Surface total alkalinity, salinity and temperature: a study case in the Southwestern Atlantic Ocean

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BACKGROUND & RATIONALE

Total alkalinity in open ocean surface waters is mainly controlled by salinity, although biogeochemical processes may contribute to changes in it. Here we analysed surface total alkalinity samples (AT) from the EstARte-SUL cruisealong the Brazilian shelf break in the SW Atlantic, from 23°S to 32°S, in October 2014 (Fig. 1).

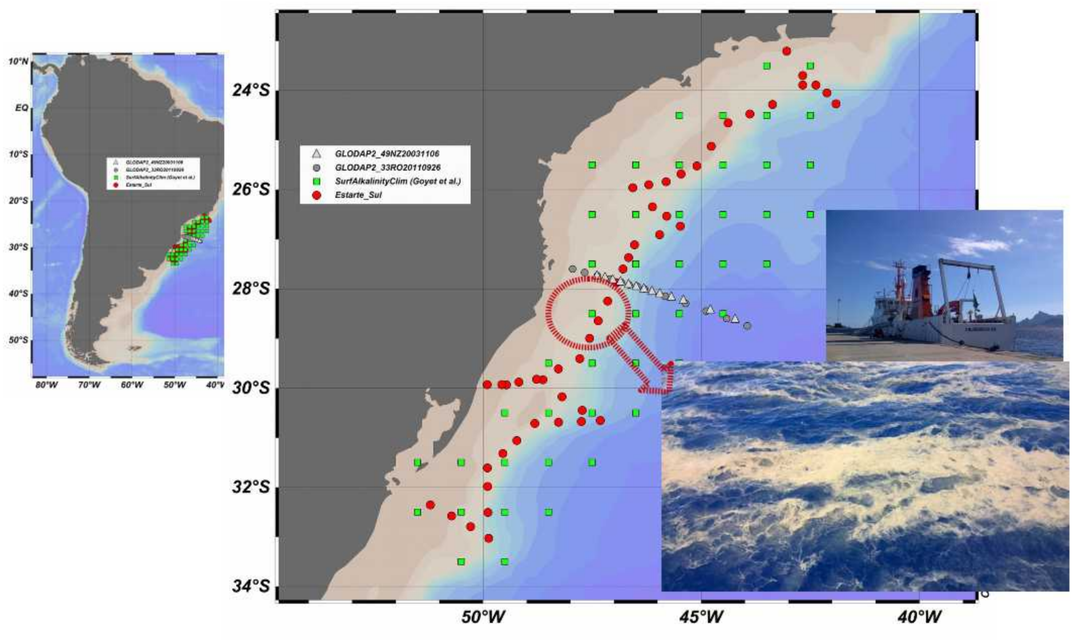

Fig. 1 – EstARte-SUL study area. Red dots correspond to the occupied oceanographic stations in Oct. 2014; green squares correspond to modeled surface alkalinity data points from Goyet et al 2003; grey circles and triangles correspond to data available in GLODAP2. Red dotted circle indicates the area were a large *Trichodesmium* sp. bloom was observed in Oct/2014.

This area of the ocean still lacks CO2-system data, and only recently more oceanographic sampling initiatives for this purpose were taken. Our main objectives are: a) correlate the AT values to surface salinity (SSS) and temperature (SST); b) check how this area relates to established AT x salinity relationships, and c) provide in the future a simple, robust tool to reconstruct historical data for AT and other CO2-system parameters for this area.

METHODS

Samples were collected and analysed according to Dickson et al. (2007). Total alkalinity analyses were conducted in closed cell titration, surface temperature and salinity data were taken from ship CTD measurements. Samples were analysed at LEOC/FURG laboratory (Fig. 2). Data was organized and analyzed using Ocean Data View software.

