Comparison of Simulated Radiances, Jacobians and Information Content for the Microwave Humidity Sounder and the Advanced Microwave Sounding Unit–B.

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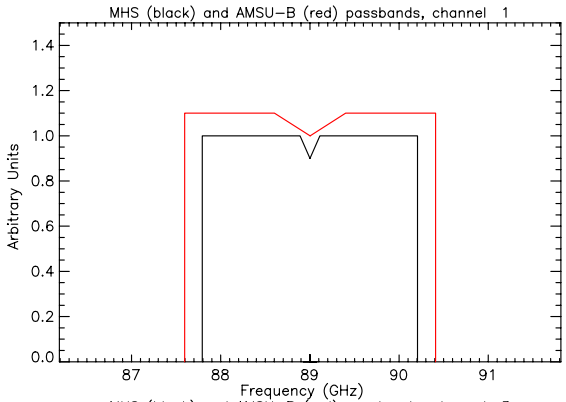
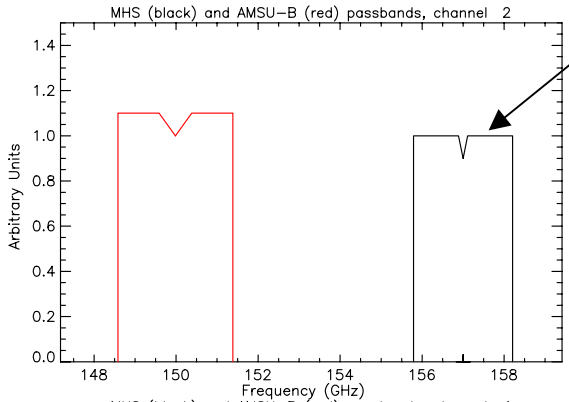
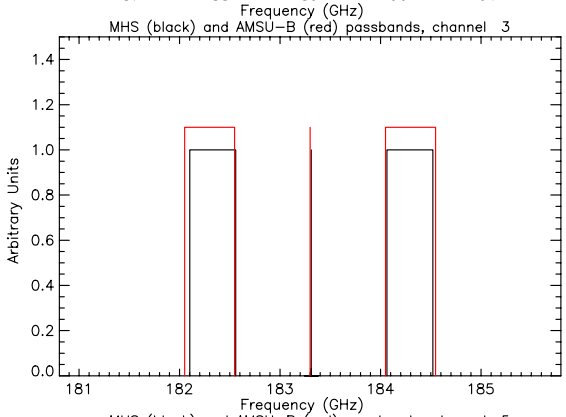
Acknowledgements

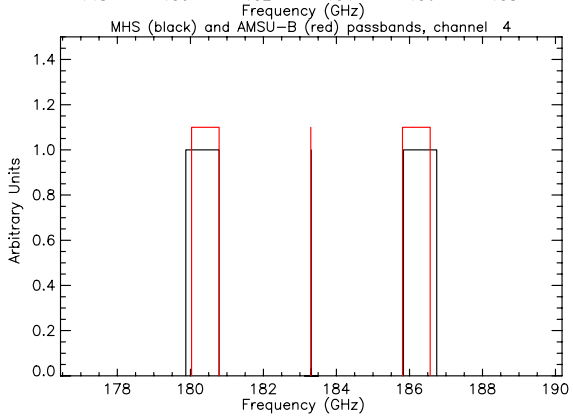
This work was performed while the author was a visiting scientist at EUMETSAT under the auspice of Dr. Johannes Schmetz.

