



CRTM Implementation in Navy Assimilation Systems

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Introduction

- Latest CRTM has been implemented into Navy operational assimilation systems:
 - NAVDAS (3D-Var)
 - NAVDAS-AR (4D-Var)
- History of CRTM usage in NAVDAS (3D-Var) beginning with prototype-CRTM (pCRTM)

Collaboration:

- Produced CRTM IASI simulations in Nov '07 helping to validate IASI performance
- Evaluate CRTM microwave emissivity model (Ruston, Weng, and Yan, 2008)
- Validate CRTM-Z Zeeman code with NRL line-by-line
- Provide feedback on platform portability, modifications made, and RTTOV comparisons



RT Model Comparison

- RT model comparison in NAVDAS (3D-Var) system
 - CRTM_rev1876 (Feb '08)
 - RTTOV-8.7
 - RTTOV-6
- Latest CRTM shows comparable results to RTTOV-8.7
 - Additional layers above model top, and inclusion of climatology in CRTM mitigated prior concerns

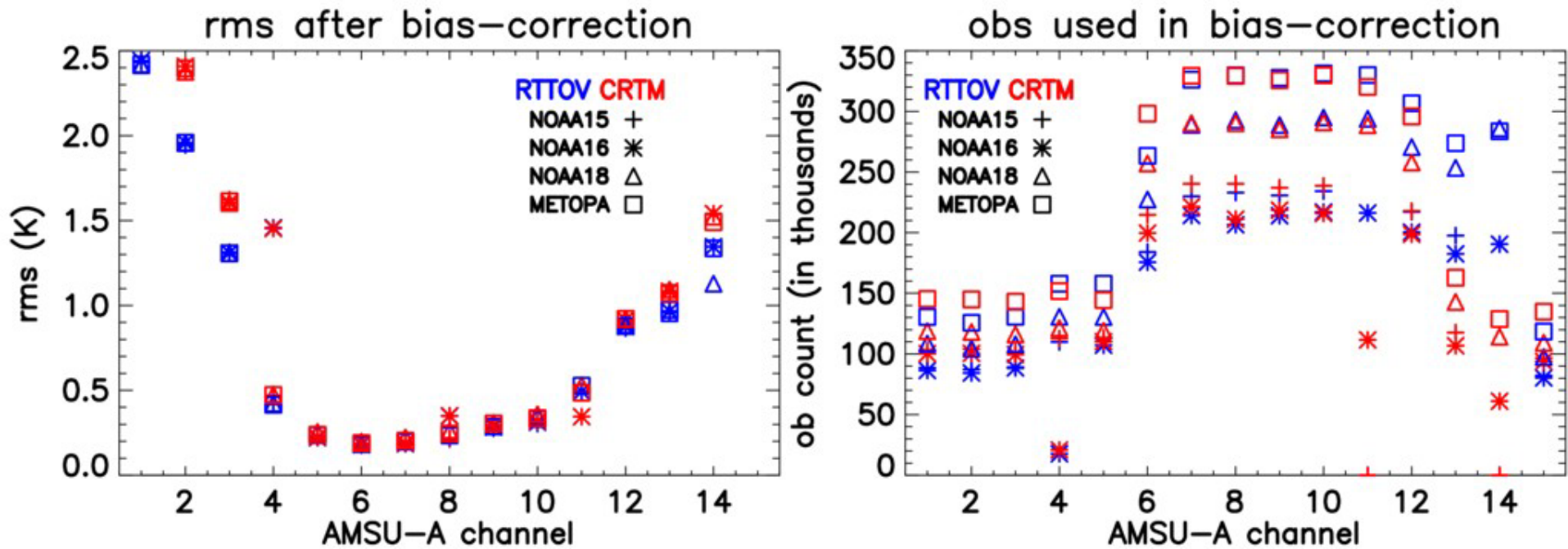
Additional Work

- Working with Xu Liu of NASA Langley on principle component (PCRTM) and assimilation of IASI PCs
- Future intercomparison



CRTM_rev1876 & RTTOV-8.7

- 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.

