

Permafrost

- ground (soil or rock and included ice or organic material) that remains at or below 0°C for at least two consecutive years; four permafrost zones
- Direct indicator of climate change
- Effects by climate → permafrost: erosion, water drainage, carbon release
- Effects on the climate → releases heat, affects moisture in an area, affects carbon cycle



Active Layer Thickness

- Ground layer in permafrost area that annually thaws
- Essential Climate Variable

Permafrost matters for vegetation

- Thin active layer: no support for tree's roots (tundra, polar desert)
- Permafrost preventing water drainage
- Warm season: water collects on surface (kept by underlying permafrost layer, can be utilized by plants)

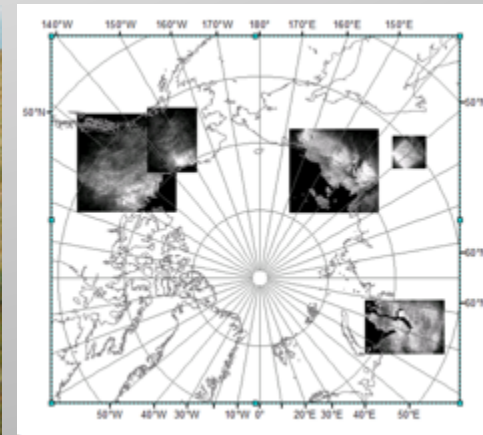
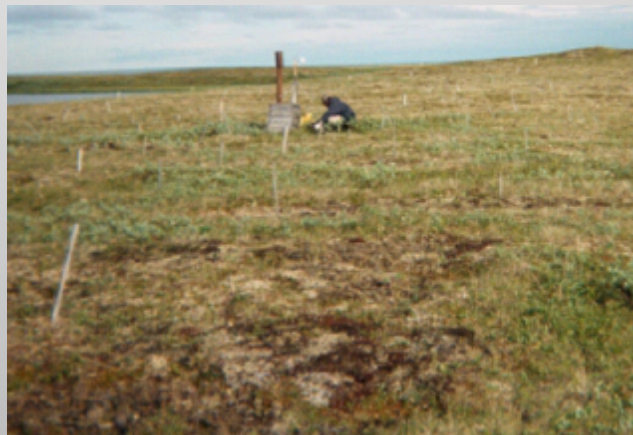


Vegetation matters for permafrost

- Plants absorb solar energy → Preventing permafrost thawing
- Damaged plant cover → Permafrost thawing, ground collapse
- Permafrost thawing → erosion, affect plants (f.e. drunken forests)

Methods

- Boreholes with thermistors
- Active Layer Grids
- Remote sensing (satellite data on surface temperature and soil moisture)



