AGU PUBLICATIONS

Paleoceanography and Paleoclimatology

Supporting Information for

Quantifying the effect of the Drake Passage opening on Eocene oceans properties and dynamics

A. Toumoulin[1], Y. Donnadieu[1], J.-B. Ladant[2], S. J. Batenburg[3], F. Poblete[4] and G. Dupont-Nivet[3,4,5]

[1]Aix Marseille Université, CNRS, IRD, INRA, Collège de France, CEREGE, Aix-en-Provence, France

[2] Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, USA.

[3] Géosciences Rennes, UMR CNRS 6118, Univ Rennes, 35000 Rennes, France.

[4] Universidad de Chile, Departamento de Geología, Santiago, Chile.

[5] Institute of Geosciences, Potsdam University, Potsdam, Germany.

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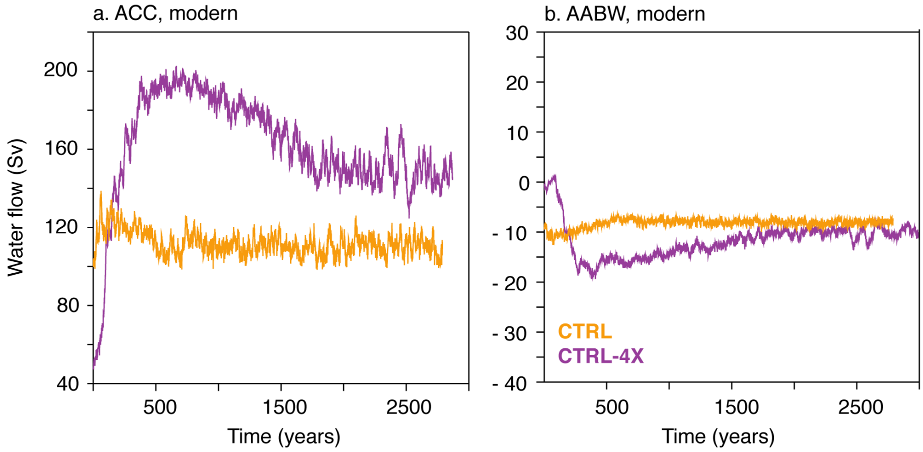
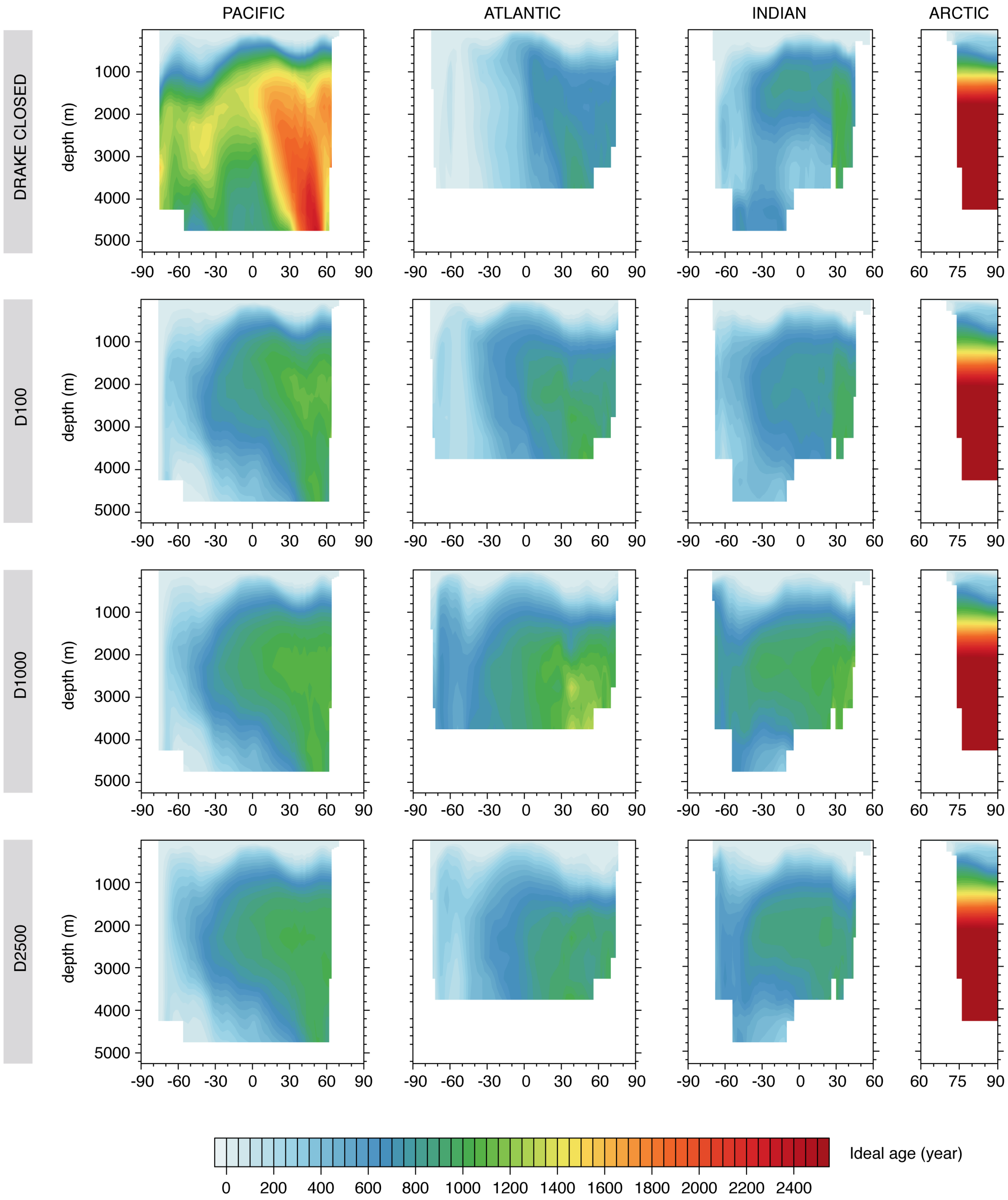
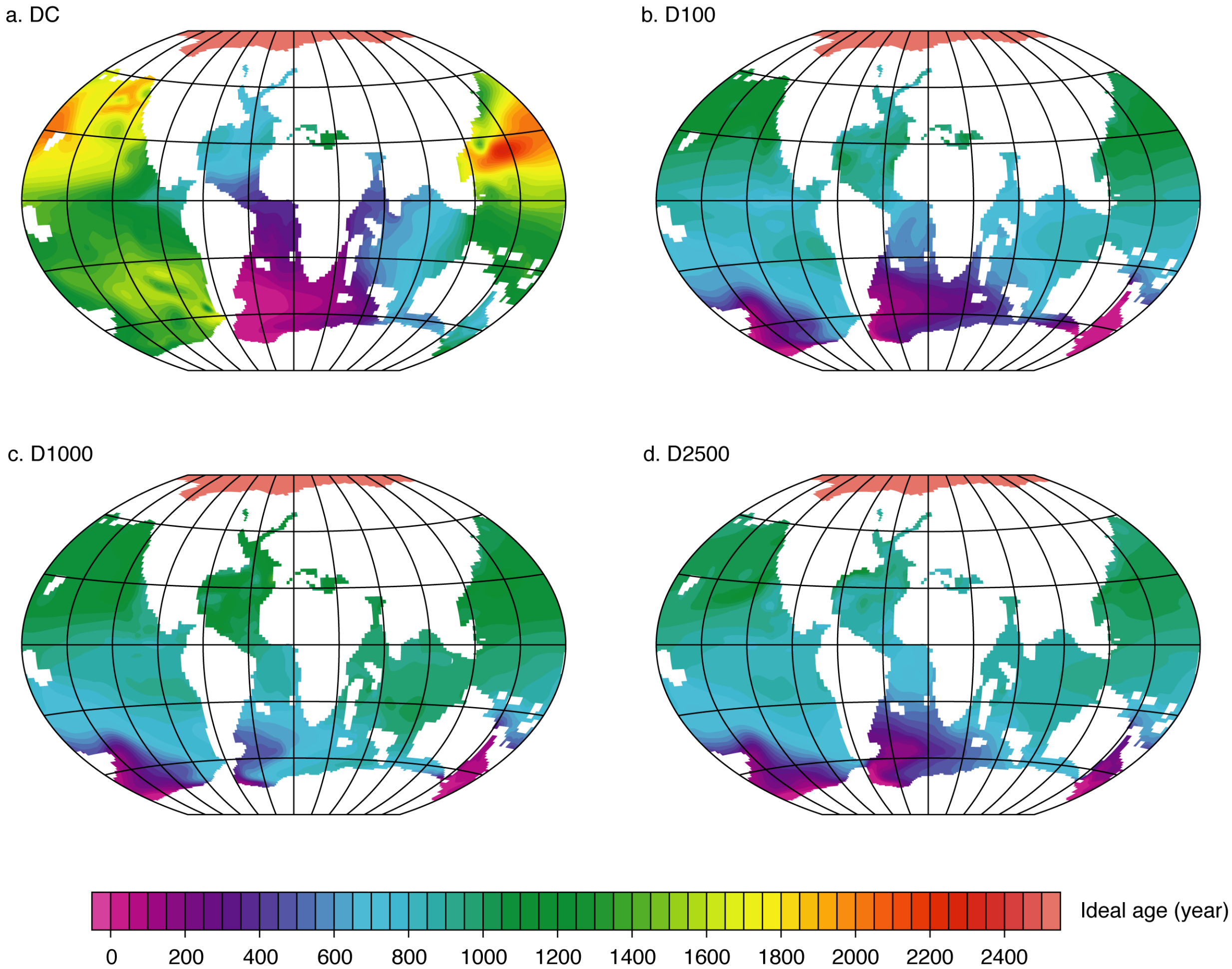


