The specificity of thermal denudation feature distribution on Yamal and Gydan peninsulas, Russia

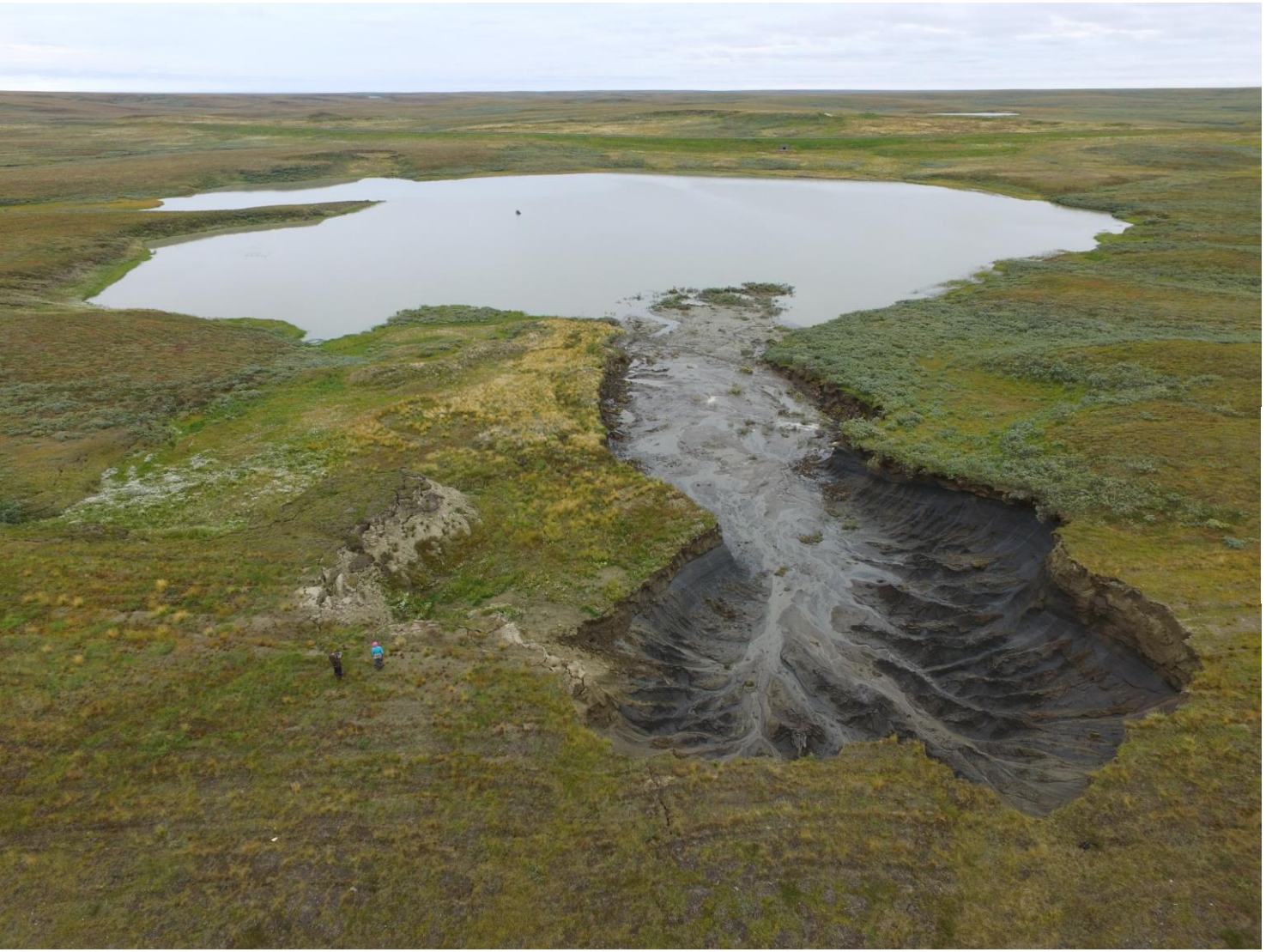

Photo credits: Artem Khomutov

