

Interactive comment on “Atlantic and Arctic sea-air CO₂ fluxes, 1990–2009” by U. Schuster et al.

Anonymous Referee #2

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Biogeosciences Discuss., 9, 10669–10724, 2012 www.biogeosciences-discuss.net/9/10669/2012/ doi:10.5194/bgd-9-10669-2012 © Author(s) 2012. CC Attribution 3.0 License. Biogeosciences Discussions This discussion paper is/has been under review for the journal Biogeosciences (BG). Please refer to the corresponding final paper in BG if available. Atlantic and Arctic sea-air CO₂ fluxes, 1990–2009 U. Schuster¹, G. A. McKinley², N. Bates³, F. Chevallier⁴, S. C. Doney⁵, A. R. Fay², M. González-D’ávila⁶, N. Gruber⁷, S. Jones^{1,8}, J. Krijnen^{1,8}, P. Landschützer^{1,8}, N. Lefèvre⁹, M. Manizza¹⁰, J. Mathis¹¹, N. Metzler¹², A. Olsen¹³, A. F. Rios¹⁴, C. Rödenbeck¹⁵, J. M. Santana-Casiano⁶, T. Takahashi¹⁶, R. Wanninkhof¹⁷, and A. J. Watson¹

Anonymous referee #

C4841

General comments

This reviewer enjoyed reading this manuscript even though it is rather long. To deal exhaustively with it needs someone who is expert in CO₂ observations, in data management, in biogeochemical modelling and in inverse modelling of ocean and atmosphere. That person is hard to find. It is this multi-spear approach, however, which gives this manuscript significant weight. I recommend its publication and make comments below which I believe will improve the presentation.

The subject is treated on a regional basis where the Arctic and Atlantic Oceans are split into 5 regions. These regions are set forward for inverse modelling work and poorly related to oceanographic characteristics. The authors mention that these regional boundaries are sub-optimal. This is particularly evident for the region termed North Subpolar which extends from 76°N to 49°N. This is a highly heterogeneous region with respect to hydrography, seasonality and productivity. It is also considered a strong sink for atmospheric CO₂. The term “Subpolar” invites confusion with the subpolar gyre which does not extend north of 65°N (See Hakkinen and Rhines, 2009) and is mentioned several times. The observations on air-sea fluxes in the subpolar North Atlantic, referred to in the Subpolar review section 1.2 and in the Subpolar discussion section 4.2, are mostly from south of 65°N. To avoid confusion the regions could simply be numbered 1 to 5.

The results of different methodologies are expressed as CO₂ fluxes. The flux is a function of the state of the sea surface, $\Delta p\text{CO}_2$ ($\Delta p\text{CO}_2$). It would be of interest, at least to some readers, to see how the different methods fare with respect to this measure. This might be described in the text and illustrated in a figure similar to Fig. 6 on seasonal cycles.

The conclusion section is brief and abrupt. It is stated twice, on p10688, line 12, and on p10693, line 24, that the best estimates of the CO₂ fluxes are from the pCO₂ climatology and the ocean inversion. This seems to be a significant conclusion which

C4842

merits being listed with the other conclusions. The recommendation on page 10695, line 25, about regional boundaries, might also be listed with the conclusions. And can the authors add in the end their view on how to proceed with the effort to better constrain the Atlantic Ocean carbon uptake?

Specific comments

Page 10669 Line 1: The title is rather bold, considering uncertainties, it seems appropriate to precede it with "Assessments of ..".

Page 10681 Line 9: A description of the NAO formulation used should be added to this section .

Page 10696 Line 4 and 6: This sounds like pCO₂ climatology, please clarify.

Page 10718 Table 8: Is there a decimal point missing in the pCO₂ database column?

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C4843