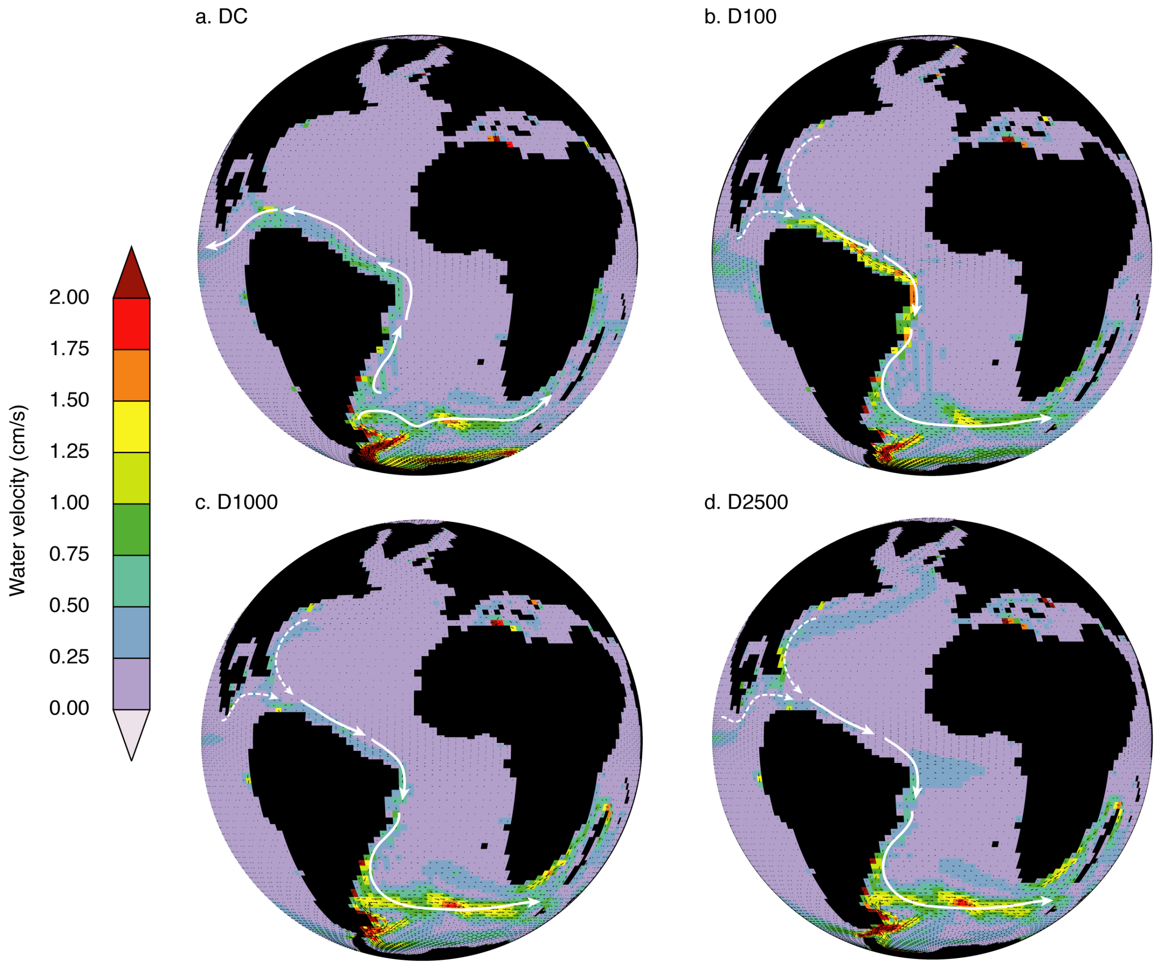
Supporting information Figure S1. Antarctic Circumpolar Current (ACC) and Antarctic Bottom Water (AABW) evolution through simulation time. Fluxes are given in Sverdrups (Sv: $10^6 m^3.s^{-1}$). ACC is measured as the transport through the Drake Passage. AABW represents the maximum overturning in the Southern hemisphere deep ocean (below 1500 m).



