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Supporting Information for

Nutrient and Carbon Export from a Tidewater Glacier to the Coastal Ocean in the Canadian Arctic Archipelago

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Introduction

Supporting information is provided to augment statements and data provided in the manuscript. Data encompasses additional information for glacier characteristics described in section 2.1.2 (Figure S1), spatial and temporal information for validation of RACMO2.3 mass balance modeling in section 2.5 (Figure S2), background on time-lapse imagery used in section 3.1 (Figure S3), mixing model results discussed in section 3.4 (Figure S4), a visualization of nutrient ratios discussed in section 4.3 (Figure S5), and a summary of samples used in this study (Table S1).

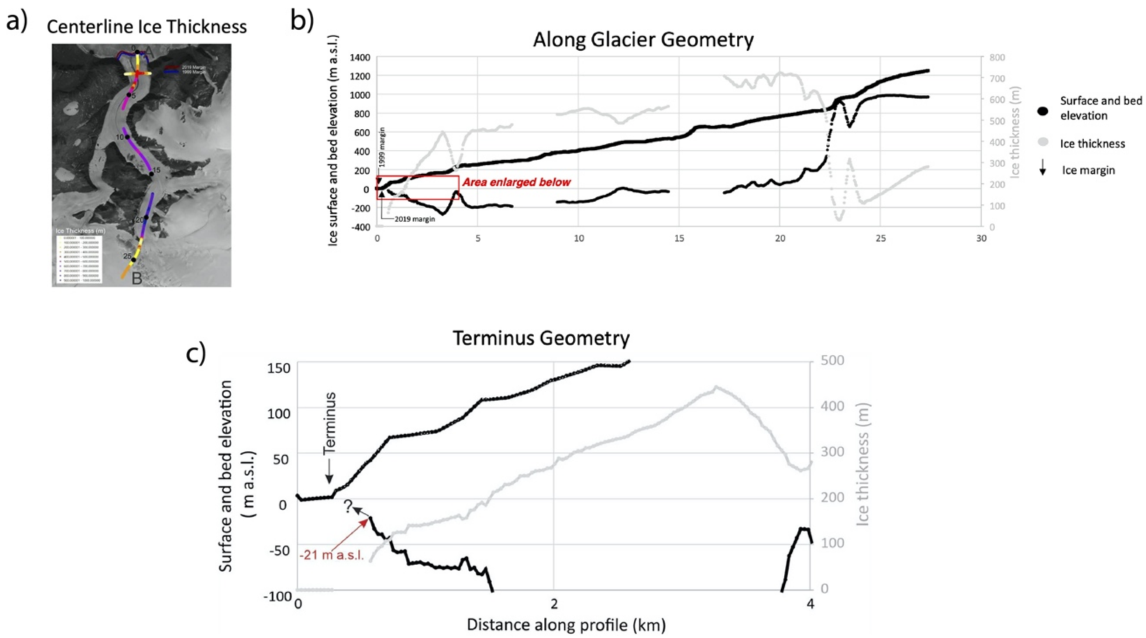

Figure S1. Summary of Sverdrup Glacier ice elevation and thickness from NASA Ice Bridge centreline data. Data from (Paden et al., 2019). The LandSat-8 imagery was obtained from the U.S.G.S. EarthExplorer Archive (U.S.G.S., Landsat-8, 2020) (a) A map showing the centerline transect from which (b) ice elevation and thickness data is derived. Panel (c) shows an enlargement of the terminus region. Ice thickness data unavailable within 600 m of the terminus.

