Geoscientific

Model Development

Discussions

GMDD

Interactive

comment

Interactive comment on "The Canadian atmospheric transport model for simulating greenhouse gas evolution on regional scales: GEM-MACH-GHG v.137-reg" *by* Jinwoong Kim et al.

Anonymous Referee #2

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This manuscript describes the set-up of a new Limited Area Model for the modelling of atmospheric CO_2 concentrations as part of the wider range of models at ECCC. The LAM is compared to the global model to assess the benefit of modelling at higher spatial resolution over the North American domain. The paper is mostly descriptive, although the Discussion draws some conclusions and presents some recommendations. As such, it does fit the scope of GMD. The manuscript fits also very well in the increasing debate about transport errors in the (inverse) modelling of CO_2. Various groups are pushing for increased resolution to minimise the transport errors and thre

is also a discussion about the advantage of LAM models versus of-line models. The manuscript is well-written and everything is clearly explained.

The authors have put together a LAM with similar characteristics as their global model, which is indeed a very sensible way to go. In my view, the paper would have been more interesting, if a regional off-line model would have been included in the study as well. This would have allowed for the additional assessment of using a LAM versus using an off-line model in terms of transport errors through for instance interpolation approximations. I do realise, however, that this would have significantly increased the work, so maybe it can be considered for future work. For this paper, it would be good to have an additional paragraph on this consideration.

My main issue is with the quality of the figures. Some of them are difficult to read (e.g., Figure 7), have washed-out colours (e.g., Figures 8 - 10), or contain too many curves or points (e.g., Figures 12 and 13). I encourage the authors to look at these figures again to see if they can be simplified or made clearer.

Some minor comments: Section 4.1, first paragraph: while I can fully understand why the STDE would be reduced with increased resolution, it is not directly obvious why the bias should be different between the different resolutions. It would be useful to comment a bit more on this in this paragraph. Page 15, line 20: this should be Section 2.5 Page 19, lines 1 - 5: it would be good to refer here to the 2019 Agusti paper as well, because it deals with the flux resolution problem by explicitly modelling these fluxes at the same resolution as the transport model.