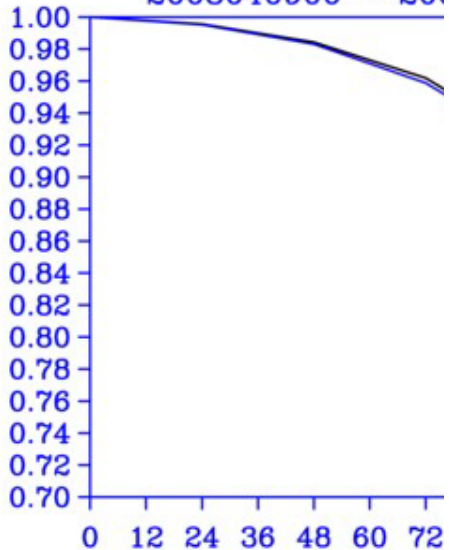




CRTM_rev1876, RTTOV-8.7, & RTTOV-6

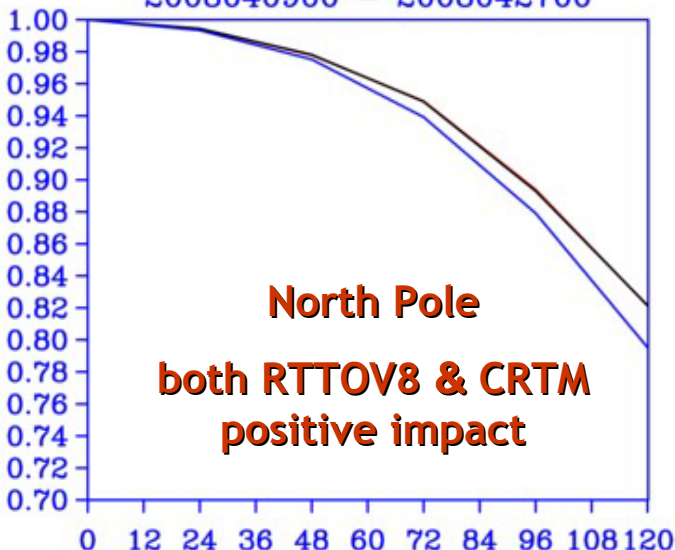
- The latest release of CRTM added climatology and extra layers above model top
- NAVDAS with CRTM is still being “spun-up”; however the verification statistics are quite similar to those from RTTOV-8.7
- Operational NAVDAS uses RTTOV-6

NOGAPS DATA ASSIMILATION TEST
500 MB NORTH HEM HEIGHT ANOMALY COR
2008040900 - 2008042700



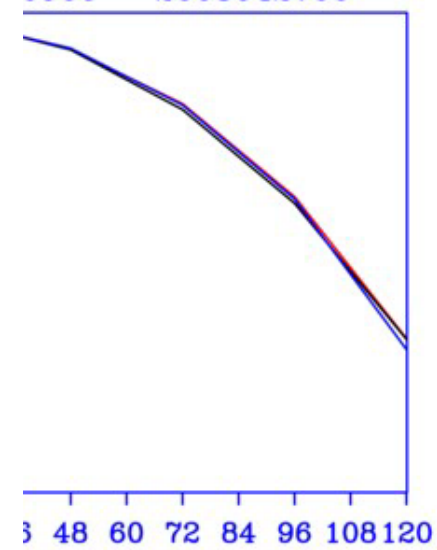
— CRTM — RTTOV6

NOGAPS DATA ASSIMILATION TEST
500 MB NP REGION HEIGHT ANOMALY COR
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— CRTM — RTTOV8 — RTTOV6

