



Supplement of

Challenges in the use of local data for regional scale mapping of C and N stocks in the continuous permafrost zone at the Yukon Coastal Plain

Julia Wagner et al.

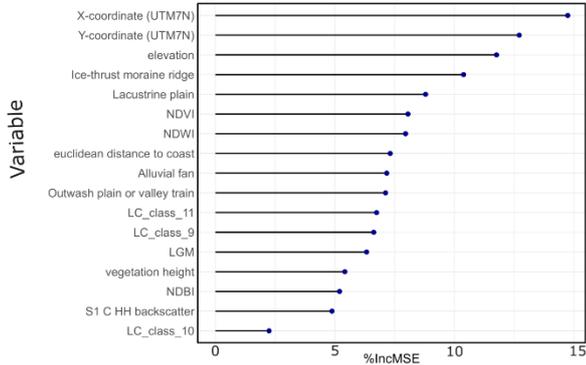
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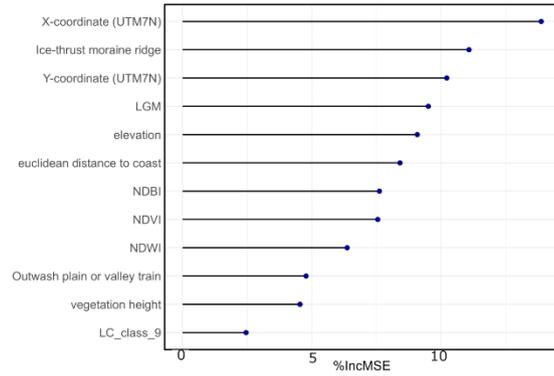
SOC stocks

whole area

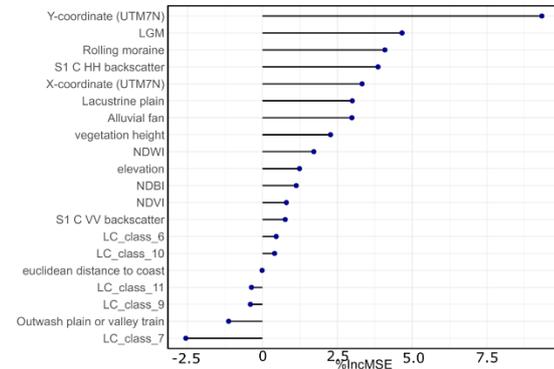
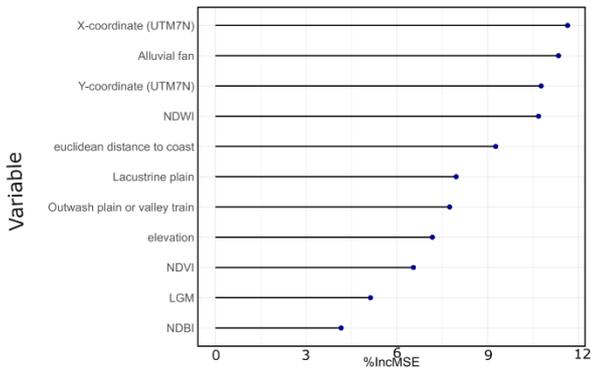
Variable Importance depth 0-30



Variable Importance depth 30-100



mainland



Herschel Island

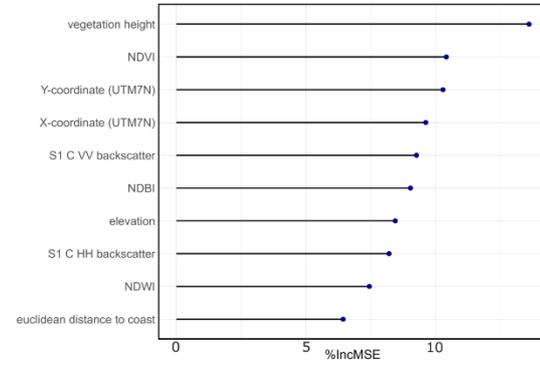
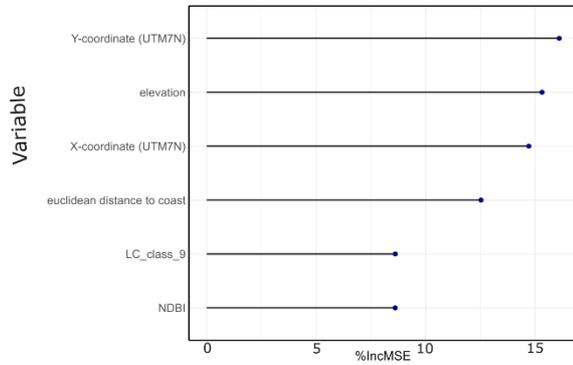
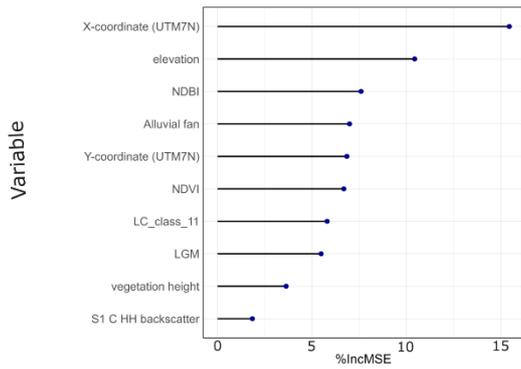


Figure S1: Variable importance plots for the different models for the SOC stocks.