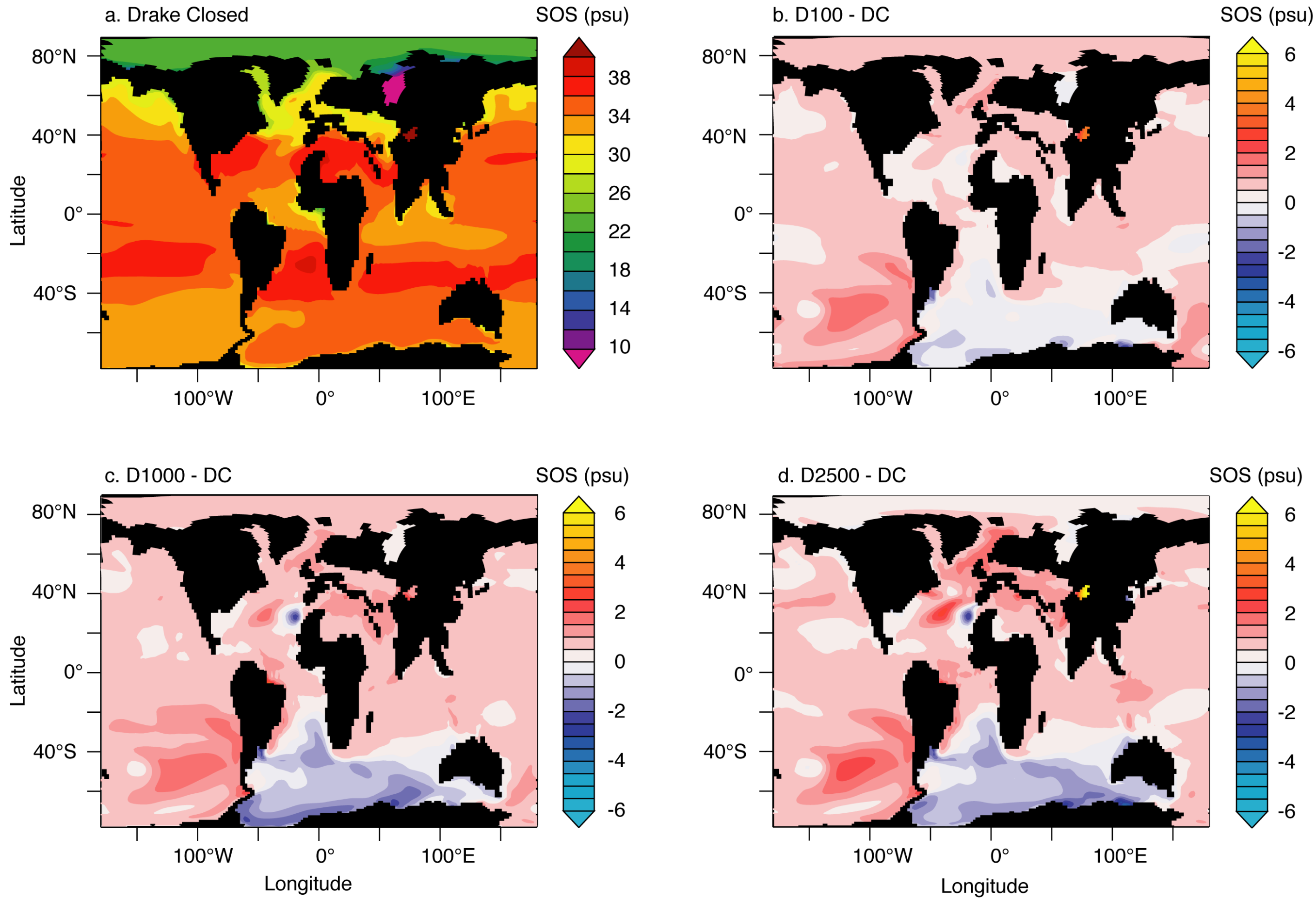
Supporting information Figure S2. Mean zonal ideal age of water per basin.