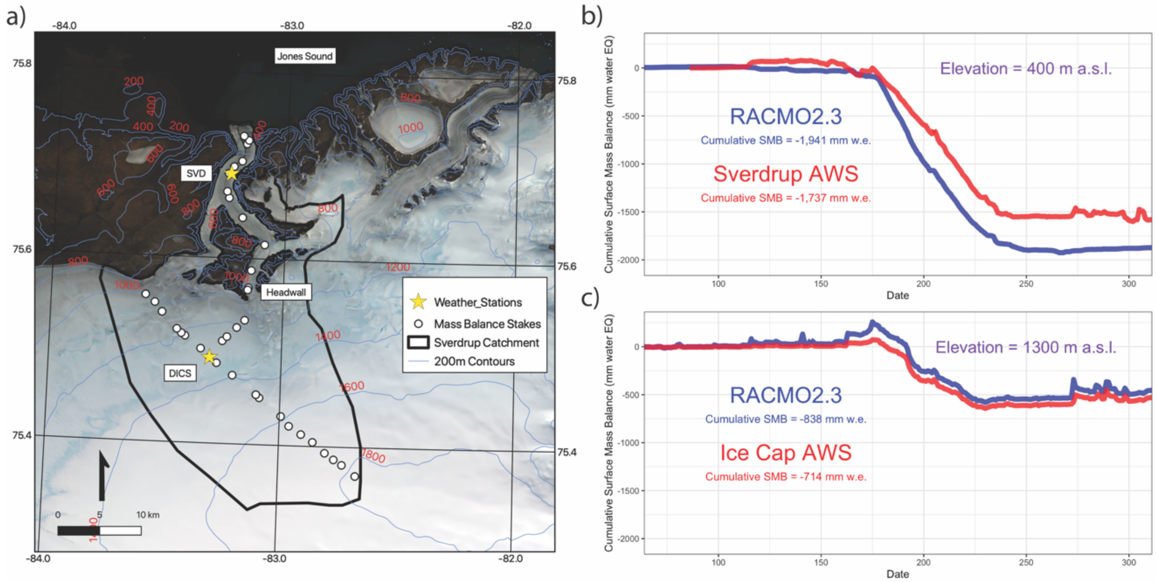

Figure S2. Sverdrup surface mass balance validation. (a) Location of data sources within the Sverdrup glacier basin, outlined in black (RGI Consortium, 2017), that were used for validating the RACMO2.3 surface mass balance model. The mass balance stake network and automatic weather stations (installed in 1959 and 1994 respectively) are maintained annually by the Geological Survey of Canada. (b) Plots comparing measured and modeled SMB were cumulated from JD 182 to 244 at both the SVD and DICS stations.

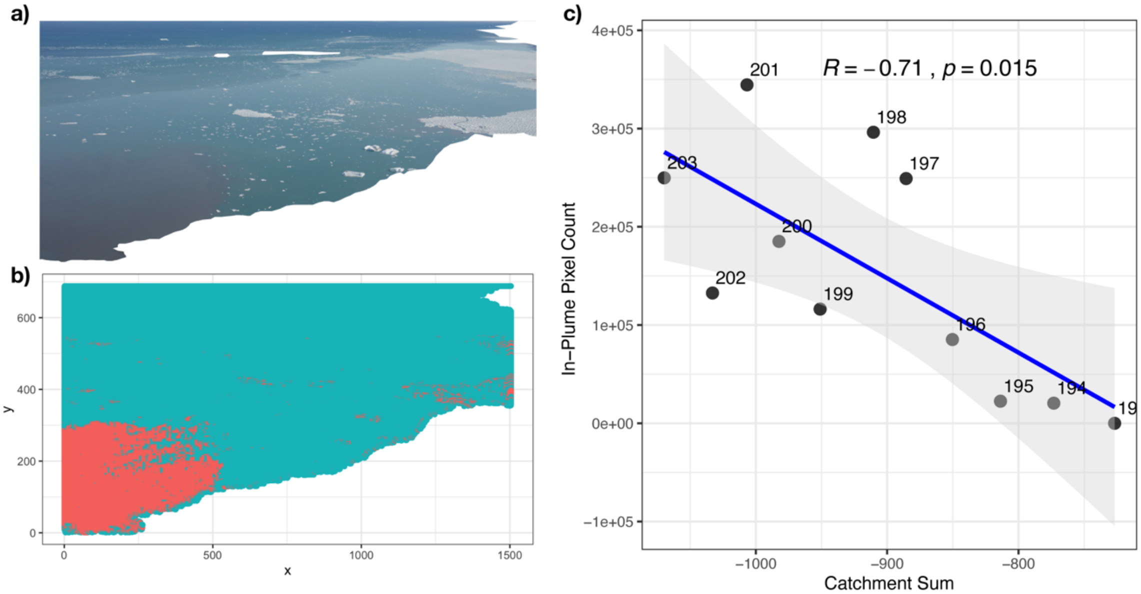

Figure S3. Time-lapse camera image summary. (a) Time-lapse camera image of Brae Bay with Sverdrup Glacier and other landmasses removed to restrict color analysis to the ocean surface. The turbid submarine plume can be seen in the foreground. (b) The result of k-means colour-based pixel clustering (n=10) with plume pixels identified in red and non-plume pixels in blue. (c) Correlation between plume pixel count (corrected to relative area) and cumulative surface mass balance from the Sverdrup AWS.

