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HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Arctic Nearshore Sediment Dynamics

from High-Resolution Phase Measuring Bathymetric Sonar Data: bathymetry, backscatter imagery, and seabed classification

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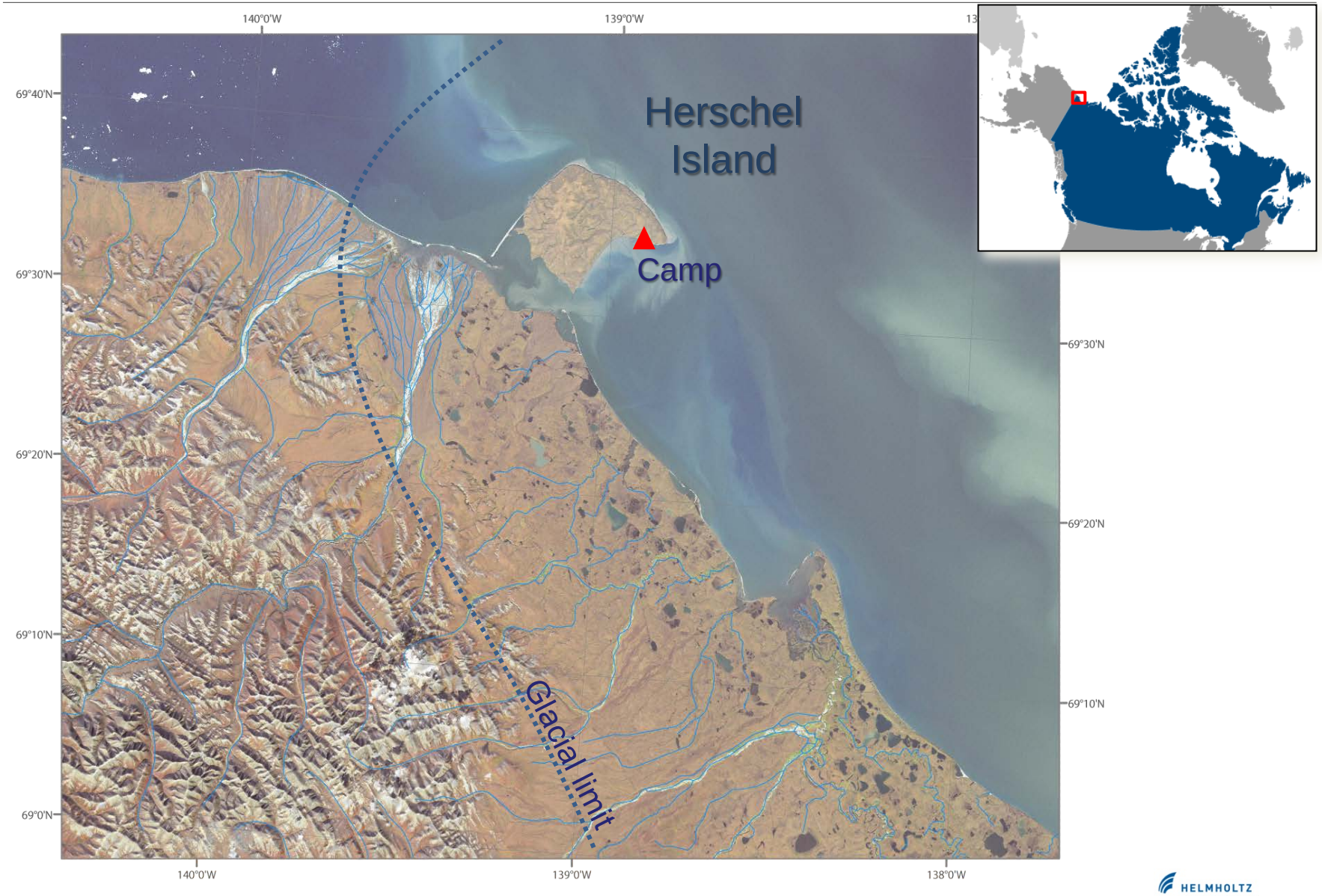
Study Area



