Massive Ice and Ice-Rich Soil detection by gravimetric surveying at Dry Creek, south-western Yukon Territory, Canada

Benoît Loranger, master’s student and Jr.Eng.
Civil and water engineering department
Direction: Guy Doré, Université Laval
Codirection: Daniel Fortier, Université de Montréal
Objectives

1) Demonstrate the ability to use a high-precision gravimeter massive ice detection purposes and ice-rich soil in permafrost areas.

2) Perform a field drilling campaign to evaluate the reliability and quality of gravimetric results obtained previously.

3) Create decisional charts of Ice volume vs. gravimetric signal.

Site rehabilitation, Dry Creek (A & B, 1994) and slope disturbance with sinkhole initiation (C, 2014).
Source: A & B: Yukon highways, TEB; C: personnal photos, 2014.
Dry Creek Problematic

Site was used as a quarry pit

Site rehabilitation between 1994-1995

Limited knowledge of underlying Quaternary surficial deposits

Practical engineering, design and construction were inadequately adapted to site context as result:
- Thermokarst development
- Differential thawing
- Other permafrost thawing problems.

≈1,70 m  
≈8,5 m
Dry Creek: Site Localisation

62° 09' 49" N; 140° 40' 55"; ~ 735 m a.s.l

1. Thermokarst
2. 8.5m thaw (2008)
Dry Creek: Works localisation

July and September 2013; Drilling: May 2014

9 gravimetric survey lines
10 boreholes
4 drillholes -> Ice
No Ice neither detected or drilled in the 6 others drillholes
Interpretation: Survey Line 7 and borehole DC-04

Topography, boreholes location (DC-4), possible location of massive ice and residual anomaly (mGal), survey line 7

Residual Anomaly (mGal) Survey line 7
Work to be done

Ice wedge assessment (Beaver Creek and Kangerlussuaq)

Quantification gravimetric results versus real ice volumes (Dry Creek and Kangerlussuaq)

Decisional chart (ice volume vs gravimetric signal)
Thanks to all partners and collaborators!