NAEFS upgrade (v6)

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Presentation for Monthly NAEFS Tele-conf
Oct. 18 2016

Highlights

- Add new bias corrected NAEFS/GEFS 0.5*0.5 degree products
  - **NCEP GEFS bias correction for 0.5degree**
    - **Decaying method only (Bo)**
    - **Hybrid of decaying bias and reforecast bias (Hong)**
- New multi-model products
  - Will present in the future
- Add precipitation products
  - Bias correction and downscaling (Still work on)

NAEFS Global Grid Exchange Variables for 0.5d

Update: August 8 2016

Variables	Levels and Categories	Total 86/43
GHT	Surface, 10, 50, 100, 200, 250, 300, 500, 700, 850, 925, 1000 hPa	12/(5)
TMP	2m, 2mMax, 2mMin, 10, 50, 100, 200, 250, 500, 700, 850, 925, 1000 hPa	13/(6)
RH	2m, 10, 50, 100, 200, 250, 500, 700, 850, 925, 1000 hPa	11/(4)
UGRD	10m, 10, 50, 100, 200, 250, 300, 400, 500, 700, 850, 925, 1000 hPa	13/(8)
VGRD	10m, 10, 50, 100, 200, 250, 300, 400, 500, 700, 850, 925, 1000 hPa	13/(8)
PRES	Surface, PRMSL	2/(2)
PRCP	APCP, CRAIN, CSNOW, CFRZR, CICEP	5/(5)
FLUX (surface)	LHTFL, SHTFL, DSWRF, DLWRF, USWRF, ULWRF	6/(0)
FLUX (top)	ULWRF (OLR)	1/(0)
PWAT	Total precipitable water at atmospheric column	1/(1)
TCDC	Total cloud cover at atmospheric column	1/(1)
CAPE	Convective available potential energy, Convective Inhibition	2/(2)
SOIL/SNOW	SOILW(0-10cm) , TMP(0-10cm down), WEASD(water equiv. of accum. Snow depth), SNOD(surface)	4/(0)
Other	850 hPa vertical velocity, Ice thickness (ICETK)	2/(1)
Notes	Current NAEFS grids at 1*1 degree New 0.5 degree fields already exchanged at 1 degree New 0.5 degree added from users request	

NAEFS bias corrected variables

Last upgrade: March 29 2016 - (bias correction)

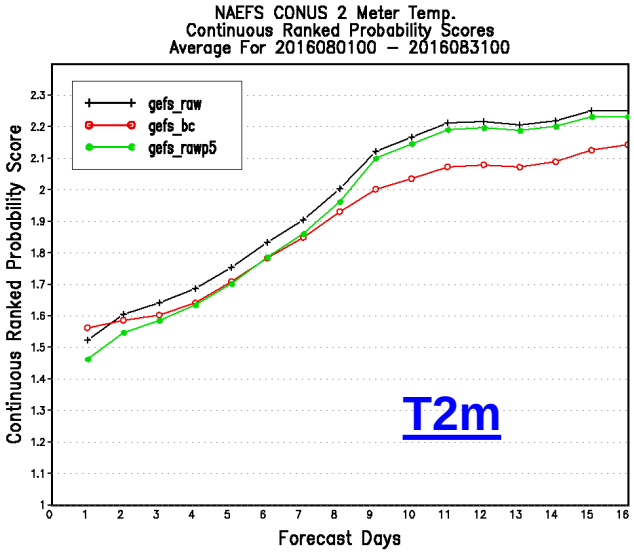
Variables	pgrba_bc file	Total 52
GHT	10, 50, 100, 200, 250, 500, 700, 850, 925, 1000hPa	10
TMP	2m, 2mMax, 2mMin, 10, 50, 100, 200, 250, 500, 700, 850, 925, 1000hPa	13
UGRD	10m, 10, 50, 100, 200, 250, 500, 700, 850, 925, 1000hPa	11
VGRD	10m, 10, 50, 100, 200, 250, 500, 700, 850, 925, 1000hPa	11
VVEL	850hPa	1
PRES	Surface, PRMSL	2
FLUX (top)	ULWRF (toa - OLR)	1
Td and RH	2m (April 8 2014)	2
TCDC	Total cloud cover (March 29 2016)	1
Notes	CMC do not apply last two upgrades yet FNMOC do not apply last upgrade yet	

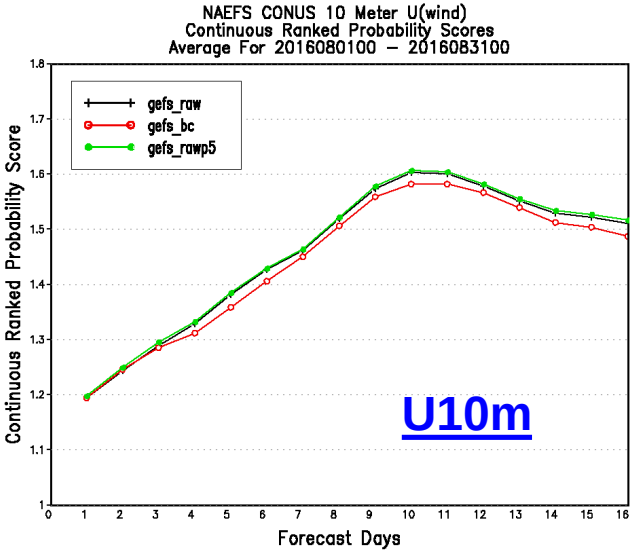
1. GEFS Bias Correction (1.0d vs. 0.5d)

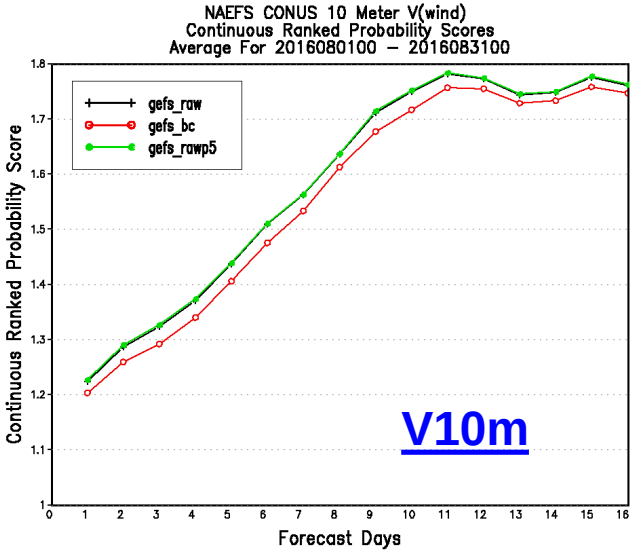
- Based on GEFS operational ensemble systems
- For raw and bias corrected ensembles
- Comparison of two resolutions (1d and 0.5d)
- Period:
  - Summer – Aug. 1st 2016 – Aug 31th 2016 after 2 months training
- Variables: T2m, U10m, V10m, DPT and etc.
- Verify against RTMA analysis for CONUS
- Comparison after interpolation to 2.5km ndgd
  - gefs_raw: 1d raw ensemble prod, 6hourly
  - gefs_bc: 1d bias corrected ensemble prod , 6hourly
  - gefs_rawp5: 0.5d raw ensemble prod , 3hourly
  - gefs_bcp5: 0.5d bias corrected ensemble , 3hourly
    - bias estimation from control 3hr forecast
- Results:
  - http://www.emc.ncep.noaa.gov/gmb/wx20cb/naefs.v6.0.0/crps_3lines_gefs/
  - http://www.emc.ncep.noaa.gov/gmb/wx20cb/naefs.v6.0.0/crps_4lines_gefs_24h/

