

## ***Interactive comment on “Toward autonomous surface-based infrared remote sensing of polar clouds: Cloud height retrievals” by Penny M. Rowe et al.***

### **Anonymous Referee #1**

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#### General

The paper is carefully designed, elaborated, and focusses on an important issue in the field of continuous atmospheric monitoring capabilities.

I am not an expert for passive IR remote sensing. I am an expert for active remote sensing. So from the ‘real-world profiling’ point of view, I simply miss comparisons with real-world cloud base observations (performed with the proposed infrared radiance spectrometer and, e.g., a ceilometer, side by side, over hours, days, months). Is there no facility (somewhere around the world, at midlatitudes or at polar latitudes) where such an observational configuration is given. . . . ?

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If there are test versions of the proposed type of spectrometers, why is there no attempt to put it close to a lidar or ceilometer?

Even the most complex and comprehensive error analysis is not really convincing (at least to me). Long test measurements and comparison with alternative approaches (e.g., cloud height observations by means of active remote sensing) are convincing, only!

If the assumed water vapor profiles have a very sensitive influence on the retrieval, I would like to see simulations with the worst cases (completely different humidity profile structures, not just a simple height-constant systematic bias for the true one. . . , or did I miss this?, and such a case is give in the article?).

What structure of cloud base did you assume? Just a simple temporally constant cloud base (a very sharp edge or increase in terms of cloud drop extinction coefficient at cloud base)?

Did you also simulate a slowly increasing extinction coefficient from base to the inner part of the dense clouds so that the cloud base is badly defined?

Did you simulate clouds. with strong virga, weak virga, some drizzle below the cloud base, which may not allow a proper retrieval?

Cloud base heights depend on updraft-downdraft characteristics (and sometimes on well organized wave motions). Thus, cloud base can vary with time (within seconds and minutes). So, did you also play around with temporally changing cloud bases, or even horizontally inhomogeneous cloud bases (in the field of view of the spectrometer)?

All the questions should be answered, and as you see, at the end you need long-term comparisons with continuously running ceilometers (or something else) to convince us (scientists) that this a reliable and useful approach what you propose.

Some details:

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The introduction is long and cumbersome. I always prefer a short introduction, just briefly mention the importance of the field, the gaps in the field, your contribution, and an outline of the paper (sections 2,3,4. . .).

Section 4 (Results): Because this is the starting point and an essential issue: Please show your true cloud base height scenarios in a figure, may be in terms of the cloud extinction coefficient for a visible (500 nm) and an IR wavelengths, you are using!

And then may be show different retrieval products (retrieval scenarios in addition).

Section 5 (Discussions): Here I began to ask myself, what does all these discussions help, without any comparisons with cloud height profiling tools, showing the reality, . . . real clouds with holes, with inhomogeneous cloud base structures etc.

So, if possible, please provide at least few comparisons with ceilometers, or at least provide a broader discussion on the need of real-world comparisons, because of the reasons, I mentioned above.

Figure 1: Cloud temperature is not very specific! Cloud base, center top temperature? What do you mean?

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