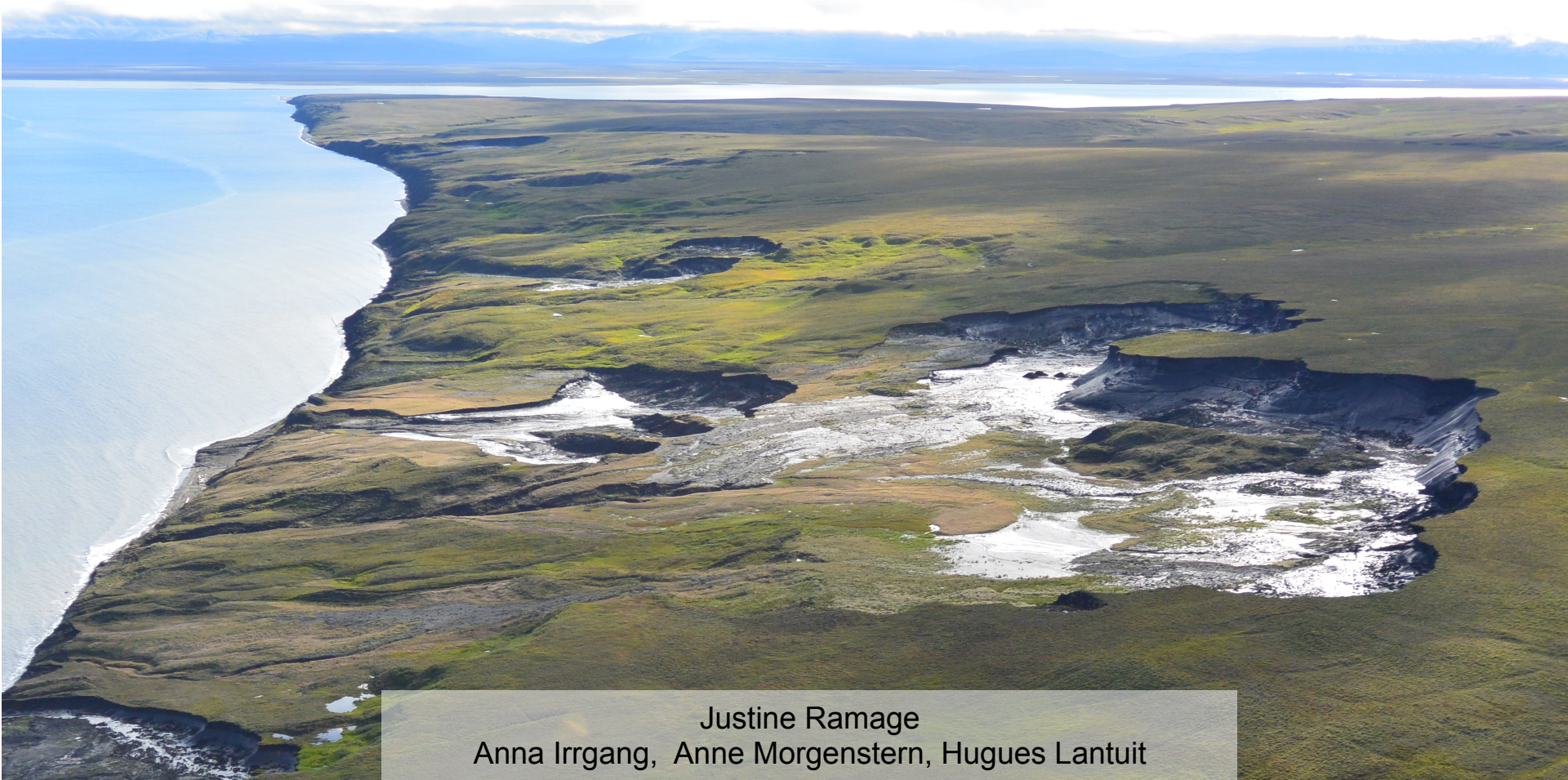
ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

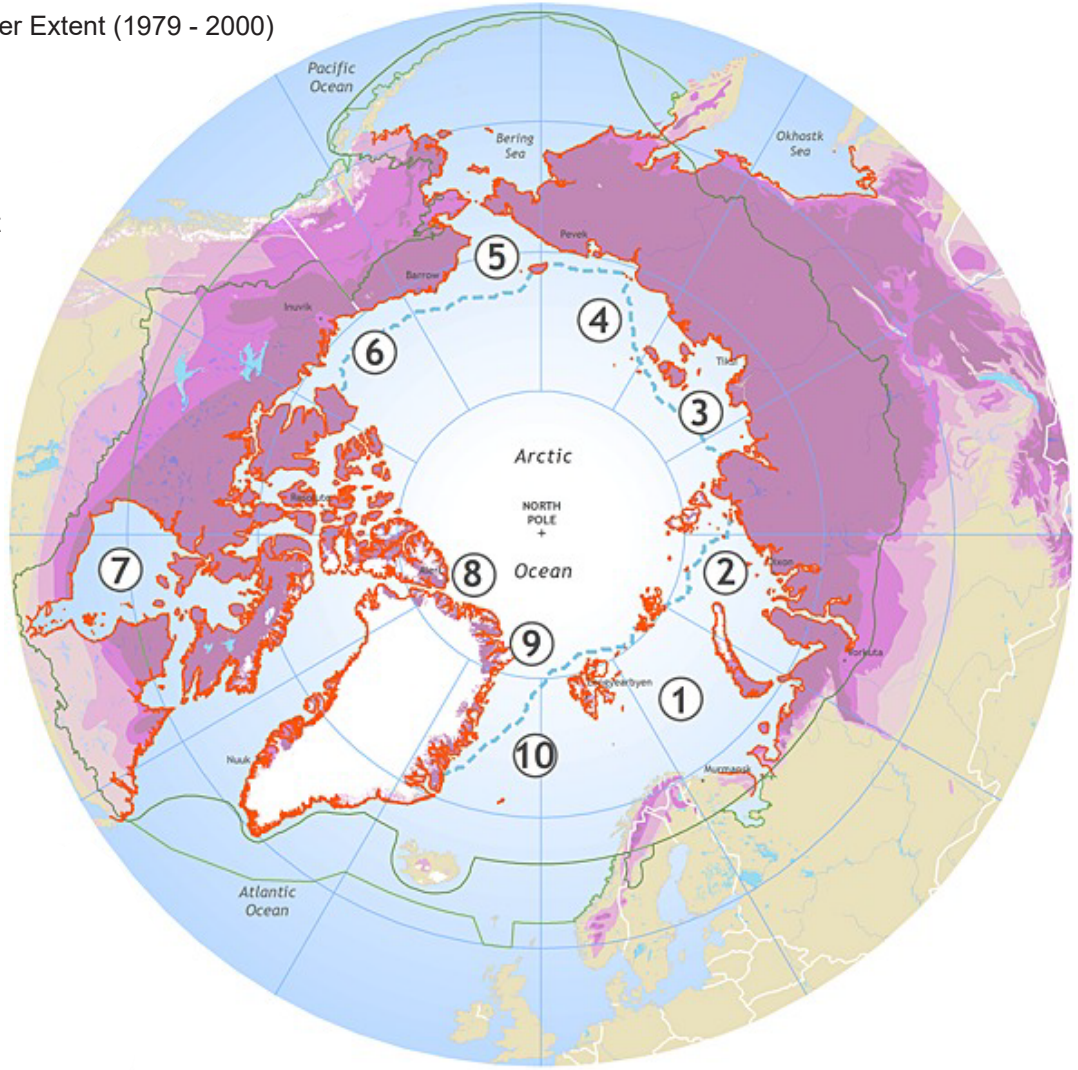
INCREASING COASTAL SLUMP ACTIVITY IMPACTS THE RELEASE OF SEDIMENT AND ORGANIC CARBON INTO THE ARCTIC OCEAN