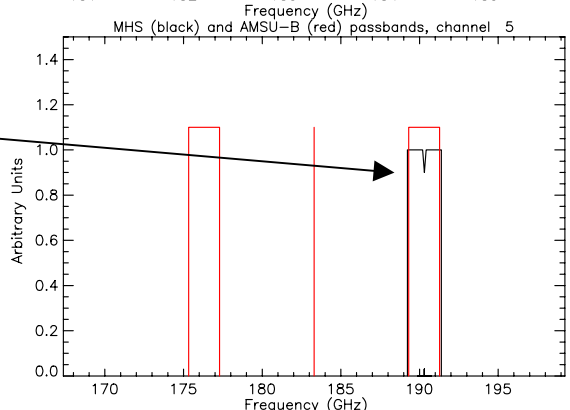
MHS(18) and AMSU-B(17) Bandpasses









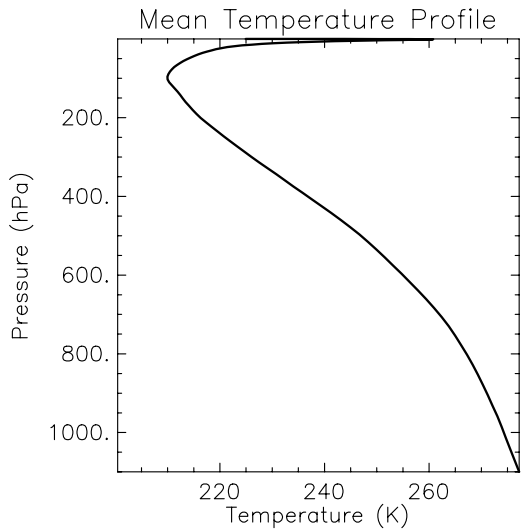


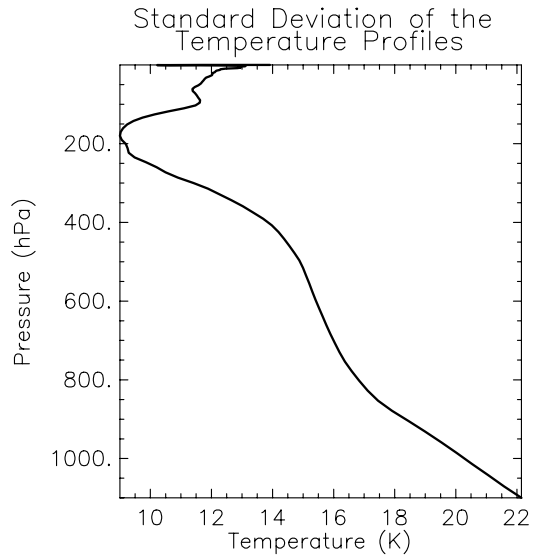
The angular notch at the central frequency of the single band channels represents the stopband. The vertical line in the other channels represents the central frequency.

