Supplementary Information for

Annually resolved Atlantic sea surface temperature variability over the past 2900 years

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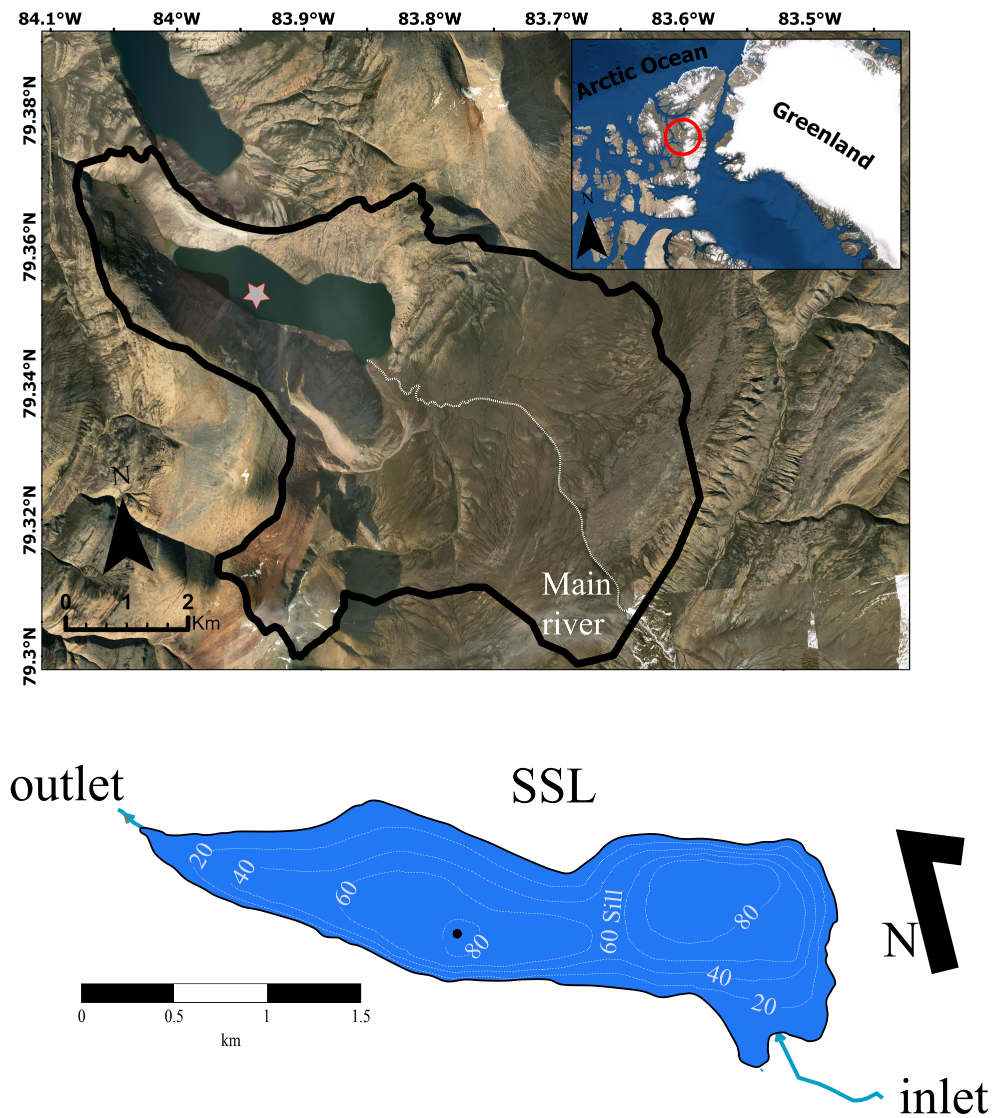

Fig. S1. 2-meter digital elevation model (DEM) map from Arctic DEM 7 Polar Geoscience Center (1). Inset at the top right is a map showing the location of South Sawtooth Lake (SSL) in the Canadian High-Arctic. The black contour delimits the catchment boundary at SSL based on the 2m DEM. Lower: bathymetry of SSL showing two basins separated by a sill of 60m. This configuration precludes erosion and deposition of coarse materials in the distal basin where the cores are located (black circle).

