GSI Testing and Evaluation

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THE DEVELOPMENTAL TESTBED CENTER (DTC)

Objectives

- Perform GSI + WRF-ARW configuration runs
  - Determine the capability and robustness of the GSI + ARW in regional applications
  - Evaluate impact from a variety of existing and proposed new operational data types

- Provide rational basis for operational centers and the research community for advancements of NWP systems

Extended Tests (FY2009)

- GSI v1.0 coupled with WRF-ARW v3.1

- 15 August 2007 (12 Z) – 15 September 2007 (12 Z)

- 15 km, 57 vertical levels, 10 mb model top

- AFWA T8 domain *(Figure)*

- Verification using Model
 Evaluation Tools (MET) v2.0

AFWA T8 Domain
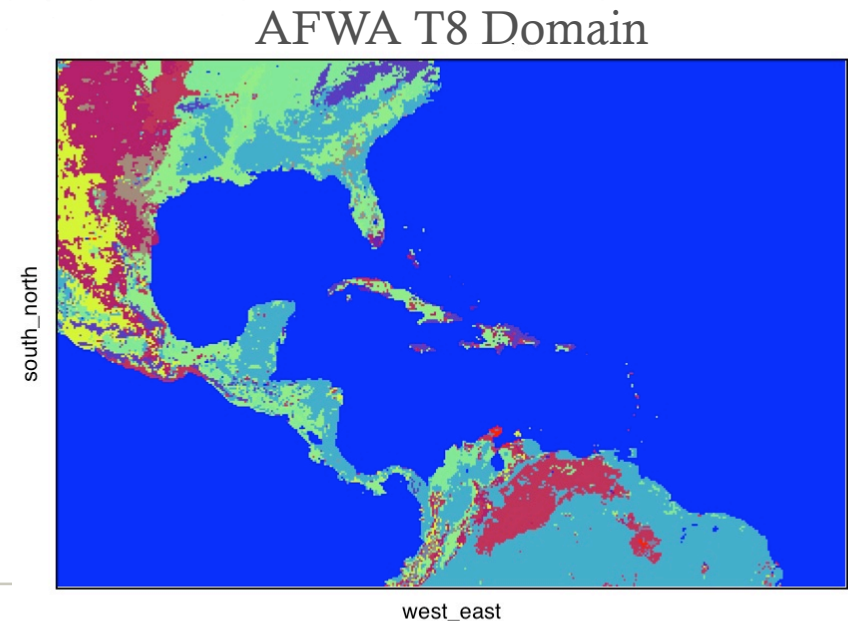
Experimental Design

- FY2009 AFWA GSI Testbed Experiments
  - GFSWRF: ARW runs started from GFS analysis every 6 hours
  - CYC_CONV: GSI (v1.0) + ARW runs in full cycling mode. PREPBUFR data were assimilated
  - CYC_CONV+RAD: CYC_CONV+AMSU-A radiance data were assimilated
  - CYC_CONV+RAD+GPS: CYC_CONV+RAD + GPS RO refractivity were assimilated
  - LCYC_CONV+RAD+GPS: same as CYC_CONV+RAD +GPS except run in limited cycling mode