Data Collection

- Websites, Word and Excel sheets, differences between labs, no standards

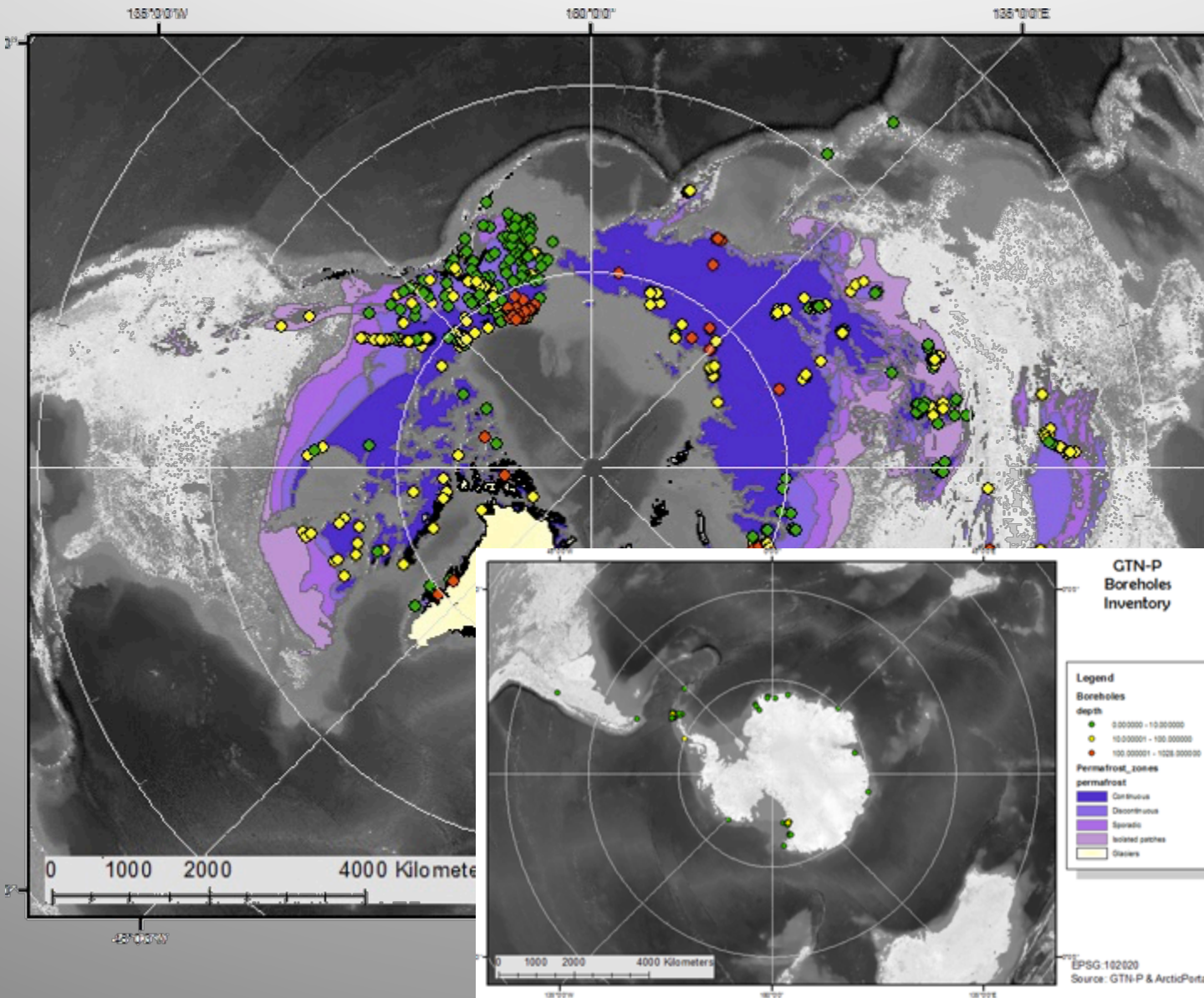


gtnpdatabase.org (PAGE 21 Work Package)



