

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-266

Anonymous Referee #2

Referee comment on "Marine CO₂ system variability along the northeast Pacific Inside Passage determined from an Alaskan ferry" by Wiley Evans et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-266-RC2>, 2021

In this paper, Evans et al. presented the full carbon system parameters along the Inside Passage of the Pacific Northwest coast of North America from November 3, 2017 to October 2, 2019. They examined their seasonal and temporal changes and discussed their controlling mechanisms, and estimated the Time of Detection. They even projected the conditions when atmospheric CO₂ reaches a level that exhausts the remaining 1.5°C carbon budget. The paper is very well-written and the data will contribute to the understanding of ocean acidification status in an important region.

Major comments:

1. Please consider adding a plot showing the internal consistency of the measurements.
2. [Ca²⁺] in the open ocean can be assumed to be conservative with salinity, which is the basis for the CO₂SYST calculation. However, in the coastal ocean, especially in low salinity areas, the [Ca²⁺]-salinity relationship can be quite different from region to region (Dillon et al., 2020). I wonder if the authors could find any directly measured calcium data in the region, so as to improve the uncertainties of the calculated aragonite saturation states.
3. The estimation of anthropogenic CO₂ levels in a coastal setup is kind of surprising. The current method to estimate anthropogenic CO₂ is mainly designed for the open ocean. For the coastal ocean, pCO₂ level is strongly controlled by many other processes, such as river and ground water input, eutrophication, benthic processes, etc. I'm not even sure if it is a good idea to provide such an estimate. The same goes true for the estimation of the conditions when atmospheric CO₂ reaches a level that exhausts the remaining 1.5°C carbon budget.
4. Please consider creating a separate section called Study site and move the current

information about the site from Introduction to the new section.

Minor comment:

1. Throughout the paper, please italicize the "p" within "pCO₂".
2. Throughout the paper, please replace "concentration" with "content", if the values are reported as per kg SW. Concentration is a term for per volume based measurements.
3. Hydrogen ion concentration -> Total hydrogen ion content (assuming you are talking about the amount estimated based on pH on Total Scale)
4. Line 39: Replace "412 ppm in 2019" to "414 ppm in 2020".
5. Line 40: Please recheck this number. I remember it is more like 600 GtC instead of 700 GtC. I could be wrong though.
6. Line 41: Replace "Friedlingstein et al., 2020" with "Friedlingstein et al., 2021".
7. Line 48: "saturation state" -> "saturation states".
8. Line 48: If you choose to use the word "more", you'll better off finding a place to mention calcite?
9. Line 52: For the change of aragonite saturation state, it is better to report a percentage number. After all, its baseline varies significantly across the global ocean. A change of 0.53 could mean dramatically different things in the polar region compared to the tropical region.
10. Line 252: The uncertainty of [H⁺] needs a unit.
11. Line 258: Please specify the gridding method you used.

