

Supporting Information for "Total and anthropogenic inorganic carbon fluxes in the Southern Ocean mixed-layer from an eddying global ocean model"

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Introduction

This supporting information provides additional figures for water masses properties, air-sea fluxes products, air-sea fluxes spatial patterns, and mixed layer carbon budget variability. It also provides the integrated air-sea fluxes in units of mol/m²/year.

References

- Hauck, J., Zeising, M., Le Quéré, C., Gruber, N., Bakker, D. C. E., Bopp, L., . . . Séférian, R. (2020, October). Consistency and Challenges in the Ocean Carbon Sink Estimate for the Global Carbon Budget. *Frontiers in Marine Science*, *7*, 571720. Retrieved 2023-03-10, from <https://www.frontiersin.org/articles/10.3389/fmars.2020.571720/full> doi: 10.3389/fmars.2020.571720
- Hosoda, S., Ohira, T., Sato, K., & Suga, T. (2010, December). Improved description of global mixed-layer depth using Argo profiling floats. *Journal of Oceanography*, *66*(6), 773–787. Retrieved 2022-12-14, from <http://link.springer.com/10.1007/s10872-010-0063-3> doi: 10.1007/s10872-010-0063-3
- Szekely, T., Gourrion, J., Pouliquen, S., & Reverdin, G. (2019, December). The CORA 5.2 dataset for global in situ temperature and salinity measurements: data description and validation. *Ocean Science*, *15*(6), 1601–1614. Retrieved 2022-12-27, from <https://os.copernicus.org/articles/15/1601/2019/> doi: 10.5194/os-15-1601-2019

	SIZ	ASZ	PFZ	SAZ	STZ	Total
Total	0.3	0.5	0.9	1.1	1.5	0.9
Anthropogenic	0.7	1.1	0.9	0.6	0.6	0.8

Table S1. Air sea fluxes of total and anthropogenic DIC as in Fig. 5.a and 6.a respectively, but in mol/m²/year.

