Atmos. Chem. Phys. Discuss., 13, C4969–C4972, 2013
www.atmos-chem-phys-discuss.net/13/C4969/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparing the cloud vertical structure derived from several methods based on measured atmospheric profiles and active surface measurements" *by* M. Costa-Surós et al.

Anonymous Referee #1

Received and published: 21 July 2013

GENERAL

The paper compares the performance of different methods to detect the presence of cloud layers from radiosonde measurements. The authors make own proposals to improve one of the techniques. The paper is a pure methodology paper. The authors do not present any new scientific findings about the atmosphere. Nevertheless, the paper can be considered for publication, because a comparison and thorough investigation of the discussed methods is valuable. I recommend that the editor checks again if ACP

is the appropriate journal for such an investigation.

SPECIFIC COMMENTS

1) The authors use the ARSCL data product delivering cloud properties. They state that active remote sensing of clouds is only done at very view places in the world. What are the other places? Cloudnet provides a rather sophisticated product of vertical cloud distribution as well and should be explicitly mentioned here (Illingworth, A. J., and Coauthors, 2007: Cloudnet. Bull. Amer. Meteor. Soc., 88, 883–898).

2) Some general weaknesses of the radiosonde methods have to be discussed. These points may have already been addressed in the cited papers describing each single method. However, as the current paper is a kind of review, some more discussion is needed. In particular, the paper should deal with the following issues:

- Radiosondes often perform poorly at low temperature and high relative humidity >80%. The usually observed biases seem to be considered in the threshold values of the different methods. However, the development of these methods partly started in the early 1990s. Since then, new radiosondes have been developed and the measurement of relative humidity has been improved. The authors do not discuss at all on which type of radiosondes their study and the previous approaches are based. How does the error in relative humidty affect the retrievals? Wouldn't it be necessary to adapt the threshold values depending on the applied radiosonde type?

- The radiative properties of clouds are determined by their phase and microphysical properties. Radiosondes can only measure relative humidity, they do not yield any information about the phase (liquid or ice) of the cloud which is absolutely critical especially for climate modelling. Can this deficit be met?

- Radiosondes are designed to measure values like temperature, pressure etc... It is generally agreed that these are representative for a whole modelling grid point. However, cloud cover can significantly change over some hundred meters. What is the

use to have one measurement point within say 10000 km^2? Why is this information as useful as the quality assured products of ARSCL or Cloudnet? I have the impression that with this method a lot of data may be assimilated into the models which are poorly quality assured.

3) The method of Minnis et al. was developed at ARM SGP Central Facility and uses "empirical parameterizations". Later it is stated that it had to be adapted for Arctic conditions. Again, for climate modelling general globally applicable methods are necessary.

- Can this method meet these criteria?

- Page: 14418, line 19: "RH values must be converted to RH with respect to ice when temperature is less than -20 °C". Does this mean that the method assumes ice-only clouds at temperatures lower than -20°C? This should be checked thoroughly because there are liquid layers observed well below -20°C (e.g., Zhang et. al. 2010, JGR).

4) The "total agreement" parameter shouldn't be used like it is. The percentages of "perfect agreement" and "approximate agreement" are summed up making the two different values effectively equal. Another parameter must be found to characterize the performance of each method. One could for example use the "perfect agreement" value alone, because it is out of question that missing one complete cloud layer could be an issue for modelling of any kind.

5) The statistical errors of the results ("total agreement") should at least be estimated based on the number of cases used.

Additional questions/hints:

- It would be interesting to see a comparison case study between the ARSCL product and a radiosonde launch at the very beginning of the paper.

- The authors justify the need of this paper by the need of improving climate predictions. ("The cloud vertical distribution ... is an important characteristic in order to describe the

impact of clouds in a changing climate.") Is this really the most important goal? If the climate would not be changing, would this research be unnecessary?

- It is important to understand the tropics, however measurements are rare. Could the methods presented here fill this gap? Can you estimate how well your methods will perform under tropical conditions?

- Radiosondes are gradually replaced by aircraft measurements. Can the measurements of aircraft also be used instead of radiosondes? (Aircraft usually intentionally avoid cloud layers...)

- Page 14419, line 12: "agree well" - please quantify (e.g., "agree within XX percent...")

- The Figures should be numbered in the order of appearance.

- Page 14425, line 21: typo "de" -> "the"

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 14405, 2013.