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Atmospheric Measurement Techniques Discussions

Interactive comment on "Microwave radiometer to retrieve temperature profiles from the surface to the stratopause" *by* O. Stähli et al.

Anonymous Referee #2

Received and published: 13 May 2013

The authors describe a ground-based millimeterwave radiometer to measure a temperature profile from the ground to the stratopause. The publication describes the technique of the instrument and also the retrieval of the temperature profile from the measurements. Finally some quality checks are presented.

A comparison with temperature profile measured by satellite instruments and radio sondes is included as well as an example of an observation of a so-called stratospheric warming.

General:

I consider the publication a quite interesting contribution to atmospheric measurement techniques and suggest the work should be published. However, the presentation

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quality is not fit for publication and should completely be revised. Most of the issues raised below are dealing with style not with the content. Therefore the list of issues is by no means complete and I recommend to do a detailed review after the publication has been brought into a more suitable form.

The readability of the manuscript suffers from repetitions and a missing line of argument. To me the manuscript looks more like a collection of material not like a manuscript written for publication. I am a bit surprised about this, because some of the coauthors have an impressive list of publications already.

Furthermore I would recommend a check on the language, i.e. copy-editing.

Abstract:

The abstract contains information which is not really important, e.g. sentence 2: " The instrument operates thermally stabilized inside a lab." The authors should remember, that the abstract and the conclusion are the parts which are read first in order to make a decision if the publication is worth reading. Therefore I would suggest to rewrite the abstract to contain only the information of what has is done and what has been achieved.

Introduction:

Generally the introduction should be reordered to make reading it more easy. The authors tend to jump, e.g. at page 3 line 23ff the authors describe what is contained in the publication, carry on with describing their own group activities and go back to the detailed content in the last paragraph of the introduction.

The authors should keep in mind that from 2014 no satellite will be able to measure stratospheric profiles of gases and temperatures will be available anymore, at least not on high altitude resolution. In my view, this is the most important justification of doing measurements of ground-based profiles using ground-based millimeter wave radiometry. Do the authors think otherwise, because they do not mention this?

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Page 2 Line 20 Please include some of the most important citations.

Page 3 line 6

Citations!

Page 3 line 13

There is a bracket missing.

Page 3 line 15-16

This sentence is not really connected to the text before.

Page 3 line 21

I think a few sentences should be written about the instrument described by Svetsov et. al. (2010) in comparison to the instrument described here, line measured, alitude range and such.

Chapter 2

Page 4 line 19 ff and equation 1

The introduction of the Rayleigh Jeans limit is too early here. The formula 1 is still general, the Rayleigh-Jeans approximation is used in equation 4.

Page 5 line 18

This sentence is a repetition of line 10 on page 4.

Page 5 line 18 and 19

The specification are noted in table 1 not figures 1 or 2.

Page 6 line 18-20

This is confusing and the important information, that the FFT measures always the same frequency range is submerged in less important detail information.

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Page 6 line 17

I doubt that the technique of using an IQ-mixer is common knowledge. Please add either a citation or describe it in more detail.

Page 6 line 25

Please be a bit more specific which details are listed in table 2.

Page 8 line 6 ff

At which temperature is the hot load?

Page 8 line 21

In consider the calibration of the spectra quite crucial. Therefor add a few more details: What do you mean by "normally stable"? What is abnormal? Has this been measured? How many weeks are several weeks?

Page 9 line 10,11

The problem is ill-posed because the noise has an excessively large influence.

Page 9 line 17

The solution is actually the probability distribution "a posteriory". The optimal estimation method restricts all distributions to be Gauss distributions, therefor the mean "a posteriory" is equal to the mode of the "a posteriory distribution".

Page 10 line 19 – 25

This paragraph does not belong here.

page 10 line 26

Is another ARTS (instead of ARTS2) package used here?

Page 11 line 10

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Which user guide?

Page 11 line 11

What does this mean? The weighting functions are the partial derivative, so there is only one state variable perturbed per partial derivative.

Generally I think section 3.3. has too much weight for this publication and it does not contain anything important in the context of temperature measurements. I would propose to just state a few facts on what is used.

Chapter 3.4.

The smoothing error is defined differently in Rodgers(2000). Please correct.

Is the error eq. 15 really random?

What is about systematic errors, spectroscopic error, calibration error and such. How much influence has the missing modeling of the Zeeman effect?

Chapter 3.5.

Again, what is normal?

Page 14 line 15

The forward model grid is coarser than the retrieval grid? Please justify.

Page 15 line 3

Is the information about the ILW taken from the TROWARA? This information should come before it is referenced. What is meant by "the retrieval works fine"?

Page 6 line 15 ff

That means there are 3 independent layers under 1000 m and 5 underneath 10 km?

Looking at figure 7 I would guess there are only three independent layers in the region

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up to 10 km.

Page 17 line 7

What do you mean be "reasonable"? Please quantify, also justify the threshold.

Chapter 4.2.3

How are they compared? Using the AVK's, directly? Are the radiosonde data binned and averaged over the bins?

Page 18 lines 5 and 17 You use the expressions "fairly well" and "reasonably well" for the same comparison. I would recommend using numbers or a graph showing the results rather than use descriptions which are not objective and even seem to contradict each other.

Page 18 line 3ff

How significant is a CC > 0.97? Why is a CC > 0.86 good? Please justify.

Page 18 lines 16-21

This seems to be a repetition of what is said earlier.

Page 18 lines 22-27

Why is this interesting? This seems completely unconnected to the rest of the manuscript.

Page 19 line 11

This is only the error due to measurement noise and the smoothing error, not the retrieval error. This error has also been called observation error in chapter 3.4. I would recommend to stick to one term.

Chapter 4.3.1 and 4.3.2

Please put the text into a stringent order and remove double information.

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Figure 14

In the text page 19 it is said, that the calculated spectra agree well to the measured except in the line center. This cannot be seen in this figure, please append a residuum for clarification of what you mean.

Technical comments:

I believe the term altitude is commonly used instead of height (above sea level). Please check this.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 2857, 2013.