- Global Background Errors computed from GFS were used for all extended runs
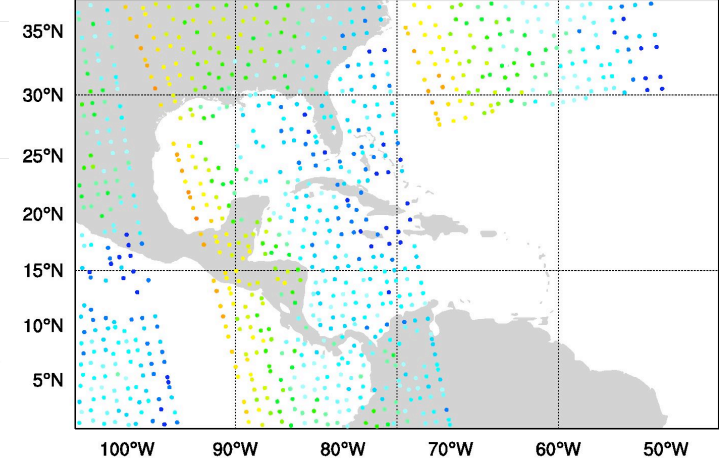
AMSU-A Radiance Bias Correction
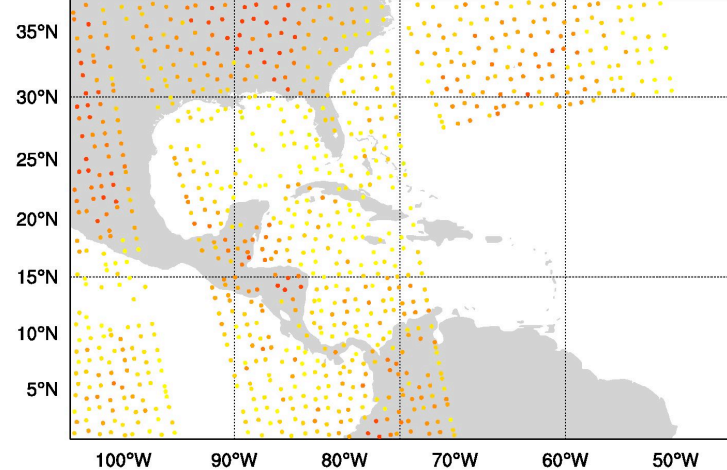
amsua_n15_ch0006   2007081512 -- 2007091512
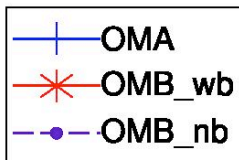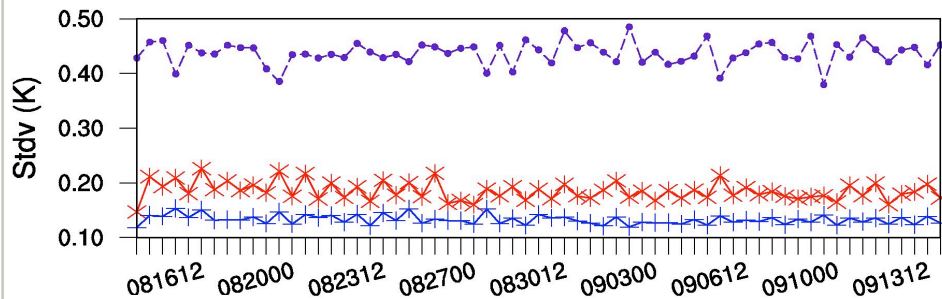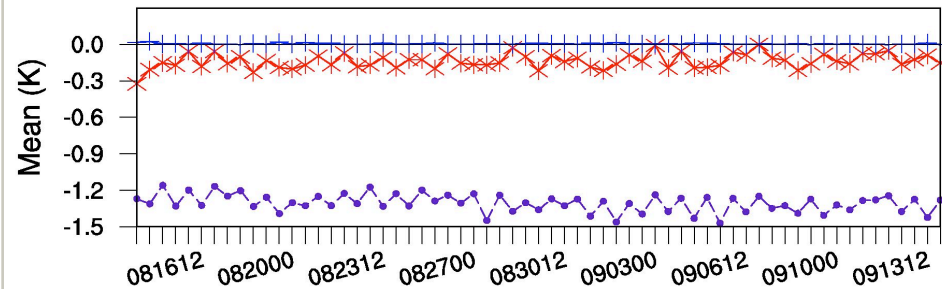