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Supplement of

New observations confirm the progressive acidification in the Mozambique Channel

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Figure S1: Time-series of fCO_2 (µatm) and pH_T in the southern Mozambique Channel based on observations (black circles) and from the FFNN model (grey diamonds) for the same periods. Standard-deviations are indicated by vertical bars. The differences (FFNN minus Observation) are also shown (Open squares, right axis). In 2018 the fCO_2 from the model is high compared to the observations.

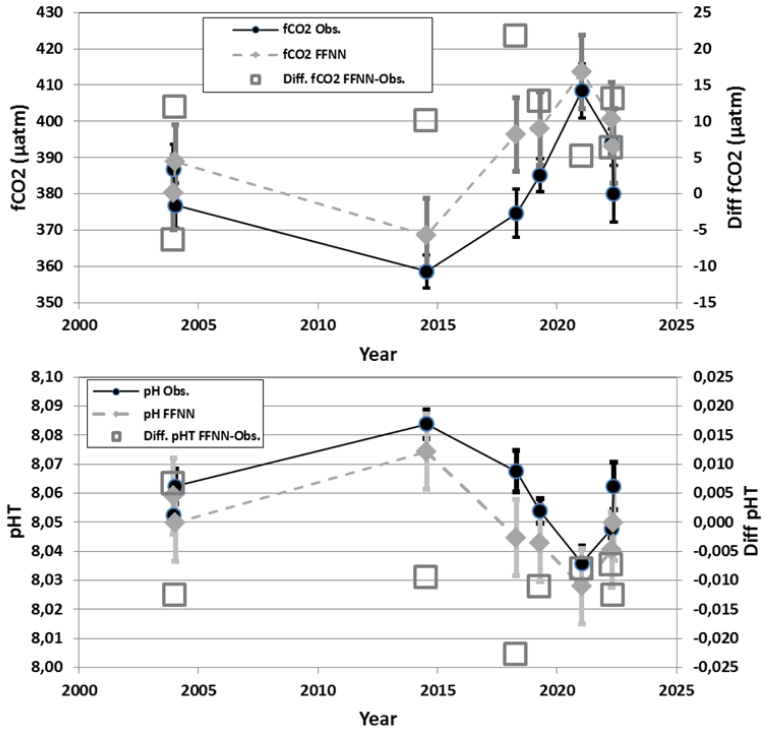

Figure S2: Profiles of N-C_T (filled circles, line), C_{ant} (open circles, dashed) and density (Sigma-0) at the station occupied in June 1995 (blue) and in December 2003 (red) (GLODAP station 591 at 42°E/24.7°S). In June, N-C_T and C_{ant} concentrations are homogeneous in the deep mixed-layer (0-70m). In surface, N-C_T in June and December are very close, coherent with the seasonal cycle (Figure 4). Note that the same C_{ant} concentrations (40 µmol.kg^{-1}) were evaluated below 100m in 1995 and 2003 whereas in surface C_{ant} values in December are unrealistic.

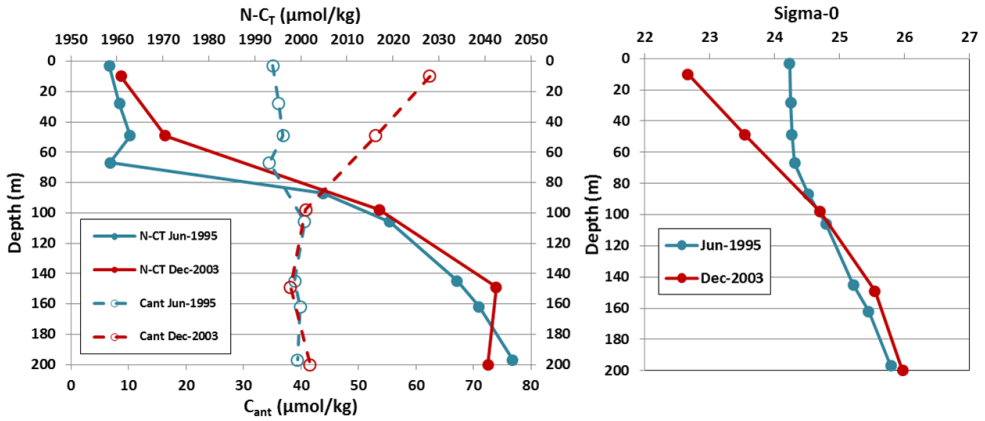

Figure S3: Seasonal cycle of fCO_2 (black), fCO_2 normalized at temperature 27°C (red) and C_T (grey) in the southern Mozambique Channel (24-30°S) derived from the monthly climatology (reference year 2010, Fay et al, 2024).

