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Supplement of

Drivers of phytoplankton bloom interannual variability in the Amundsen and Pine Island Polynyas

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Table S1. Average bloom period chlorophyll-*a* (chl*a*) concentration (1998-2017) in mg m^{-3} and mg m^{-1} for the Amundsen (ASP) and Pine Island (PIP) polynyas. The * marks the significant difference in mean chl*a* between the polynyas (p-value < 0.005).

	ASP	PIP
Area integrated chl*a* (10^{11} in mg m^{-1})	3.31 ± 1.14 *	2.16 ± 1.11 *
Chl*a* (mg m^{-3})	5.21 ± 1.39 *	3.69 ± 1.11 *

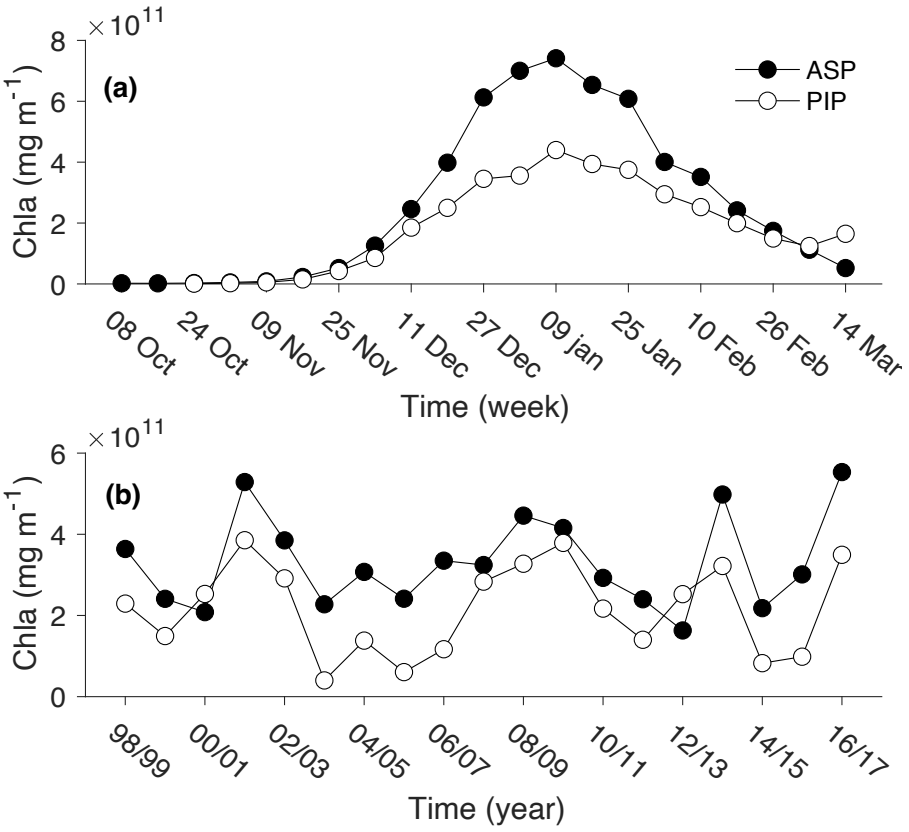

Fig. S1. (a) Weekly area integrated chlorophyll-*a* (chl*a*) climatology (1998-2017) for the Amundsen (ASP; filled circles) and Pine Island (PIP; open circles) polynyas. (b) October-March mean area integrated chl*a* time series of ASP (filled circles) and PIP (open circles).