Justine Ramage
Anna Irrgang, Anne Morgenstern, Hugues Lantuit

Introduction

- Sea Ice median September Extent (1979 - 2000)
- CAFF Arctic definition
- AMAP Arctic definition
- Permafrost Coastlines
- Continuous Permafrost
- Discontinuous Permafrost
- Sporadic Permafrost
- Isolated Patches

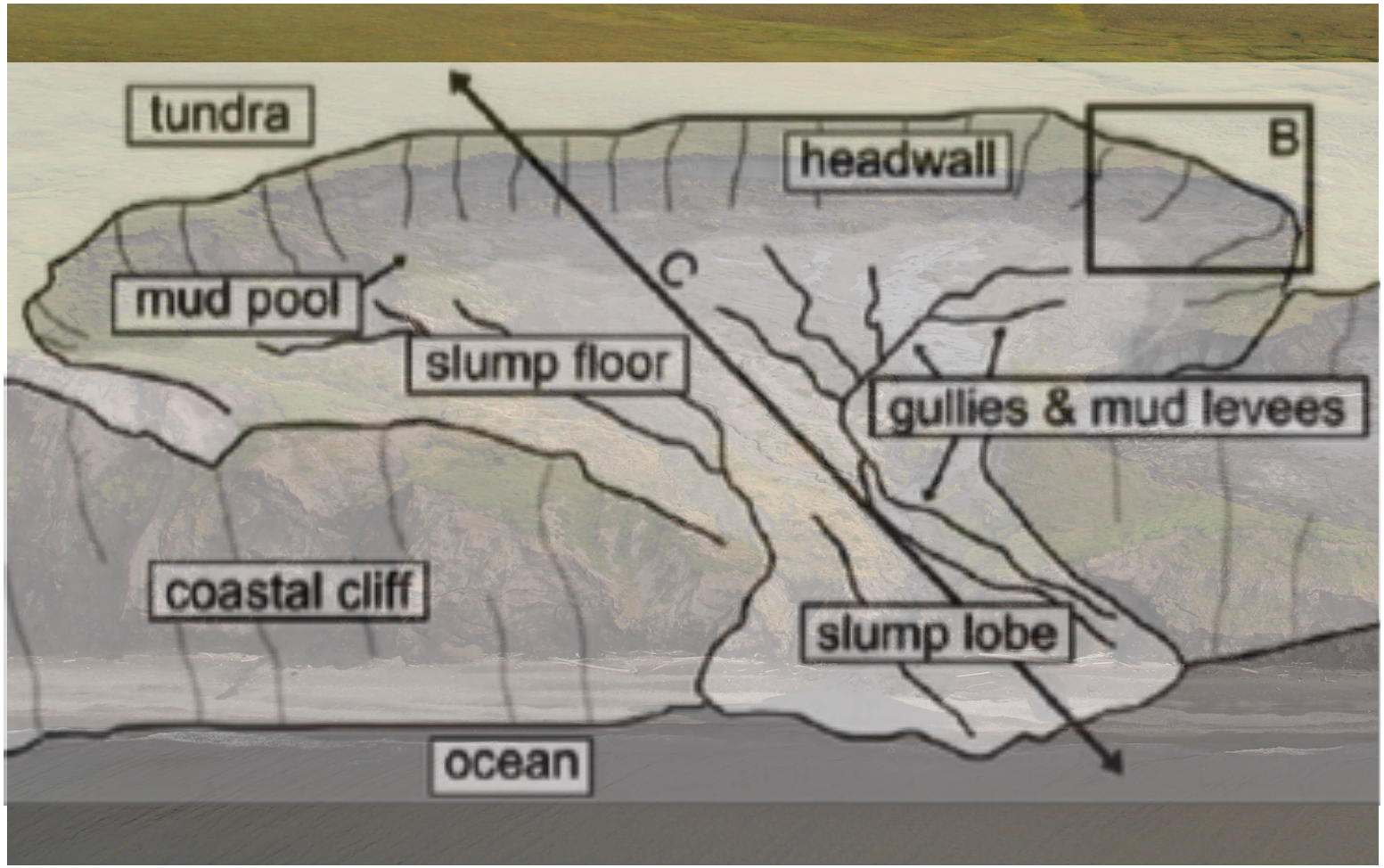


1. Barents Sea
2. Kara Sea
3. Laptev Sea
4. East Siberian Sea
5. Chukchi Sea
6. Beaufort Sea
7. Hudson Bay
8. Lincoln Sea
9. Wandel Sea
10. Norwegian Sea