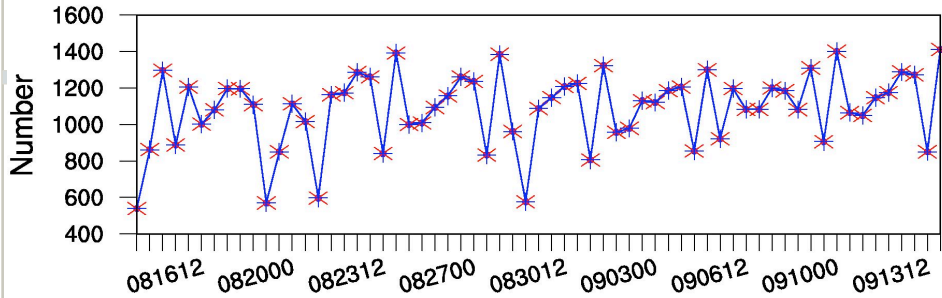
Before Bias Correction
mean: -1.31   stdv: 0.46   2007081600
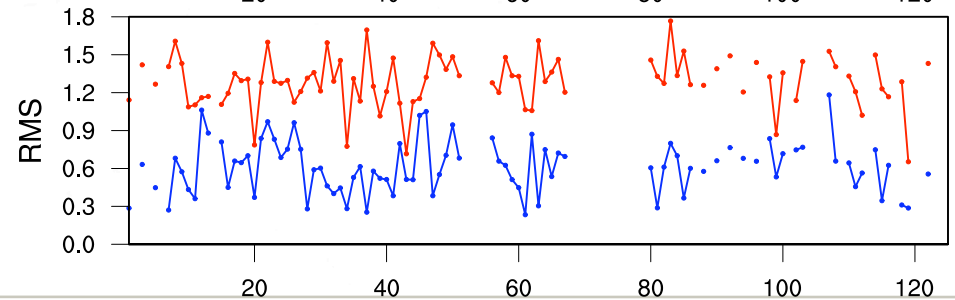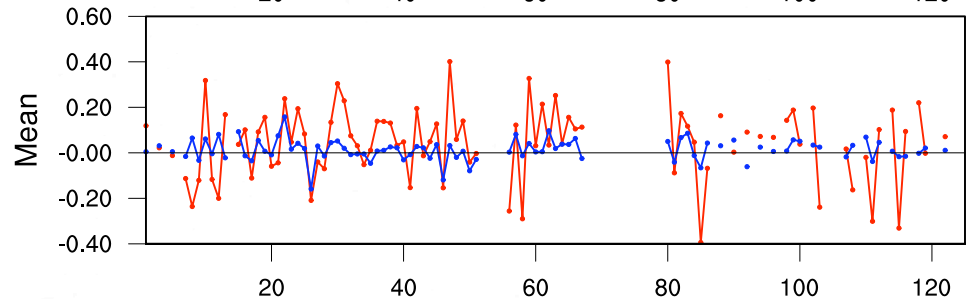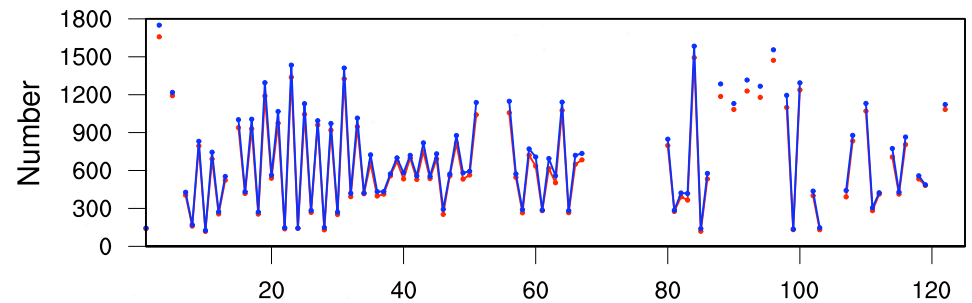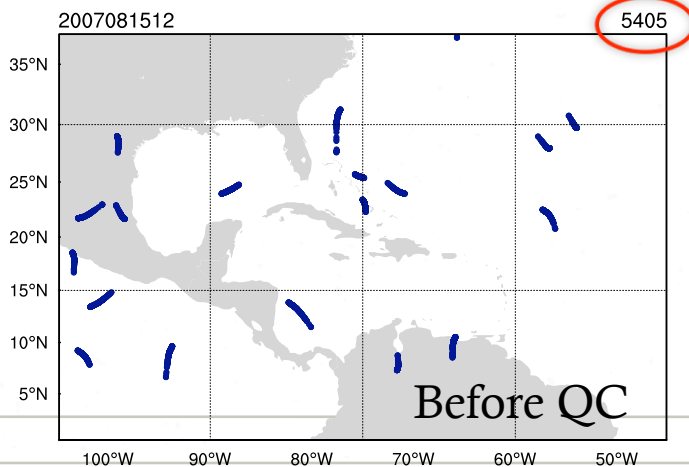
After Bias Correction
mean: -0.21   stdv: 0.21   2007081600

