GDAS/GFS V14.0.0 Schedule

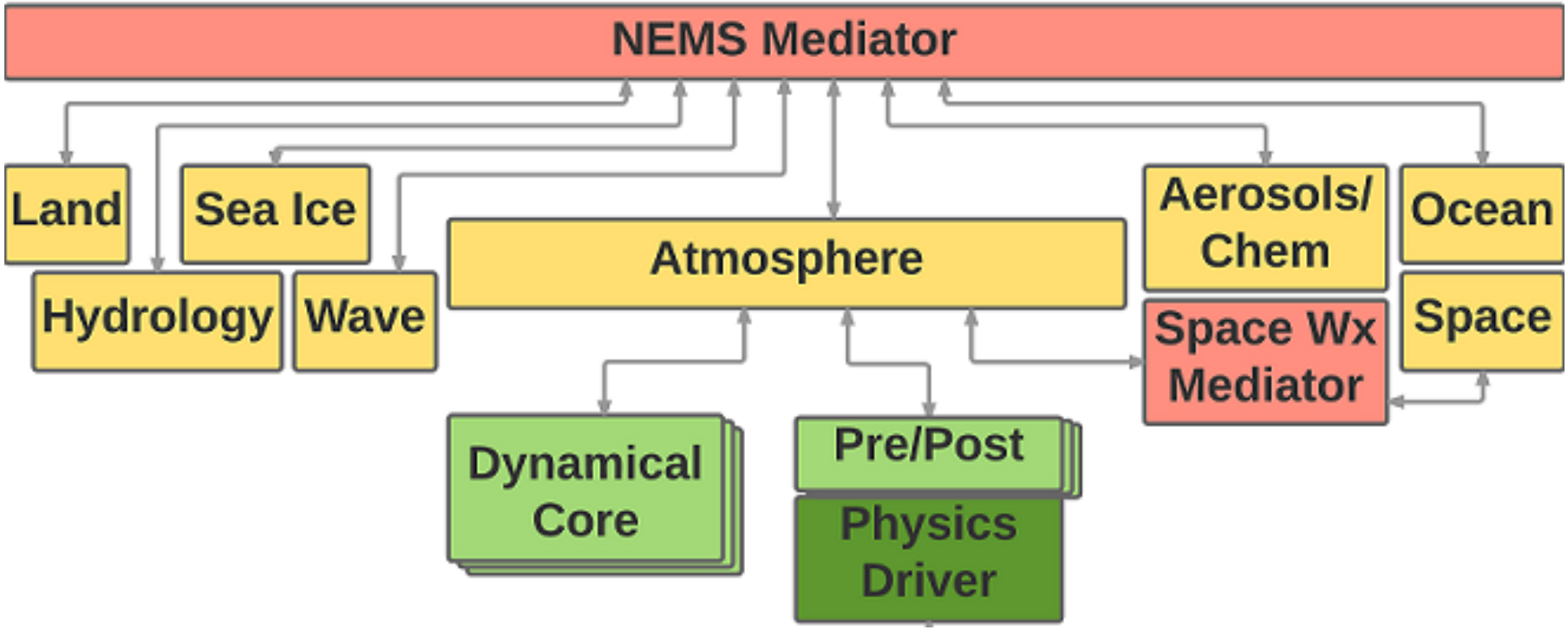
Milestone (NCEP)	Date	Status
Initial coordination with SPA team	8/1/16	Complete
Submit frozen codes to NCO to setup real-time and retrospective runs	10/28/2016 → 10/17/2016 . EMC real-time and retro using devonprod	Complete
Pre-CCB Briefing to EMC and OD	1/20/2017	
Completion of full retrospective runs	**1/31/2017**	
EMC testing complete/external evaluation complete	**1/31/2017**	
EMC CCB/NCEP OD approval	**2/1/2017**	
Final GFS and all downstream codes submitted to NCO	2/1/2017	
All non-GFS downstream codes submitted to NCO	2/1/2017	
Technical Information Notice Issued	2/15/2017	
SPA begins prep work for 30 day test	2/1/2017	
24-hr parallel production test	3/1/2017	
30-day evaluation begins	***3/30/2017***	
30-day evaluation Ends	***4/29/2017***	
IT testing ends	4/29/2017	
Final Management Briefing	5/5/2017	
Operational Implementation	***5/10/2017***	

NOAA Environmental Modeling System

- **shared, portable, high performance software superstructure and infrastructure**
- **common superstructure for all NCEP models.**
- **Modularize large pieces of the models**
- **Divide atmospheric models down into Dynamics and Physics components but no further.**
- **Take history file I/O outside the science parts**

  into a common Write component.
- **Keep science code and parallelization codes same as before.**

NEMS Component Schematic



Land Surface Changes for Q3FY17 NEMS GFS

- IGBP 20-type land classifications and STASGO 19-type soil classifications
- The new MODIS-based snow free albedo
- The new MODIS-based maximum snow albedo
- Diurnal albedo treatment
- Unify two snow fields between radiation driver and Noah LSM
    - Snow cover
    - Snow albedo
- Fix excessive cooling of T2m during sunset
- Increase ground heat flux under the deep snow

Improving the Stable Surface Layer in the GFS2017

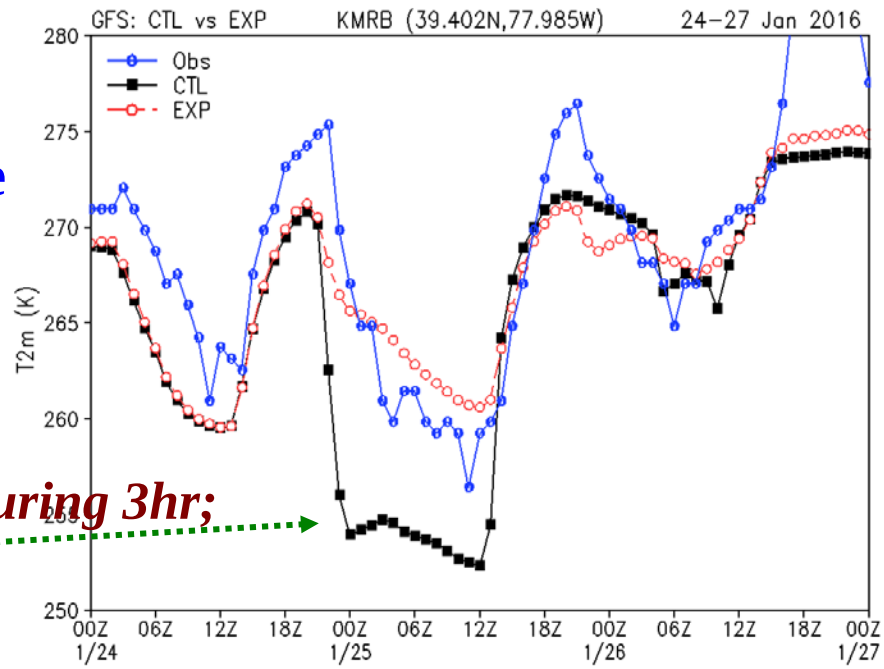
Introduction of a stability parameter constraint that prevents the land-atmosphere system from fully decoupling:

$$z/L < z/L|_M = \ln(z/z_0)/[2*\alpha*(1-z_0/z)]$$

Here z is the height, L is the Obukhov length, $z0$ is the momentum roughness length, and α=5.

