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Distribution and Evolution of Coastal Retrogressive Thaw Slumps Along the Yukon Coast, Canada

INTRODUCTION

Retrogressive thaw-slumps (RTSs) are among the most dynamic thermokarst landforms in the Arctic. Those **slope failures created by permafrost thaw** are initiated when active layer detachments or wave erosion expose the ice-rich permafrost layers to solar radiation (de Krom, 1990).

RTS occurrence is mostly driven by climatic factors, such as **air temperatures** (Kokelj et al., 2015; Balser et al., 2014; Lamoureux, 2009; Lantz and Kokelj, 2008; Leibman, 2003), **precipitation events** (Lacelle et al., 2010) but also by **changes in ground thermal conditions** (Kokelj et al., 2009).

The few studies focusing on coastal RTSs show that, in some areas, RTSs undergo a period of enhanced activity (Lantuit et al., 2012; Kizyakov et al., 2013; Leibman et al., 2008; Lantuit and Pollard 2005; Wolfe et al., 2001). However RTSs are **heterogeneous** and do not develop everywhere along the coast.

In order to better predict Arctic coastal dynamics, it is crucial to get a better overview of RTS distribution along the Arctic coasts and to evaluate the role of local and geomorphic forcing.

With this study, we highlight the dynamics of retrogressive thaw slumps along the Yukon Coastal Plain, eastern part of the Beaufort Sea by
1) measuring their **evolution** on a ca. 235 km coastline over the last 59 years (1952-2011),
2) determining the **prevailing factors** accounting for their distribution and driving their expansion.

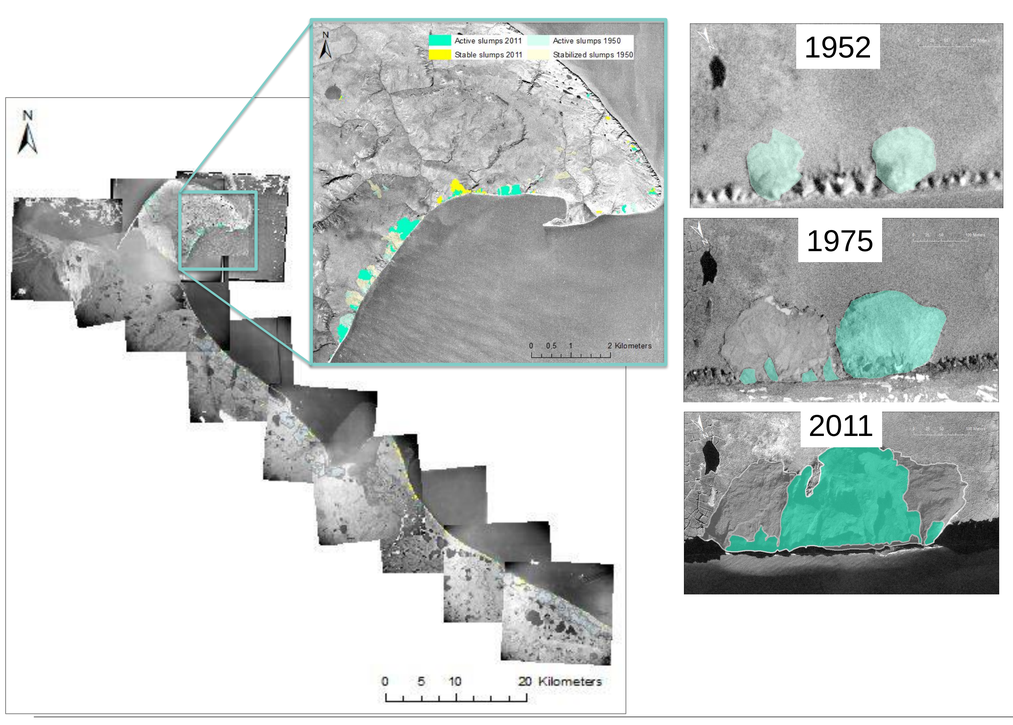
Figure 1: RTSs along the Yukon Coast, 2015.

