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Interactive comment on “Was the North Atlantic Ocean well-ventilated during Oceanic Anoxic Event 2 in the mid-Cretaceous?” by I. Ruvalcaba-Baroni et al.

Anonymous Referee #2

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This contribution explores the biogeochemical state of the proto-North Atlantic Basin (NAB) before and during the OAE2. Three main hypotheses are tested : the increase in P supply either from continental weathering or from the Pacific, the impact of the degree of anoxia of the Pacific waters on the oxygenation of the NAB, and the impact of the oceanic mixing inside the NAB. The paper is pretty well written and clear. I think it is a valuable contribution to the OAE problematics. I recommend publication of this ms with minor revision.

1) I think the title is misleading. Asking the question about ventilation suggests that the study is devoted to the reconstruction of the dynamics of the Atlantic ocean. But it is not the case, since the biogeochemical model described in this contribution is driven

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by the output from a physical model coming from Topper et al. (2011). I would focus more on the biogeochemistry in the title, rather than on the dynamics of the system.

2) a critical constrain of the study is the choice of the NAB subdivisions in the model (the so-called boxes). It is said that the division is based on the location of upwelling and downwelling and the bathymetry during OAE2 (page 13240, line 2 and 3). Can you be a bit more explicit ? What is the dominant factor : upwelling/downwelling or bathymetry ? Can you discuss in a few words the sensitivity of the model results to the geometry of the numerical model ? I guess it is not negligible.

3) I think a brief discussion of the origin of riverine SRP during the OAE2 would be welcome. If the SRP is coming from continental rock weathering, increasing this flux by 10 or even 60 would require an increase in continental runoff by a similar factor. Such a tremendous increase cannot be sustained by the Earth system, simply because there is not enough incoming solar energy. Lehr et al. (2009, EPSL, 277, 453-463) have demonstrated that even if almost all the solar energy is converted into latent heat, global runoff can only increase by a factor of 2. The amount of energy coming from the sun is an absolute limit to the runoff increase. This was calculated for the specific case of the snowball super greenhouse aftermath, but there is little doubt that the runoff cannot increase by a factor of 10 or more globally. Are you thinking of regional changes, or other hypotheses ? The increase in P delivery to the ocean is often invoked to explain OAE, but it is time now to propose some scenarios.

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