GFS Test: 00Z, 2016-01-24 Cycle

T2m @ MRB Martinsburg RGNL, WV



CTL: Rapidly cooling more than 15 °C during 3hr;
EXP: Substantially improved

Update in GFS cumulus convection schemes with scale and aerosol awareness

- **Scale-aware, aerosol-aware parameterization**
- **Rain conversion rate decreases with decreasing air temperature above freezing level.**
- **Convective adjustment time in deep convection scheme proportional to convective turn-over time with convective available potential energy (CAPE) approaching zero after adjustment time.**
- **Cloud base mass flux in shallow convection scheme function of mean updraft velocity.**
- **Convective inhibition (CIN) in the sub-cloud layer additional trigger condition to suppress unrealistically spotty rainfall especially over high terrains during summer**
- **Convective cloudiness enhanced by suspended cloud condensate in updraft.**
- **Significant improvement especially CONUS precip in summer.**

The NSST in the NCEP GFS

- **Near-Surface Sea Temperature describes oceanic vertical temperature structure near surface due to the diurnal warming and sub-layer cooling physics processes**
- **SST, satellite data assimilation, and weather forecasting improved by analyzing SST together with atmospheric analysis variables with advanced GSI data assimilation techniques and resolving SST diurnal variability in the prediction**
- **Impact on weather forecasting is positive in tropics, neutral in northern and southern hemisphere**

Fig.1 (O-B) Histogram for one IASI window channel, 10-day statistics. Improved by NSST in bias, rms and number of used data

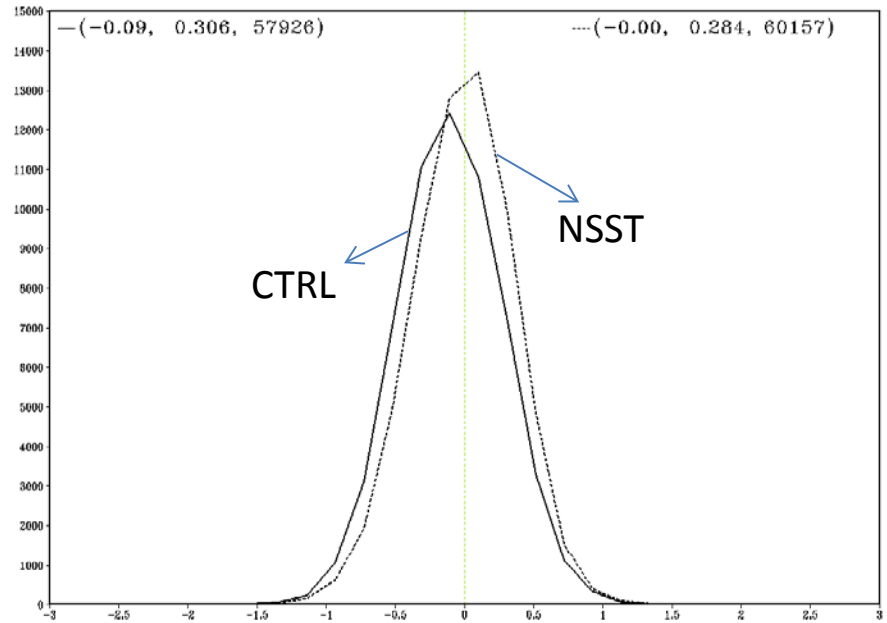
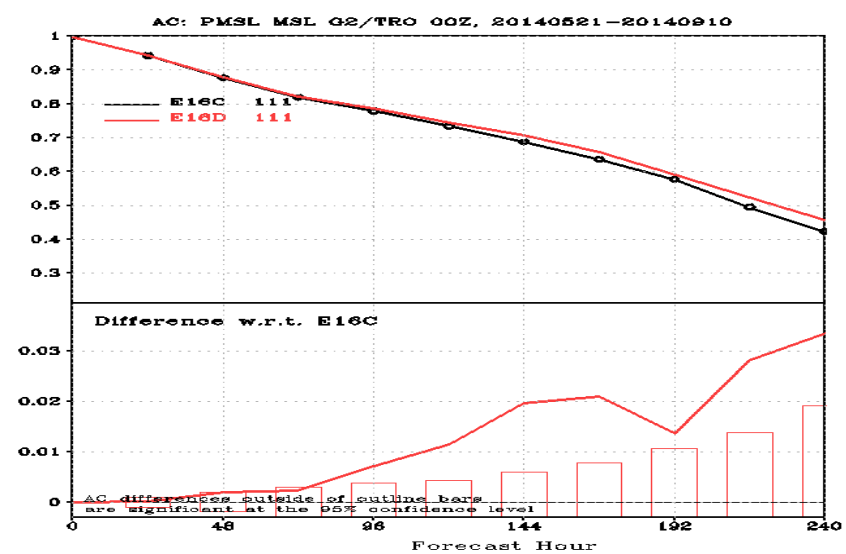


Fig.2 Mean sea level pressure forecasting in tropics improved by NSST. Based on 111 predictions



Data Assimilation/GSI
1) Near Sea-Surface Temperature Analysis.
2) Readiness for CrIS Full Resolution Data and add/extend RARS and DBNet capability.
3) Fix to cloud water increment bugs.
4) Changes to land surface type specification for CRTM.
5) Inclusion of Megatropiques SAPHIR radiance assimilation.
6) Inclusion of GPM/GMI radiance assimilation.
7) Turn on VIIRS AMVs.
8) Log-Normal wind QC for AMVs.
9) Use GOES clear-air water vapour winds.
10) Inclusion of extra GNSS-RO observations.

GCWMB real time (prnemsrn)

period: real time
status: real time
machine: Luna (currently Luna)
monitoring/verification: http://www.emc.ncep.noaa.gov/gmb/wd20rt/vsdb/prnemsrn/

GCWMB 2015 Summer retrospective (pr4rn_1505)

period: 2015050100 ~ 2016010200 (246 days)
status: 2015052418
machine: Surge (currently prod Cray)

GCWMB 2015 Winter retrospective (pr4rn_1512)

period: 2015121500 ~ 2016051518 (151 days)
status: 2015122412
machine: Luna (currently dev Cray)

GCWMB 2016 Summer retrospective (pr4rn_1605)

period: 2016050100 ~ 2016103018 (184 days)
status: 2016050118
machine: Surge (currently prod Cray)

Will consider running summer 2014 if needed

Post-processing

--1/8° files to 36 hours on ftp for downstream modelers for ICs, BCs

SPC interested for fire weather hourly for v3.0 National Blend of Models

--do away with 2.5° files

--vertical velocity calculated differently

Evaluation

--involve field as in last GFS implementation

--NCEP centers, NWS regions evaluations

--STI MEG global group

--web page, VLAB forum (?)

