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The very rapid decrease of the north Atlantic subpolar gyre carbon sink during recent years (2001-2007)

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The evolution of oceanic carbon sinks and sources represents an important step for understanding the changes in the global carbon cycle and better predicting the future climate. Results are based on several cruises in the high latitudes of the north Atlantic Ocean conducted between Iceland and the Newfoundland (SURATLANT program). In this study, we used data from 1993 up until the early 2007 for both hydrological and carbon parameters (Dissolved Inorganic Carbon, DIC and Total Alkalinity, TA) measured in the North Atlantic subpolar gyre (53˚N-62˚N). A first analysis (1993-2003) showed that DIC and TA concentrations appeared relatively stable indicating a complex balance between primary production, vertical mixing, horizontal transport and anthropogenic CO_2 increase. The oceanic fugacity of CO_2 ($f CO_2^{oc}$) evolution computed with all DIC/TA pairs indicates an increase at a rate of +2.95 ($\pm$ 0.52) μatm.yr^{-1}, faster than atmospheric measurements based on the Mace Head data : +1.78 ($\pm$ 0.07) μatm.yr^{-1}. This increase was attributed to the rapid warming (up to 1.2˚C over 10 years) observed when the North Atlantic Oscillation index moved into a negative phase in winter 1995/96 [Corbière et al., 2007]. This analysis has been prolonged by adding new data obtained for the period 2004-2007. We now focus on the most recent period (2001-2007) and we determine that the concentration of $f CO_2^{oc}$ has increased at a greater magnitude +7.58 ($\pm$0.83) μatm yr^{-1} than previously while $f CO_2^{atm}$ rise at a rate of +2.00 ($\pm$0.17) μatm yr^{-1} over the same period. Because no

specific trend was observed on sea surface temperature, this very rapid change could be attributed to changes in seawater chemistry (an increase in DIC and a decrease in alkalinity). If the effects of changing DIC and TA are removed from the data, $\sim$90% of the observed 6 years trend in fCO_2^{oc} disappears. The difference between oceanic and atmospheric fCO_2 trends results in a large reduction with time in the strength of the CO_2 sink. This concurs with recent research in the north Atlantic Ocean [Schuster et al., 2007]. Estimating the north Atlantic ocean sink and this rapid change represents an important challenge for both modelling community. These results also highlight the need for continuing to monitor the ocean uptake at the scale of the North Atlantic and long-term sea surface ocean observations (DIC, TA and fCO_2).

References:

Corbière, A., Metzl, N., Reverdin, G., Brunet, C. and Takahashi, T. 2007. Interannual and decadal variability of the oceanic carbon sink in the North Atlantic subpolar gyre. *Tellus* 59B, 168-178.

Schuster, U., Watson, A.J., Bates, N., Corbière, A., Gonzalez-Davila, M., Metzl, N., Pierrot, D., Santana-Casiano, M. 2007. Trends in North Atlantic sea surface pCO_2 from 1990 to 2006. Submitted to *Deep-Sea Res. II*, special issue SOCOVV.