**Climate
of the Past
Discussions**

# Interactive comment on "Using paleo-climate comparisons to constrain future projections in CMIP5" *by* G. A. Schmidt et al.

**Anonymous Referee #1**

The manuscript seems to be a follow-up report of a workshop held in Hawaii in 2012 on joint analysis of paleo simulations and proxy reconstructions. The abstract and the introduction prompt the reader to expect a theoretical framework and best-practice recommendations on how to use proxy records to analyse the skill of paleo model simulations, and how the joint comparison of simulations and reconstructions can lead to better constrain climate projections. (this last point is prominently included in the title).

The manuscript is generally clearly written and I think it can be understood by both the modelling and proxy community. However, I was disappointed by an unclear manuscript structure and the quite disjoint sections. After reading the manuscript, I was left wondering about which the theoretical framework and the best practice recom-

mendations actually were. I am aware that to write a workshop report for a scientific journal is not always easy, as the objectives of the workshop participants are quite often too diverse. But then the manuscript should be clear at the outset that this text is not intended to be a proper research article but rather a workshop report with some working examples without no specific results on this matter. After a general introduction, the manuscript includes a collection of section that have very little connection to one another, and that perhaps due to space limitations, are only a short introduction to a line of research without going into deeper detail. Some of these sections included in the manuscript are clearly more useful than others. For instance, section 4.2 on how to constrain climate sensitivity from simulations of the Last Glacial Maximum, or section 3.1 showing that the temperature signal of the external forcing may be more strongly felt in the tropics than at high latitudes or over the continents, and thus past temperatures in these regions may be a better predictor for future temperatures (Here, however, I would argue that the magnitude of the response is only one aspect of the metric, the other aspect being the magnitude of the internal variability ). Another enlightening example is the simulation of ENSO (section 5.1) although in this case the authors make the point that the modelling results are too ambiguous as to provide a useful metric for future projections. I did not find other sections particularly useful. For instance, I fail to see the point of section 5.2 on the spectral properties of the simulated temperatures and proxy records. How can the spectra be used to quantitatively discriminate among models ? This section seems to be rather a short summary of the deficiencies of paleo simulations in replicating different spectral regimes, and the authors themselves do not seem particularly convinced judging from the caveats about forcing uncertainties added at the end of this section. Finally, section 5.3 appears as short discussion about the risks of using the classical Palmer Drought Severity Index as an indicator of past or future droughts, but it does not contain any indication of how the frequency or intensity of simulated droughts may serve as a discriminating metric across model simulations. This section also misses an important discussion on what is the variable that can be effectively reconstructed from proxies. Is it soil moisture,

is it precipitation, is it a mixture of both and if yes, how could they be disentangled ? is it some modified Palmer Index? If this section were to be coherent with, say, section 4.2, the reader would expect suggestions of where and in which seasons should past droughts be used to constrain future drought projections. As it is, the section is narrowly focused.

It is not straightforward to see how the recommendations included in the Conclusions can be derived from examples of the previous sections, although they all sound reasonable. To me they are probably the result of general discussions held at the workshops, but they certainly are not connected to the specific examples shown previously.

Thus my general recommendation would be:

-to warn the reader at the outset that the manuscript is a workshop 'progress' report that includes some ad-hoc suggestions, but certainly it does not include a theoretical framework or best-practice suggestions. As a workshop report, I think the manuscript may be useful and informative. I would not say it fulfils the standard of a classical research article or review paper.

-to homogenize the different sections, not so much in terms of style, but in terms of content and scope. They are now widely different. The present version looks rather like a juxtaposition of different texts written individual authors, and some of them are not necessarily related to constraining future projections from paleo simulations. This is in my view particularly true for sections 5.2 and 5.3. I think that this over arching goal should be clearly discernible in all examples, even though it can be difficult to provide a detailed derivation for each of them.

Some particular suggestions:

'The scale over which a record is representative can be a major issue in comparing paleodata and model output. All types of records are responding to local conditions, and for basic meteorological variables it is rare for a record to be representative for

spatial scales of more than 50–100 km (though many records, such as tropical ice core 18$\delta$ O, may have strong correlations to climate further afield; e.g. Schmidt et al., 2007). Comparisons at these scales often require some form of dynamical or statistical down-..'

The spatial coherence depends in general on the time scale. Usually the spatial coherence strengthens with time scale, at least for temperature. It is unclear to me to which time scale the quoted 50-100 km would apply.

The manuscript stress the advantage to use the same climate model for paleo simulations and future projections so that the lessons obtained from past climate can be better projected into the future. However, in the CMIP5 data base, this is not always the case. The resolution/version of the paleo models is often different from those used for climate projections. To what extent they can be considered the same model is an open question

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