GTN-P Data Management System Main interface

Boreholes



GTN-P Boreholes Inventory

Legend

Boreholes depth

- ◆ 0.000000 - 10.000000
- ◆ 10.000001 - 100.000000
- ◆ 100.000001 - 1028.000000

Permafrost_zones permafrost

- Continuous
- Discontinuous
- Sporadic
- Isolated patches
- Glaciers

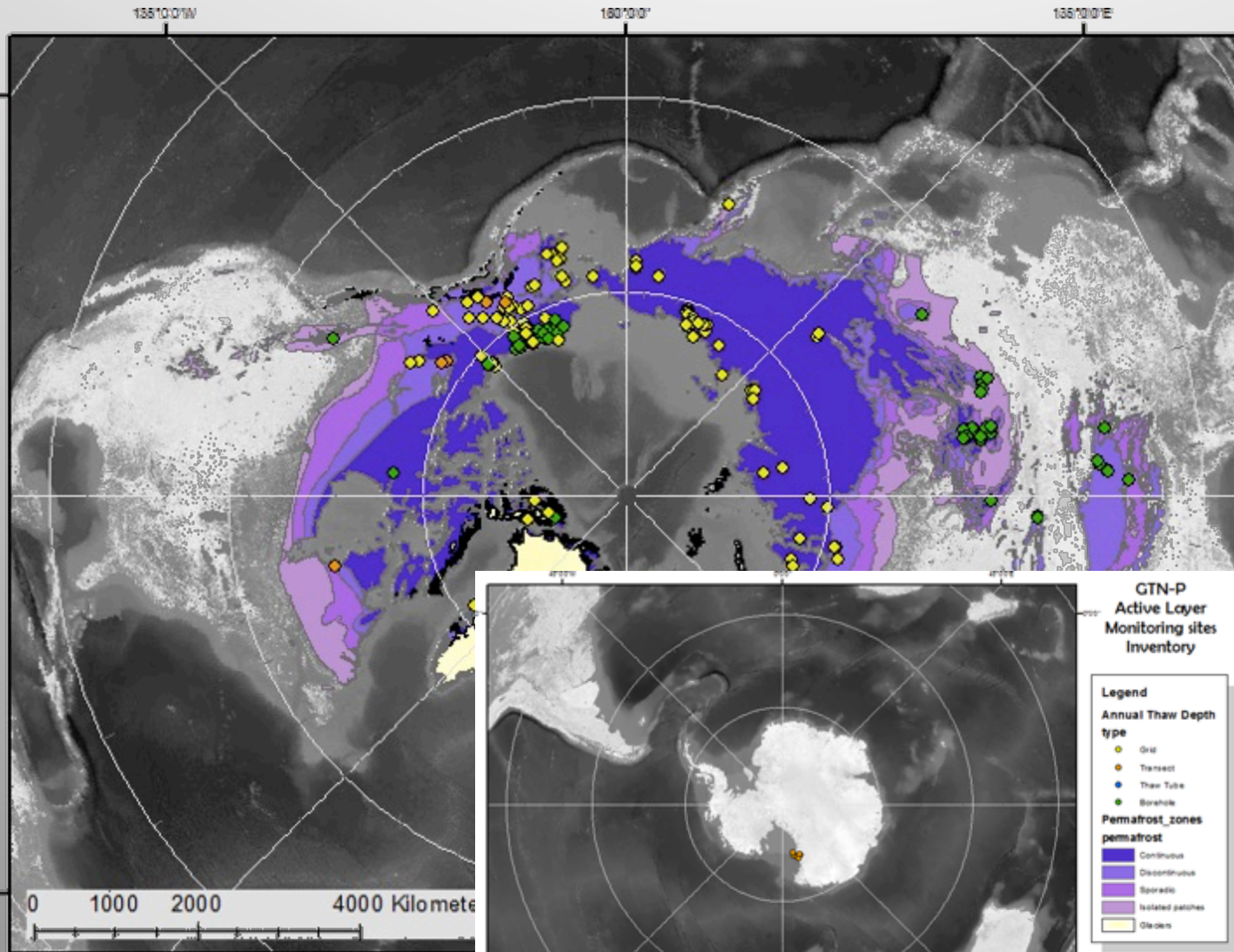
GTN-P Boreholes Inventory

- Legend
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EPSG:102017

Source: GTN-P & ArcticPortal

Active layer monitoring sites



GTN-P Active Layer Monitoring sites Inventory

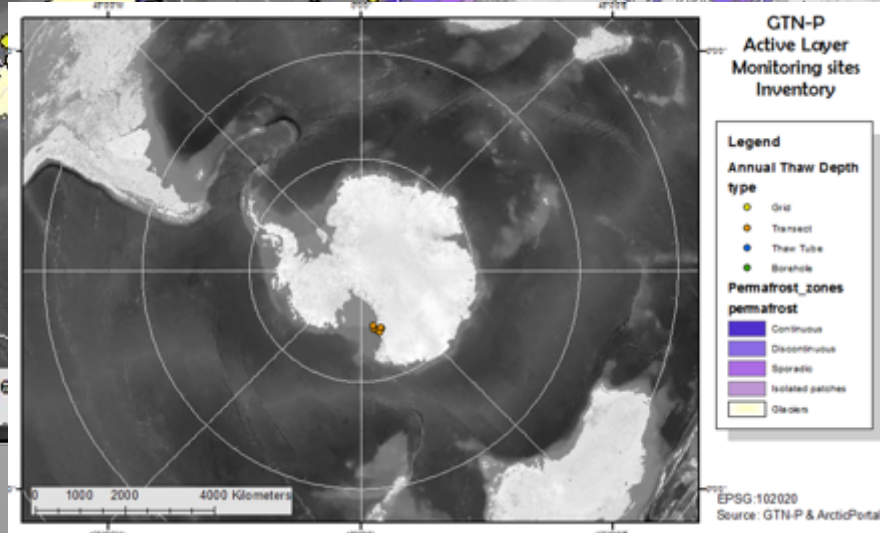
Legend

Annual Thaw Depth type

-  Grid
-  Transect
-  Thaw Tube
-  Borehole

Pemafrost_zones permafrost

-  Continuous
-  Discontinuous
-  Sporadic
-  Isolated patches
-  Glaciers



EPSG:102017
Source: GTN-P & ArcticPortal

ESA DUE Permafrost

- The main purpose of the ESA DUE Permafrost project is to define, demonstrate and validate, permafrost monitoring information service from local to large scale, mainly towards climate change studies and addressing the pan-boreal/arctic zone.
