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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.

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My apologies. I uploaded the wrong response to Referee 5. The correct response is given here.

Response to Referee #5

We agree that our general assumption is that warming will lead to increased fire. However, we do not claim that this is the only factor influencing fire. Analyses of satellite-era data, cited in the paper (e.g. Krawchuk et al., 2009; Bistinas et al., 2014), show that other factors play a role but that that the impact of temperature, when these other factors are taken into account, is strong and positive. On palaeo-timescales, the paper by Daniau et al. (2012, also cited in the text) shows that globally the influence of tem-

perature is positive whereas changes in moisture lead to an increase in regions where increased moisture improves fuel loads and a decrease where increased moisture creates a situation where the fuel is too wet to burn. Analyses by Marlon et al. (2013) considered the impact of climate on regional patterns, and showed that the strength of the relationship with temperature varied regionally but was always positive. We will cite this paper and will add regional analyses of the charcoal-temperature relationship to this paper (see response to Referee #1). We will also expand the Introduction to make it clear that our focus here on temperature is because we are assessing the magnitude of the global fire feedback, and not analysing the relative importance of the multiple controls on fire.

The analyses of the satellite-era data are inconclusive for many reasons. We discuss the limitations of the data, but we could have gone further into this aspect – for example, there is substantial disagreement between burnt area among different satellite data products, and certain trends that are apparent in GFED4 are not present in alternative data sets (e.g. cci). We agree that it is possible that the influence of temperature variability on interannual timescales might be different from its influence on decadal-to-millennial timescales, but we cannot establish this from the palaeodata because there is too little annually-resolved information and the interval for which we have satellite data is too short to be able to investigate even decadal variability. Again we should stress the difference between apparent responses to a single variable and the underlying relationship when all factors are taken into consideration. We therefore propose to expand the discussion of the controls on fire, including the evidence from previous palaeo-studies in the Introduction (see response to Referee #1). We will also expand the discussion of the limitations of the satellite-era data, and expand on our brief mention of potential differences between inter-annual and longer-term responses in the Discussion.

We excluded agricultural fires on the assumption that these are set by humans during suitable short-term weather conditions, and that their incidence, timing and size are

unrelated to climate or other environmental conditions. They also represent a very small contribution to total fire emissions. We will add a sentence to explain this in the text.

We will define the variable name N_t in the text.

1750 CE marks the start of the nearly monotonic rise in atmospheric CH4 concentration towards the present day and, with it, a trend towards less negative δ13C. This date also marks the beginning of the Industrial Revolution and thereafter there is increasing scope for human alteration of CH4 sources and their isotopic signatures, e.g. through expansion of grazing and human modification of fire patterns in the first instance, and the direct input of fossil-fuel derived CH4. See e.g. KR Lassey et al.: Atmospheric Chemistry and Physics 7: 2119–2139, 2007 and S Houweling et al.: Global Biogeochemical Cycles 22: GB1002, 2008. There is still no generally accepted account of the causes of variations in CH4 and its isotopes from 1750 onwards. This is not surprising, given that the data record only two quantities, whereas the possible variations in sources are many.

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