

Clim. Past Discuss., community comment CC6  
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## Reply on AC1

Dr. Istvan Daruka

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Community comment on "Orbital insolation variations, intrinsic climate variability, and Quaternary glaciations" by Keno Riechers et al., Clim. Past Discuss.,  
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Regarding the ambiguity posed by parameter tau in Eqs. (29a-b) of the commented paper, I mention the following.

While the Authors keep most of the notations used for the DD16 model, they replace the temperature anomaly variable  $\tau(t)$  with  $y(t)$  and introduce a constant,  $\tau = 100$ . It seems that this parameter is related to set/tune the time-scale, but as it is not discussed explicitly in the text I found it ambiguous and confusing when comparing with the original DD16 model.

Furthermore, it is not noted either in the commented paper that the original DD16 model included a stochastic noise term as well (Eq. 2) which the commented paper neglected unnoticed.

In terms of mimicking the MPT-like behavior and timings of terminations, in their response AC1, in comparison of the original and modified DD16 models, the Authors wrote that "*a model behavior that not only resembles the MPT but also shows correct timings for most of the terminations.*"

In our 2016 paper ( <https://link.springer.com/article/10.1007/s00382-015-2564-7> ), based on the original DD16 model, we already pointed out that a small perturbation in the climatic damping coefficient  $\kappa$  could lead to a remarkable shift of the glacial cycles, constituting a climatic butterfly effect, substantially modifying the timing of terminations as displayed in our Fig. 8. *This is why we have not fine tuned or modified our model any further, as we considered the actual timings of terminations as "haphazard realizations".*

For a better comparison, it would be welcomed to mention explicitly our Fig. 1 in terms of reproducing the MPT-like behavior as we earlier agreed on in our private communication, e. g. including your suggestion: "*The original model was shown to produce the MPT-like behavior; see Fig. 1 in Daruka and Diltevsen (2016).*" and based on the above adding that "*However, due to the revealed critical parameter dependence, the original DD16 model was not fine-tuned/ developed further on the actual timings of terminations.*"

It would also be welcomed to see whether this intriguing, *parameter-perturbation induced climatic butterfly effect would still prevail in case of parameters  $\alpha(t)$  and  $\beta(t)$  in the modified DD16 model as well.* This could be quickly implemented and rapidly investigated in case of interest, but I understand if this would point beyond the current scope and aims

of this commented paper.

But if there was the same climatic butterfly effect, the revealed remarkable match with the realized timings of terminations might indicate a sort of "mean-field dominance", hinting that these climatic perturbations might average out rather well. This would indicate that a smooth effective parameter dependence might be a good approximation in terms of conceptual modeling, thus such a finding might have a conceptual significance as well even in more generic terms.