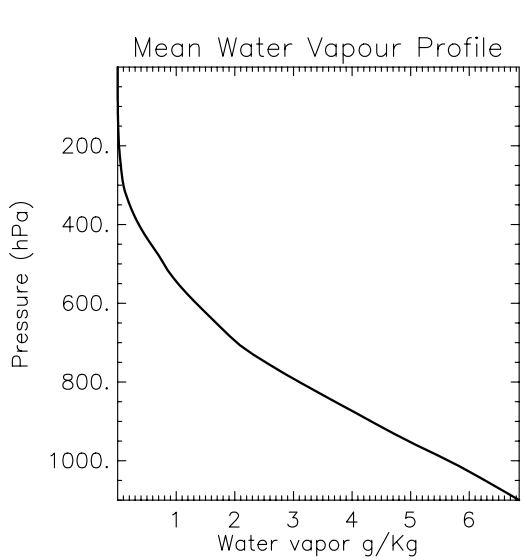
Simulations

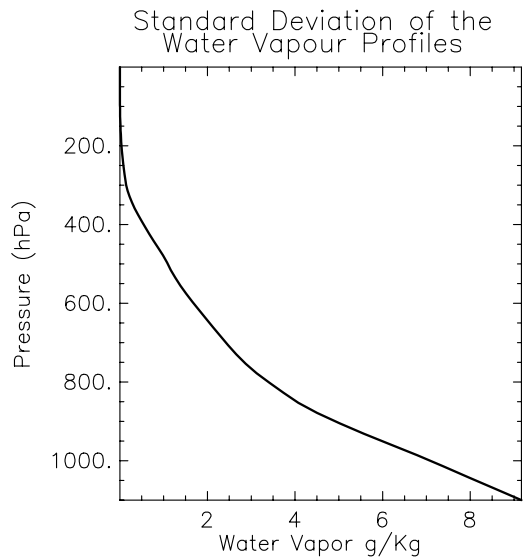
- JCSDA Community Radiative Tranfer Model (OPTRAN V 6.0)
- UMBC AIRS 48 profile-100 layer set
- Surface emissivity set to 0.6
- Nadir view