Introduction

Slump along the Yukon Coastal Plain, 2015

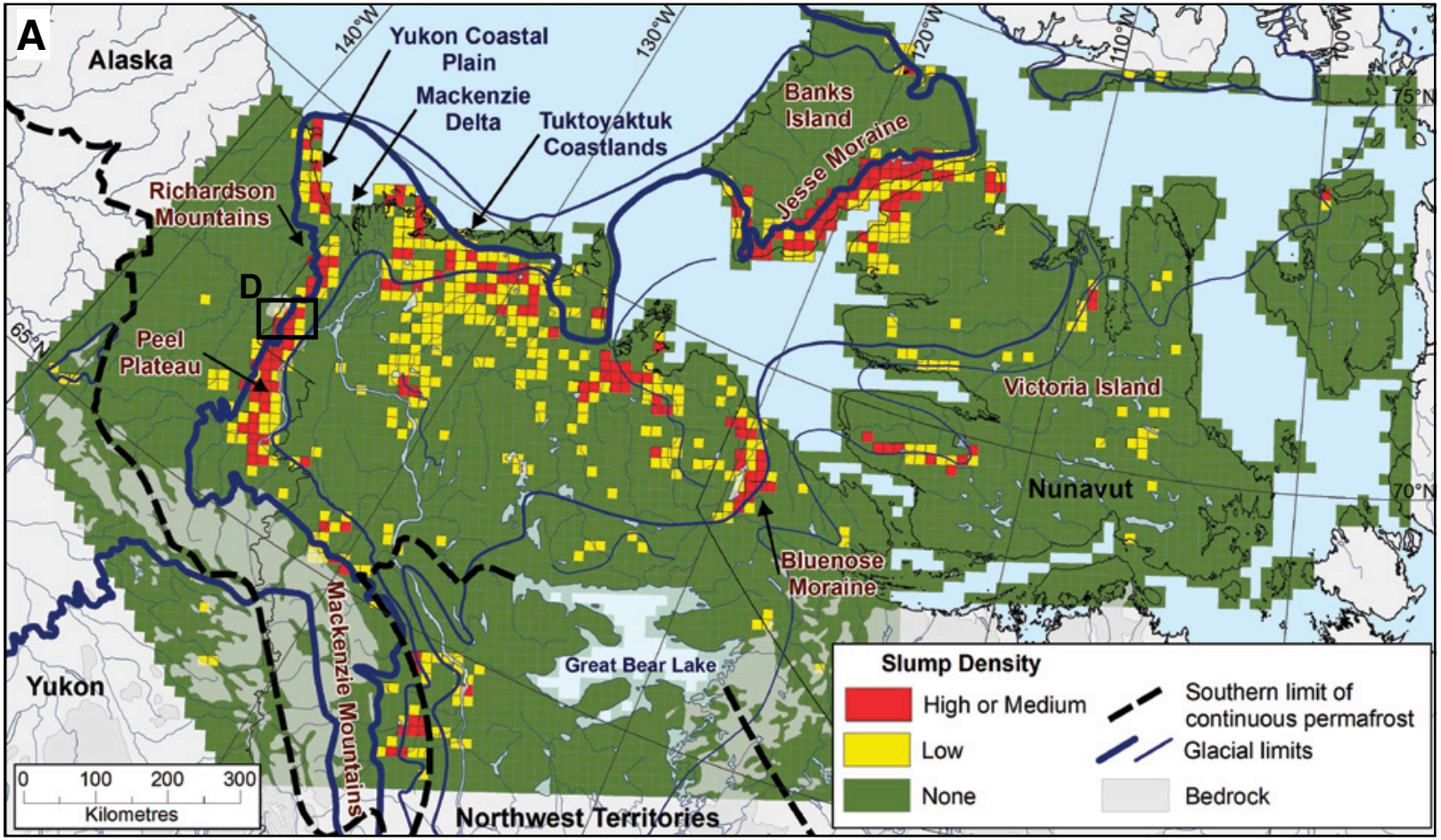
Introduction



Slump along the Yukon Coastal Plain, 2015

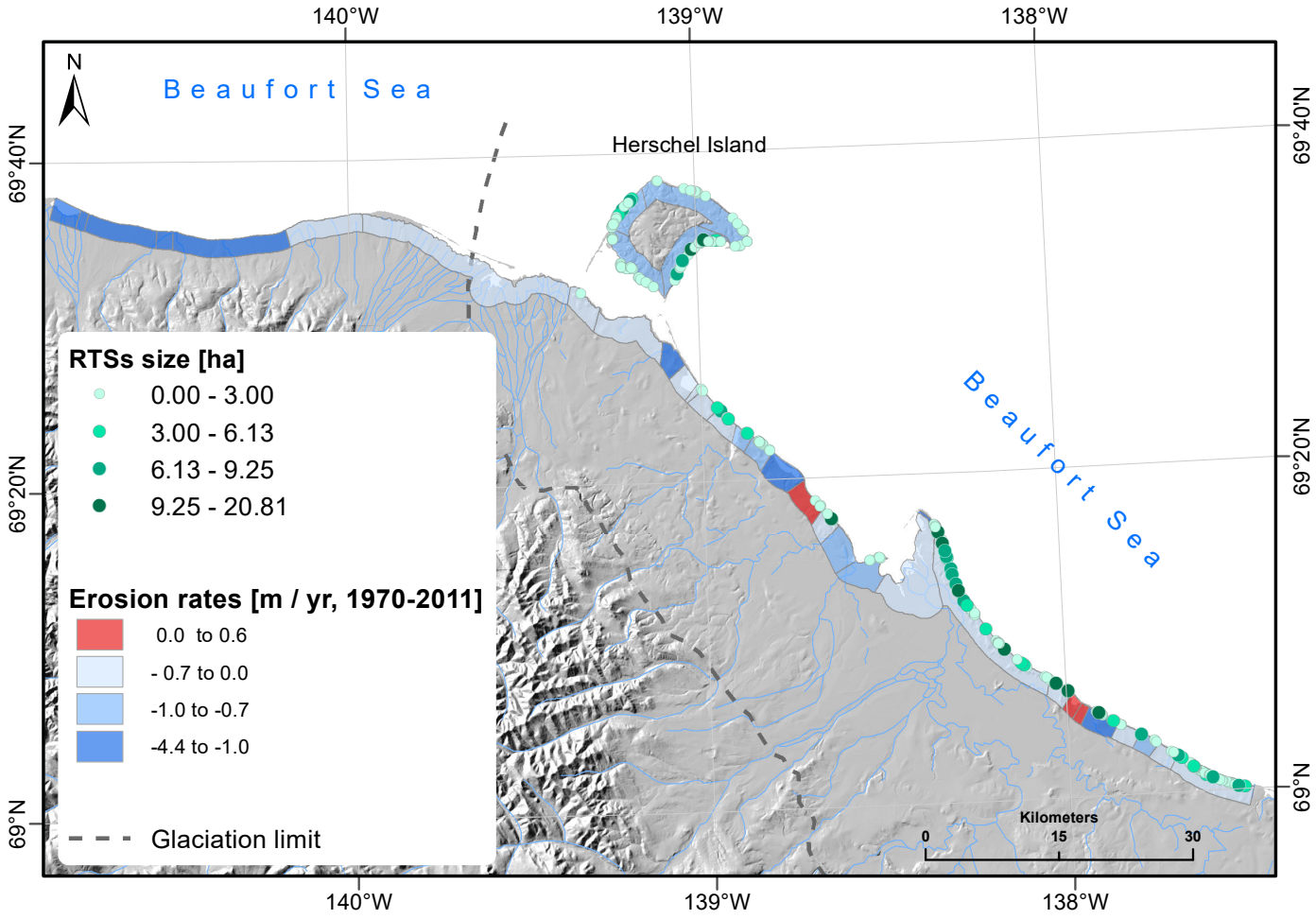
Lantuit, H., & Pollard, W. H. (2005). Temporal stereophotogrammetric analysis of retrogressive thaw slumps on Herschel Island, Yukon Territory. *Natural Hazards and Earth System Science*, *5* (3), 413-423.

Introduction



Kokelj, S. V., Lantz, T. C., Tunnicliffe, J., Segal, R., & Lacelle, D. (2017). Climate-driven thaw of permafrost preserved glacial landscapes, northwestern Canada. *Geology*, *45* (4), 371-374.

