

Supplementary Figures for:

Hauck, Nissen, Landschützer, Rödenbeck, Bushinsky, Olsen (2023): Sparse observations induce large biases in estimates of the global ocean CO<sub>2</sub> sink: an ocean model subsampling experiment. *Phil. Trans. R. Soc. A* 20220063. <https://doi.org/10.1098/rsta.2022.0063>

This file contains Figures S1 to S7.

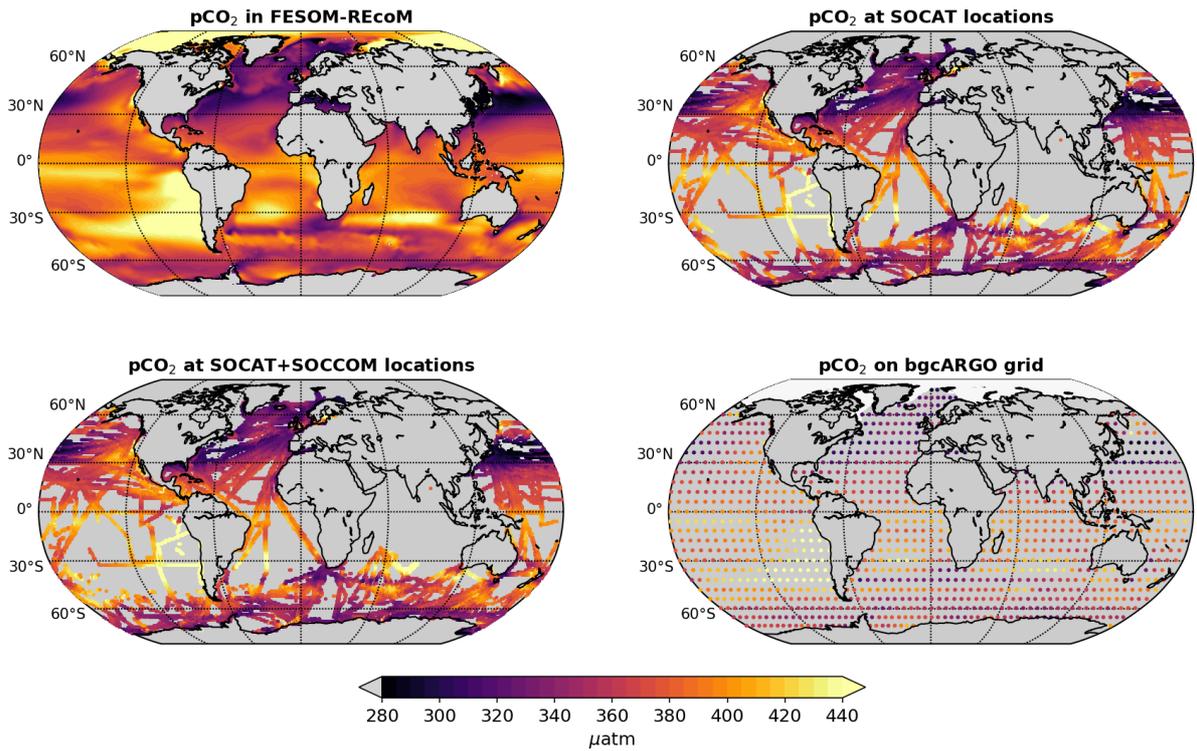


Figure S1: Mean partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) 2009-2018 as in Figure 1, but for the Southern Hemisphere summer months (December-February).