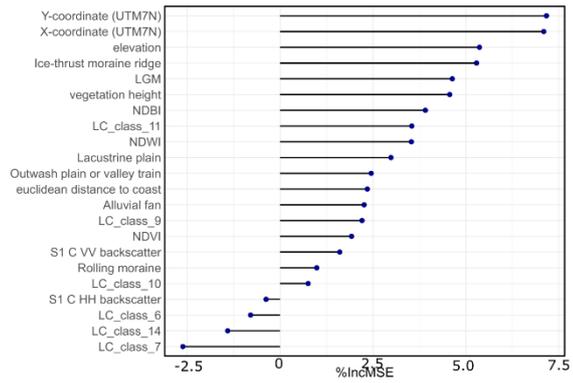
N stocks

whole area

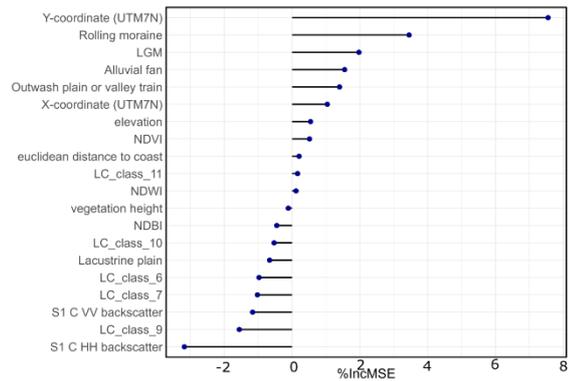
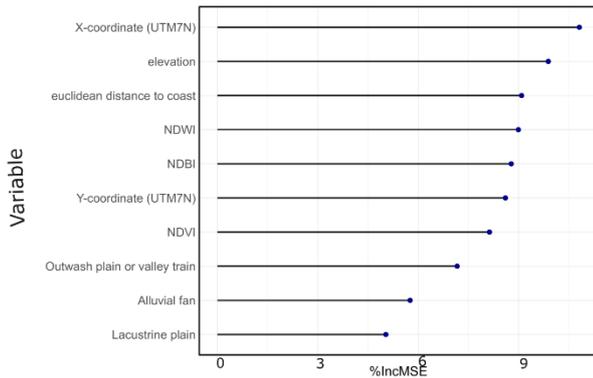
Variable Importance depth 0-30



Variable Importance depth 30-100



mainland



Herschel Island

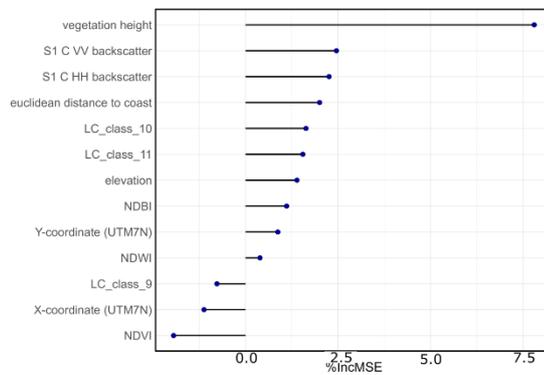
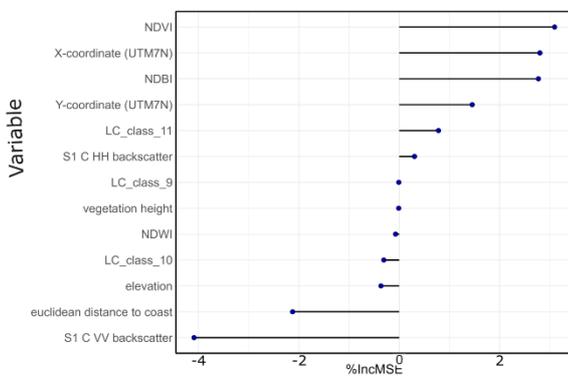


Figure S2: Variable importance plots for the different models for the N stocks.

