

Interactive comment on “A simple metabolic model of glacial-interglacial energy supply to the upper ocean” by J. L. Pelegrí et al.

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The main novel idea in this manuscript is that the amount of solar energy transformed by the Earth System switches between two different states (basal and enhanced) through the utilization of proximal and remote nutrients. With this idea in mind we propose a very simple model, what we call a metabolic model, for the transformation of solar energy. The supply of dissolved inorganic carbon (DIC) and nutrients to the autotrophic productive ocean occurs through remineralization of upper-ocean organic reserves (proximal sources) and the advection of deep-ocean waters (remote sources). The metabolic rationale leads to an equation which turns out to be the same equation we would derive from simple conservation arguments for DIC in the upper compartment of a two-box ocean (a perfectly valid physical approach). This equation, with only

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two controlling parameters, is tuned to provide a good fit to atmospheric CO₂, which changes in approximate linear proportion to variations of DIC in the upper ocean.

The editor suggests the physiological analogy is no good because it does not explain behaviours that standard models can explain. We have proposed this very simple model, inspired on the metabolism of complex beings such as mammals, as a tool to better understand some patterns of energy transformation in the Earth System. The fact that it does explain the gross pattern of the CO₂ glacial-interglacial changes is, we believe, a success. We agree with the editor that standard models do better than our idealized very simple model, no doubt about that, but they are indeed much more complex. The editor should agree that simple models can be very illuminating, a very simple model that reproduces well the gross pattern of the Vostok CO₂ time-series may be very useful to better understand some of the key mechanisms controlling the glacial-interglacial transitions.

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