

Reduced CaCO₃ flux to the seafloor and weaker bottom current speeds curtail benthic CaCO₃ dissolution over the 21st century

Olivier Sulpis^{1*}, Carolina O. Dufour², David S. Trossman³, Andrea J. Fassbender⁴, Brian K. Arbic⁵, Bernard P. Boudreau⁶, John P. Dunne⁷ and Alfonso Mucci¹

¹GEOTOP and Earth and Planetary Sciences Department, McGill University, Montreal, QC, Canada

²Atmospheric and Oceanic Sciences Department, McGill University, Montreal, QC, Canada

³Institute of Computational Engineering and Sciences, The University of Texas at Austin, Austin, TX, USA

⁴Monterey Bay Aquarium Research Institute, Moss Landing, CA, USA

⁵Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI, USA

⁶Department of Oceanography, Dalhousie University, Halifax, NS, Canada

⁷Geophysical Fluid Dynamics Laboratory, National Oceanic and Atmospheric Administration, Princeton, NJ, USA

*correspondence: Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Princetonlaan 8A, 3508 TA Utrecht, The Netherlands. Email: o.j.t.sulpis@uu.nl

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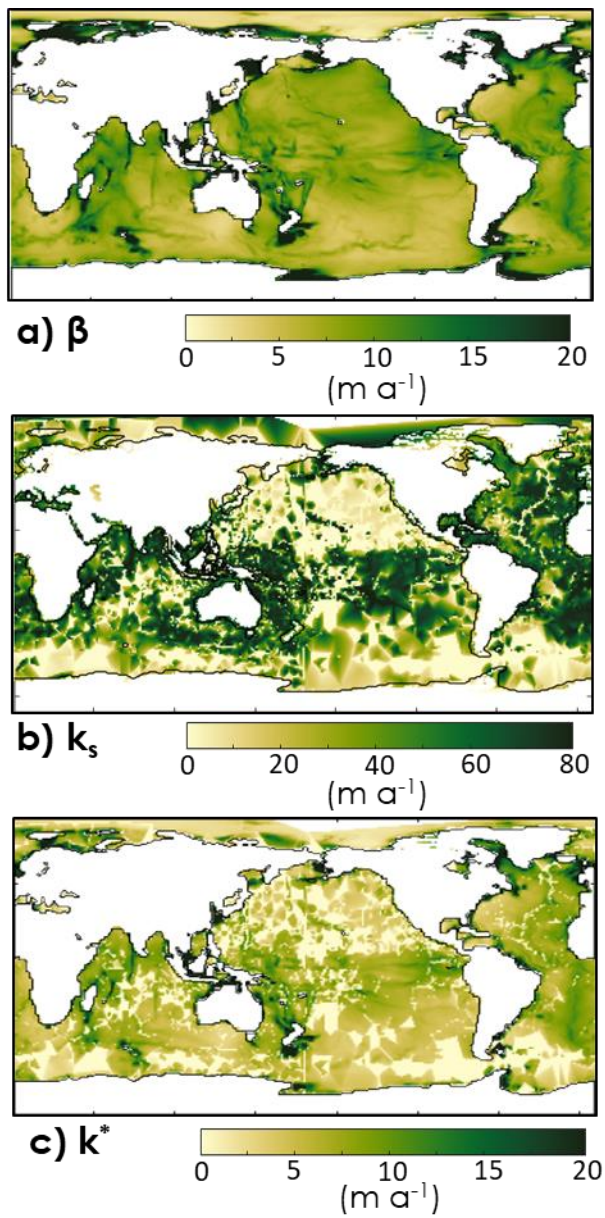


Figure S1. CMIP5 model mean **(a)** water-side CO_3^{2-} mass transfer coefficient (β), **(b)** sediment-side CO_3^{2-} mass transfer coefficient (k_s) and **(c)** overall CO_3^{2-} mass transfer coefficient (k^*) under RCP8.5 and averaged over the last 30 years of the simulation (2071-2100).

