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Earth System Dynamics
Discussions

Interactive comment on "The biomass burning contribution to climate-carbon cycle feedback" *by* Sandy P. Harrison et al.

Anonymous Referee #5

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The authors present an estimate for the feedback of global fires onto the carbon cycle under changing temperatures. The methods involve combining methane isotope data and charcoal sediment data to identify the relationship in the timeseries to a temperature reconstruction for the past two millennia. The authors find a positive feedback between fire emissions and global temperature in the paleo record. There is also an attempt to find a feedback in the satellite-era data on an annual basis. This path of inquiry is less successful with no statistically significant relationship found for natural fires over the short timeseries. This paper takes a nice approach to address this question of the fire-carbon cycle feedback for the paleo data. I have suggestions for expanding on the current discussion in the paper and have a few additional comments listed below.

General comments:

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Discussion paper

1. There is a general assumption throughout the paper, supported by the results of the analysis, that warming global temperatures lead to an increase in global fire. For reasons of atmospheric moisture deficit this makes intuitive sense and this relationship between temperature and fires has been shown for boreal fires in particular. Present day fire emissions are largely from the tropics – is there evidence (apart from the conclusions of this study) or literature to support the expectation of a positive global feedback? I suggest discussing how important tropical fires are or are thought to have been for the paleo time period and also what is the thinking for why global fire emissions increase with increasing temperature on long time scales. Is there any evidence for precipitation trends that are correlated to global temperatures, especially tropical precipitation?

2. I am glad the authors include the analysis of the present day in this study. The authors are very careful to note the limitations of the data here and the limitations of the conclusions that can be drawn from it. It is not surprising maybe that no significant relation can be identified in the satellite-era data but in my view this is still worth pointing out and discussing in the paper. I would like the authors to not only note the data limitations but also consider making the point that this is a very different question that is being asked compared to in the paleo sections of the paper. Fires may respond very differently on a global basis to the large annual swings in temperature (and regional differences) compared to centennial timescale temperature trends. If you agree, I recommend discussing this more in the Discussion and Conclusions section (there is some text in this vein on page 9) and also giving a short preface to this idea in the results section.

Minor comments:

Pg. 3, Lines 25-26: I am wondering why agricultural fire emissions are excluded (noting that they are a quite small category) but deforestation fires are kept in the “total fire emissions” sum. Adding a very short justification of this choice would be helpful.

Pg. 4, Line 5: Note that the variable name Nt is being used to represent the charcoal normans.

Pg 5, Lines 25-27: Why do the relationships between the charcoal and CH4 isotopes/temperature become distorted after 1700 CE?

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