1d and 0.5d Ensembles Comparison (CRPS)

Verified Again RTMA CONUS Analysis







gefs_raw: 1d prod raw GEFS

gefs_bc: 1d prod bias corrected GEFS

gefs_rawp5: 0.5d prod raw GEFS

* All ensemble forecasts are interpolated to 2.5km CONUS ndgd grid before verification

1d and 0.5d Ensembles Comparison (Ensemble Mean RMSE/Spread)
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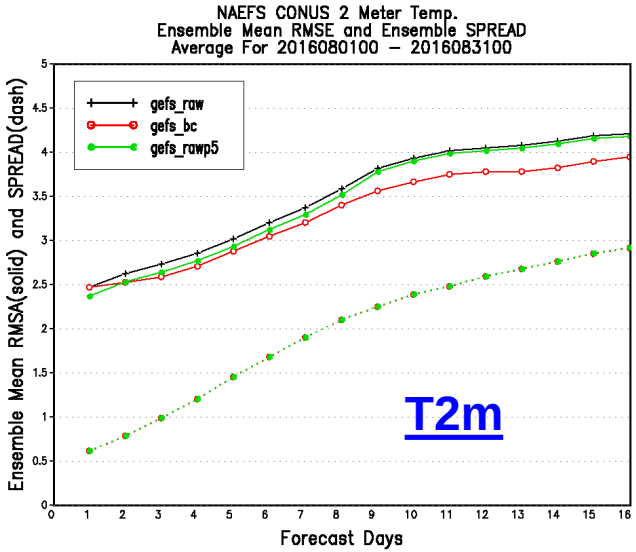

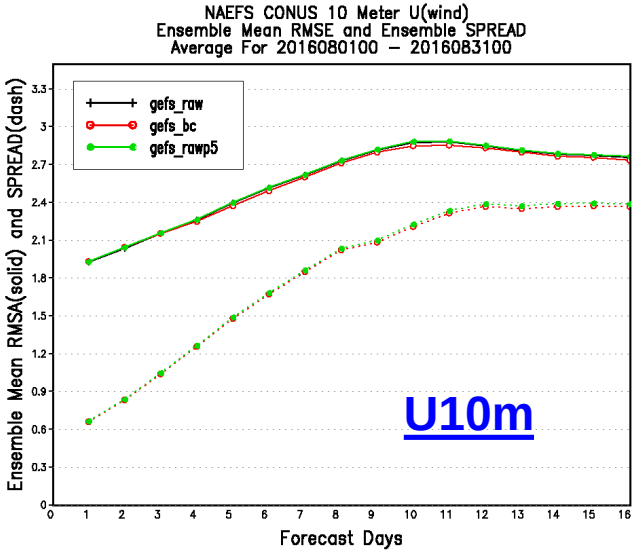

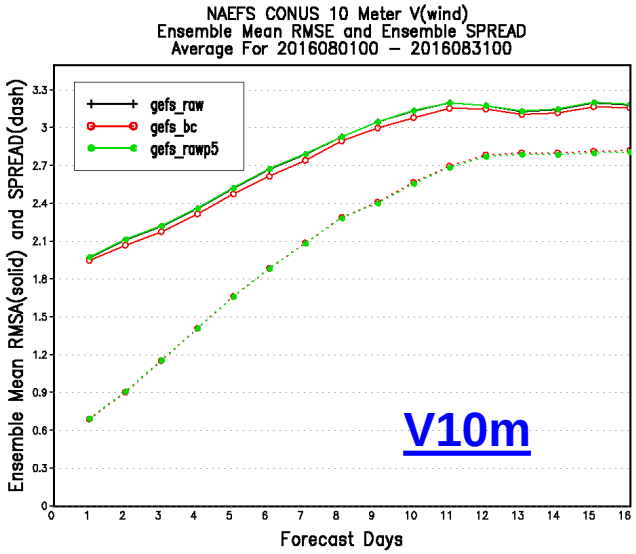

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1d and 0.5d Ensembles Comparison (CRPS)

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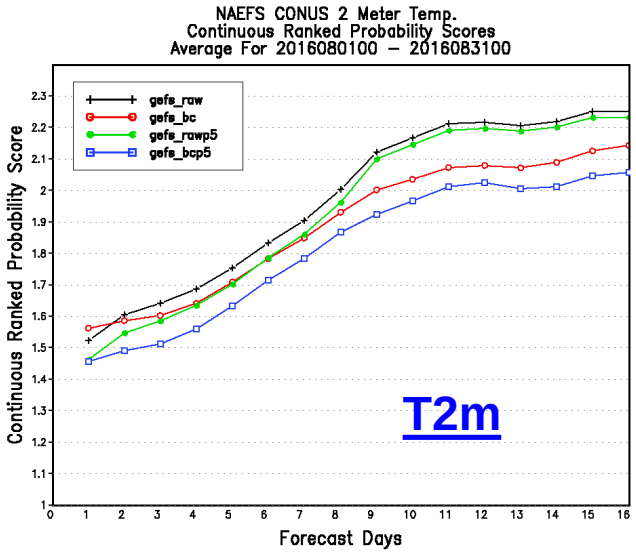

