**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "CO at 40–80 km above Kiruna observed by the ground-based microwave radiometer KIMRA and simulated by the whole atmosphere community climate model" *by* C. G. Hoffmann et al.

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1   General remarks

This short paper compares CO mixing ratio data from a ground-based microwave instrument with the output of a model. Models which cover the mesosphere are common, as are chemical transport models driven by assimilated wind fields, so that their behaviour tracks that of the real atmosphere. However, models which do both of these

things are rare: until recently most CTMs did not extend much above the stratopause and most models covering the mesosphere were free-running. The model used here is not exactly a CTM; it is an established whole-atmosphere model with fully-coupled chemistry and transport. The new variant of it used here is important because it can be nudged to follow the real dynamics of the atmosphere at a specified time, *and* that it models the entire mesosphere. And as the authors note, there are a number of good reasons for comparing this new modelling tool to real data.

The paper is well written and the figures are produced with due care: they are generally legible and have sensibly-sized labels.

I recommend that the paper should be published, subject to a number of corrections.

2 Specific comments

- Fig. 1: I do not find this figure particularly informative. It would be better to show the averaging kernels themselves as well as the sensitivity shown in the left-hand panel. I do not think that the right-hand panel is very informative at all. The figure should cover the vertical range 0-120km so that the reader can see what the useful range is for himself.

- Fig. 2: I would be in favour of plotting the left-hand panel of this figure with a logarithmic VMR axis. The differences in the right-hand panel should be shown as percentages of the total VMR — this would allow the reader to see what is going in the lower part of the figure. It might also be a good idea to show the MLS and SDWACCM data at their original resolution, so that the reader gains an idea of what the KIMRA averaging kernels have done to the data.

- Page 570 line 10: It is hard to know what the words "consistently more curved" mean in this context. I find them either wrong or misleading. A less vague de-

scription might be that the KIMRA profile is more curved between 60 and 65 km and less curved elsewhere.

- Fig. 3: I would be in favour of showing repeats of this figure for 45 km and 75 km as well, to give the reader an impression of whether the three time series agree better or worse at different altitudes.

- Pages 572-3 and Fig. 4: As with Fig. 1 it would be good to see this figure extended above 80 km so that we can see where the model and data cease to be correlated at the top end of the range. This would add weight to the statement on line 10 of P573, linking the correlation coefficients to the sensitivity of KIMRA. To do this may require extending one or more of the datasets upwards in some manner (which should be documented) in order that the KIMRA averaging kernels can be applied.

- Page 573: The correlation coefficient is only one way of quantifying and summarising the relationship between two measures of the same thing. You would hope to find a linear relationship between the two CO values at a given altitude with a slope of 1 and an intercept of 0. For a given positive value of correlation coefficient, the slope could be any positive value. It might be illuminating to plot profiles of the slope of the relationship as well as of the correlation coefficient.

- Page 574 and Fig. 5: I do not feel that Fig. 5 adds anything useful to Fig. 4: I think that Fig. 5 could be eliminated. On the other hand, the figure in the supplement is somewhat illuminating; I would include that material in the main paper and do away with the supplement. In any case, the purpose of supplements is to allow the inclusion of items such as animations, datasets etc. which can not be incorporated into the paper proper.

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3 Technical corrections

- Page 562 line 29: "build" should be "built".

- Page 562 line 19: "all other" should read "both of the other"

- Page 574 line 26: "is likely due" should be "is probably due". Despite ending in "ly", likely is an adjective, not an adverb. Use of likely as an adverb is a sloppy colloquialism that has no place in scientific writing. (The fact that IPCC use "likely" in this way does *not* make it correct usage.)

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