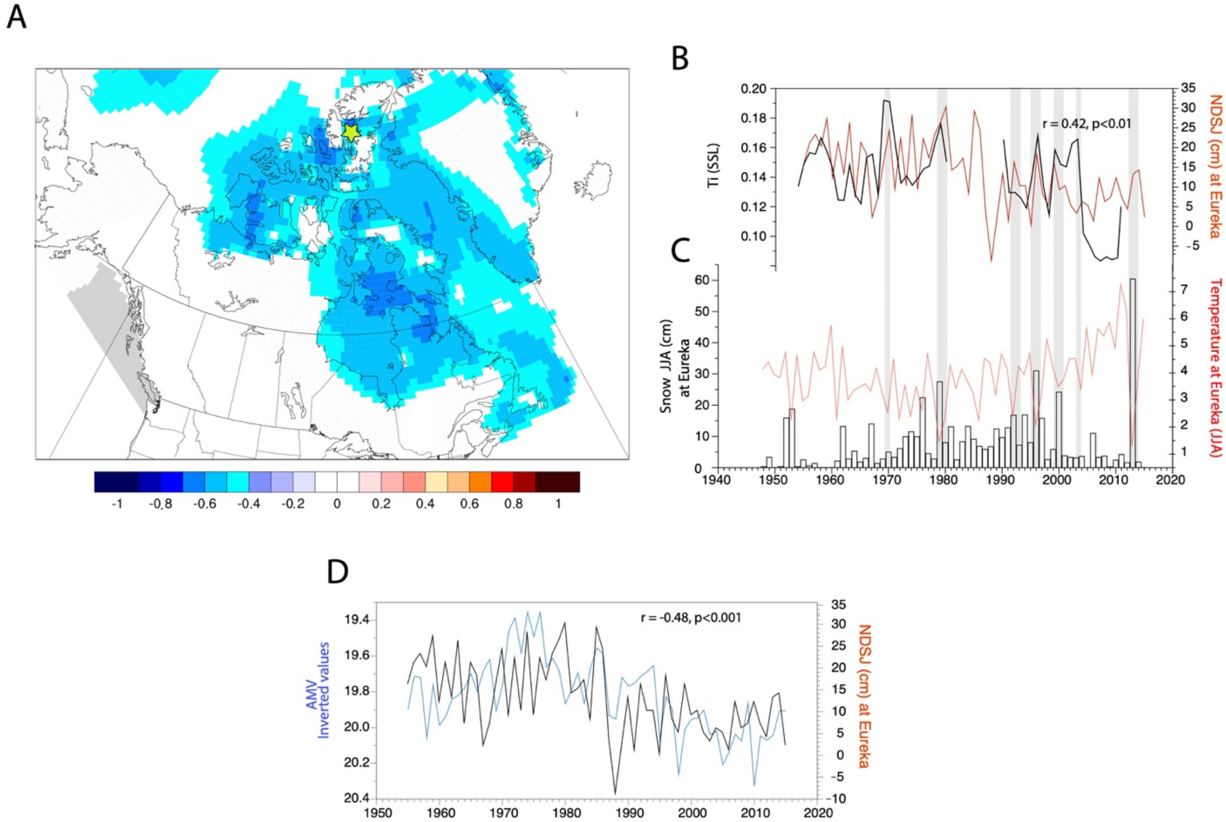

Fig. S2. A) Spatial correlation between AMV (2) and freezing degree days (3). Strong negative correlation found in Greenland and the Canadian High-Arctic implying cooler temperature during AMV-. B) Ti at SSL compared to the number of snow on the ground after the 1st June (NDSJ). C) Temperature and snow on ground recorded at Eureka weather station. D), Same as B, but instrumental AMV (JJA) (2) is compared to NDSJ. Data from snow depth is from Eureka weather station.

