Biogeosciences Discuss., 12, C2723–C2726, 2015
www.biogeosciences-discuss.net/12/C2723/2015/

Biogeosciences Discussions
Open Access

Interactive comment on "Dynamics of air–sea CO_2 fluxes in the North-West European Shelf based on Voluntary Observing Ship (VOS) and satellite observations" *by* P. Marrec et al.

Anonymous Referee #2

Received and published: 10 June 2015

This manuscript describes several years of surface ocean CO2 measurements in the Western English Channel, and has used these to derive algorithms that can map the CO2 distribution, and its fluxes, in space and time. The manuscript is well-structured, and both the data and results presented are interesting and valuable to a wider scientific community. The coastal oceans are very important in the global ocean carbon sink, but the poor data availability makes it difficult to quantify the magnitude of carbon uptake by shelf seas and continental margins. Well-founded working algorithms will help a great deal towards minimizing uncertainties in both the regional and total ocean carbon uptake. I find no major flaws with the manuscript and will recommend that it is published after minor revisions. There are, however, a few points that the authors

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

should consider and discuss in more depth. These are outlined below.

Major issues:

1. You have used a wind speed product from the NCEP/NCAR reanalysis, which has a spatial resolution of 2.5° by 2.5°. Your entire study area is quite small (5° latitude by 6° longitude), and the area where your data are collected and your algorithms are defined is much smaller than that. The wind speeds used thus have a very low resolution compared to the observations, which are all inside one NCEP/NCAR grid cell. I would urge the authors to check the effect on the results from using a higher wind speed product, for example the 0.125° by 0.125° monthly average data from ERA-interim. Using a higher resolution wind speed product may not affect the MLR results very much, but I suspect that it will matter quite a lot for the calculations of air-sea CO2 fluxes. 2. You do not present any uncertainties for your flux estimates. Have you calculated uncertainties? If not, you will have to do this as otherwise you have no basis for your comparison of different provinces nor the comparison of different studies. See for example Lauvset et al. (2013) or Omar et al. (2007) for examples of such a calculation and evaluation. It would strengthen your results tremendously if you can show that your study area is a significant carbon sink over a full seasonal cycle. 3. The manuscript is, as mentioned, well structured but is at times difficult to read and it is repetitive. The language would probably benefit from a thorough editing. The authors should carefully revise the entire manuscript for clarity and flow, and remove the many repetitions of certain findings/results/conclusions.

Minor issues:

Page 5642, Line 7: The gas transfer velocity coefficient is calculated, the wind speed is the remotely sensed data. Page 5642, Line 10: “relative uncertainties of 17 and 16 uatm”. Relative to what? Page 5647, Lines 13-15: Did you calculate the uncertainty yourself (using known uncertainties in your input data), or did you use the number given by Zeebe and Wolf-Gladrow? If the latter, then the ±5.8 is likely to be the lower end of

BGD

12, C2723–C2726, 2015

the uncertainty estimate. Page 5647, Lines18-19: “we estimated uncertainties relative to high-frequency pCO2 measurements of ±5.2” This sentence is not very clear. Do you mean that the underway pCO2 measurements have this uncertainty? Do you base this on comparison with the discrete data only, or have you also done some form of error analysis for the underway measurements? If the former, then 5.2 is probably not different from 5.8 and it would be more correct to say that the discrete and underway measurements give the same pCO2 values. Page 5648, Line 26: It is not really binning when you regrid high-resolution data onto a coarser grid, but that is semantics. This terminology is used in other places in the manuscript also. Page 5652, Line 4-5: It is not necessary to inform the reader that 1.7 times 10 is 17. Page 5652, Line 22: SOCATv2, which has data until 2011, contains 10.1 million measurements from more than 2660 cruises. The information you state here is for SOCATv1.5 which contains data only up to 2007. Page 5653, Line 8-9: “averaged over each defined province (Fig. 2, Sect. 2)”. This needs more explanation, it sounds like you compared one average data point in each province to the algorithm based estimate. Page 5654, Line 7-8: Like for wind speed, there are higher resolution sea level pressure data products available. Page 5654, Line 22: use smaller than rather than inferior to Page 5655, Line 1-5: These two sentences repeat the same information and are awkwardly written. Please revise. Page 5655, Line 6: Have you checked what the result is if you do not include Chl a in your MLR? It would be interesting to see. Page 5656, Line 1: do you mean intra-annual? Section 4.2: You are inconsistent in how you compare the observations (i.e. SOCAT) and the model (i.e. pCO2 calculated using the algorithms). Always compare the model to the observations, not the other way around. In addition, it would be worthwhile to use some of the statistical tools for data-model comparison outlined in (Stow et al., 2009). Section 4.3.1 and 4.3.2: These subheadings do not adequately relate to what is presented in the sections. Both sections mostly discuss variabilities in Chl a, and not pCO2 or air-sea CO2 fluxes. Please revise such that the presented Chl a data is better related to the pCO2 and flux results. Figures: Some of the figures, especially Figure 3, have quite poor resolution which makes them difficult

BGD
12, C2723–C2726, 2015

to read. Please increase the resolution.

References:

Lauvset, S. K., Chierici, M., Counillon, F., Omar, A., Nondal, G., Johannessen, T., and Olsen, A.: Annual and seasonal fCO2 and air–sea CO2 fluxes in the Barents Sea, Journal of Marine Systems, 113–114, 62-74, 2013.

Omar, A. M., Johannessen, T., Olsen, A., Kaltin, S., and Rey, F.: Seasonal and interannual variability of the air-seaCO(2) flux in the Atlantic sector of the Barents Sea, Marine Chemistry, 104, 203-213, 2007. Stow, C. A., Jolliff, J., McGillicuddy, D. J., Jr., Doney, S. C., Allen, J. I., Friedrichs, M. A. M., Rose, K. A., and Wallheadg, P.: Skill assessment for coupled biological/physical models of marine systems, Journal of Marine Systems, 76, 4-15, 2009.

Interactive comment on Biogeosciences Discuss., 12, 5641, 2015.