Anthropogenic carbon distribution and ocean acidification state in the Patagonian shelf break region

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Background

- **Oceans are known to play an important role in absorption of CO_2 released in the atmosphere.**
- **Motivated by the increasing emissions by human activity, reaching a record value since 1750, many studies have been conducted to understand and quantify the anthropogenic carbon (C_{ant}) absorption, distribution and effects in the oceans.**

Findings

- **C_{ant} absorption in the entire water column, with low values in the deeper region of the northern study area, and no C_{ant} above 1000 m – NADW, AABW (by TrOCA) – Fig 2.**
- **Higher C_{ant} values were observed near Río de La Plata mouth and in AAIW (TrOCA), while higher values for C_T^0 were found south of 40°S – SASW – Fig 2.**
- **C_{ant} average values were (± methods precision) of 67.59 ± 3.5 mmol kg^{-1} and 89.30 ± 1.3 mmol kg^{-1} for TrOCA and C_T^0, respectively.**
- **Using C_{ant} results, the state of oceanic acidification (ΔpH) was distinctly estimated from both methods, with average values (± standard deviation) of −0.179 ± 0.168 and −0.173 ± 0.052 for TrOCA and C_T^0, respectively, indicating an annual pH reduction of −0.001 yr^{-1} since 1750 – Fig 2.**