--verification against analyses, observations

--precip, 2m T, T_d, 10m winds over CONUS, Alaska

--hurricane tracks, tropical storm cyclogenesis

--EMC case studies proposed by field, MEG cases

--real time data on ftp, MAG

--real time maps-western region?, Fanglin Yang, MAG

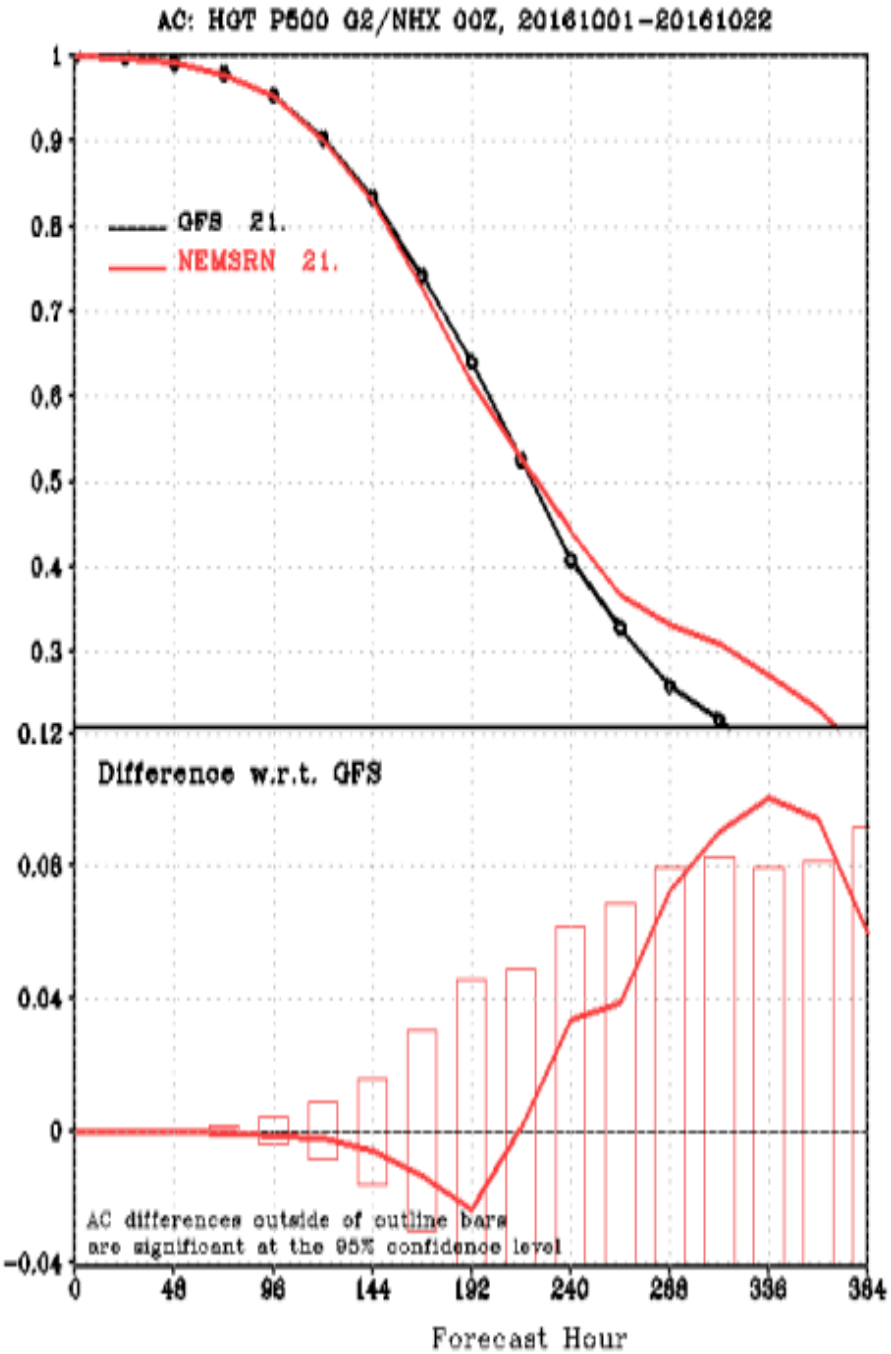
--retrospectives—WCOSS –NCEP Centers

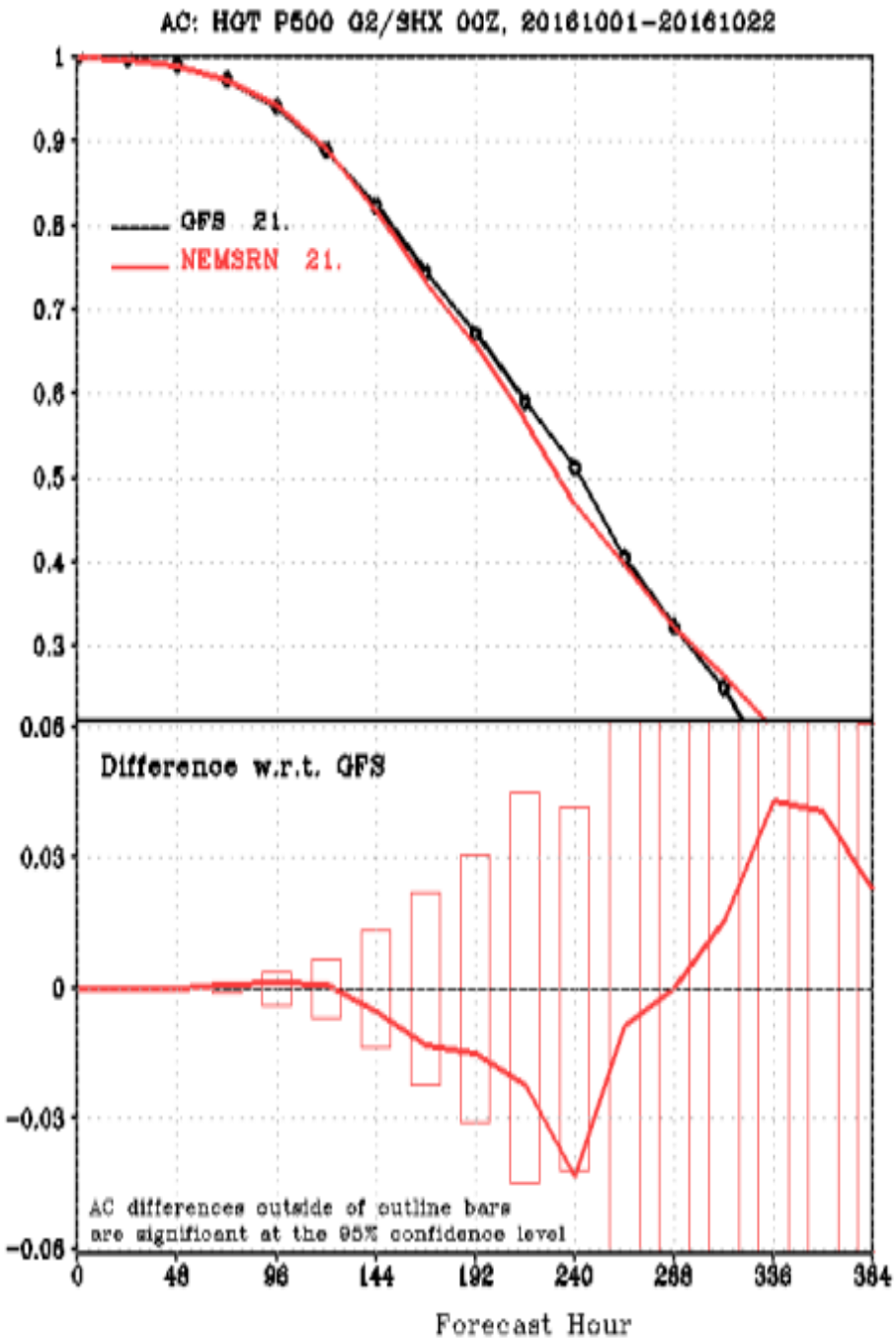
--retrospectives—NWS regions—case studies

Expect

--little change to large-scale statistics
--better precipitation, especially summer
--improved near surface fields
--less patchiness in near surface fields

Backup slides


AC: HGT P500 G2/NHX 00Z, 20161001-20161022
GFS 21.
NEMSRN 21.
Difference w.r.t. GFS
AC differences outside of outline bars
are significant at the 95% confidence level
Forecast Hour


