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Interactive comment on "Redox regime shifts in microbially-mediated biogeochemical cycles" *by* T. Bush et al.

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We appreciate the detailed and helpful comments of Dr Meysman. We are particularly pleased that he values the simplicity of our model as we agree that simple mathematical models have an important role to play in understanding biogeochemical phenomena.

He points out that we might refer to oxygen and acetate on the axes of Fig 2, as in the simple model v_or is assumed to scale with the availability of acetate and v_ro is assumed to scale with the availability of oxygen. However, in Fig 2 the ratio of v_or/v_ro is the thing being varied (and not oxygen or acetate). Consequently, for clarity we suggest keeping the current axis labels, but adding an explanation in the legend such as "maximal reducer growth rate v_or, or electron donor [acetate] availability" and "maximal oxidizer growth rate v_ro, electron acceptor [oxygen] availability".

He points out that the model is governed by the ratio of v_or/v_ro. This is indeed true - and can be seen in the mathematical analysis presented in the supplementary information. It is therefore also true that Fig 2a and Fig 2c present very similar information. However, we do still think there is value in presenting both Figs 2a and 2c for the sake of completeness and clarity. Furthermore, for the abiotic-biotic case Fig 2b and Fig 2d do not provide the same information, because the abiotic-biotic case is not symmetric. We suggest adding a few sentences in the text explaining that for the biotic-biotic case it is actually only the ratio of v_or/v_ro that controls the behaviour of the model.

He suggests an interesting case of a model with a fixed input of the electron acceptor (F_O2), and a fixed input of the electron donor (F_Ac). We agree that it is highly likely that such a model would produce redox regime shifts in response to variation of these fixed input rates. However, such a set of models represent a broad spectrum of possibilities and would be worth detailed exploration. For example, such models could look at whether temporal variations (arising from seasonal dynamics) in electron donor/acceptor inflow rates generate redox regime shifts, and could also include spatial dynamics. We therefore suggest adding some sentences to the discussion introducing this idea as a possible interesting avenue for further work.

We appreciate all of the minor comments and plan to implement them.

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