Earth Syst. Sci. Data Discuss., referee comment RC2
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Comment on essd-2022-294

Anonymous Referee #2

Referee comment on "OceanSODA-UNEXE: a multi-year gridded Amazon and Congo River outflow surface ocean carbonate system dataset" by Richard P. Sims et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-294-RC2, 2022

The authors reconstructed gridded carbonate system datasets by using a data matchup method based on relationships between carbonate parameters and others which had already been established in the past. While many studies have explored such relationships based on ship-based observations during these decades, the authors utilized these efforts in an effective manner. Such a study is unique and is worth being published, but there are major concerns to be clarified before publication in this journal. I'd like to encourage the authors to improve the study and to revise the manuscript for better understanding.

General comments

Oceanographic characteristics of the studied areas considered, one of the important points of the method is skill to estimate carbonate parameters of low salinity seawaters, which are complexly influenced from both river outflows and heavy precipitation along the ITCZ. On the other hand, relatively higher salinity (S > approx. 34) seawaters in these regions have similar chemical properties to those in the nearest open ocean, where large scale ocean circulations dominate the seawater carbonate chemistry. According to attached supplement files, measurement data used in the matchup process were not necessarily restricted to those of low salinity seawaters. It should be emphasized that the presented method derived more appropriate TA and DIC of low salinity seawaters than others did.

Moreover, secular trends of CO2 were not considered in this study, though time-series reconstructions were addressed. It is needed to show reasonable explanation about that.

Nowadays prevalent machine learning-based methods are used for carbonate system reconstructions; five of the six methods which were cited for evaluating observation-based CO2 sink in the IPCC AR6 assessment used machine learning (Canadell et al, 2021, e.g. Fig. 5.8). It should be explained carefully that this study has some limitation that novel reconstructions cannot be included and legacy of past studies only be used.

Specific comment

Overall

Unnatural uses of brackets "()" have to be checked.

P3 71

Before OceanSODA is presented, successive efforts of investigating empirical relationships between TA/pCO2/DIC and other parameters based on observations have to be mentioned here.

P3 L72-76

A brief explanation of OceanSODA is necessary.

P4 L103

A brief explanation of RMSDe is necessary.

P8 L244- Figure 1

Fig. 1 obviously shows that the four selected algorithms have the lowest RMSDe, but doesn't explain whether they are the best even in low salinity regions. It is questionable that Lee et al. 2000; 2006, which propounded global algorithms and (the latter) didn't use salinity as explanatory variables, have the best skill in low salinity Congo basin. This point should be clarified.

Fig. 4, 5, 8, 9

If DICs were successfully reconstructed, trends of increase in DIC and pCO2 and decrease in pH and Ωs would be also derived. The trends are worth being mentioned in the text to support the validity of this datasets.

Canadell, J. G. et al.: Global Carbon and other Biogeochemical Cycles and Feedbacks. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 673–816, https://doi.org/10.1017/9781009157896.007. 2021

Lee, K. et al.: Global relationships of total inorganic carbon with temperature and nitrate in surface seawater, Global Biogeochemical Cycles, 14, 979-994, https://doi.org/10.1029/1998GB001087, 2000.

Lee, K. et al.: Global relationships of total alkalinity with salinity and temperature in surface waters of the world's oceans, Geophysical Research Letters, 33, L19605,

https://doi.org/10.1029/2006GL027207, 2006.