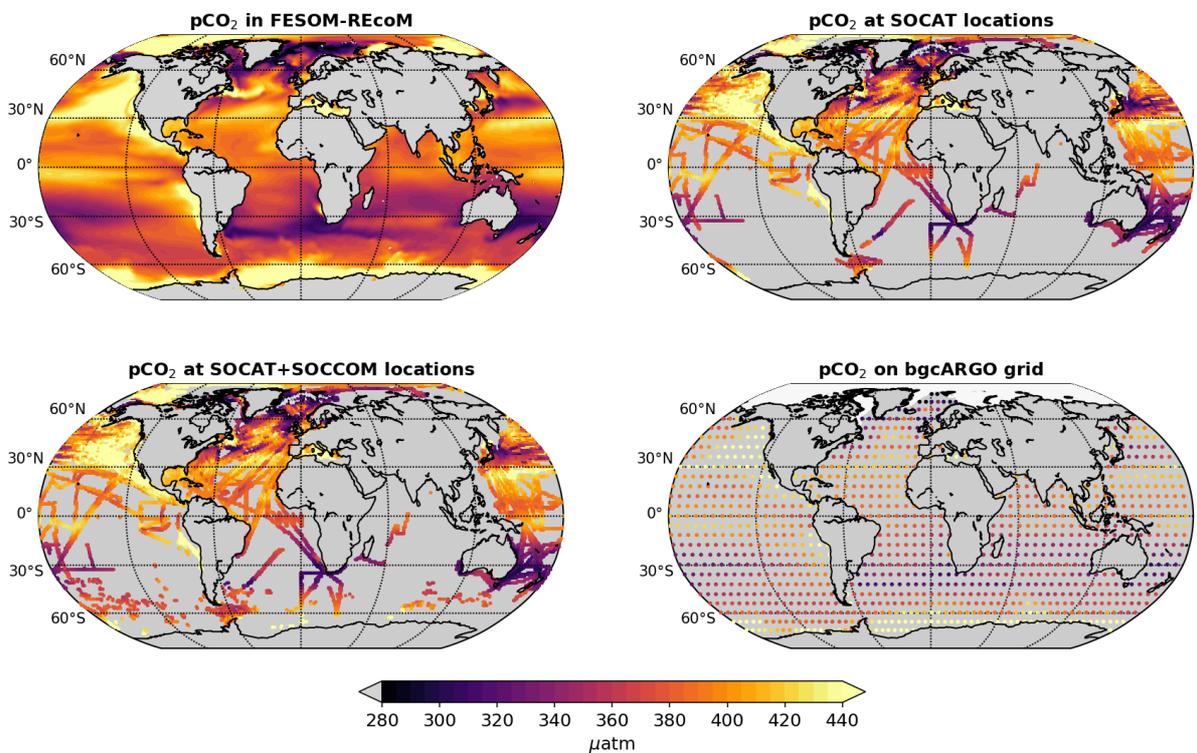


Figure S2: Mean partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) 2009-2018 as in Figure 1, but for the Southern Hemisphere winter months (June-August).

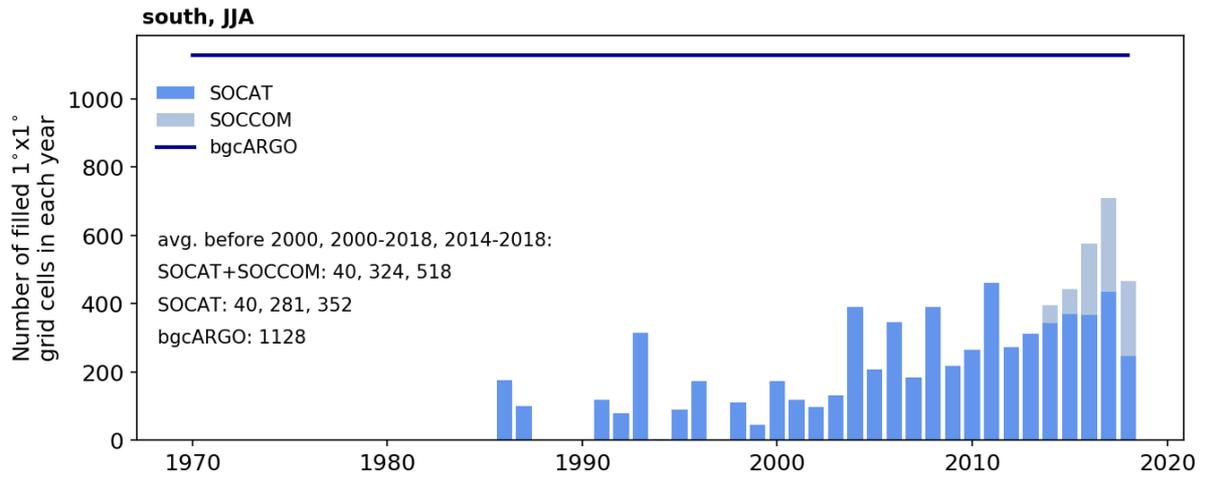


Figure S3: Number of monthly  $1^\circ \times 1^\circ$  grid cells covered in the Southern Ocean in the winter months June-August.