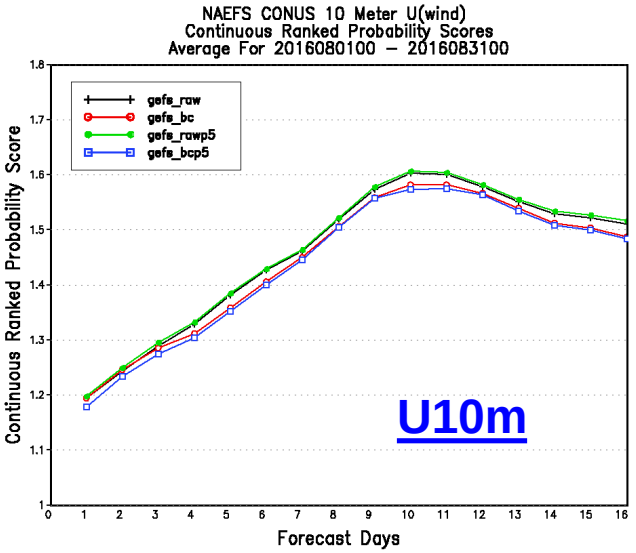

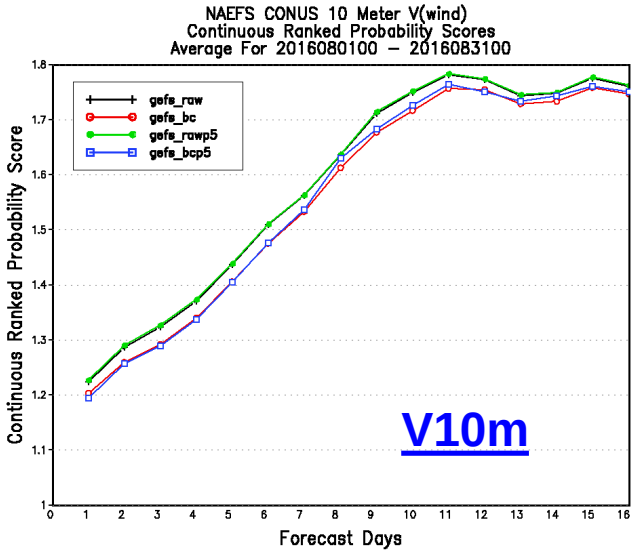

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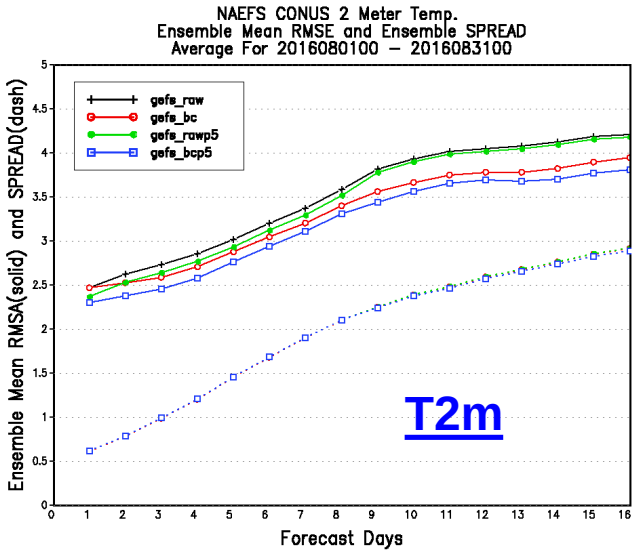

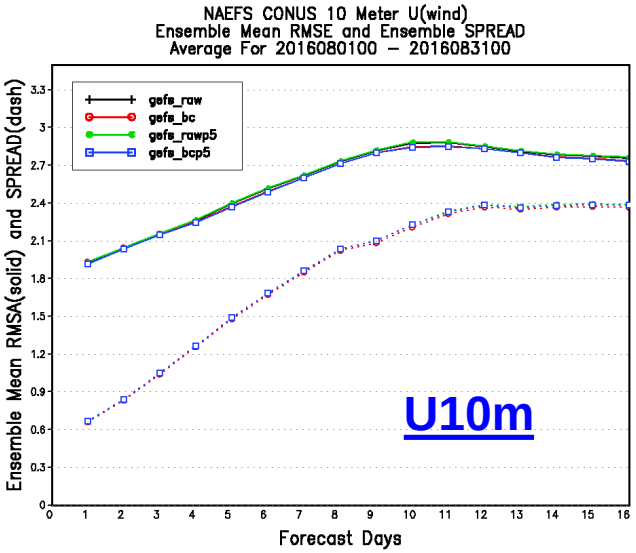

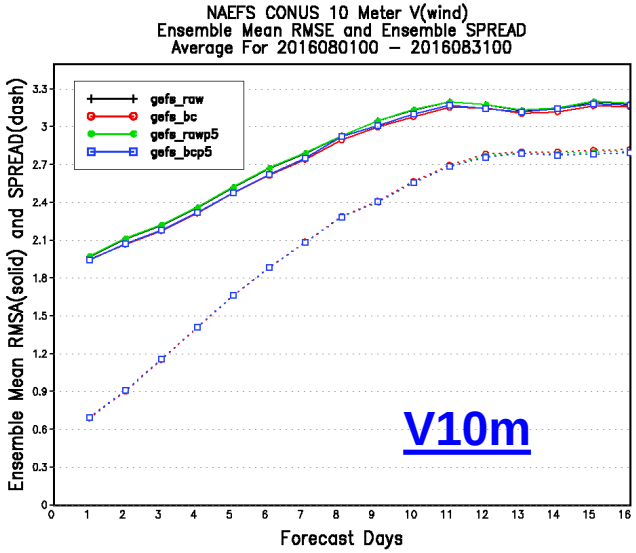

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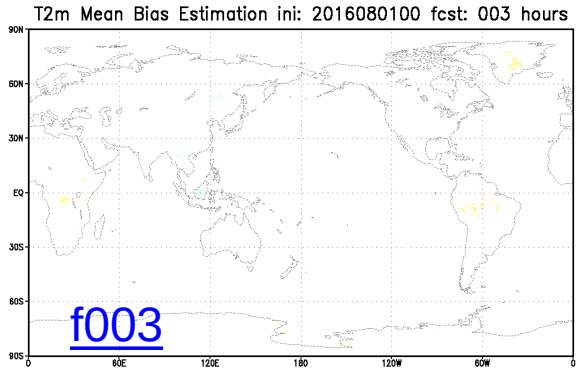
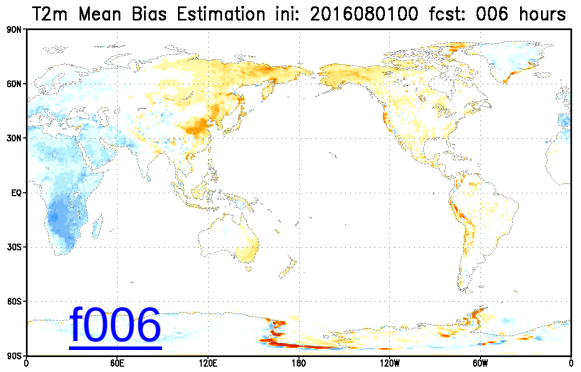
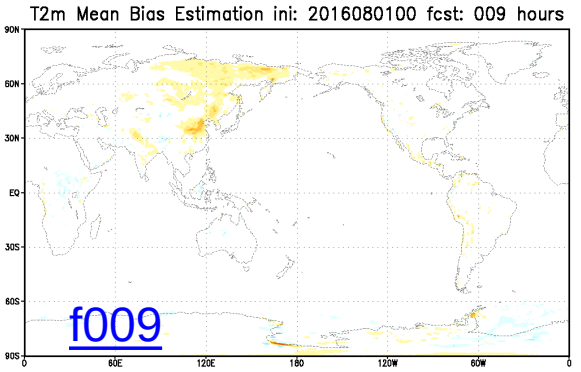
2. GEFS Bias Correction (3 hrly)