Legend:
- OMA
- OMB_wb
- OMB_nb

DATE

-2.00 -1.77 -1.55 -1.32 -1.09 -0.86 -0.64 -0.41 -0.18 0.05 0.27
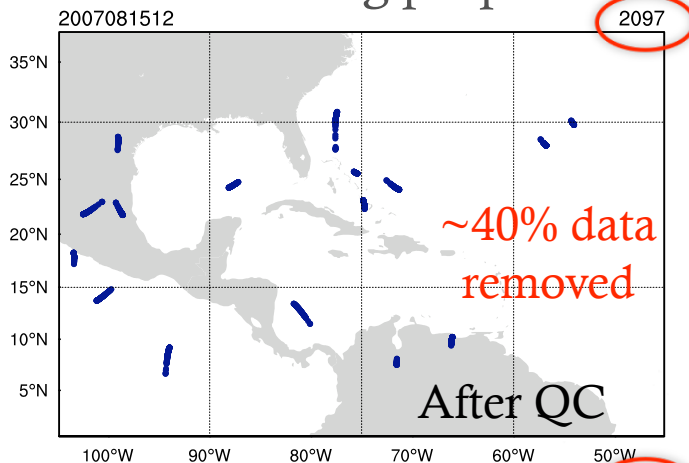
GPS RO Refractivity DA

- GSI v1.0 QC rejected nearly all data

- Based on NCEP/EMC discussion, QC similar to GSI v2.0 applied to 1.0 for testing purposes

~40% data removed

After QC

Before QC

GSI   gps_740_COSMIC1 2007081512 - 2007091512

OMB   DATE   OMA

Observation Impact

Verification against PREPBUFR observations using MET
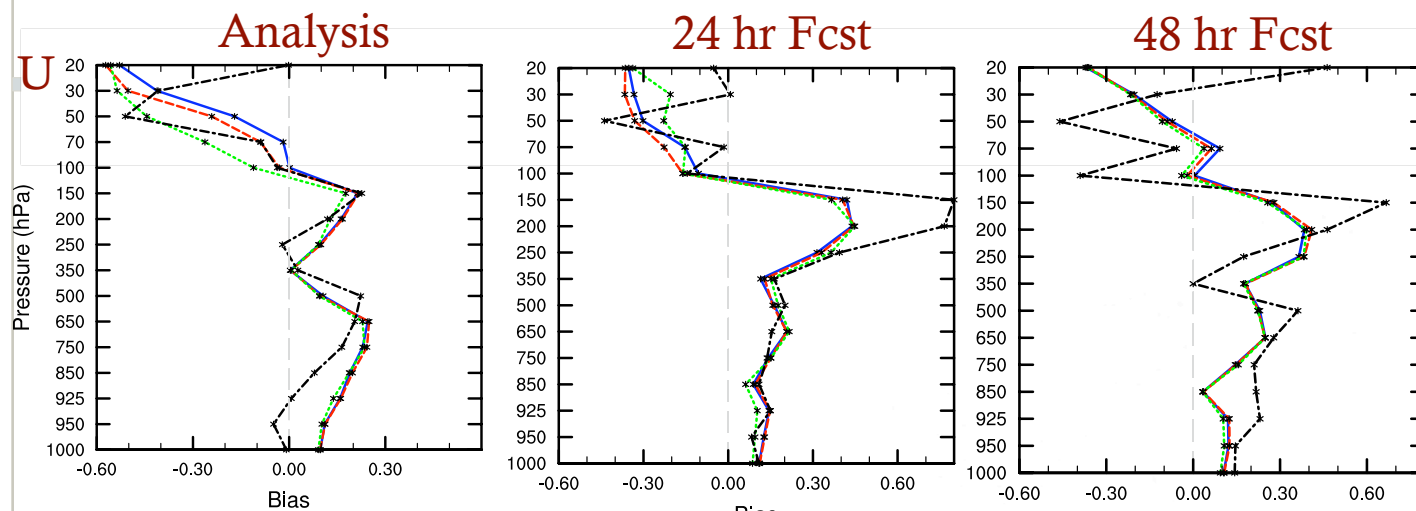
Observation Impact