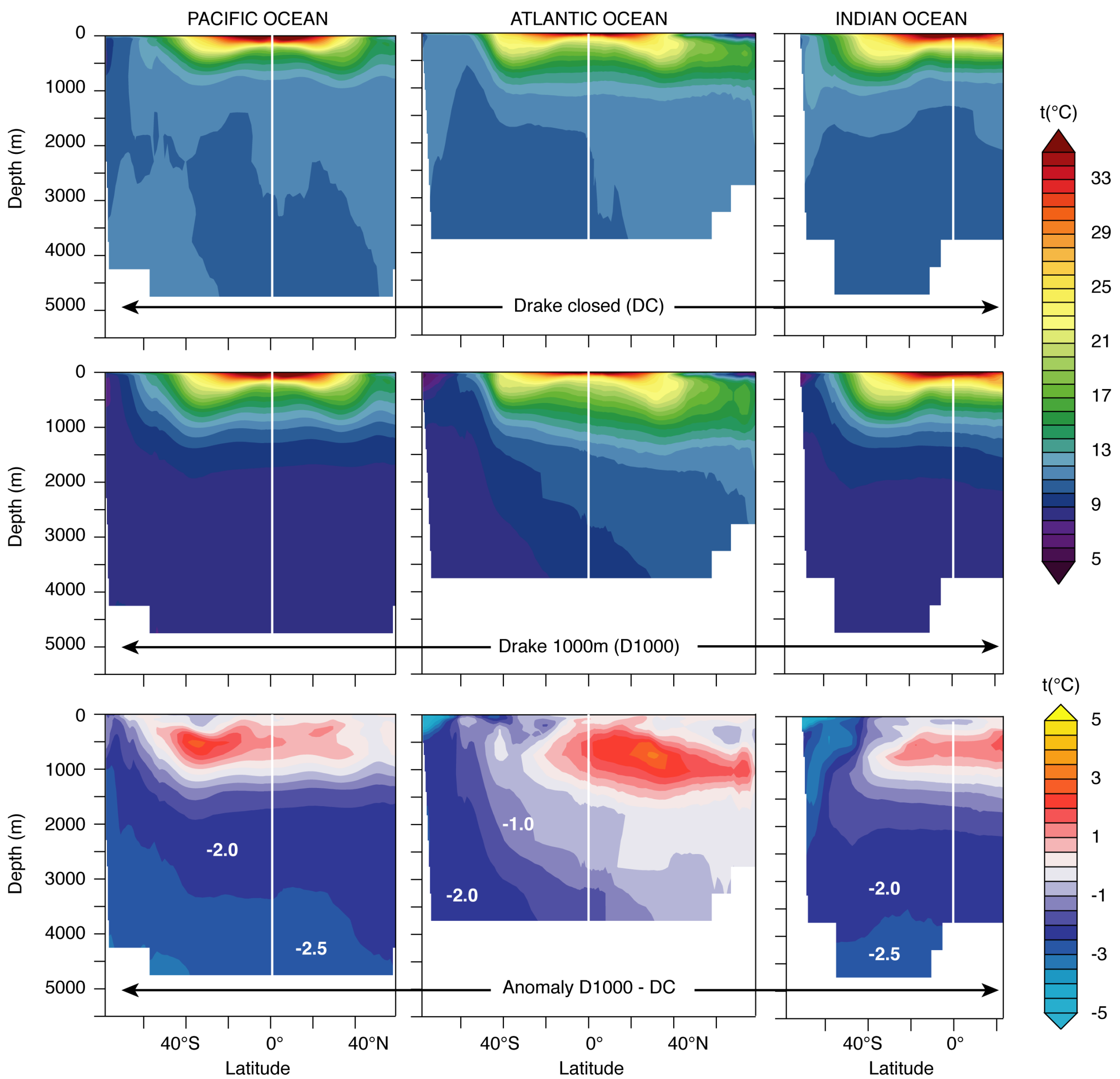
Supporting information Figure S3. Global maps of the ideal age at 2290m.



