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Title: Sensitivity of biomass burning emissions estimates to land surface information

Authors' response to anonymous referee #2

We appreciate the quick review from the anonymous referee #2. The comments are helpful to improve our manuscript, and we will revise the manuscript by following the referee's comments.

In the manuscript entitled "Sensitivity of biomass burning emissions estimates to land surface information", authors explored the sensitivity of biomass burning emission estimates to land surface information under four scenarios, based on land use and aboveground biomass. This paper just provided the results of different scenarios. It seems not a sensitivity analysis. The quantification results of sensitivity indicators are not outstanding. The sensitivity of quantified single parameter could be considered.

We approve that quantitative analyses regarding the sensitivity of individual variables could help to emphasize our results and improve the manuscript. We will additionally analyze this point and describe the results in the revised manuscript.

1. How to explain the meaning of equation 2?

   Eq. (2) shows variability of flammable fuels as a function of burning efficiency, above-ground biomass, and number of fire occurrence. We will add short explanation on Eq. (2).

2. Which variable of the formula can LCC and ACB provide data for? Please explain the relationship between LCC/ACB and emission estimation in detail.

   We agree with the comment that the relationship between LCC/AGB and emission estimates is not clear in the manuscript. We will clarify it.

3. What is the difference between providing data by MCD12Q1 and MOD14A1?

   Both MCD12Q1 and MOD14A1 are MODIS products, but the former is a product to provide global land cover types at yearly intervals and the latter is one for thermal anomalies and fire events. In our study, MCD12Q1 is used for land cover classification, whereas MOD14A1 is used to estimate changes in burned area.

4. Please supplement the discussion of the proportion of various types of biomass emissions (e.g., crop, forest, etc.) under different scenario for different LCC and AGB, and compare them with other studies.

We agree with the reviewer on comparing different emission scenarios based on land cover types. We will add this analysis in the revised manuscript.

5. In this paper, the different types of crops straws were not considered in the emission factors and activity data. There is comparable difference in emission factors of various crops straw, such as corn, rice, wheat, etc.

Emission factor could differ among different types of crops, while fixed emission factors are applied in our study. This is because that it is not able to obtain information on types of crops from the LCC data we used. As the reviewer suggested, this 'rough' LCC classification could be a factor of uncertainty in emission estimates, and we will discuss this point on the impact of different types of crops to biomass burning emissions by citing corresponding previous studies.

6. In this paper, MNM is set as the background station, whether it is similar to other pollution sources of the other two stations.

The MNM station is located in an isolated island over the Pacific and observation data at this station can be generally treated as background variability. We will add additional explanation on the MNM station.

7. Line 105-106, why the concentration of CH4 is fixed and what is the basis for setting it?

There are no observation data covering global distribution of atmospheric CH_4 variability including its vertical profile information, and the variability in the upper troposphere and stratosphere is little known. Thus, we decided to use fixed CH_4 concentration in our model simulation. The value of 1,800 ppb is maximum concentration of 'whole-atmosphere monthly mean CH_4 concentration' derived from Greenhouse gases Observing SATellite (GOSAT; Yokota et al., 2009) observations in the period 2009 - 2015. We agree that the manuscript should be revised to explain this point.

Yokota, T., et al. "Global concentrations of CO2 and CH4 retrieved from GOSAT: First preliminary results." SOLA 5 (2009): 160-163.

8. Line 194–195, the data is not well expressed.

This suggestion is not clear, but we will describe additional explanation for Table 4.

9. Fig.4: Incomplete display of broken line chart.

We could not correctly comprehend this comment, because broken lines are not used in Fig. 4.