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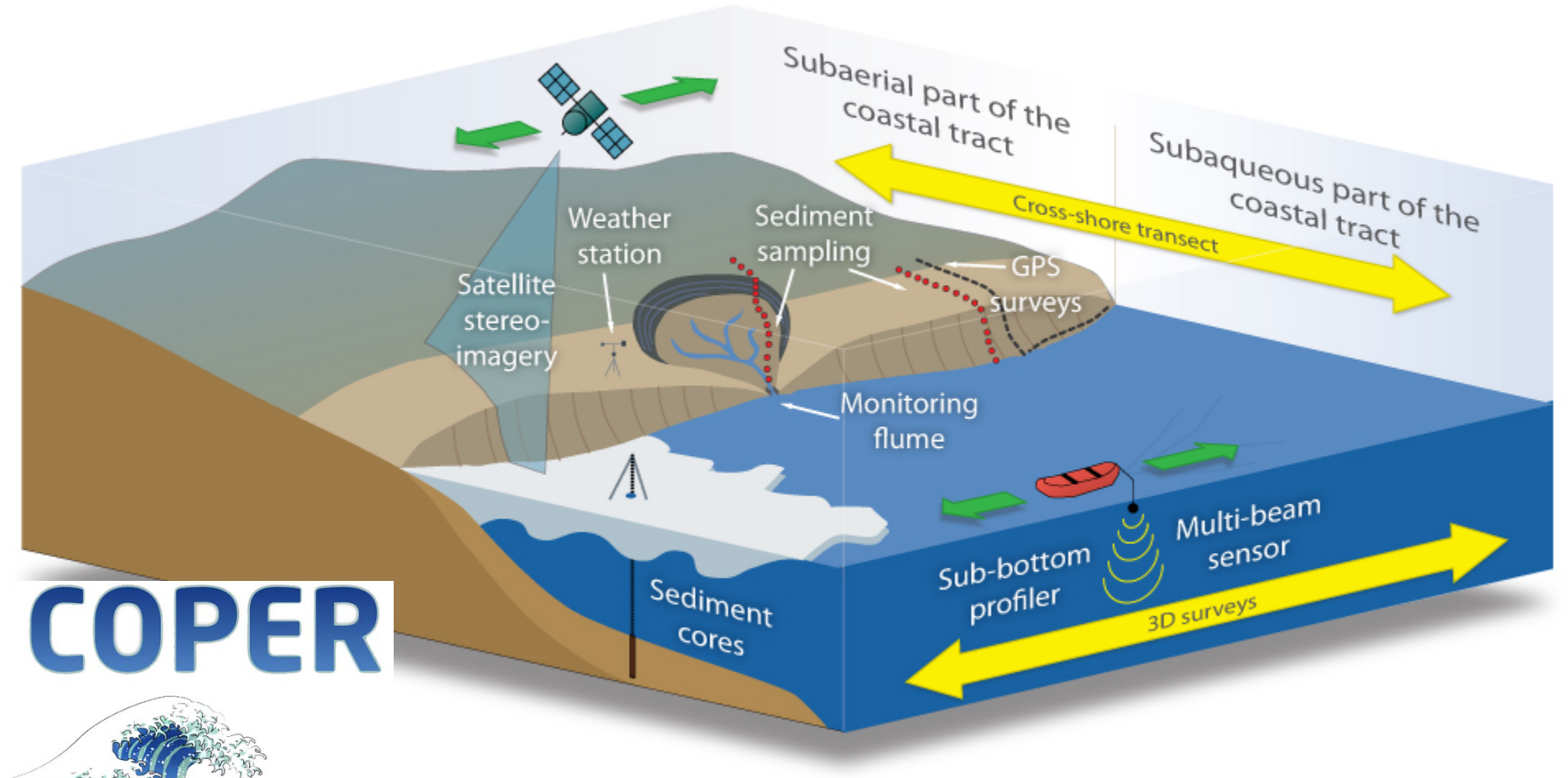
Rationale



COPER

Coastal Permafrost Erosion (and carbon release)

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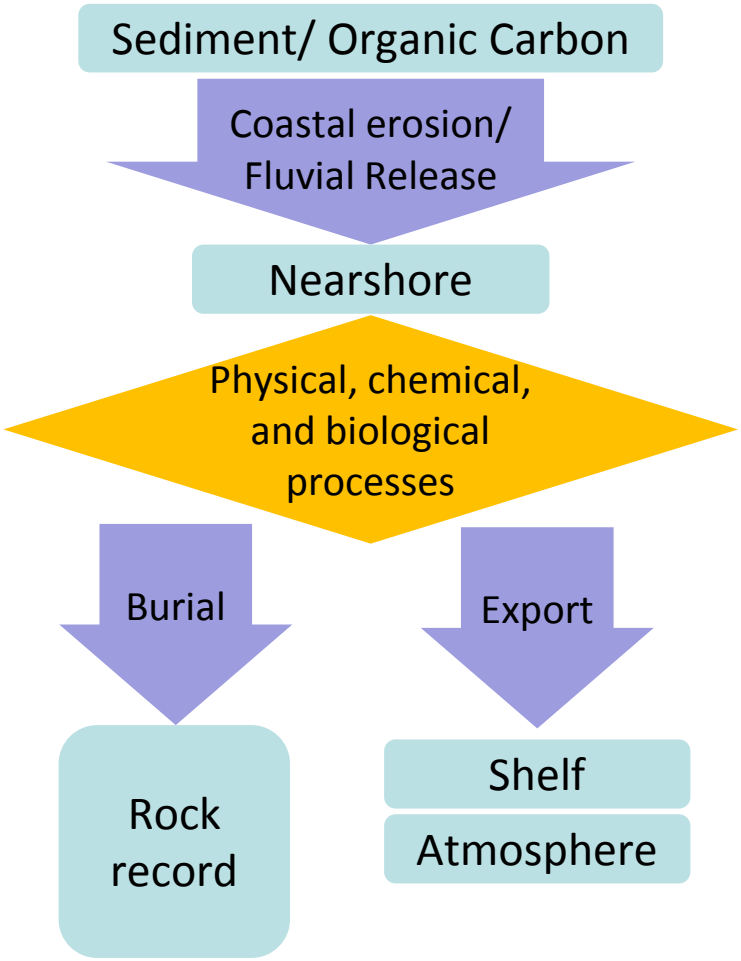
Carbon and sediment transport in the nearshore zone



