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Biogeosciences Discussions



# *Interactive comment on* "Interannual variability of air-sea CO<sub>2</sub> fluxes and carbonate system parameters in the East Siberian Sea" *by* I. I. Pipko et al.

**Anonymous Referee #1**

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Comments on "Interannual variability of air-sea CO2 fluxes and carbonate system parameters in the East Siberian Sea" by Pipko et al.

General comments

The study provides interesting data on the spatial-temporal distribution of the carbonate system (CS) with special emphasis on the air-sea exchange of CO2. The paper summarizes an impressive multiannual data set from one of the most remote and under sampled, but also most climate sensitive coastal shelf seas, the East Siberian Sea, and is therefore of high interest to the Journal Biogeosciences and to the special issue in particular. The data presented, most of the analyses and the general conclusions

appear sound in general. However, the manuscript appears far too long with a lot of redundant parts and unnecessary discussions (see below). I recommend therefore major revisions that focus on the overall structure and on formulations of clear hypotheses regarding processes governing the CS within the ESS that can be better constraint by the presented data. I would recommend to structure the paper according to the observed confronting water masses ("Siberian Coastal Current" and "open marine water masses") instead of discussing first the West-Siberian, then the East-Siberian and finally the interannual variability within these basins. Moreover, the main results of the manuscript, i.e., the presentation of year to year changes in air-sea CO2 fluxes of the entire ESS during the two atmospheric regimes appear rather short and more emphasiz on how these calculations have been done (spatial averaging) and the related uncertainties should be presented.

Specific comments:

Page 1228: Line 14: high productive compared to what? Line 20: how can that be: a sink of CO2 and simultaneously a net flux of CO2 into the atmosphere?

Page 1229: Line 6: “marine hydrology”: I would use hydrography for marine waters and hydrology for fresh waters (this should be used consistently throughout the manuscript) Line 24: there were a bunch of recent publications that should be given (also by the co-authors from this manuscript)

Pages1230-1231: I would suggest having a “study area” paragraph in the M&M section;

Page 1231: Line 8 and following: the two atmospheric regimes are central in the discussion of the data; I would suggest mentioning already here the position of the Siberian coastal current and introducing the structure of the paper according to the position and extend of the two confronting water masses as a result of the two atmospheric regimes. Page 1232, second paragraph: please indicate what is new in this paper. Is this purely a review of three surveys or does it add something new; the overall budget I guess??



BGD

8, C234–C237, 2011

Page 1235: Line 24: what is a significant fraction; you mention at several occasions in the manuscript the effect of sea ice and melting, but you do not constrain this in any way; thus I would take it out.

Page 1237: Line 11 and following: this is the main and new finding in the manuscript and is rather shortly presented. As I understand are these data the basis for the "first direct air-sea CO2 flux multi-year considerations" presented at page 1247. The reader cannot reproduce how the spatial averaging has been done leading to the conclusion presented at page 1247; is this a stable front that we see in 2008 or is this only a snapshot view. How certain are these estimates, how variable is the coastal current also within the discussed years. The reader needs simply more information on this and more room should be provided in this paper (both in the result and discussion section) on this central point of the presented paper.

Page 1238: General: I would suggest to present the key implications of this paper in the introductory part of the discussions (they are presented far later at page 1247): indicate the net CO2 air-sea fluxes of the coastal current and the surrounding water masses. Later on you can discuss the major processes and uncertainties involved (but only those you have really data for, the others such as melting sea ice or resuspension should be only mentioned shortly); moreover you should discuss the uncertainty in spatial averaging of the two water masses and their related air-sea fluxes Line 17 and following: a consumption of 1 mol C m-2 is 12 g m-2 and if we assume an f-ratio of 0.1 to 0.3 the overall PP can be between 50-100 gC m-s which is not too low. However, the measured consumption of CO2 is net, i.e, the PP may be much higher since respiration adds continuously CO2 to the water column

Page 1239: the data presented in this paper do not help to explain coastal erosion patterns; I would therefore suggest to cut down this discussion significantly

Page 1240: Line 6 and following; this is redundant information that should be given in the result section Line 19 and following section in 1241: your data do not shed new



BGD

8, C234–C237, 2011

light on melting, brine formation and so forth, i.e. cut this discussion down significantly; Alling et al 2010 says that ice does not play a major role!

Page 1242: Line 19: normally the euphotic zone is given as the 1% light level

Page 1243: In what respect does your data set presented help to explain benthic boundary layer phenomena? In case not cut down the discussion on this issue.

Page 1245-1246: Instead of discussing interannual variability as a sub-chapter I would use the two water masses “Siberian Costal Current” and “surrounding water masses” or “open marine water masses” to present and discuss the major processes governing the CS and air-sea fluxes

Page 1247: The main finding presented here need better estimates of uncertainties (spatial averaging) as well as the potential of processes unaccounted for (short discussion!) as the effect of CH4 oxidation in the water column and a potentially huge degassing event after ice-break up as observed in lakes

Page 1249: Line 14: maybe add here some info on global patterns of coastal seas as a carbon pump

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Interactive comment on Biogeosciences Discuss., 8, 1227, 2011.