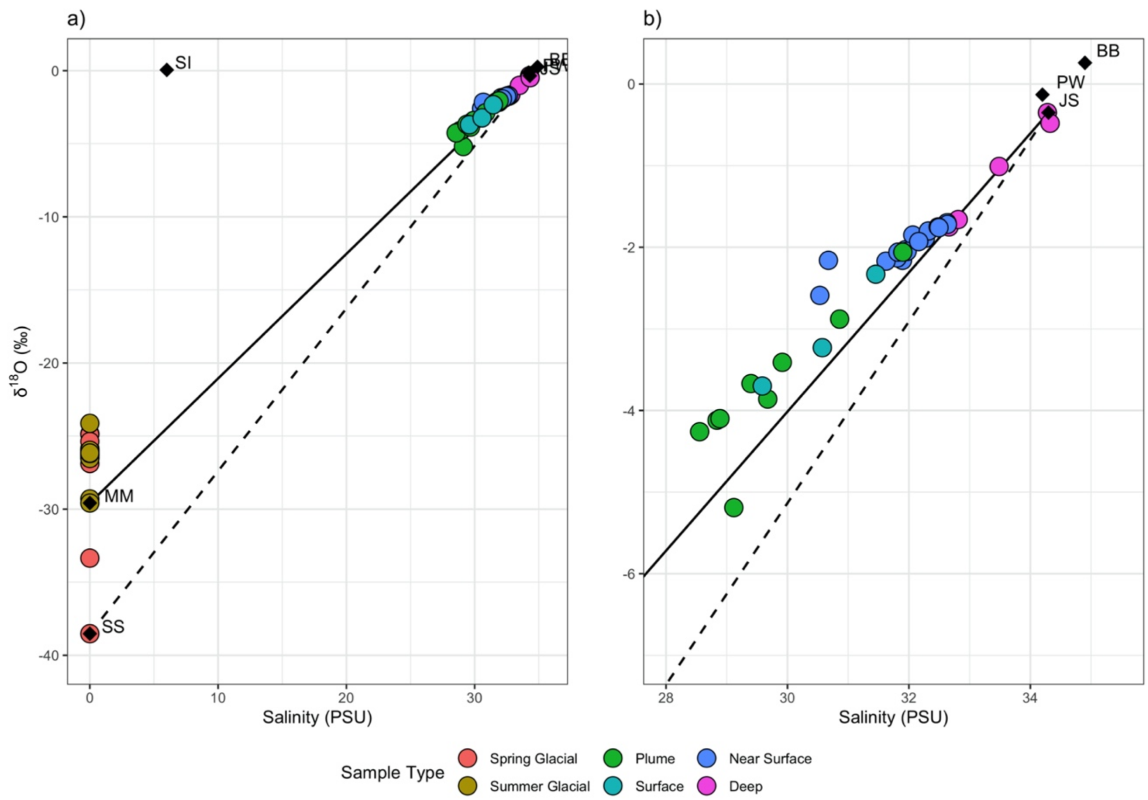

Figure S4. δ^{18}O versus salinity. (a) δ^{18}O versus salinity in spring and summer glacial meltwater, marine plume water (>10% glacial melt using Equation 2b), and surface (0-10m), near surface (10-100m), and deep (>100m) marine water. Black diamonds denote Jones Sound deep water (JS), supraglacial meltwater (SM), marginal runoff (MR), sea-ice meltwater (SI), polar water (PW), and Baffin Bay deep water (BB) end-members (MR, SI, PW, BB, from Alkire, 2010). (b) An enlarged version of (a), highlighting marine samples. Water properties of JS, SM, MR, SI, PW, and BB end-members used are listed in Table 3

