PROGRESSIVE DECREASE OF THE N. ATLANTIC MIDLATITUDE SINK FOR ATMOSPHERIC CO_2

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We present monthly means of observations of sea surface and atmospheric pCO_2 and associated variables made on board commercial vessels operating in the mid-latitude North Atlantic between the UK and the Caribbean. The measurements were made using automated instrumentation in 1994 -1995, and again from 2002 - present, allowing the study of changes which have taken place over a large region of the North Atlantic over almost a decade. Sea surface pCO_2 has increased faster than atmospheric pCO_2 over the whole region, so that ΔpCO_2 has decreased, reducing the mid-latitude North Atlantic sink from the atmosphere. The change in ΔpCO_2 is largest in the north and east, and smallest in the south and west of the region. The main increase in sea surface pCO_2 and decrease in ΔpCO_2 occurred during the minimum of the seasonal cycle of oceanic CO_2, i.e. during summer in the subpolar regions, and winter in the tropics and subtropics. The trends we see are consistent with data from independent studies such the Bermuda Atlantic time series [*Gruber et al*., 2002], and analysis of trends in the Sub-Polar North Atlantic [*Lefevre et al*, 2004]. Changes in sea surface temperature, either measured from the ships or from re-analysis, are insufficient to explain the shift in ΔpCO_2. Other possible explanations are either a decrease in biological activity, or a decrease in winter-time mixing and renewal of surface waters, of which the latter seems most likely. The results show that long term observations of parameters related to marine CO_2 are imperative to fully understand the marine CO_2 cycle and the changing sink for atmospheric CO_2 in the oceans.

REFERENCES

Cooper D.J., A.J. Watson, and R.D. Ling (1998), Variation of pCO_2 along a North Atlantic shipping route (U.K. to the Caribbean): A year of automated observations. *Mar. Chem., 60,* 147-164.

Gruber N., C.D. Keeling, and N.R. Bates (2002), Interannual variability in the North Atlantic Ocean carbon sink. *Science, 298,* 2374 – 2378.

Lefevre N., A.J. Watson, A. Olsen, A.F. Rios, F.F. Perez, and T. Johannesses (2004), A decrease in the sink for atmospheric CO_2 in the North Atlantic, *Geophys. Res. Lett., 31*, L07306, doi: 10.1029/2003GLo18957