ATMS Microwave Sounder Assimilation at FNMOC with NAVGEM/NAVDAS-AR

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ATMS data acquired from AFWA in HDF5 format

Gaussian averaging: ch03-22
\( \sigma = 36 \text{km} \)
full width at half maximum \( \sim 85 \text{km} \)

Assimilate: ch04-15 and 18-22

Quality Control: surface sensitive channels checks involve sea-ice, cloud liquid and scattering; all channels innovation against
\( 3 \star (\sigma_o^2 + \sigma_b^2)^{1/2} \)

Thinning: 1.25° for global system

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**Gaussian Weighted Spatial Average**

\[
\hat{T}_B(s,b) = \sum_{i=1}^{N} w_i(p)T_B(\delta s_i, \delta b_i)
\]

\[
w_i(p) = \exp\left(\frac{-r_i^2}{2\sigma^2}\right)
\]

\[
r_i = \| (s,b), (s + \delta s_i, b + \delta b_i) \|
\]

\(N = 100\) pre-computed closest points
Each channel’s standard deviation of the bias corrected innovation is shown as a horizontal bar aligned with the peak of the channel temperature weighting function.
ATMS Impacts for ~30-day period

Includes both T and q sensitive channels

ATMS observation count
Almost double AMSU-A or SSMIS
ATMS Observation Impacts by Channel
NRL and GMAO Comparisons

ATMS observation sensitivity (FSO) from assimilation at FNMOC and GMAO

http://gmao.gsfc.nasa.gov/forecasts/systems/fp/obs_impact/

http://www.nrlmry.navy.mil/metoc/ar_monitor/
The following slides depict 30 day time series of O-B for ATMS

On 20 November, new SDR TBs were being produced using a new set of coefficients for beam efficiency and scan bias.

Previously these coefficients were set to (1,0) for each channel, so that the TDR $T_B$ was equivalent to the SDR $T_B$.

Each NWP center performs their own set of channel dependent bias corrections to bring the global O-B to a near zero values. Several predictors are employed in these variational bias corrections schemes, one or more of which involve the scan position bias.

As you can see, from the following charts, all centers show a discontinuity in the O-B departures for the 20th of November, with the exception of the NCEP/EMC GFS model.
NAVGEM/NAVDAS-AR Operational ATMS Assimilation
30 Day Time Series of Global O-B Departures

Innovation NPP ATMS ch06 53.596 +/- 0.115 GHz

bias = 0.012  mean = -0.0075  stdv = 0.23  exp:ar_radiance_ops

bias: Mean Raw Departure
mean: Mean Bias Corrected Departure
shaded: O-B Std. Dev. about mean
ATMS Radgram from FNMOC OPS
Discontinuity in O-B about 20Nov2013
VarBC recovers rather quickly; however, ATMS SDRs are different going forward

http://www.nrlmry.navy.mil/metoc/ar_monitor/
Uncorrected Raw Departure depicts the “new” state of ATMS SDRs.
Uncorrected Raw Departure depicts the "new" state of ATMS SDRs
Statistics for RADIANCES from NPP/ATMS
Area: lon_w = 0.0, lon_e = 360.0, lat_n = -90.0, lat_s = 90.0
Operational Suite (0001) [Time step = 6 hours]
Departures: blue = uncorrected, red = bias corrected +/- SD (dots)
platform: atms_npp
region: global (180W-180E, 90S-90N)
variable: ges_(w/o bias cor) — obs (K)
valid: 06Z12NOV2013 to 06Z12DEC2013

channel 5
\( \chi \) 0.1707
f 52.80 GHz
\( \lambda \) 5877.89 \( \mu \)m
avg: 0.295
sdv: 0.821

channel 6
\( \chi \) 0.1015
f 53.60 GHz
\( \lambda \) 5593.56 \( \mu \)m
avg: 0.260
sdv: 0.277

channel 7
\( \chi \) 0.0585
f 54.40 GHz
\( \lambda \) 5510.89 \( \mu \)m
avg: 0.258
sdv: 0.230

channel 8
\( \chi \) 0.0598
f 54.94 GHz
\( \lambda \) 5456.72 \( \mu \)m
avg: 0.514
sdv: 0.196