The Permafrost Information System PerSys – An Open Access geospatial data dissemination and visualization portal for products from ESA DUE GlobPermafrost

Sebastian Laboor[1], Guido Grosse[1], Sina Muster[1], Birgit Heim[1], Antonie Haas[1], Christian Schaefer-Neth[1], Ingmar Nitze[1], Annett Bartsch[2], Kirsten Elger[3]

[1] *Department of Periglacial Research, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany, sebastian.laboor@awi.de*
[2] *ZAMG Zentralanstalt für Meteorologie und Geodynamik, Vienna, Austria,*
[3] *Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences, Potsdam, Germany*

Abstract

The objective of the GlobPermafrost Project (2016-2019) initiated by the European Space Agency (ESA) is to better understand the global impact of changes in permafrost by providing earth observation data for the science community. For this purpose, various remote sensing products on the subject of permafrost are developed, discussed and optimized with the users of these products. The Permafrost Information System (PerSys) was developed for the user-friendly provision and visualization of these data products and is part of the Arctic Permafrost Geospatial Center (APGC). The PerSys Data Catalogue allows users to conveniently search for permafrost related datasets, obtain descriptions and previews, receive information on data prototypes and download the final published data products. The PerSys WebGIS provides detailed visualizations of the data products and their attributes and enables users to compare and combine several datasets.

Keywords: Permafrost Information System, ESA GlobPermafrost, Remote Sensing, Data Catalogue, WebGIS

Introduction

Permafrost is an important component of the Cryosphere, which is affected by rapid warming of the Arctic. The degradation and thaw of permafrost in vertical as well as lateral directions results in a reduction of permafrost in high latitudes and high altitudes. Since permafrost affects the ecosystem conditions of the about 23 million square kilometer large permafrost region, its loss has strong effects on hydrology, geomorphology, biogeochemistry, and biota. Remote sensing has become an essential tool for quantitatively detecting and monitoring changes in permafrost and associated landscapes over large regions and with repeated observations.

Remote sensing based products for the permafrost region are quickly growing in numbers. However, different storage locations, formats and observation targets pose a challenge for the usability of valuable datasets. The European Space Agency (ESA) has supported permafrost-focused remote sensing activities in two recent projects, ESA DUE Permafrost (2009-2012) and ESA DUE GlobPermafrost (2016-2019; http://www.globpermafrost.info). The ESA DUE Permafrost project with spatial coverage of the northern hemisphere developed, validated and implemented earth observation to support research communities and international organizations in their work on better understanding permafrost characteristics and dynamics. Now, the GlobPermafrost project expands on this successful approach by including both polar hemispheres as well as mountain permafrost regions.

Here we present the Permafrost Information System (PerSys), which combines a comprehensive data catalogue and a state-of-the art WebGIS within the framework of the ESA DUE GlobPermafrost project.

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ESA GlobPermafrost Products

Products in GlobPermafrost cover different aspects of permafrost by integrating in-situ measurements of subsurface properties and surface properties, earth observation, and modelling. Currently, the GlobPermafrost team is creating prototype datasets for defined remote sensing derived products and targeting various user groups across 5 broad themes: permafrost extent, permafrost-specific land cover classes, hotspot regions of permafrost change, local sites of high research interest in the user community ("cold spots"), and mountain permafrost (see Table 1). Registered users are able to assess the usability and validity of the products

and provide feedback to the GlobPermafrost team. The feedback of the user groups is used to improve the developed remote sensing products.

Table 1. GlobPermafrost products.

Product	Example Datasets
Coldspot	Bedfast (Grounded) Lake Ice from Sentinel-1A
	Land Cover Classification from TerraSAR-X
Hotspot Region of Permafrost Change	Trends of land surface change from Landsat time-series 1999-2014
Land Cover Prototype	Land Cover Prototype Wetness Level
	Land Cover Prototype Shrub Height
	Winter Backscatter Classes from Sentinel-1
	Land Cover Classification from Sentinel-1 and Sentinel-2
Mountain Permafrost	Rockglacier Inventory with Indication of the State-of-activity
	InSAR-derived Surface Deformation Map
Permafrost Extent and Properties	Ground Temperature Map of the Northern Hemisphere Permafrost Region

Permafrost Information System

To bring the resulting data products closer to the permafrost user communities, the Permafrost Information System (PerSys) has been conceptualized as an open access geospatial data dissemination and visualization portal for remote sensing derived datasets produced within the GlobPermafrost project. The prototype and final remote sensing products and their metadata will be visualized in the PerSys WebGIS and described via the PerSys Data Catalogue. The WebGIS visualization is managed via the AWI WebGIS infrastructure maps@awi (http://maps.awi.de) relying on OGC-standardized Web Mapping Service (WMS) and Web Feature Service (WFS) technologies for data display and visualization. The PerSys WebGIS projects allow visualization of raster and vector products such as land cover classification, Landsat multispectral index trend datasets, lake and wetland extents, InSAR-based land surface deformation maps, rock glacier velocity fields, spatially distributed permafrost model outputs, and land surface temperature datasets. Each of these WebGIS projects is adapted to the spatial scale of the specific products, ranging from local to hemispherical coverage. The PerSys Data Catalogue provides metadata and access to all mature-state and final-state GlobPermafrost products.

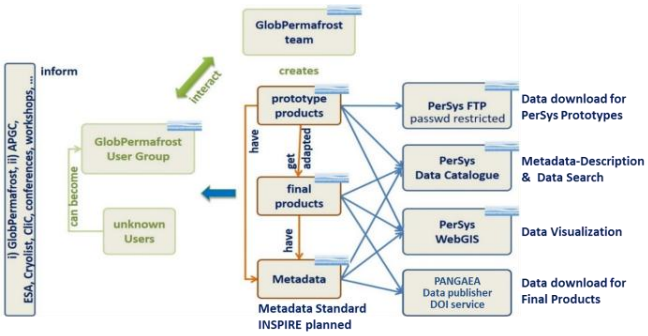

Figure 1. PerSys conception.

PerSys can be accessed through the GlobPermafrost project webpage. PerSys is also a core component of the Arctic Permafrost Geospatial Center (APGC), a geodata portal for permafrost launched within the framework of the ERC PETA-CARB project at the Alfred Wegener Institute Helmholtz Centre for Polar- and Marine Research. The APGC framework features a range of permafrost-specific geospatial data projects, including PerSys, and will allow searching for project-specific geospatial data by tags, keywords, data type and format, licence type, or by location. PerSys is available within APGC since early 2017.

In addition, the Open Access data library PANGAEA, as a certified member of The International Council for Science (ICSU), serves as permanent archive for the GlobPermafrost final products, providing permanent Digital Object Identifiers (DOIs) for each archived dataset. The ESA DUE Permafrost final products are already published in PANGAEA under DOI doi:10.1594/PANGAEA.780111.

The final GlobPermafrost remote sensing products published in PANGAEA will remain visualized in the PerSys WebGIS and catalogued, searchable and accessible via the PerSys Data Catalogue.

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