Objectives

- Establish a baseline dataset to
  - Assess intensity of physical processes (e.g. ice scour)
  - Map sediment distribution
  - Assess volumetric change along the coastal tract
  - Investigate influence of seafloor geomorphology on erosion
  - Quantify carbon sequestration

Methods

- Collect bathymetry and sidescan imagery
- Process
  - Bathymetry: GS+
  - Backscatter: GeoTexture (process, mosaic, classify)
- VanVeen benthic grabs
- Validate classification

Experimental setup

Kongsberg GeoSwath Plus Compact

- phase measuring bathymetric sonar
- 240º view angle
- Frequency: 500 kHz

- MRU: IXSEA Octans 3000
- RTK GPS (Trimble R4)

Experimental setup

- RV Christine

Experimental setup

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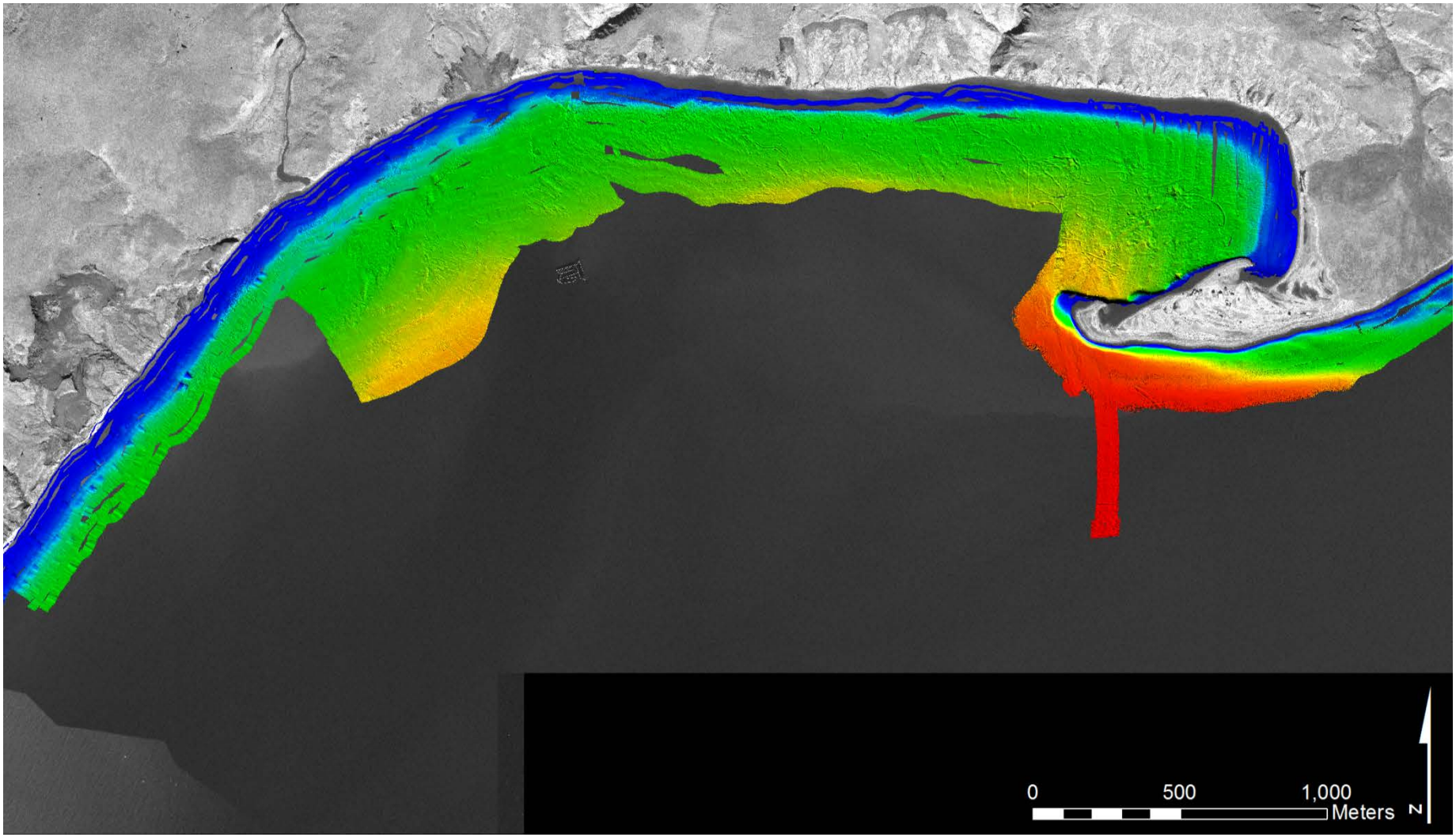
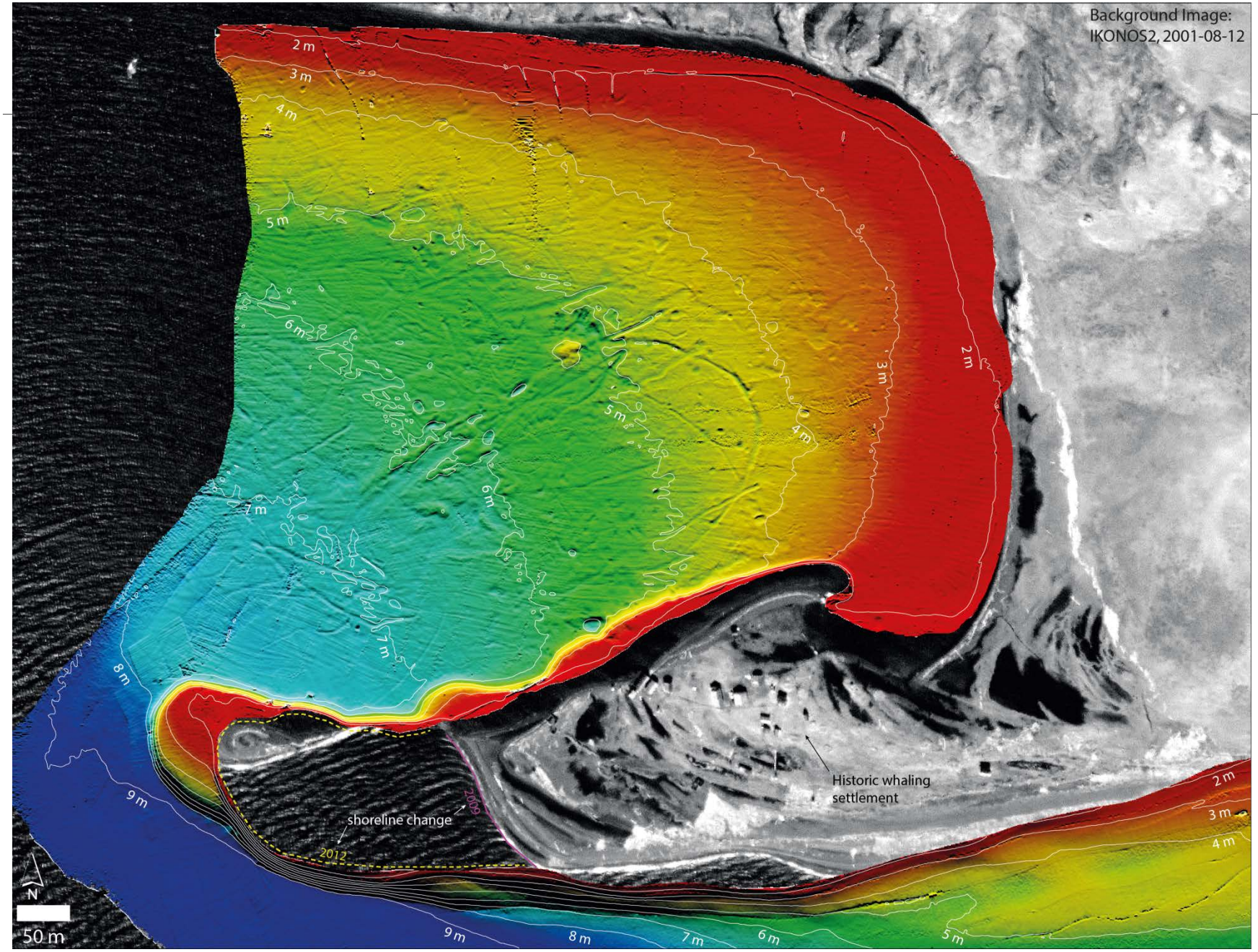
Bathymetry