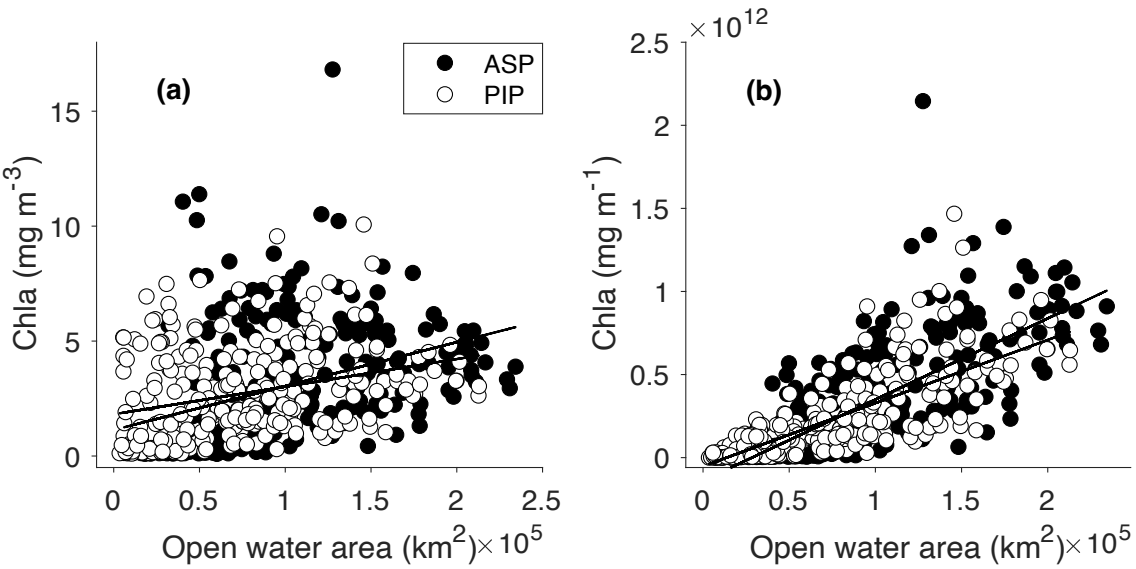

Fig. S2. Relationship between the polynya size and average chlorophyll-*a* (chl*a*) in (a) mg m^{-3} and (b) mg m^{-1} for the Amundsen (ASP; filled circles) and Pine Island (PIP; open circles) polynyas. All relationships are significant at 95% confidence level.

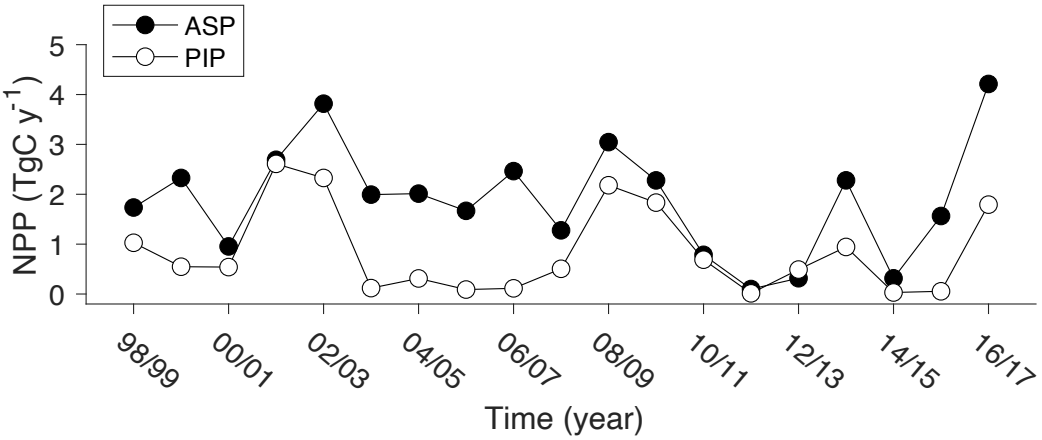

Fig. S3. Annual integrated net primary productivity (NPP) for the Amundsen (ASP; filled circles) and Pine Island (PIP; open circles) polynyas.