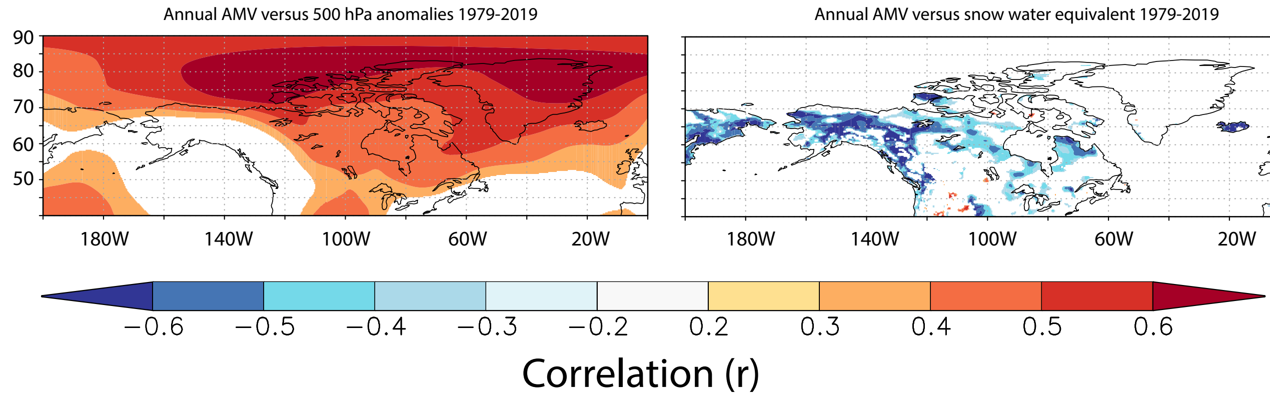

Fig. S3. Left: annual atmospheric pressure at 500hPa from Era-Interim (3) correlated to instrumental AMV (2). Right: snow water equivalent (3) correlated to AMV (2).