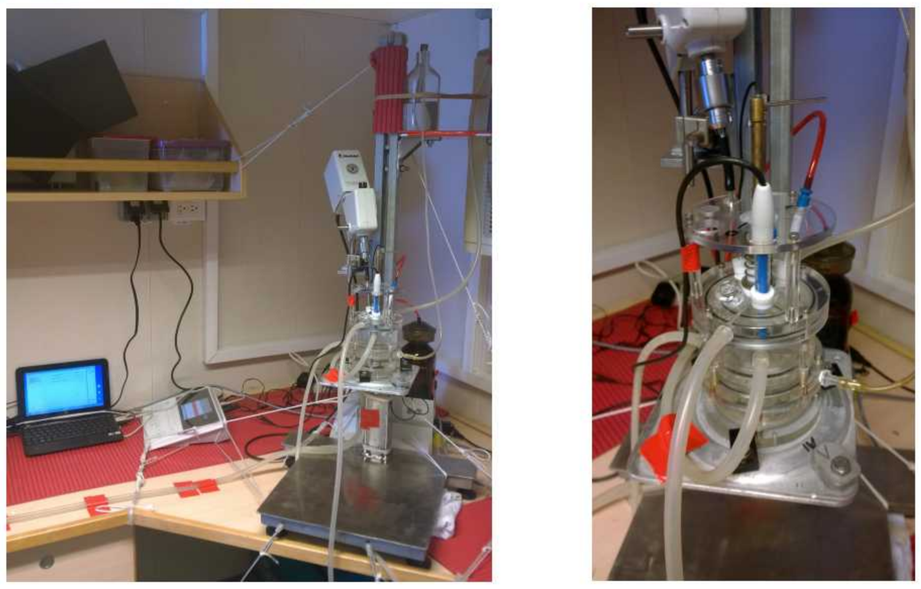

Figure 2 – Closed cell titration system for the determination of total alkalinity

FINDINGS

Along almost all the cruise track we have found the influence of Tropical Waters (TW), that flows southward with the Brazil Current. The southernmost stations were influenced by the Patos Lagoon plume, with lower surface salinity (Fig. 3).

