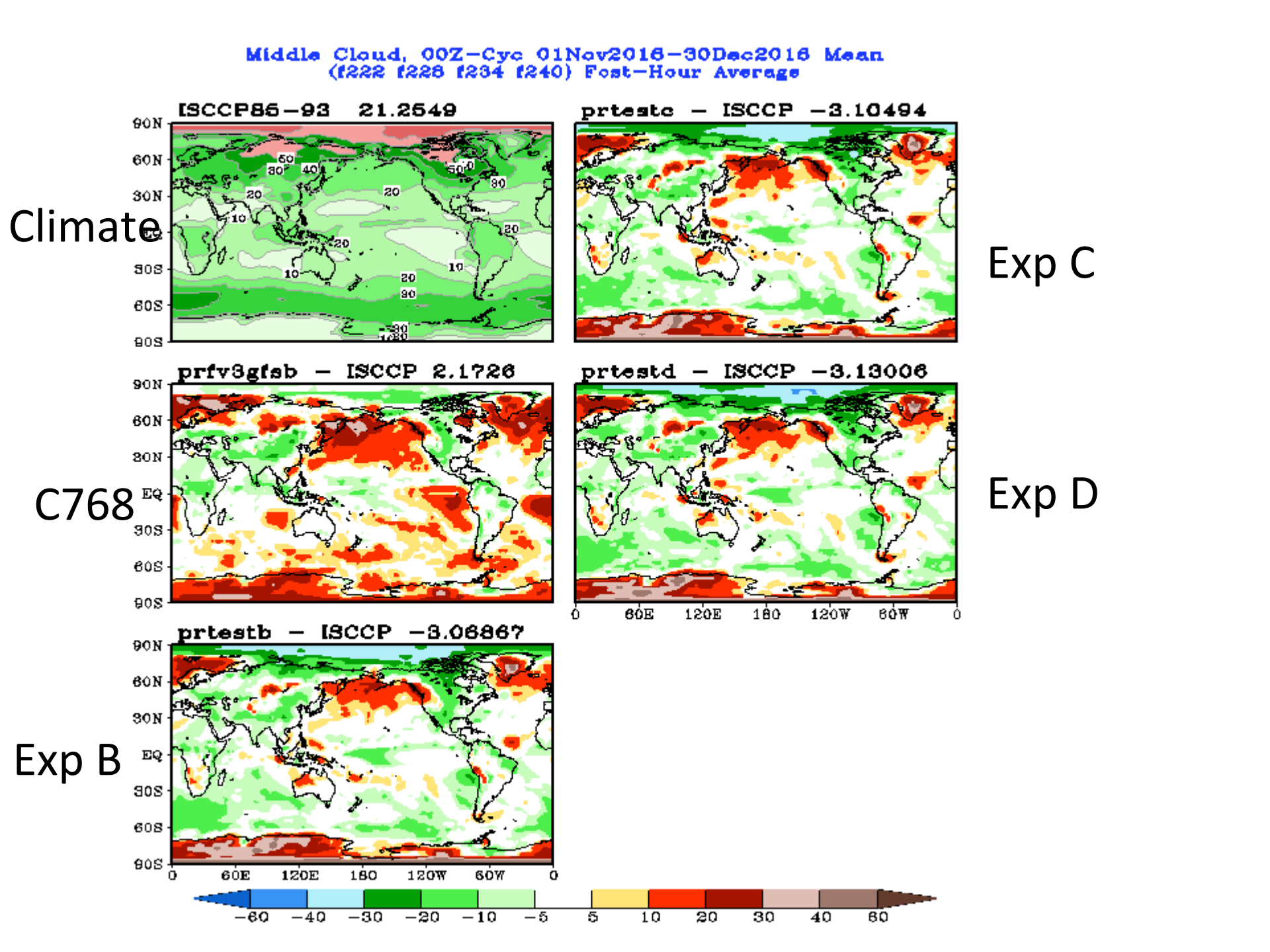
Climate

Exp C

C768

Exp D

Exp B


Middle Cloud, 00Z-Cyc 01Nov2016-30Dec2016 Mean
(f222 f228 f234 f240) Fost-Hour Average
ISCCP86-93 21.2549
prtestc - ISCCP -3.10494
prfv3gfsb - ISCCP 2.1726
prtestd - ISCCP -3.13006
prtestb - ISCCP -3.06867
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
-60 -40 -30 -20 -10 -5 5 10 20 30 40 60
Climate
Exp C
C768
Exp D
Exp B

