## Overall assessment

I think this is a fundamentally solid study, but the writing still needs significant work. In particular, the title could be significantly sharper, some of the concepts are not well defined and some of the statements and arguments are not clearly explained. Overall, I recommend publication after a major revision.

## General comments

Through simulations with the *Verbitsky et al.* (2018) model, the authors make the important point that the dominant period of the glacial cycles may depend on the initial values of the system's state variables. We found a qualitatively similar result with the periodically forced calcifier-alkalinity model (compare Figs. 3a and 3b in *Omta et al.* (2016)). A corollary of this is that the Mid-Pleistocene Transition may not have been due to a change in the Earth system but rather due to simple coincidence (as illustrated in Figs. 5 and 6 of the manuscript). Having said this, I think the title (and thus the overall framing) could be significantly stronger. An initial value problem is defined as a differential equation together with an initial condition (*Wikipedia*, 2025), which can be as simple as:
$\frac{dx}{dt} = x$, $x(0) = 1$
In other words, the title "Milankovitch theory as an initial value problem" doesn't really convey much of a message at all. I think a title such as "Sensitivity of glacial dynamics to initial values" would summarize the central point of the article much better. I would also suggest removing the essentially meaningless and potentially confusing words "In this case the Milankovitch theory becomes an initial value problem" (l. 14/15) from the abstract.

## Specific comments

- Point (b), p. 2, l. 72–75: The ***memory duration*** concept is not well defined. Is it the time it takes for the system to get within 1% or 10% (or another fraction) of its steady-state value?

- Point (c), p. 2, l. 76: As their name indicates, short-memory systems have a short memory of their initial condition. Even so, it is not true that these systems are entirely initial-value independent. By definition, every dynamical system is dependent on its initial value, at least at $t = 0$.

- Point (e), p. 2, 82–84: "A significant portion ... is adjusted accordingly." This is quite a convoluted statement, which I suggest simplifying to: "A long-memory system (low $a$, high $\tau$) may have the same steady state $a\tau$ as a short-memory system (high $a$, low $\tau$)."

- p. 6, l. 209–211: I don't think Fig. 4 provides a clear illustration of the point that the dominant period of the oscillations can be sensitive to the initial conditions. Looking at Fig. 4a, it appears to me that all three simulations converge to the same oscillation.

- p. 6, l. 224/225: To me, it is not immediately clear why a glaciation area of 12.3 $10^6$ $km^2$ would be equivalent to a ten-fold reduction of the terrestrial mass influx. Could you elaborate, perhaps by deriving this from eqs. (3–5)?

- p. 9, l. 319–322: "A dynamical bifurcation, i.e., abrupt changes of dynamical properties of the system as a result of small changes of governing parameters, should always be accompanied by an incomplete similarity of corresponding similarity parameters." This is an interesting point. Would it be correct to say that the bifurcation occurs at the end of the parameter range where the incomplete similarity applies?

- p. 10, l. 374: What do you mean by "hardly predictable"? Is that unpredictable or difficult to predict?

- p. 14, l. 500: "the timescale of vertical advection in ice sheets is defined by the same mass balance". I would say that it is the other way around: the mass balance is defined by (among other things) the advection timescale. Could you explain what you mean here?

## Minor corrections

- p. 2, l.80: ... makes advection ... → ... makes the advection ...

- p. 2, l. 84: ... that the nature ... → ... that nature ...

- p. 3, l. 101: ... identifying the deterministic ... → ... identifying deterministic

- p. 3, l. 114: ... on poorly ... → ... on the poorly ...

- p. 5, l. 203: Also like in VCV18, ... → Also similar to VCV18, ...

- p. 13, l. 459: ... that the nature ... → ... that nature ...

- p. 14, l. 508: ... with the Nature ... → ... with nature ...

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# Bibliography

Omta, A. W., B. W. Kooi, G. A. K. van Voorn, R. E. M. Rickaby, and M. J. Follows (2016), Inherent characteristics of sawtooth cycles can explain different glacial periodicities, *Climate Dynamics*, *46*, 557–569.

Verbitsky, M. Y., M. Crucifix, and D. M. Volobuev (2018), A theory of Pleistocene glacial rhythmicity, *Earth System Dynamics*, *9*, 1025–1043.

Wikipedia (2025), *Initial value problem*, https://en.wikipedia.org/wiki/Initial_value_problem.