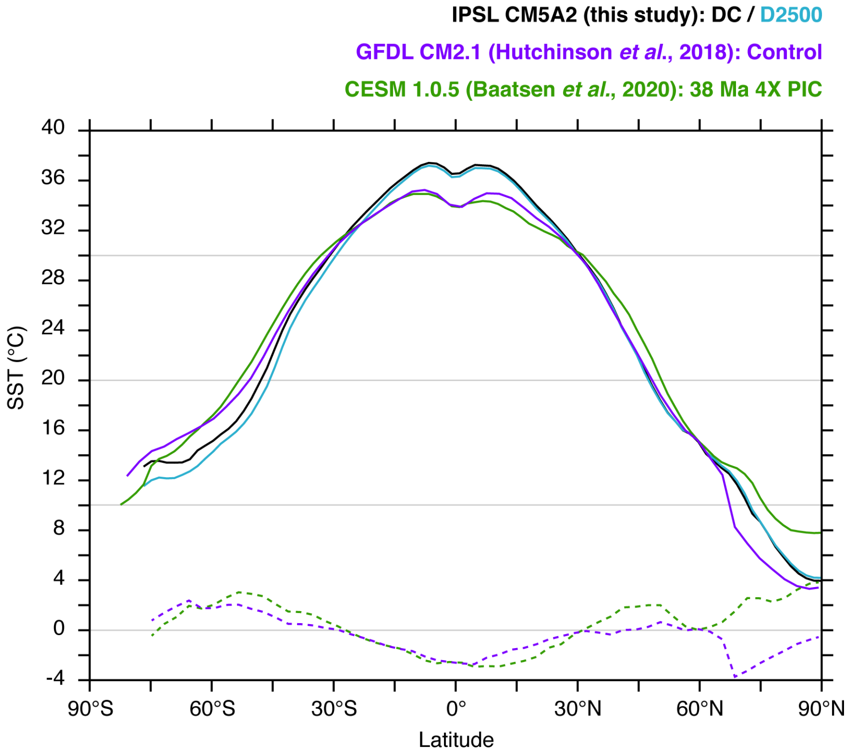
Supporting information Figure S4. Mean annual ocean currents velocity (cm/s) between 1203 and 1608 m depth, mid-depth of the layer = 1405 m. White lines are schematic qualitative representations of the main circulation patterns.