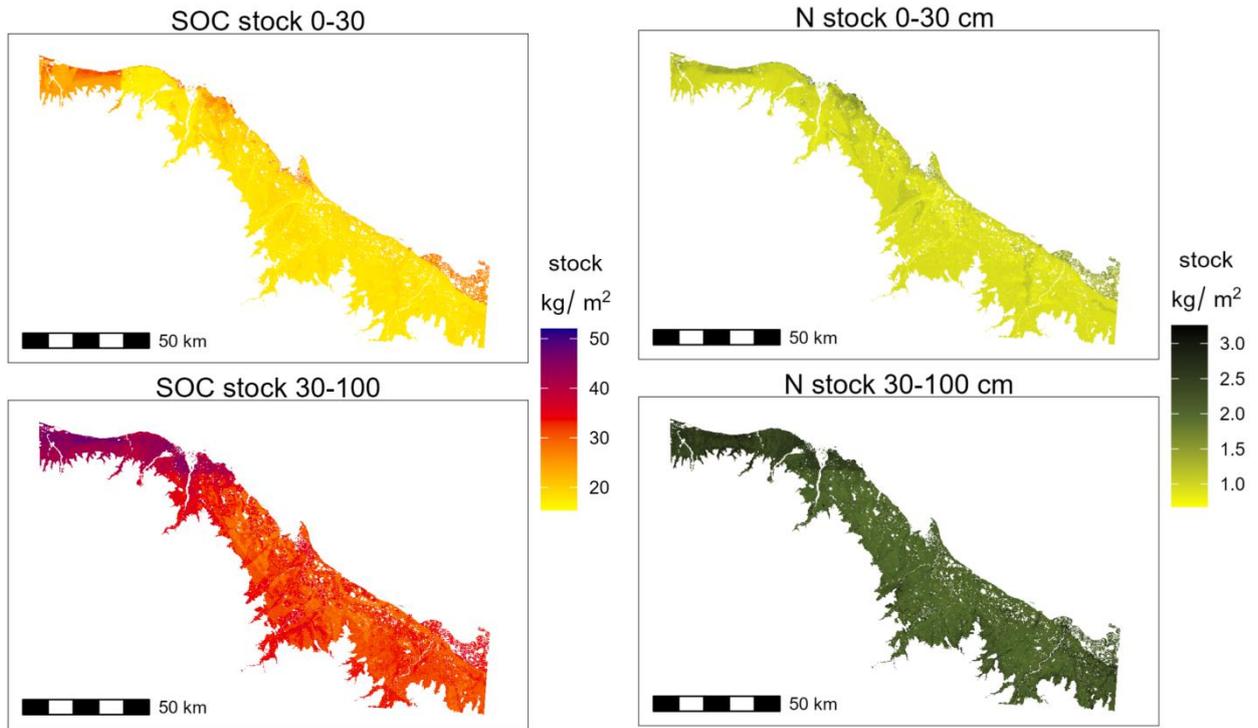


Figure S3: Prediction of soil organic carbon (SOC) and nitrogen (N) stocks for the mainland (mainland models).

