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Atmospheric Chemistry and Physics Discussions

Interactive comment on "First Odin sub-mm retrievals in the tropical upper troposphere: humidity and cloud ice signals" *by* M. Ekström et al.

M. Ekström et al.

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We are thankful for the work that the referee has put into commenting the paper. Especially the useful suggestions and references to papers that can contribute to the scientific interpretation and discussion of the results in this paper. The lack of such quantitative discussion and scientific output is one of the general remarks made by the referee. To shortly answers this, our intention with this paper and the accompanying paper by Eriksson et al., is to demonstrate the method of retrieval of UTH and cloud ice properties as well as demonstrating some of the capabilities of Odin-SMR. Comparisons with other instruments, e.g. Aura/MLS, and scientific discussions are planned for a future publication. The above mentioned references will then be of great interest.

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Major points:

1.a) The use of 100 MHz average to decrease the periodic pattern in the baseline only decrease the influence of this undulation and thermal noise. The systematic biases are unaffected by this averaging, and more important, so are the other random retrieval errors given in Table 2. The spectral averaging is considered when giving the numbers in the table of random retrieval errors. To decrease these errors we then need to average over several spectra. We will include the precise figures for the frequency bands in the revised paper, either in the text or in the figure.

1.b) The weighting functions shown are the derivatives of the spectra w.r.t. to a doubling of H_2O for three cases of RHi. Here the weighting functions are also integrated over altitude giving the unit K/1·km, where the 1 stands for a change of 1 (=100%). A doubling of the humidity makes the measurement saturate at a higher altitude in the atmosphere, and given the positive lapse-rate of the troposphere the measured brightness temperature therefore decreases.

1.c) The x-axis is ΔT_B, but we chose the more general 'cloud signal' since the limits for cloud detection are different for the two frequencies (501 GHz and 544 GHz). For the same reason we did not put any number on the cloud signal (ΔT_B) needed for 100% saturation. The figure was intended to be a schematic showing the principle, not giving exact figures.

1.d) Yes, 'window channels' refers here to the 100 MHz band that is averaged. It will be clarified in the revised paper.

1.e) Part of the quality criterion is to look at the T_B range of the transfer function. This is simply a measure of the importance of an error in brightness temperature (noise and calibration) on the retrieved quantity. For the tropical conditions the distributions of T_B ranges for 501 GHz and 544 GHz are very narrow with mean values only 1–2 K above the quality criterion. The actual ranges in the figure are 15.6 and 10.9 K respectively.

2.a) The systematic component of the total error will be included in the presentation of

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the results.

2.b) Systematic error in the atmospheric temperature field will be included in the table of systematic errors.

2.c) In the caption of Fig 16, μ and σ refer to the mean and standard deviation of the in-cloud humidity distribution. These are mentioned in the text, but we will clarify the caption. Also the number of data values in the comparison of MOZAIC and Odin-SMR will be added the caption of Fig 6.

2.d) The systematic pointing offset has a negligible impact. We expect that consecutive spectra within a scan have correlated pointing offset, but that the offset is uncorrelated from scan to scan. Since we only use a few spectra from each scan the error is only included as a the random component.

2.e) The referee points out that there is no real discussion of the total systematic error and its effect on the statistics, this is a shortcoming that we will improve in the revised paper.

3. As discussed above, this paper is focused on the methodology of the retrieval and scientific discussions have been left out. The references provided by the referee are however valueable for the future work with this data set. The retrieval of the cloud ice properties has been further elaborated by Eriksson et al. in the accompanying paper.

We appreciate that the referee have indicated the minor points/typographical errors, these will be corrected in the revised paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 8649, 2006.