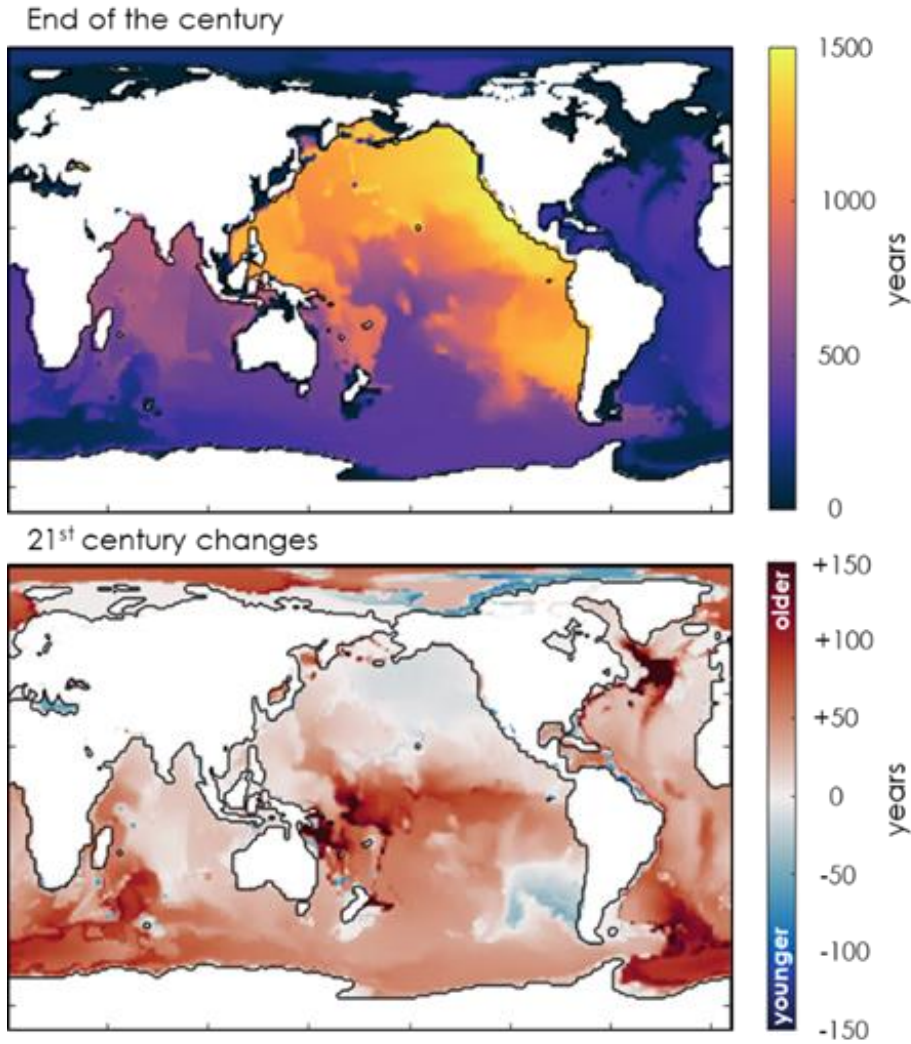
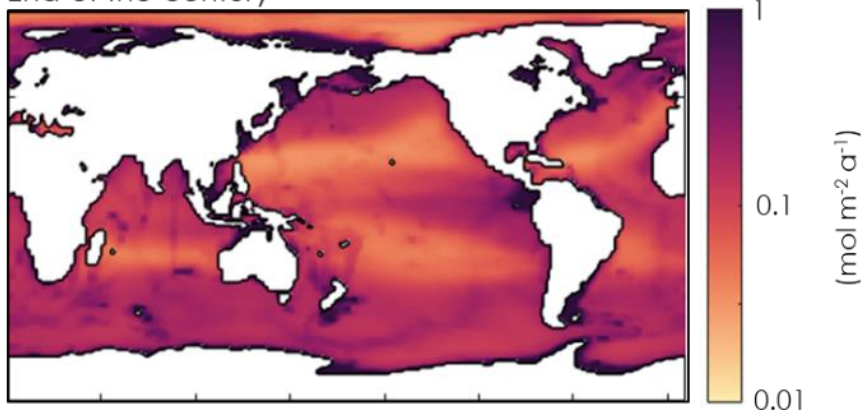