Verification against ECMWF model using MET

Analysis   24 hr Fcst   48 hr Fcst

• Radiance and GPS assimilation showing general improvement over GFSWRF run during fcst hours.
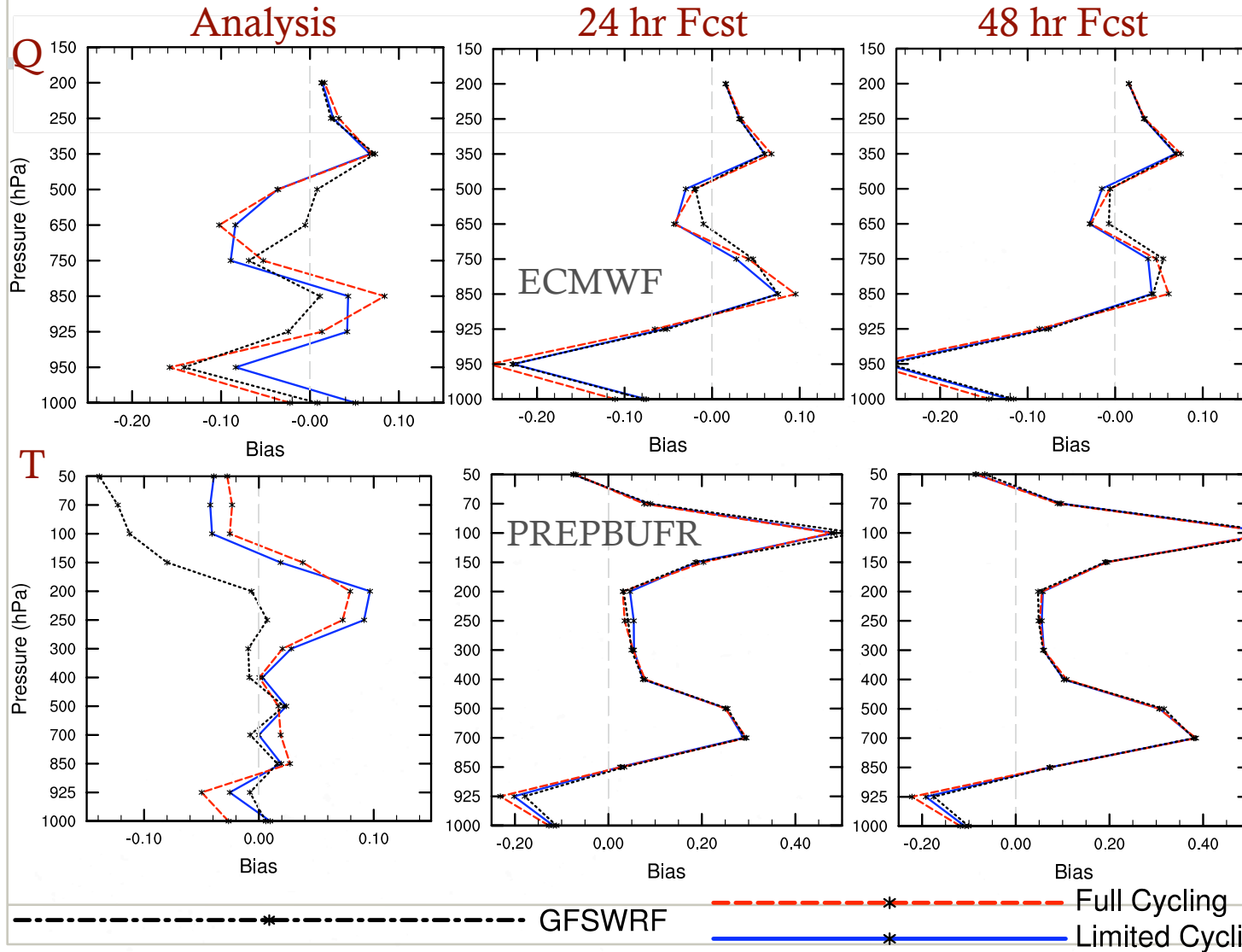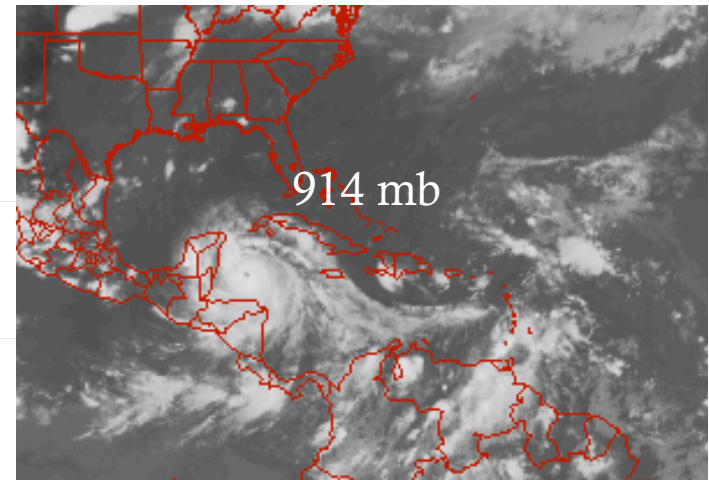
• GPS neutral impact over AMSU-A