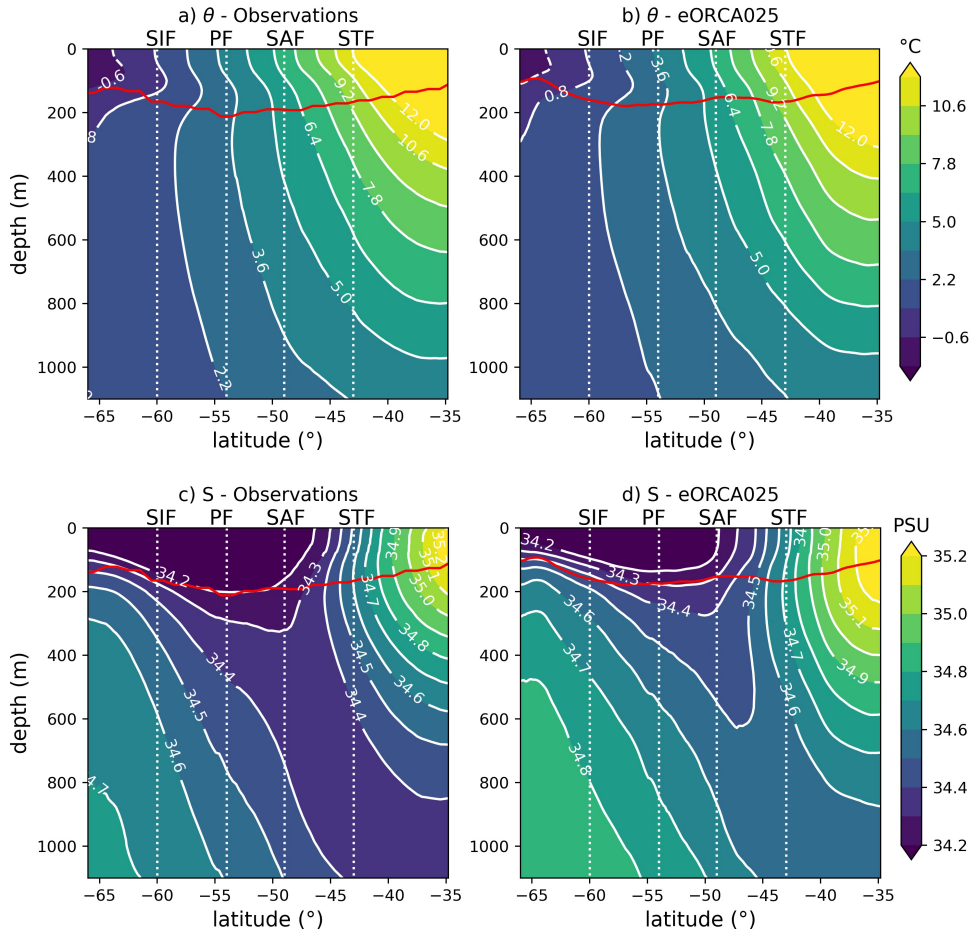


Figure S1. Zonally averaged cross-sections for (a,b) potential temperature and (c,d) practical salinity in (a,c) our model and (b,d) in observations (Szekely et al., 2019). The mixed layer is represented by a red line for our model (a,c) and observations (b,d) (Hosoda et al., 2010).

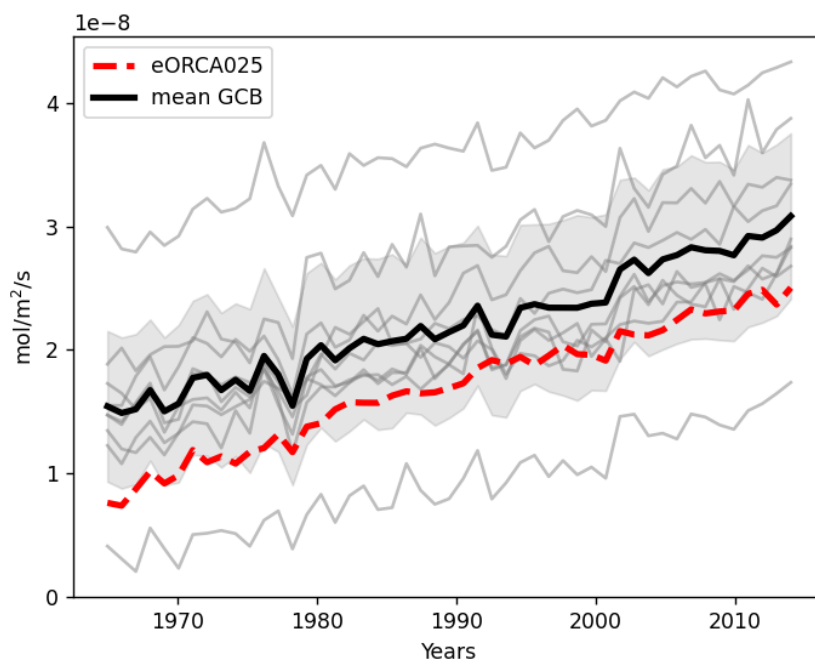


Figure S2. Air-sea CO₂ fluxes in the model (red) compared to GCB estimates (gray) integrated south of 35°S. Grey shading represents the standard deviation spread of the GCB models (Hauck et al., 2020).

