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Interactive comment on “Climate-CH₄ feedback from wetlands and its interaction with the climate-CO₂ feedback” by B. Ringeval et al.

Anonymous Referee #1

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The paper address the feedback between climate and methane cycle due to changes in CH₄ emissions from wetlands. This topic is suitable for *Biogeosciences*. The paper delivers quantitative estimate for additional rise in atmospheric burden of methane due to this feedback under SRES A2 anthropogenic scenario. Moreover, the paper suggests a conceptual framework for diagnosing interactions between changes in global mean temperature and atmospheric burdens of carbon dioxide and methane. This framework is original in many respects (but not in all, see next paragraph). All methods employed in the paper are valid and clearly outlined. The presentation is well structured. The language is fluent.

The basic shortcoming of the paper that it does not properly credit earlier work related to the subject of the manuscript. In particular, it is stated in lines 5–6 at page 3223 that

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"Neither of the previous studies . . . explicitly accounted for changes in CH₄ concentration and its effect on CH₄" (I guess, this sentence contains a misprint, and "CO₂" should be substituted instead of the last "CH₄"). This is not true. Explicit response of CH₄ atmospheric concentration accounting for feedback between climate and CH₄ emission from wetlands and, consequently, for additional changes in CO₂ concentration in the atmosphere was considered in (Volodin, 2007: Relation between temperature sensitivity to doubled carbon dioxide and the distribution of clouds in current climate models, *Izvestiya, Atmos. Ocean Phys.*, 44 (3), 288-299, doi: 10.1134/S0001433808030043) and (Eliseev et al., 2008: Interaction of the methane cycle and processes in wetland ecosystems in a climate model of intermediate complexity, *Izvestiya, Atmos. Ocean Phys.*, 44 (2), 139-152, doi: 10.1134/S0001433808020011). The basic result of these two papers was quite similar to that obtained in the present manuscript: feedback between climate and methane cycle substantially enhances CH₄ storage in the atmosphere but hardly affects atmospheric concentration of CO₂ and global climate. Furthermore, in [Eliseev et al., 2008] an explicit study of climate-methane cycle feedback parameter, defined analogously to the present study, was performed. As a result, it is important to cite both works in the presented manuscript and compare the obtained results with the results reported in these papers (in particular, in Sect. 3.2).

Additional editorial remarks are as follows:

— Analogously to (Friedlingstein et al., 2006), in Eq. (2) at page 3207 a linear relation between change in CH₄ concentration in the atmosphere and global temperature is used. More correct is to get this relationship as a linearisation of more stringent, square root (see, e.g., (IPCC, 2001)) dependence between methane radiative forcing and its concentration. I guess, for reader's convenience, it would be suitable to indicate this procedure explicitly.

— Symbol F_{CF} used in Eq. (9) is not defined.

— In line 13 at page 3214, the paper by Ringeval et al. (2011) is cited. This paper does

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not enter the list of references. Is it the same as Ringeval et al. (2010b) in this list?

— Possible misprint in line 6 at page 3223 is reported earlier in my review.

— Captions for Figs. 1 and 5 report about colour lines. However, these figures are plotted in black and white.

— The panels in Fig. 3 are too small.

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