Interactive comment on "Objective extraction and analysis of statistical features of Dansgaard-Oeschger events" *by* Johannes Lohmann and Peter D. Ditlevsen

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We thank the reviewer for his/her evaluation of the manuscript and helpful comments. Below, we reply to all comments of the reviewer.

1." [. . .] aim is to obtain mechanistic understanding of the DO cycles. This is not true in my opinion, since only statistical features are reported. These features can be used for benchmarking modelling studies testing different mechanisms, but this is not done in this paper."

We agree that this is not the best wording to describe the goal of the paper. We did

not mean "mechanistic" in the sense of "physical mechanism", but rather "empirical", indicating how the properties of the cycles develop over time, as a function of previous cycles and forcings. We use the word "empricial" instead in the revised manuscript.

2. "[. . .] remove the word "causal" [...]. Only statistical similarities are tested, and no conditioning is performed to infer conditional dependencies. Also, no dynamical models are used, which could provide some hints at actual causality."

We agree that the word "causal" is problematic to use in our context and re-moved/replaced it throughout the manuscript.

3. "I don't think that previous work on the DO cycles is sufficiently recognized by the au- thors. [. . .] "

We agree that a paragraph summarizing previous hypotheses is helpful and included one at the beginning of the introduction.

4." [. . .] ice volume [. . .] strong influence on the interstadial durations; this observation has, however, been made previously: Mitsui and Crucifix (Clim Dyn 2017) show from a statistical point of view that including this forcing is supported by the data, and Boers et al. (PNAS 2018) use it explicitly to infer the interstadial cooling rate during interstadials."

We thank the reviewer for pointing this out. We are aware of these studies, but we don't discuss them in the manuscript, because we do not actually argue for a correlation of the interstadial durations and ice volume. Even though this is not discussed in the manuscript, we find that for the whole data set, the correlation is not significant at 95% (can be seen in Fig. 5), and the influence of ice volume on interstadial durations is mostly due to the long interstadials 23.1 and 21.1 occurring at low ice volume. This fact is then further obscured by the short 23.2 and 21.2 happening during the same period.

In the paper, we are presenting results on the cooling rates as a predictor of the inter-

stadial durations, a connection of the cooling rates and forcings (such as ice volume), referring to earlier work (Schulz 2002), and argue that CO_2 is actually a better predictor than ice volume.

5. "The ultimate goal of this study is to provide the statistical basis for discriminating between different mechanisms to explain the DO events, but comparison of different mechanisms is not performed. Do the statistical features you extract give some hints at which of the prominent hypotheses listed above (point 3) are more likely? It would be nice to include at least a discussion on this at the end, as it is somewhat promised in the beginning."

We agree that this is desirable and reworked large parts of the Discussions Section in order to establish a stronger connection of our work and leading hypotheses or model experiments concerning DO events. To test our results in more detail in future studies, more models, or at least more runs of existing models, under different forcing scenarios are needed.