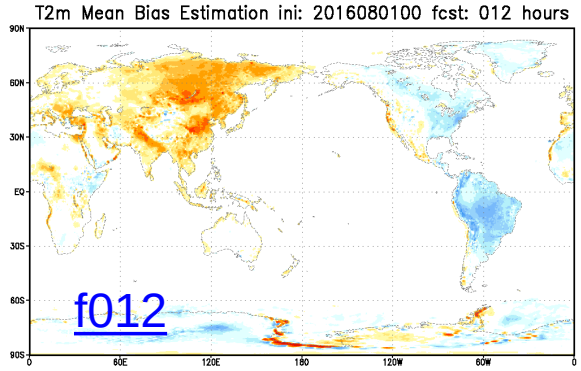
- How can we have bias valid for f03, f09 ……?
  - There is no analysis for 03, 09, 15 and 21UTC
- What is good approximation?
  - Bias average of f06 and f12 for f09?
    - Will not use f09 forecast to calculate bias
  - Use closed forecast as best analysis?
    - f03 of 06UTC forecast is best guest of 09UTC
    - Still use f09 forecast to calculate bias
  - Diurnal variation of temperature? Any comments?

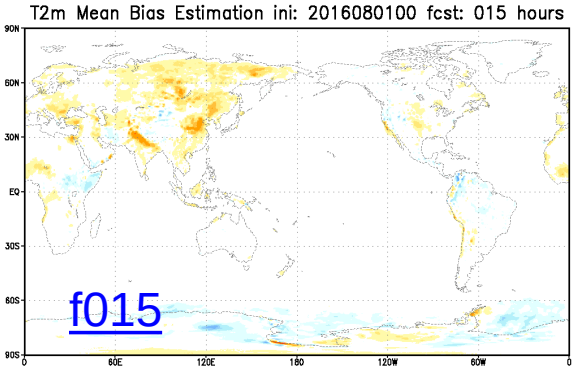
T2m Bias Estimation For different Lead Time against c00f03

