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Interactive comment on "Causal relationships vs. emergent patterns in the global controls of fire frequency" *by* I. Bistinas et al.

Anonymous Referee #2

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The manuscript analyses environmental drivers and their influence on observed burnt area by using generalized linear modelling for earth observational and other data. The authors make the point that drivers controlling burnt area are different from fire ignitions, however this is not clearly analysed and described in the text. In the presented form the manuscript describes some interesting thought but is not really presenting new insights. The methods used are well described, but the other sections require some improvement before the manuscript can be published, which I will describe in the following. A. Introduction 1. In lines 5-10 (p. 3867) the authors state that global controls increase wildland fires and attribute it to climate change. However, the cited literature do not present analyses about climate change attribution. This must be corrected. 2. Why is the term "process-based" put in parantheses? 3. The authors should include work from Kloster et al and Li et al. (BG 2014) on fire modelling and future

climate applications using the fire component of the CLM model. Also the model approach used in those models to simulate human-caused ignitions must be included in the introduction B. Data and Methods 4. Why are only 5 years of burnt area data used in the statistical analysis? This is a very short time frame to conclude about the climatic influence. 5. The authors used the GFED3 product to analyse burnt area data. Why was not the GFED4 product used? Have burnt area attributed to deforestation & degradation and agricultural waste burning been eliminated from the analyses? IF not, please explain why? 6. On page 3873, l. 3-4, the authors take the maximum daily temperature as a surrogate that there will be enough energy to heat the fuel particle to the ignition temperature. I think this assumption implies an error because it ignores the energy of the ignition source. Air temperature can only lead in extreme circumstances to self-inflammation which is usually supported by the content of volatile substances in the fuel. Please correct your assumption to what the use of Tmax actually means in the text. 7. Building a simple soil moisture model is interesting, but the underlying assumptions require a sensitivity study as to what extent the data and equations used in the model influence the calculated soil moisture. 8. Paragraph starting in line28 (p. 3873) can be merged with the above paragraph. C. Results 9. The description of the predicted global fire distribution (seasonality maps) in Fig. 2 must be expanded and describe where results are different from the observations and discuss later in the discussion section what are the possible reasons for the model errors. Presenting a R^2 for each season map is not sufficient. In addition, it must be explained why the R^2 in MAM and SON is so low? Is this related to the simple soil moisture model? How is this behaving in seasonal dry areas and classical grazing areas? Isn't the latter reducing fuel load, thus observed area burnt? 10. P. 3878, l. 10-20. Discuss all published model approaches regarding human-caused ignitions, see e.g. Kloster et al. (2010, 2012) and Thonicke et al. 2010. Also make clear in the text that the drivers of fire ignition differ from factors determining area burnt. This is what your objective of this study is, but it requires a clearly written text to make this understandable. D. Discussion

11. The argumentation of the first paragraph in the discussion is not clearly written.

Please revise what you wanted to express here. 12. P. 3879, from line 22, the point discussed here is not new in fire modelling science. The reason presented here is exactly why in the past modellers working on fire risk and fire regimes have introduced fuel classes. You need to reflect on this literature and relate your outcome to this. 13. P. 3880, l. 13-19. Human population has been related to fire suppression in fire modelling approaches before. Please analyse respective literature and include it in your argumentation. 14. P.3881, this part of the discussion is not well written and arguments are not clearly developed. In my opinion, the evidence presented here does not convince why previous model assumptions have to be corrected, since the model assumption have not been discussed. So the reader does not know what should be corrected. 15. What are the other effects that counteract the acceleration of burnt are with increasing fire ignitions? The way it is presented here, it reads like a misconception. Also, existing fire models do take into account that the number of potential human-caused ignitions decreases with increasing human population density.

Interactive comment on Biogeosciences Discuss., 11, 3865, 2014.