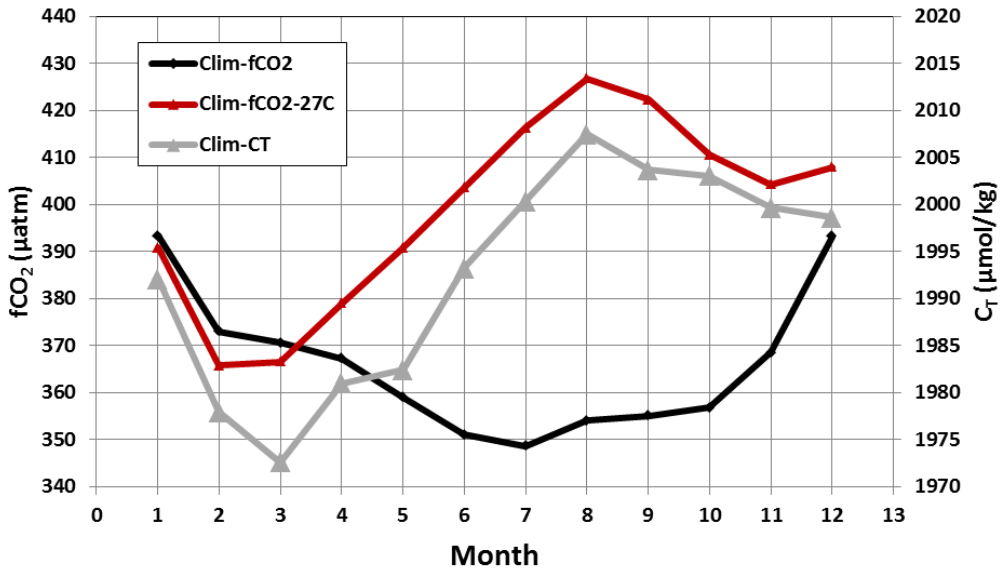

Figure S4: Monthly sea surface temperature anomalies (°C) at 25°S-40°E obtained from http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCDC/.ERSST/.version5/.anom/, last access 12 May 2025. The red line is the linear trend of +0.011 °C per year (i.e. +0.11 °C per decade).

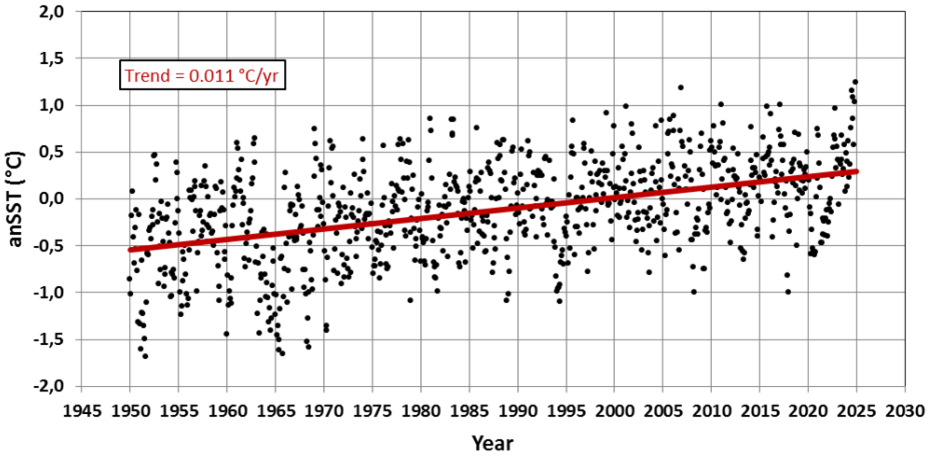

Figure S5: Time-series of air-sea CO_2 flux (black, negative for ocean sink) and C_T concentration (grey and 12-month running mean in red) averaged in the southern Mozambique Channel (24-30°S) based on the FFNN-LSCE model over 2015-2023. When the sink is stronger (e.g. in 2020) the C_T increase is faster.