AC: HGT P500 G2/SHX 00Z, 20161001-20161022
GFS 21.
NEMSRN 21.
Difference w.r.t. GFS
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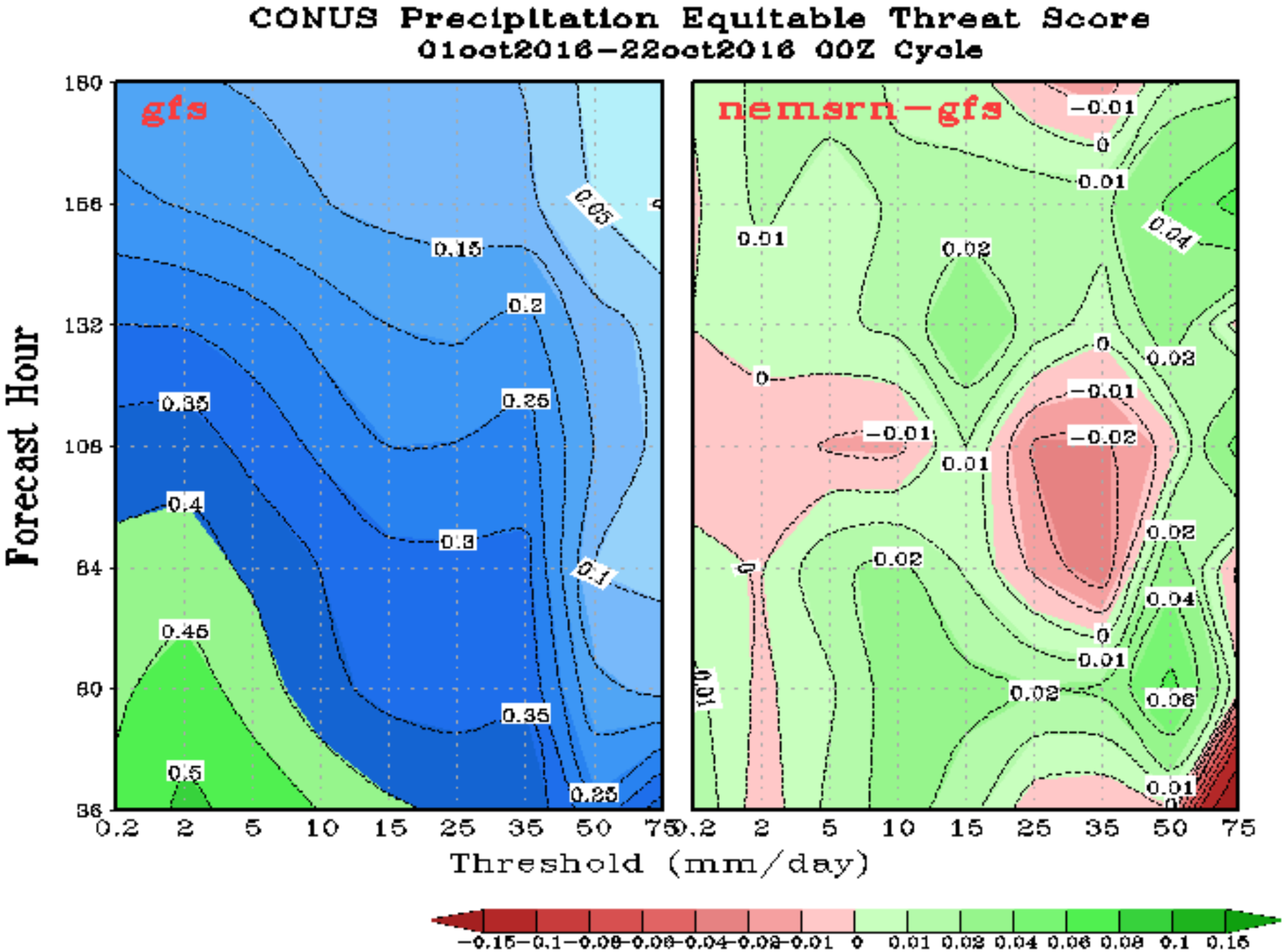