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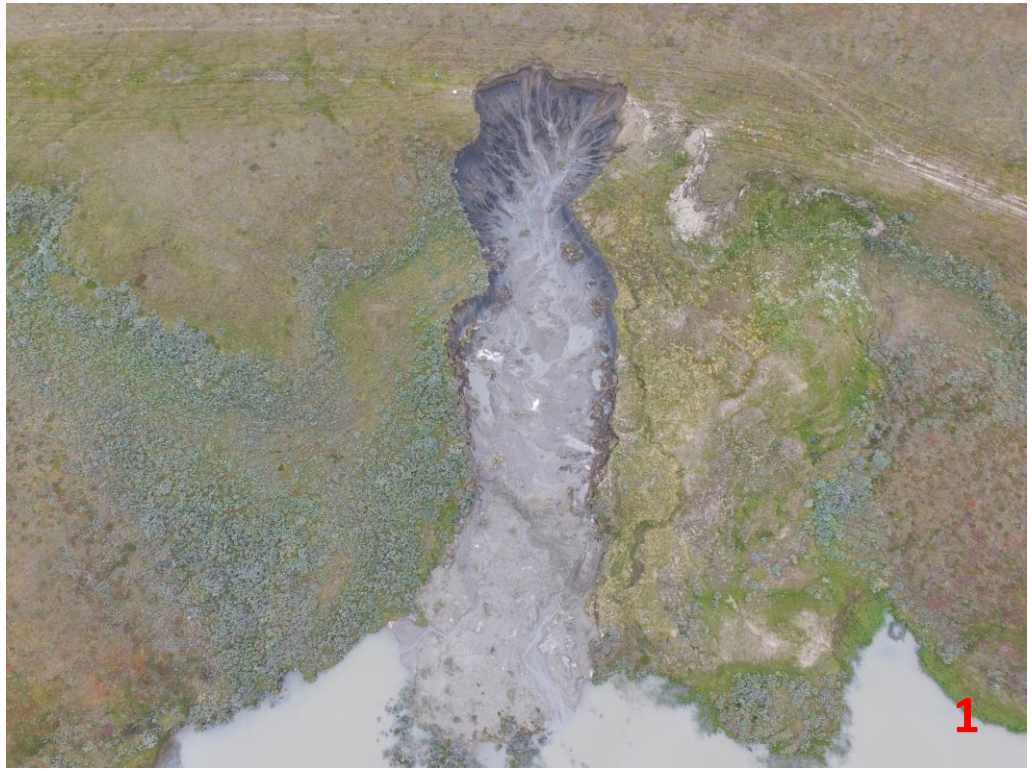
The reported study was partially funded by RFBR according to the research project #18-05-60222

