

RC2

The paper by Melcher et al “Advances in conceptual modelling of the variable nature of DO events” introduces a novel model that realistically reproduces the patterns of DO events in the NGRIP record using modulating ocean parameters. The paper is well written and can be published after a minor revision.

*The authors would like to thank RC2 for their thorough, nice, and concise comments. We have implemented most of the suggestions. If nothing is specified below, it has just been implemented.*

The paper by Melcher et al “Advances in conceptual modelling of the variable nature of DO events” introduces a novel model that realistically reproduces the patterns of DO events in the NGRIP record using modulating ocean parameters. The paper is well written and can be published after a minor revision.

My comments are as follows:

The current title of the paper is more suitable for a review than for a novel research item, and it can be improved as follows: “A novel model of the dynamics of Dansgaard-Oeschger events in the NGRIP record”.

*We sincerely thank the reviewer for their suggestion and have adopted the proposed new title, with a slight change as it is not specific for the NGRIP record. New title “A novel model of the dynamics of Dansgaard-Oeschger events as seen in the ice-core record”*

Multiple acronyms used in the paper would be convenient to introduce in a small table in the beginning.

*As each acronym is introduced with the proper full name, we feel a table will just add length to an already lengthy paper*

Writing style could be improved. In lines 28-29, replace “supports the essential understanding of the underlying processes required to predict” with “is essential for prediction”. In line 45, “taking another approach, other studies have approached” must be improved. In line 103, “the relationship between the model and the time series of the model” can be omitted (obviously, the time series produced by the model is its trajectory).

*Line 28 and 45 has been improved.*

*The introduction to Section 2.2 has been rewritten, and we hope the issues have been sorted. We think it's important to explain the relation between the model equations, the regimes of Fig. 3, and the time series of Fig. 4 for readers with limited mathematical/technical experience in the field.*

Type I & II events are denoted with or without capital letters, and sometimes with a dash. They, as well as interstadials, are mentioned with a reference but not well introduced for general readership.

*Removed capitalization and dash in Type I and II.*

*Stadial and Interstadials are introduced in line 32.*

In Fig.1, panel b, the y-axis for  $P(t)$  has not units – is it in kiloyears? If so, aren't values within 0.8 kyr too small for stadials in a window of 20 kyr?

*You are correct 0.8 kyr is too small. However  $P$  is found by (time in stadial in window / length of window) making it a time fraction and thereby unit less or strictly speaking 0.8 [20 kyr/20kyr]. We have written [fraction] in all axis labels with  $P$  to clarify this.*

In Eqs. 1,2, NOISE could be replaced with some notation, and a short description of the noise would be useful (distribution, scaling properties?)

*Have been replaced with  $\sigma dW$  and a reference to end of section 2.3.5 where the details are provided together with the role and bounds of the sigma parameter. We do not want to add more technical details to section 2.2.*

“Box model”, “earth system models” do not need to be capitalised.

The fixed points are repeatedly called “fixpoints” (including the legend of Figure 3).

*This point has been fixed*

In line 258, remove either “equations” or “Eqs”

Add dot at the end of Eq.10. Remove comma after “where” in line 264

*We have removed the comma but rewritten around what is now equation 10. This was done to comply with RC1 comments on clarity for deriving the model.*

In line 310, remove “achievable”. This is discussed in the section and does not need to be mentioned in the section title.

*Changed to subsection title to “Output space”*

In line 359, “because” should be with a small letter.

In line 370, e.g. should be between commas.

Add the missing dot at the end of the caption of Figure 7.

In line 453, brackets are not necessary.

*Implemented and further cleaned up*

In several places (Eqs. 7,9,11), the text line after the equation is indented – either remove the blank line after the equation or add command \noindent

*This has been done for all but the piecewise after eq 8, where the indent was found necessary*