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Interactive comment on "Three-dimensional methane distribution simulated with FLEXPART 8-CTM-1.1 constrained with observation data" *by* Christine D. Groot Zwaaftink et al.

Anonymous Referee #3

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The article by Groot Zwaaftink et al deals with nudging of modelled methane concentration fields towards surface observation data. It is an interesting and important contribution in its field, and suitable for publication in GMD. The paper is well written. I have a couple of minor comments, which are given in the following:

I agree that using spatially inclusive data sets, such as satellite data, would provide a valuable addition for evaluation of the model results. The data has limitations (biases etc.) but still they could possibly be used for retrieving e.g. latitudinal band averages of the column concentrations and compared to corresponding model products, to see e.g. the changes in the north-south gradient and annual cycle.

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Moreover, I am missing an example (figure?) of how the effect of nudging is seen on the evolution of concentrations at different altitudes over a time period of days/weeks.

You mention in line 123 that you save the output in 2x2 degree resolution. Why is this resolution chosen, though you have the ability for 1x1 resolution ? Generally, how would the results change if you made the simulations in a higher spatial resolution? And the kernel settings, e.g. choices for the spatial nudging kernel sizes?

Is the vertical kernel size hz (Eq. 2) related to tropospheric boundary layer height? Could you use e.g. model predictions of boundary layer height for hz? Or add night/day variation to hz? Boundary layer height might not be meaningful for all stations, as they are located at different altitudes and sampling routines vary, but should there be some variation in the hz from station to station ?

Seems that quite much trust is given to the stations with low standard deviation, as in NV3 the concentrations are forced to follow observations at Palmer Station almost from point to point (Fig 5). The bias is corrected, but the concentration is forced to stay close to the value given by the observation, which is made only once per week. Could you elaborate this a little bit more, you say that this is a more realistic choice for a remote low emission site, but is the model ability to make predictions and fill in the gaps then lost?

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