

## ***Interactive comment on “Teleconnection between the climates of the Polar Regions during the last ice age” by Xiao Yang and Jose A. Rial***

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We would like to start our response by thanking both reviewers for their efforts in evaluating and commenting on our manuscript. The reviewers have offered constructive suggestions for a comprehensive and objective discussion of the models to not only base on their skills to reproduce climate records, as done in this study, but also on the abundance and strength of the supporting evidence from past literature. We will integrate these changes into the revised manuscript. At the same time, we found and would like to further clarify some of the misunderstandings in the reviewers' comments, especially the ones associated with the physical mechanisms of the PhaseSync model and with the concept of phase synchronization itself. We hope that through the following clarifications, we have resolved some of the major criticisms from the reviewers.

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Response to Reviewer 2:

“Anonymous Referee #2”, or AR2, has mainly argued that by comparing the correlation between the model simulations and the actual records provides not sufficient evidence to adopt the PhaseSync model over the others.

AR2 was correct in observing the small increase from  $\sim 0.6$  to  $\sim 0.7$  in correlation when reproduce a particular frequency band of the Greenland record using the PhaseSync model (Figure 3d). However, the models' ability to reproduce records are fully explored in the next figure (Figure 4b) where various possible parameter values are tested. Depending on the parameter values, the increase of correlation from using PhaseSync model can be as big as 0.4 (Figure 4). Such difference is further summarized in Figure 5, where model skills in reproducing polar records from both poles are compared.

As AR2 noticed, the PhaseSync model, described in this study, has a natural lineage from previous publications (Oh et al., 2014; Rial, 2012; Yang et al., 2014). And to fully understand the model, these literature needs to be reviewed together. We would be happy to include key points for this model in the revised version of the manuscript to make this study better self-contained.

AR2 also suggested the authors to include more details on the chronology used. It is true that the chronology is critical to our analysis. We have used only published AICC2012 chronology (Veres et al., 2013) and given citation wherever appropriate. However, as a clarification, we will add detailed description of the chronologies used in this study in the revised version of the manuscript.

AR2 also kindly suggested us to closely compare the models for certain individual events to gain insight on the relative skills of the models. The numeric tests in this study were designed to assess the models' ability to reproduce millennial scale variabilities, which all three models were originally proposed for explaining. On the contrary, comparing model skills for certain millennial-scale events likely involves components of the records that belong to centennial or even higher frequency bands, which the models

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may be unfit for.

#### References

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