Supplement of Biogeosciences, 18, 3189–3218, 2021
https://doi.org/10.5194/bg-18-3189-2021-supplement
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Biogeosciences Open Access EGU

Supplement of

Ocean carbon cycle feedbacks in CMIP6 models: contributions from different basins

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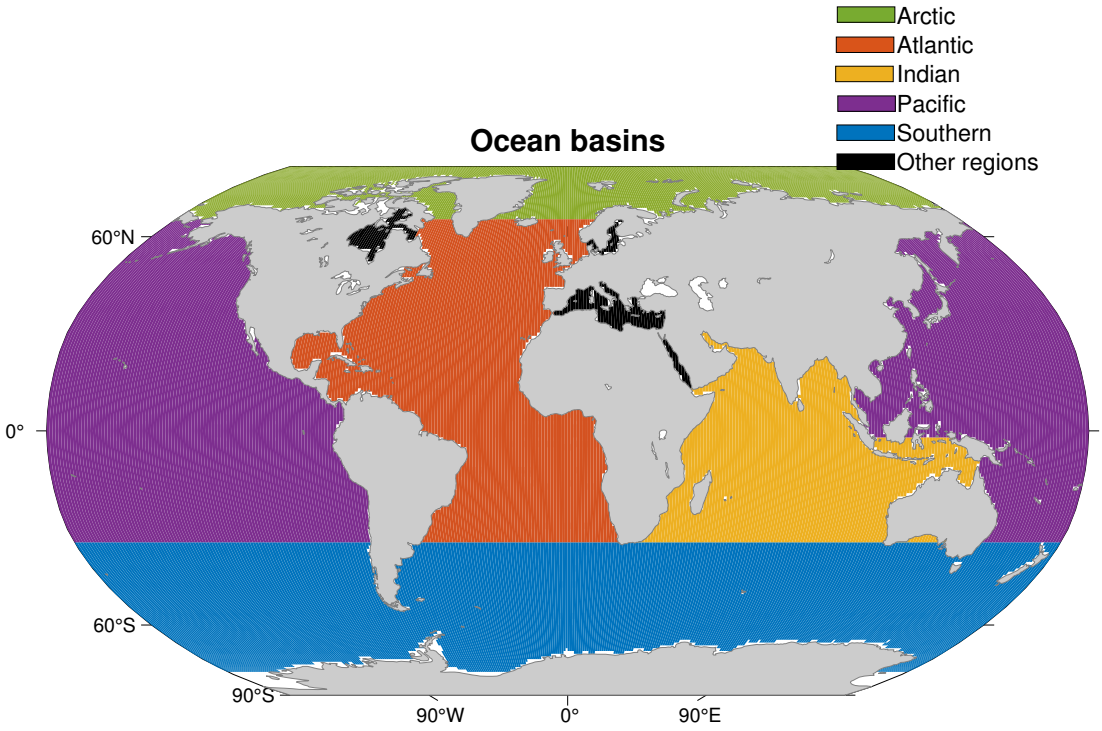

Figure S1. Separation of the global ocean into different basins as used in our analysis: Arctic, Atlantic, Indian, Pacific, and Southern Oceans. Semi-enclosed seas including the Mediterranean Sea, the Red Sea, the Baltic Sea and Hudson Bay are denoted as other regions (black).

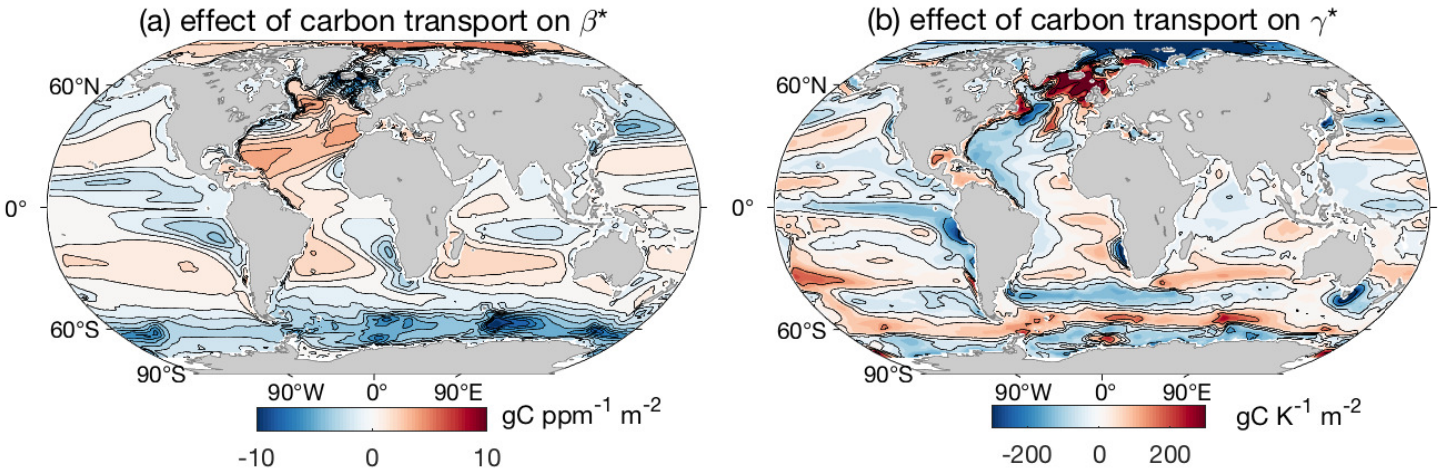

Figure S2. Geographical distribution of the effect of the ocean transport of carbon, $\mathcal{G}$, on the carbon cycle feedback parameters estimated based on the regional carbon storage: (a) effect of transport on β^*; and (b) effect of transport on γ^*. The effect of the transport is shown as the inter-model mean based on 11 CMIP6 Earth system models (Table 1).