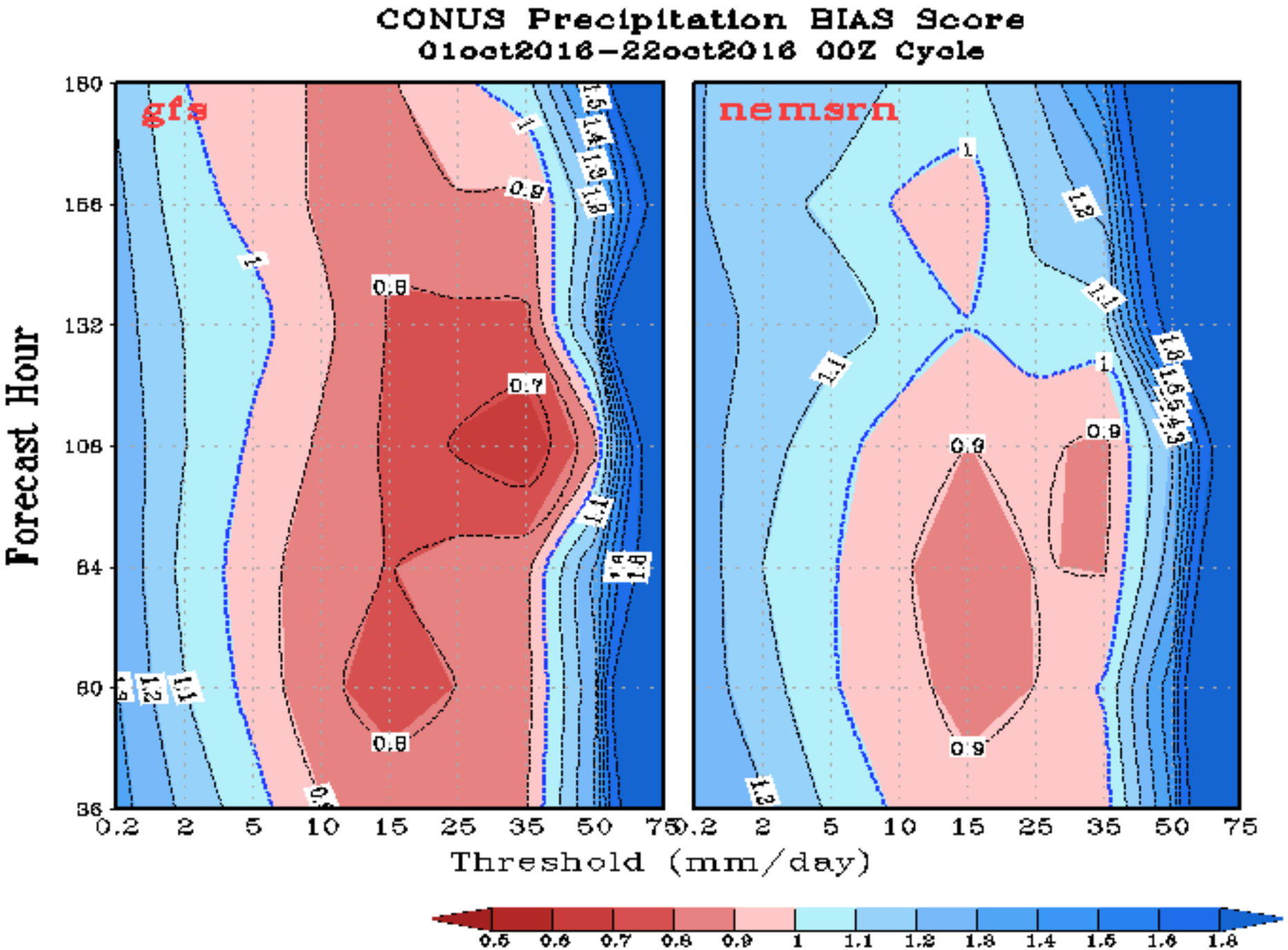
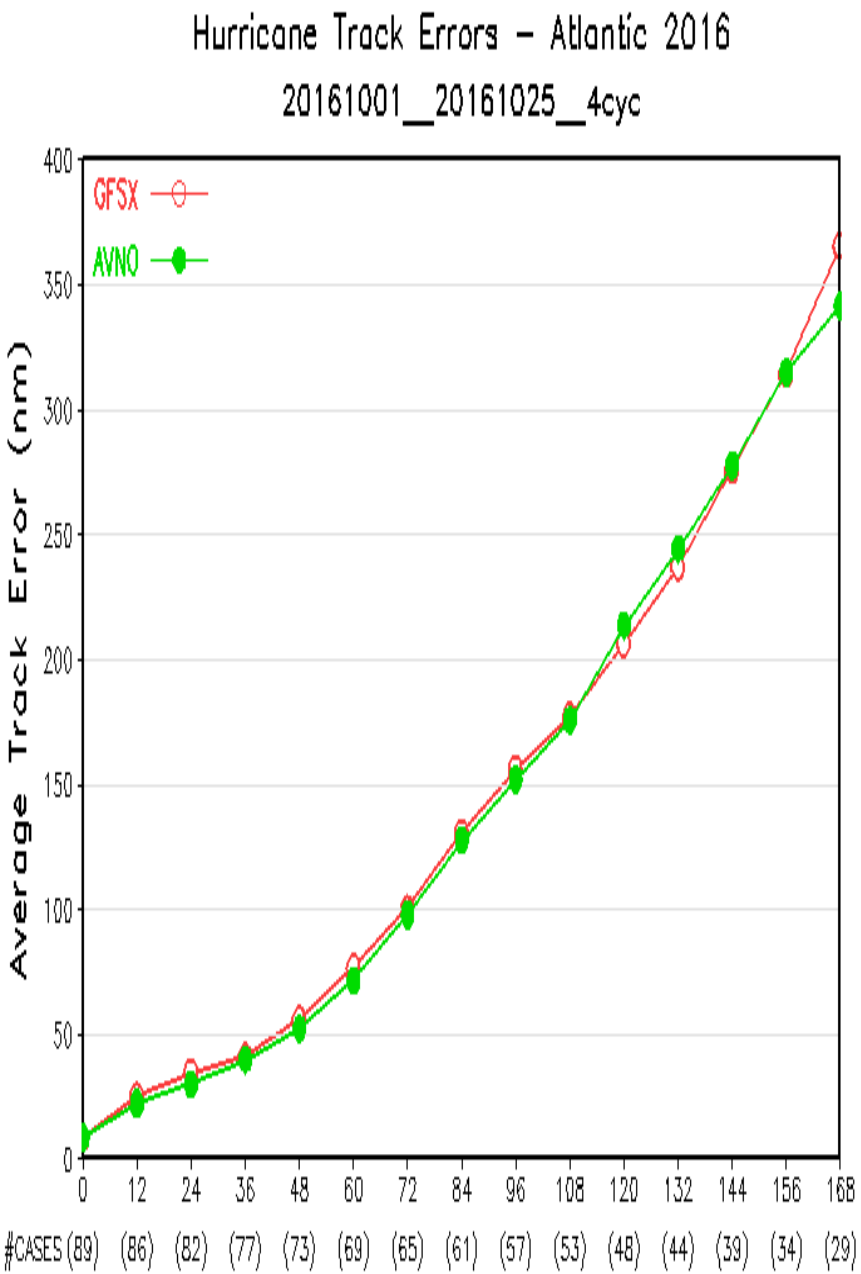
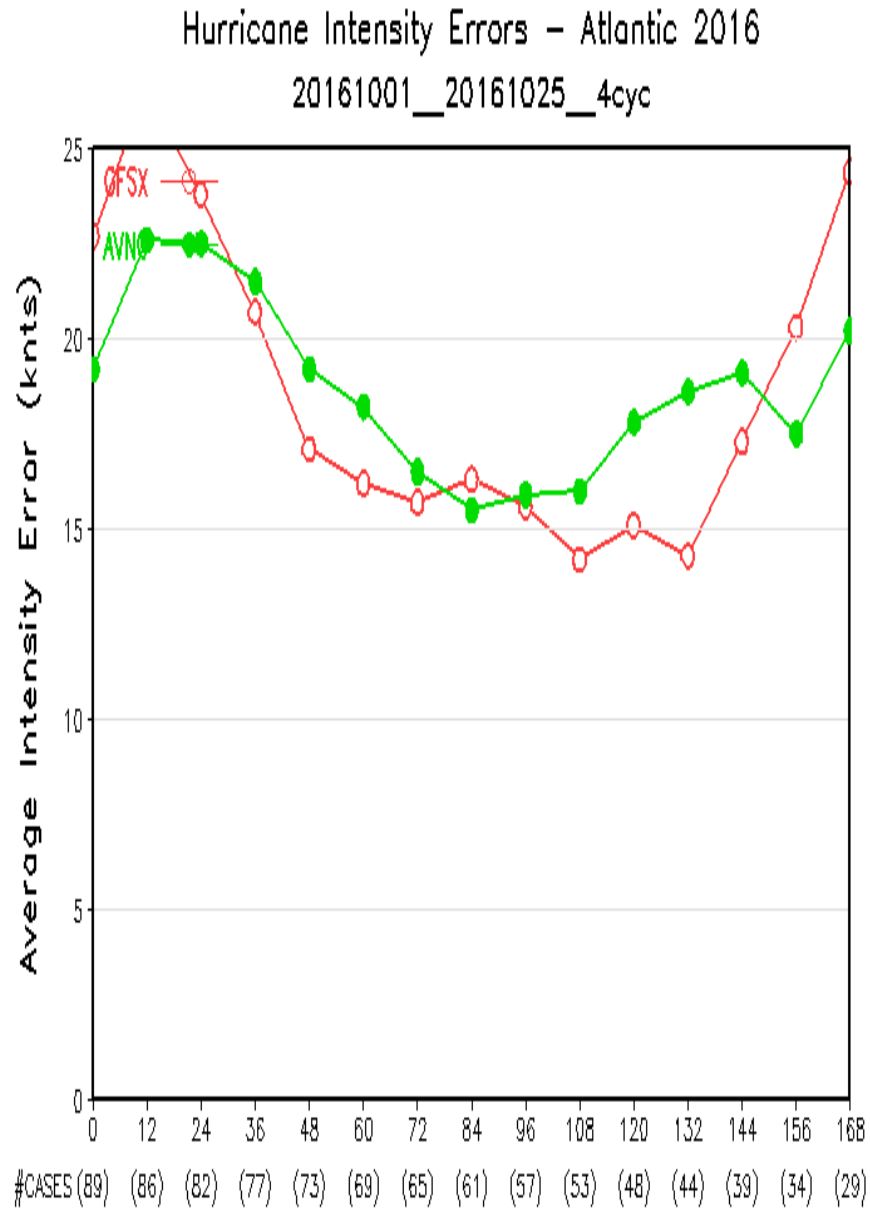
Forecast Hour