- Permafrost is a subsurface phenomenon and cannot be directly observed with satellite data. Yet, monitoring can be done based on indicators and via permafrost models.



Variable	Sensor	Spatial Coverage	Temporal Coverage	Resolution	Frequency
Surface Temperature	AATSR	panarctic	2005-2009	25 km x 25 km	Monthly
	MODIS	panarctic	since 2000	25 km x 25 km	Monthly
			since 2007		Weekly
		regional ¹	since 2007	1 km x 1 km	Monthly, weekly
Surface Soil Moisture	Metop ASCAT	panarctic	since 2007	25 km x 25 km	Weekly

Products

Land surface temperature
 Snow
 Land cover
 Terrain
 Landsurface hydrology

gtnpdatabase.org

Permafrost Temperatures

▼ Custom Search

Depth in meters Minimum: Maximum:

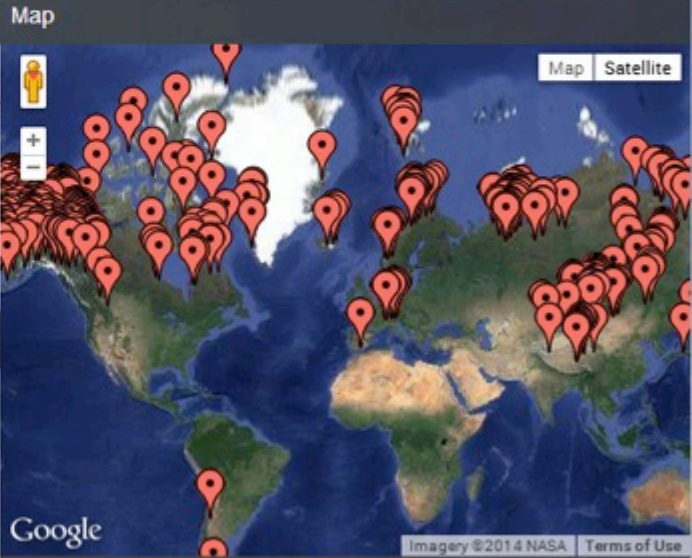
Vegetation Zone

Data

Search:

Name	Site	Country	GTN-P	Depth
Olkhon-Pit	Olkhon	Russia		3.65
Toolik Lake 1	Toolik Lake	United States	US 58	92
Tuymada 70	Yakutsk	Russia	RU 73 08_0002	70

Showing 1 to 3 of 3 entries (filtered from 1,073 total entries)