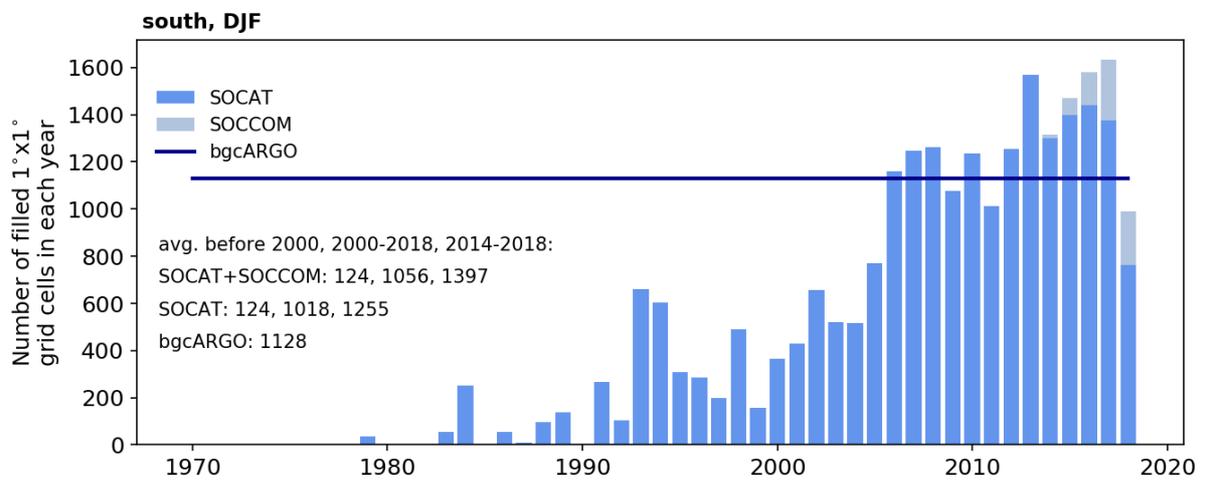


Figure S4: Number of monthly  $1^\circ \times 1^\circ$  grid cells covered in the Southern Ocean in the summer months December to February.

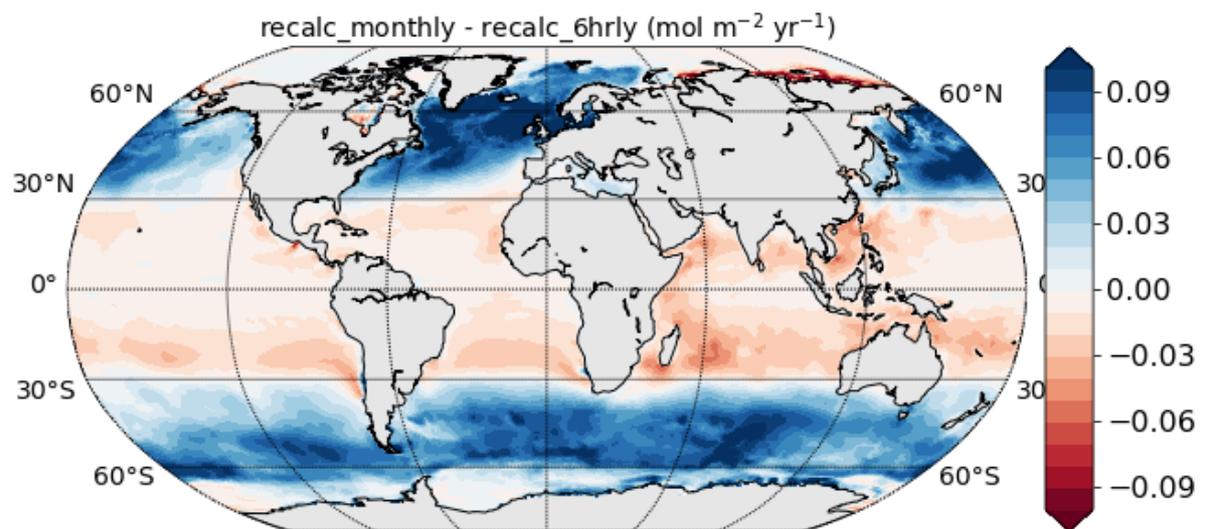


Fig. S5:  $\text{CO}_2$  flux ( $\text{mol m}^{-2} \text{yr}^{-1}$ ) difference between offline  $\text{CO}_2$  flux calculation from monthly and from 6-hourly kw660,  $p\text{CO}_2$ , T, S,  $K_0$  data.