CONUS Precipitation Equitable Threat Score
01oct2016-22oct2016 00Z Cycle
gfs
nemsrn-gfs
Forecast Hour
Threshold (mm/day)
0.2 2 5 10 15 25 35 50 75
36 60 84 108 132 156 180
-0.15 -0.1 -0.08 -0.06 -0.04 -0.02 -0.01 0 0.01 0.02 0.04 0.06 0.08 0.1 0.15


CONUS Precipitation BIAS Score
01oct2016-22oct2016 00Z Cycle
gfs
nemsrn
Forecast Hour
Threshold (mm/day)
0.2
2
5
10
15
25
35
50
75
36
60
84
108
132
156
180
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.8



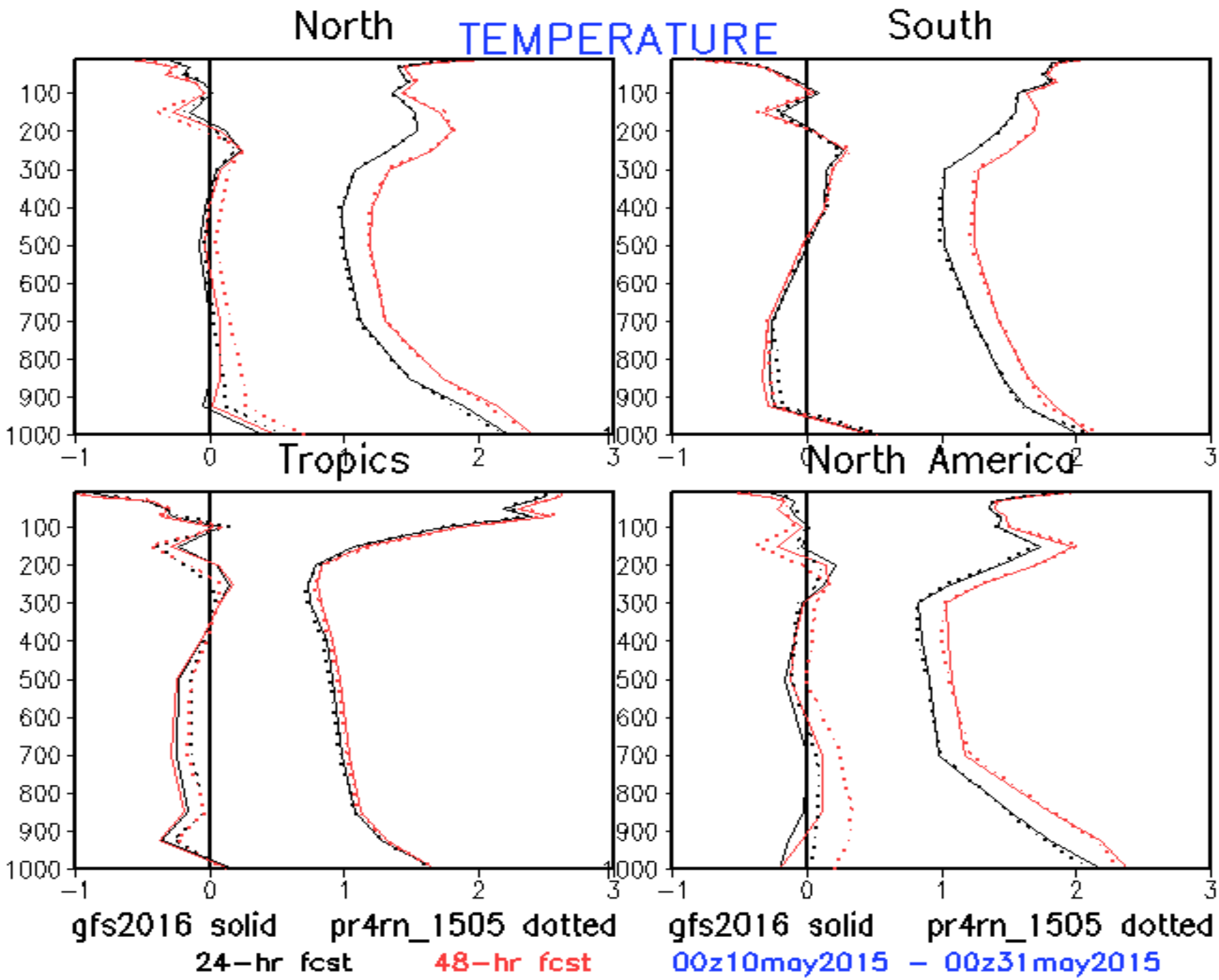


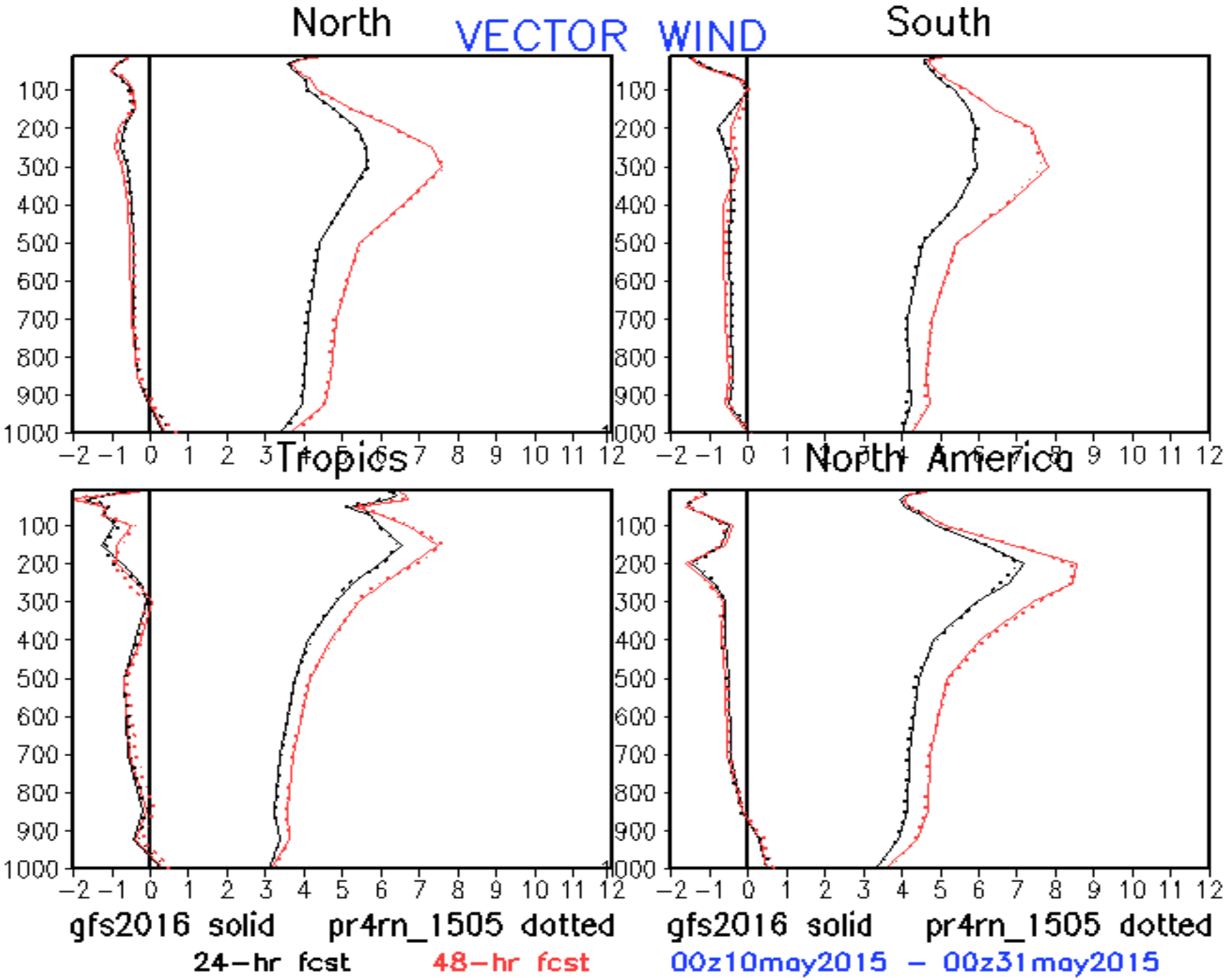
Confidence Level (%) of Student-t Tests

