Biogeosciences Discuss., 11, C5831–C5833, 2014
www.biogeosciences-discuss.net/11/C5831/2014/

Biogeosciences Discussions Open Access

Interactive comment on "Modeling pCO₂ variability in the Gulf of Mexico" *by* Z. Xue et al.

Anonymous Referee #2

Received and published: 11 October 2014

General Comments: In "Modeling the pCO2 variability in the Gulf of Mexico", Xue and co-authors carry out a study that models sea surface pCO2 and CO2 fluxes in the Gulf of Mexico, with special attention to the Louisiana shelf. Until recently, this area was a gap in global and regional carbon estimates. Coupled models provide a useful tool to evaluate variability in the area.

Specific Comments: In my opinion, the results in this paper need a little more work. I do think there is value in this work, based on the small number of modeling studies carried out Gulf-wide and a promising approach. What worries me more has to do with the way pCO2 is handled. In section 2 (page 12676 starting on line 20) I'd like to see a brief description of the biogeochemical module that is the key to this paper, instead of having to read 3 other papers to learn about it.

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

Likewise, since the paper focuses on pCO2, more detail as to how it was computed from DIC and TA should be provided. e.g. What constants were used? pCO2 is often expressed in units of uatm. Did the authors convert the observations, in uatm, to ppm before comparing with model results?

The authors use secular air pCO2 for their model, but they are trying to look at seasonal and spatial variability, not long-term trends. What is the advantage of using secular pCO2 in this case? Authors should justify in their paper why they are using it. When they compute air-sea CO2 fluxes and compare them with observation-based estimates, what air pCO2 has been used in the observations?

The authors state that their model captures the measured pCO2 in 6 out of 11 cruises for the Louisiana Shelf, but that is basically 50% of the times, so hit or miss results and they consistently overestimate pCO2 values. Since the model has high resolution, and the Louisiana shelf is so complex due to the influence of the river plume, it would be interesting to see if a more detailed data-model comparison (instead of a one point mean) provides more information on how to fine-tune the model for future exercises.

For the Gulf-wide comparisons, please re-word page 12679 line 4. These are not LDEO in-situ data. They are data gathered by several institutions, most notably NOAA, that were shared in the LDEO database. Please refer to it as a database. In this database there are very few points outside the northern Gulf of Mexico, particularly in the TX and MX regions. That makes observation means heavily biased toward behavior in the northern Gulf and, in my opinion, make model-data validation Gulf-wide a subject for discussion that has been ignored in this paper. Differences observed between data and model results in regions with few observations are less “problematic” than in areas with high data, and in fact, models might do a better job in those poorly sampled regions than data-based estimates. There is no mention of this in the paper.

On page 12686, lines 15-17, and in Table 2, since pCO2 was calculated from DIC and TA model estimates, it makes sense that these parameters correlate well, I’m more

BGD

11, C5831–C5833, 2014

intrigued about how pCO2 calculated from DIC and TA in shelf waters during the spring correlates so poorly with DIC. Would the authors like to elaborate a bit more on what they think could be the reasons for this? Would this be an indication that DIC model estimates are off in this case?

Technical corrections: In the introduction, why do the authors reference projections from IPCC 2001 instead of using more recent projections, such as the latest IPCC report? There are some typos scattered in the text. The use of English could be improved (e.g. all of section 3.3, but in any case, have another read with fresh eyes of all the paper). In Figure 1, the in-situ observations are in black, not red.

Interactive comment on Biogeosciences Discuss., 11, 12673, 2014.