Earth Syst. Sci. Data Discuss., 6, C12–C17, 2013
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Earth System Science Data Discussions

Interactive comment on "Mesospheric CO above Troll station, Antarctica observed by a ground based microwave radiometer" *by* C. Straub et al.

H. C. Pumphrey (Referee)

hugh.pumphrey@ed.ac.uk

Received and published: 16 April 2013

1 Statement of involvement

I should state for the record that I am not un-connected with the work described in the paper under review. I have collaborated with one of the authors (D. A. Newnham) on this dataset at an earlier stage in its development. At that time, we identified the appearance of the "shoulders" which the spectral line acquired in 2008. I wrote up our finding in a short report which I gave to Dr. Newnham.

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2 General remarks

This paper describes measurements of CO in the middle atmosphere by a ground-based microwave radiometer. Such measurements are not trivial to make. While they may initially appear of limited value compared to satellite datasets, it is important to realise that there are few planned missions with the capability for detailed measurements of stratospheric chemistry, so ground-based instruments may be of importance in providing data continuity into the future, in addition to providing valuable correlative data for extant satellite missions. It is therefore useful that the authors are making the data available to the scientific community and the paper should be published for that reason. The paper is carefully prepared, requiring remarkably few technical corrections, and the standard of written English is very good. I have confirmed that the data are available as stated and that they are in a form which is straightforward with which to work.

3 Specific comments

Abstract " due to very low CO concentrations below approximately 80 km altitude in summer, profiles can only be retrieved during Antarctic winter." That isn't strictly true. It may be the case that your retrieved profile has sufficiently large error bars and a sufficiently small mixing ratio that it is not statistically different from zero. But you can nevertheless obtain the profile.

Abstract The wording should make it clear that the DOI presented at the end of the abstract (doi:10.5285/DE3E2092-406D-47A9-9205-3971A8DFB4A9) is for accessing the data. As it is, the reader may think that it is the DOI for the paper itself. Use of a DOI in this manner to refer to a dataset is a new thing to me and will be to many other readers.

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Page 3 Line 18 "The profiles presented are stored in the database of the British Antarctic Survey." It might at this point be worth giving a URL by which the reader can access the data. It is probably most robust to give http://dx.doi.org/10.5285/DE3E2092-406D-47A9-9205-3971A8DFB4A9 Although the DOI has been given at the end of the abstract, not everyone is yet aware that URLs of the above form can be used to locate datasets. It is worth noting that this URL currently points to a page that describes the data and has a button at the top labelled "Request data" which takes you to a form to be filled in. However, if you scroll down the page you discover that it is not necessary to fill in the request form; you can download the data immediately.

Page 6 line 2 "...the baseline can be approximated by a 6th order polynomial curve fitted to the data." Approximated how well? The authors should explain why they chose a 6th order polynomial and not any other order. They should also explain how they prevented the polynomial from fitting part of the spectral line itself. When I worked on this data I found that fitting the baseline with a quadratic (over a smaller frequency range) tended to give this sort of problem. It may be that by choosing a large enough bandwidth the polynomial uses all of its fitting potential to fit the standing waves and none to fit the lineshape. Or maybe the authors excluded the line centre region when determining the polynomial coefficients.

Page 6 line 4-7 As noted above, I described the "shoulders" mentioned here in an internal report which I delivered to Dr. Newnham. The authors should probably acknowledge this report as a personal communication although, as it is grey literature, they can't do a formal reference of it. The main recommendation of my report was that the cause of the "shoulders" should be identified — it is good to see that the authors have succeeded in doing this. They should probably state in more detail than there is here, or at page 7 line 20, how the form of the empirical correction was arrived at.

Page 7 line 3 The authors should state how large the frequency offset was: I got it to be between -50 and -160 kHz most of the time. The authors should explain as far as they can the physical cause of the frequency offset. My own opinion was that it was partly

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a Doppler shift due to winds in the mesosphere and partly an instrument calibration issue. But I never learned enough about the instrument to quantify the relative sizes of these two effects.

Page 7 line 7 and Fig. 5 I note that in both of the examples in Fig. 5 the a priori profile is considerably larger than the retrieved profile. I can't tell if that is always the case as the supplied data files do not contain the a priori profile. The authors might like to consider adding an extra column to the data files containing the a priori profile assumed for each file. The difference between retrieved and a-priori profiles is considerably larger than the a priori errors. This suggests to me that it might be possible to relax the a priori errors a little, achieving slightly less of an a-priori contribution to the final result, without the retrieved profiles becoming too ragged.