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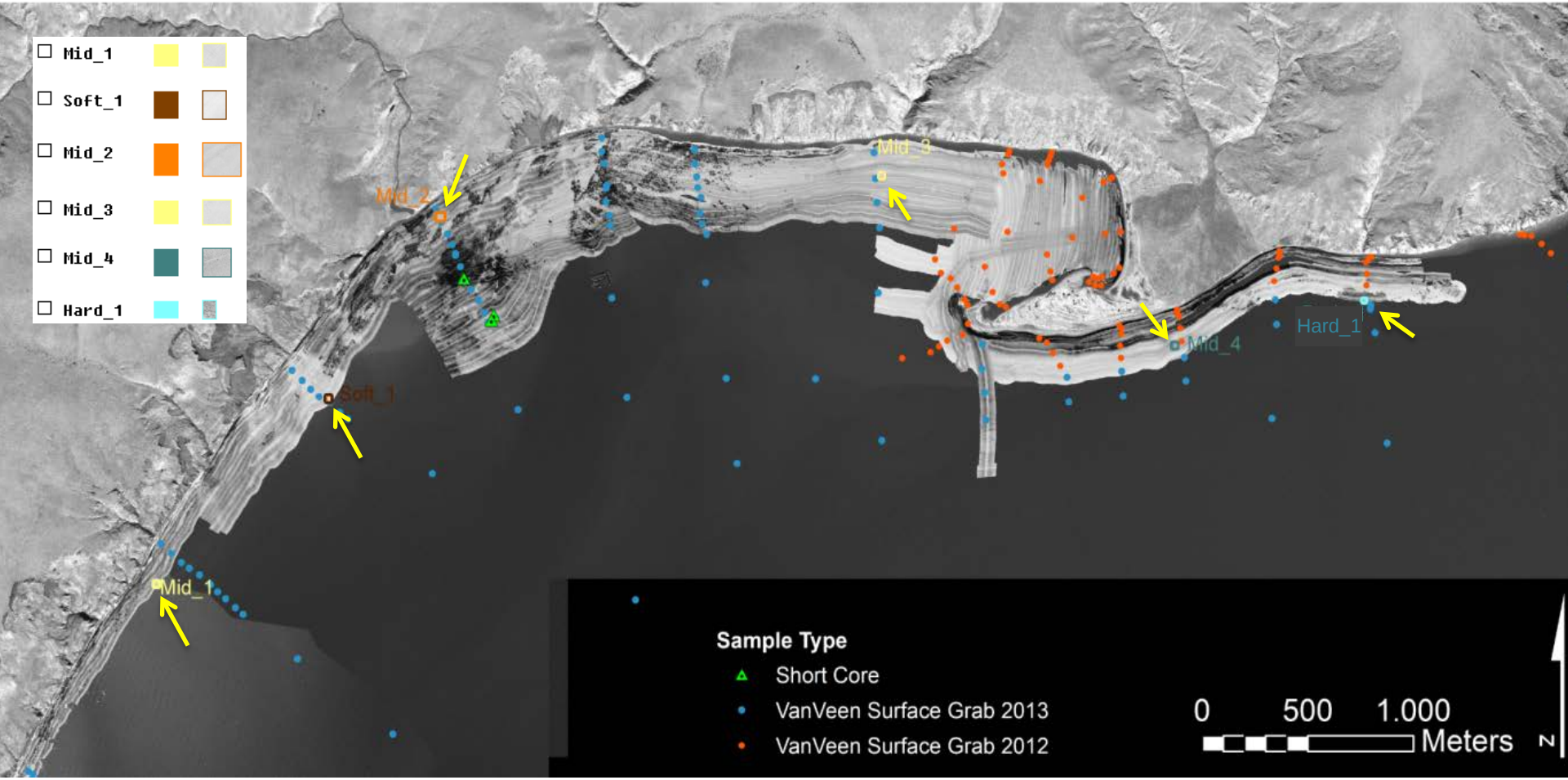
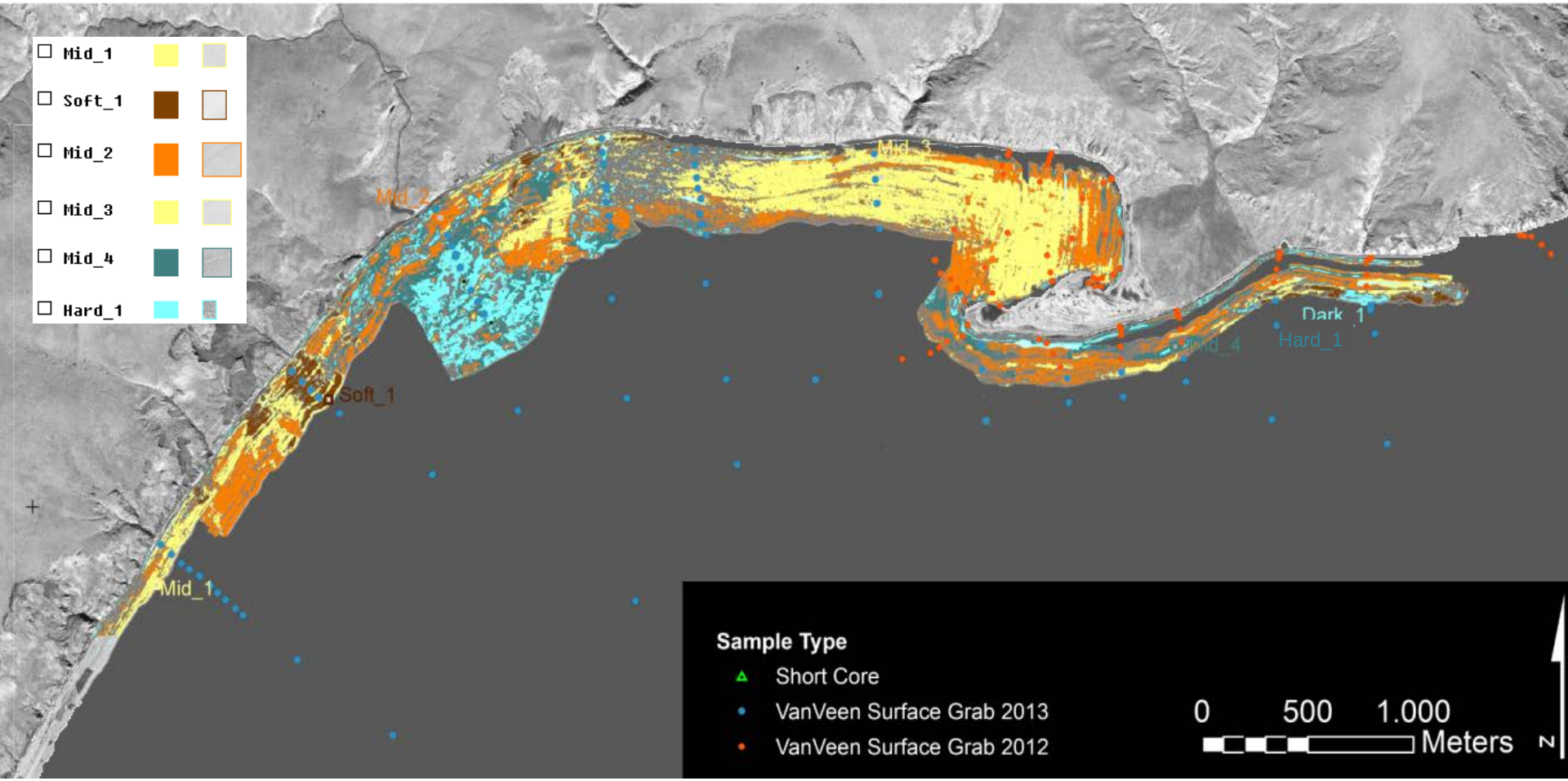
Classification and Validation

