



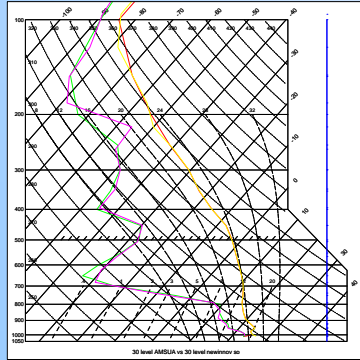
Implementing Radiance Assimilation in NAVDAS-AR: Lessons Learned



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NAVDAS-AR Design Considerations

- Observation pre-processing routines for NAVDAS-AR
 - NAVDAS-AR initially used NAVDAS observation pre-processing routines
- For NAVDAS, the innovations are computed from the gridded fields
 - 720x361 fields, 30 pressure levels
 - 3-, 6-, and 9-hr forecasts
 - Interpolated to observation location and time
- Innovations used by NAVDAS-AR are recomputed from the model trajectories (spectral → gaussian grid, sigma coordinates) interpolated to the ob location
- Vertical profiles of temperature and humidity are not the same
 - Esp. in regions with strong vertical gradients (e.g. tropopause, stratopause)
 - Computed Tbs are not the same - and show systematic differences (bias)
 - Bias corrections can vary between the two (gridded fields vs. AR trajectory)
- Where should data selection, QC and statistical monitoring performed?



Differences between temperature and humidity background profiles for 30 pressure-level (prep; green and red) and 30 sigma level (AR; magenta and yellow) backgrounds for the RT model. AMSU-A locations are in the tropical western Pacific.

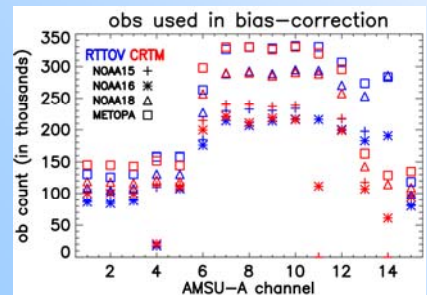
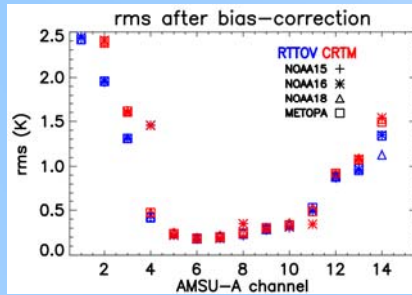
NOAA-15, AMSU-A Bias Corrected Innovations Assimilated channels, 2008032612

Channel	Number	NAVDAS Prep Bias	NAVDAS Prep S.D.	AR Trajectory Bias	AR Trajectory S.D.
4	3541	0.024	0.482	-0.012	0.49
5	3577	0.023	0.235	-0.015	0.235
6	8590	0.024	0.199	0.011	0.198
7	9486	0.004	0.197	0.007	0.190
8	9504	-0.005	0.220	0.027	0.202
9	9389	-0.061	0.283	0.029	0.256
10	9191	0.011	0.385	0.027	0.317

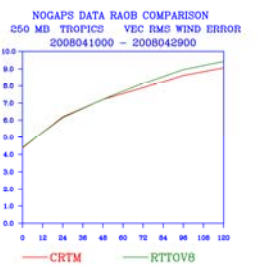
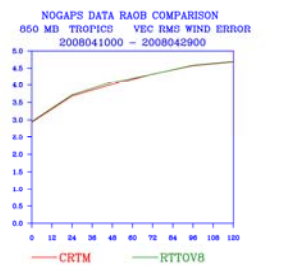
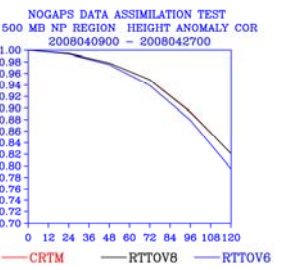
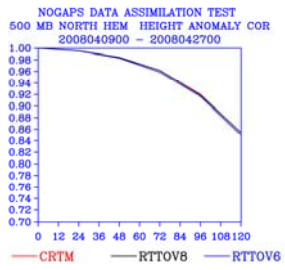
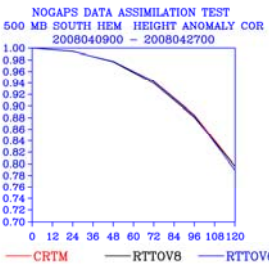
- The mean bias-corrected innovations are small for each case. However, the mean innovations tend to be of opposite sign, and the difference between the means can be large.
- Bias corrections based on the prep routine innovation statistics, and applied to AR-generated innovations can lead to biases in the analyses.
- For the above example, the 30-level NOGAPS fields are output onto 53 pressure levels for input to CRTM. The bias-correction statistics are generated from the AR-computed innovations.

Comparisons between RT Models RTTOV-6 vs. RTTOV-8.7 vs. CRTM v1812

- Issue**
- Operational RT model RTTOV-6 is no longer supported
 - Cannot add assimilation of new sensors (AIRS, IASI, METOP-A AMSU) without upgrading RT models
 - Previous tests with JCSDA CRTM gave worse NWP forecast skill, even with an additional AMSU-A sensor
 - Ongoing testing with RTTOV-8.7 and CRTM v1812
 - Added stricter QC, new RT models have smaller forward model errors

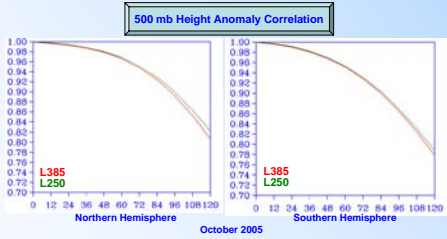


- RMS statistics for assimilated channels very similar for the two RT models.
- Ob counts are similar, except for the higher-peaking channels.
- The RTTOV-8.7 setup uses NESDIS ATOVS retrievals to provide the background above the model top (4 hPa).
- For CRTM, the input profile is limited to 4 hPa and below.

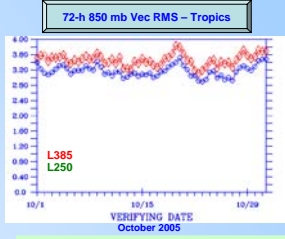


- The latest release of CRTM is much improved.
- NAVDAS with CRTM is still being "spun-up"; however the verification statistics are quite similar to those from RTTOV-8.7
- Operational NAVDAS uses RTTOV-6

NAVDAS/NOGAPS Background Error Correlation Length Scale Tests



Background error correlation length scale; L = 385 km → L = 250 km



→Still room for improvements to existing system →Results were very similar for NAVDAS-AR

Acknowledgements: This work was funded by the Office Of Naval Research and the Space and Naval Warfare Systems Command PMW-120.