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

Anonymous Referee #1

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1 General comments

The manuscript analyses the simulation results with the six different emission scenarios with observations at Cape Grim, Tasmania, toward constraining the South East Australian methane emissions. The analysis is focused on the non-baseline events of the concentrations which are influenced by the local and regional emissions.

It is interesting that the two different model runs show overall similar mean features in seasonal cycle, when the ratios of residual CH₄ concentration and radon from the two model runs are compared to minimize the impact of the transport difference between

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the models. The authors discuss the main differences between the model ratios and the observations, and attribute the discrepancies between the models and observation to the representation of wetland methane. But they do not mention differences between models and other specific mismatches, this leaves questions.

The manuscript is descriptive with the simulation results with the prescribed emission scenarios. It would have been nice to see additional model experiments to support their implications. From the comparison between the simulation results and observations, the authors conclude that the austral winter wetland methane emissions are overestimated, but suggesting the springtime maximum of wetland emissions. To support the idea, the authors show the satellite measurements (Fraser et al., 2011), but it would be more interesting and supportive to try to assess (at least partially) the sensitivity of seasonality in wetland emission to the simulated residual CH₄ concentrations, as well as the ratio of CH₄ and radon.

2 Detailed comments

- Section 3.1: The authors state that the maximums of WLBB and EXTRA are in December and January due to biomass burning, as seen Figure 3. I wonder how much the annual wetland emission in WLBB and EXTRA and how the seasonality looks like, compared to the wetland fluxes in CTL and CTL_E4 and BB which has annual total of 1.24Tg/yr with high emissions for May to October. How about the CH₄ emission from rice cultivation? How significant the rice emission among the total CH₄ emissions and in the seasonality? The seasonal variation of wetland (and rice) CH₄ emission is one of the key points in this study. These would be helpful to understand the results discussed in the later sections.

- Table 2: The difference between WLBB and EXTRA is only rice CH₄ emission. The inter-annual variation periods of wetland emissions are different between WLBB and EXTRA in Table 2? Why?

- Section 3.2: The description on ACCESS is not clear. How different is the run for

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this study from the run for TransCom-CH4? Why this ACCESS run can be analysed on synoptic variations for statistical purpose, but not for individual events? It would be helpful to give more description of the ACCESS model, and to explain why the two models used in this study.

- Section 4: ".exceptionally high methane concentration in January and February ... (BB, WLBB and EXTRA)" But it seems inconsistent with Figure 4, where high concentrations in January and February can be seen in BB and WLBB and INV in (a)ACCESS, and BB and INV in (b)CCAM. EXTRA shows the lowest concentrations among the simulations by both model runs.

- Figure 4:BB and EXTRA are in similar colors. It is hard to distinguish.

- Section 4.1: the model experiments with injection levels of fire methane have been conducted. The results are described very briefly, but it is not clear. Does the simulation with fire methane emitted in higher model level give comparable amplitude to the observation?

- Section 4.2: the discussion here is mainly regarding the difference of wetland emissions. But in Figure 7, the model runs with CTL_E4 show the difference each other, unlike the other simulations. So I would like to see some explanation on CTL-E4. How different are anthropogenic emissions between EDGAR 3.2 and EDGAR 4.0 for south-eastern Australia? I understand both are annually constant with no seasonal variation. If the difference is only increasing trend (seen in Figure 3b), CTL_E4 simulation results can be expected to be similar to CTL in this study which is focused on the non-baseline events? But the results of CTL_E4 are different from CTL, especially in ACCESS run. Furthermore, the seasonal cycles of both model ratios are not close to the observations, but the springtime ratios are more comparable to the observations than other emission scenarios.

- P.21205: The discussion on Wang and Bentley (2002) is not easy to follow. They suggested the large reduction of CH4 emission in the region of interest in this study? In

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Section 3, however, it can read that the CH₄ emission estimated by Wang and Bentley (2002) is comparable or slightly larger than those by Fraser et al. (2011) and EDGAR.

- p.21205, L24: Please spell out NSW.

- Figure 7, "tracers" should be "emission scenarios"? It is hard to see the bars of standard deviation for January and December. Their presentations need to be improved.

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

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