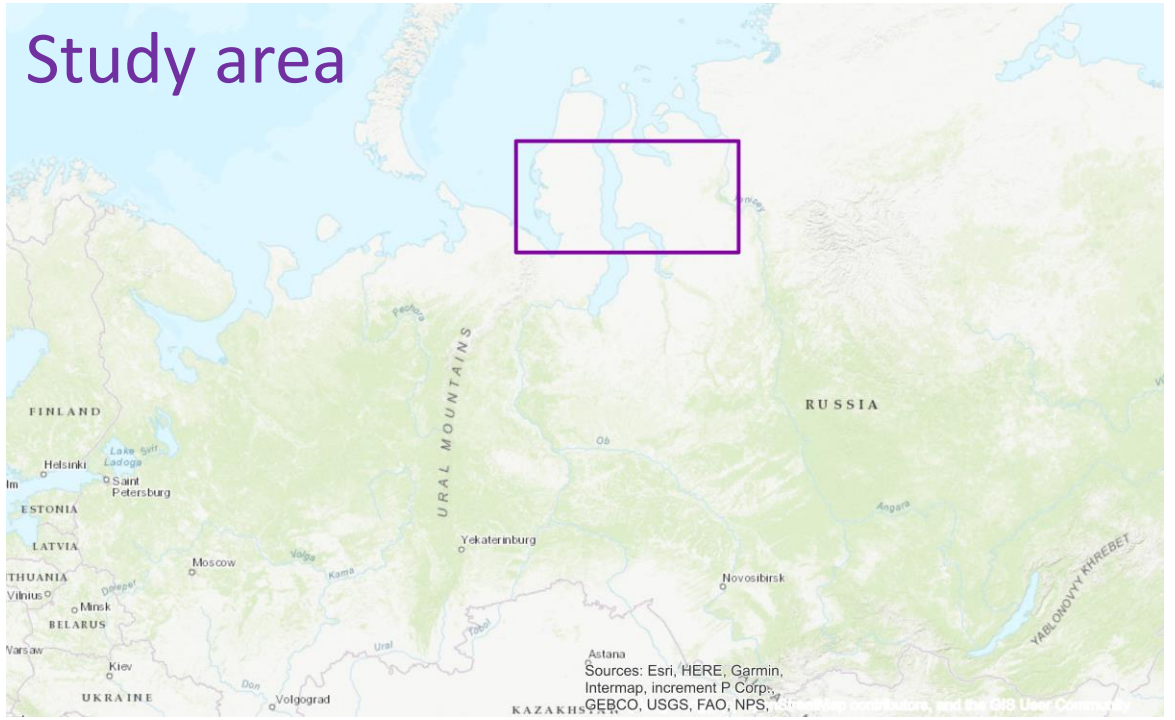
Subject of research

We focus on **thermocirques** – thermal denudation features of semi-circle specific shape resulting from set of retrogressive thaw slumping related to tabular ground ice thawing (Kizyakov, Leibman, 2016)



1. Active thermocirques. UAV image.
Photo credits: Rustam Khairullin

Study area



2. Stabilized thermocirques. UAV image.
Photo credits: Rustam Khairullin

Methods

Yandex.maps service:

- Availability to browse free satellite images
- Spatial resolution from 15 m up to 0.4 m
- Opportunity to create and download georeferenced KML-file
- Last update - 2018

Visual identification of the features of thermal denudation using <u>image interpretation characteristics:</u>

snow or a shadow defining the outline of a headwall

semi-circle specific shape

recently exposed sediments (Segal et al., 2016)

poorly developed vegetation (Segal et al., 2016)