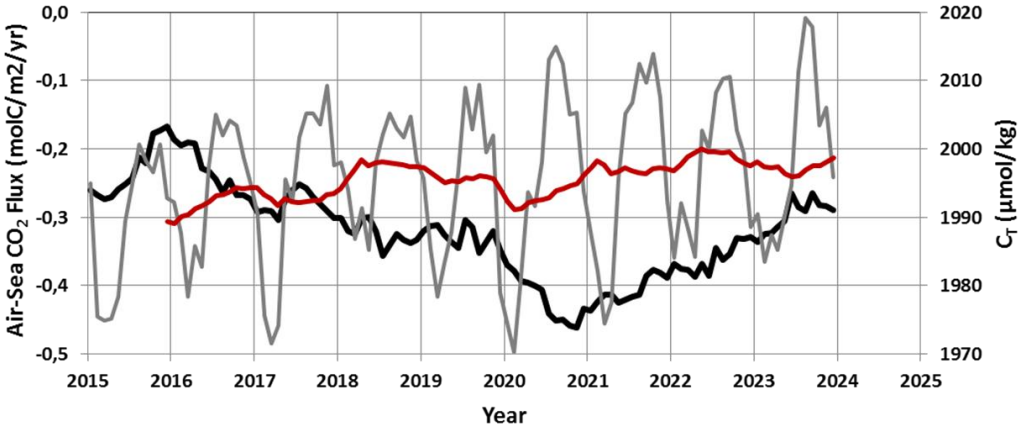

Figure S6: Time-series of oceanic fCO_2 versus atmospheric CO_2 in the southern Mozambique Channel (24-30°S) based on averaged observations between 1963 and 2022 (circles) and the FFNN model over 1985-2023 (grey diamonds, dashed grey line). Available observations are shown for all seasons but the trend of +1.089 µatm.ppm^{-1} (red dashed line) evaluated using only April-May data (red circles).

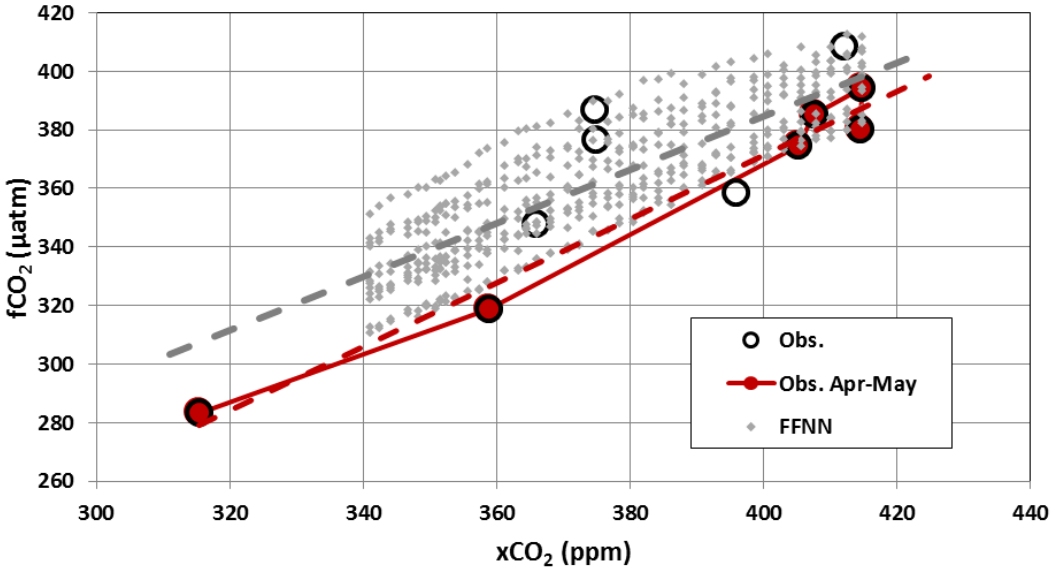

Figure S7: Map of Ω_{ar} in September 2023 in the Mozambique Channel based on the FFNN model. South of 20°S, Ω_{ar} < 3.3. Figure produced with ODV (Schlitzer, 2018).

