[Self-shading and meltwater spreading control the transition from light to iron limitation in an Antarctic coastal polynya]

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Additional Supporting Information (Files uploaded separately)

Captions for Datasets S1 to S12

Introduction

Data needed to plot graphs is given in a series of netcdf files; full model outputs are replicable using the MITgcm as described in acknowledgements. Each caption describes the size of the file, and its contents.

Data Set S1.

jan_state.nc
- o dimensions: 150 x 150 x 65
- o variables: 6
- o January-averaged diagnostics for temperature [TEMP; deg. C], salinity [SALT; psu], zonal velocity [UVEL; m s^{-1}], meridional velocity [VVEL; m^{-1}], global [MELTWATER; m^3 m^{-3}] and local meltwater [LOCAL_MELTWATER; m^3 m^{-3}] tracers; full domain coverage with the depth at the center of each vertical level provided.

Data Set S2.

meltpump.nc
- o dimensions: 12
- o variables: 6
- o Monthly (spatially averaged) diagnostics for ice shelf melt rate [MELTRATE; kg m^{-2} s^{-1}], sea surface temperature with [SST_MELT; deg. C] and without [SST_NOMELT; deg. C] ice shelf melting; total iron in top 100m of ocean without melt [IRON_NOMELT; mol Fe m^{-3}], with melting but no iron in meltwater [IRON_PUMP; mol Fe m^{-3}] and with iron in glacial meltwater [IRON_GMW; mol Fe m^{-3}].

Data Set S3.

npp.nc
- o dimensions: 72
- o variables: 11
- o 5-day averaged (and spatially averaged) diagnostics for mixed layer depth with [MLD_MELT; m] and without [MLD_NOMELT; m] ice shelf melting, sea ice coverage with [SEAICE_MELT; m^2 m^{-2}] and without [SEAICE_NOMELT; m^2 m^{-2}] ice shelf melting; the euphotic depth [ZEU; m] due to self-shading; finally the NPP without melt [NPP_NOMELT; mol C m^{-3} s^{-1}], with melting but no iron in meltwater [NPP_PUMP; mol C m^{-3} s^{-1}], with iron in glacial meltwater [NPP_GMW; mol C m^{-3} s^{-1}], without self-shading [NPP_FIXED; mol C m^{-3} s^{-1}], without iron uptake [NPP_FLAT; mol C m^{-3} s^{-1}] and without either self-shading or iron uptake [NPP_MAX; mol C m^{-3} s^{-1}].

Data Set S4.

profiles.nc

- o dimensions: 40
- o variables: 10

o October [OCT_IRR; W m^{-2}] and December [DEC_IRR; W m^{-2}] profiles of irradiance with depth. December profiles of growth rate with [MU_SHADED; day^{-1}] and without [MU_FIXED; day^{-1}] self-shading; similarly for chlorophyll [CHL ~; mg Chl m^{-3}], small [SM ~; mol C m^{-3}] and large [LG ~; mol C m^{-3}] phytoplankton. Data is horizontally averaged and given for top 40 vertical levels only, which covers depths down to 150m.

Data Set S5.
hovmuller.nc

- o dimensions: 950 x 12
- o variables: 6
- o Horizontally and monthly averaged nitrate concentration with [NO3_SHADED; mol N m^{-3}] and without [NO3_FIXED; mol N m^{-3}] self-shading; similarly for oxygen [O2 ~; mol O$_2$ m^{-3}] and iron [FE ~; mol Fe m^{-3}]. Here data is given according to actual depths, down to 950m, rather than on a level-by-level basis.

Data Set S6.
npp_shading.nc

- o dimensions: 950 x 72
- o variables: 2
- o NPP profiles with [NPP_SHADED; mol C m^{-3} s^{-1}] and without [NPP_FIXED; mol C m^{-3} s^{-1}] self-shading.

Data Set S7.
budgets.nc

- o dimensions: 12
- o variables: 13
- o Monthly and spatially averaged contributions to iron budget with meltwater pump only [PUMP], with iron in glacial meltwater [GMW] and without iron uptake [FLAT ~]. Included are uptake [~ UPT; mol Fe s^{-1}], recycling [~ REC; mol Fe s^{-1}], remineralisation [~ REM; mol Fe s^{-1}], scavenging [~ SCAV; mol Fe s^{-1}] and overall biological tendency [~ BIO; mol Fe s^{-1}].

Data Set S8.
timing.nc

- o dimensions: 150 x 100
- o variables: 10

o Maps of the date (days from 1st July) at which iron limitation overtakes light limitation [IRON_LIM], and the date at which sea ice retreats – for each of the nine sensitivity experiments.

Data Set S9.

melt_profiles.nc

- o dimensions: 49
- o variables: 9
- o Profile of annually integrated bulk ice shelf melt rate (m yr^{-1}) with depth for each sensitivity experiment; depth of ice shelf at each vertical level down to grounding line provided.

Data Set 10.

sensitivity_maps.nc

- o dimensions: 150 x 100
- o variables: 10
- o Maps of self-shaded euphotic depth in December [ZEU; m]; December mixed layer depth (m) for cold_med [MLD_COLD], base_med [MLD_BASE] and warm_med [MLD_WARM] experiments, similarly for December sea surface temperature [SST ~] and October meltwater distribution [MELTWATER ~].

Data Set 11.

iron_sensitivity.nc
- o dimensions: 12
- o variables: 8
- o Iron concentration (mol Fe) integrated over the surface 100m on a monthly average, for each of the eight sensitivity experiments (results for base_med already given in meltpump.nc)

Data Set 12.

npp_sensitivity.nc

- o dimensions: 72
- o variables: 8
- o 5-day averaged NPP (g C m^{-3} day^{-1}) of the eight sensitivity experiments (results for base_med already given in npp.nc)