Earth Syst. Dynam. Discuss., 5, C138–C139, 2014
www.earth-syst-dynam-discuss.net/5/C138/2014/

Earth System Dynamics Discussions Open Access

Interactive comment on "Burial-nutrient feedbacks amplify the sensitivity of carbon dioxide to changes in organic matter remineralisation" *by* R. Roth et al.

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Received and published: 13 May 2014

This is a state-of-the-art calculation, the latest in a series of studies that are well-described in the introduction section. The authors clearly describe the distinction between closed system behavior and open, which responds on a much longer time scale but with generally larger amplitudes.

I guess the part of the simulation that is the weakest, a reflection of the state of the science rather than any deficiency in the paper, is in the calculation of organic carbon burial as a function of oxygen concentration and organic carbon deposition rate. Organic carbon burial depends also on the grain size of the sediment, and on the

mineral deposition rate. River deltas can capture significant fractions of global carbon deposition. This uncertainty primarily affects the longer-term "open system" response, which is therefore much more uncertain than the shorter-term responses. The short-term responses seem quite believable, and that we might actually be able to predict them. The longer term responses from model are probably better viewed as potential or hypothetical.

Another frontier of science which this paper brings us to is the factors that determine the remineralization depth scale, and in particular the impact of CaCO3 sinking, as ballast, on the organic carbon sinking depth scale.

I didn't follow the discussion of the prescribed-production model run in section 3.1.2. The rational for doing it is understandable enough, as an attempt to deconvolve the impacts of changes in surface production vs. remineralization depth scale. The distinction is rather artificial, as demonstrated that the model blows up if you try to impose it for too long. But what I don't understand is the conclusion that there is no equilibrium CO2 change for the open system. There is no equilibrium for the prescribed-production model, but that's not the normal open system model.

Interactive comment on Earth Syst. Dynam. Discuss., 5, 473, 2014.