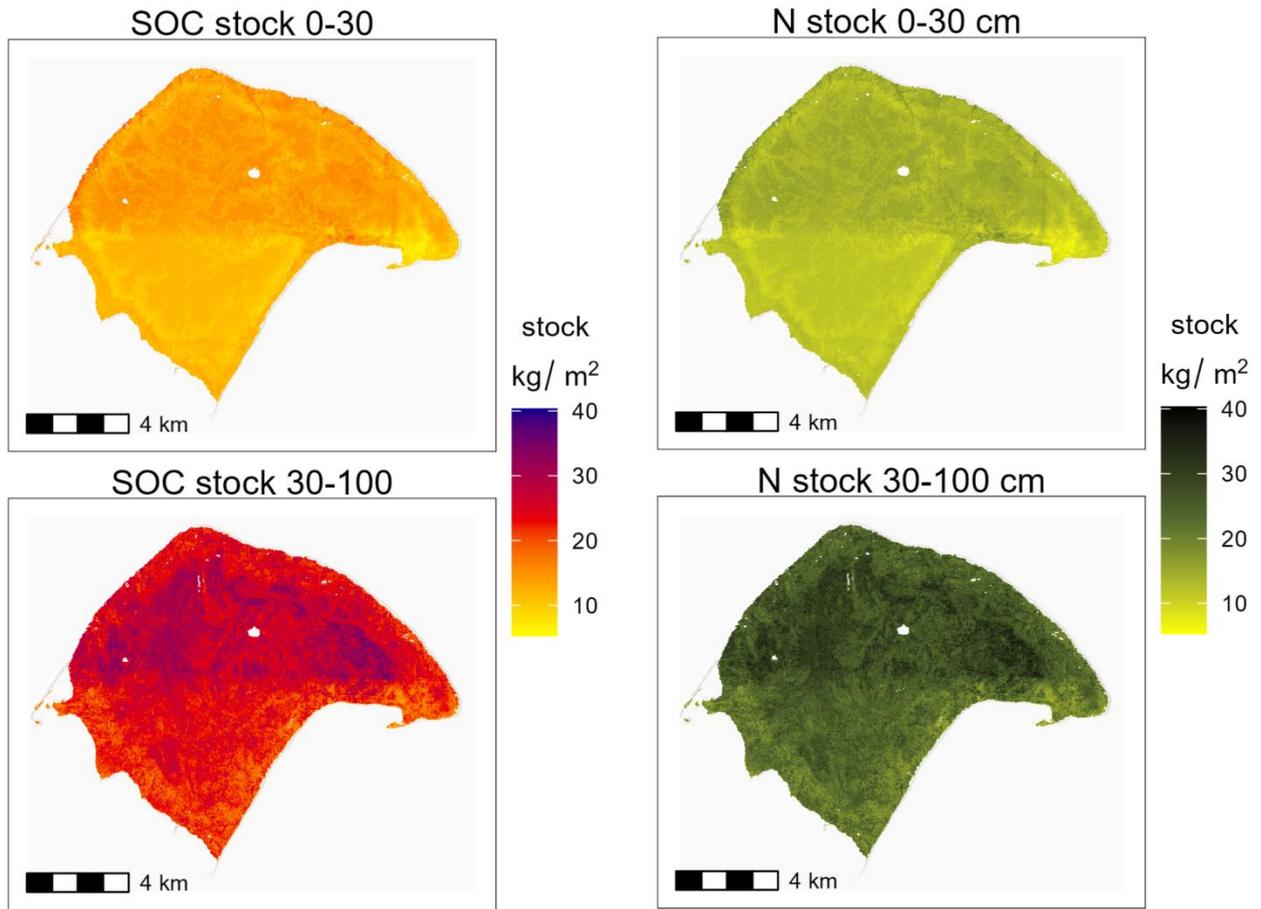


Figure S4: Prediction of soil organic carbon (SOC) and nitrogen (N) stocks for Herschel Island (Herschel Island models) (Basemap: ESRI (2024)| Powered by Esri).