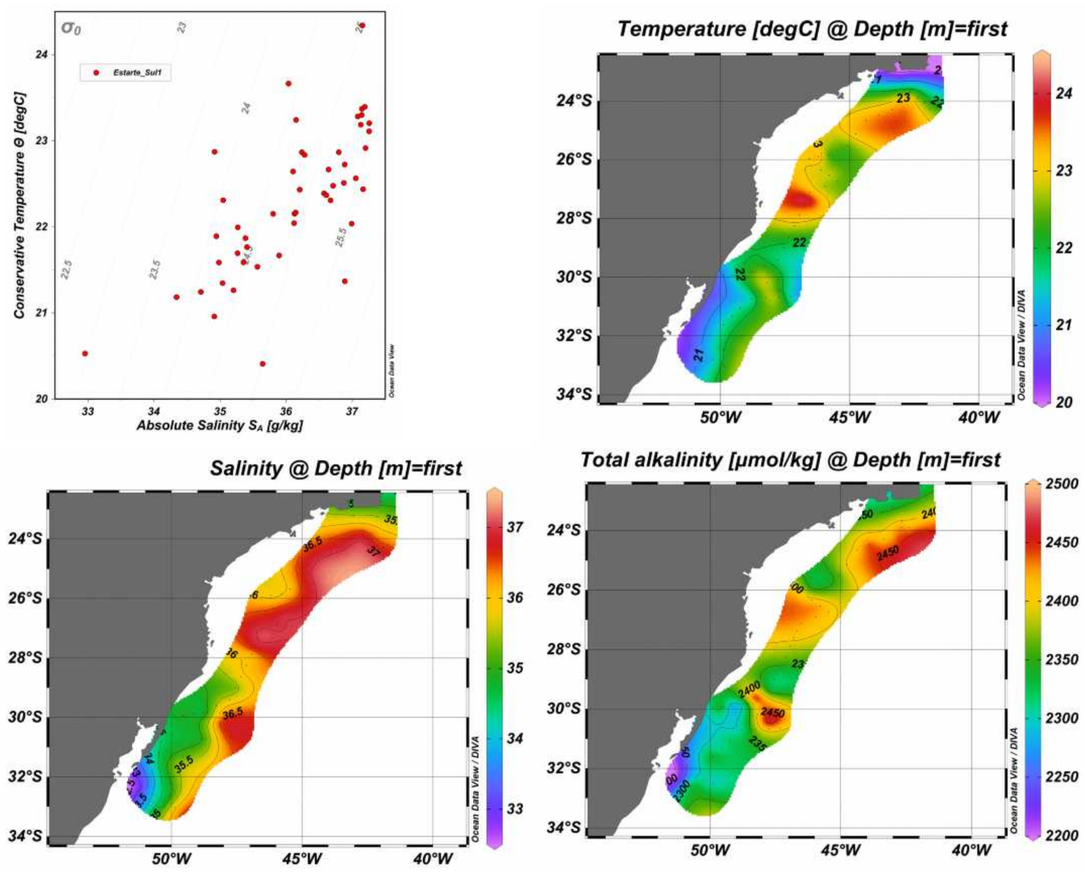

Fig. 3 – Surface water properties along the EstARte-Sul cruise (Oct/2014). Upper left panel: T-S diagram for surface water samples; upper right panel: surface temperature (in °C); lower left panel: surface salinity; lower right panel: surface total alkalinity (in µmol/kg).

AT data from 2014 was positively related to surface salinity (TA = 50.81SSS + 546.26, R^2 = 0.90, n = 48) and to SST (TA = 95.34SST + 305.88, R^2 = 0.47, n= 48) (Fig. 4).

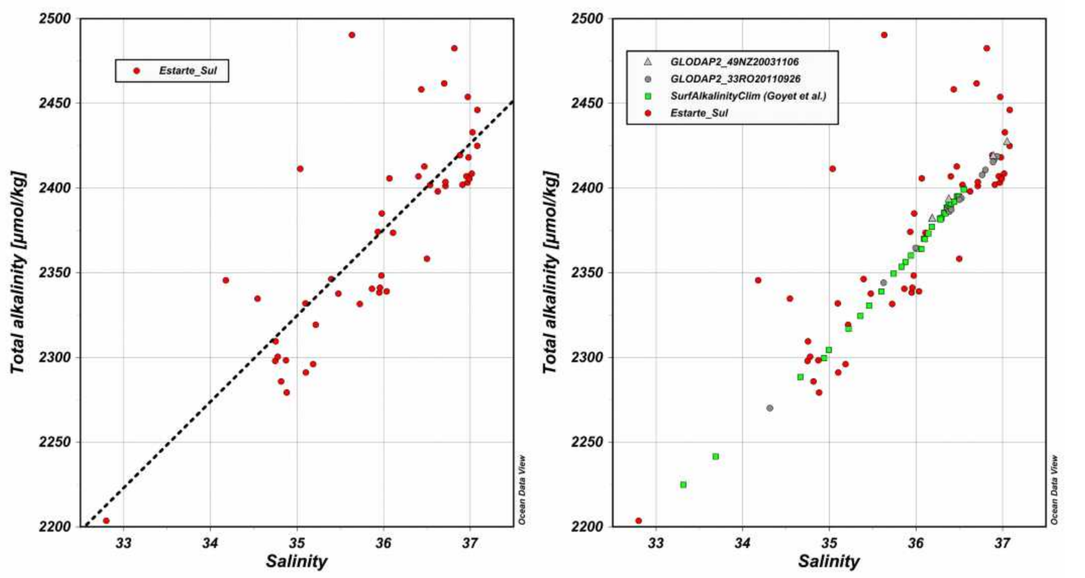

Fig. 4 – Left panel: Salinity vs Total Alkalinity data for the EstARte-Sul cruise; Right Panel: EstARte-Sul data and other available observation (GLODAP2) and model data (Goyet et al. 2003) for the same period (spring).

CONCLUSIONS

Preliminary results point to a control on AT by the balance between evaporation and precipitation in the open ocean region, despite the *Trichodesmium* bloom in 2014. "Offlyers" in Fig. 4 correspond to inner shelf stations.

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