Map Satellite

Google

Imagery ©2014 NASA Terms of Use

Perform a detailed search through permafrost temperature sites

gtnpdatabase.org

Edit Borehole: Ahmelo lake 5_07*

General Drilling Measurement Observation Accessibility Disturbance SEO

General Information

Name *
Ahmelo lake 5_07*

GTN-P Code
RU 68 06_0015

Borehole Code
5_07*

Borehole Depth (m) *
15

Site *
Cherskii

Responsible Countries *
 Antarctica
 Argentina
 Austria
 Brazil
 Canada
 China
 Denmark

Timezone *
GMT +11:00 hours

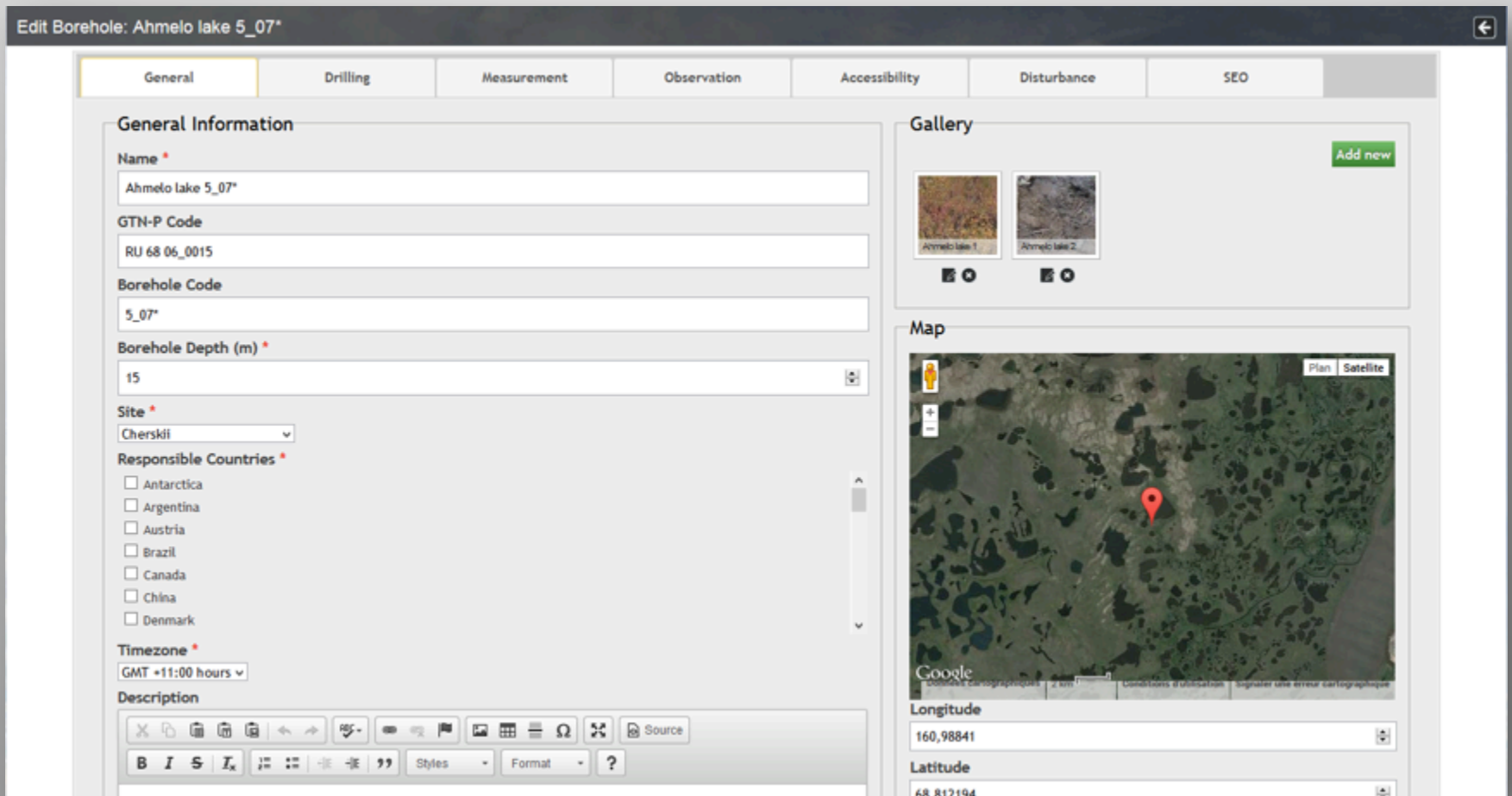
Description

Gallery Add new

Map

Longitude
160,98841







Latitude
68.812194



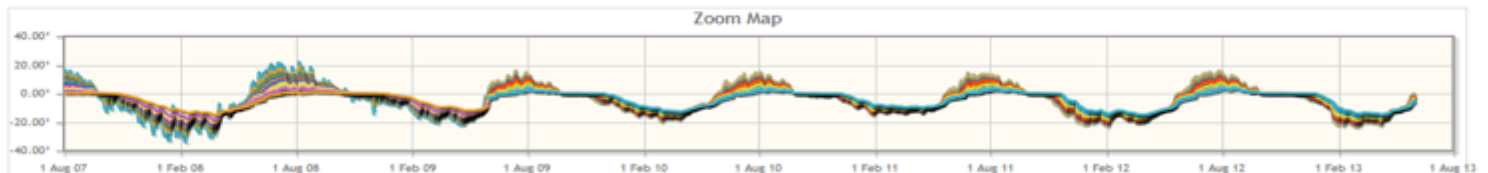
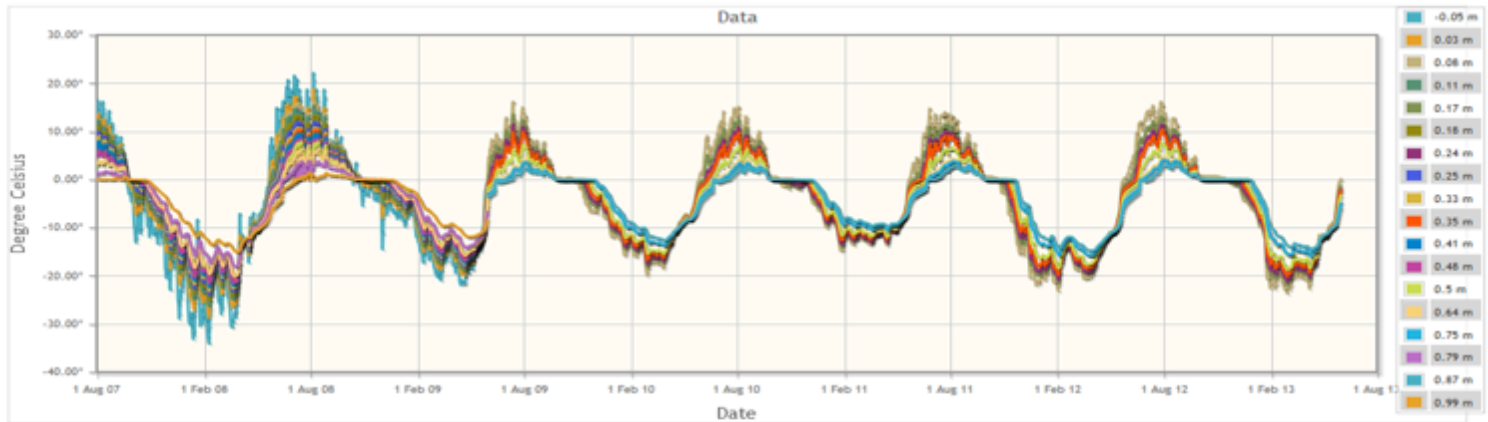
Edit Add a new Monitoring Site

