

Supplementary information for ‘Sea ice and the ocean mixed layer over the Antarctic shelf seas, Petty et al.’

Table S1. Model Variables

Symbol	Variable Description
A	Ice concentration
c_B	depth-dependant dissipation coefficient for convective mixing
c_w	depth-dependant dissipation coefficient for wind mixing
E_i	annual shelf sea ice export, $\text{m}^3 \text{yr}^{-1}$
F_{fresh}	direct freshwater flux from ice/snow growth/melt, $\text{kg m}^{-2}\text{s}^{-1}$
F_{ice}	heat flux from the base of the ice to the ocean surface, W m^{-2}
F_{ice}^S	net salt flux into the mixed layer from the ice fraction, m s^{-1}
F_{lat}^o	latent heat flux over the open ocean fraction, W m^{-2}
F_{lw}	2 m incoming longwave radiative heat flux, W m^{-2}
F_{lw}^o	incoming longwave radiative heat flux absorbed by the open ocean, W m^{-2}
F_{lwout}^o	longwave blackbody heat flux from the open ocean surface, W m^{-2}
F_{ocean}	ocean surface layer to mixed layer heat flux, W m^{-2}
F_{pe}	net salt flux into the mixed layer from net precipitation, m s^{-1}
F_{rain}	freshwater flux over the entire grid cell from rainfall, $\text{kg m}^{-2}\text{s}^{-1}$
F_{sens}^o	sensible heat flux over the open ocean fraction, W m^{-2}
F_{snow}	freshwater flux over the entire grid cell from snowfall, $\text{kg m}^{-2}\text{s}^{-1}$
F_{sw}	2 m incoming shortwave radiative heat flux, W m^{-2}
F_{swabs}	shortwave radiation absorbed by the open ocean fraction, W m^{-2}
F_{swthru}	shortwave radiative heat flux absorbed by the ocean through the ice, W m^{-2}
F_{salt}	direct salt flux from ice/snow growth/melt, $\text{kg m}^{-2}\text{s}^{-1}$
$F_{surface}$	net heat flux into the ocean surface from the ice and open ocean, W m^{-2}
G_i	annual shelf sea ice growth, $\text{m}^3 \text{yr}^{-1}$
h_{bath}	seabed depth, m
h_{mix}	mixed layer depth, m
H_{frzmlt}^S	heat potential for ice growth/melt from the ocean surface layer, W m^{-2}
H_{frzmlt}^{mix}	heat potential for ice growth from the mixed layer, W m^{-2}
M_i	annual shelf sea ice melt, $\text{m}^3 \text{yr}^{-1}$
P_{wind}	power input to the mixed layer from wind stirring, $\text{m}^3 \text{s}^{-3}$
P_{heat}	mixed layer (mechanical) power input from surface heat flux, $\text{m}^3 \text{s}^{-3}$
P_{net}	net mixed layer (mechanical) power input, $\text{m}^3 \text{s}^{-3}$
P_{pe}	mixed layer (mechanical) power input from net precipitation, $\text{m}^3 \text{s}^{-3}$
P_{salt}	mixed layer (mechanical) power input from ice/snow net salt flux, $\text{m}^3 \text{s}^{-3}$
Q_a	2 m specific air humidity, g g^{-1}
S_b	salinity directly below the mixed layer
S_{mix}	mixed layer salinity
S_{ocean}	Southern Ocean 3D salinity grid
T_a	2 m air temperature, $^{\circ}\text{C}$

T_b	temperature directly below the mixed layer, °C
T_f	freezing temperature of sea water in the mixed layer, °C
T_{mix}	mixed layer temperature, °C
T_{ocean}	Southern Ocean 3D temperature grid, °C
T_S	ocean surface temperature, °C
\mathbf{u}	ice velocity, m s ⁻¹
\mathbf{U}_w	geostrophic ocean velocity, m s ⁻¹
U	10 m zonal wind speed, m s ⁻¹
u_\star	effective ocean surface friction velocity, m s ⁻¹
V	10 m meridional wind speed, m s ⁻¹
V_i	volume of ice per unit area, m
w	entrainment rate, m s ⁻¹
W_{heat}	annual mixed layer (mechanical) energy input from surface heat flux, J m ⁻²
W_{net}	net mixed layer (mechanical) power input, J m ⁻²
W_{pe}	annual mixed layer (mechanical) energy input from net precipitation, J m ⁻²
W_{salt}	annual mixed layer (mechanical) energy input from ice/snow salt flux, J m ⁻²
W_{wind}	annual mixed layer (mechanical) energy input from wind mixing, J m ⁻²
Δb	buoyancy difference across the mixed layer base
τ_i	ice-ocean wind stress, N m ⁻²
τ_o	open water wind stress, N m ⁻²
