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Atmospheric Measurement Techniques Discussions

Interactive comment on "Cloud geometry from oxygen-A band observations through an aircraft side window" *by* Tobias Zinner et al.

Anonymous Referee #1

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The paper presents a method to characterize the distance and height between airborne and cloud properties. The authors adapt an old concept based on the O2 A-Band absorption, usually applied to retrieve cloud top altitude of plane-parallel homogeneous cloud from satellite. The novelty and interest of the paper lie in the necessity to apply algorithm to finite clouds with sides. In this framework, authors have to realize extensive 3D radiative transfer simulations to develop look-up table based a "cloud wall". Several sensitivity tests were made concerning different geometry setup, cloud properties and cloud environment (aerosol, surface). At the end, comparisons of the distance retrieval with stereo measurement show a bias of 3.8 km that the authors attribute quite easily to 3D radiative effects.

At this point, I'm completely agree with the referee 3 that the paper cannot be published

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Discussion paper

without a validation of this assumption. Before accepting the paper, I request that the authors realize the simulation mentioned in page 15 and in the conclusions using cloud resolving model output and 3D radiative transfer simulation. Applying the algorithm to this simulated data will enable to confirm that 3D effects shortened the retrieved distance of an order of 3-4 kilometers and will strengthen the interest of the paper.

Other comments and questions:

1- In the introduction, the authors cite the papers demonstrating the concept of using O2 band to retrieve cloud top altitude (Yamamoto and Wark 1961, Wu, 1985, Fisher et Grass 1991) but do not mention the most recent papers as nothing were done since 1991. Can the authors actualize the references adding more recent bibliography concerning cloud top retrieval using O2-band?

2- Page 1, line 24, add reference for the retrieval of cloud top from brightness temperature.

3- Figure 1. For more clarity concerning the angle definitions, the authors should add the sensor zenith angle limits that are used for the sensitivities test and LUT computation.

4- Section 2.2.1. Present here the basic cloud used for the sensitivity test. How is the LWC and microphysics variability inside the cloud? Horizontally and vertically homogeneous?

5- Page 5, line 17: How to be sure you are in the saturation regime? If not what happens, is the distance shortened or stretched out?

6- Figure 3 and page 5, line 26: I found very weird and confusing to normalize the radiances to the minimum value. Normalizing them to the maximum value would allow to understand more easily the figure and the absorption differences according to the parameters.

7- Page 6, line 30-35. How to know if the cloud side is sufficiently vertical to apply the

method?

8- Figure 4. Similar to suggestion 3. Explain clearly or with a schematic why with an airborne at zs=6km, the angular range of sensor zenith angle is between 71 and 99°.

9- Figure 5. Can you add or indicate the relative standard deviation value in percent?

10- Page 14. Line 3. Please begin to describe the figure 7 and how are select the grey dot before analyzing the figure.

11- Page 14- line 6: What is an "objective" analysis? How do you select the horizontal cloud deck points?

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