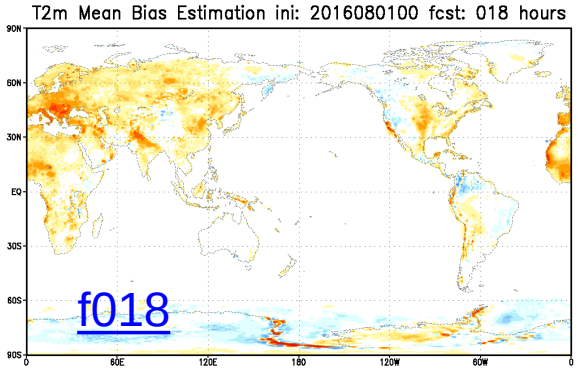


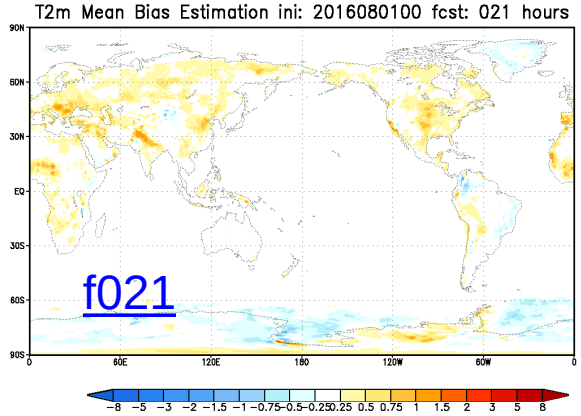


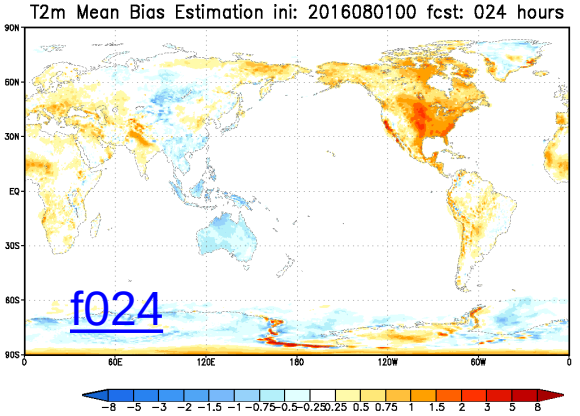


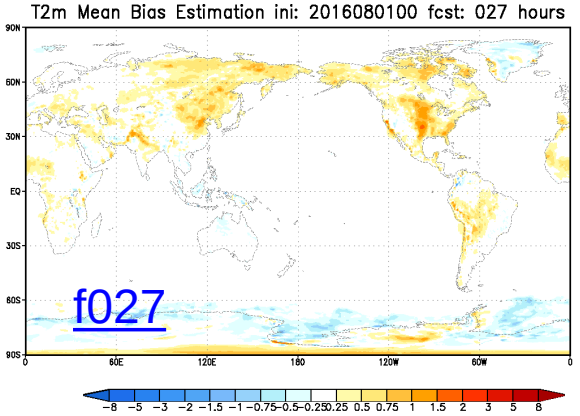




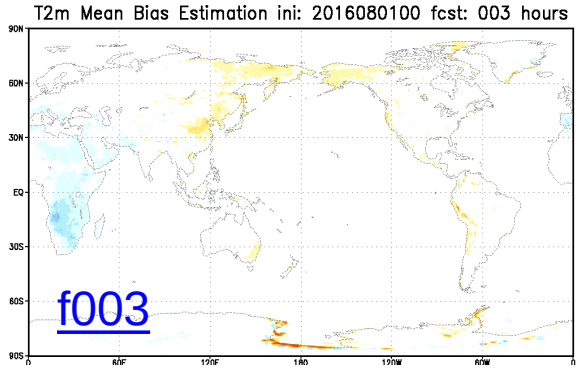


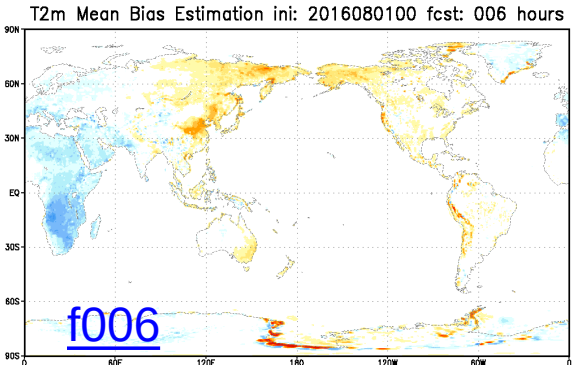


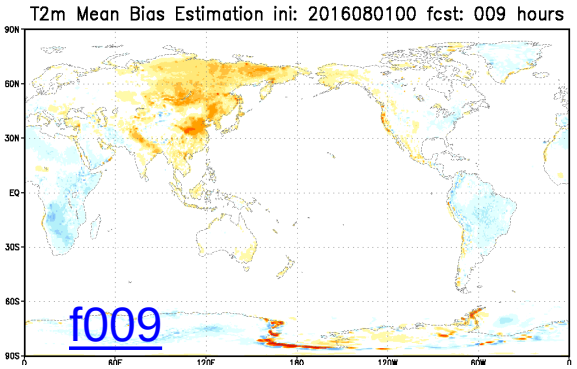


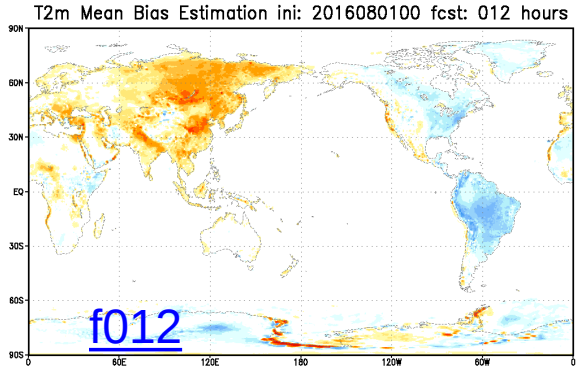


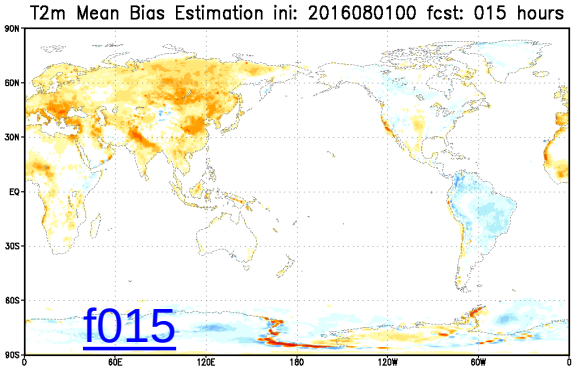
T2m Bias Estimation For different Lead Time (mean)