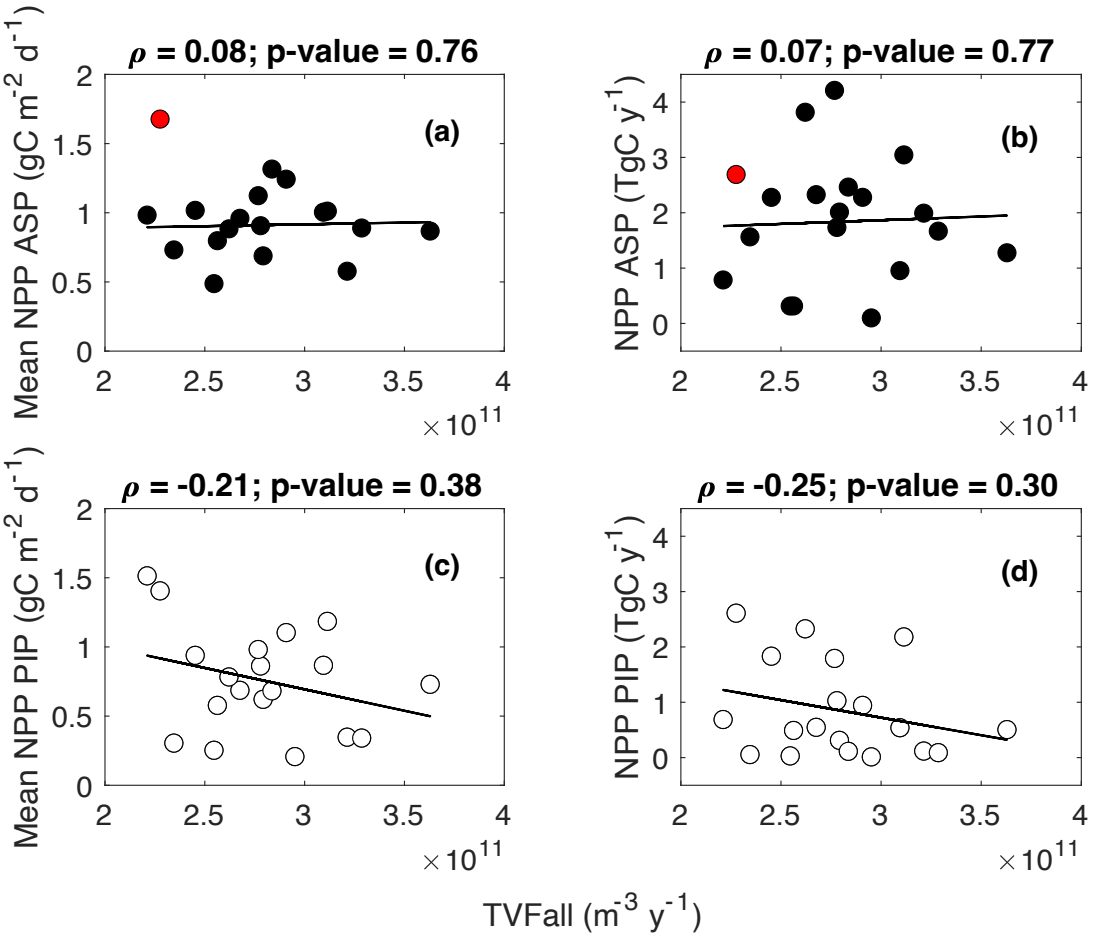

Fig. S4. Scatter plots of mean and integrated net primary productivity (NPP) with the total volume flux (TVFall) for (a-b) the Amundsen (ASP) and (c-d) the Pine Island (PIP) polynyas from 1998 to 2017. The fitted lines and statistics exclude the 2001/02 year (red outlier) for the ASP regressions to match Fig. 4. TVFall is an annual integral representing the sum of all ice shelves (see methods section) for the Amundsen Sea Embayment (ASE).