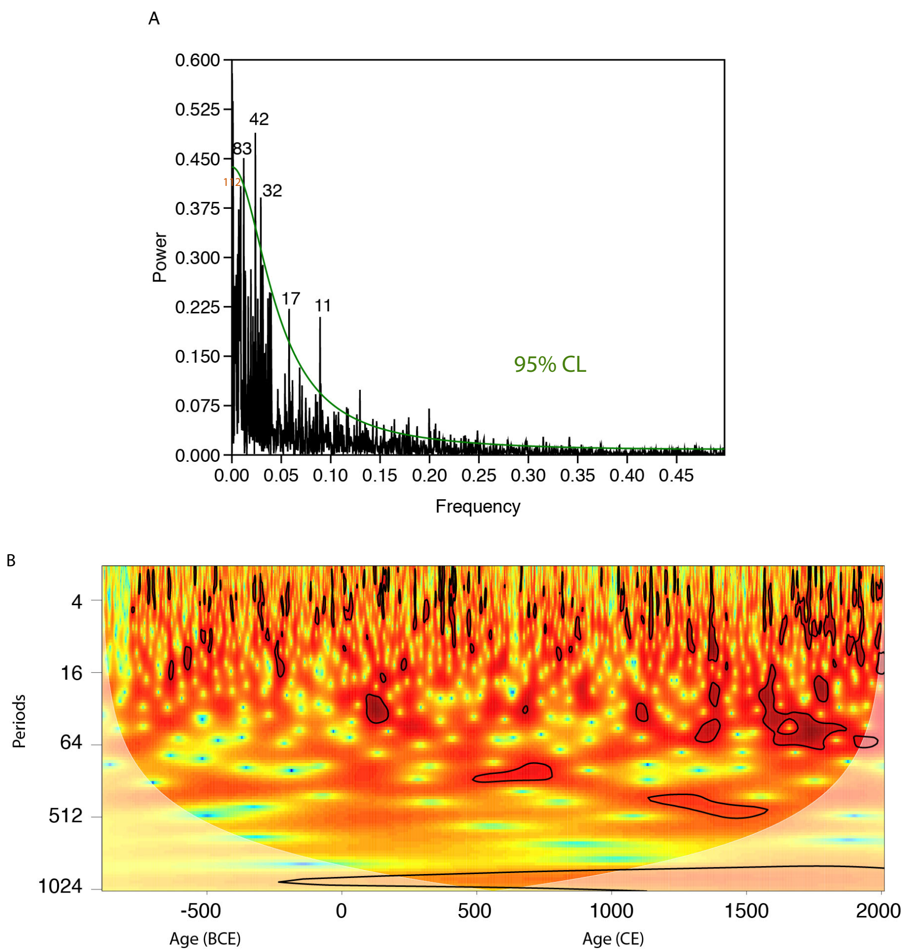

Fig. S4. A: Spectral analysis of the reconstructed annual AMV showing significant (>95% confidence level: green line) with spectral peaks at centennial to decadal scale. Note that the 112 year periodicity (orange) is significant at the 90% CL. Spectral analysis was performed using a Welch window (4) B: Wavelet spectrum of the reconstructed AMV at SSL showing a persistent multidecadal variability (40-80 year cycle) from ~1600 CE to present. Regions with higher than 95% confidence level are shown in black contour.