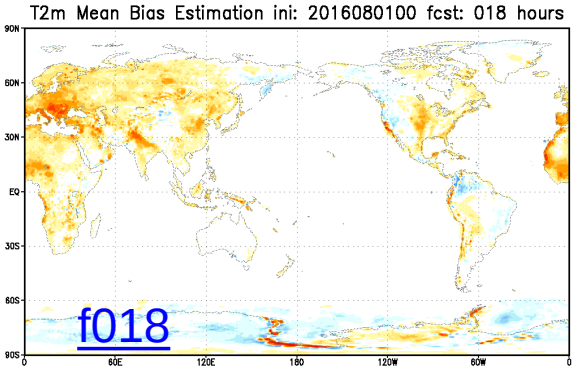


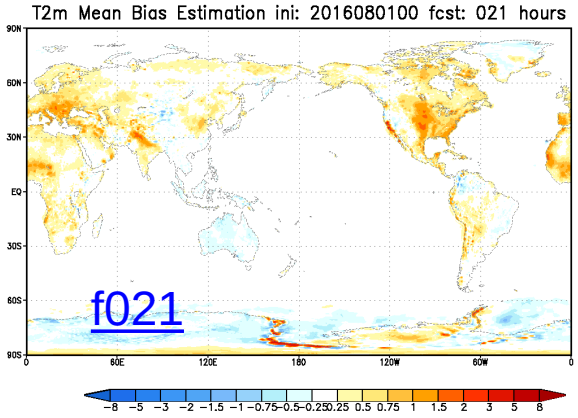


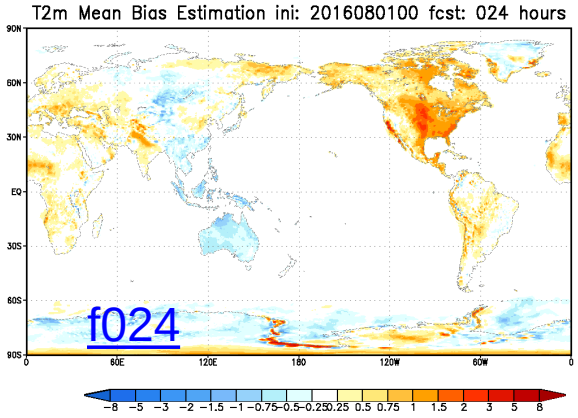


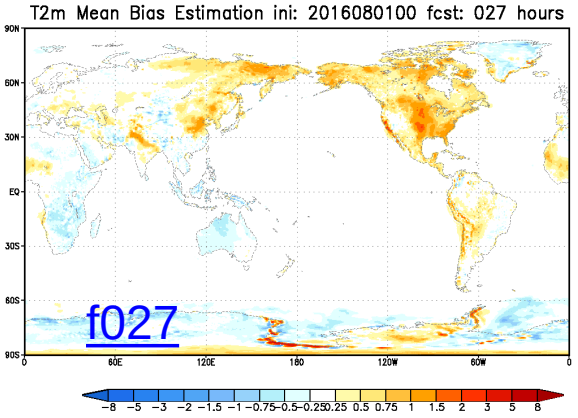




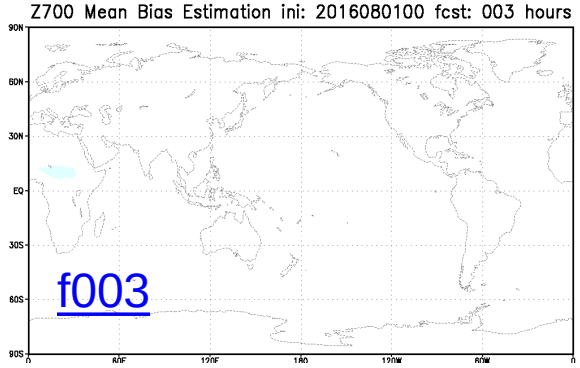


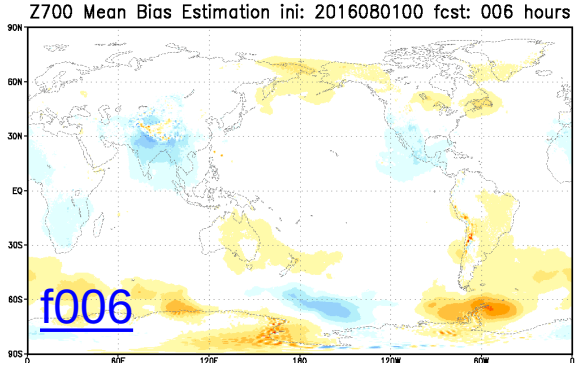


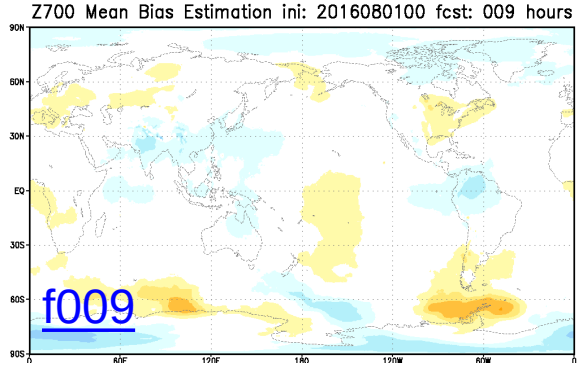


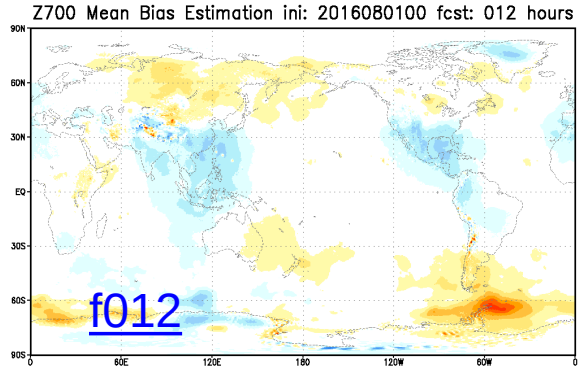


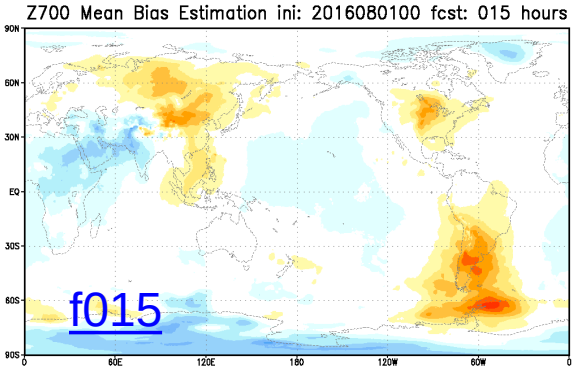
Z700 Bias Estimation For different Lead Time against c00f03