•normalised SMO mosaic



Selection of textures



Probability matrix

	Mid_1 0	Soft_1 1	Mid_2 2	Mid_3 3	Mid_4 4	Hard_1 5
0	0.928	0	0	0.174	0	0
1	0	0.999	0	0.001	0	0
2	0	0	1	0	0	0
3	0.071	0.001	0	0.825	0	0
4	0	0	0	0	0.956	0.007
5	0	0	0	0	0.044	0.993

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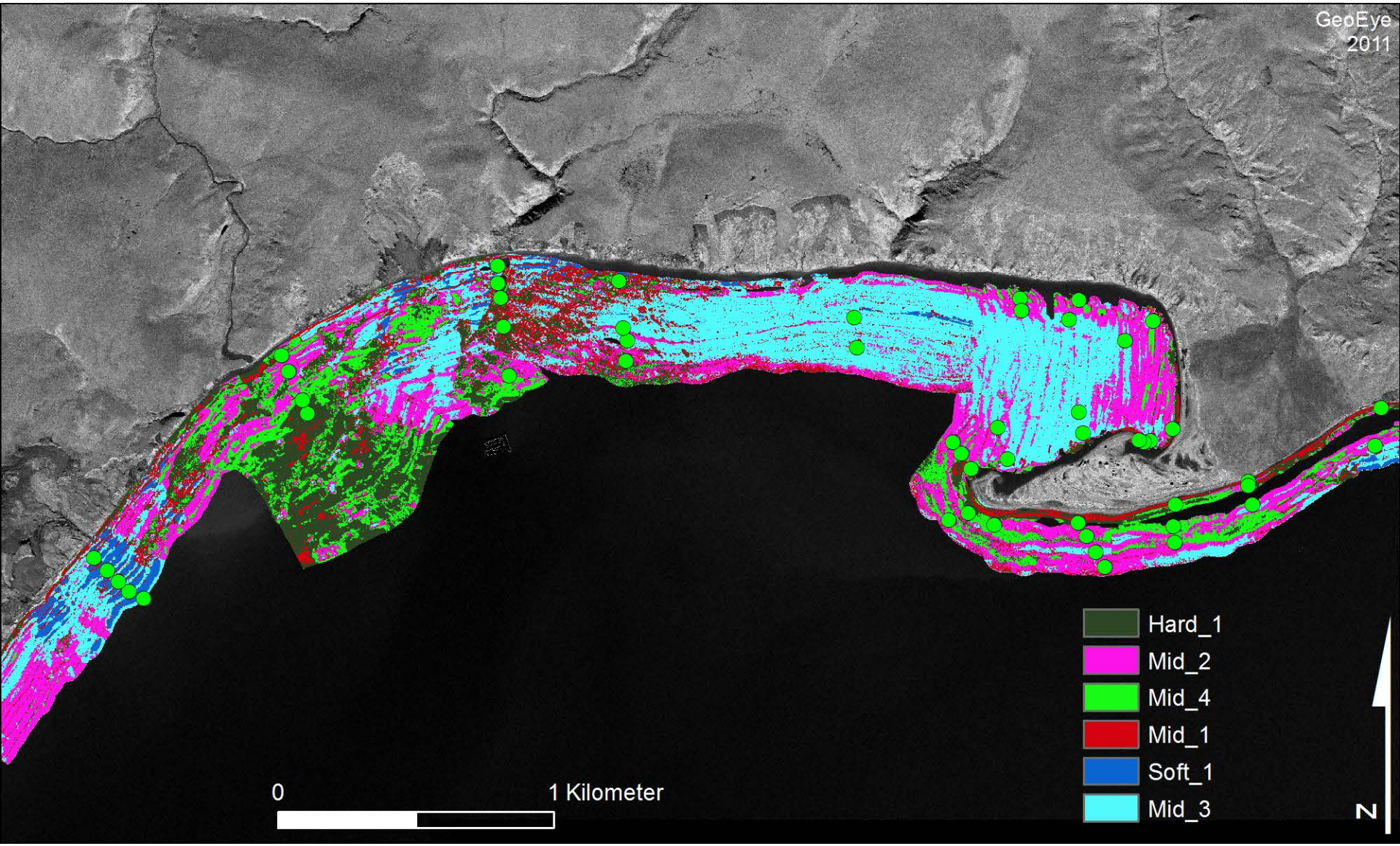
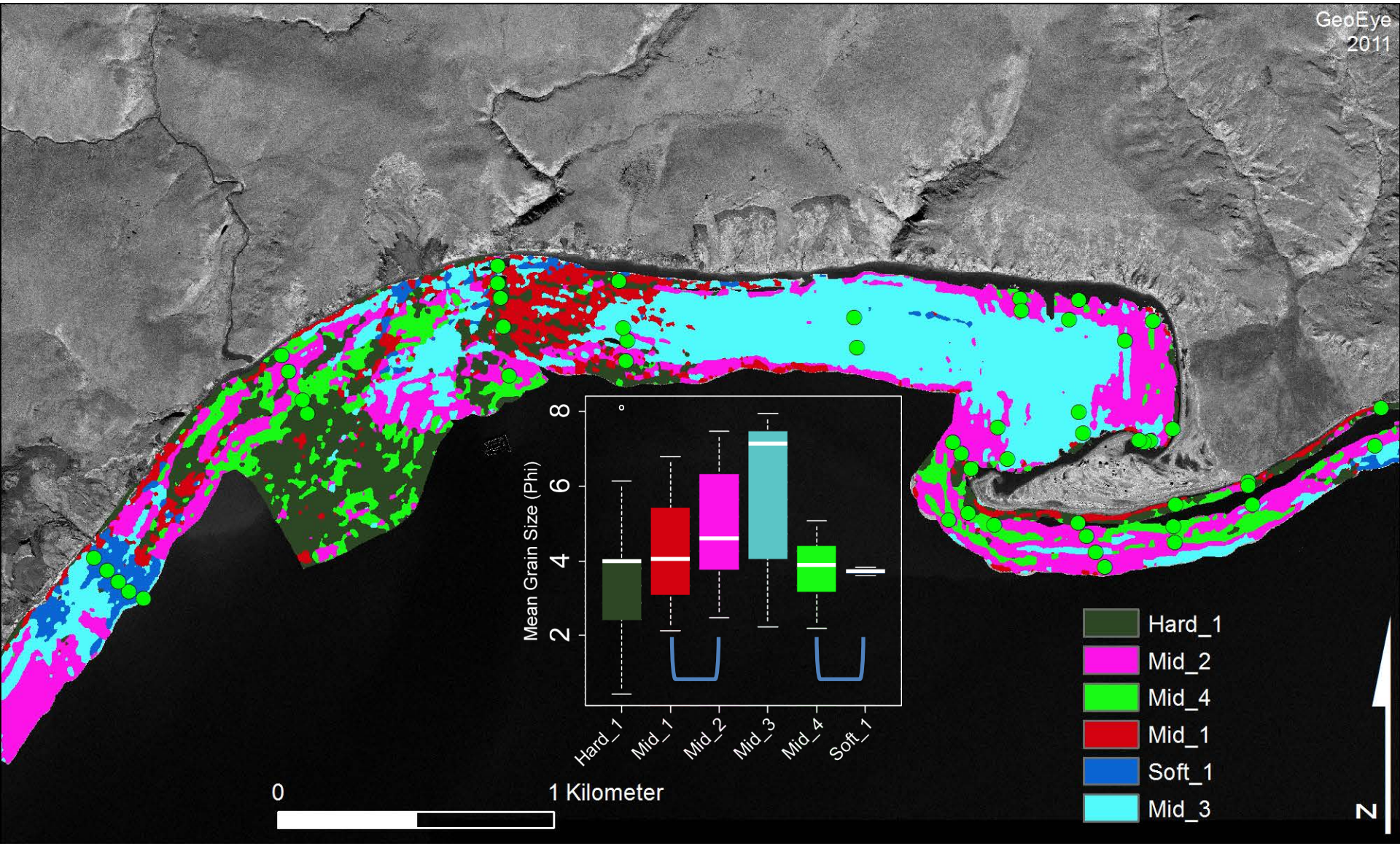
Separation matrix