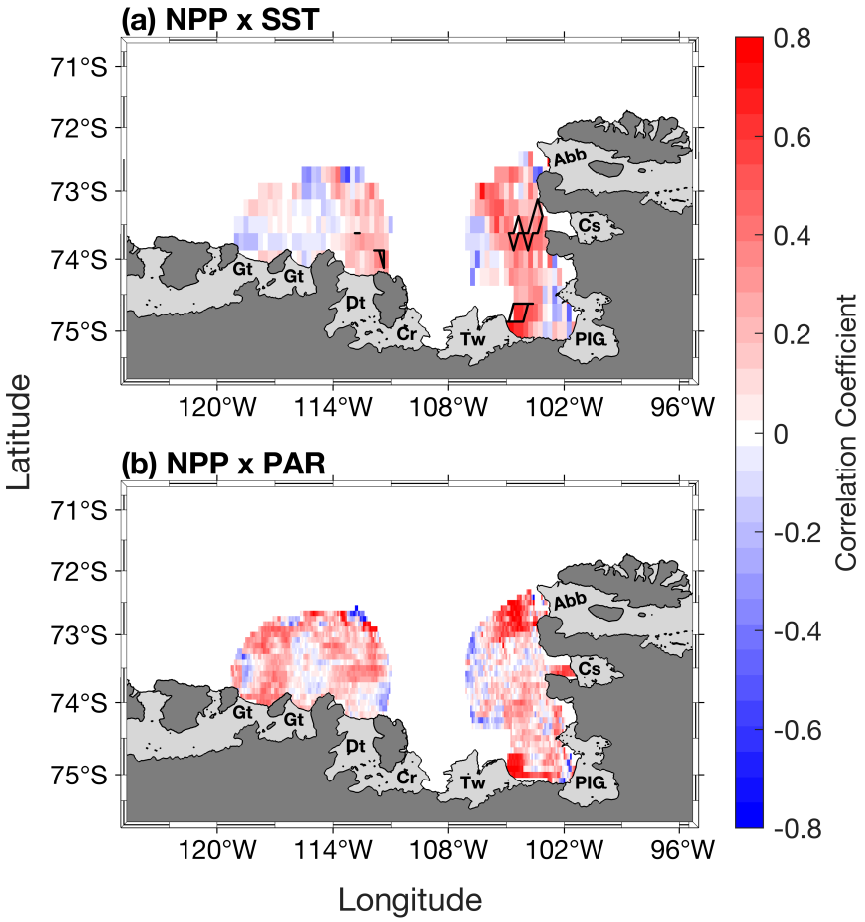

Fig. S5. Spatial correlation maps between net primary productivity (NPP) and (a) sea surface temperature (SST) and (b) photosynthetically available radiation (PAR). Data are monthly and span 1998 – 2017 from October to March (n=114). The black contour represents significant correlations at 95% confidence level. Seasonality was removed before performing the correlation. Data outside of the summer climatological polynyas' boundaries were masked out.

Table S2. Linear fit statistics (Spearman's rank correlation) for mean, maximum chlorophyll-*a* (chl*a*) and net primary productivity (NPP) as a function of sea surface temperature (SST), photosynthetically available radiation (PAR), and mixed-layer depth (MLD) in both polynyas (n=19). Excluding the 2001/02 year for ASP removes the significant relationship between PAR and max chl*a* and does not change the other relationships.

	Amundsen Sea polynya (ASP)						Pine Island polynya (PIP)					
	Mean chl*a*		Maximum chl*a*		NPP		Mean chl*a*		Maximum chl*a*		NPP	
	Rho	p-value	Rho	p-value	Rho	p-value	Rho	p-value	Rho	p-value	Rho	p-value
SST	-0.16	0.51	-0.12	0.62	0.19	0.43	0.58	0.009*	0.61	0.006*	0.63	0.005*
PAR	0.35	0.14	0.47	0.04*	0.46	0.05	0.62	0.007*	0.58	0.01*	0.67	0.002*
MLD	0.01	0.97	0.05	0.84	0.05	0.83	0.59	0.009*	0.56	0.01*	0.28	0.24

