

## ***Interactive comment on “Did the Roman Empire affect European climate? A new look at the effects of land use and anthropogenic aerosol emissions”***

***by Anina Gilgen et al.***

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Received and published: 30 August 2019

*We are glad that the reviewer enjoyed reading our paper and thank for his/her suggestions. Our answers are italicised.*

It was a pleasure to read the paper entitled “Did the Roman Empire affect European climate? A new look at the effects of land use and anthropogenic aerosol emissions”. The paper focuses on the impact of the Ancient Romans around 100 AD. This period corresponds to the maximum expansion of the Roman empire, under the Emperor Trajan, and was considered by the authors as representative of a potential past

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anthropogenic impact on the climate system. The authors evaluate the anthropogenic effect of land use and aerosol emissions. In my view, the paper is really well written, properly structured and easy to read. The authors properly discussed the assumptions introduced that provided the uncertainties in the model. Perhaps, a more detailed archaeological discussion would further increase the quality of this paper. I was wondering, for example, what is the potential influence of Roman battles in your model, where thousands of people moved in Europe (e.g. during the Dacian War), burned villages, re-worked metals and so on. This impact should be intense, and maybe influenced significantly the population size and distribution in short times.

*Thank you for this interesting suggestion. We agree that the quality of the paper improves by including these aspects. The following changes were made:*

- *In Section “Uncertainties and Limitations”, we briefly discuss the influence of wars: “**Another simplification is our lack of spatial and temporal variations: for many variables, we estimated one “typical” value for the whole Roman Empire, and our anthropogenic emissions show no trends over the years (e.g. caused by wars). The time around AD 100 was a relatively stable period, characterised by expansion of infrastructure, economic wealth, and quite low military activities. Nevertheless, the emissions were more dynamic in reality than in our simulations, e.g. due to Trajan’s Dacian Wars (AD 101/102 and AD 105/106), which caused population movements as well as a possible change in anthropogenic aerosol emissions (e.g. regional emissions associated with warlike activities such as burning of villages).**”*
- *The last paragraph of “Conclusions” was extended: “**Simulations with a higher spatial resolution would moreover allow to account for the large regional variations in aerosol emissions within the Roman Empire – information which can be provided by archaeologist and historians. Therefore, further***

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*work should include collaborations with them in order to incorporate better understanding of human behaviour in Classical Antiquity, particularly on fuel consumption and the timing and extent of the use of fire. Such collaborations could also allow to assess the effect of economic crises (e.g. in the third century AD) and wars on aerosol emissions.”*

- *In Section “Fuel consumption per capita”, we shortly mention the impact of glass recycling: “Note that calculating emissions for individual sectors can be very challenging; as an example, recycling of glass was common (Stern 1999; Freestone 2015), which needs to be considered when estimating fuel consumption associated with glass making.”*

In my view, the paper meets the standards of this journal and I have nothing against its publication in cp. Please correct Pompeji (it sounds German to me) (p.7 L. 28).

*We corrected it.*

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2019-56>, 2019.