

Interactive comment on “The sensitivity of estuarine aragonite saturation state and pH to the carbonate chemistry of a freshet-dominated river” by Benjamin L. Moore-Maley et al.

Anonymous Referee #1

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This paper deals with the effect of variable boundary conditions in a river on the estuarine pH and saturation state. It does so by applying a previously described model that is used to run a large number of scenarios of feasible riverine conditions. Obviously the subject is an important one, and the tools used, modeling, are suitable to achieve the goals in the manuscript. However, I found this paper particularly difficult to read and to keep focus on the findings that it describes. In the end I even wonder what it is that I have learned here that I did not already know.

The reasons for this are diverse: First of all, too much information is being compressed in this manuscript, and in some of the figures - e.g. figure 4 is particularly difficult to

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interpret. A few well-chosen scenarios would have been much easier to explain and to depict. Secondly, too little information is given about the system under study, so that it is not clear what processes actually might actually produce the patterns or how relevant these findings are for other systems. Thirdly, the model description is too vague - it is even unclear if the 1-D model resolves the vertical extent (which I think it does) or has the dimension arranged along the estuarine length axis (which I think it should).

The 2008 paper from Salisbury et al, that is used to back up the scarcity of papers on estuarine carbonate chemistry is outdated by 10 years, and there are indeed some recent papers on this subject that are not mentioned in the manuscript, e.g. Volta et al., 2015 (Hydrology and Earth System Sciences), Cai et al, 2017 (Nature Communications) to name a few. There is also older work e.g. Regnier et al., 1997- marine Chemistry, that deals with (modeling of) pH in estuaries and that are not mentioned in the manuscript.

Finally, while the paper shows that, under some conditions of freshwater influence, the estuarine pH and saturation appears more sensitive, it is not clear why this is so. Of course, carbonate chemistry is a difficult discipline, but procedures to formalize the attribution of processes on pH shifts have been developed in the past and were recently put in a consistent framework by Hagens and Middelburg, 2016, *Geochem. Cosmochim. Acta* 187. The absence of a discussion that untangles the importance of processes on the modeled pH changes in a more quantitative way makes it hard to grasp the relevance of these results for other systems.

So in conclusion, while the subject is an important one, the way the manuscript is structured does not lead to a large enough increase in insight for this paper to be accepted in its current state.

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