Page 9 lines 22-24 "For these plots (described below) the values closest to the indicated pressure levels are used without taking differences in the vertical resolution of the datasets into account." This may or may not be a mistake, given the very different resolutions of the ground-based instrument when compared to MLS and WACCM. The authors have done the convolution with their instrument's averaging kernels for the comparisons shown in Figs. 8 and 9, so they should be able to state how much difference it makes to ignore the resolution difference. Also, the authors should state how the MLS data for this plot were selected in terms of horizontal co-location. It is possible that they have used the $\pm 1^{\circ}$ latitude, $\pm 5^{\circ}$ longitude criteria mentioned on page 10 line 13; if so, it is worth remarking that there are days when as many as four and as few as zero MLS profiles fulfil their criteria.

Page 13 lines 18-20 "... the BAS radiometer will be taken back to Antarctica during the austral summer of 2012/2013..." Given that this austral summer is now almost over, "will be taken" should be changed to "was taken" (assuming that the instrument was indeed shipped to Antarctica as planned).

Fig. 3 I do not find that this figure conveys the nature of the "shoulders" described at

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page 6 line 5 very clearly. They become somewhat obvious when you are working with the data yourself, but it is not easy to construct a figure that conveys them clearly to the reader. My own attempt is in Fig. 1 below. I have used a different range of colours for the "before" (greens) and "after" (pinks) periods, indicated the location of the shoulders with arrows, and included several spectra (each displaced from the next by 0.25 K) in order to distinguish the "shoulders" from the day-to-day variability. Even with all this, you have to study the plot for a while in order to see the nature of the change that occurred on 9 August 2008.

Fig. 7 It is easy to see from this figure that the MLS and MR data are correlated on a timescale of months. But it is difficult to infer from this figure whether they are correlated on a timescale of days, or whether all that short-term variability is noise in one or both instruments. I am not sure what solution to suggest, but the authors may like to see whether they can identify one.

4 Technical corrections

Page 10 line 25 "to use WACCM" should be "the use of WACCM"

Page 12 line 12 "compare" should be "compared".

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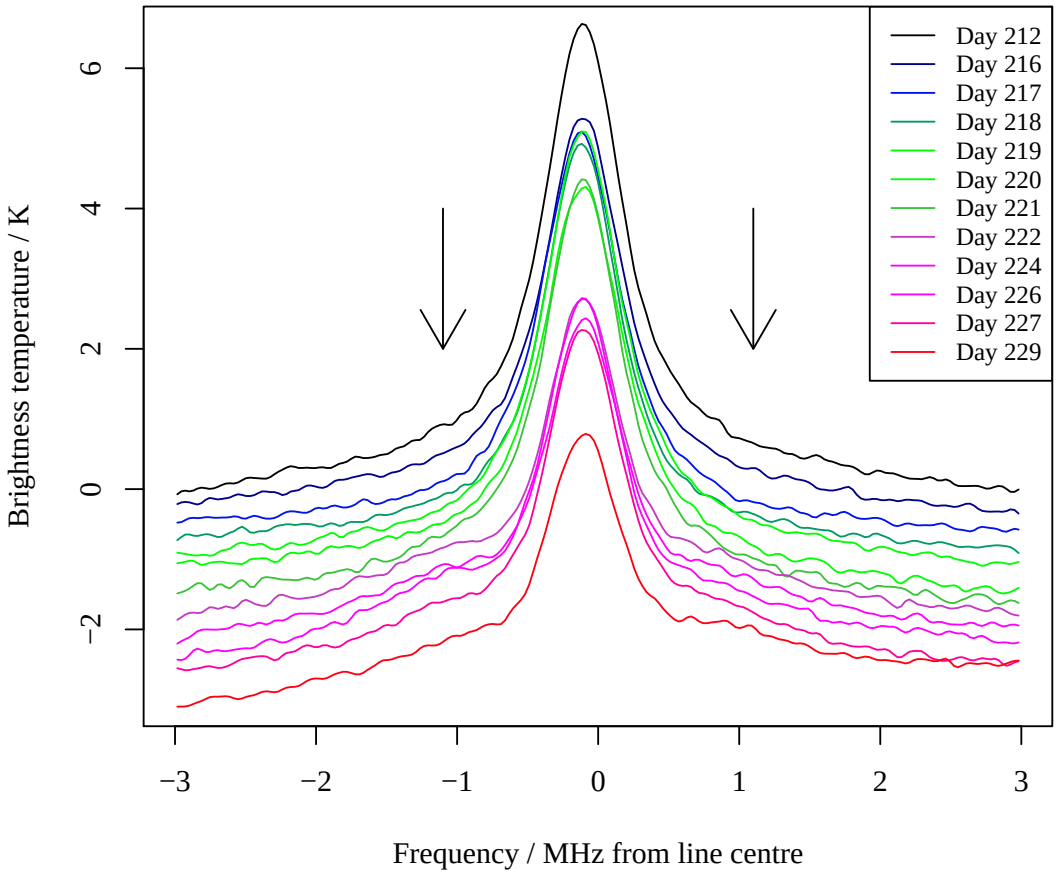

Fig. 1. Spectra for days around day 222 (9 August) 2008. Arrows indicate the "shoulders" which appear on day 222 as described in the paper under review.

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