

## ***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 #2**

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This study shows implications that the CH<sub>4</sub> emission scenarios that have been used for previous modeling studies may have incorrect seasonal variations in southeastern Australia. Some scenarios have unrealistically large biomass burnings when unusually large fires occurred, and other sets of scenarios have a larger wintertime wetland emission. Moreover, the authors indicate that all the CH<sub>4</sub> scenarios underestimate the springtime wetland emission. These findings are derived from the comparison between model simulated and observed CH<sub>4</sub> concentrations at Cape Grim. The reviewer finds that the most novel and interesting aspect of the manuscript is that model error effects on the emission estimate, which is often impeditive in such model-observation compar-

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ison analysis, are diminished by using CH<sub>4</sub>-radon ratios. This paper is well written and clearly structured. The reviewer believes that this paper contains results that could be of interest to the GHG research community. This manuscript is publishable after minor revisions.

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 CH<sub>4</sub> variations, a different conclusion could be made. Even if CH<sub>4</sub> data are excluded at times when CCAM fails to reproduce observed high-radon concentration, are seasonal patterns of CH<sub>4</sub> concentration and CH<sub>4</sub>-radon ratio still similar to those shown in the manuscript?

Minor comments:

It would be helpful that the CH<sub>4</sub> budget estimates for southeastern Australia (by this study and other previous papers) are summarized by a table.

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

Figure 2: Why is the year 2003 chosen for showing CH<sub>4</sub> and radon observation time series, though radon data are missing in one month?

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

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

P21198, L5: Maybe, the wetland emission included in the EXTRA scenario is from

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VISIT (Ito and Inatomi, 2012), but not from Ringeval et al. (2010).

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.

P21199, L15: When are “two periods”?

P21199, L16-18: Is the feature of the large winter CH<sub>4</sub> differences coherently found in all the years?

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).”

P21200, L3: “H<sub>2</sub>” => “hydrogen (H<sub>2</sub>)”, “CO” => “carbon monoxide (CO)”

P21205, L14: “WLBB” might be “WLBB/EXTRA”

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