Improvements in F16 SSMIS Data Assimilation into National Centers for Environmental Prediction Global Forecast System
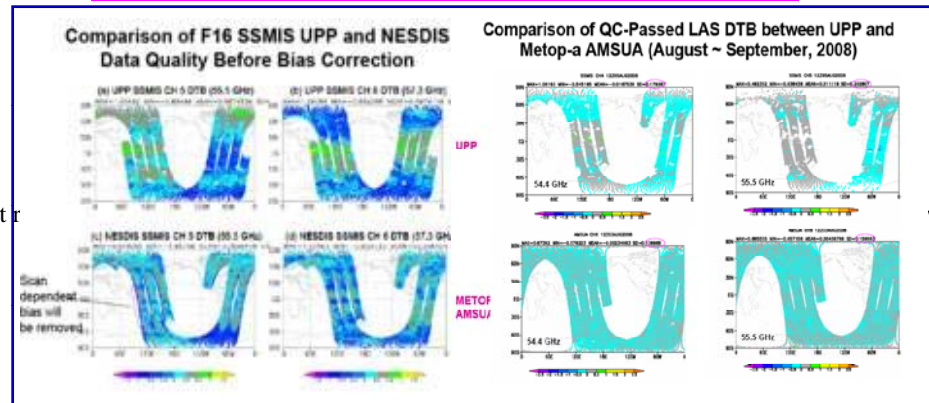
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ABSTRACT

The original F16 SSMIS data at low atmospheric sounding (LAS) channels display persistent r   , tw

F16 SSMIS LAS Data Quality Assessments

Comparison of F16 SSMIS UPP and NESDIS Data Quality Before Bias Correction

Comparison of QC-Passed LAS DTB between UPP and Metop-a AMSUA (August ~ September, 2008)

Experiment Designs

Δ Analysis: GSI 3D-Var (July 2007)

Δ Resolution: T382L64

Δ Assimilation Period: Aug. 1 – Sept. 30, 2008

Δ Only MW "clear" radiances at cloud-affected sounding are used

Δ Bias correction scheme (Derber and Wu)

Δ Experiment Legend:

Contrl.: No Satellite Data

AMSUA1: Contrl. + NOAA-18 (CH. 4-9)

AMSUA2: Contrl. + METOP-A (CH. 4-9)

SSMIS1 : Contrl. + UPP (CH. 2-7)
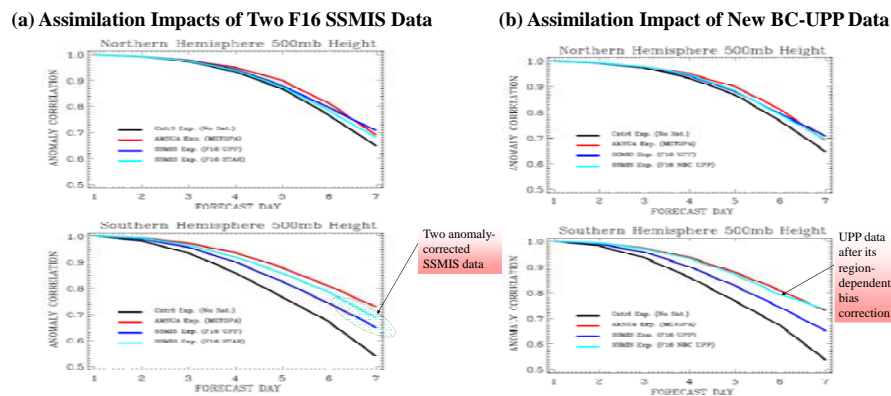
SSMIS2 : Contrl. + STAR (CH. 2-7)

F16 SSMIS Data

Δ UPP BUFR data (Bell et al., Kunkee et al., 2008)

Δ STAR binary data (Yan and Weng 2008; Yan and Weng, 2009)

Δ Both data including corrections for antenna emission, warm load anomaly, and scan dependent correction

New Bias Correction Algorithm for UPP Data
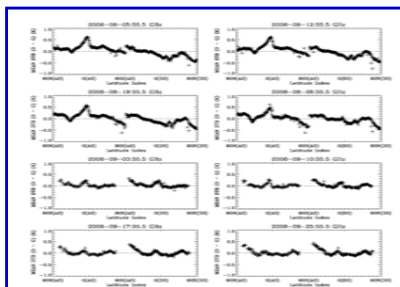
Due to the residual calibration error, the UPP LAS data displays strong region-dependent bias feature along observation latitude and node. This Bias is removed using a latitude and node dependent bias correction scheme.

Quality control

Δ **Oceans:** CLW (Weng) for cloud detection, 0.1 mm as thresholds (primarily for cloud-affected channels

Δ **Land:** use an empirical algorithm for cloud detection for cloud-affected channels:

$|T_{B,52.8}^{OBS} - T_{B,52.8}^{BK}| < \delta_1$ **and** $|T_{B,50.3}^{OBS} - T_{B,50.3}^{Clear}| < \delta_2$

Δ **A gross check** for the data quality at non-cloud-affected channels:

Instrument	Criterion for BC-satellite brightness temperature bias (ΔT$_e$=OBS-BK)					
	52.8	53.6	54.4	55.5	57.3	59.4
AMSU-A	-	< 6 K	< 6 K	< 6 K	< 6 K	< 6 K
SSMIS	-	<0.5 K	<1.0 K	<0.5 K	0.5 K	0.5 K

SSMIS Assimilation Impacts

(a) Assimilation Impacts of Two F16 SSMIS Data

(b) Assimilation Impact of New BC-UPP Data

Two anomaly-corrected SSMIS data

UPP data after its region-dependent bias correction

• SSMIS can make impacts similar to AMSU over northern hemisphere but slight lower than AMSU over southern hemisphere

• The performance for the current period of experiments is better from STAR data sets than that from UPP data sets over southern hemisphere

• New bias correction makes the UPP data produce much improved assimilation impact on GFS

References

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2. Kunkee, D. B., S. Swadley, G. A. Poe, Y. Hong, M. Werner,2008: Special Sensor Microwave Imager/Sounde
3. Yan, B. and F. Weng, 2008: Intercalibration between Special Sensor Microwave Imager and Sounder (SSMIS
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