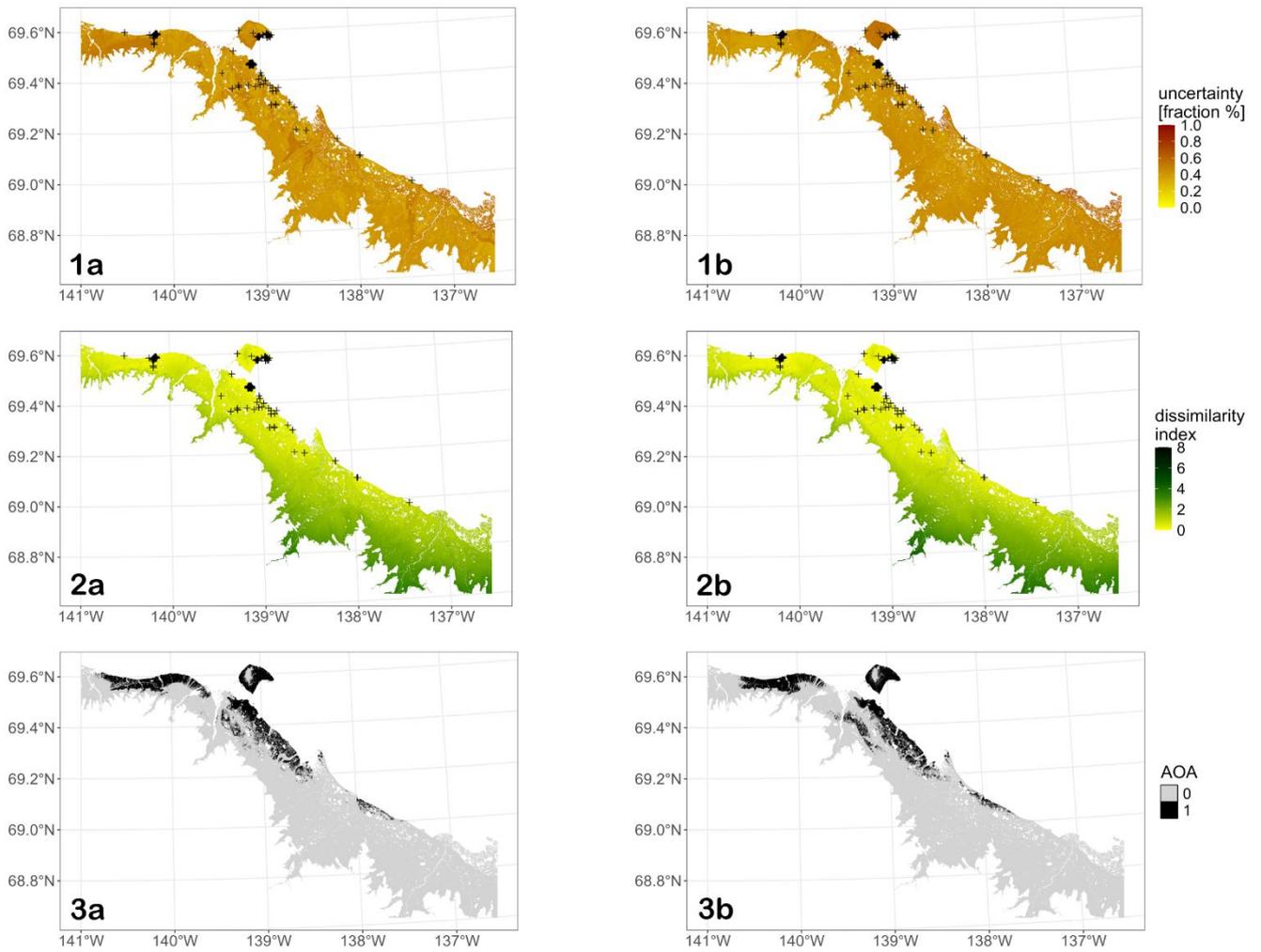
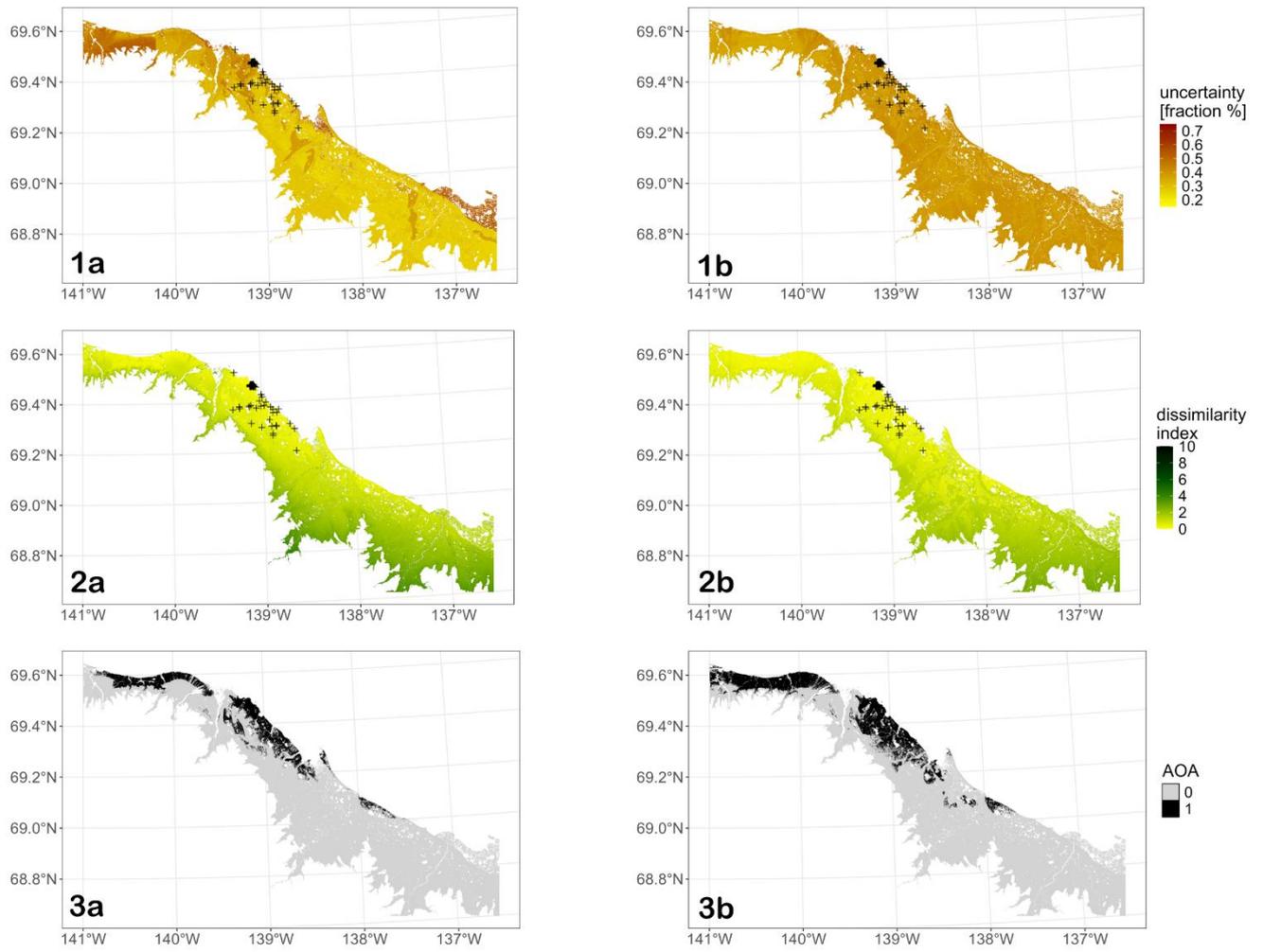
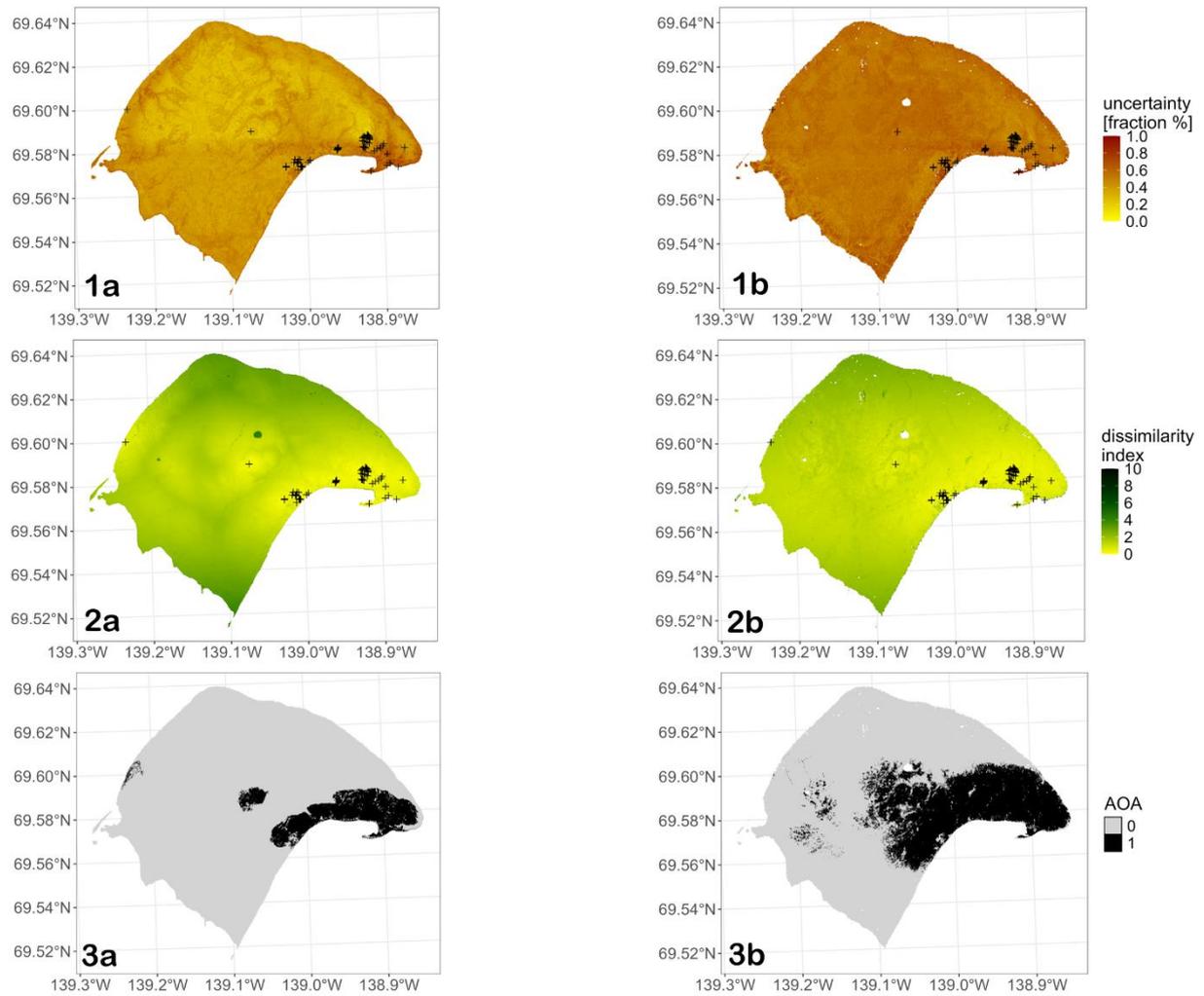


