

Clim. Past Discuss., referee comment RC2
<https://doi.org/10.5194/cp-2021-136-RC2>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on cp-2021-136

Anonymous Referee #2

Referee comment on "Orbital insolation variations, intrinsic climate variability, and Quaternary glaciations" by Keno Riechers et al., Clim. Past Discuss.,
<https://doi.org/10.5194/cp-2021-136-RC2>, 2021

My expertise is in deterministic dynamical systems, so I will focus my comments on that aspect of the paper.

This is a useful paper which summarises paleoclimate research and shows how a nonautonomous dynamical systems approach could be useful. I like that the paper has many examples and is easy to read. Nevertheless, there are a few areas for improvements.

More significant:

1. It is not clear to me what level of mathematical knowledge this paper is targeting. The paper begins assuming very little knowledge, by examining Hopf Bifurcations in equations (3--5) which are a topic covered in any dynamical systems course. Yet later in the paper readers are assumed to know what the 'Hausdorff semi-distance' is. I think it would be better to assume less mathematical knowledge than more, perhaps the Hausdorff semi-distance could be replaced by a more informal comment about the system approaching \mathcal{A}_t . Another place the analysis could be streamlined without loss of understanding is by setting $\beta = \mu/2$ in equation (17) thereby reducing the number of parameters. The paragraph starting on line 304 provides conclusions without justification, which are only obvious to people familiar with dynamical systems. Perhaps a figure would help here?
2. The point of this paper is to demonstrate the advantage of the NDS picture over the

autonomous

picture, yet much of the analysis could be done in the autonomous regime using standard assumptions

about timescale separation. In the analysis of the FHM model, γ is taken to be a slow

oscillation which allows for a discussion (lines approximately 385--400) that would be familiar to people who had only worked with autonomous systems. In the Daruka-Ditlevsen model, α

and β are again slow parameters, so why shouldn't this be analysed with the classic tools

of autonomous dynamical systems? I think it would be useful to emphasise what extra information the

nonautonomous picture gives us, and what would go wrong analysing it using the tools from

autonomous dynamical systems.

3. I find the section on RDS a bit disconnected from the rest of the paper. There are no concrete paleoclimate applications given and the section introduces concepts such as the Random Attractor which is

not defined even informally and are not used in the rest of the paper. I would recommend either cutting

this section or adding in a simple paleoclimate example.

4. Figures 8 and 9 are seriously misprinted, e.g. Fig 8e has times labelled as -20000,-000,-0000,-000,0,000,0000.

I realise this is a matter of personal preference, but might the PBA figures e.g. 5a look clearer

if projected onto the x-y plane? I always find 3D figures confusing.

Figure 5c doesn't seem useful, perhaps it could

be replaced by the trajectories of the system with different ω/ν values.

Little things:

1. Lines 31--32 'an the' should be 'and'.
2. Around lines 455, what do the parameters mean physically?
3. Lines 518--527, why not quote Emiliani and Geiss directly?