

Atmos. Meas. Tech. Discuss., referee comment RC1  
<https://doi.org/10.5194/amt-2021-163-RC1>, 2021  
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## Comment on amt-2021-163

Anonymous Referee #1

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Referee comment on "New sampling strategy mitigates a solar-geometry-induced bias in sub-kilometre vapour scaling statistics derived from imaging spectroscopy" by Mark T. Richardson et al., Atmos. Meas. Tech. Discuss.,  
<https://doi.org/10.5194/amt-2021-163-RC1>, 2021

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### General Comments:

This well written manuscript deals with future spaceborne imaging spectrometers expected to measure water vapour columns with horizontal resolutions of  $< 100$  m. The authors simulate biases in water vapor scaling statistics that will occur at high solar zenith angles due to a solar light path traversing neighboring pixels. To reduce the biases, the authors propose a sampling strategy perpendicular to the solar azimuth angle. This is evident, and the described bias reduction is what one would expect. The merit of this study, which fits very well to AMT, is a quantification of the expected biases in water vapor scaling statistics. The study still lacks details on assumed measurement uncertainties, see specific comments.

### Specific Comments:

- Spatially nonuniform aerosol distributions (as stated in the abstract) are in my opinion not enough addressed. They probably pose the highest challenges to spectroscopy. On the other hand, they may be difficult to assess, and the resulting biases difficult to quantify. It would nevertheless be of high merit to include them in your model framework and to show some related simulation results in section 2.
- In section 2.2 you define parameters related to assumed measurement uncertainties and biases. Since they are used throughout the study, it would be good to describe them better here, perhaps including a figure which illustrates sensitivity (a1) and bias (a2). In addition, you should be more specific concerning the impact of aerosol layers (comment 1), and concerning probable error correlations between (for example)

surface albedo and aerosol concentration variations. Finally, can you assess the impact of simulation idealizations and simplifications which you have likely undertaken?

Technical Comments:

p.5 line 3: "with CWP calculated in the same manner as the TCWV": also pressure-weighted? Likely not.

p.7 line 6: "random errors that we estimate": please give examples (numbers) for these errors, in % of the TCWV.