GFSWRF

CYC_CONV

CYC_CONV+RAD+GPS
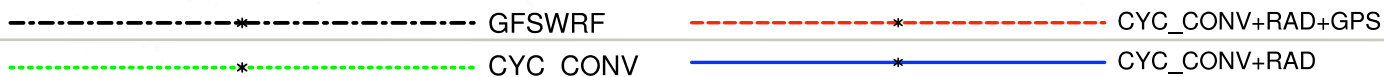
CYC_CONV+RAD

Run Schemes
Full Cycling vs. Limited Cycling

Hurricane Dean

GFS WRF

1000.83 mb

914 mb

Sea Level Pressure Contours: 900 to 1100 by 4

999.75 mb

965.59 mb

Limited Cycling

Full Cycling

Hurricane Dean - Track Error

GFSWRF
LCYC_CONV+RAD+GPS
CYC_CONV+RAD+GPS
CYC_CONV+RAD
CYC_CONV

Track Error (km)

Fcst Hour

Ongoing Efforts

- Extended tests (1 month) using latest versions: GSI v2.0 coupled with WRF-ARW v3.2
  - AFWA T8 domain (15 km resolution, 57 vert. levels, 10 mb model top)
  - Additional testing domain

- Continued data impact studies
  - Currently testing GPS RO using GSI v2.0 default QC

