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Atmospheric Measurement Techniques Discussions

Interactive comment on "Boundary-layer water vapor profiling using differential absorption radar" *by* Richard J. Roy et al.

Anonymous Referee #2

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The paper describes novel ground-based measurements performed by a DAR in the 183 water vapour absorption bands and a retrieval methodology to extract water vapour profiles from them. The paper is generally clear, well written and well presented.

I have some comments that I would like to be addressed by the authors.

1) In The statement at line 7 and 8 in the abstract you should clearly state that this is obtained in conditions of high SNR. Also it is driven by the range of your frequency within the absorption line, this should be mentioned otherwise the reader may generalize this conclusion erroneously.

2) Line 14 page 2: the authors should mention the obvious caveat of attenuation in reducing the SNR (too much water content/rain drives the signal below sensitivity).

3) Line 4 page3: it would be beneficial to discuss when the assumption of negligible multiple scattering is negligible or refer to previous literature.

4) Line 4-7 page 4: I am not fully convinced by this maximum differential absorption from particulate extinction of 0.01 dB/km. I haven't tried a specific computation but liquid cloud extinction is proportional to $1/\lambda$. So (assuming that the changes in refractive indices are negligible) a change of roughly 3% in lambda should correspond to a change of 38 dB/km/(g/m^3), which means that a deep cumulus cloud with 3 g/m^3 could produce 0.08 dB/km (an order of magnitude larger than quoted).

5) Line 10 page 5: What is the rationale for using a ΔF_{chirp} of 60 MHz and thus a range resolution of 2.5 m (with the obvious need of averaging later on for improving the SNR?)? Why not using a smaller bandwidth in first place?

6)Line 11-12 page7: I do not see the need of dropping the v subscript on κ, I would recommend to keep it for clarity (otherwise the reader may think it is the total extinction).

7)Generally in literature SNR values are stated in dB. In Fig.4 and its discussion you use linear units. Fig6 is also confusing to me, why using an obscure value like eta in the x-axis instead of using the SNR itself?

8) Fig5: it could help the reader to have a double y axis with the plot of the relative humidity and its uncertainty as well.

9) Fig5: A couple of points at low and far ranges from the two independent datasets in the bottom right panel seem to disagree, any comment?

10) Fig6: apart from the selection of the x-axis I struggle in extracting information from this figure. Why not doing a contour plot of σ_ρ/ρ using SNR vs rho e.g. for 100 200 and 400m integration? Anyhow I would ask the authors to try to rethink the figure and present it in a more understandable way.

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