Figure S2. Bottom-water age since the last contact with the surface, as simulated by the ESM2M model under the RCP8.5 scenario. The top panel represents the 2071-2100 averaged value and the bottom panel depicts the change between the 2006-2035 average and the 2071-2100 average. Output of the age tracer were not available in HadGEM2-CC and IPSL-CM5A-MR.

Sinking particulate organic carbon flux to the bottom

End of the century



21st century changes

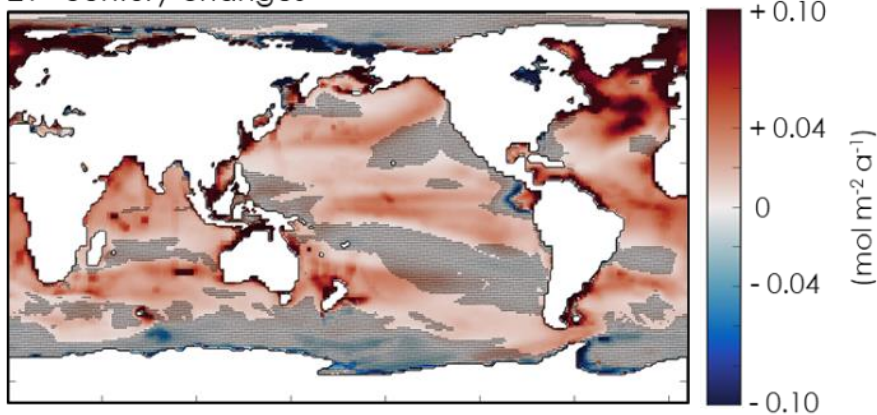


Figure S3. CMIP5 model mean (**top**) sinking fluxes of particulate organic carbon (*POC*) at the bottom, averaged over the last 30 years of simulation and (**bottom**) *POC* sinking flux to the bottom changes between the first 30 years and the last 30 years of simulation. Gray shaded areas indicate that not all models agree on the sign of the change.