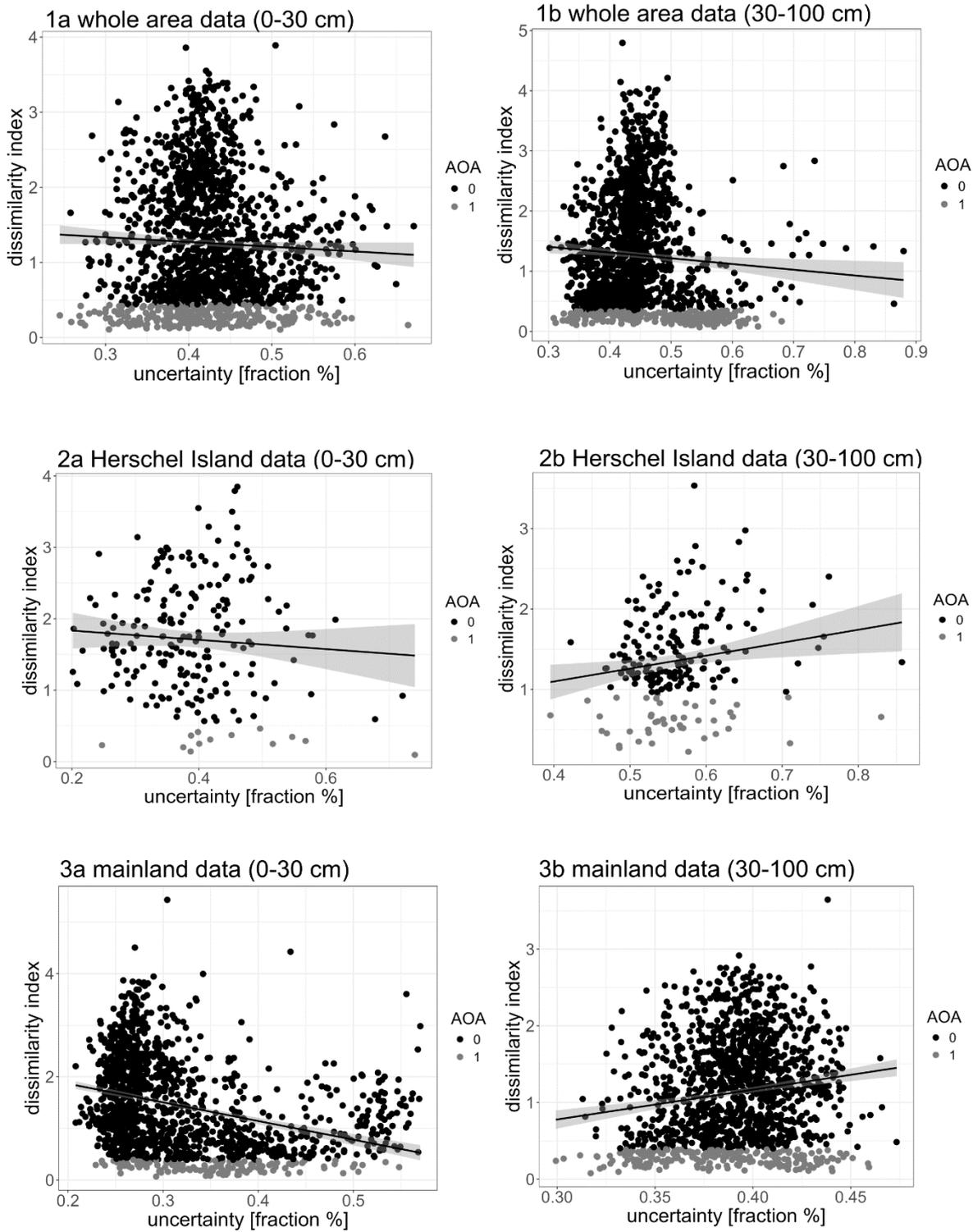
Figure S5: Comparison of uncertainty, dissimilarity index and AOA for the whole area models for SOC stocks at depth 0-30 (1a, 2a, 3a) and at depth 30-100 (1b, 2b, 3b).



