

Interactive comment on “Constraining the temperature history of the past millennium using early instrumental observations” by P. Brohan et al.

Anonymous Referee #2

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Climate simulations over the past millennium still display a wide range of divergence, probably caused by the different external forcings applied to drive climate models with also different climate sensitivities and ocean heat up-take. The manuscript presents an interesting proof of concept that the use of early-observational data sets from the beginning of the 19th century can help to narrow the uncertainty in the estimations of past temperature evolution over the past millennium as simulated by climate models. The rationale is the comparison between the different temperature simulations to a new data set of ship-logs, which is being now digitalized.

The instruments on board may have been affected by a bias relative to modern

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instruments. The comparison with model data does not target the difference between present temperatures and those reported for the early 19th century, but rather the temperature drop caused by the strong volcanic eruptions that occurred at that time. This sounds quite reasonable but then, in my opinion, the validation of the climate models becomes restricted to their response to the volcanic forcing. It may narrow the uncertainty of the model response only in this regard and not the uncertainty in the temperature evolution over the past millennium.

It has indeed been argued that volcanic forcing may be the most important contributor to the forced temperature variability over the past millennium, but I do not think this point can be considered proven in view of the still existing large uncertainties in the volcanic (and solar) forcing and their time correlation over the past centuries. In this sense the title of the manuscript seems a bit far-fetched, although the focus on the volcanic response is in itself quite interesting. Following through, I would have wished that the manuscript offers more information about the response to the early 19th century eruptions, in terms for instance of spatial patterns and/or seasonality. I am not sure whether the data would allow for this, but if yes, a comparison between the observed and modelled patterns and between observed and reconstructed patterns would be very informative. The reconstructions are presented only as spatial averages, but some of the most recent do allow a more detailed spatial analysis. For instance, Mann et al. (2009), for some reason not included in this manuscript, did produce spatially resolved temperature reconstructions.

As a side comment, previous studies that have explored the influence of volcanic and solar forcing on the magnitude of temperature deviations in the early 19th century are not cited. The authors may want to have, a look at Wagner and Zorita (2005) :The influence of volcanic, solar and CO₂ forcing on the temperatures in the Dalton Minimum (1790–1830): a model study. *Climate Dynamics* DOI 10.1007/s00382-005-0029-0.

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