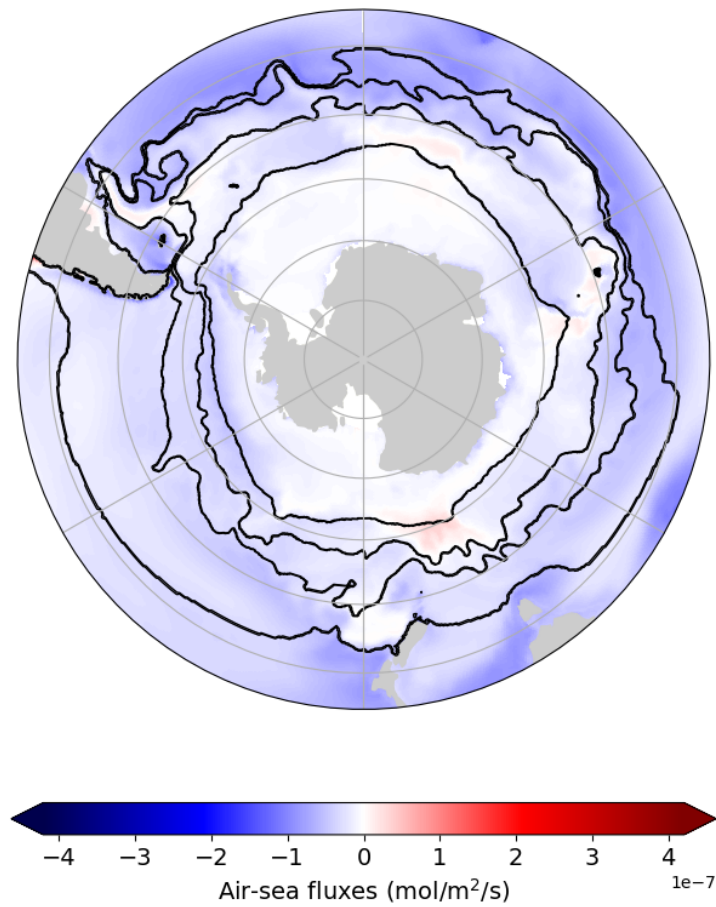


Figure S3. Map of total sea-air CO₂ fluxes averaged over 1995-2014. Contours represent the different boundaries of our regions. Positive fluxes represent outgassing.

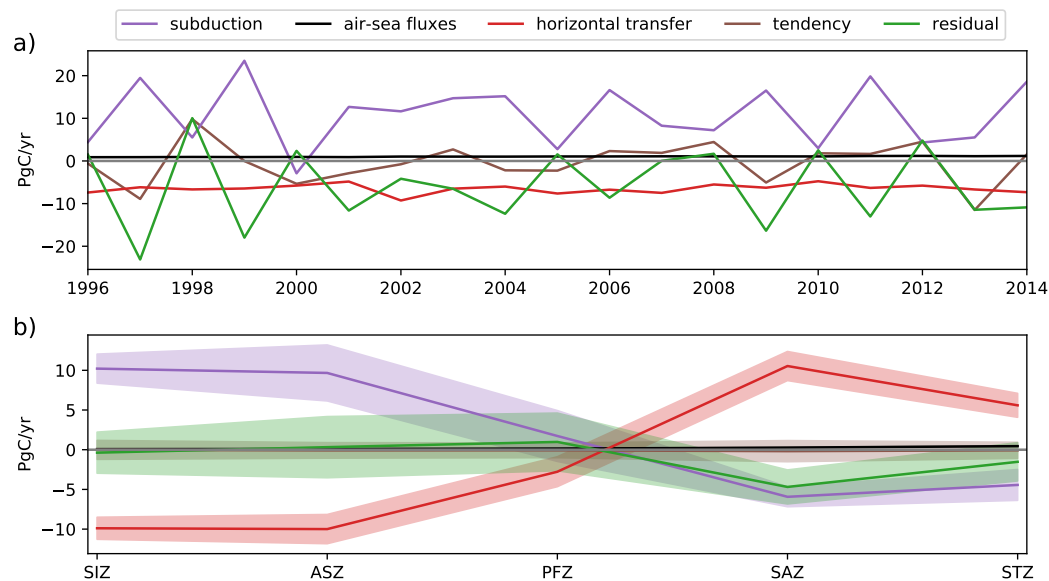


Figure S4. Interannual variability of total DIC fluxes within the mixed layer a) integrated within each of the five regions over 1995-2014 with the thick line corresponding to the average over 1995-2014 and the shaded area corresponding to the 20-year interannual variability, and b) integrated over the SO (south of 35°S for each year of the 1995-2004 period).

