Earth System
Science
Data

Interactive comment on "A high-frequency atmospheric and seawater pCO$_2$ data set from 14 open ocean sites using a moored autonomous system" *by* A. J. Sutton et al.

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Sutton and colleagues present, describe, and assess a data set of high-frequency surface carbon measurements made at various locations in the ocean over several years. Such data sets are of essential importance to any attempt to quantify and understand the role of the ocean in the gloabl carbon cycle and thus in the climate system. I clearly recommend publication of this manuscript. Find below some comments meant to help further improving the accessibility of this information.

- In addition to Fig 3, a table listing the numerical coordinates of the moorings would

be helpful.

- p 388 line 22: Can you give the reference for this statement?

- p 388 lines 23-26: I feel this motivation sounds weak and thereby understates the actual importance of the mooring data. Can you be more specific? Examples that come to my mind are assessment of controls on pCO2 as manifested in relationships between pCO2 and other variables at short time scales, test of parameterizations of carbon-cycle processes as used in models, or assessment of rectification effects (the effects of covariance of high-frequency variations in pCO2 and other variables on longer time scales).

- p 389 l 9-12: Can you be more specific as to whether the presented data are identical to those in SOCAT v2, or if revisions have been done meanwhile?

- p 390 l 14: Are the O2 measurements for internal diagnostic purposes only, or could they also be used in other scientific studies?

- p 390 l 25: Refer the reader to Fig 2 here.

- p 391 l 10-12: How large is the non-linearity of the sensor?

- p 392 l 1: Spell out "MBL"

- p 392 l 16: "averaged data" - specify what particular average this refers to here

- p 393 l 16: Can you comment on the rationale of the 3 μmol/mol threshold, especially why it is larger than the accuracy given in this paper?

- p 394 l 17: I'm concerned about the use of GLOBALVIEW MBL reference values to do actual corrections to the local data, given that these reference values do not contain any longitudinal variations and are also coarse in latitude. I looked at longitudinal variations of near-surface atmospheric CO2 levels as simulated by an atmospheric tracer transport model constrained by atmospheric CO2 data and SOCAT pCO2 data [TM3 with CO2 fluxes from Jena inversion s90_v3.5 with ocean prior oc_v1.2, see

Rödenbeck et al (2014)] (attached figure). In the example considered (difference of 4 TAO locations from the mean over these 4 locations, 2 arbitrary years out of a longer simulation), there are longitudinal atmospheric CO2 gradients across the TAO array of up to 4 ppm (other gradients may occur elsewhere). Though this simulation may differ from the truth in the details, I expect gradients on this order to be realistic; similar gradient are also present in the TAO measurements. Thus, couldn't deviations from the MBL reference just be real?

In any case, the description of the correction needs to be more specific. What is the exact criterion for correction? How exactly is it applied? Do you correct the atmospheric value only, or also the surface-ocean value?

- p 397 l 12: "validation" seems too strong a word here, given that local CO2 and the MBL reference are not expected to coincide.

- p 398 l 5: sentence not clear to me.

- p 398 l 14: Not sure about atmospheric CO2 being well mixed, see above.

- p 400 l 15: Did you mean "confidence interval"?

- p 403 l 19-21: While I agree to the message of this paragraph, this particular formulation (lines 19-21) is misunderstandable: The discrepancy of the Rödenbeck et al (2013) estimate from the TAO170W data arises because that particular location is not well-constrained from the SOCATv1.5 set, not because the calculation misses carbon upwelling in general. Also, Rödenbeck et al (2013) is not actually a "model" (in the sense of process simulation model) but just a "data-driven scheme" (even if some process contributions are indeed parameterized).

- Tab 3: over which time period is the growth rate calculated?

- Tab 4: "The closest MAPCO2 value in time and space" - formulation not really clear.

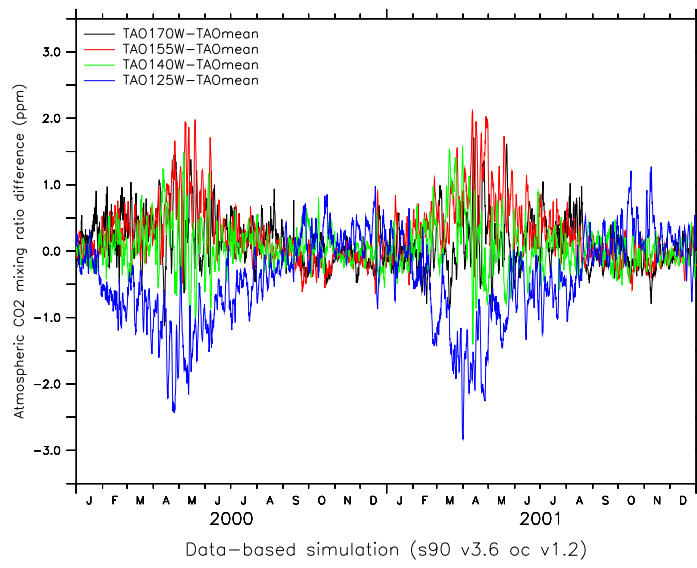- Fig 3: I like very much the way of plotting the variability by size and partioned outer

ring.

Reference:

C. Rödenbeck, D.C.E. Bakker, N. Metzl, A. Olsen, C. Sabine, N. Cassar, F. Reum, R.F. Keeling, and M. Heimann: Interannual sea-air CO2 flux variability from an observation-driven ocean mixed-layer scheme. Biogeosciences Discuss., 11, 3167-3207, doi:10.5194/bgd-11-3167-2014, 2014.

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Fig. 1.

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