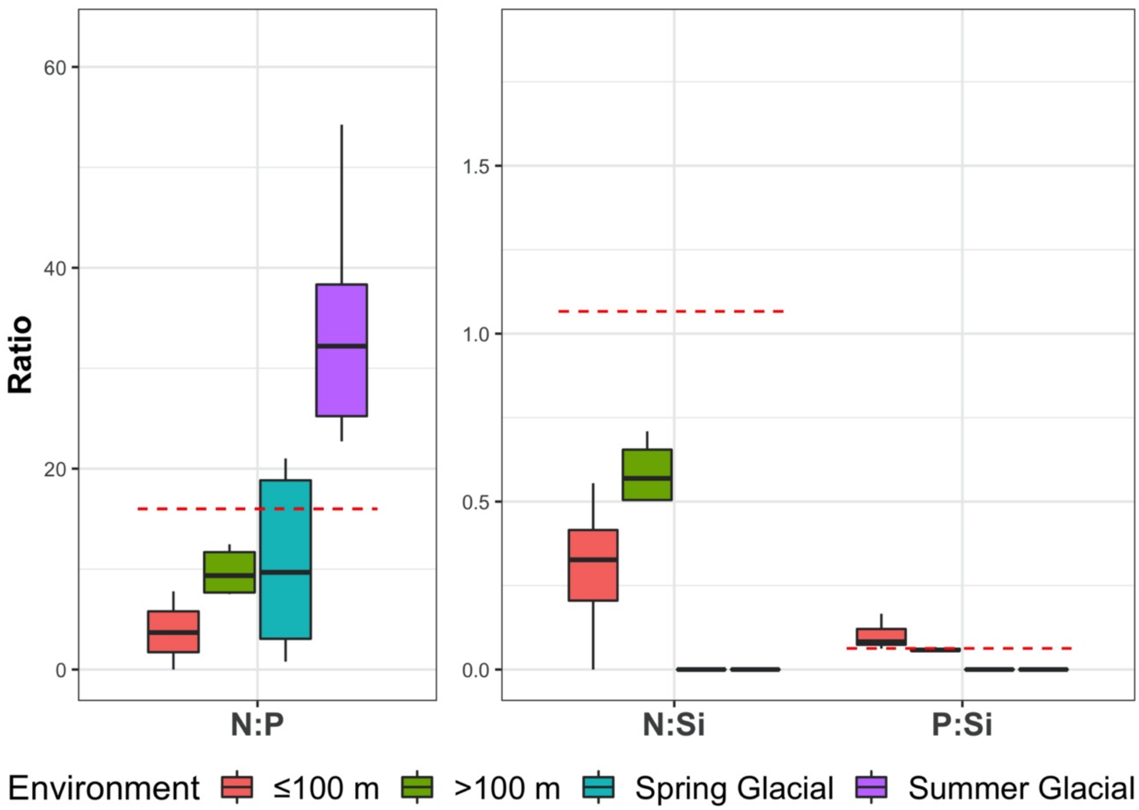

Figure S5. Box plots of marine nutrient ratios. (a) and (b) plots denote different y-scales. Red dotted lines represent the Redfield ratio between the elements on the x-axis. Marine samples and some spring glacial samples are NO_3^- limited with respect to both P and Si. The whiskers extend to 1.5 times the inter-quartile range (distance between first and third quartile) in each direction.

Table S1. Summary of samples collected and presented in this study.