UMBC Profile Statistics

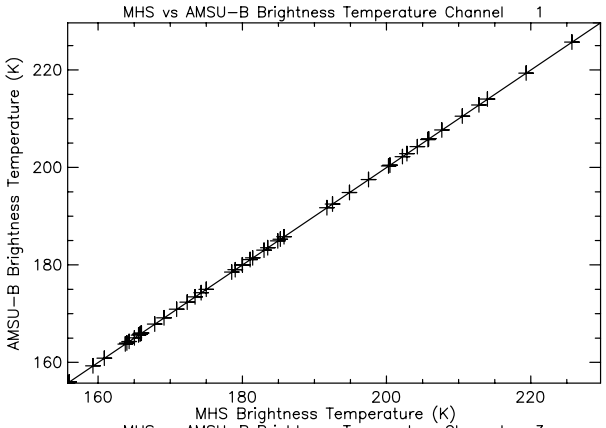


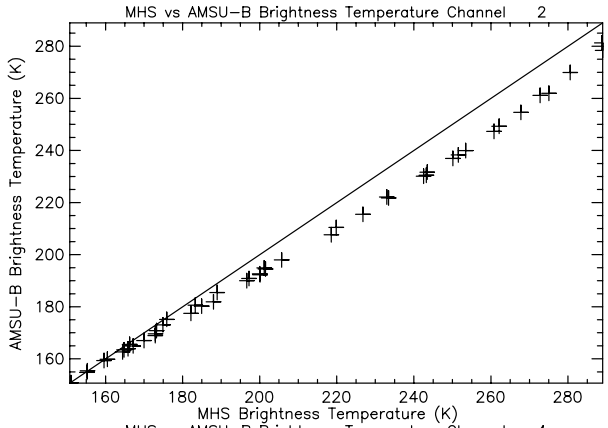


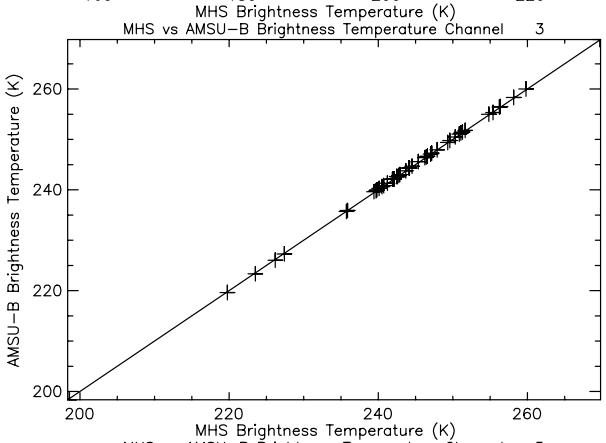


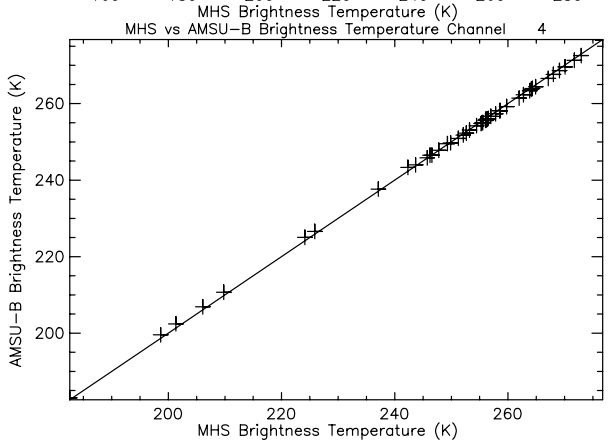


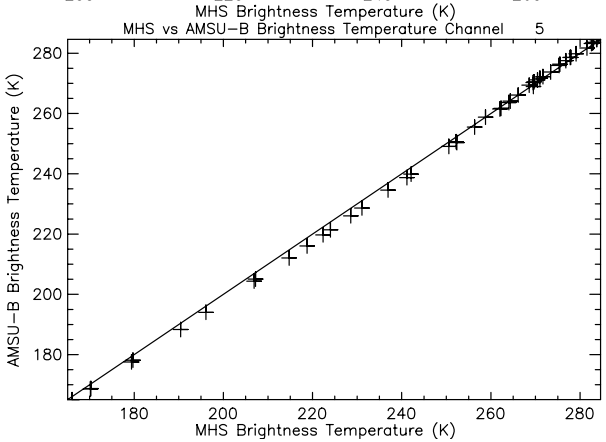
MHS vs AMSU-B Brightness Temperatures





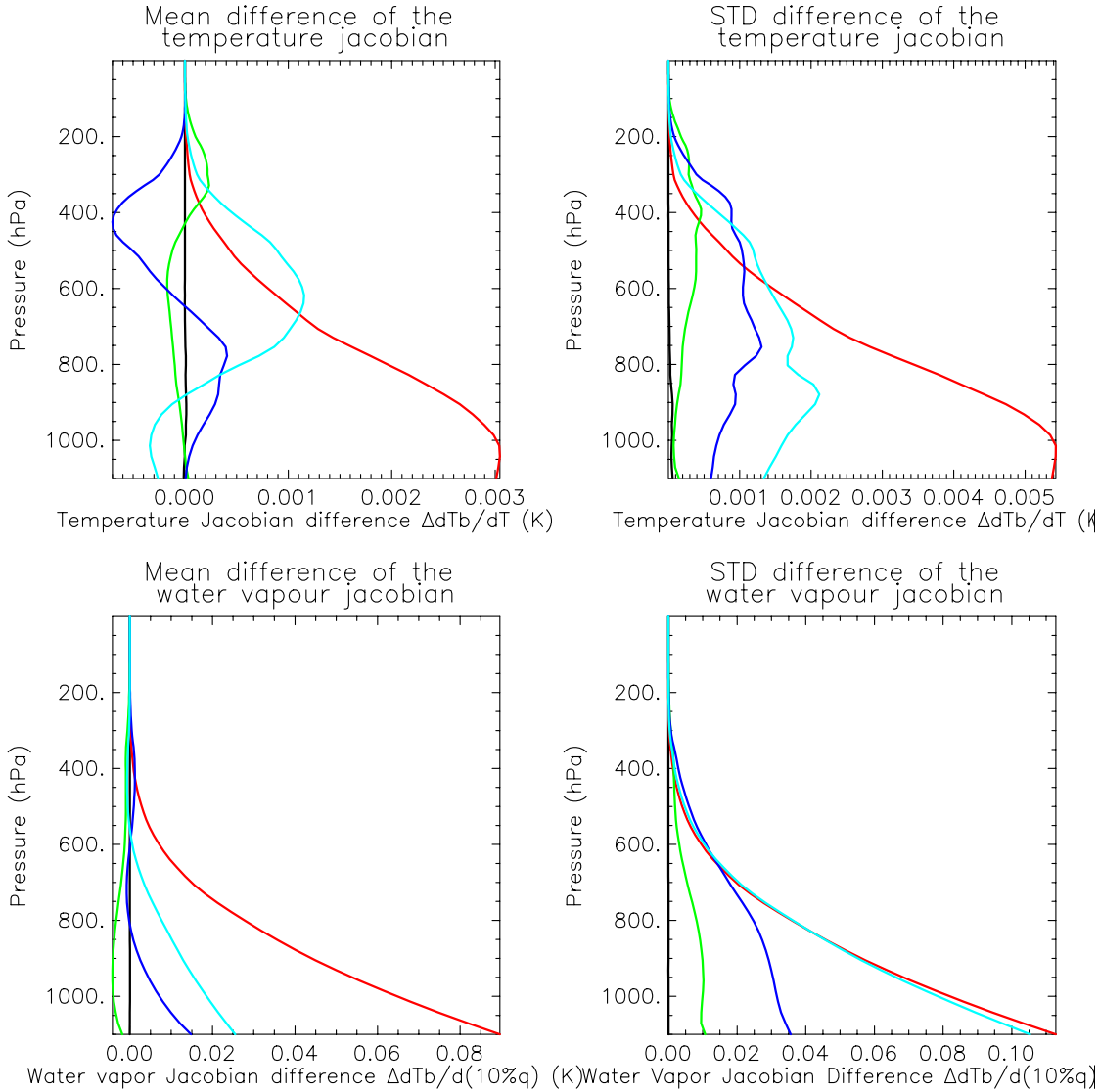






MHS - AMSU-B Brightness Temperature difference for the UMBC AIRS 48 profiles		
Chan	**Mean difference (K)**	**Standard Deviation**
1	-0.0123	0.0035
2	6.6553	4.7687
3	-0.0992	0.1091
4	0.0903	0.4982
5	0.7148	1.3365

Mean and standard deviation of the difference between the MHS and AMSU-B Jacobians for the 48 UMBC atmospheres. The figures are colour coded such that black = channel 1, red = channel 2, green = channel 3, blue = channel 4 and cyan (light blue) = channel 5.