	Mid_1 0	Soft_1 1	Mid_2 2	Mid_3 3	Mid_4 4	Hard_1 5
0	0	6.4	6	**2.7**	10.1	7
1	10.3	0	13.4	12.1	15.1	8.9
2	7.2	9.6	0	13.6	6.4	5.7
3	**2.1**	4.7	7.1	0	11	7.3
4	21	20.3	9.2	32.3	0	3.1
5	36.2	36.2	18.6	51.4	6.4	0

Validation



Validation

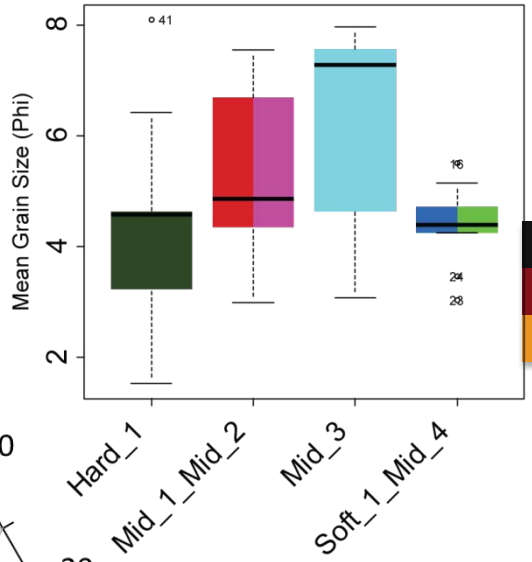

GeoEye
2011
Mean Grain Size (Phi)
2
4
6
8
Hard_1
Mid_1
Mid_2
Mid_3
Mid_4
Soft_1
0
1 Kilometer
Hard_1
Mid_2
Mid_4
Mid_1
Soft_1
Mid_3
N

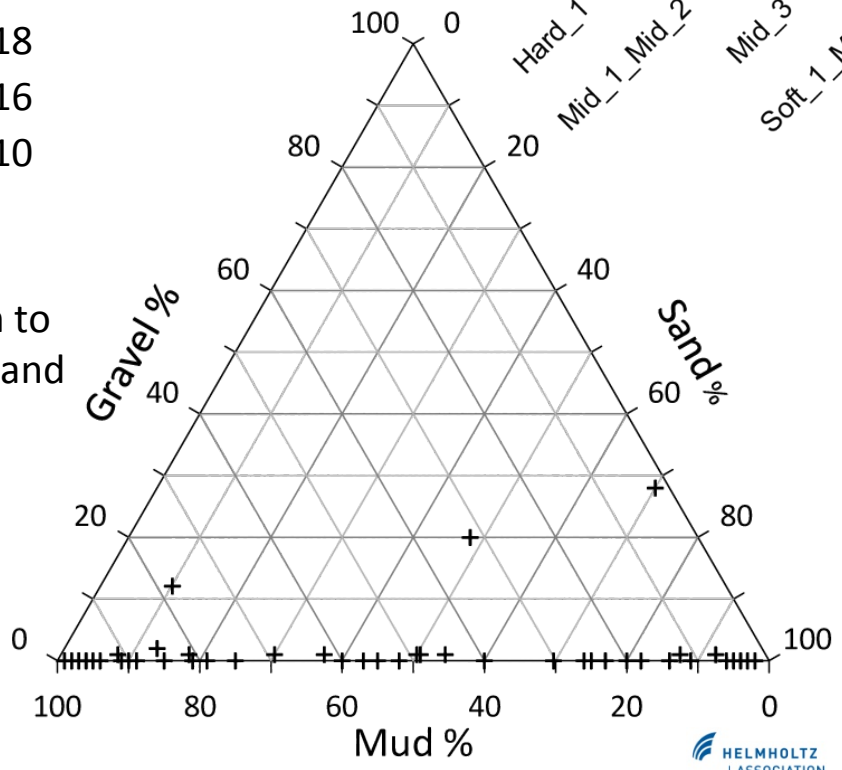
Sediment Data

ANOVA	Df	Sum Sq	Mean Sq	F Value	Pr(>F)
CombinedClasses	3	50.09	16.697	5.422	0.00254
Residuals	52	160.12	3.079		

CombinedClasses	mean	sd	data:n
Hard_1	3.694	2.0029635	12
Mid_1_Mid_2	4.844	1.7382992	18
Mid_3	6.037	1.9713133	16
Soft_1_Mid_4	3.747	0.8388623	10

Texture	clay	silt	fine sand	medium to coarse sand
Hard_1	1	4	5	2
Mid_1_Mid_2	0	11	7	0
Mid_3	0	13	3	0
Soft_1_Mid_4	0	3	7	0





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Conclusions

- GeoTexture is a valuable tool for classifying bottom textures
- Strongly dependent on user input
- Need more data to validate, although results very promising
- Get better data next time
- Find the easy button!

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Thanks!
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