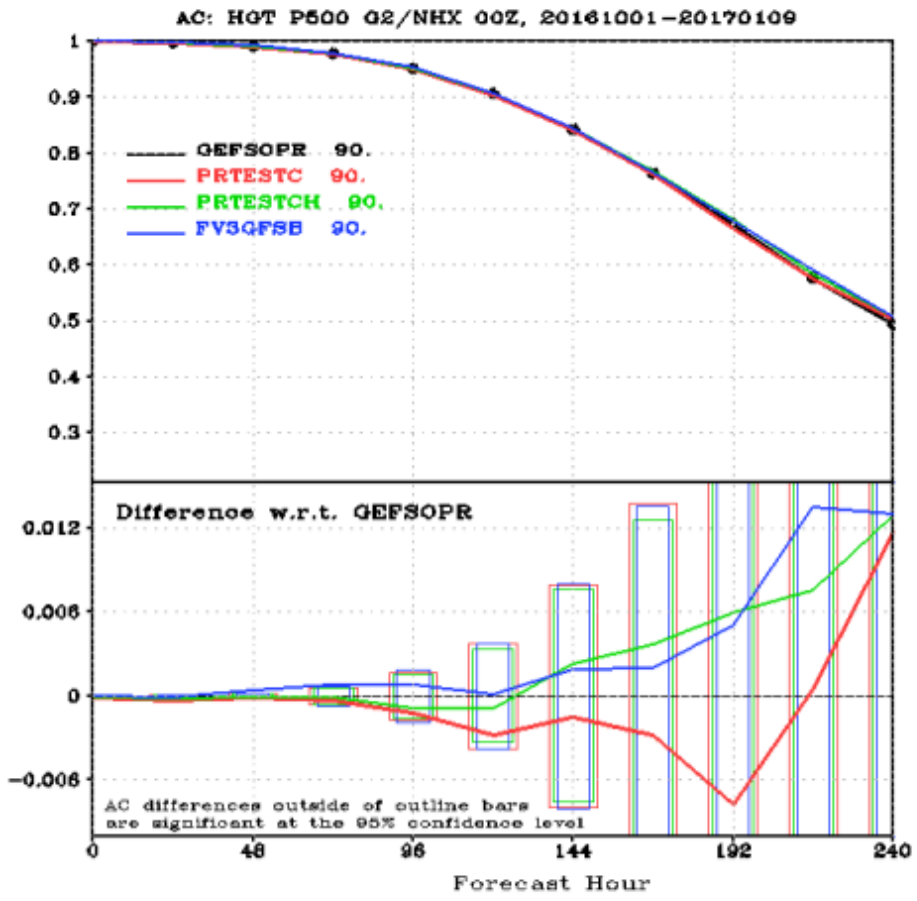
- **Non-hydro .vs. hydrostatic**

- **EXP C:** cdmbgwd=1.0,1.2, non-hydro
- **EXP CH:** As Exp C, except for hydrostatic