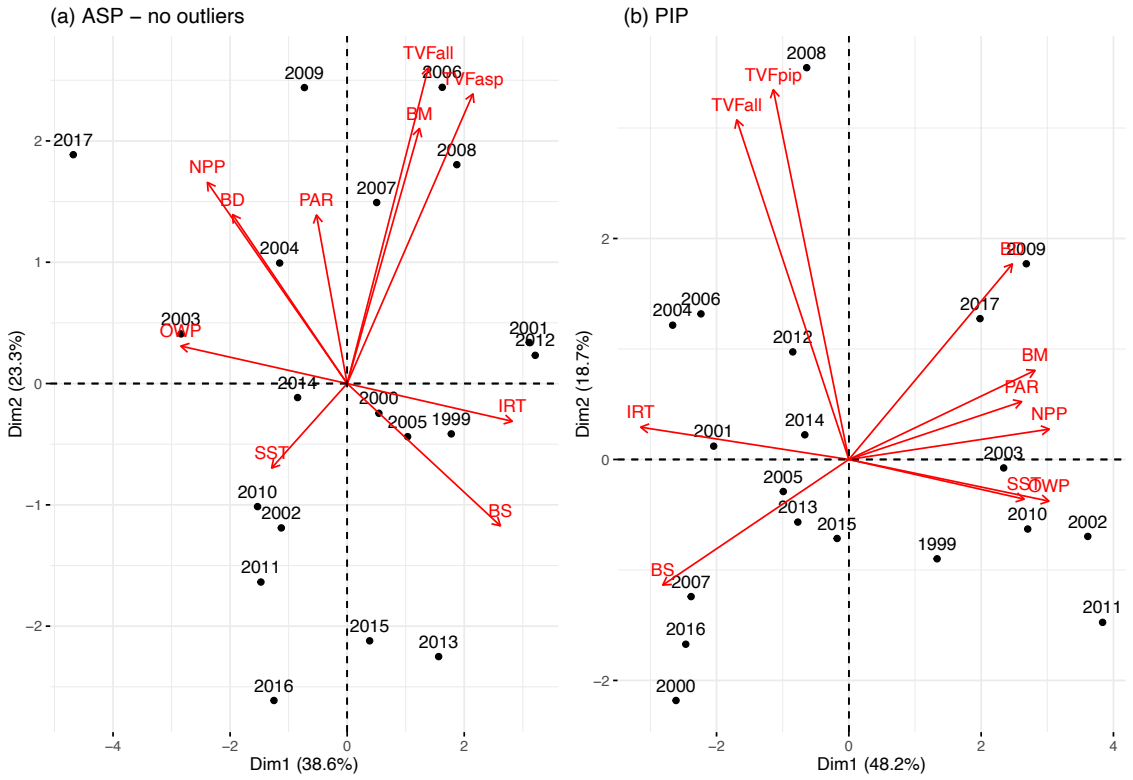

Fig. S6. Principal component analysis biplot of environmental parameters (red) and years (black) for (a) the Amundsen (ASP) and (b) the Pine Island (PIP) polynyas. TVFasp = total volume flux for ASP; TVFpip = total volume flux for PIP; TVFall = total volume flux for all ice shelves; BM = bloom mean; PAR = Photosynthetically available radiation; BD = bloom duration; NPP = net primary productivity; OWP = open water period; SST = sea surface temperature; MLD = mixed-layer depth; BS = bloom start; IRT = ice retreat time. Same as Fig. 7 in the main manuscript but without year 2001/02 for the ASP.

