### Introduction

3 yr PhD project (2014-2017)
ERC-funded PETA-CARB project – Rapid Permafrost Thaw in a Warming Arctic and Impacts on the Soil Organic Carbon Pool

**Project Objective**
Spatio-temporal dynamics of rapid permafrost thaw processes

**Methods**
Remote sensing time-series, Data analysis/pattern recognition, Field work

**Goals**
a) Detection of thermokarst lake shore dynamics
b) Automated monitoring of thaw processes
c) Development of landscape process models

### Key Study Sites

<table>
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<tr>
<th>Study Areas</th>
<th>Lena Delta</th>
<th>Alaska North Slope</th>
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<td><strong>Fig. 1: Key Study Sites. Map altered after Brown et al. (2007).</strong></td>
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### Data and Time-Series

**Remote Sensing Time-Series**

- **Main Data Sources:**
  - Landsat, RapidEye
  - High acquisition frequency – daily to bi-monthly
  - Large spatial coverage
  - Good spectral range
  - Mission security

- **Additional Data Sources:**
  - DEM, aerial imagery (historic, recent), VHR optical data, field measurements

**Time-Series Analysis**
Rapid detection of sudden changes (e.g. lake drainage)
Monitoring of gradual changes (subsidence, lake formation)
Application of state-of-the art time-series processing methods – e.g. TIMESAT, BFAST

### Methods and Analysis

#### Continuous Data Acquisition
- Automatic acquisition tracking and retrieval
- Minimize cloud contamination due to high frequency

#### Automated Data Processing Environment
- Data download
- File operations
- Image stacking/redistribution
- Atmospheric correction
- Index calculation
- Subsetting

#### Temporal Analysis
- Seasonal to decadal scale (data availability)
- Analysis of different multi-spectral indices
- Extract temporal signatures

#### Spatial Analysis
- Spatial patterns and interconnections
- Anthropogenic impact
- Detection of process scale

**Field Work**

- **Lena Delta 2014, Alaska 2015**

**Outlook**

**Spatio-Temporal Process Model**

- Comparison of study areas
- Landscape dynamics
- Data Analysis

**Continuous output/update for calculation of thermokarst related carbon fluxes**

**Multiple disciplines will benefit from a better knowledge of the spatio-temporal thermokarst landscape dynamics**

**Provide toolkit/software library for large scale analysis**

Integration with other remote sensing time-series models/analysis tools (e.g. LandTrendr, webEOM, TIMESAT)

**Technology**