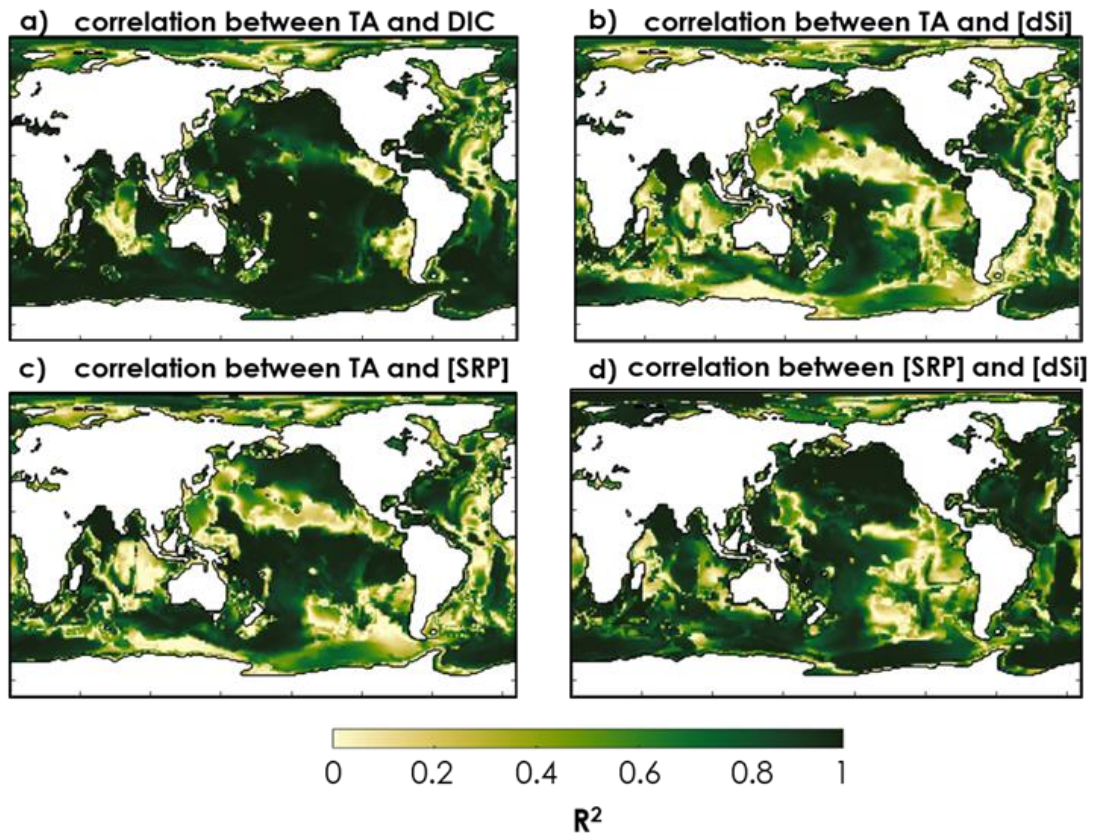


Figure S4. CMIP5 model mean correlation coefficient of a linear regression between (a) TA and DIC, (b) TA and [dSi], (c) TA and [SRP] and (d) [SRP] and [dSi] between 2006 and 2100.

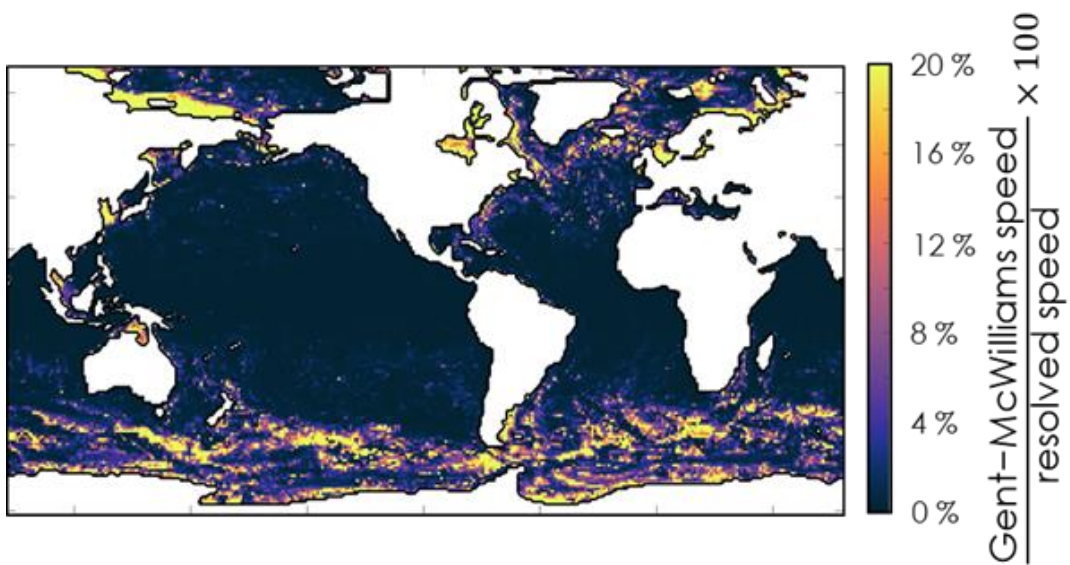


Figure S5. Ratio of the parameterized bottom current speed to the resolved bottom-current speeds in CM2-1deg. The parameterized current speed is calculated from the parameterized mesoscale eddy mass transport [Griffies *et al.*, 1998]. The data used in this map is an averaged of the 30 first years of a simulation where the atmospheric partial pressure of CO₂ (pCO₂) increases by 1% per year.

