

## ***Interactive comment on “Global land-atmosphere exchange of methane and nitrous oxide: magnitude and spatiotemporal patterns” by H. Tian et al.***

**Anonymous Referee #1**

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Review of Tian et al., 2013

This study conducted a global-scale simulation of CH<sub>4</sub> and N<sub>2</sub>O fluxes using a process-based ecosystem model. Authors discussed the global budget, spatial variation, interannual variation, and long-term trend. Topic and methodology are potentially interesting; however, I have some concern in this manuscript.

1. First, the new finding after previous bottom-up estimates is not clear in this study. As reviewed in the introduction, many process models have already simulated global CH<sub>4</sub> and N<sub>2</sub>O fluxes. It is needed to be clarified what is the originality of this study, and then what is the major findings and progress in this study.

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2. The model was previously evaluated in USA and China (Tian et al., 2010, 2011; Xu et al., 2010); but the model for the global application is not well evaluated. Author compared the mean fluxes for some selected sites (Table 1), which is totally insufficient. In addition, surprisingly, no statistics was shown for Table 1 for comparison to the modeled results. Recently, much flux observations were available (e.g., Appendix A in Nicolini et al., 2013), which could be useful in model evaluation. Further comprehensive model evaluation is required before discussing global simulation data.

3. Authors discussed the simulated global budget, spatial variation, interannual variation, and long-term trend as it was true. However, no evaluation was conducted. For example, was the simulated interannual variation of the global budget consistent with the atmospheric concentration record? Inter-comparison of bottom-up models is insufficient as discussed in Melton et al. (2013). Without detailed evaluation for site, regional, and global scales, simulated results are only impractical argument.

4. As reported in previous studies (e.g., Melton et al., 2013), areal extent of wetland is one of the most important in determining CH<sub>4</sub> budget and its interannual variation. Since description for wetland extent was not available in the manuscript, I am not sure how the model treated interannual variation of the areal extent and its linkage to hydrologic cycle. At least, for discussing climate change effect to the trace gas exchange, detailed modeling for areal extent of wetland is required.

Detailed Model input data is better summarized in a table.

Quality of some figures (e.g., Figs. 5-7) are poor.

Page 19820 Line 2: This is not true uncertainties, and must underestimate true uncertainties. Further comprehensive analysis is required.

References: Melton, J. R. et al., 2013, Biogeosciences, 10, 753-788. Nicolini, G. et al., 2013, Atm. Env., 81, 311-319. Tian, H. et al., 2010, Biogeosciences, 7, 2673-2694. Tian, H. et al., 2011, J. Geophys. Res., doi:10.1029/2011JG001393. Xu, X. F. et al.,

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