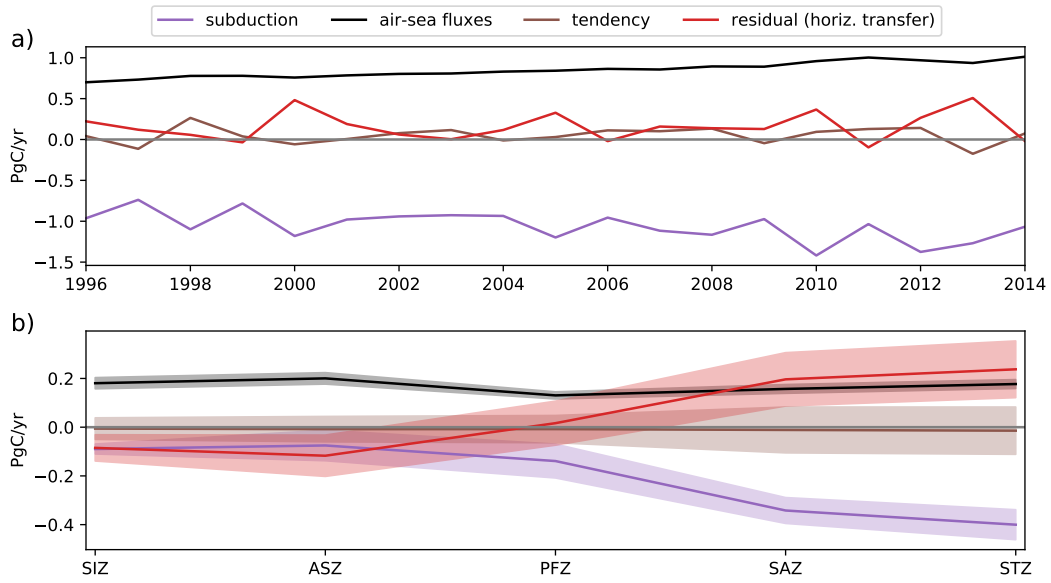


Figure S5. Same as Fig. S4 but for anthropogenic DIC.

