Interactive comment on "Wetter environment and increased grazing reduced the area burned in northern Eurasia: 2002–2016" *by* Wei Min Hao et al.

Anonymous Referee #2

Overview

The manuscript is a concise but yet relevant data analysis of the area burned over Northern Eurasia in 2002-2016 based on satellite products supported by other collected datasets. The topic of the paper fits the journal aims and scope, and the general conclusions are in general agreement with the results shown in the paper. The statistical methods applied are reasonably well described. Below the authors, will find comments and suggestions that I think could improve several aspects of the manuscript before its publication.

Abstract

- **Line 23**. First sentence needs an adjective like "current" unless the authors want to refer to a much more general assessment than the response of Northern Eurasia to current climate change.

- **Line 33**. I would not use the verb "may" in the abstract: either use "can" and develop this assessment in the paper, or skip this assessment in the abstract.

Introduction

- **Lines 46 to 56**. I think that the terminology "warming hiatus", although coming from IPCC, might be confusing for readers that are not in the topic. Several authors prefer the term slowdown, for example references [7, 2, 3]. Unless that the authors have a given opinion on this, in line 50 they could better indicate as *hiatus/slowdown* and, possibly, they could include relevant references that used the term slowdown.

- **Lines 46 to 56**. Here also is interesting for potential readers to comment about hemispherical the differences on this "warming hiatus/slowdown", as it seems important in the context of the paper. The last the version of the dataset Had-Crut (see figure 1 here included) highlights these aspects and the global mean increase of temperature is tempered by the Southern Hemisphere but the Northern Hemisphere has a more clear warming signal at the period analysed in the paper.

- **Line 53**. I would write here something "geographical components" if the authors are referring to this. Otherwise, the sentence may indicate divergence of variable inputs to calculate the FWI (that might be or not also the case).

- To remark about the sensitiveness to current climate change of Northern Eurasia, here is a good point to add recent references to this aspect [6], or any other that the authors consider descriptive. It would support the first assessment of the abstract.

- **Line 82, 83**. This is a key fact in the context of last sentence of the abstract and could be mentioned on the discussion about modelling.

Methodology. Mapping burned areas

- **Line 88 and 89**. I would recommend a better link of this aspect about uncertainties with the validation done by (). Also note that it seems that there is an improvement in the use land cover from [5] to this manuscript. However, is the validation method conditioned by the differences in land cover datasets used?

- **Lines 90 to 95**. I consider a bit confusing these sentences. In particular if "This study used" are referring to the previous [5, 4] studies or the current manuscript under review. I recommend rewriting these sentences and being more clear "This study uses . . ." "That study used" or directly "[5] used. . ." to be sure that the reader is not lost.

- **Line 95**. This dataset no longer available. Is that used from previous studies [5, 4] or also for this one?

Data sources. Land Cover

- Maybe add a comment about consistency in the products of Land Cover here mentioned (MOD12) and those of section 2.1. I understood well, that they are from same sensor but with different retrieval algorithm? Is it important a degree of consistency?

Statistical Analysis

- The M-estimation is often used to avoid that outliers condition the result. Was this a preventive decision or actually the dataset has outliers? Probably here the authors can refer already to the Figures when describing methods: annual trends Figure 2, and rank correlations Figures 5 and 6. Here also when it is indicated the validation of the estimation of burned areas, the authors may add also that it is shown in Figure 3. This helps readers.

- **Line 159**. Any particular reason for gamma distributed response or previous studies that used this hypothesis?

- **Line 169**. Any particular reason for beta distributed or previous studies that used this hypothesis?

Results

- For **Figure S1.1** a reduced vertical range from 0 to 2 may help to visualize differences. Although I understand that the authors considered a common range for all the possible effects from figures **S1.1** to **S1.4**

- **Lines 332 to 353**. The authors highlight the role of human-related factors and how they affect the predictability of Dynamic Global Vegetation Models. I found the figures S2 and S3 interesting for the discussion. Note, however, that Kazakhstan has been in the Russian Federation until 1991, so I understand that figures are trying to link the grazing intensity with this aspect. But without any specific reference, it may be a reasonable/possible link but anyway soft link. At this point I don't know if other factors in Kazakhstan could affect equally (or at least contribute to) the grazing intensity implied by Figures **S2** and **S3**. For example, the human population decreased in the 90's and increased during the 2000's.