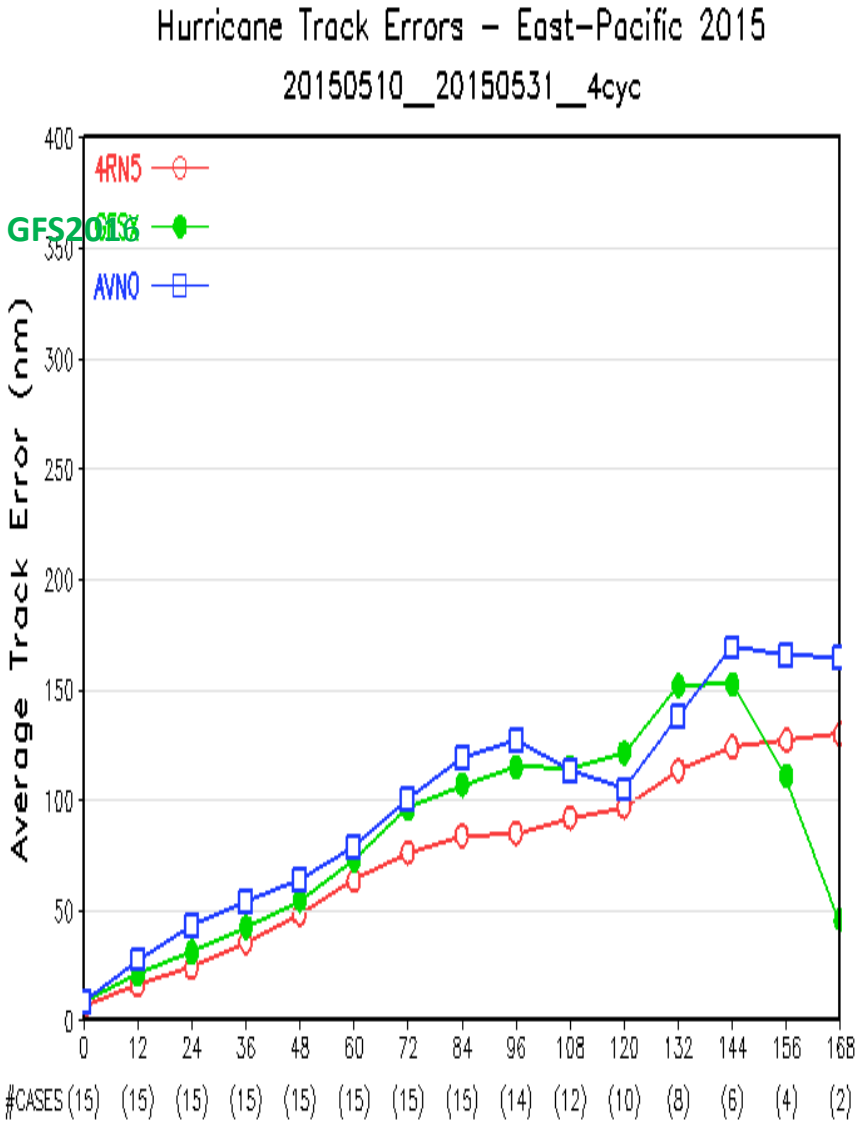
GFSX_AVNO	57	96	98	70	88	87	65	64	64	54	86	81	52	50	66

Confidence Level (%) of Student-t Tests

GFSX_AVNO	99	99	88	84	99	98	79	77	60	93	95	98	82	88	92

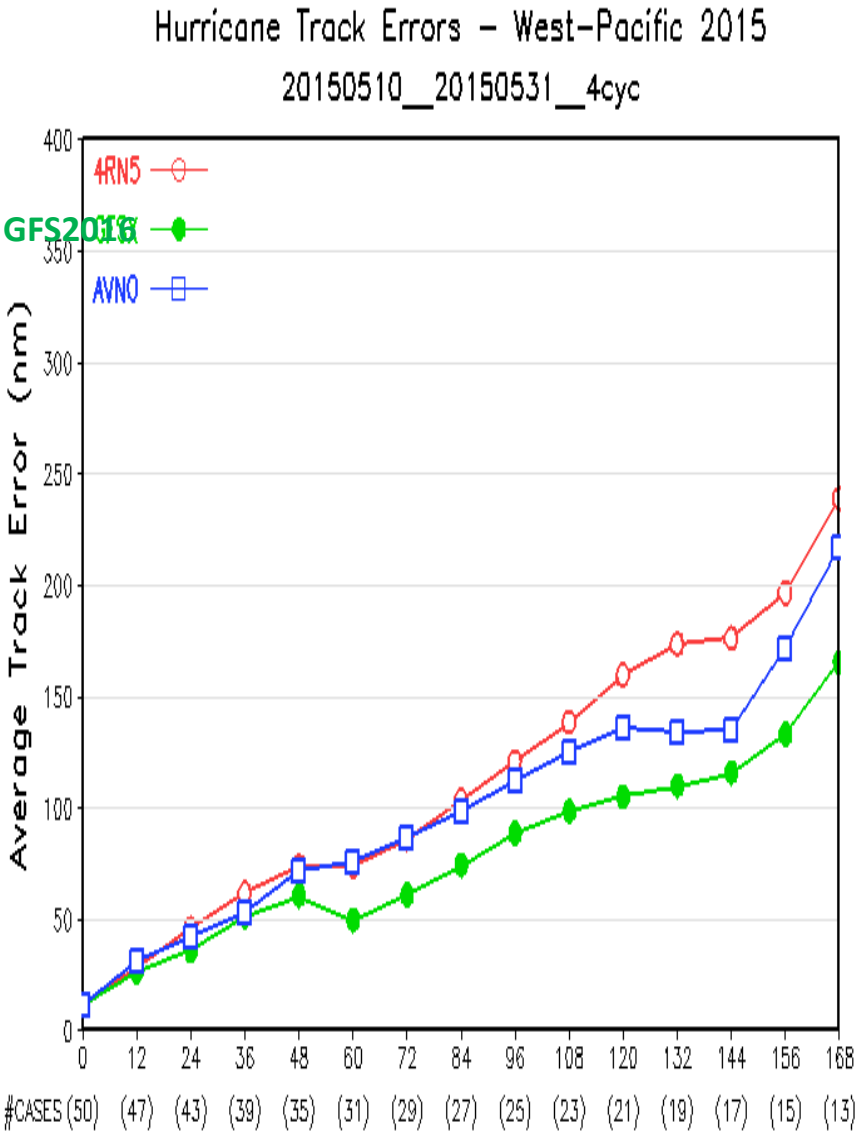

TEMPERATURE
North
South
Tropics
North America
100
200
300
400
500
600
700
800
900
1000
−1
0
1
2
3
gfs2016 solid
pr4rn_1505 dotted
24−hr fcst
48−hr fcst
00z10may2015 − 00z31may2015


VECTOR WIND
North
South
Tropics
North America
100
200
300
400
500
600
700
800
900
1000
−2 −1 0 1 2 3 4 5 6 7 8 9 10 11 12
gfs2016 solid
pr4rn_1505 dotted
24−hr fcst
48−hr fcst
00z10may2015 − 00z31may2015