Ground Temperature

Data Collections

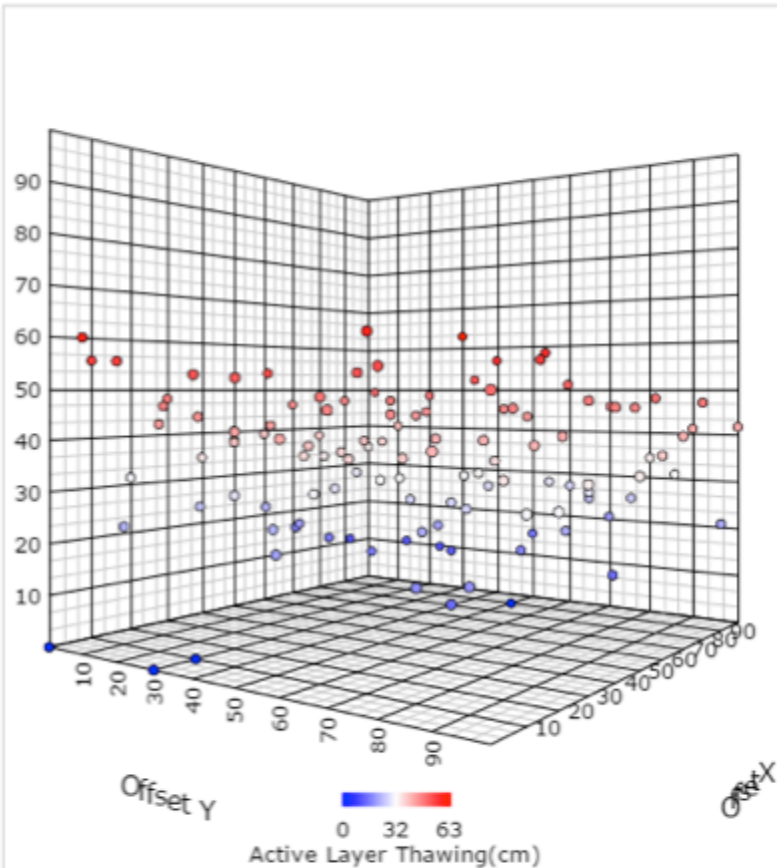
 Name: Franklin Bluf... From: 01. Aug 2007 To: 05. Aug 2008 Data Count: 5936 Null Values: 0.52 %	 Name: Franklin Bluf... From: 01. Jun 2008 To: 31. May 2009 Data Count: 5840 Null Values: 0.09 %	 Name: FBD_b_10 From: 01. Jun 2009 To: 31. May 2010 Data Count: 2920 Null Values: 0.00 %	 Name: FBD_b_11 From: 01. Jun 2010 To: 14. Aug 2011 Data Count: 3520 Null Values: 0.00 %	 Name: FBD_b_12 From: 01. Jun 2011 To: 31. May 2012 Data Count: 2928 Null Values: 0.00 %	 Name: FBD_b_13 From: 01. Jun 2012 To: 31. May 2013 Data Count: 2920 Null Values: 0.00 %
---	---	---	---	---	---

Published Data



Active layer Thawing

Date: 2006-09-26 00:00:00



Do we have wrong or old data. Let us know via [Email](#)

Data Collections



Name: R36_andryushk...
From: 22. Sep 2005
To: 17. Sep 2011
Data Count: 1573
Null Values: 3.12 %

Published Data

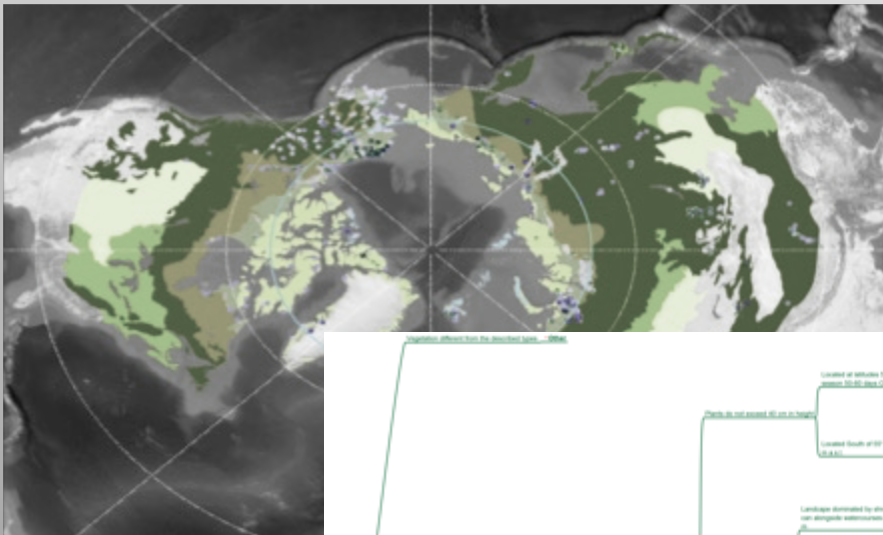
2005-09-22 00:00:00 2006-06-21 00:00:00 2006-09-26 00:00:00
2011-09-17 00:00:00