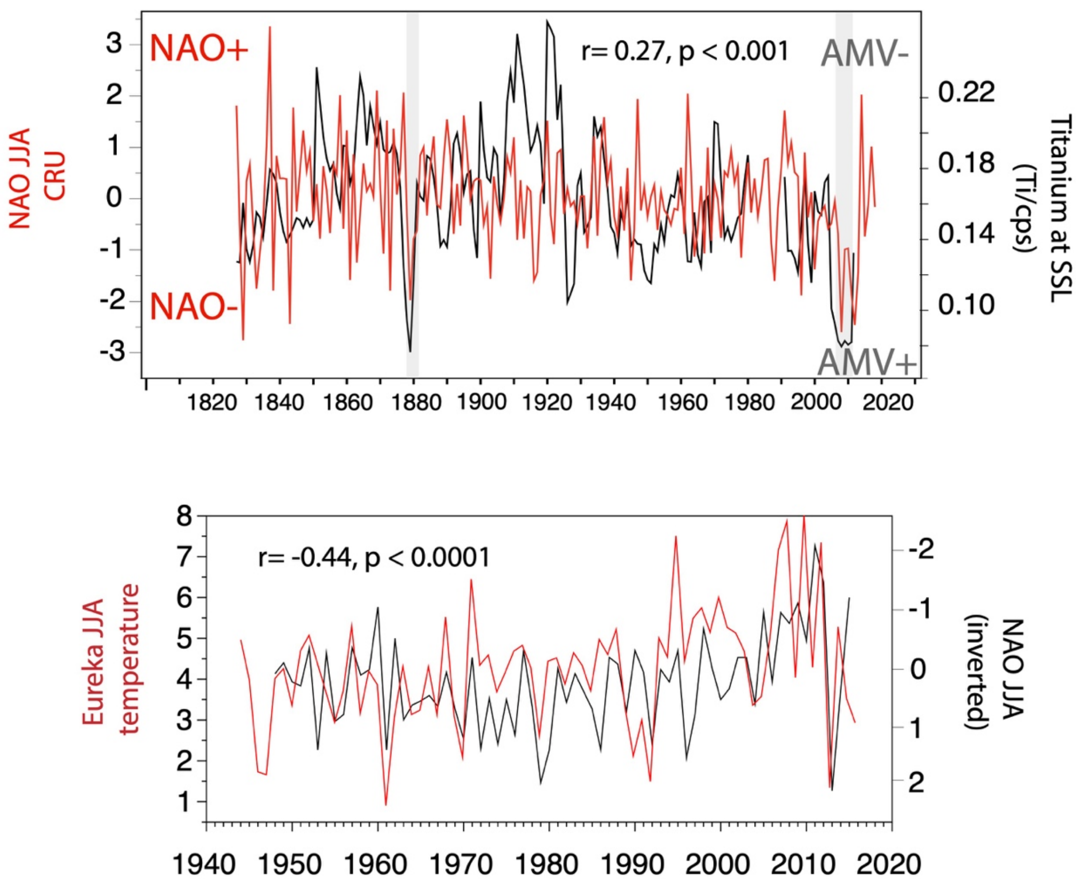

Fig. S5. Upper panel: Instrumental North Atlantic Oscillation (NAO) during JJA (5) versus Titanium variability at SSL. Lower panel: Summer temperature (JJA) at Eureka weather station compared to instrumental NAO JJA (5).

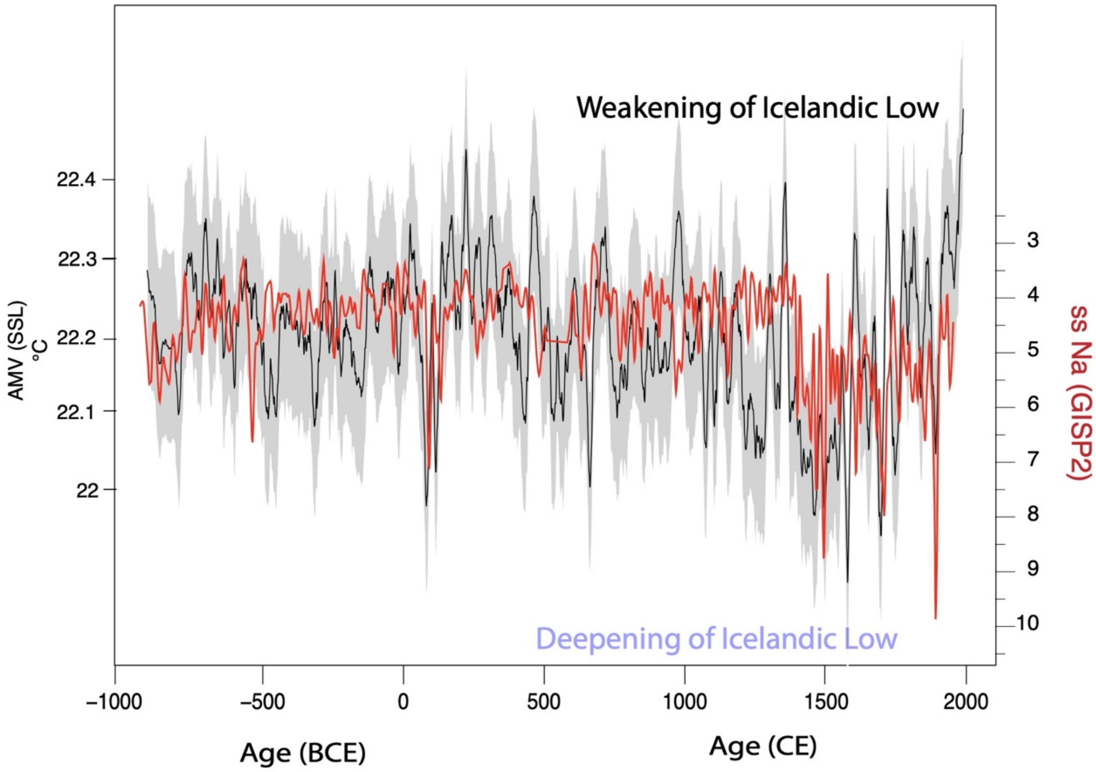

Fig. S6. AMV_{SSL} compared to sea salt Sodium (ssNa ppb) from GISP2 (6), a proxy of Icelandic Low variability. ssNa has a 3 year sample resolution and is filtered by a 7-point Gaussian filter. The correlation between AMV_{SSL} and ssNa (GISP2) is $r = -0.28$, $p < 0.001$.

