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Interactive comment on "Relative impacts of global changes and regional watershed changes on the inorganic carbon balance of the Chesapeake Bay" *by* Pierre St-Laurent et al.

Anonymous Referee #2

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The manuscript describes a model sensitivity experiment assessing the impacts of atmospheric carbon dioxide, water temperature and riverine nitrogen, carbon and alkalinity on the inorganic carbon budget of Chesapeake Bay. Model sensitivity experiments are an essential tool for understanding the individual and combined impacts of different components of complex non-linear systems. The experiment is well designed. The modelling system used is based on an established published model; modifications for the current work are clearly described and model validation is included. The result that the two global changes (temperature and CO_2 concentrations) have opposite impacts on air-sea CO_2 flux is expected, but the experiments also show mitigating impacts on DIC export and Net Ecosystem Production and give estimates of all magnitudes. Like-

wise, the impacts of two regional changes (riverine nitrogen and carbon loads) partially mitigate changes in air-sea CO_2 fluxes and NEP. The results are interesting and give an insight into the likely future carbon budget in Chesapeake Bay. The manuscript is well written and structured, with appropriate figures and tables.

In the sensitivity experiments, the meteorological forcing is the same as the control simulation (early 2000s) and the water temperature and riverine DIC and alkalinity experiments use values estimated from mid 20th century data. To avoid any confusion for the reader, it would be useful to reinforce (perhaps in the conclusion section) that the sensitivity experiments are not modelling actual early 1900s conditions.

One technical correction: the labels of figure 3b refer to TIC; DIC is used in the caption.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-117, 2020.