35 **Figure S6: Comparison of uncertainty, dissimilarity index and AOA for the mainland models for SOC stocks at depth 0-30 (1a, 2a, 3a) and at depth 30-100 (1b, 2b, 3b).**



40 **Figure S7: Comparison of uncertainty, dissimilarity index and AOA for Herschel Island models for SOC stocks at depth 0-30 (1a, 2a, 3a) and at depth 30-100 (1b, 2b, 3b).**



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Figure S8: Uncertainty versus dissimilarity index for the whole area models (1a and 1b), Herschel Island (2a and 2b) and the mainland (3a and 3b). The values are sampled from the raster files at random locations throughout the study area.

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Table S1: Dissimilarity Index (DI) thresholds chosen by the area of applicability (AOA) method.

model	AOA Thresholds
<i>whole area</i>	
SOC stock 0-30 cm	0.44
SOC stocks 30-100 cm	0.35
N stocks 0-30 cm	0.39
N stocks 30-100 cm	0.39
<i>mainland</i>	
SOC stock 0-30 cm	0.39
SOC stocks 30-100 cm	0.39
N stocks 0-30 cm	0.34
N stocks 30-100 cm	0.047
<i>Herschel Island</i>	
SOC stock 0-30 cm	0.54
SOC stocks 30-100 cm	0.95
N stocks 0-30 cm	0.60
N stocks 30-100 cm	0.58

Table S2: Comparison of average soil organic carbon (SOC) [kg/m²] and N stocks [kg/m²] for each model prediction depicting the whole area and additionally the AOA of each respective prediction and predictive model.

Prediction	Depth [cm]	type	mean	StDev	median	min	max	PCT90	range
whole area	0-30	SOC-stocks	17.2	2.4	16.8	6.6	38.7	20.0	32.1
whole area (only AOA)	0-30	SOC-stocks	19.2	3.8	18.5	6.6	38.7	24.9	32.1
mainland	0-30	SOC-stocks	18.9	2.8	18.0	12.5	38.7	23.5	26.2
mainland area (only AOA)	0-30	SOC-stocks	21.1	4.1	19.3	12.5	38.7	27.5	26.2
Herschel Island	0-30	SOC-stocks	12.8	1.9	12.8	5.0	22.8	15.2	17.7
Herschel Island (only AOA)	0-30	SOC-stocks	11.9	2.5	12.0	5.0	22.8	14.8	17.7
whole area	30-100	SOC-stocks	31.5	4.8	30.4	11.6	57.9	39.4	46.3