Values small probably because of thinness of layers

Retrieval Improvement

- Error covariance defined by Rogers (1976)

$$\mathbf{S} = \left(\mathbf{B}^{-1} + \mathbf{K}(\mathbf{x})^{\mathrm{T}} \left(\mathbf{O}+\mathbf{F}\right)^{-1} \mathbf{K}(\mathbf{x})\right)^{-1}$$

- B – background covariance, courtesy Tony McNally *
- O – prelaunch NEDT for MHS18, measured on-orbit for AMSU-B17 – Tsan Mo
- F – set to 0.2K (Fourrié and Thépaut (2003))

*This matrix was computed from an ensemble of data assimilation experiments where the members differed because of random perturbations to the observations

NEDT used (K)

MHS-18 Prelaunch, AMSU-B17 OnOrbit

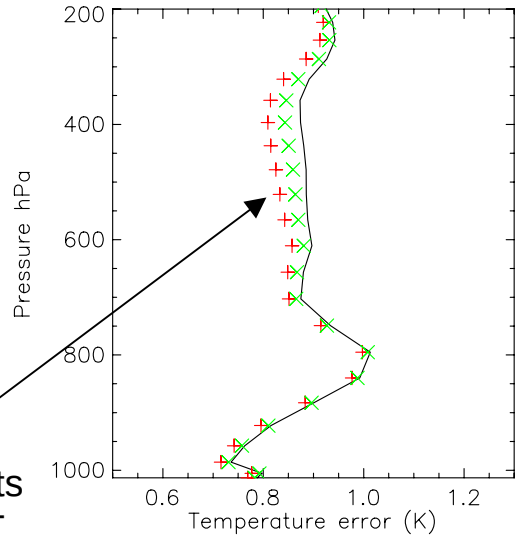
	1	2	3	4	5
MHS	0.22	0.35	0.45	0.35	0.40
AMSU-B	0.33	0.54	0.92	0.63	0.77