Introduction

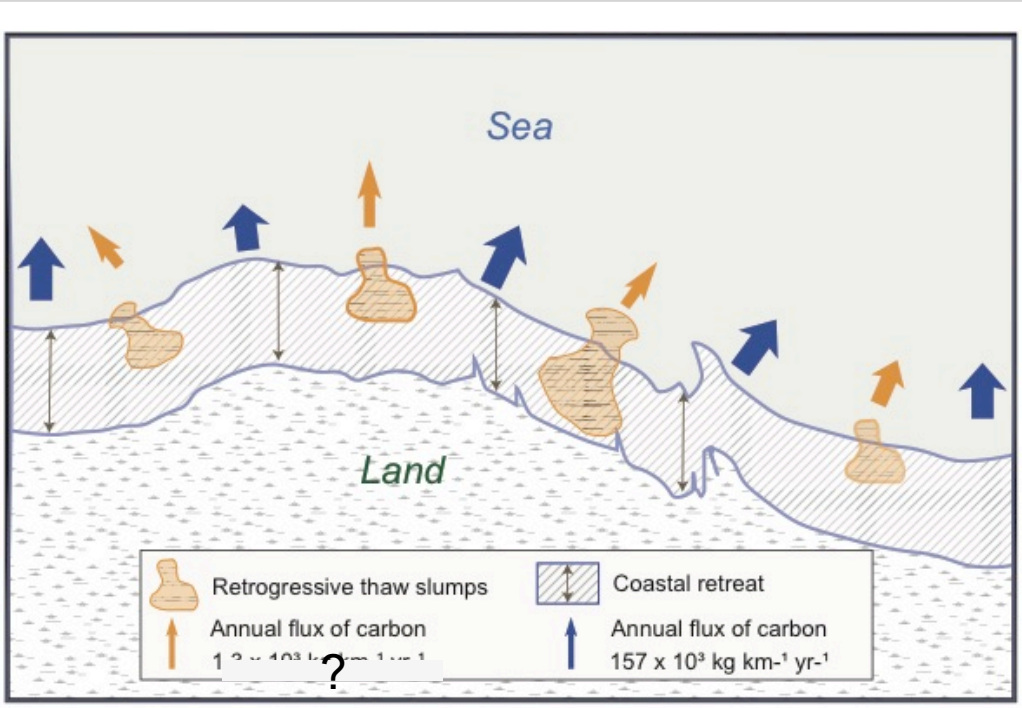


Ramage et al., 2017

Objectives

The objectives are:

- ✓ to measure their evolution on a ca. 150 km coastline along the Yukon Coast between 1951 and 2011
- ✓ to estimate the amount of carbon released from the land to the shore



