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## ***Interactive comment on “Characterization of merged AIRS and MLS water vapor sensitivity through integration of averaging kernels and retrievals” by C. K. Liang et al.***

**Anonymous Referee #1**

Received and published: 24 August 2010

This paper analyzes the sensitivity of AIRS and MLS to Upper Tropospheric/Lower Stratospheric (UT/LS) water vapor using each instrument's respective averaging kernels and presents a methodology to “merge” profiles from AIRS and MLS using each instrument's respective verticality profile. The paper is well written and the science of this work is clear and of high quality. That said, this manuscript is suitable for publication in AMT with minor revision.

General Comments:

P2839, Line 15 through P2840, Line 10: Very nice discussion of the information con-

veyed by the averaging kernels and verticality.

#### Specific Comments:

P2839, Line 4: "...with a quality flag of "PGood." The total verticality (TV) and also possibly the local verticality (LV) will include layers above and below both PGood and PBest. Can you comment on how your inclusion of layers for pressures greater than PGood or PBest might affect the weighting of profiles as described in Section 3.2? Have you performed an analysis similar to the ones shown in Figures 2 and 3 where PgOOD is required to be greater than some threshold (e.g., MIN(750hPa, PsurfStd))?

P2858, Figure 6: As indicated in the manuscript text, AIRS sensitivity to water vapor falls off rapidly above  $\sim$ 250hPa. In Figure 6, there appears to be large a mismatch between the mode of the gray distributions (AIRS) and the mode of the black distributions (MLS) between 147hPa and 215hPa. This seems to indicate that there is a bias between AIRS and MLS profiles most probable values and in the joint distribution of the difference between the "joined" profile and the MLS profile. On P2847, the authors state that the differences between "joined" profiles and retrievals from either instrument are generally within expected uncertainties; however some more discussion regarding differences between raw retrievals would be appreciated. Can you comment on the magnitude of the biases between MLS and AIRS and how biases in profiles from either instrument may compromise the merging of profiles using the instrument dependent verticality? Also, the addition of curves showing the cumulative distribution functions might be better to gauge outlier rates.

#### Technical Corrections:

P2834, Line 22: "...mix dry cold dry...", delete extra "dry."

P2837, Line 5: Insert a hard stop between "...that span the entire atmospheric column." and "The "joined" curve in ..."

P2837, Line 14: "the limb geometry of MLS senses through ..." consider revising this

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sentence.

P2839, Line 8: Insert “where” between “...the vertical distribution” and “the AK peaks.”

P2841, Line 7: “...AIRS is spuriously moving ... “ revise to “ ... the AIRS algorithm is spuriously moving ... “

P2844, Line 20, “percent” should be “fractional.”

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, 3, 2833, 2010.

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3, C1296–C1298, 2010

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