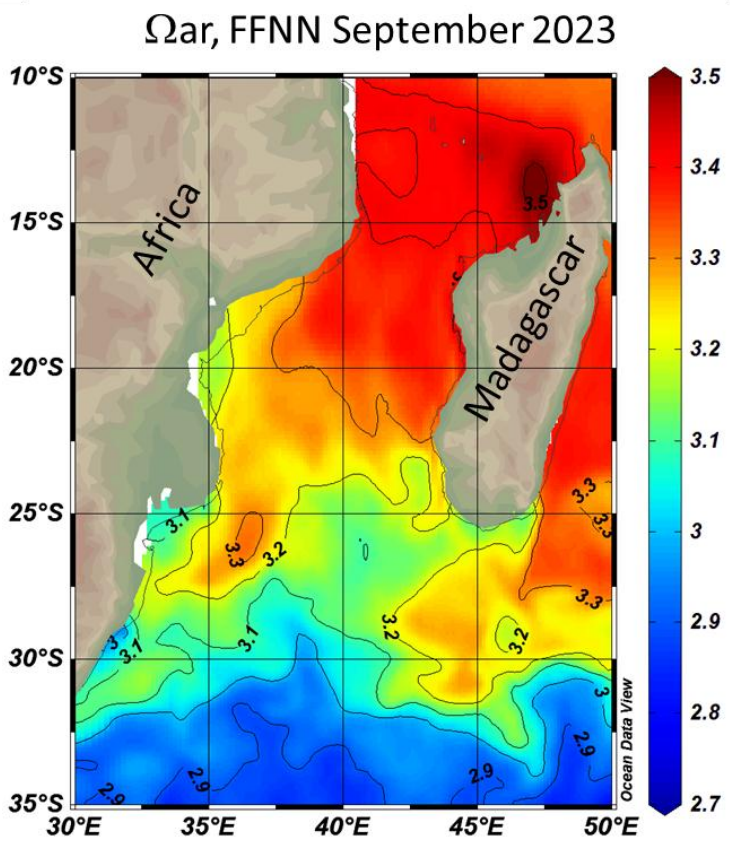

Figure S8: The relationship between C_{ant} and atmospheric CO_2 used for the reconstruction (Equation 2) was described by Metzl et al (2025b). It was evaluated from the C_{ant} concentrations in subsurface using data in 1987 to 2021 and correlated to the atmospheric CO_2 concentrations. (a) Time-series of anthropogenic CO_2 concentrations (C_{ant}) over 1987-2021 estimated in subsurface (layer 100-150m) from the GLODAP-v2023 data (Lauvset et al, 2024) completed with OISO cruise in 2021 (location of selected stations in the insert map, color code is for year). The figure shows the Cant concentrations calculated for each sample (black) and the C_{ant} averaged in the layer 100-150m for each period (grey triangles). Over the period 1987-2021, the C_{ant} trend is +1.03 ±0.14 µmol kg^{-1} yr^{-1} (dashed grey line). The red curve is the atmospheric fCO_2. (b): same data for C_{ant} versus atmospheric fCO_2 (slope= +0.512 ±0.050 µmol kg^{-1} $µatm^{-1}$).