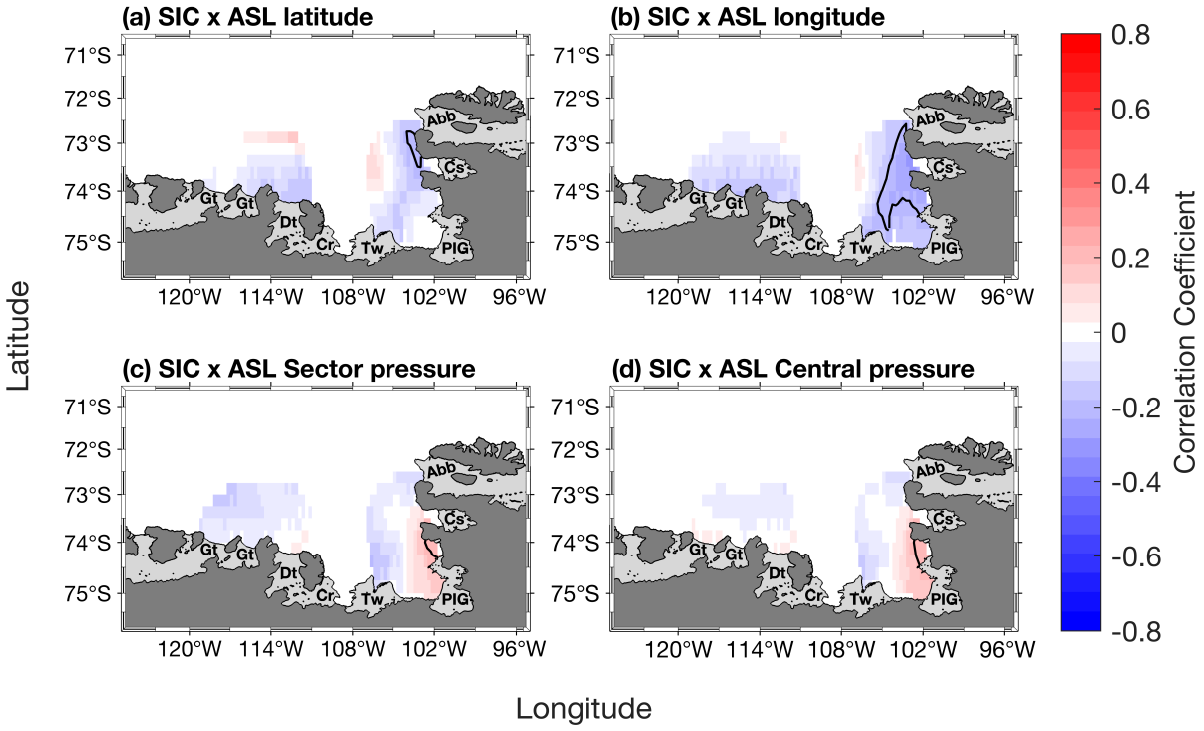

Fig. S7. Spatial correlation maps between sea-ice concentration (SIC) and (a) Amundsen Sea Low (ASL) latitude, (b) longitude, (c) mean sector pressure and (d) actual central pressure (n=114). The black contour represents significant correlations at 95% confidence level. Seasonality was removed before performing the correlation like in Fig. 7. Data outside of the summer climatological polynyas' boundaries were masked out.

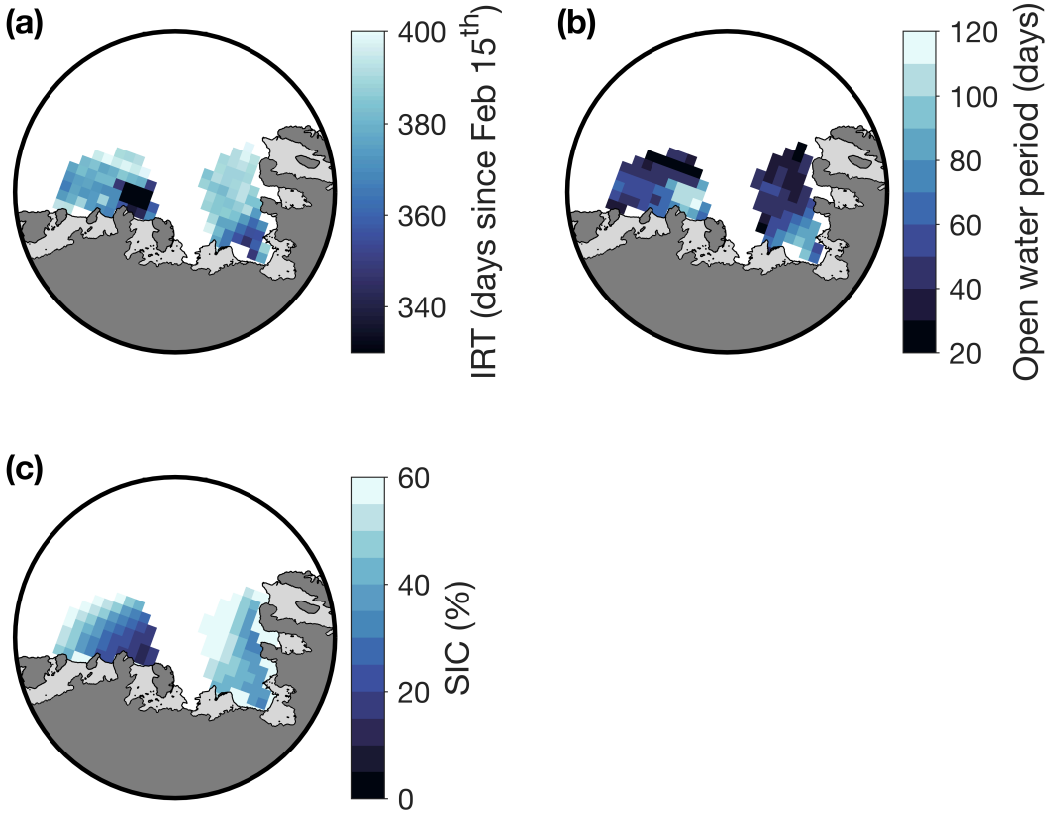

Fig. S8. Sea-ice phenology metrics climatology maps (1998-2017) of (a) ice retreat time (IRT), (b) open water period, and (c) sea-ice concentration (SIC). The SIC climatology is from October to March. Open water period was determined using a 15% SIC threshold. Data outside of the summer climatological polynyas' boundaries were masked out.