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Geoscientific Instrumentation Methods and Data Systems Discussions
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Interactive comment on "A compact receiver system for simultaneous measurements of mesospheric CO and O_3" *by* P. Forkman et al.

Anonymous Referee #2

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General comments:
There exist very few ground-based instruments that are capable to measure the altitude profile of CO in the mesosphere. The instrument at the Onsala Space Observatory as described in the paper by Forkman et al. is a state of the art instrument operated in double side band mode allowing to observe ozone and CO at the same time in a frequency switching mode. The paper is clearly written and interesting and merits publication. However there are two topics I would like to see improved before final acceptance: discussion of trustable altitude range of the retrieved CO profile and the tropospheric corrections.

Specific comments:

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

Trustable altitude range:
The authors claim that data are useful for an altitude range where the contribution from the a-priori profile is less than 20%, i.e. where the measurement response is >80%. The measurement response is equal to the area under the averaging kernels. In case of CO retrieval these kernels show distinctive problems. There is a strong negative part for lower altitudes. The authors claim that this is not critical as at these altitude changes in the VMR profile of CO are not expected and values in VMR is small. Unfortunately the wavering kernels also suffer from another problem. The park of the kernel significantly deviates from the nominal altitude and in fact none of the kernels parks above 80km as can clearly be seen in Figure 9. The plot of the measurement response and of the kernels in this same figure clearly shows that according the definition of the authors data are usable up to an altitude of approx. 93km (left part of figure). On the other hand it is clear that the kernels practically have no contribution. Misleading also is the white line in Figure 8 indicating the same problem of the measurement response. In some occasions it even goes to an altitude of 100km where definitely Doppler-broadening does not allow to retrieve any meaningful information. The authors must deal with this problem. It is not sufficient to merely refer to a previous work by Hoffmann saying that this is a typical behavior of the CO retrieval. I would like to see a detailed discussion with information about where the kernels peak and the usefulness of the measurement response in this context.

Tropospheric correction:
I have read this paragraph several times but have not understood how the correction is done. I do not understand what is described on p. 326. The whole process with the random number r is at least for me not understandable. Please reword this whole paragraph in a way it is more clear what you do. Explain why you do not use just the information from one of the two dual-channel radiometers. What is the advantage of this information about the fractional cloud cover if you observe in one direction.

Further comments:

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Observations are taken at an elevation angle of 80°. Please indicate why this selection was made. The spectral resolution is 25 kHz. Discuss this resolution in context with the Doppler broadening.

Technical comments:
p. 318, eq.(10): say that this is the classical Y-factor measurement
p. 320, l.18: CW source is connected to the radiometer
p. 321, l. 4 and 9. Please indicate how g_{lsb} and G_L and g_{usb} and G_U are related
p. 325, l. 26: constructed of data
p. 326, l. 4: say what LWC is
p. 328, l. 3 and 4 I think in order to give the degree of freedom one should not use the sign for degree.

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 5, 311, 2015.