impurity of the lake water

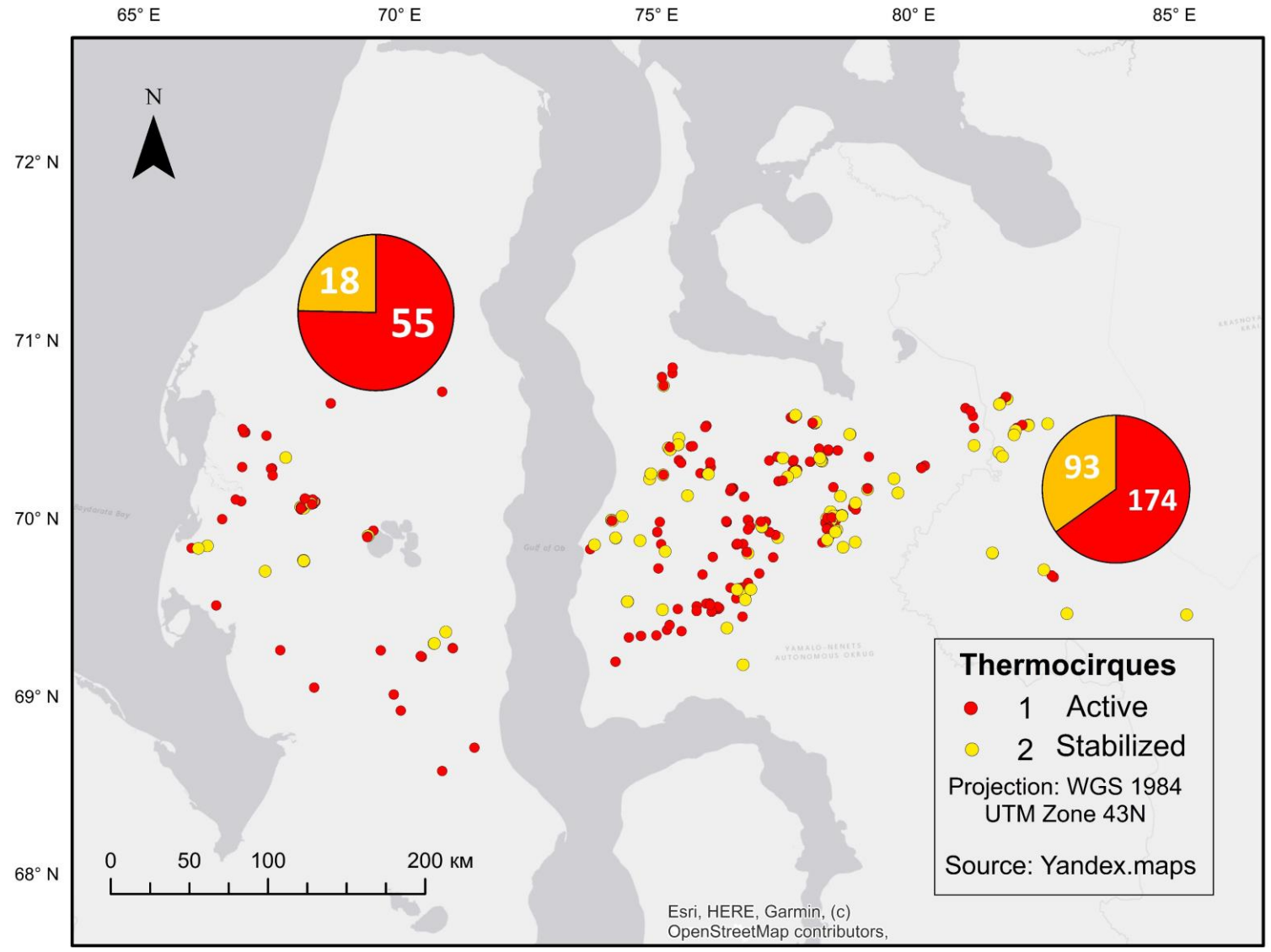
similar color of tundra environment

well-defined outline

1 - active

Source: Yandex.maps, 2018, https://maps.yandex.ru/

2- stabilized



Verification:

1. Active

WorldView-2, 0.4 m

Yandex.maps, 2018,
https://maps.yandex.ru/

2. Stabilized

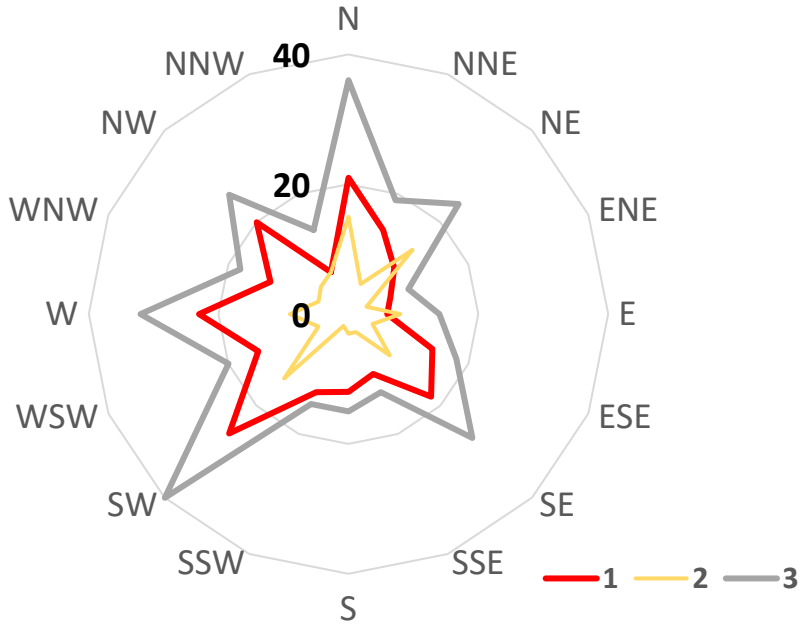
WorldView-2, 0.4 m

Yandex.maps, 2018,
https://maps.yandex.ru/

- In total more than 400 objects were identified
- We focus on 341 well-defined thermocirques
- Northernmost feature 71°N, southern limit 69°N

