Surface CO₂ measurements in the English Channel with VOS

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Ships of opportunity were used to investigate ocean-atmosphere CO₂ fluxes in the Biscay Bay. In several times due logistical issues, some of the ship transits between Spain and France were extending further north, up to the English Channel. This way, in the inner zone of English Channel were performed continuous measurements of pCO₂ in air and seawater, temperature, salinity, oxygen and fluorescence during Spring 2003 (20 transects) and Autumn 2003 (2 transects) and 2004 (3 transects).

During Spring the surface waters of the Channel were strongly undersaturated, with a minimum of 260 µatm. The data were divided in two periods according to phytoplankton activity: the peak stage (March-April) and late stage (May-June). The relationship between the chlorophyll (Chla (mg/m³)) and fCO₂ obtained in the bloom showed a high correlation coefficient ($fCO₂ = 380 - 33.3 \times Chla \quad (r^2=0.83)$). With zero chlorophyll level, fCO₂ reaches a close value to atmospheric equilibrium (time data serie of meteorological station of Mace Head (Irland) estimated 378 ppm of atmospheric pCO₂ in this period). The regression corresponding to the late stage yielded a significative correlation coefficient though less important than in bloom period ($fCO₂ = 328 - 8.2 \times chla \quad (r^2 = 0.13)$).

During the autumn transects whole Channel was oversaturated in CO₂. The sea surface temperature (SST (°C)) was the main factor controlling fCO₂ in September 2003, month of the maximum fCO₂ average according to Borges et al. (2003), 470 µatm ($fCO₂ = 139 + 16 \times SST \quad (r^2 = 0.40)$) and in November 2004 ($fCO₂ = 294 + 7 \times SST \quad (r^2 = 0.39)$). This relationship is consistent with the hypothesis suggested by Frankignoulle et al. (1996) that associates the autumn oversaturation with the entrance of warmer water from the North Atlantic.

Air-sea fluxes obtained for the four studied periods were -9.3, -9.5, 11.2 and 2.5 mmol·m⁻²·day⁻¹, respectively, that seems to confirm that English Channel is a continental shelf region with a high variation of surface CO₂ level and without a significant uptake of atmospheric CO₂ on an annual scale.

REFERENCES