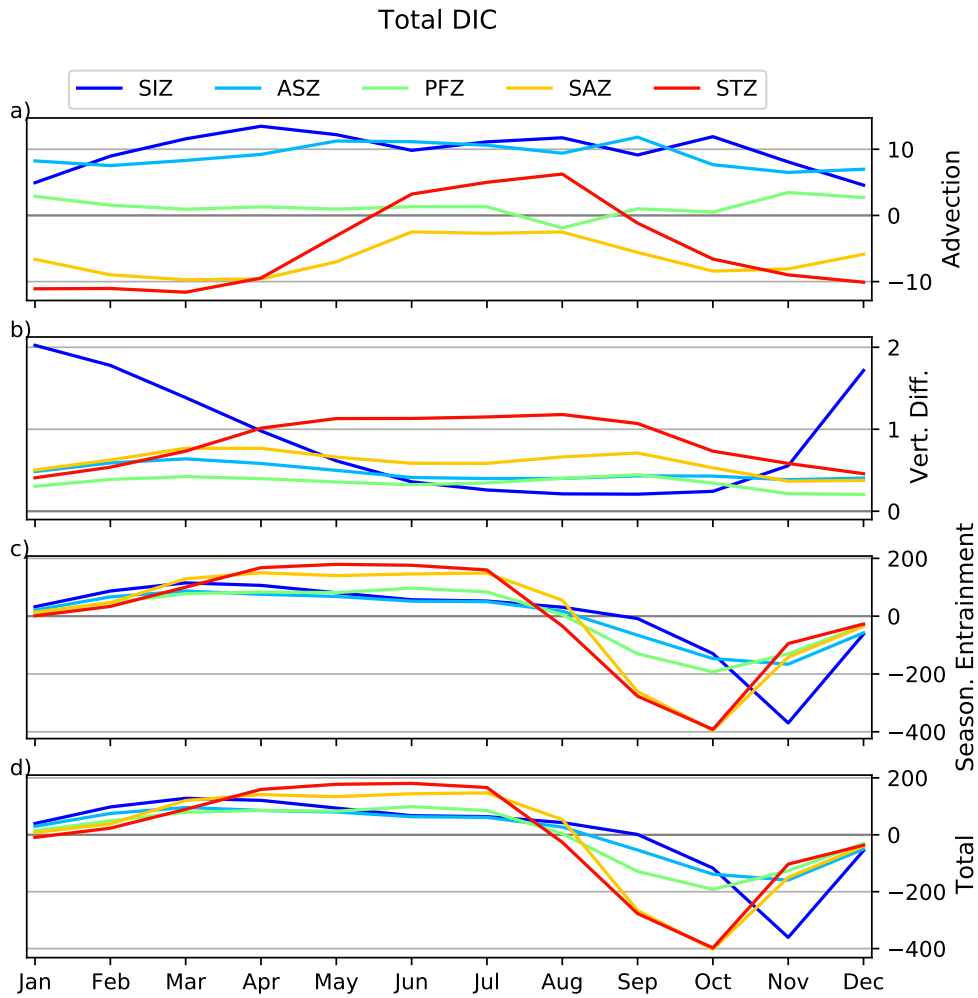


Figure S6. (a-d) Seasonal climatology of the dominant processes driving the subduction of total DIC across the mixed layer base, in PgC/year. Positive values correspond to obduction. Climatologies are computed over the 1995-2014 period for each region of the SO.

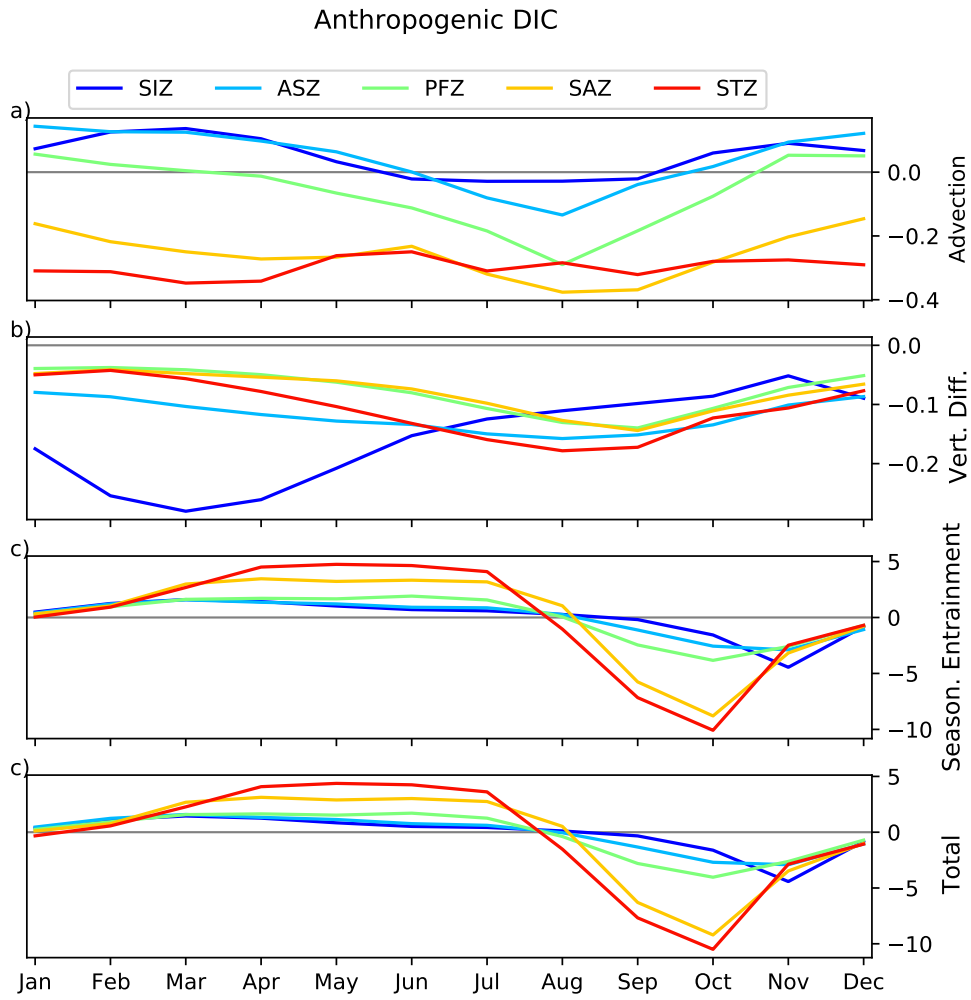


Figure S7. Seasonal climatology over the period 1995-2014 of the major subduction fluxes of anthropogenic DIC, in PgC/year. See Fig. S6 for details.