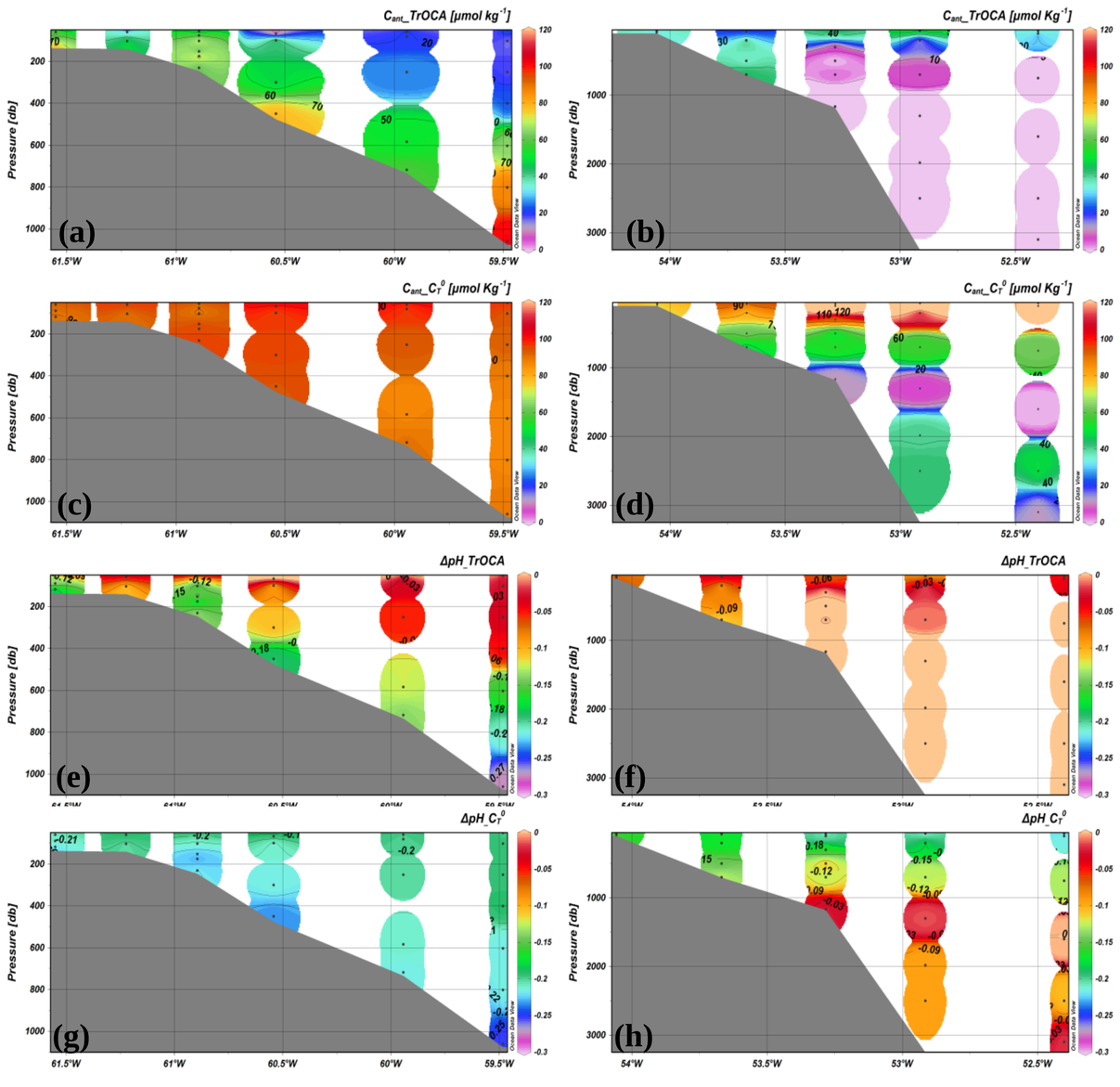

Figure 2. C_{ant} and ΔpH distribution in sections along 47°S (left side) and 36°S (right side) in the Patagonian shelf and shelf break. (a, b) C_{ant}_TrOCA (µmol kg^{-1}), (c, d) C_{ant}_C_T^0 (µmol kg^{-1}), (e, f) ΔpH_TrOCA, (g, h) ΔpH _C_T^0.

Methods

- **Cant concentration was determined through TrOCA and C_T^0 methods in the Patagonian shelf break (36°S-50°S), from hydrographic and carbonate data sampled during two consecutive spring cruises (2007 and 2008) – Fig 1.**

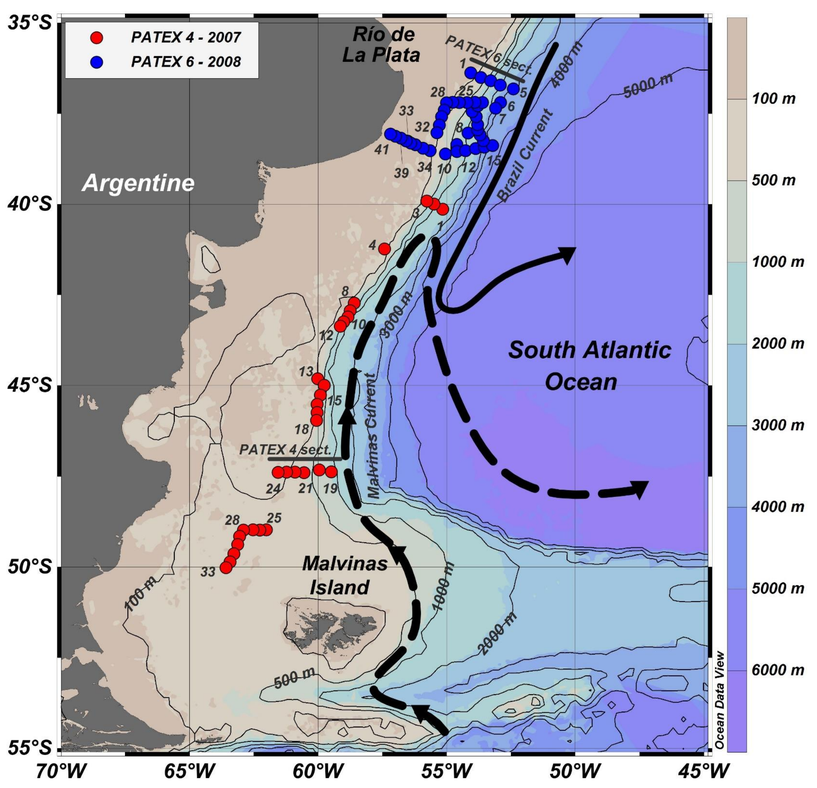

Figure 1. Study region. Hydrographic stations of PATEX 4 (spring 2007; red dots) and PATEX 6 (spring 2008; blue dots) cruises in the Patagonian shelf break. The main flow of Brazil and Malvinas currents are show by the black arrows (see Strub et al., 2015 for details about the regional ocean circulation in the area). Bathymetry shows in colour.

- **Calcite and aragonite saturation levels are not yet at a risk position, although may be affected by C_{ant} absorption and ocean acidification (except for aragonite in depth levels: 1060 m at 47.4°S/59.5°W, 1500 m at 38.4°S/53.5°W and 2013 m at 38.4°S/53°W).**

Conclusions

- **The Patagonian shelf break, which is considered one of the strongest CO_2 sinking region in the World Ocean, seems to be an important area for C_{ant} absorption, and the results showed here shed some new light on knowledge of the CO_2 system behaviour in the area.**

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This study contributes to the Brazilian Ocean Acidification Network activities www.broa.furg.br

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