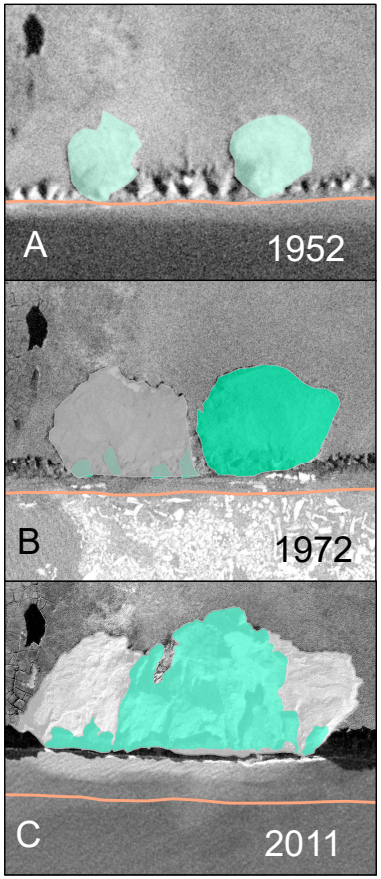
Part 1: evolution

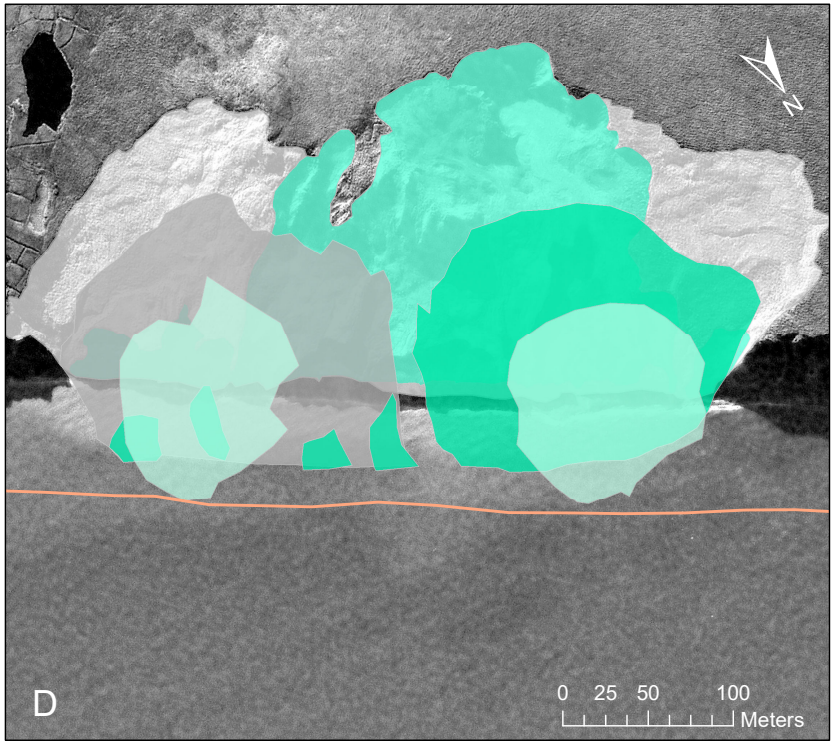
A. Landform identification

1. Georeferencing aerial photos (1950s and 1970s)

2. Landform digitalization and classification

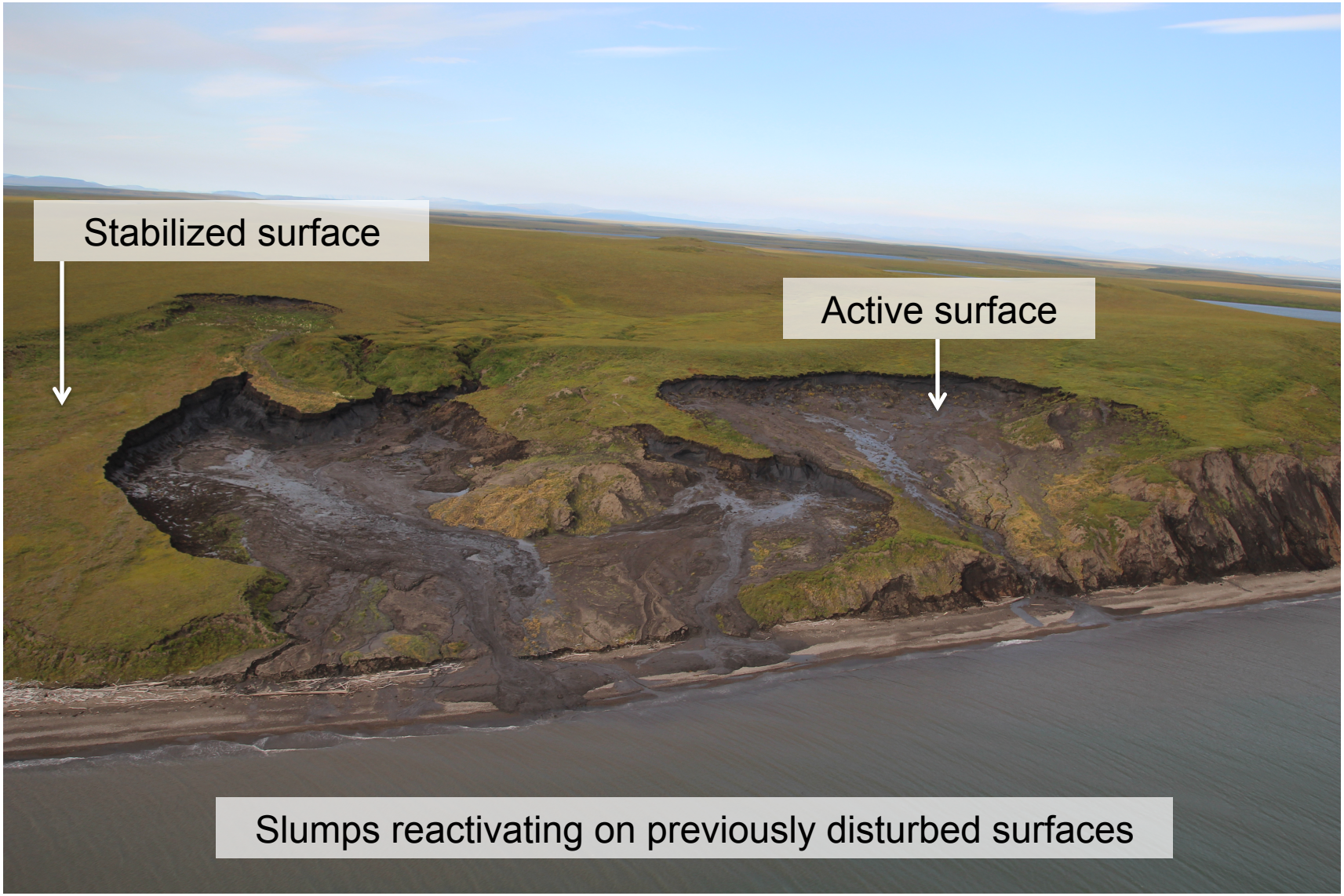
3. Extraction of geospatial data





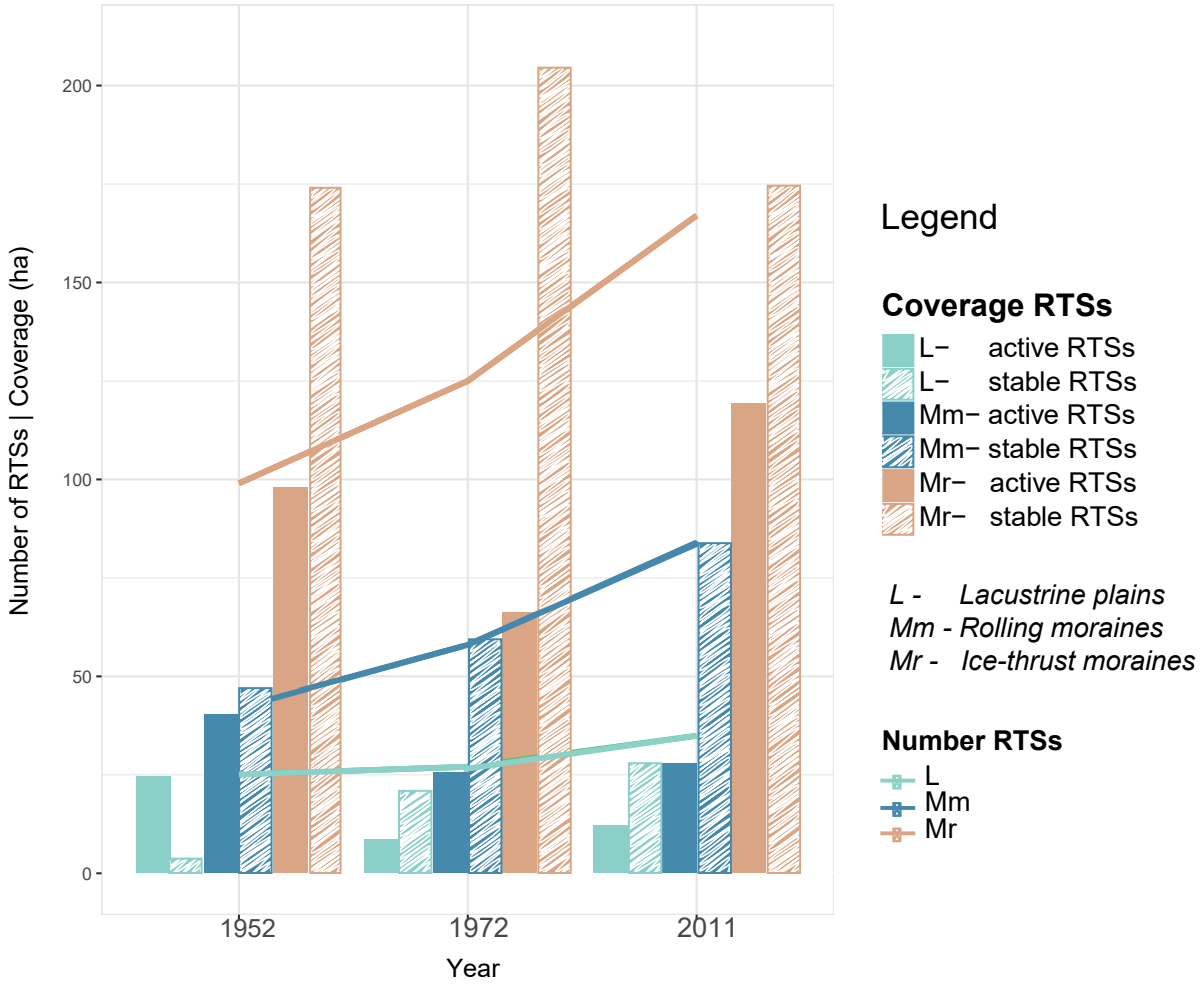
Shoreline 1952
Active RTSs 1952
Active RTSs 1972
Stable RTSs 1972
Active RTSs 2011
Stable RTSs 2011