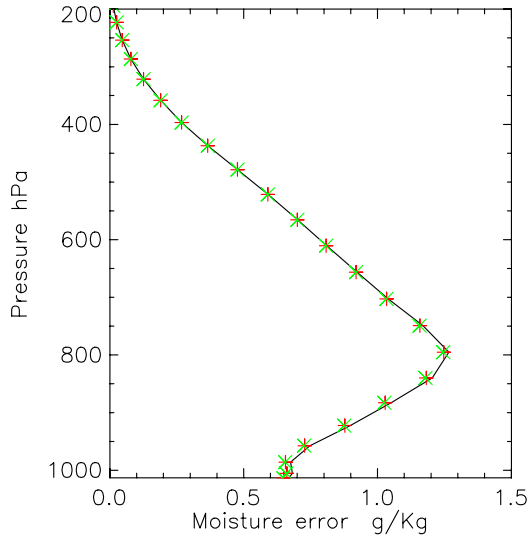
Improvement of AMSU-B and MHS information over ECMWF covariances for a hot and moist atmosphere.

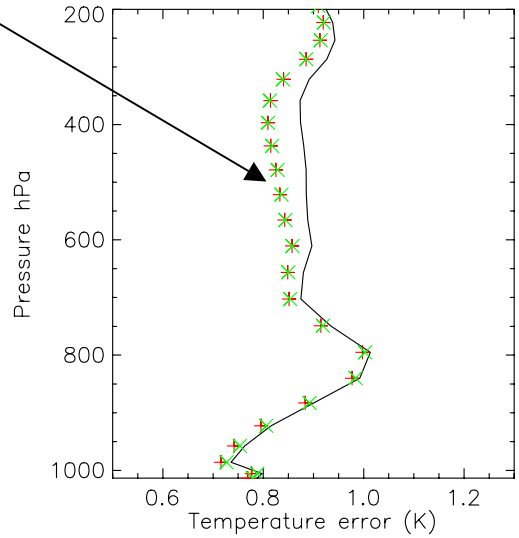
Instrument Unique NEDT

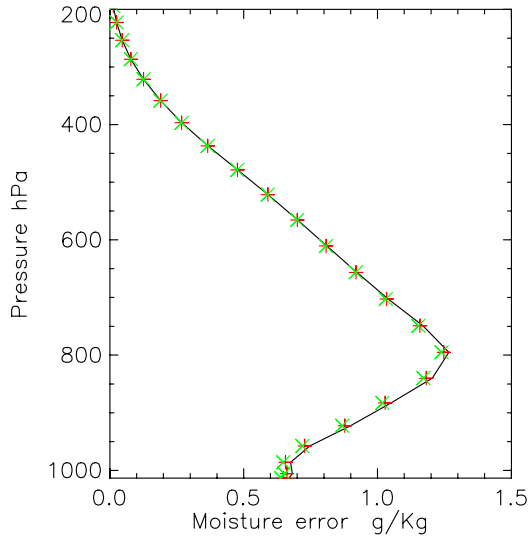
Suggests improvements due to NEDT

Both use MHS NEDT



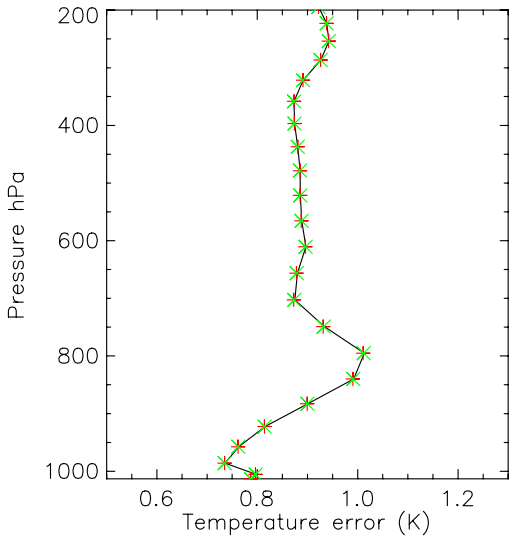