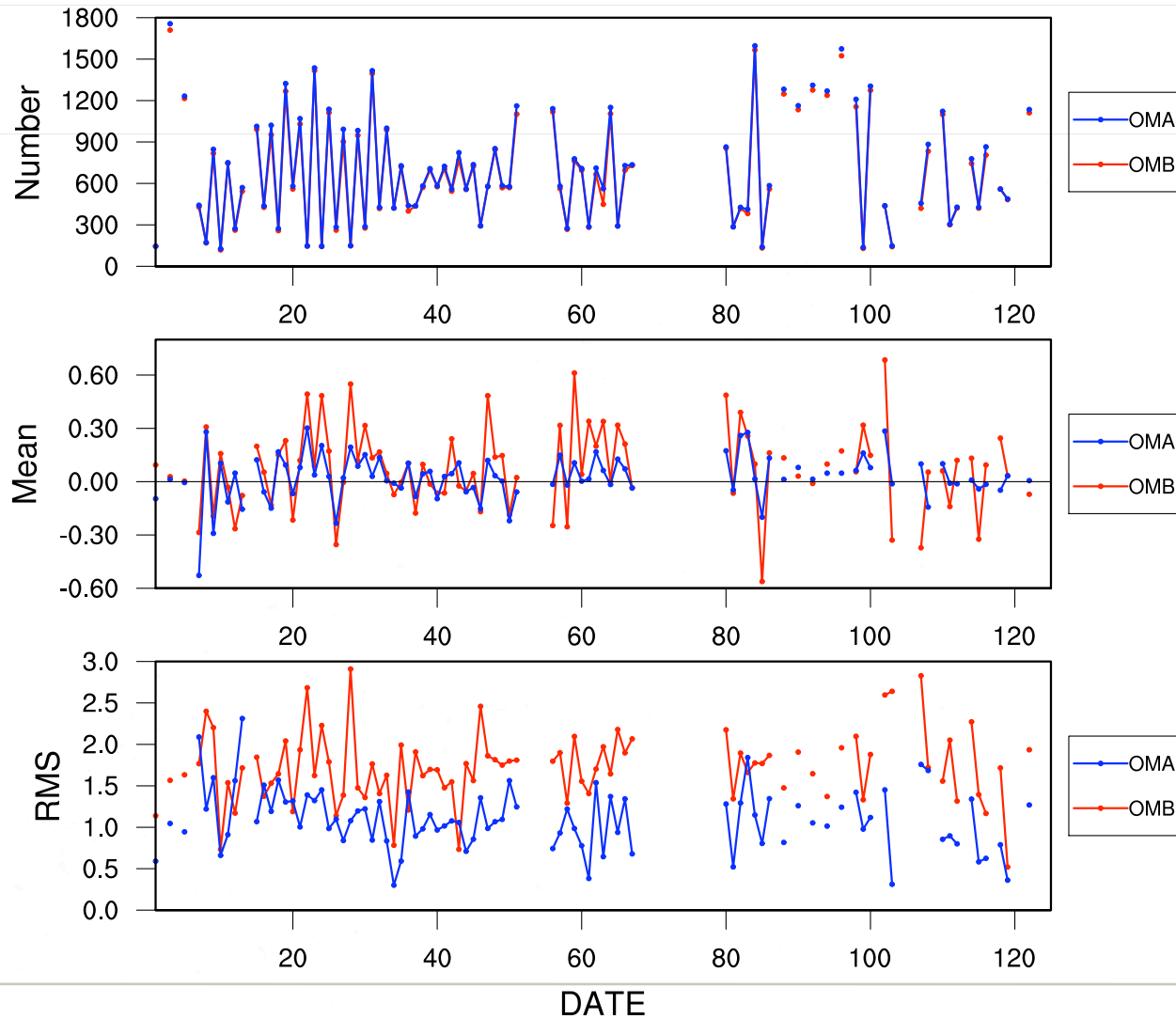- Testing of WRF ARW specified Background Errors

Summary and Conclusions

- A series of monthly experiments were run using GSI+ARW to investigate the capability and performance of the system
  - Aspects included background errors, observation impact, running schemes
  - Verified against observations (PREPBUFR) and independent analysis (ECMWF)

- Based on FY2009 tests
  - Using global background errors, GSI + ARW working properly
  - Assimilating AMSU-A radiance data shows some improvement, particularly at upper levels and during fcst hours
    - Addition of GPS RO data shows neutral impact
  - GSI v1.0 QC rejected most GPS data, testing done with v2.0
    - FY2010 tests using GSI v2.0 default QC
  - Limited cycling showing potential improvements on analysis and fcst

Questions?

GPS RO Before QC

GSI gps_740_COSMIC1 2007081512 - 2007091512

AMSU-A Bias Correction