Part 1: evolution



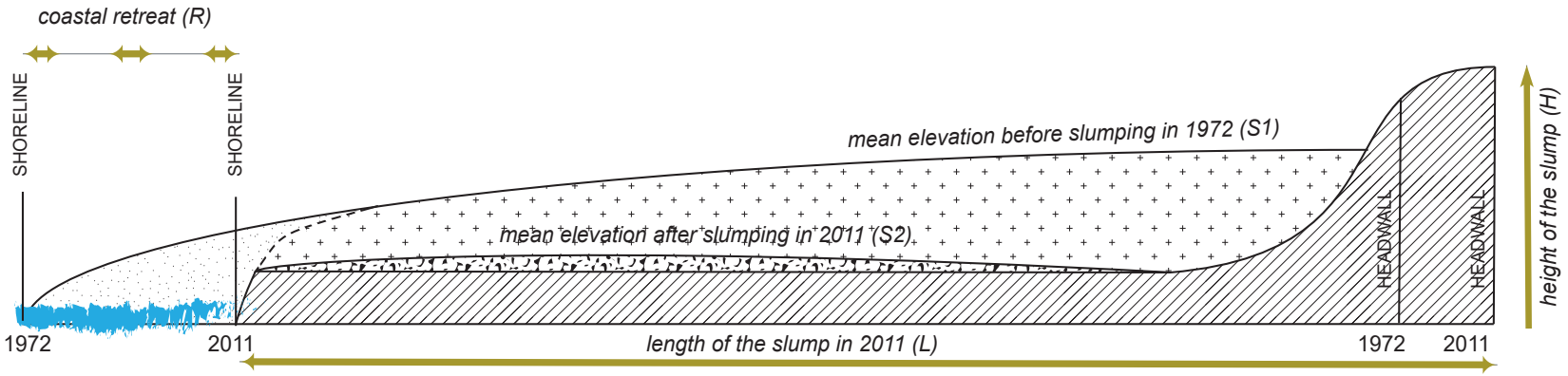
Part 1: evolution

Evolution of slumps 1952-2011



Part 2: fluxes

B. Volume estimations



a Retrogressive thaw slump in 2011

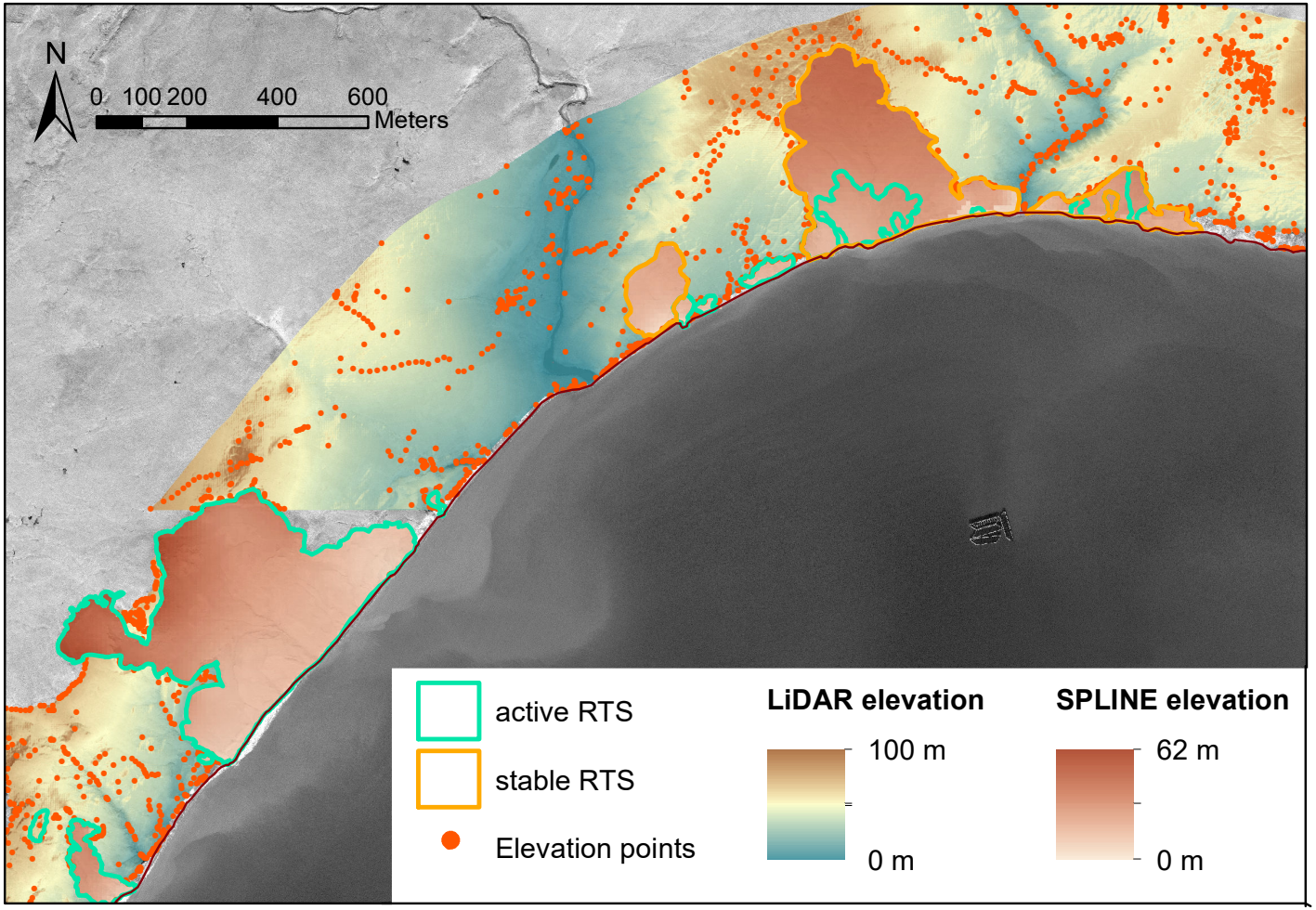
b Volume of material eroded due to slumping between 1972 and 2011 ((*S1 -S2)*L)*)

c Volume of material reworked and settled in the retrogressive thaw slump between 1972 and 2011 (estimated to be *5.5 %*)

d Volume of material eroded and transported alongshore due to coastal erosion between 1972 and 2011 (R * *dH*)