DATA ASSIMILATION TEST
HEM HEIGHT ANOMALY COR
0900 - 2008042700

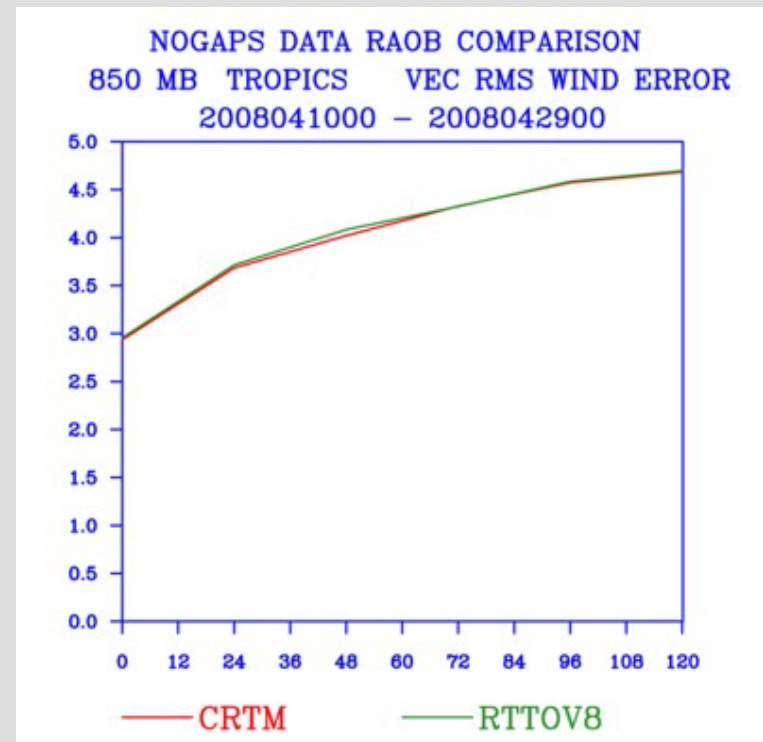
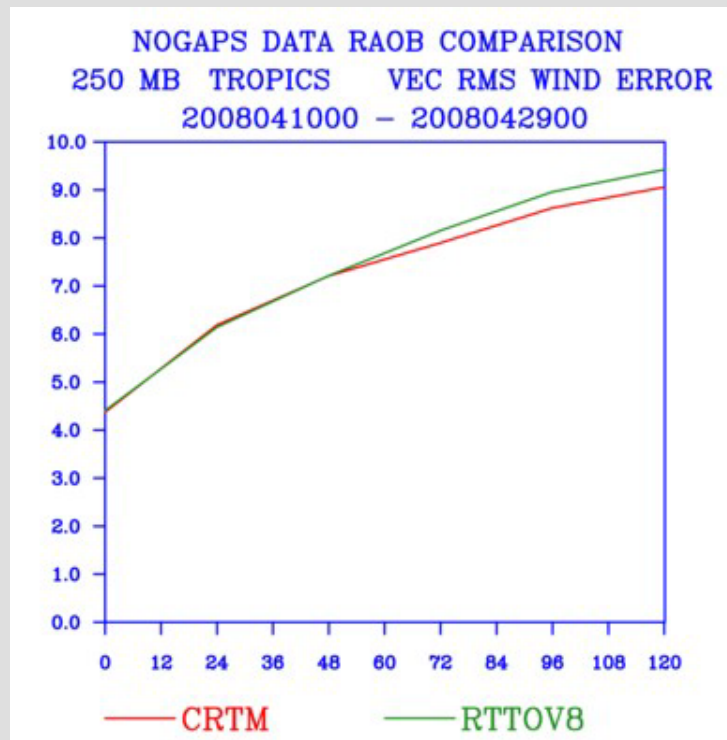