METHODS

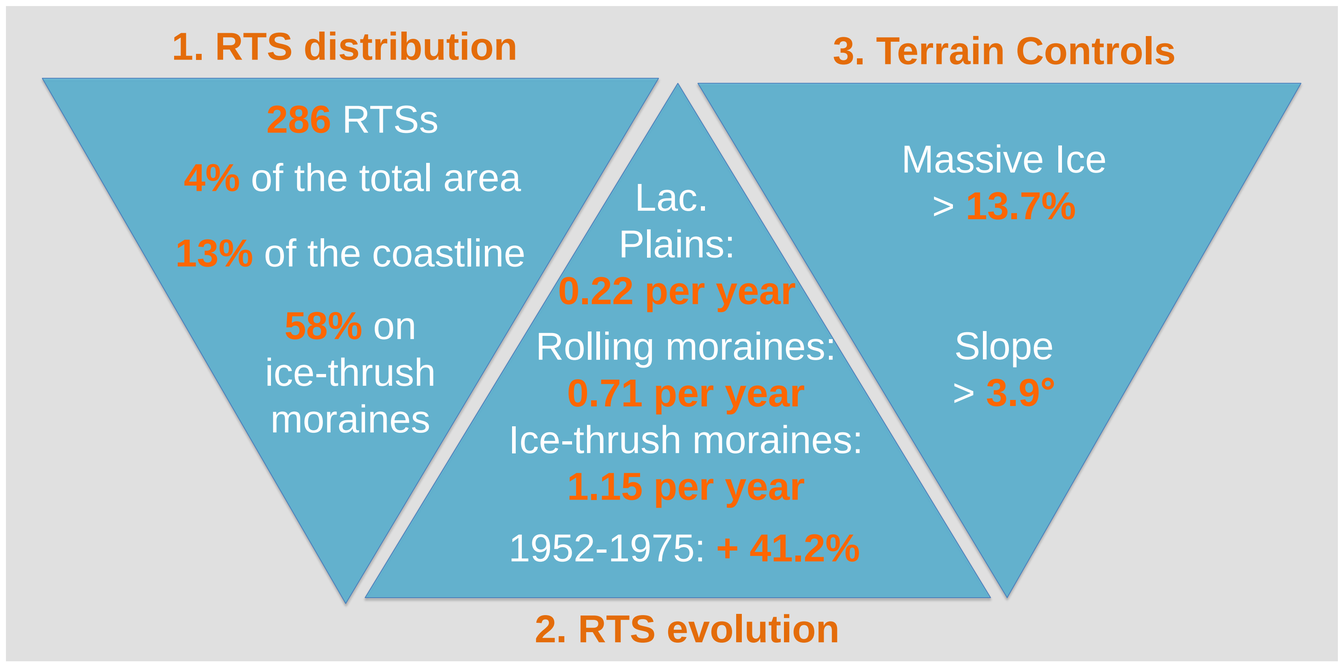
1. Mapping RTSs on georeferenced aerial photographs from 1952, 1975 and high resolution satellite imagery from 2011.