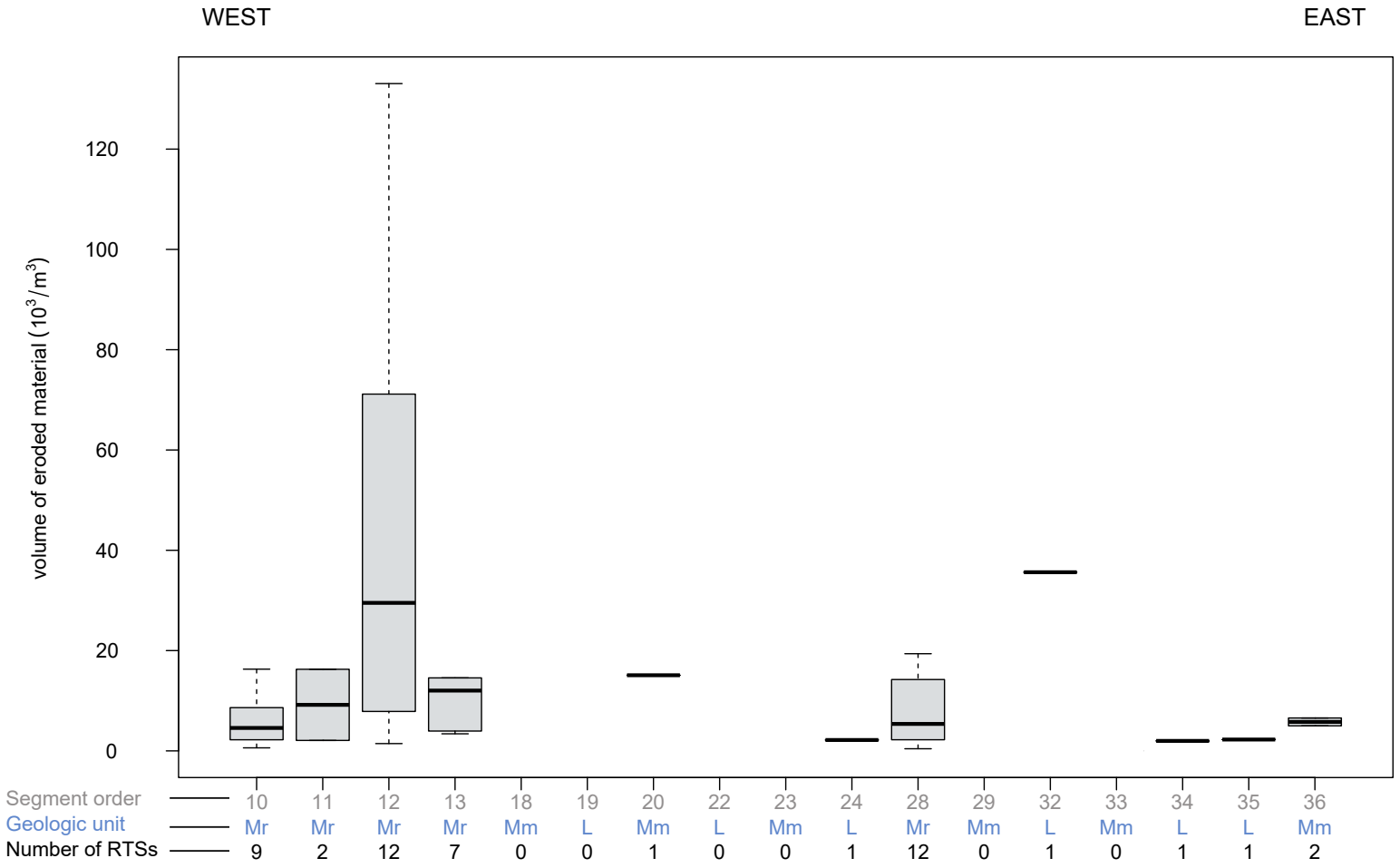
Part 2: fluxes

B. Volume estimations

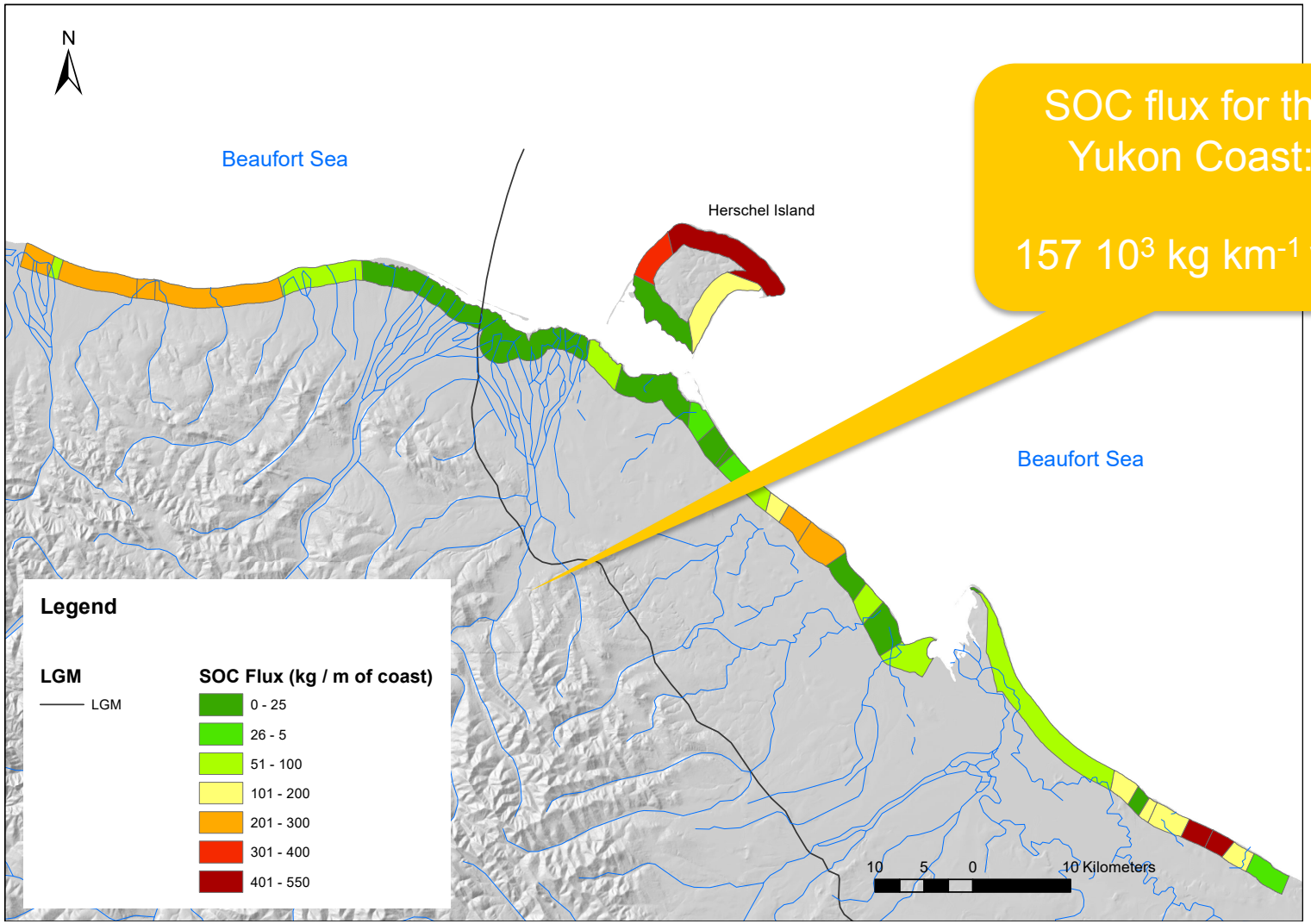


Part 2: fluxes

”New” slumps 1972-2011

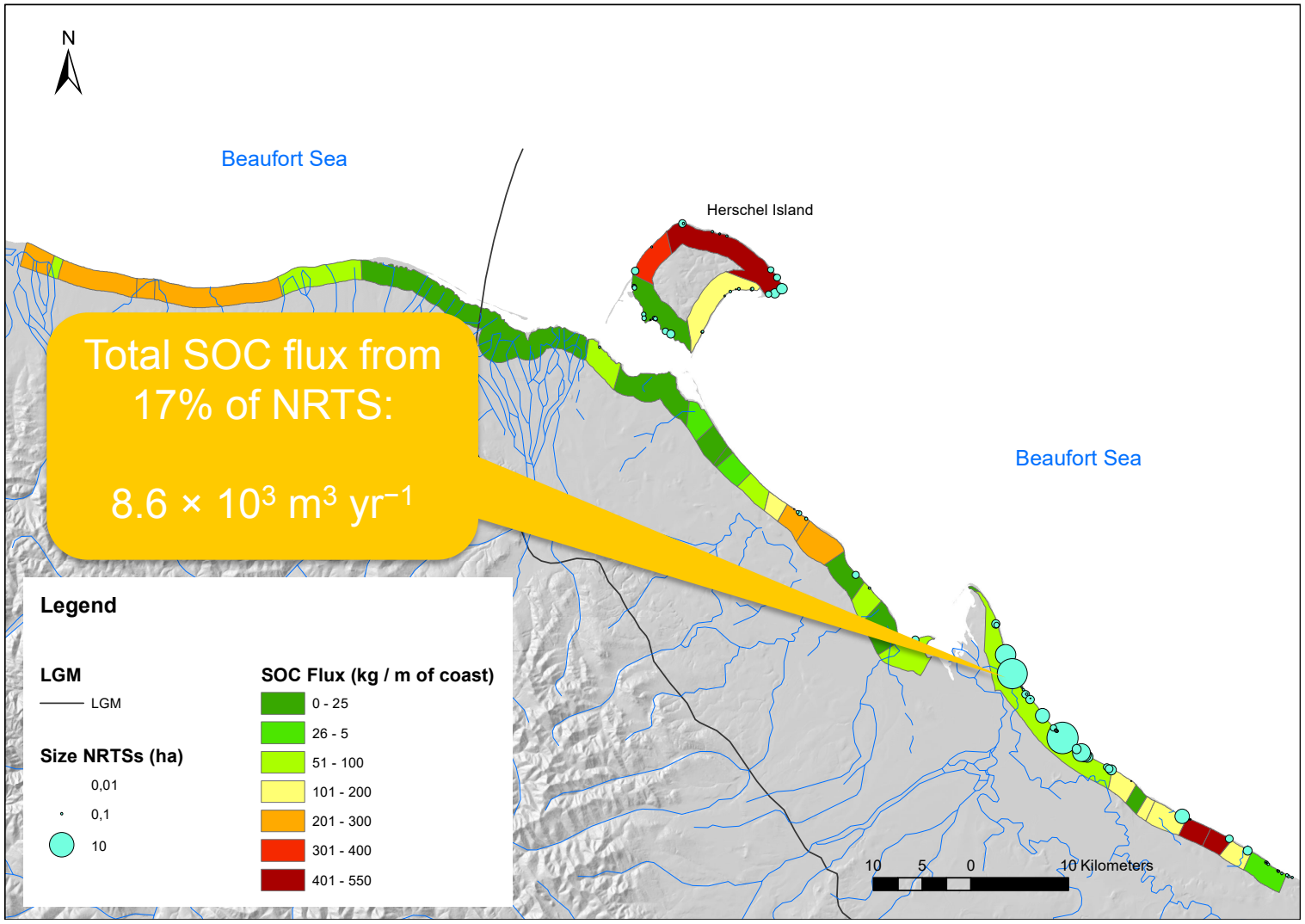


Part 2: fluxes

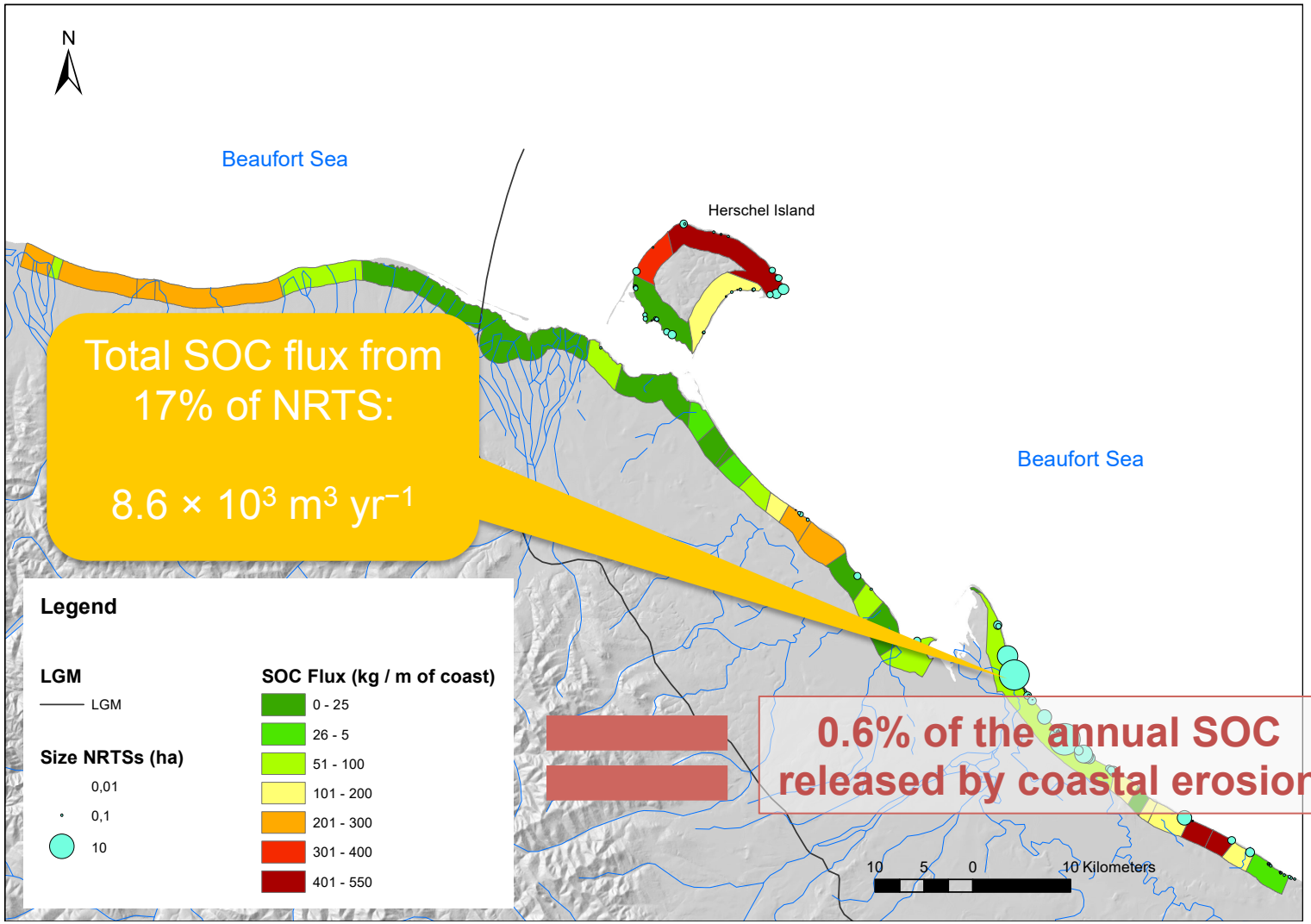


Couture, N. J., Irrgang, A., Pollard, W., Lantuit, H., & Fritz, M. (2018). Coastal erosion of permafrost soils along the Yukon Coastal Plain and fluxes of organic carbon to the Canadian Beaufort Sea. *Journal of Geophysical Research: Biogeosciences*, *123*(2), 406-422.

Part 2: fluxes



Part 2: fluxes



CONCLUSIONS

Increase in the number of RTS since 1950s by

73%

Increase in the area covered by RTSs by

14%

17% of the RTSs have contributed to the annual release of SOC through coastal erosion by

0.6%