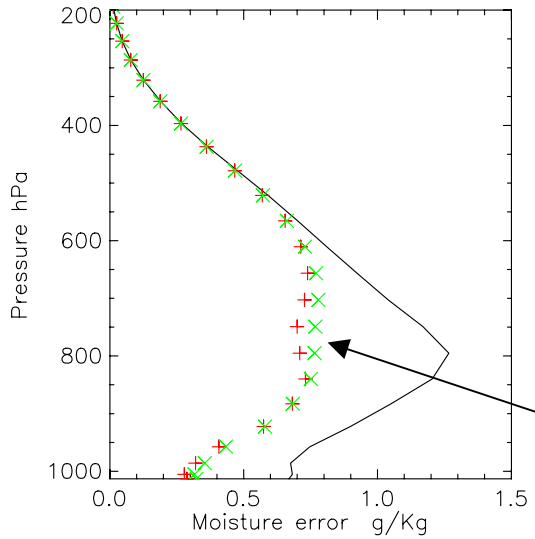




Improvement of AMSU-B and MHS information over ECMWF covariances for a cold and dry atmosphere.

Instrument Unique NEDT





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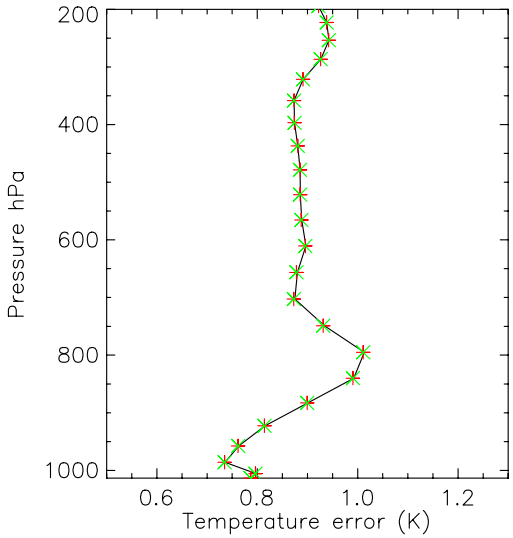
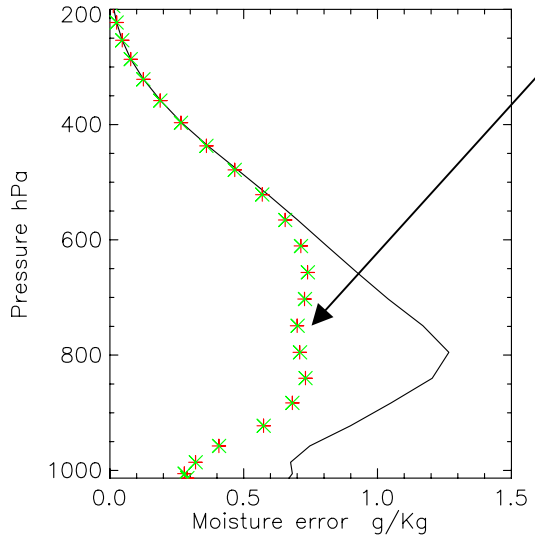
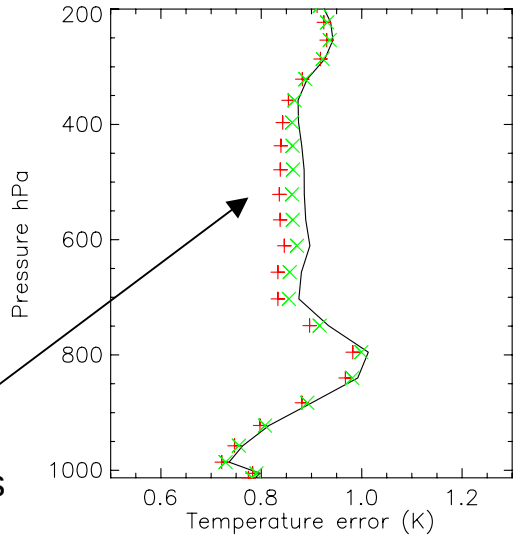


