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Climate of the Past Discussions
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# *Interactive comment on* "Optimizing sampling strategies in high-resolution paleoclimate records" *by* Niels de Winter et al.

**Niels de Winter et al.**

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Dear Alberto Reyes, dear reviewers,

We would like to thank both reviewers for their constructive comments on our manuscript. We are confident that their suggestions will help us improve our manuscript and will try our best to implement them during our revision. The reviewers made a range of minor suggestions, which we will address in a point-by-point rebuttal on resubmission. Below, we briefly summarize our strategy for revising the manuscript in response to the more substantial points raised by the reviewers.

Methodology – The major concern by Reviewer #2 seems to be our presentation of the methodology for our reconstruction approaches. We will revise the Aim and Meth-



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ods sections of the manuscript such that the different reconstruction approaches are better explained on first mention and will include more detail in these explanations to clarify the difference between the approaches. In addition, we have now compiled all R scripts used for creating virtual data and reconstructions into a documented R package which is available through the online open-source R database CRAN (https://cran.r-project.org/web/packages/seasonalclumped). Following Reviewer #2, we will adapt Figure 4, splitting it up into two figures to allow for more room for the flow chart illustrating how the virtual datasets are created. If this split causes the number of figures to be too high, we are happy to move the flow chart with the example of Case 31 to the supplement, although we prefer to keep it in the main text.

Definitions – Both reviewers raise valid concerns about our use of definitions and references for cases, reliability benchmarks (e.g. accuracy and reproducibility) and methodology. To improve the clarity of our explanations, we will go through the manuscript in detail to make sure all our terminology and references to cases and reconstruction approaches are consistent and well-defined.

Benchmarks for testing – Both reviewers raised questions about our use of benchmarks for mean annual and seasonality against which to test our reconstructions. We would like to clarify that we use the range in monthly $\delta$18Osw (most enriched minus most depleted month) as our benchmark for seasonality in $\delta$18Osw. We retain that our use of mean annual temperature as benchmark is justified. Even though many studies reconstruct "mean growing temperature", the ultimate goal of climate reconstruction is to obtain more information about climate variables independent from the archive. In our view the conversion to mean annual temperature must be made eventually and this presents a source of uncertainty which we wanted to include in our analysis. Finally, our use of 0‰ VSMOW as a benchmark for mean annual $\delta$18Osw does not overestimate inaccuracies of the $\delta$18Oc-method, since almost all our virtual datasets are based on variability around this value. If anything, this $\delta$18Osw assumption underestimates the real inaccuracy of $\delta$18Oc reconstructions because in many cases the mean annual

$\delta$18Osw value is not known in the fossil domain and its estimates may be much farther from the true value.

Data presentation – Both reviewers made suggestions on how to improve the way in which we present the data generated in our study. In reply to the suggestion by reviewer #1, we will modify Figures 6 and 7 (overviews of accuracy and reproducibility of all cases) to make it more intuitive to spot the differences between cases at first glance. We like the idea of using a color-coded heatmap to visualize this complex data and will experiment with this concept. The original Figures 6 and 7 will be retained in the supplement. In response to concerns from both reviewers, we will adapt the colour scheme used throughout the manuscript to make it more accessible to colour-blind readers. We appreciate the suggestion by Reviewer #2 of using the Colorbrewer tool and we will use this tool to select our colours.

Outlook to future research – Both reviewers agree that our somewhat lengthy outlook chapter (section 5.4) makes the (already quite complex) manuscript too long. We therefore opt to follow the suggestion of Reviewer #1 to summarize the entire section 5.4 into one paragraph to save space.

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