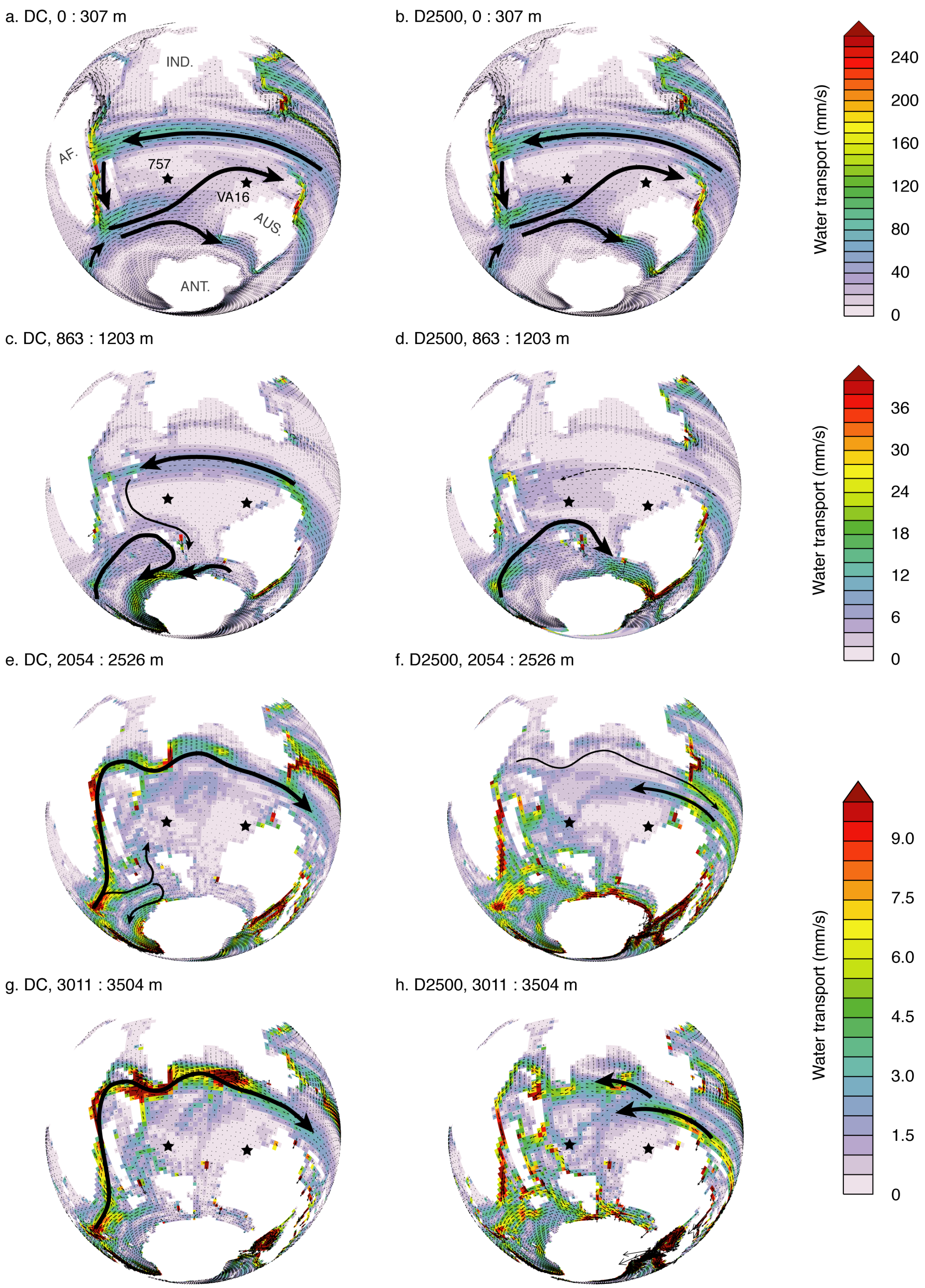
Supporting information Figure S5. Mean annual surface salinity (psu: Practical Salinity Unit = grams of salt / kilogram of water) for (a) DC, and in anomaly with DC for (b) D100, (c) D1000 and (d) D2500.