2. Extraction of morphological information from a LIDAR dataset (2013, 1 m resolution).

3. Statistical analyses, using simple and boosted regression trees.



KEY FINDINGS



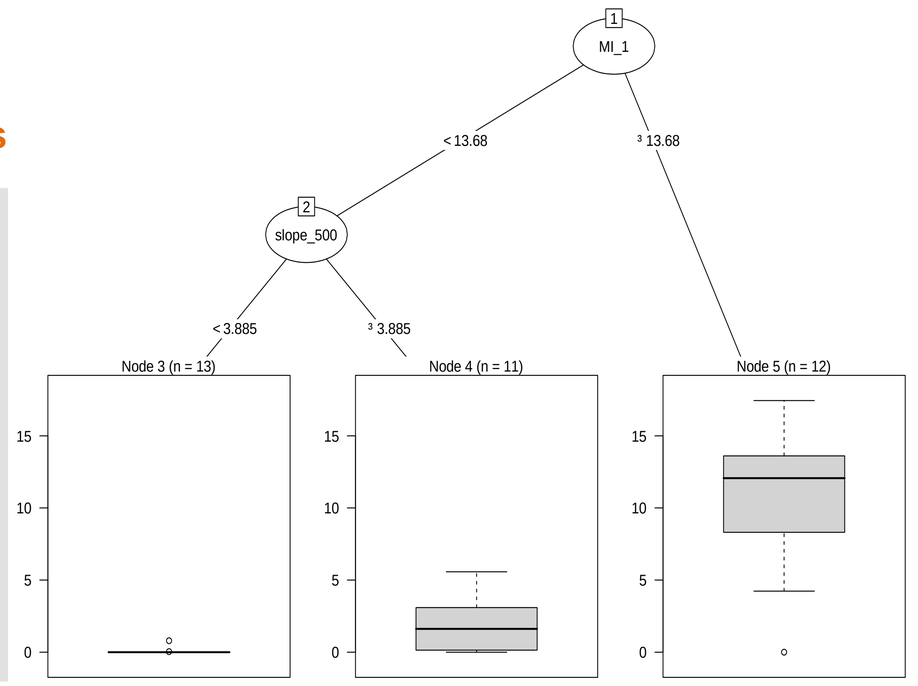
RESULTS

3. Terrain Controls

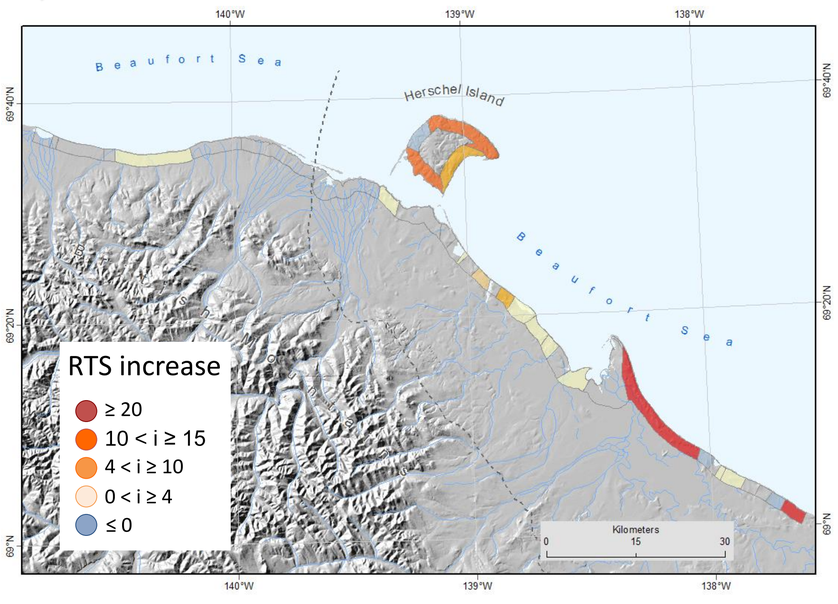
Massive ice (MI_1)[1] and slope (slope_500) played major control over the size of RTSs.

Large RTSs occurred mostly on coastal segments where the volume of massive ice bodies were > 13.7%

Where massive ice was < 13.6%, RTSs developed where the slopes were > 3.9°

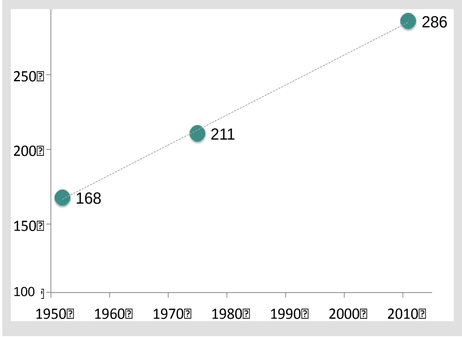


2. RTS evolution



RTSs increase along the coast was heterogeneous.

RTSs developed mostly on moraine deposits, especially on ice-thrush moraines, +1.15 RTS per year.



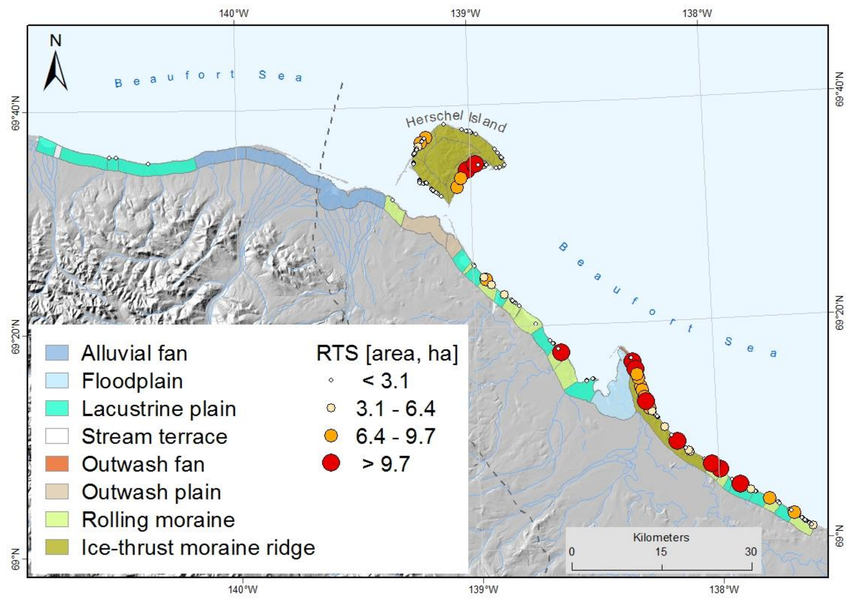
1. RTS distribution

In 2011, we mapped 286 RTSs along the Yukon Coastal Plain.

Most of the RTSs were located within the previously glaciated area (east of the study area).

58% of the RTSs were found on ice-thrush moraines.

Their size was heterogeneous and the larger RTSs were stabilized and located on moraine deposits.



[1] Data obtained from:
N. Couture, 2010: Fluxes of soil organic carbon from eroding permafrost coasts, Canadian Beaufort Sea. *PhD Thesis, McGill University, Montreal*.

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