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Biogeosciences Discussions

Interactive comment on "Air-sea CO₂ fluxes in the Atlantic as measured during the FICARAM cruises" *by* X. A. Padin et al.

Anonymous Referee #3

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General comments: The manuscript presents the air-sea CO2 fluxes in the Atlantic Ocean along meridional cruise tracks during boreal autumn and springs seasons. It also identifies an empirical algorithm for modelling surface seawater CO2 fugacity (fCO2) from other parameters in order to analyse the forcing of the fCO2 variability.

The manuscript is well structured and represents a substantial scientific contribution notably because of a unique dataset. I recommend publication after the authors addressed the following comments.

Specific comments: The authors group their data into established biogeochemical oceanographic provinces and local (i.e. within province) latitudinal variations in surface seawater properties are presented/discussed in the manuscript (e.g. Fig. 2). However, the existence and influence of longitudinal gradients are not considered. Such gradi-

ents are especially relevant for the North Atlantic where cruise tracks vary substantially (Fig. 1 in the manuscript). This poses the question: do cruise track changes contribute to the interannual (i.e. inter-cruise) variations presented in section 3.3?

Data from two seasons (boreal spring and autumn) is analysed in the manuscript and authors refer to the observed spring-autumn differences as seasonal changes, seasonal shifts, and/or seasonal differences, seasonal amplitude etc. in several places of the manuscript. The above terms are also normally used to describe changes that take place over a complete annual cycle. To avoid ambiguity, authors need to be more specific about which seasons they are referring to. For instance, sentences like "Differently, almost negligible seasonal SST differences were observed in equatorial regions (NECC region; Table 2)." could be modified to " Differently, almost negligible spring-autumn SST differences were observed in equatorial regions (NECC region; Table 2)."

Technical comments: The title should be changed for more accuracy by including "spring and autumn seasons", For example: "Air-sea CO2 fluxes in the Atlantic during boreal spring and autumn seasons". Page 5590, line 24: "released to the atmosphere only half of it (_9.1 PgC yr−1 at present; Canadell et al., 2007.." should read " released to the atmosphere (_9.1 PgC yr−1 at present; Canadell et al., 2007) only half of it.." Page 5591, line 22 at the end. Please give examples of databases. Page 5592, middle of line 5, remove the word "at". Page 5594, lines 15-19: The use of different SST and SSS senors can introduce offsets, could this be the case for the present data? Page 5595, lines 8 – 10, the sentence starting with "Finally,.." If I understand it correct, fCO2_atm was computed and compared with pCO2_atm, and any values for which the difference was greater than 0.3% were not used. In nay case, please clarify how fCO2_atm was computed. Page 5598, lines 21 – 22: Authors state that "In general, Northern Hemisphere waters were warmer than Southern waters during the boreal autumn while the opposite prevailed during boreal springs (Fig. 2a, e)." This is not exactly true, except for NEC, NECE, SEC and STG provinces. Page 5602, line 9: the sentence beginning with "Alternatively,.." is difficult to understand. I guess the

authors try to explain the cause of the super-saturation, but the word "alternatively" confuses since there is only one explanation put forward. Regardless, there is a need for a clarification. Page 5602, lines 26-28: please provide reference for the seasonal shifts described for chl-a. Page 5603, middle of line 11 “SAC” should read “SAS”. Page 5603, middle ofline 14 “SAS” should read “SAC”. Page 5603, line 28, sentence starting with “All records. . .” I do not understand the last part of this sentence. Page 5605, lines 9-11: I do not understand last part of the sentence ”..so as to include them as well and complete the database.” Page 5605, line 14-15: ”The interannual variability of SST and ïĄĎfCO2 indicate a warming and increasing CO2 saturation of surface waters in the Eastern North Atlantic (Fig. 3a, b).” But these trends were not significant, correct? Page 5605, lines 17-21: It is difficult to know whether the authors suggest a relationship between NAO and warming and fCO2 saturation, or if they are referring to an established relationship. Page 5605, line 27: ”Fig. 4c” should read ”Fig. 3c”. Page 5608, last line: I do not understand the sentence starting with “Furthermore, ..”

Figure 1: please give the full names of the provinces in the legend. Figure 2: the resolution is poor; the meaning of CPC does not appear anywhere in the manuscript. I do not find it necessary to differentiate different cruises.

Interactive comment on Biogeosciences Discuss., 6, 5589, 2009.