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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Determinants and predictability of global wildfire emissions" *by* W. Knorr et al.

Anonymous Referee #1

Received and published: 17 April 2012

This paper reports a sensitivity study of the emission of trace gases and aerosols from biomass burning. The paper is within scope of ACP and will be of interest to a number of communities. There are a number of issues that require additional discussion and/or clarification before publication. I outline these issues (Major comments) below.

Major comments

1) One aim of this paper is to present a framework for exploring the sensitivity of emissions from wildfires to various model inputs. It is therefore important that this framework is described clearly. However, I found the methodology used by the authors difficult to follow in places. I think the paper would be improved if this framework was detailed more clearly, potentially through inclusion of a schematic outlining the methodology/framework.

2) An important issue that I think requires more discussion in the paper is uncertainty in fuel loads. This is likely to be a large, and maybe dominant uncertainty in emissions from wildfire. As the authors point out it is harder to observe fuel loads from space than it is burned area. Despite this the paper does not really attempt to explore uncertainty in fuel loads (very little mention of fuel loads in Methods, Results or Discussions). How sensitive are emissions to assumptions about fuel loads? Your paper concludes that global emissions are most sensitive to burned area and combustion completeness. Are fuel loads less important? This issue needs more discussion. Ideally I would like to see an additional set of simulations where you explore the sensitivity of emissions to fuel load. If this is not possible then authors should make it clear that the sensitivity to fuel load was not fully explored in this study.

3) The authors conclude that choice of burned area product has the greatest impact on the interannual variability in emissions (Abstract: P4244, Line 18). If true, this is quite an important result as it implies that climate driven changes to emissions will be mostly due to changes in burned area, rather than changes to, for example, fire severity. However, I found little analysis or discussion in the paper to support this conclusion. This conclusion should be removed from the paper unless the authors include additional analysis and discussion that adequately supports it.

Other than burned area, what inputs to your model vary on an interannual basis? One important variable that might impact interannual variability in emissions is fire severity. Hotter, drier conditions might drive more severe fires and increased combustion completeness. However, I think that you assume that combustion completeness is constant in any simulation and has no interannual variability. I would like to see extra discussion on this point.

What is the role of fuel loads in controlling the interannual variability in emissions? LPJ-GUESS will simulate interannual variability in fuel loads. Different vegetation models would likely have different interannual variability in fuel loads driving interannual variability in emissions. How do you know that the sensitivity to different vegetation models

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and fuel load would be less than the sensitivity to burned area? Please include additional discussion on this point.

Minor comments

Page 4246, L14-15: Radar and LIDAR remote sensing have now been used to estimate biomass loads.

P4248, L15-L17. Please clarify this sentence. What sort of disturbance are you referring to here? Why do you assume a 100 year return interval?

P4254 L20-25. It would be helpful if you calculated the uncertainty due to herbaceous fuel for comparison here.

P4256, L28- P4257, L1. Is the interannual variability over Africa really greater for MODIS than GFED3? In Fig. 3b this does not appear to be true. Please provide some quantitative statistics to back up your point here.

P4259, L26. Remove the word “to”

P4259, L20-25. I can’t find where these experiments are described in the Methods or Results sections of the paper. Is this the first time these experiments are mentioned?

P4259, L20-L25. The uncertainty in combustion factors of herbaceous fuels reported here does not appear to match the uncertainty range reported and used elsewhere in the paper (P4254. L12-14). Please explain.

P4262, Line 25. The current study explores the uncertainty in present day wildfire emissions. In my opinion I do not think the current study gives much information on the ability of models to predict the impacts of climate change on wildfire emissions. Please clarify.

P4262, Line 27. Please explain what you mean by “factors that allow determination of the associated burn conditions”.

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P4263 L2-L5. There is a body of literature where this has already been explored. Please see and cite some previous work here (e.g., Duncan and Logan, ACP, 2008).

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 4243, 2012.