Table S1. Matrix correlation between reconstructed AMV_{SSL} and different climate proxies from the North Atlantic referred in the text. Numbers in parenthesis are the site locations of individual records from Figure 1. The correlations are unfiltered (annual or otherwise at the resolution of the lowest timescale resolution of the two records). Mean r and p values are shown with the percentile confidence intervals at 95%, calculated from 10,000 non-parametric stationary bootstrap iterations, shown in brackets.

	Coefficient correlation		**Significance**	
Climate archives	mean	95% CI	mean	95% CI
AMV _wang	0.22	[0.11, 0.31]	10^{-4}	[10^{-14}, 10^{-3}]
AMV_Mann	0.15	[0.10, 0.22]	10^{-4}	[10^{-12}, 10^{-2}]
Europe_temp	0.17	[0.08, 0.25]	10^{-5}	[10^{-11}, 10^{-4}]
Arctic_temp	0.15	[0.07, 0.23]	10^{-4}	[10^{-14}, 10^{-3}]
Northern_Hemis_temp	0.22	[0.18, 0.41]	10^{-7}	[10^{-16}, 10^{-5}]
Rapid-17-5P_temp (2)	0.25	[0.08, 0.36]	0.007	[10^{-6}, 0.02]
Rapid-17-5P/EN539 t. Quinqueloba (2)	-0.38	[-0.21, -0.54]	10^{-4}	[10^{-10}, 10^{-2}]
δ^{18}O Islandic arctica (3)	-0.11	[0.06, -0.22]	0.04	[10^{-4}, 0.07]
BWT_Malagen Fjord (4)	0.26	[0.11, 0.40]	10^{-3}	[10^{-8}, 10^{-3}]
SE Greenland sea-ice (5)	-0.23	[-0.02,-0.32]	0.02	[10^{-5}, 0.09]
δ^{18}O DYE-3 (6)	0.36	[0.21, 0.51]	10^{-5}	[10^{-10}, 10^{-2}]
Cariaco Basin bulloides (7)	-0.20	[-0.11, -0.31]	10^{-6}	[10^{-12}, 10^{-3}]

Table S2. Same as Table S1, but using a 21-year centered running mean filter on the time-series.

	Coefficient correlation		Significance	
Climate archives	mean	95% CI	mean	95% CI
AMV _Wang	0.35	[0.22, 0.42]	10^{-5}	[10^{-14},10^{-3}]
AMV_Mann	0.24	[0.16, 0.32]	10^{-5}	10^{-12}, 0.003
Europe_temp	0.36	[0.21, 0.59]	10^{-7}	[10^{-11}, 10^{-4}]
Arctic_temp	0.32	[0.17, 0.43]	10^{-6}	[10^{-14}, 10^{-3}]
Northern_Hemis_temp	0.43	[0.31, 0.62]	10^{-8}	[10^{-16},10^{-5}]
Rapid-17-5P_temp (2)	0.42	[0.22, 0.58]	10^{-4}	[10^{-6}, 0.02]
Rapid-17-5P/EN539 t. Quinqueloba (2)	-0.68	[-0.44, -0.74]	10^{-6}	[10^{-10}, 10^{-2}]
δ^{18}O Islandic arctica (3)	-0.27	[-0.16, -0.39]	0.004	[10^{-4}, 0.009]
BWT_Malagen Fjord (4)	0.48	[0.35, 0.67]	10^{-6}	[10^{-8}, 10^{-2}]
SE Greenland sea-ice (5)	-0.36	[-0.28,-0.52]	10^{-4}	[10^{-6}, 0.008]
δ^{18}O DYE-3 (6)	0.59	[0.35, 0.78]	10^{-6}	[10^{-14}, 10^{-4}]
Cariaco Basin bulloides (7)	-0.40	[-0.11, -0.51]	10^{-7}	[10^{-10}, 10^{-4}]

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