Sample ID	Field Season	Water Type	Latitude	Longitude	Date Sampled
SVD-E-BI	Spring	Glacial	75.721883	-83.135511	4/23/2019
SVD-E-CI	Spring	Glacial	75.721883	-83.135511	4/23/2019
SVD-E-OW	Spring	Glacial	75.721883	-83.135511	4/24/2019
SVD-S-SI1	Spring	Glacial	75.690072	-83.24175	4/27/2019
SVD-S-SI2	Spring	Glacial	75.680422	-83.241139	5/7/2019
SVD-S-SS1	Spring	Glacial	75.690072	-83.24175	4/27/2019
SVD-S-SS2	Spring	Glacial	75.680422	-83.241139	5/7/2019
SVD-W-BI	Spring	Glacial	75.6932	-83.295547	4/27/2019
SVD-W-CI	Spring	Glacial	75.6932	-83.295547	4/27/2019
SVD-W-EI	Spring	Glacial	75.6932	-83.295547	4/27/2019
Ter_122	Summer	Glacial	75.45251	-83.9642	8/11/2019
Ter_123	Summer	Glacial	75.431782	-83.75203	8/10/2019
Ter_124	Summer	Glacial	75.324576	-83.61921	8/10/2019
Ter_125	Summer	Glacial	75.44951	-83.9624	8/10/2019
Ter_137	Summer	Glacial	75.324576	-83.61921	8/17/2019
Ter_138	Summer	Glacial	75.45251	-83.9642	8/10/2019
Ter_142	Summer	Glacial	75.44951	-83.96	8/11/201
Ter_144	Summer	Glacial	75.431782	-83.75203	8/11/2019
Ter_145	Summer	Glacial	75.4410.28	-82.425797	8/11/2019

Ter_150	Summer	Glacial	75.324576	-83.61921	8/11/2019
Ter_156	Summer	Glacial	75.45251	-83.9642	8/11/2019
VIO_22_2	Summer	Marine	75.745318	-83.286913	8/4/2019
VIO_22_3	Summer	Marine	75.745304	-83.286712	8/4/2019
VIO_22_4	Summer	Marine	75.744421	-83.283686	8/4/2019
VIO_23_2	Summer	Marine	75.749411	-83.195611	8/4/2019
VIO_23_3	Summer	Marine	75.749457	-83.194641	8/4/2019
VIO_24_2	Summer	Marine	75.750464	-83.194493	8/5/2019
VIO_24_3	Summer	Marine	75.750653	-83.192476	8/5/2019
VIO_25_2	Summer	Marine	75.76624	-83.114772	8/5/2019
VIO_25_3	Summer	Marine	75.765982	-83.113633	8/5/2019
VIO_26_2	Summer	Marine	75.766485	-83.160463	8/5/2019
VIO_26_3	Summer	Marine	75.766634	-83.159086	8/5/2019
VIO_27_2	Summer	Marine	75.766401	-83.223602	8/5/2019
VIO_27_3	Summer	Marine	75.766907	-83.222663	8/5/2019
VIO_27_4	Summer	Marine	75.767907	-83.22156	8/5/2019
VIO_28_2	Summer	Marine	75.763739	-83.28998	8/5/2019
VIO_28_3	Summer	Marine	75.76363	-83.290265	8/5/2019
VIO_29_2	Summer	Marine	75.749558	-83.201819	8/5/2019
VIO_29_3	Summer	Marine	75.749648	-83.202058	8/5/2019
VIO_30_10	Summer	Marine	75.762128	-83.242813	8/62019
VIO_30_4	Summer	Marine	75.759826	-83.236499	8/62019

VIO_30_5	Summer	Marine	75.759945	-83.234649	8/62019
VIO_30_9	Summer	Marine	75.761268	-83.243766	8/62019
VIO_31_2	Summer	Marine	75.827572	-82.979912	8/7/2019
VIO_31_3	Summer	Marine	75.827551	-82.979653	8/7/2019
VIO_31_4	Summer	Marine	75.82693	-82.976227	8/7/2019
VIO_31_5	Summer	Marine	75.826822	-82.976102	8/7/2019
VIO_32_2	Summer	Marine	75.891288	-82.918896	8/7/2019
VIO_32_3	Summer	Marine	75.892769	-82.9243	8/7/2019
VIO_32_7	Summer	Marine	75.891282	-82.923124	8/7/2019
VIO_32_8	Summer	Marine	75.892368	-82.926896	8/7/2019
VIO_33_2	Summer	Marine	75.938474	-82.795895	8/7/2019
VIO_33_3	Summer	Marine	75.938601	-82.796334	8/7/2019
VIO_33_4	Summer	Marine	75.932145	-82.769379	8/7/2019
VIO_33_5	Summer	Marine	75.935699	-82.780024	8/7/2019