

## ***Interactive comment on “Signal detection in global mean temperatures after “Paris”: an uncertainty and sensitivity analysis” by Hans Visser et al.***

**Anonymous Referee #2**

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This study considers the question of estimating by how much global temperatures have changed since 'pre-industrial' times, assessing the uncertainty in different trend models and due to different global temperature datasets. The analysis is interesting, though the results are not too surprising. However, I have some major concerns:

1) Framing: the authors emphasise repeatedly that they are estimating changes since a particular baseline and implying that this is what the Paris agreement meant by 'pre-industrial'. This is not the case - the introduction of Hawkins et al. (which the authors cite) discusses this issue at length. In addition, Schurer et al. (2017, NCC) was very recently published, highlighting again that there was likely some additional warming due to anthropogenic factors before 1850. The authors may also like to examine Otto et al. (2015) for an alternative approach to estimating the warming since the 19th

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century. The text in the discussion on this topic is appropriate however.

2) Terminology: some of the phrasing is very confusing when referring to and/or distinguishing between natural \*forced\* variability (volcanic, solar) and internal \*unforced\* variability. These terms are sometimes mixed and it's not always clear what the authors mean. For example, in the abstract (and L86) the authors claim the models are corrected for natural variability, when they mean the forced component, but the introduction uses natural variability to mean both forced and unforced variations. On L133, the authors refer to the 'historicalNat' runs 'for natural unforced variability', which is not true - those runs include both natural forced and internal unforced variations as the next sentence correctly states. Variability is also used for the spread or range between different estimates, adding further confusion. The authors should carefully check each use of this type of phrasing and make it far more precise.

3) GCM analysis: the 106 members used cannot be 'one per model' as there were not that many models in CMIP5. It's not clear what the authors have used here - there must be more than one historical part of the runs for some of the models. There are also 43 piControls on Climate Explorer, and very few are less than 200 years, not only the 20 that the authors have used - why have they not used the others? Also, in section 3.2, the authors could use the AR(1) value from each model's own control run to fit a spline to the historical run of that same model, rather than assume the same across every model. Also, how has the correction for natural forcings been applied (L250)? Has the mean across the historicalNat runs been subtracted from each historical run? If so, this is inconsistent as the response to volcanic eruptions varies significantly across models.

Smaller points:

L47 - 21th -> 21st

L56 - this uncertainty does not include expert judgement

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L87 - this sentence could be read to imply that GCMs should have 'priority' over the observations for answering the question of how much the surface has warmed, but I don't think the authors mean that?

L146 - I'm not sure the UNFCCC would suggest that pre-industrial should be defined when a particular dataset happens to begin?

L163-4 - do you need all five of those references to the lead author's previous papers?

L191 - this not appropriate for a scientific analysis

L216 - delete 'is'?

L220 & L307 - three 'variability' in the same sentence, all referring to slightly different things?! The first is a 'range'? The sentences following this are also not clear.

L279 - not sure this is quite true - there is a signal of these eruptions in the observations but it is probably weaker than the GCMs suggest. But I agree this is probably partly a coverage issue.

L288 - most of the time, the models are not tuned to the trend, but are tuned on the mean present-day climate state.

L303 - is 'best guess' the appropriate term?

L315 - it would be useful to use other historical ensemble members to check this statement (where they exist), as they provide another estimate of the change in temperature for the same model.

References:

Otto et al. (2015). Embracing uncertainty in climate change policy. *Nature Climate Change*, doi:10.1038/nclimate2716

Schurer et al. (2017). Importance of the pre-industrial baseline in determining the likelihood of exceeding the Paris limits. *Nature Climate Change*, doi: 10.1038/nclimate3345

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