Table S1. Inter-model mean and standard deviation for the carbon-concentration feedback parameter based on carbon storage, β^* (PgC ppm^{-1}), and carbon-climate feedback parameter based on carbon storage, γ^* (PgC K^{-1}), and the contribution from the saturated, disequilibrium and regenerated carbon pools, based on 11 CMIP6 Earth system models (Table 1). Diagnostics are from years 121 to 140, and for the global ocean and different ocean basins as shown in Fig. 5. The standard deviation is shown in the parentheses. Note that for the global ocean β^* and γ^* are equivalent to β and γ.

Parameter β^*				
	β^*	β_{sat}	β_{dis}	β_{reg}
Global	0.821 (0.077)	3.962 (0.090)	-3.148 (0.115)	0.007 (0.021)
Pacific	0.244 (0.032)	1.634 (0.042)	-1.393 (0.042)	0.003 (0.011)
Southern	0.224 (0.028)	1.027 (0.028)	-0.804 (0.044)	0.001 (0.006)
Atlantic	0.216 (0.028)	0.739 (0.014)	-0.526 (0.027)	0.003 (0.005)
Indian	0.098 (0.011)	0.492 (0.011)	-0.394 (0.015)	0.001 (0.002)
Arctic	0.027 (0.004)	0.049 (0.003)	-0.022 (0.004)	0.000 (0.000)
Parameter γ^*				
	γ^*	γ_{sat}	γ_{dis}	γ_{reg}
Global	-15.53 (6.66)	-12.63 (2.02)	-14.52 (6.05)	11.62 (6.92)
Pacific	-4.80 (2.69)	-4.91 (0.77)	-1.74 (1.44)	1.85 (1.63)
Southern	-3.21 (2.73)	-3.86 (0.63)	-5.48 (3.11)	6.13 (3.50)
Atlantic	-4.78 (3.30)	-1.41 (0.82)	-6.03 (3.41)	2.65 (1.94)
Indian	-1.24 (0.84)	-1.37 (0.31)	-0.67 (0.30)	0.79 (0.85)
Arctic	-1.17 (0.76)	-0.99 (0.50)	-0.31 (0.42)	0.13 (0.16)

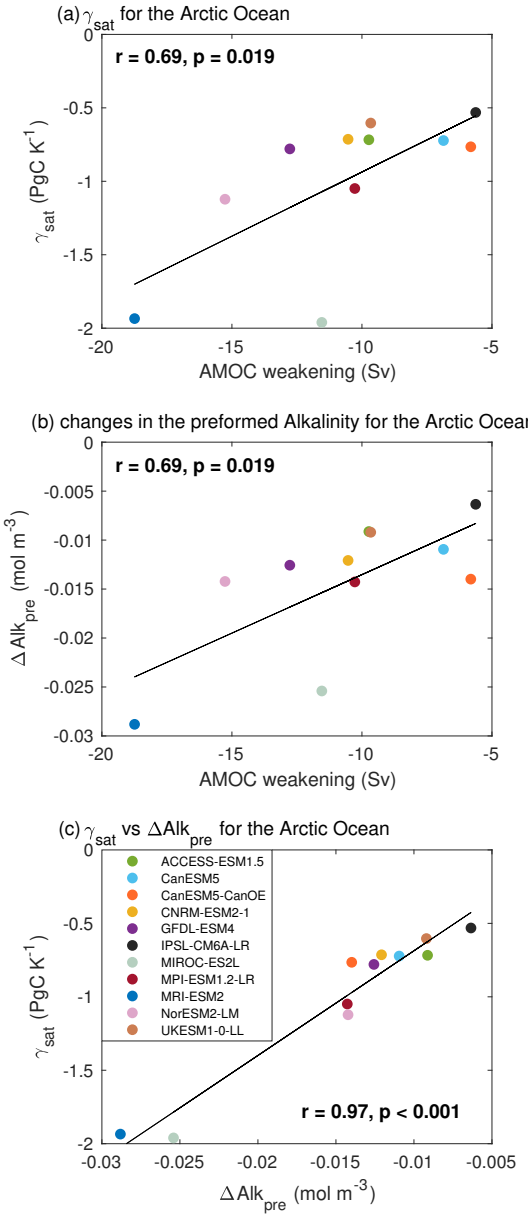

Figure S3. (a) Dependence of the saturated part of the carbon-climate feedback parameter based on carbon storage, γ_{sat} (PgC K^{-1}), on the Atlantic Meridional Overturning Circulation (AMOC) weakening with climate change in the Arctic Ocean; (b) dependence of the climate-driven changes in preformed alkalinity, ΔAlk_{pre} (mol m^{-3}) on AMOC weakening in the Arctic Ocean; and (c) dependence of γ_{sat} to ΔAlk_{pre} in the Arctic Ocean in 11 CMIP6 models (Table 1). The black lines correspond to the regression line based on an ordinary least squares regression, with the corresponding correlation coefficient, r, and p-value shown in each panel. Diagnostics are from years 121 to 140 (the 20 years up to quadrupling of atmospheric CO_2).