

Interactive comment on “Why could ice ages be unpredictable?” by M. Crucifix

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I am grateful to reviewer #1 for his / her thoughtful and particularly encouraging comments, which will naturally be addressed in the revised version of the manuscript.

Whether ice ages would occur in absence of astronomical forcing is a question that is difficult to answer convincingly. For example, a same autonomous system may either be excitable or exhibit a limit cycle depending on the value of its parameters. In this case the two regimes are separated by a bifurcation, for example a Hopf bifurcation in the van der Pol oscillator. However, as the system is being forced by, say, a periodic forcing (to keep things simple), the description of the system must be adapted. For example, the relevant bifurcations may now be torus bifurcations. Furthermore, the parameters that originally produced distinct regimes (excitable and limit cycle) in the autonomous case, may well belong to a same regime in the forced system, and hence

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will present very similar dynamical behaviours.

The best we can do is probably to attempt a statistical model selection procedure based on available data and evidence (how hard it could be, as we may want to introduce subjective priors about the parameters and/or the physical relevance of the equations) and see whether or not those models that are favoured are those that have a limit cycle when they are no longer astronomically forced. Given the subjective character of the choices involved in such a statistical exercise, and the difficulty to assess these choices as predictors of the behaviour of the autonomous Earth (which has never and will never be observed), any answer will probably be of meager value.

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