Variable	GFDL-ESM2M	HadGEM2-CC	IPSL-CM5A-MR	CMIP5 model mean
<i>T</i>	4 x10⁻⁴³ (↑)	2 x10⁻⁴⁴ (↑)	1 x10⁻⁴³ (↑)	7 x10⁻⁴⁶ (↑)
<i>S</i>	<i>1 x10⁻²² (↓)</i>	<i>1 x10⁻³³ (↓)</i>	<i>1 x10⁻¹⁸ (↓)</i>	<i>2 x10⁻³⁶ (↓)</i>
<i>DIC</i>	4 x10⁻⁴⁶ (↑)	1 x10⁻⁴⁶ (↑)	2 x10⁻⁴⁶ (↑)	1 x10⁻⁴⁶ (↑)
<i>TA</i>	4 x10⁻⁴¹ (↑)	<i>2 x10⁻³² (↓)</i>	<i>1 x10⁻¹⁹ (↓)</i>	6 x10⁻³⁶ (↑)
[<i>SRP</i>]	8 x10⁻⁴² (↑)	-	3 x10⁻⁵ (↑)	9 x10⁻²⁹ (↑)
[<i>dSi</i>]	2 x10⁻⁴⁶ (↑)	<i>5 x10⁻³⁶ (↓)</i>	2 x10⁻¹⁸ (↑)	9 x10⁻³⁰ (↑)
<i>U</i>	<i>2 x10⁻²¹ (↓)</i>	<i>2 x10⁻²⁴ (↓)</i>	<i>2 x10⁻⁷ (↓)</i>	<i>4 x10⁻²⁵ (↓)</i>
<i>F</i>	<i>2 x10⁻⁴ (↓)</i>	<i>2 x10⁻²⁸ (↓)</i>	<i>5 x10⁻³³ (↓)</i>	<i>1 x10⁻⁴⁴ (↓)</i>

Table S1. p-values of a Mann-Kendall trend test on the world-averaged CMIP5 model mean variables presented in Fig. 2. p-values smaller than 0.05 (in *italic*) indicate that the bottom-current time series shows a statistically significant monotonic decreasing trend over the corresponding timeframe (i.e., from 2006 to 2100). **Bold** indicates a statistically significant monotonic increasing trend. p-values higher than 0.05 indicate no specific trend.

model	doubling atmospheric pCO ₂ over 80 years	RCP8.5 from 2006 to 2100
GFDL-ESM2M	-	<i>2 x10⁻²¹ (↓)</i>
HadGEM2-CC	-	<i>2 x10⁻²⁴ (↓)</i>
IPSL-CM5A-MR	-	<i>2 x10⁻⁷ (↓)</i>
CM2-1deg	<i>2 x10⁻²³ (↓)</i>	-
CM2.5	<i>2 x10⁻¹⁰ (↓)</i>	-
CM2.6	<i>1 x10⁻⁹ (↓)</i>	-

Table S2. p-values of a Mann-Kendall trend test on the bottom-current speeds (*U*) time series presented in Fig. 6a. p-values smaller than 0.05 (in *italic*) indicate that the bottom current time series shows a statistically significant monotonic decreasing trend over the corresponding timeframe (i.e., from 2006 to 2100).

Reference

Griffies, S.M. (1998) The Gent–McWilliams Skew Flux. *Journal of Physical Oceanography* 28, 831–841, [https://doi.org/10.1175/1520-0485\(1998\)028<0831:TGMSF>2.0.CO;2](https://doi.org/10.1175/1520-0485(1998)028<0831:TGMSF>2.0.CO;2)