whole area (only AOA)	30-100	SOC-stocks	34.1	6.8	32.9	11.6	57.9	43.4	46.3
mainland	30-100	SOC-stocks	33.7	4.5	32.7	22.7	58.1	41.4	35.5
mainland area (only AOA)	30-100	SOC-stocks	37.6	6.1	37.2	22.7	58.1	45.5	35.5
Herschel Island	30-100	SOC-stocks	25.2	4.4	24.8	8.8	47.4	31.2	38.6
Herschel Island (only AOA)	30-100	SOC-stocks	25.1	4.7	24.5	8.8	47.4	31.5	38.6
Herschel Island from mainland prediction	0-30	SOC-stocks	20.7	1.1	20.7	16.0	34.7	21.8	18.6
Herschel Island from whole area	0-30	SOC-stocks	14.8	1.7	15.1	6.6	26.9	16.5	20.3
mainland from whole area	0-30	SOC-stocks	17.3	2.4	16.9	10.3	38.7	20.1	28.4
Herschel Island from mainland prediction	30-100	SOC-stocks	38.4	2.0	38.4	31.8	47.8	41.0	16.0
Herschel Island from whole area	30-100	SOC-stocks	27.8	3.2	27.9	11.6	45.3	31.6	33.7
mainland from whole area	30-100	SOC-stocks	31.6	4.8	30.5	17.6	57.9	39.5	40.3
whole area	0-30	N-stocks	0.93	0.13	0.90	0.49	2.38	1.11	1.89
whole area (only AOA)	0-30	N-stocks	1.04	0.18	1.01	0.49	2.38	1.30	1.89
mainland	0-30	N-stocks	0.97	0.15	0.94	0.64	2.49	1.14	1.85
mainland area (only AOA)	0-30	N-stocks	1.19	0.25	1.14	0.64	2.49	1.52	1.85
Herschel Island	0-30	N-stocks	0.84	0.08	0.84	0.45	1.21	0.93	0.75
Herschel Island (only AOA)	0-30	N-stocks	0.84	0.09	0.86	0.45	1.21	0.94	0.75
whole area	30-100	N-stocks	2.11	0.24	2.05	1.12	3.62	2.47	2.49
whole area (only AOA)	30-100	N-stocks	2.26	0.30	2.30	1.12	3.62	2.62	2.49
mainland	30-100	N-stocks	2.18	0.25	2.08	1.47	3.61	2.58	2.14
mainland area (only AOA)	30-100	N-stocks	2.41	0.29	2.44	1.47	3.61	2.75	2.14
Herschel Island	30-100	N-stocks	2.04	0.32	2.03	0.97	3.60	2.45	2.64
Herschel Island (only AOA)	30-100	N-stocks	1.95	0.32	1.92	0.97	3.60	2.36	2.64
Herschel Island from mainland prediction	0-30	N-stocks	1.14	0.11	1.12	0.85	2.13	1.26	1.28
Herschel Island from whole area	0-30	N-stocks	0.93	0.13	0.90	0.49	2.38	1.11	1.89
mainland from whole area	0-30	N-stocks	0.93	0.13	0.90	0.64	2.38	1.11	1.74
Herschel Island from mainland prediction	30-100	N-stocks	2.34	0.11	2.33	1.90	3.32	2.46	1.42
Herschel Island from whole area	30-100	N-stocks	2.11	0.24	2.05	1.12	3.62	2.47	2.49
mainland from whole area	30-100	N-stocks	2.11	0.24	2.05	1.31	3.62	2.47	2.30

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Table S3: SOC and N stocks for 0-100 cm depth for the different models (sum of the predictions for 0-30 cm and 30-100 cm).

Prediction	SOC stocks 0-100 cm		N stocks 0-100 cm	
	[kg/ m ²]		[kg/ m ²]	
models	mean	StDev	mean	StDev
whole area	48.7	6.6	3.03	0.30
mainland	52.5	6.3	3.15	0.32
Herschel Island	38.0	5.6	2.87	0.34
sum of mainland and Herschel Island	52.2	6.6	3.14	0.32

75 **Table S4: Information on date of the sampling campaign, coring/ sampling methods. Laboratory methods and number of samples per study.**

Study	date of the campaign	coring device	Method to measure SOC/N	amount of samples
Couture et al. 2018	September 2003 and August 2004, 2005, 2006, and 2009	active layer, soil pit: NA, permafrost CRREL corer (7.5 cm inner diameter)	Elementar Vario EL III elemental analyzer	337
Obu et al. 2017	July 2013	NA	Elementar vario EL III and Elementar vario MAX C	128
Ramage et al. 2019	July and August 2015	active layer, soil pit: fixed volume cylinders; permafrost: steel pipe	carbon-nitrogen analyzer (Vario EL III elemental analyzer, Elementar®)	316
Siewert et al. 2021	2015	active layer, soil pit: fixed volume cylinders; permafrost: steel pipe	analyzer (CE Instrument EA 1110 elemental analyzer) coupled to an isotope ratio mass spectrometer (Thermo Fischer Scientific Instruments, Delta V Advantage)	409
Wagner et al. 2023	end summer 2018 and 2019 maximum annual thaw of the active layer depth	active layer, soil pit: fixed volume cylinders; permafrost: steel pipe	elemental analyzer (CE Instrument EA 1110 elemental analyzer) coupled to a continuous-flow isotopic ratio mass spectrometer (IRMS, DeltaPlus, Finnigan MAT)	Ptarmigan Bay: 297, Komakuk Beach: 395
DTLB dataset	April 2019	SIPRE permafrost corer	Elementar Soli TOC® cube (TOC), Elementar Rapid Max N exceed analyser (TN)	737 (subsampling of cores, samples below 1 m depth available)

References:

ESRI: Esri. "World Hillshade" [basemap],

<https://www.arcgis.com/home/item.html?id=1b243539f4514b6ba35e7d995890db1d>, accessed:

80 2025-03-05, 2024.