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Climate of the Past Discussions

Interactive comment on "The Plio-Pleistocene climatic evolution as a consequence of orbital forcing on the carbon cycle" *by* Didier Paillard

Anonymous Referee #1

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The contribution by D. Paillard explores the causes of the impact of orbital forcing on the long term evolution of the global carbon cycle. A simple model is built, accounting for the carbon, alkalinity, and carbon isotope mass balance. It is then forced by various mathematical functions (including periodic signals and long term trends). The author shows that the carbon cycle may have been controlled by the modulation of organic carbon burial in sediments, responding to orbital forcings.

This paper presents a clever method, and I think that such kind of conceptual study brings new valuable informations on how the carbon cycle operates in the latest Cenozoic.

I have only one point at this stage. It is related to equation 1a and 2b. One term is missing, but I'm not sure this will lead to major changes in the conclusions, invalidating

the study, or not. But this should be discussed.

Volcanism is not the only source of carbon at the million year timescale. The oxidation of petrogenic organic carbon exposed on the continental surfaces is releasing carbon to the ocean-atmosphere system. The rate is not well known, but it is probably of the same order of magnitude than the volcanic degassing (Blair et al., 2003, GCA). The C isotopic signature of this flux is quite different (around -25 permil) compared to volcanism. And its geological evolution depends on tectonic activity, physical erosion and continental runoff. The behavior of this source of carbon depends heavily on the geomorphic setting. Galy et al. (2007, Science) have shown in the specific case of the Himalaya that 50 to 70 % of the petrogenic carbon exposed in the Himalayas is being oxidized. In the case of the Amazon, it can be expected that most of this petrogenic organic carbon has been oxidized. Blair et al (2003, GCA) estimate a global flux of about 3 to 4 Tmol/yr of carbon released by this process. Note that this flux is included in all numerical model of the carbon cycle at the geological time scale (check Berner 2004 for instance).

This flux exerts a important control on the isotopic budget of carbon, owing to its negative signature. Incorporating it explicitly in the present model may change the results of the study. This additional source should be tested and its role discussed.

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