Using Kokelj et al. (2009) method thermocirque orientations were defined

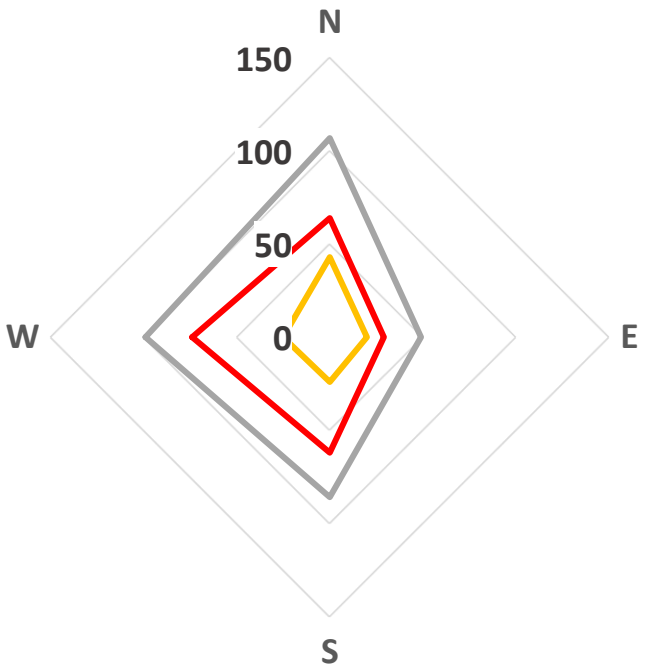
Yamal and Gydan



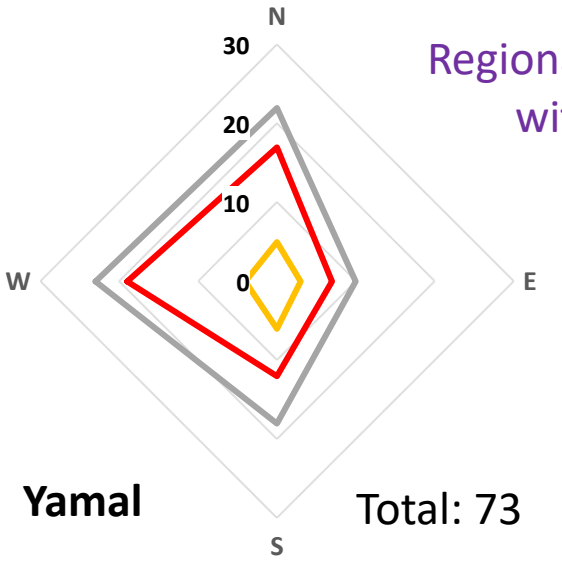
Grouped into 4 classes

1. **Active thermocirques**
2. **Stabilized thermocirques**
3. **Both**

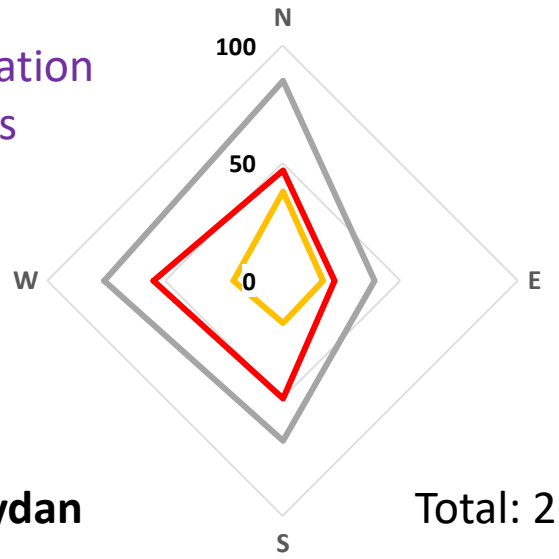
Yamal and Gydan



Regional differentiation within samples



Yamal Total: 73



Gydan Total: 268

- Thermocirque orientations were not randomly distributed ($\chi^2_{0.05,\,3} = 23.188$, $p < 0.001$)
- Statistically significant (Bonferroni corrected $p < 0.0083$) prevalence of all orientations over E

Conclusions:

- Dominance of active thermocirques over stabilized on both peninsulas
- Northern border of thermocirque distribution 71°N, southern limit 69°N
- Detailed analysis of identified thermocirque orientation shows predominance of SW and N on both peninsulas
- Thermocirque orientations are not randomly distributed
- Statistically significant prevalence of all orientations over E

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1. Kizyakov, A. I., and M. O. Leibman. "Cryogenic relief-formation processes: a review of 2010–2015 publications." *Earth's Cryosphere XX (4)* (2016): 40-52.
2. Kokelj, S. V., et al. "Origin and polycyclic behaviour of tundra thaw slumps, Mackenzie Delta region, Northwest Territories, Canada." *Permafrost and Periglacial Processes* 20.2 (2009): 173-184.
3. Segal, Rebecca A., Trevor C. Lantz, and Steven V. Kokelj. "Acceleration of thaw slump activity in glaciated landscapes of the Western Canadian Arctic." *Environmental Research Letters* 11.3 (2016): 034025.