Update from October 2014

- Total number of data: **3317721**
- Total number of datasets: **1 361**
 - Surface Temperature (Satellite): **869**, datasets from 2000-2013
 - Ground Temperature: **144**, datasets from 1982-2014
 - Active Layer Thickness: **75**, datasets from 1992-2012
 - Surface Soil Moisture (Satellite): **75**, datasets from 1992-2012
 - Air Temperature: **30**, datasets from 2001-2013
 - Surface Temperature: **24**, datasets from 2001-2013
- Number of boreholes: **1 077**
- Number of active layer monitoring sites: **242**
- Deepest borehole: 1028 m ([Marryatt K-71, Canada](#))
- Longest Ground Temperature Record: **30 years, 1 month, 17 days**
([Umabybyt 20, Russia](#))

Assessing Vegetation Zones

- 9 vegetation zones
- Tutorial with decisive attributes, distribution and characteristic species
- Support for assessing vegetation zones



Vegetation Type *

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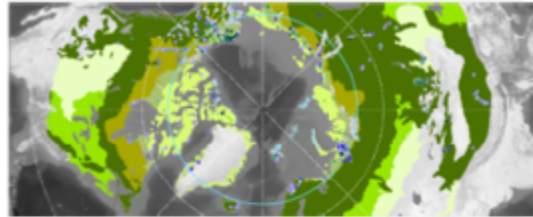
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- Polar Desert
- Tundra
- Shrub Tundra
- Forest Tundra
- Coniferous Forest
- Deciduous Forest
- Grassland
- No Vegetation
- Other



Assessing Vegetation Zones

Tutorial



In the following, a tutorial is provided showing how to assess vegetation types. There are nine vegetation types at choice which are subsequently described in detail and represented with maps, example pictures and pictures of common plant species. The classification and distribution of the vegetation types is orientated on two systems:

- Bioclimatic subzones in the Circumpolar Arctic, developed by the Panarctic Flora (PAF) initiative and the Circumpolar Arctic Vegetation Map (CAVM) project.
- Global Ecological zones (GEZ) spatial dataset developed by the Global Forest Resources Assessment (FRA) of the Food and Agriculture Organization of the United Nations (FAO).

Polar Desert
Tundra
Shrub Tundra
Forest Tundra
Coniferous Forest
Deciduous Forest
Grassland
No Vegetation
Other

GTN-P
PAGE21
DUE PERMANENT



Herschel Island

- The lengthening growing season on Herschel Island and slightly warmer winter temperatures in some years has led to an increase in the active layer depth over the last three decades.
- measuring the plants in the 12 long-term plots in two of the island's vegetation zones



Crossing metadata with vegetation

Analysis: boreholes per vegetation zones

- Coniferous Forest: 123=11.4%
- Deciduous Forest: 27=2.5%
- Forest Tundra: 127=11.8%
- Grassland: 89=8.3%
- No Vegetation: 129=12%
- Polar Desert: 38=3.5%
- Shrub Tundra: 121=11.2%
- Tundra: 296=27.5%
- Other: 127=11.8%

ALL: 1,077

- Monitoring long-term changes in vegetation, hence climate change



Thank you!

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