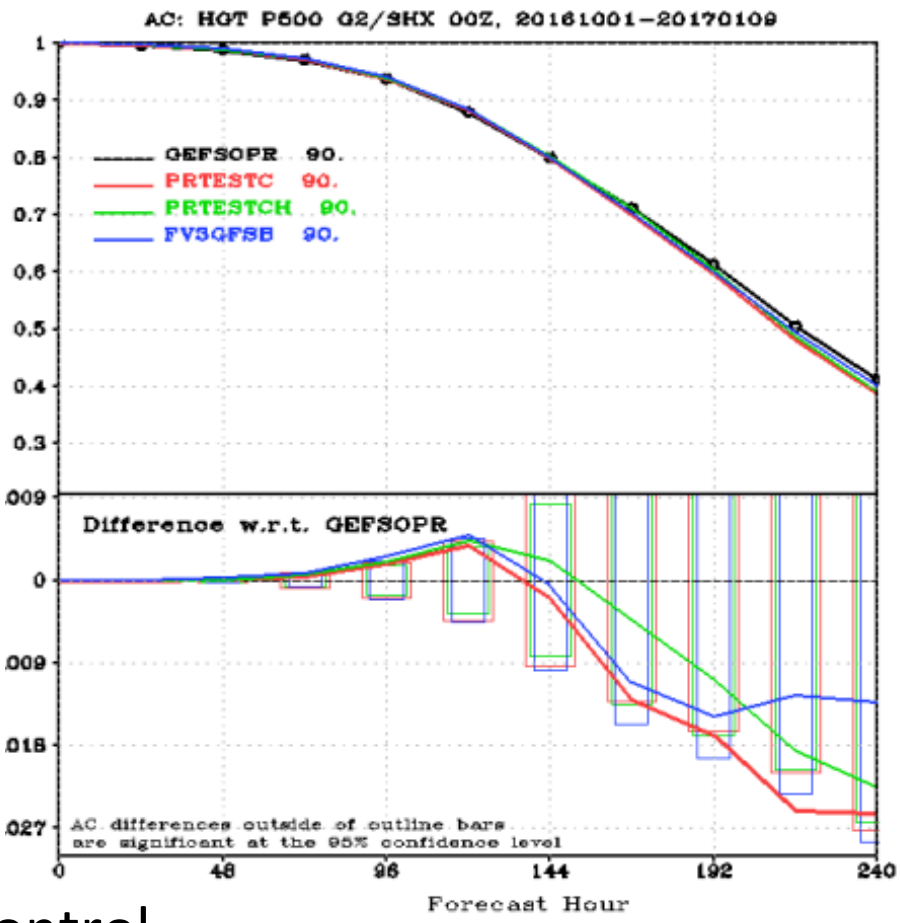
- http://www.emc.ncep.noaa.gov/gmb/wx11wm/nems_gefs/fv3_2/