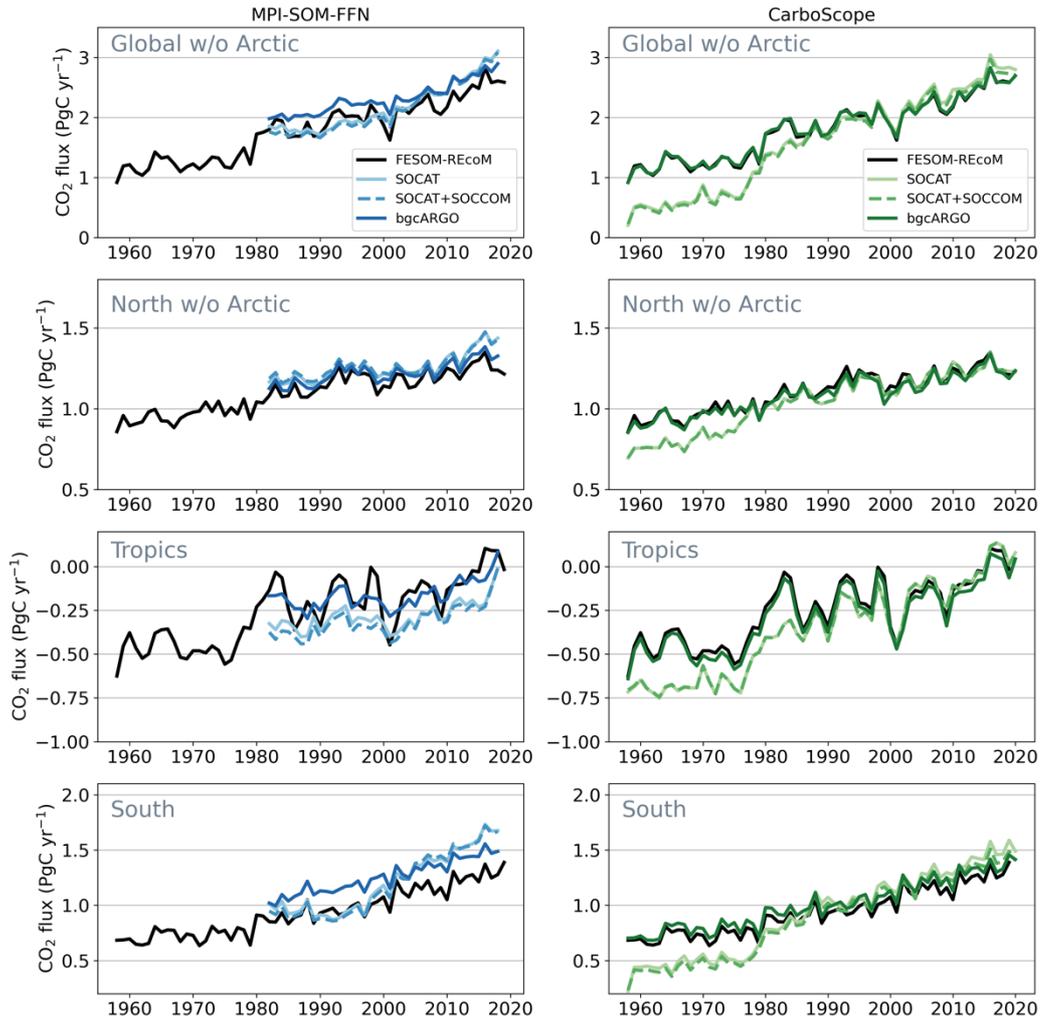


Figure S6: Same as Figure 4 in the main text, but with different prior for decadal anthropogenic CO<sub>2</sub> uptake in CarboScope. Instead of OCIM, a simulation of FESOM-REcoM anthropogenic CO<sub>2</sub> flux forced with increasing atmospheric CO<sub>2</sub> and repeated year atmospheric forcing fields is used as prior (see methods). Differences to the experiment with OCIM prior used in the main text are largely confined to the period before 1990 in the SOCAT and SOCAT+SOCCOM sampling schemes.

