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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulations of atmospheric methane for Cape Grim, Tasmania, to constrain South East Australian methane emissions" *by* Z. M. Loh et al.

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We thank the reviewer for their helpful comments. Each comment is addressed below, with the original review in italics and our responses in normal font.

Major comments:

The authors should show how well such low-resolution global models reproduce local tracer transport phenomena (here, local does not mean the southeastern Australia region, but means a much smaller region). If the models cannot simulate local transport phenomena, it cannot be ruled out that the model-observation discrepancies are

caused by the model error. If the models fail to reproduce local transport and some local emission contributed seasonal CH4 variations, a different conclusion could be made. Even if CH4 data are excluded at times when CCAM fails to reproduce observed high-radon concentration, are seasonal patterns of CH4 concentration and CH4-radon ratio still similar to those shown in the manuscript?

Low resolution global models (with low resolution input fluxes) are unlikely to reproduce local tracer transport phenomena. Additionally, using offshore grid-points to represent Cape Grim, aims to minimise the influence of local fluxes to preferentially focus on regional signals. Given this modelling strategy, the reviewer asks a valid question as to whether the analysis is sensitive to local flux signals in the observations and whether local signals contribute to any of the discrepancy seen between model and observed seasonality. To test this, we have repeated the calculation of the monthly observed methane-radon ratios but excluding all methane-radon pairs for times when the observed wind speed is lower than 3 m/s at 10m. Since local signals are more likely to dominate when wind speed is low, this should minimise the influence of local fluxes on the analysis. We find that there is no significant change to the observed seasonality of methane to radon ratio. Monthly ratios change by at most 0.4 ppb/(Bq m-3) or less than 6%. Given the small impact of this wind speed filter, we have chosen not to modify the text.

Minor comments:

It would be helpful that the CH4 budget estimates for southeastern Australia (by this study and other previous papers) are summarized by a table.

This has been added (Table 3).

P21193, L4: "Cape Grim has been operating..." => may be like "The Cape Grim station has been operating..."

Done

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Figure 2: Why is the year 2003 chosen for showing CH4 and radon observation time series, though radon data are missing in one month?

There was no specific reason for showing 2003. We have changed the figure to 2006 which has more complete records. The text in paragraph 2, Section 2 has been modified accordingly.

P21193, L25: Which inlet data did the authors use for their analyses, 75m or 10m?

Data from both inlets are used. This information has been added to the text (Sec 2, paragraph 3: "The data from both inlets are used in this study.").

P21196, L16: Please clarify that EXTRA has the same IAV biomass burning emission as BB and WLBB.

This information has been added (Sec 3.1, paragraph 2: "EXTRA uses the same biomass burning as BB and interannually-varying model generated wetlands and rice emissions from the VISIT model").

P21198, L5: Maybe, the wetland emission included in the EXTRA scenario is from VISIT (Ito and Inatomi, 2012), but not from Ringeval et al. (2010).

The wetland emission in EXTRA had been incorrectly attributed to Ringeval et al. The text (Sec 3.1, paragraph 2, as point above) and table 1 have been corrected.

P21199, L5: Please elaborate why did the authors choose the model output points that are located slightly to the north of Cape Grim. If the model grids were chosen by seeing how well radon concentrations are simulated (as stated in P21202, L10-12), please describe it here.

For CCAM this was the nearest ocean grid point. For ACCESS the choice was made based on the radon simulation. Two sentences have been added to the appropriate paragraph in Sec 3.2 (was paragraph 3, now paragraph 4).

P21199, L15: When are "two periods"?

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This information has been added (Sec 4, paragraph 1: "The first feature was two periods, December 2002 to February 2003 and November 2006 to January 2007, with very high peak... ").

P21199, L16-18: Is the feature of the large winter CH4 differences coherently found in all the years?

Yes. 'each' has been added before 'winter' in the appropriate sentence to make this clear and Figure 4 has been extended to show three years to further illustrate this point.

P2199, L25-27: "the remaining emission : : :. Bousquet et al. (2006)" should be changed to like "the remaining emission scenarios using modified wetland emissions (WLBB and EXTRA) or that based on the inversion of Bousquet et al. (2006) (INV)."

Done.

P21200, L3: "H2" => "hydrogen (H2)", "CO" => "carbon monoxide (CO)"

Done.

P21205, L14: "WLBB" might be "WLBB/EXTRA"

Done.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 21189, 2014.