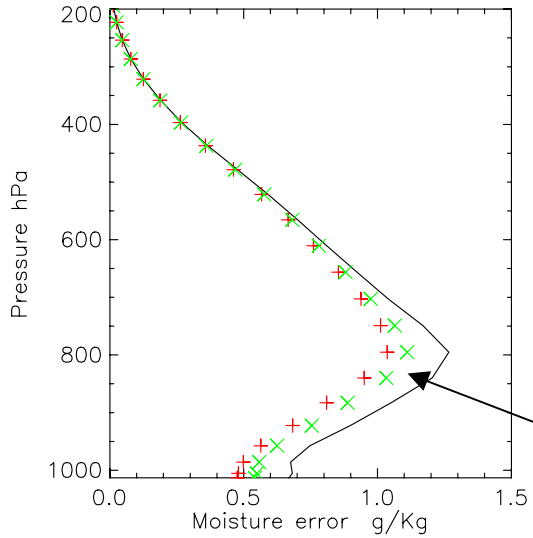


Improvement of AMSU-B and MHS information over ECMWF covariances for the US Std atmosphere.

Instrument Unique NEDT

Suggests improvements due to NEDT





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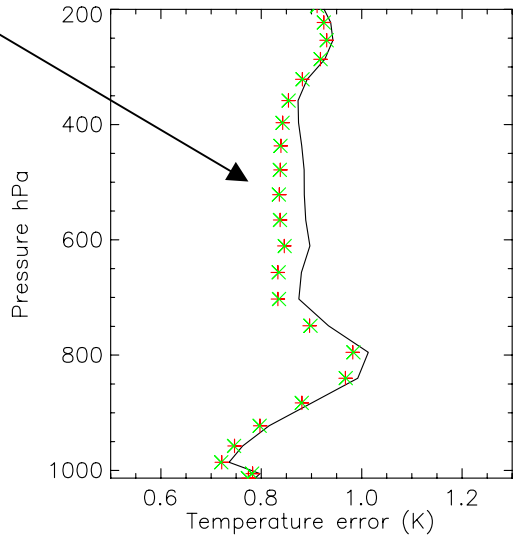

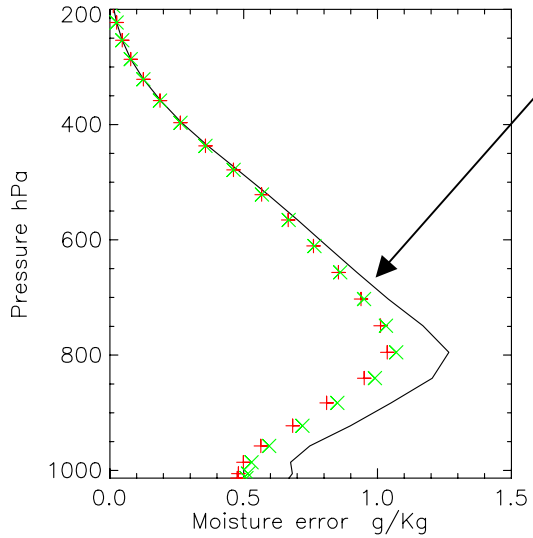

Conclusions

- It can be expected that the MHS will demonstrate a slight improvement in retrieval skill as compared to the AMSU-B due to the better NEDT performance of the MHS.

- This improvement will be airmass dependent.

- Experience has shown that on-orbit measured NEDT is somewhat better than that measured pre-launch, so the retrieval improvement estimates presented here may be an slight underestimate. This favors the AMSU-B in this study.