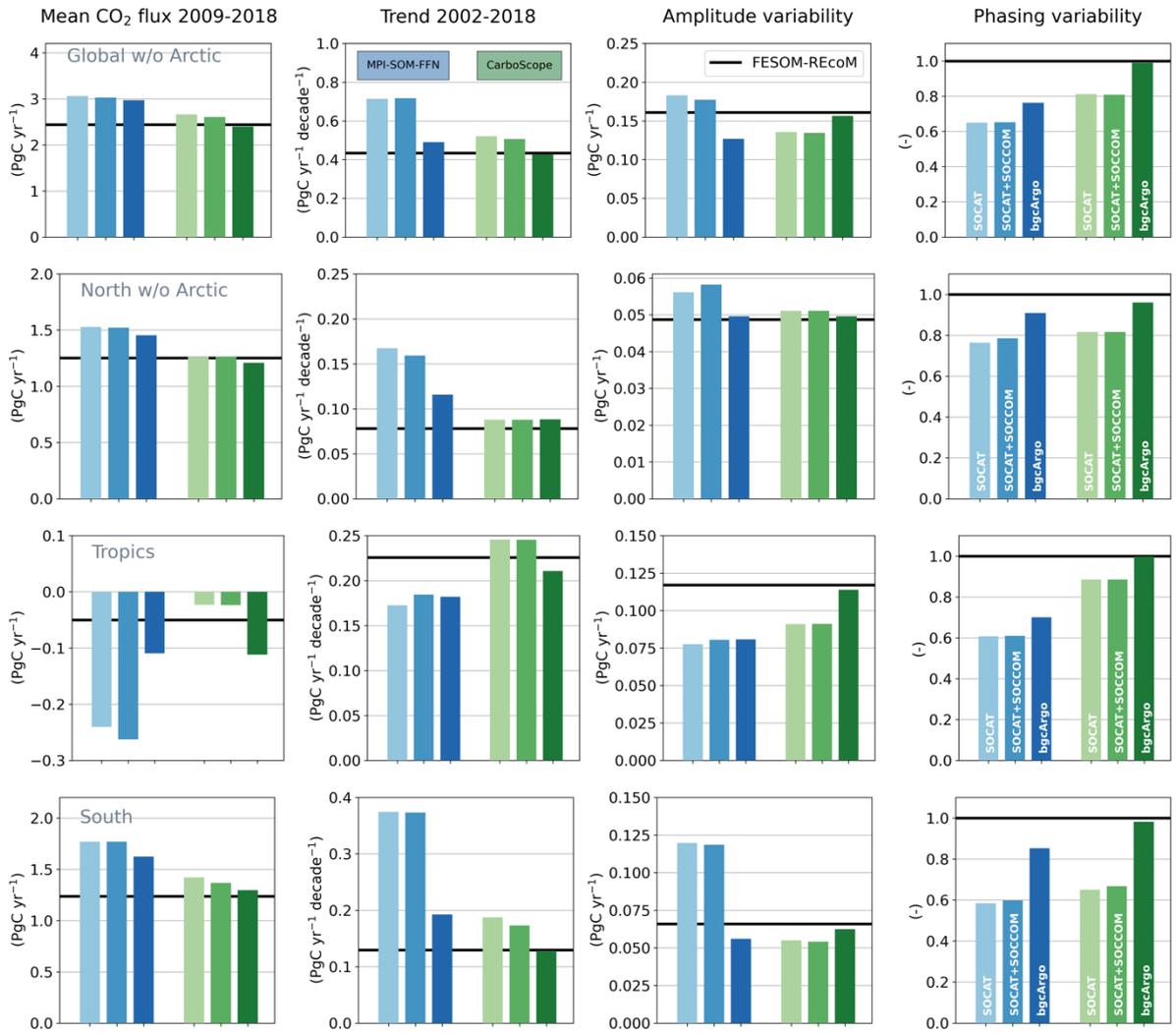


Figure S7: Same as Figure 5 in the main text, but with the native gas-exchange calculation used for MPI-SOM-FFN (CarboScope unchanged). This leads to a stronger deviation from FESOM-REcoM in mean and trend in the high latitudes, and also affects the measures of variability.