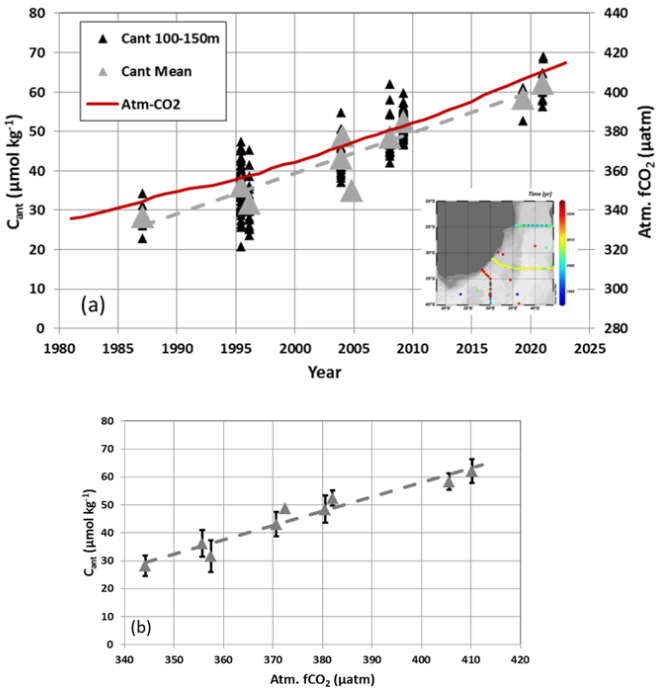

Figure S9: Time-series of the difference of (top) oceanic fCO_2 and C_T concentrations and (bottom) pH_T and Ω_{ar} between the reconstruction using SSP85 scenario and the FFNN-LSCE model over 1985-2023 in August or with observations (July 2014, red). The differences are calculated from data presented in Figure 8 and the mean values listed in Table S1.

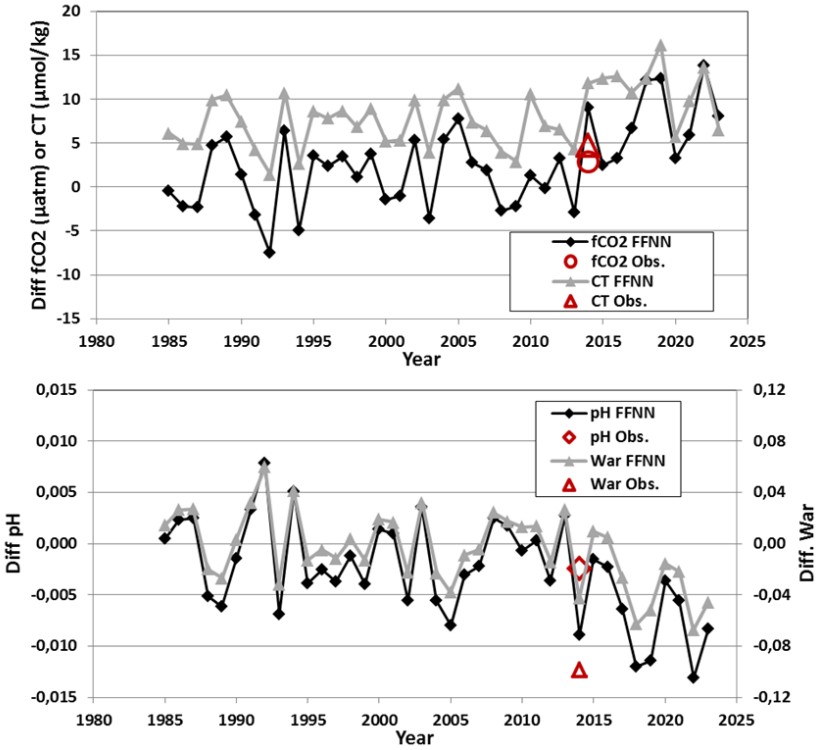

Table S1: Mean difference between the reconstruction and the FFNN model for August 1985-2022 and with observation in July 2014. SD are in brackets.

Method	Year	fCO_2 µatm	C_T µmol.kg^{-1}	pH_T TS	Ωar -
Rec.-FFNN	1985-2022	2.6 (4.9)	7.9 (3.4)	-0.003 (0.005)	-0.005 (0.029)
Rec.-Obs.	2014	2.8	4.8	-0.002	-0.099

Figure S10: Top: Time-series of weekly SST in the Mozambique Channel, at 23°S/40E over 2019-2025. In January 2025 SST reaches 31°C (data from https://data.marine.copernicus.eu/product/, Multi Observation Global Ocean ARMOR3D L4 MULTIOBS_GLO_PHY_TSUV_3D_MYNRT_015_012). Last access 12/5/2025. Bottom: Map of Marine Heat Wave category for January 5th 2025 In the Indian Ocean. The location of the BGC-Argo float in the southern Mozambique Channel is indicated by orange circle.