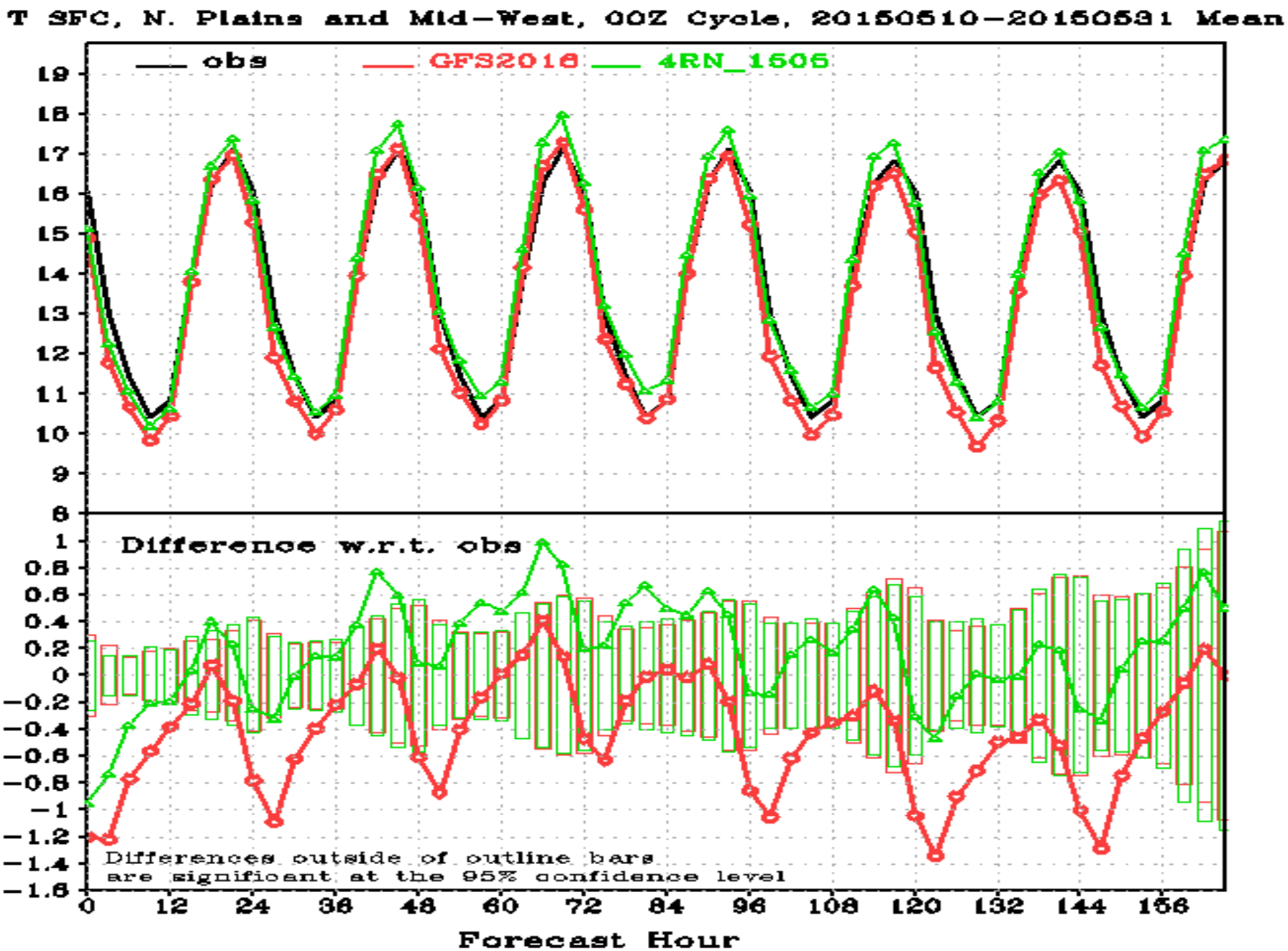
Confidence Level (%) of Student-t Tests

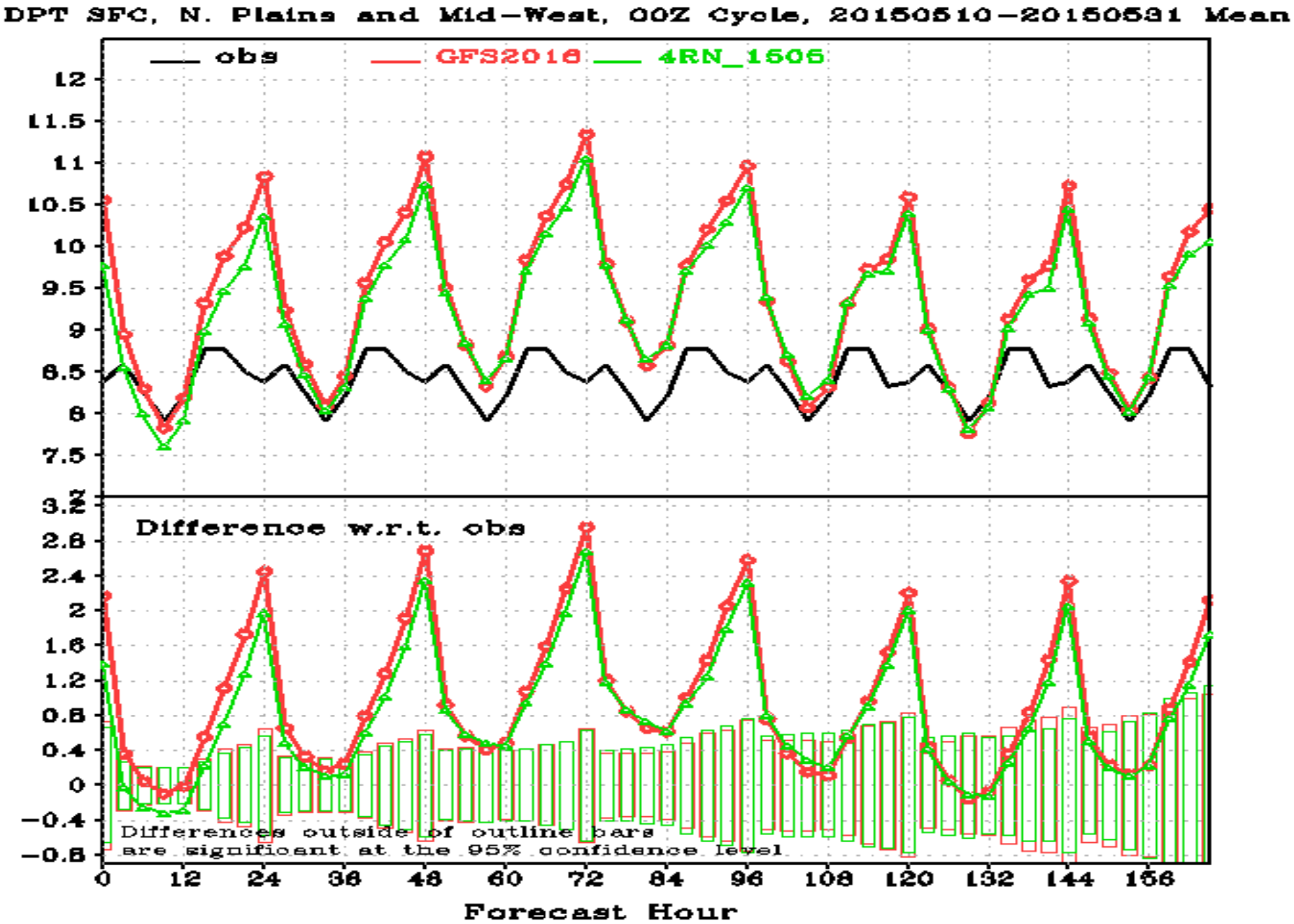
4RN5_GFSX	92	95	92	99	91	89	98	98	99	93	90	89	69	58	99
4RN5_AVNO	88	99	99	99	99	99	99	99	99	99	73	82	81	70	72
GFSX_AVNO	53	97	99	99	98	90	76	89	86	52	93	83	77	90	92



Confidence Level (%) of Student-t Tests

4RN5_GFSX	57	75	99	99	99	100	99	99	99	99	99	99	99	99	99
4RN5_AVNO	60	89	90	97	64	63	51	68	77	83	91	98	98	87	78
GFSX_AVNO	56	97	97	88	98	99	99	99	99	99	99	96	95	99	99


T SFC, N. Plains and Mid-West, 00Z Cycle, 20150510-20150531 Mean
obs
GFS2016
4RN_1506
Difference w.r.t. obs
Differences outside of outline bars
are significant at the 95% confidence level
Forecast Hour


DPT SFC, N. Plains and Mid-West, 00Z Cycle, 20150510-20150531 Mean
obs
GFS2016
4RN_1506
Difference w.r.t. obs
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Forecast Hour