

Table S1. List of state variables in the coupled sea ice-ocean biogeochemical model.

Symbol	Description	Unit
[IA]	Ice algae in the bottom-ice skeletal layer	mmol N m ⁻³
[NO ₃] _{ia}	Nitrate in the bottom-ice skeletal layer	mmol N m ⁻³
[NH ₄] _{ia}	Ammonium in the bottom-ice skeletal layer	mmol N m ⁻³
[Si] _{ia}	Silicate in the bottom-ice skeletal layer	mmol Si m ⁻³
[P1]	Small phytoplankton in the water column	mmol N m ⁻³
[P2]	Large phytoplankton in the water column	mmol N m ⁻³
[Z1]	Small zooplankton in the water column	mmol N m ⁻³
[Z2]	Large zooplankton in the water column	mmol N m ⁻³
[D1]	Small detritus in the water column	mmol N m ⁻³
[D2]	Large detritus in the water column	mmol N m ⁻³
[BSi]	Biogenic silica in the water column	mmol Si m ⁻³
[NO ₃]	Nitrate in the water column	mmol N m ⁻³
[NH ₄]	Ammonium in the water column	mmol N m ⁻³
[Si]	Silicate in the water column	mmol Si m ⁻³