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Interannual variability of oceanic CO2 parameters in the Eastern North Atlantic subtropical gyre

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Time-series approach is the best procedure to detect long term trends and changes against the background of the interannual variability of biogeochemical processes and hydrodynamics. Since 1996, hydrography properties, pCO2, fCO2, pHt, AT, CT, nutrients and chlorophyll a have been measured in surface waters on monthly cruises at the European Station for Time Series in the Ocean at the Canary Islands, ESTOC, located in the Northeast Atlantic subtropical gyre. With over nine years of oceanographic data, seasonal and interannual trends of CO2 species and air-sea exchange of CO_2 have been evaluated. This area is acting as a minor source of CO_2, with an average outgassing value of 40 mmol CO2 m^{-2} yr^{-1} controlled by the dominant Trade Winds blowing from May to August. The effect of short-term wind variability on the CO_2 flux has been addressed increasing air-sea fluxes by 63% for 6 hourly sampling frequencies. The processes governing the monthly variations of CT have been determined. On an annual scale, biological drawdown accounts for the decrease in inorganic carbon from March to October, while mixing processes control the CT increase from October to the end of Autumn. From March to October, when CT decreases, mixing at the base of the mixed layer (11.5 ± 1.5 mmol m^{-3}) is compensated by air-sea exchange, and a net organic production of 25.5 ± 5.7 mmol m^{-3} is estimated. After removing seasonality variability, fCO2sw increases at a rate of 1.3 ± 0.3 uatm yr^{-1} and consequently total inorganic carbon increases at a rate of 0.9 ± 0.2 umol kg^{-1} yr^{-1}, while pHt25 decreases at a rate of 0.0017 ± 0.003 and total alkalinity decreases slightly at a rate of 0.08 ± 0.02 umol kg^{-1} yr^{-1}. The relationship between the biogeochemical anomalies observed ant the modes of climate variability such as NAO and EP have been described.

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