Figures

- It is possible that the journal required an increase in resolution of several Figures to ensure good printing quality.

- In caption Figure 4, I would add write *Northern Eurasia (including Kazakhatan)* for non-linear readers of the paper.

- Also in Figure 4. Did the authors find any reason for differences between even years than in odd years? It seems to be a close to systematic pattern: burned area in even years is larger than odd years.

Typos

- There is a typo in the reference here [1] of the paper (ORCGIDEE but it should be ORCHIDEE)

References

[1] J. F. Chang, N. Viovy, N. Vuichard, P. Ciais, T. Wang, A. Cozic, R. Lardy, A.-I. Graux, K. Klumpp, R. Martin, and J.-F. Soussana. Incorporating grassland management in OR-CHIDEE: model description and evaluation at 11 eddy-covariance sites in europe. *Geoscientific Model Development*, 6(6):2165–2181, December 2013.

[2] R Checa-Garcia, K P Shine, and M I Hegglin. The contribution of greenhouse gases to the recent slowdown in global-mean temperature trends. *Environmental Research Letters*, 11(9):094018, September 2016.

[3] John C. Fyfe, Gerald A. Meehl, Matthew H. England, Michael E. Mann, Benjamin D. Santer, Gregory M. Flato, Ed Hawkins, Nathan P. Gillett, Shang-Ping Xie, Yu Kosaka, and Neil C. Swart. Making sense of the early-2000s warming slowdown. *Nature Climate Change*, 6(3):224–228, February 2016.

[4] Wei Min Hao, Alexander Petkov, Bryce L. Nordgren, Rachel E. Corley, Robin P. Silverstein, and Shawn P. Urbanski. Daily black carbon emissions data from fires in northern eurasia for 2002-2015.

[5] Wei Min Hao, Alexander Petkov, Bryce L. Nordgren, Rachel E. Corley, Robin P. Silverstein, Shawn P. Urbanski, Nikolaos Evangeliou, Yves Balkanski, and Bradley L. Kinder. Daily black carbon emissions from fires in northern eurasia for 2002–2015. *Geoscientific Model Development*, 9(12):4461–4474, December 2016.

[6] Tomonori Sato and Tetsu Nakamura. Intensification of hot eurasian summers by climate change and land–atmosphere interactions. *Scientific Reports*, 9(1), July 2019.

[7] Xiao-Hai Yan, Tim Boyer, Kevin Trenberth, Thomas R. Karl, Shang-Ping Xie, Veronica Nieves, Ka-Kit Tung, and Dean Roemmich. The global warming hiatus: Slowdown or redistribution? *Earth's Future*, 4(11):472–482, 2016.
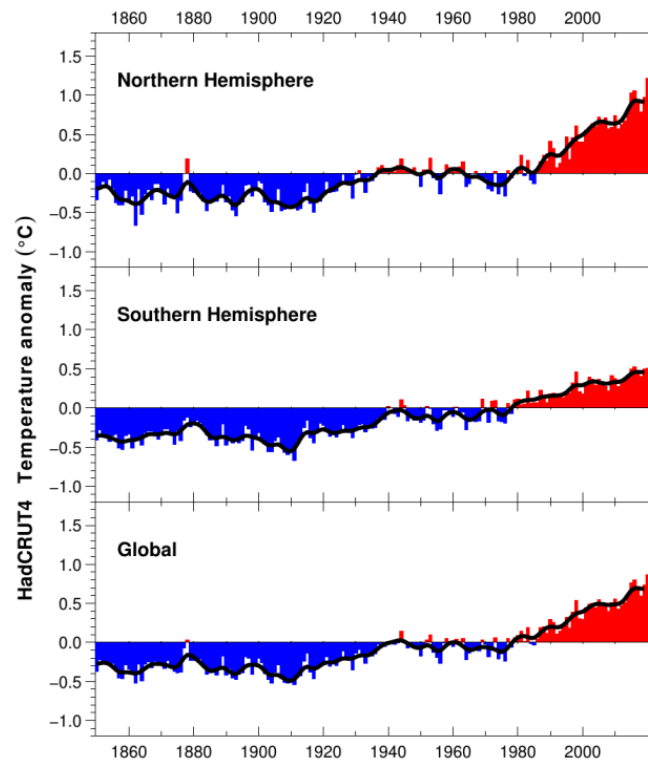
Fig. 1. HadCRUT4 temperature anomalies. Hemispherical differences.