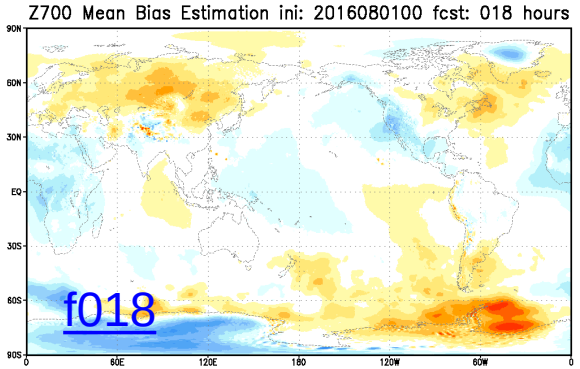


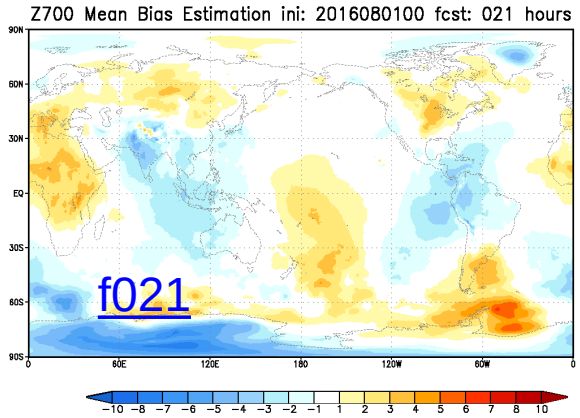


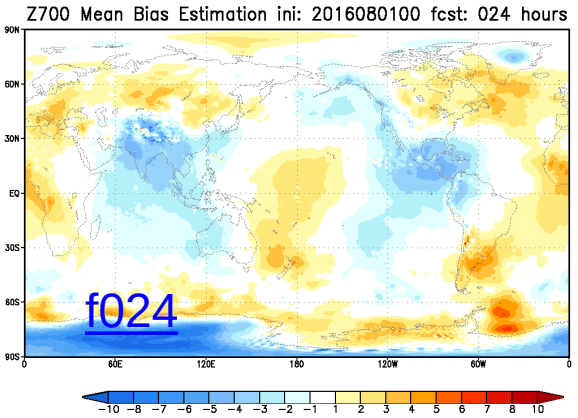


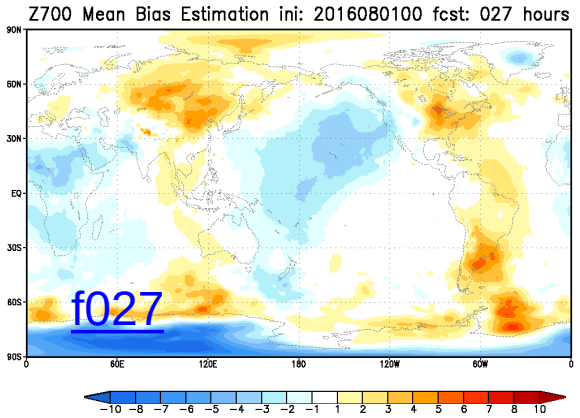












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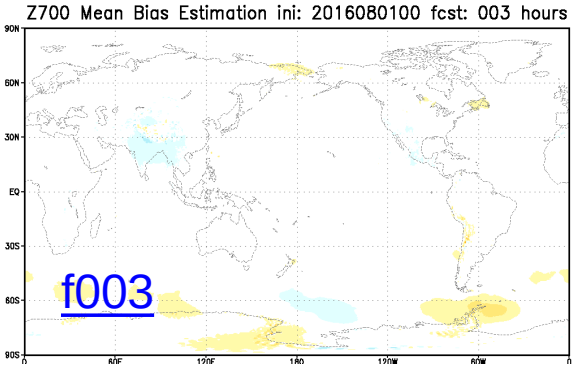
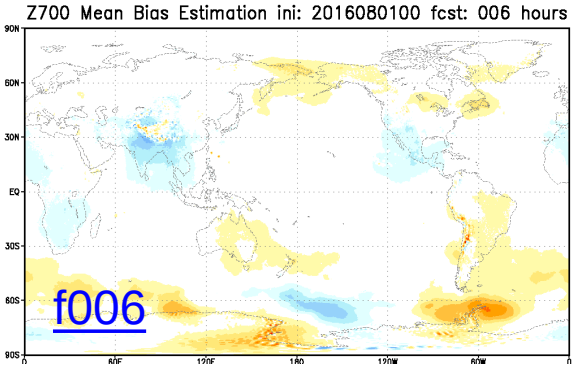
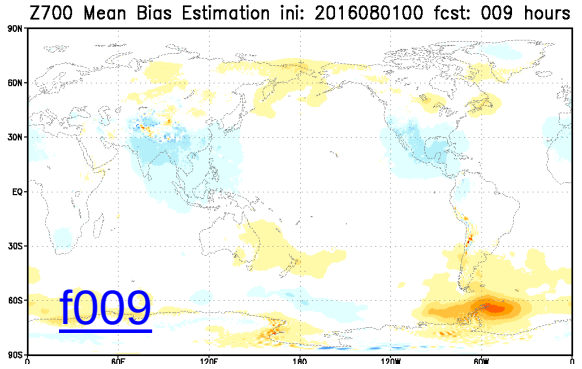
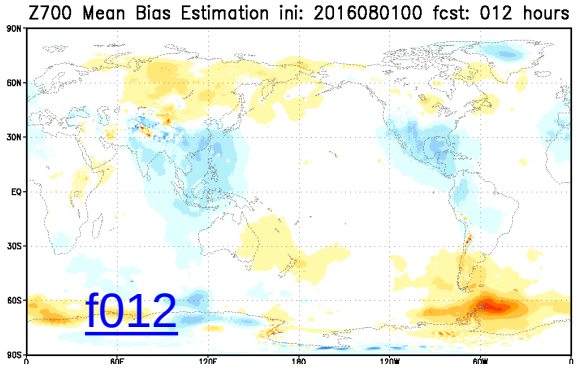
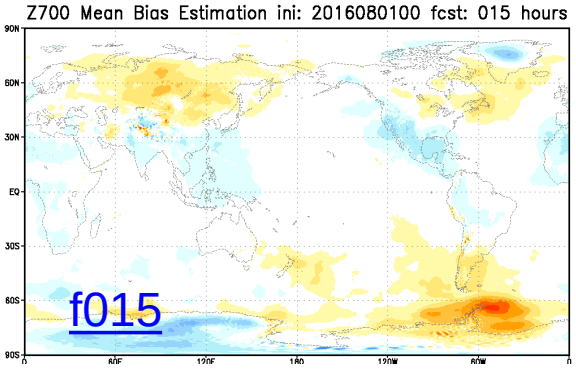
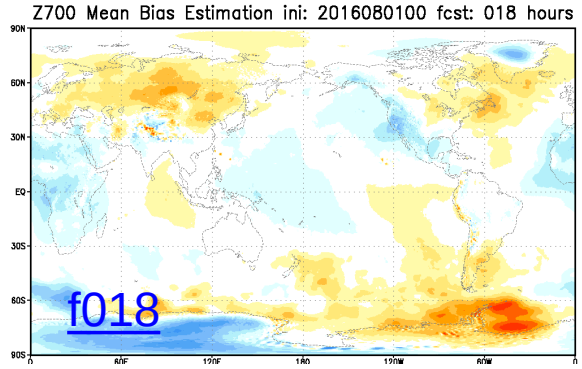


