**Polyar – Process of Organic transport to the Lakes of the Yamal Region**

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### Introduction

Climatic and environmental fluctuations in the permafrost zone lead to activation of various cryogenic processes. This activation results in a strong redistribution of substances and changes in biochemical composition of the water bodies. Lakes in the Arctic are good indicators of changing natural conditions. Thus, we analyze the interconnection between water bodies and their catchments on Yamal Peninsula in temporal and spatial extent. Main objective of this research is to study which processes affect the quality and quantity of dissolved organic matter in the water bodies across the Yamal Peninsula (central, eastern and coastal parts) in the continuous permafrost zone. The studies are based on barymetric in-situ measurements and water sampling, optical and SAR remote sensing, and topographic data analysis.

### Water sampling

**Lake samples** in the study area were chosen according different optical properties. The lakes were sampled for:
- 1) colored dissolved organic matter (CDOM) 2011-2014;
- 2) cations and anions (KA) 2014;
- 3) suspended matter (SPM) 2014.

### Sample analysis in laboratory

**Water samples** were analyzed in Otto-Schmidt laboratory (Saint-Petersburg, Russia). For CDOM concentration a dual-beam spectrophotometer SPECORD was used. We see CDOM concentrations changing significantly between the years for some specific lakes.

### Results

- **Climatic and environmental Fluctuations in the permafrost zone lead to activation of various cryogenic processes.**
- **Catchment based approach – vegetation**
  - **Lake extent analysis**
    - **To analyze lake extent dynamics we use radar remote sensing data TerraSAR-X.**
    - **TerraSAR-X, X-band applications for tundra permafrost landscapes: seasonal lake dynamics, snow extent, lake surface roughness, landslide dynamics, elevation changes**

### Acknowledgements

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### Catchment based approach – snow

It is assumed that the more snow is in catchment the more active erosion processes will be in spring season and more matter can be transported into the lakes. To analyze a snow distribution in catchments an approach for snow water equivalent (SWE) spatial mapping for tundra landscapes has been developed. The methodology is based on statistical analysis of snow survey data and GIS-analysis.

### Catchment based approach – coastal activity

To assess the possibility of the organic matter transport from catchments to lakes it is necessary to analyze the intensification extent of coastal processes (thermoerosion, thermabrasion, cryogenic landslidies). The activity of the described processes depends mainly on climatic and background conditions (topography, hydrology).

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### Table: Sample Analysis in Laboratory

<table>
<thead>
<tr>
<th>Lake ID</th>
<th>CDOM absorption (440 nm)</th>
<th>CDOM concentration (µg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LK-04</td>
<td>22.980</td>
<td>1,0</td>
</tr>
<tr>
<td>LK-19</td>
<td>22.980</td>
<td>0,910</td>
</tr>
<tr>
<td>LK-31</td>
<td>22.980</td>
<td>0,910</td>
</tr>
</tbody>
</table>

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### Bathymetry

It is very important to know the bottom structure and to take the water volumes in lakes into account and to know about re-suspension and wind influence that may also influence the CDOM behavior.

### Lake extent analysis

To analyze lake extent dynamics we use radar remote sensing data TerraSAR-X. The water bodies detection algorithm is based on a TSX time series establishing a threshold value. Interannual changes in lake extent are highly pronounced for floodplain lakes and occur less for lakes located in higher geomorphological levels.

### Acknowledgements

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### Remote-Sensing CDOM observation

To analyze CDOM concentrations in lakes using optical remote sensing data an algorithm described in Kutzer et al. (2005) was used. It is based on the spectral ratio of the green vs. the red band, which is well correlated with CDOM absorption at 440 nm. Here the evaluation for several lakes is shown on the figure below (atmospheric corrected GeoEye-1 satellite image taken in 15/08/2009. NGA license, University Alaska Fairbanks, NASA LCLUC Yamal. CDOM absorption from 2011 Yamal expedition).