Supporting information Figure S6. Mean annual meridional temperatures for: (left column) Pacific Ocean, (middle column) Atlantic Ocean, (right column) Indian Ocean, and from the top to the bottom: DC, D1000 and the anomaly D1000 *minus* DC. The white vertical line represents the equator.



Supporting information Figure S7. Comparison of mean annual latitudinal sea-surface temperature gradient of this study with those of models GFDL and CESM (°C). Blue and black lines are DC and D2500 values (this study), purple and green lines correspond to 38 Ma simulations from GFDL and CESM, respectively. GFDL data are taken from Hutchison *et al*. (2018) and CESM data are courtesy of M. Baatsen (see Baatsen *et al*., 2020). GFDL and CESM simulations were launched with the same 38 Ma paleogeographies, which slightly diverge from our 40 Ma paleogeography (e.g. India location, extent of the Turgai strait). Similarly to our study, both simulations use high pCO_2: 800 ppm for GFDL and 1120 ppm for CESM. The CESM simulation additionally includes a methane concentration of 2684 ppb. All three simulations are parametered with modern orbital configurations. Dashed lines are anomalies of these two simulations with respect to the DC experiment.



Supporting information Figure S8. Circulation pattern in the Indian Ocean for DC and D2500. Water velocity (mm/s). Black arrows illustrate the main circulation pattern within the basin. Stars indicate two of the sites used in Franck *et al.* (2006) and Martin & Scher (2006).

Supporting information Table S1. Freshwater input into the high latitude basins (poleward of 50°) of the Pacific and Atlantic Oceans. Positive values represent a net freshwater input into the basin. Fluxes are weighted by basin area and, thus, are expressed per millions of square meter of ocean (mSv/1.e6 m^2).

Basin	Simulation	DC	D100	D1000	D2500
Pacific NH (>50°N)	Total freshwater input	39.5	38.4	39.4	39.3
	Total runoff input	12.7	12.6	12.7	14.1
Pacific SH (<50°S)	Total freshwater input	26.6	24.8	25.2	23.8
	Total runoff input	2.2	2.2	2.3	2.3
Atlantic NH (>50°N)	Total freshwater input	44.6	43.4	45.6	45.6
	Total runoff input	25.2	25	26	28.2
Atlantic SH (<50°S)	Total freshwater input	26.9	26.6	26.1	24.9
	Total runoff input	4.3	3.6	3.2	3.4