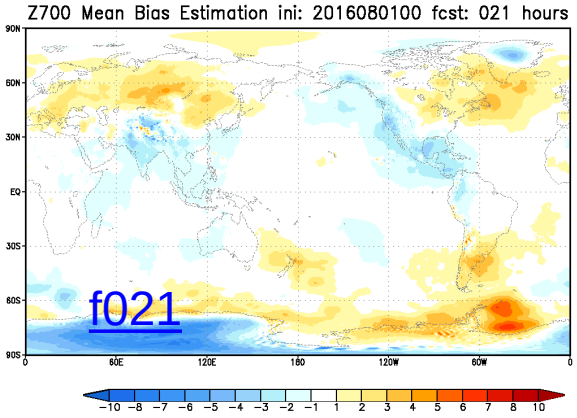


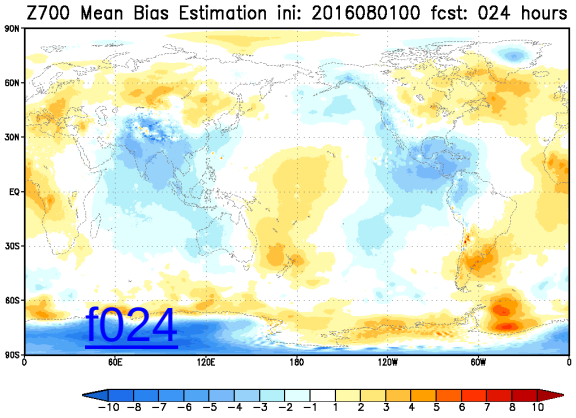


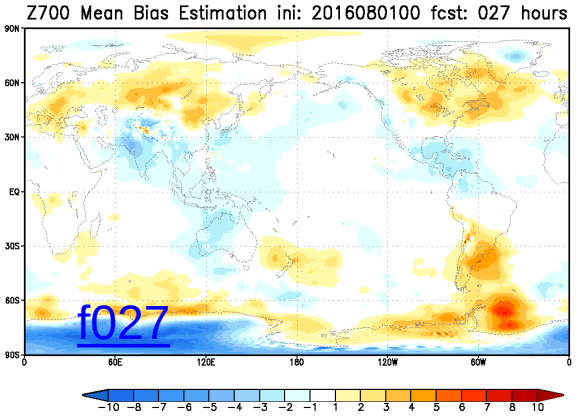




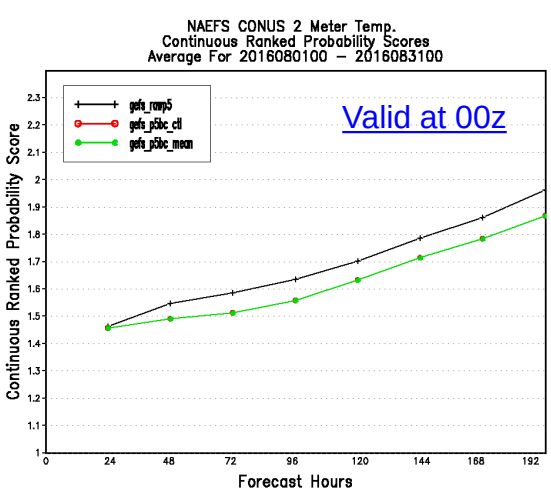


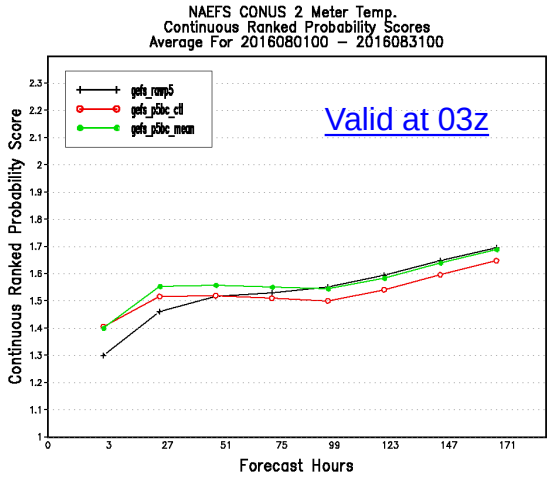


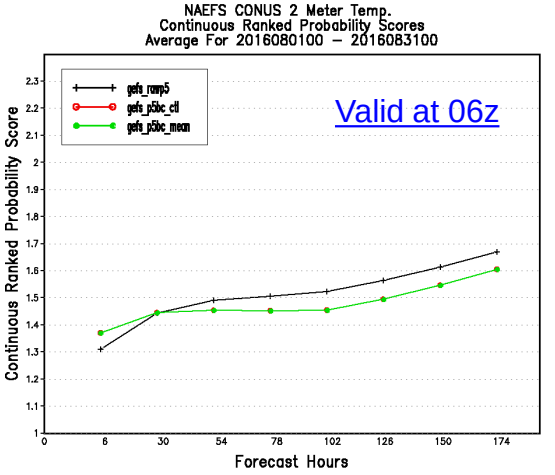


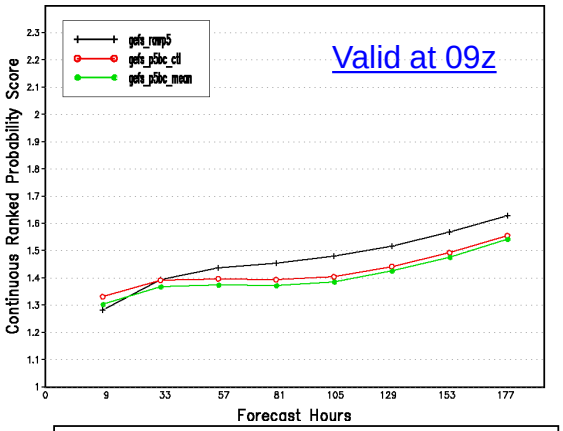


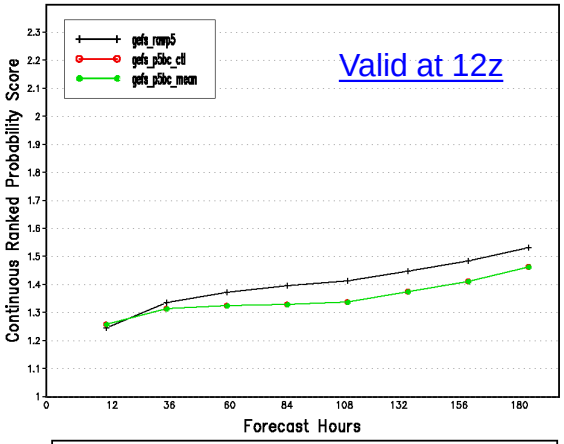
Comparison from 2 Bias Estimations (0.5d T2m CRPS)

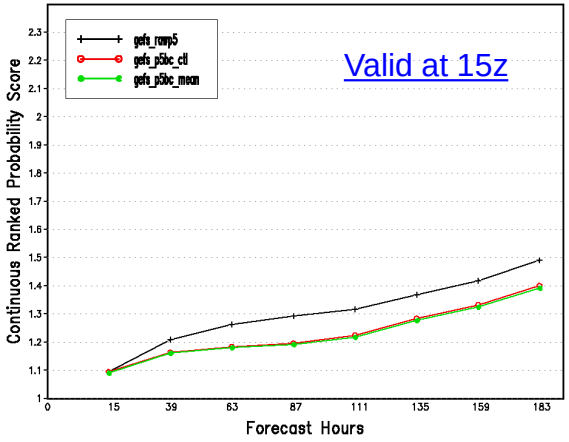


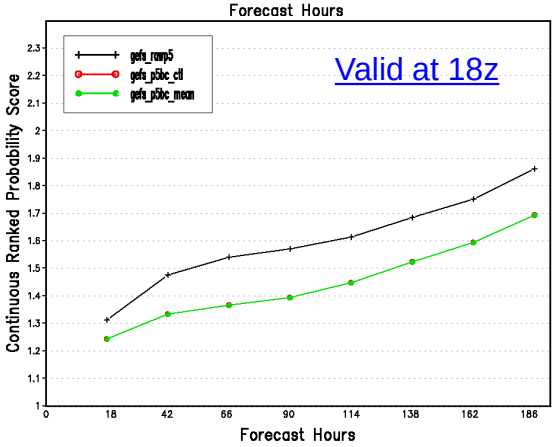


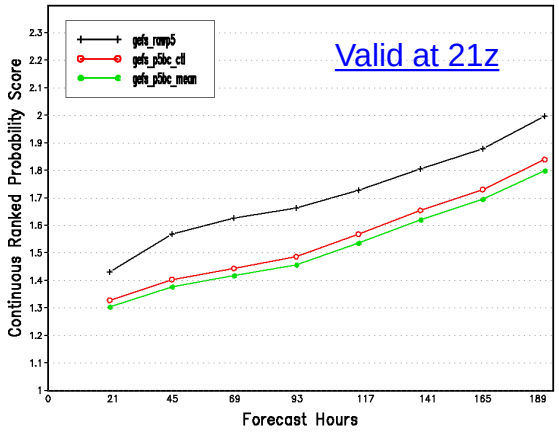












gefs_rawp5: 0.5d prod raw GEFS
gefs_p5bc_ctl: 0.5d bias corrected GEFS using ctl as true
gefs_p5bc_mean: 0.5d bias corrected GEFS using averaged bias

* 24 hour interval valid at different analysis time 00z, 03z, 06z, 12z, 15z, 18z and 21z

background

New Products From NAEFS v6 Upgrade

- NCEP/GEFS
  - 0.5d bias corrected forecasts (3 hourly for day 8, new pgrb2ap5_bc)
  - 0.5d anomaly forecast (new pgrb2ap5_an)
  - 0.5d bias corrected prcp (prcp_gb2)
  - 2.5km bias corrected and downscaled prcp for CONUS (new ndgd_prcp_gb2)
  - 0.5d RMOP, ANF and EFI(data and images?)
- CMC
  - 0.5d raw GEFS forecast (/dcom)
  - 0.5d bias corrected forecast (/dcom)
- NAEFS
  - 0.5d probabilistic forecasts (new pgrb2ap5_bc)
  - 0.5d anomaly forecast (new pgrb2ap5_an)

Summary

- Good impact after resolution change from 1d to 0.5d
  - All variables have been improved (more or less) after resolution increase
- Bias correction methods could apply to 0.5d GEFS ensemble
  - works very well on 0.5d ensemble
  - 2-meter temperature has high improvement through bias correction and resolution increase
- Continue work on 3hrly forecast bias correction method