— RTTOV8 — RTTOV6



CRTM_rev1876 & RTTOV-8.7

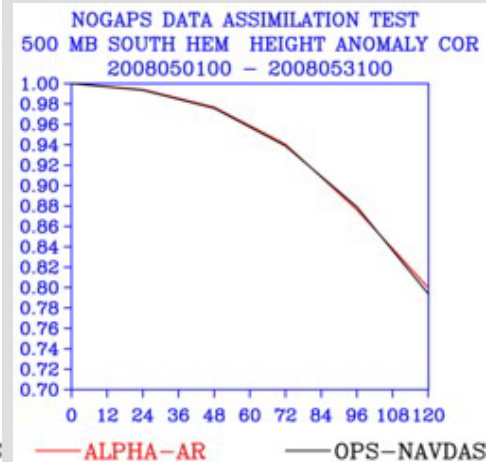
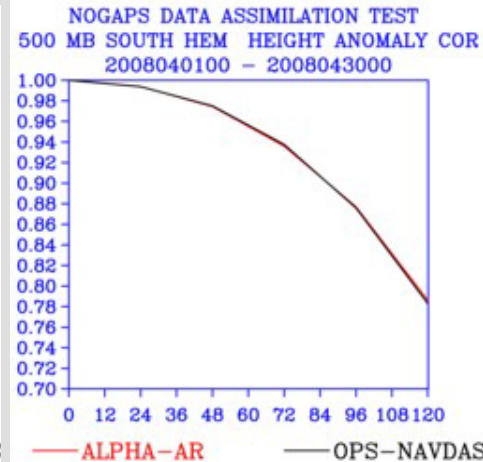
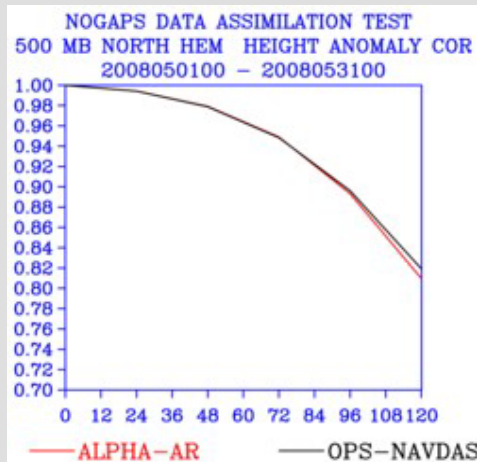
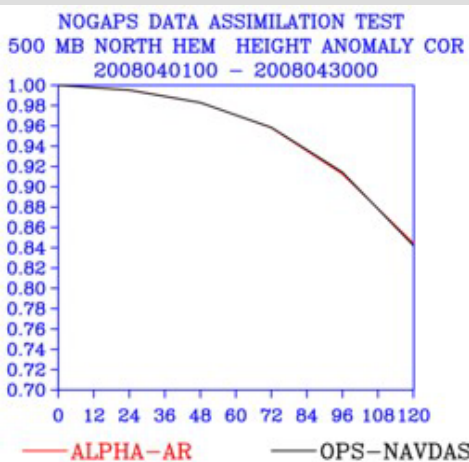
- CRTM exhibiting improvement in tropical winds at 250mb against raob





CRTM in NAVDAS-AR

- CRTM_rev1876 has been implemented into NAVDAS-AR
- Results neutral against current “well-tuned” operational system
- Executes within operational time constraints

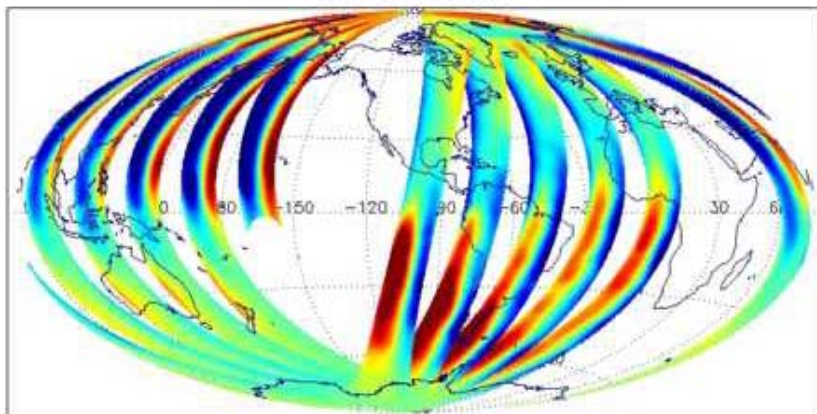




RTM Comparisons (LBL vs. CRTM-Z)

- Global Simulations using NOGAPS-ALPHA and CIRA-86 Climatology
 - NOGAPS-ALPHA extends to 0.0005 hPa (~95 km)
 - CIRA-86 Climatology extends T(p,z) to 100 km
 - NRL LBL RTM vs Fast Model with Zeeman Effects Included
 - NRL LBL -- 6 Hours of CPU time per SSMIS rev
 - NRL LBL -- explicitly calculates Zeeman effect on TBs
 - CRTM-Z -- compares to NRL LBL within 1.0 K in the mean
 - CRTM-Z -- under 30 sec CPU time per SSMIS rev

DMSP F-16 NRL LBL RCP - CRTM-Z Ch. 20 60.792668±.357892 GHz
DTG: 2007062012



**NRL LBL with Earth Rotation Doppler
vs.
CRTM-Z without Earth Rotation Doppler**

-2.00 -1.50 -1.00 -0.50 0.00 0.50 1.00 1.50 2.00



Conclusions

- Performance of CRTM_rev1876 respectable and is targeted for operational implementation
- Only RT system implemented into NAVDAS-AR (4D-Var)
- CRTM-Z with Zeeman effects is efficient and accurate; needs Earth rotation Doppler shift effects
- Feedback with development team has been profitable for both sides