500 HGT AC

NH



SH



Black: T574L64, GEFS operational control

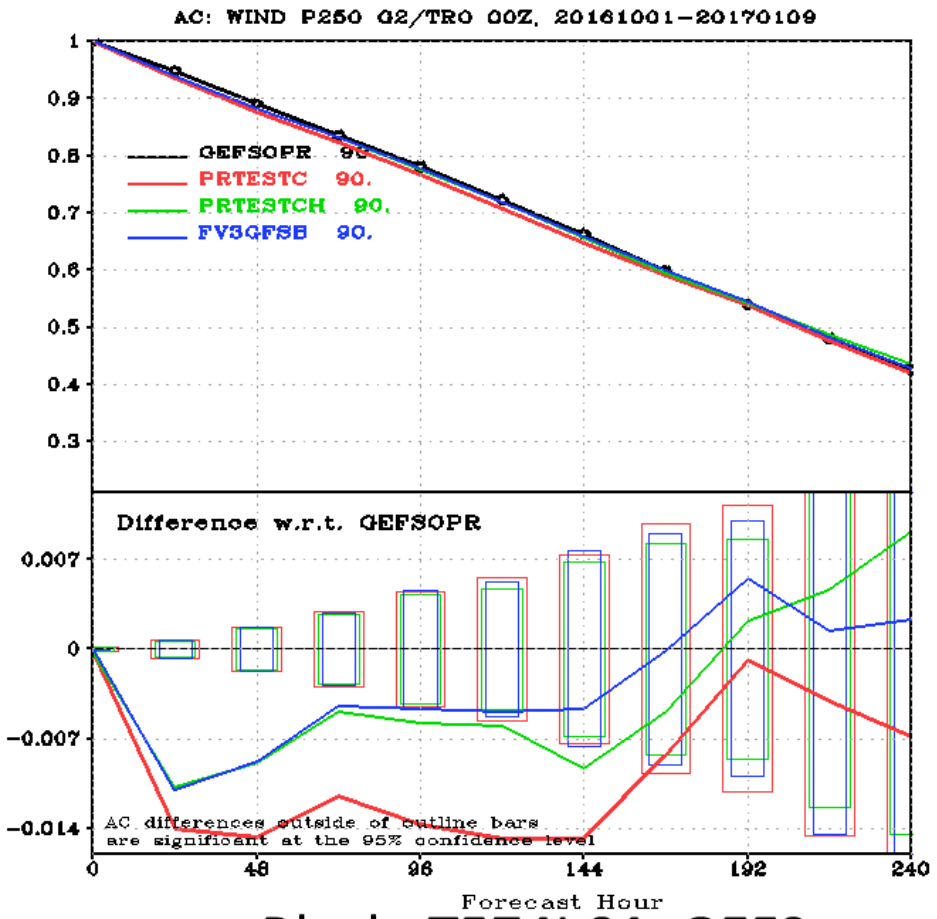
Red: C384, non-hydro

Green: C384, hydro

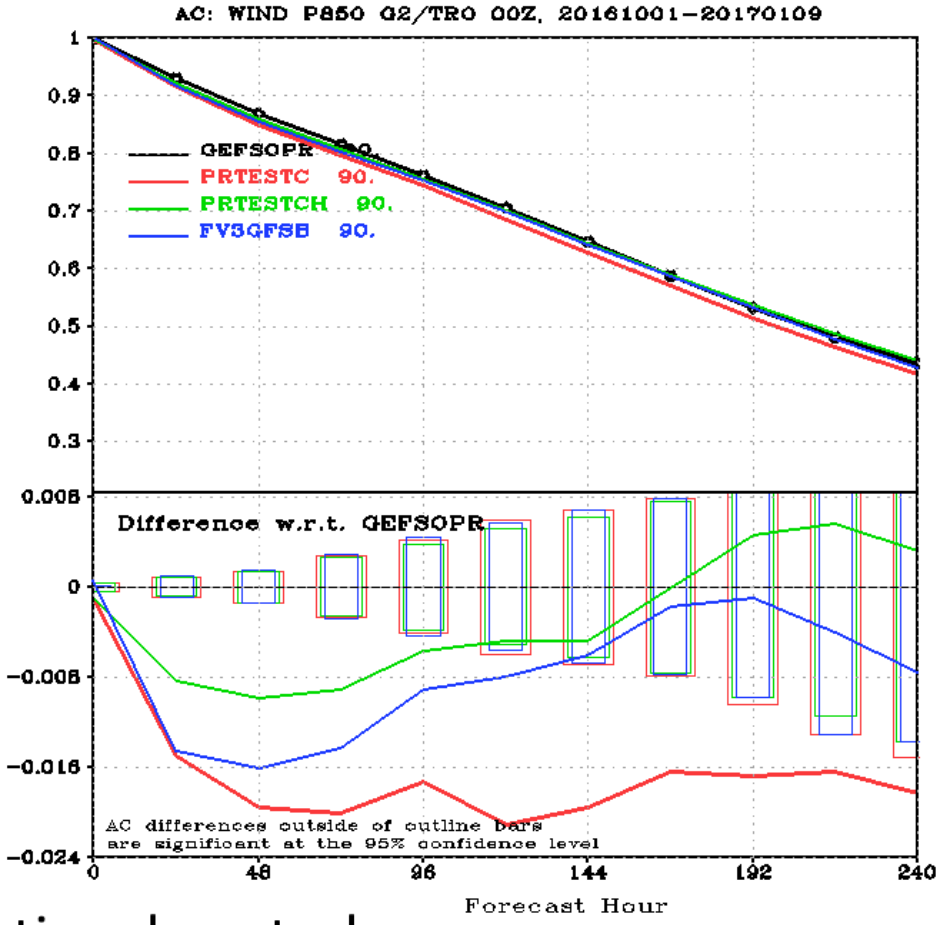
Blue:C768, non-hydro

Tropical vector wind AC

250 hPa



850 hPa



Black: T574L64, GEFS operational control

Red: C384, non-hydro

Green: C384, hydro

Blue:C768, non-hydro

Conclusions

- EXP “C” and “E” have best scores from others.
  - Exp C: cdmbgwd=1.0,1.2
  - EXP E: cdmbgwd=0.8,1.5
- Hydrostatic is better than non-hystrostatic for C384
- C384 has better low and middle cloud cover than C768
- FV3GFS C384 with the hydrostatic option and tuned cdmbgvd is comparable with C768 and GEFSv11
- Degradation of tropical wind forecast at the first week in FV3GFS

Future plans

- Use new FV3GFS version
- Use C384 and C192 parameter settings provided by GFDL
- Test C192 for the GEFS second segment forecast
- Test FV3 NEMS version when ready

(Will the parameter tuning based on FV3GFS be valid?)