DUE PERMAFROST: a spaceborne permafrost monitoring and information system

Birgit Heim, Julia Boike & SPARC, Hans-Wolfgang Hubberten

Alfred Wegener Institute for Polar and Marine Research,
Periglacial Section, Potsdam, Germany

Annett Bartsch, Wolfgang Wagner

Vienna University of Technology, Austria

RESPONSE

REmote Sensing of POlar Non-glaciated and Sensitive Environments

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PERMAFROST

Permafrost is defined as ground
(soil/rock and
included ice or organic material)
that remains at or below 0°C
for at least two consecutive years.
(International Permafrost Association IPA)

IPA coordinates the Global Terrestrial Network for Permafrost GTN-P

Prof. H.-W. Hubberten: **IPA president**
at AWI Potsdam, since July 2008**: IPA Secretariat**

Birgit Heim, birgit.heim@awi.de
Alfred Wegener Institute for Polar and Marine Research

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currently guest scientist at AWI Potsdam, 1rst quarter 2010:

- *Prof. V. Romanovsky*, **Head of Geophysical Institute Permafrost Laboratory GIPL, UAF Alaska**

- GIPL permafrost model
- leads IPA permafrost model group

Birgit Heim, birgit.heim@awi.de
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RESPONSE

REmote Sensing of POlar Non-glaciated and Sensitive Environments

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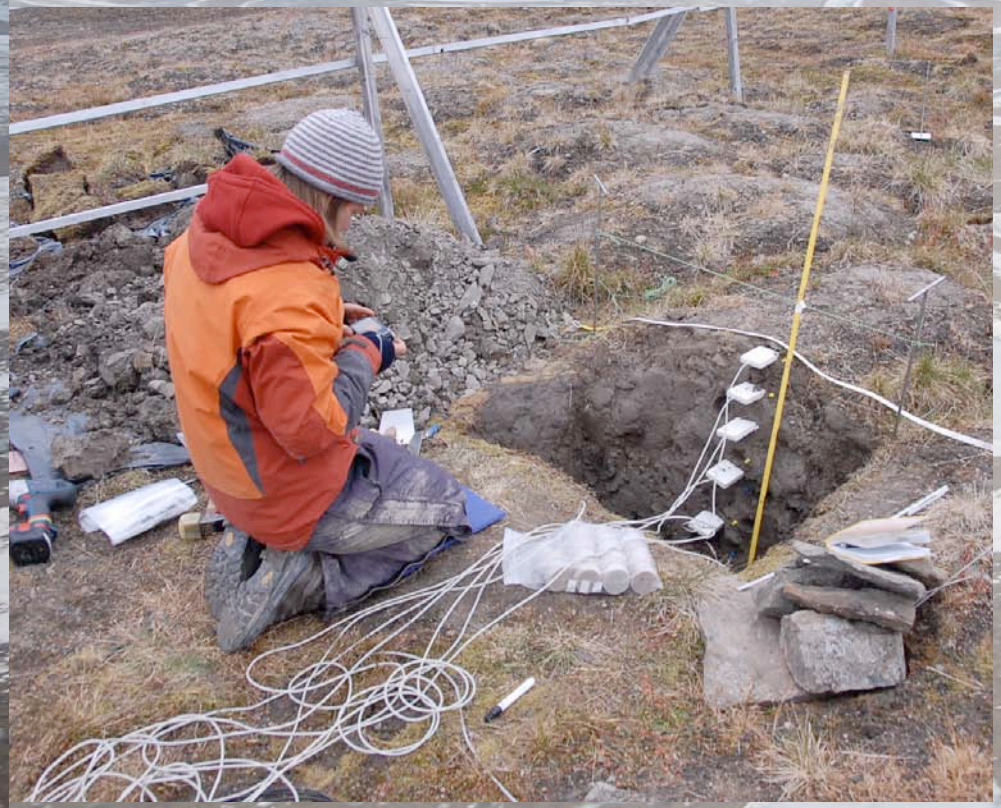
AWI: ground data, validation, scaling, remote sensing for permafrost applications

RESPONSE



SPARC

Sensitivity of Permafrost in the Arctic

-a multi-scale perspective-

HGF Un. Young Investigator Research group,

lead *Julia Boike*

NASA-LCLUC (2nd GOA) WP YAMAL,
Arctic Centre, Rovaniemi, Finland 08-10/03/2010

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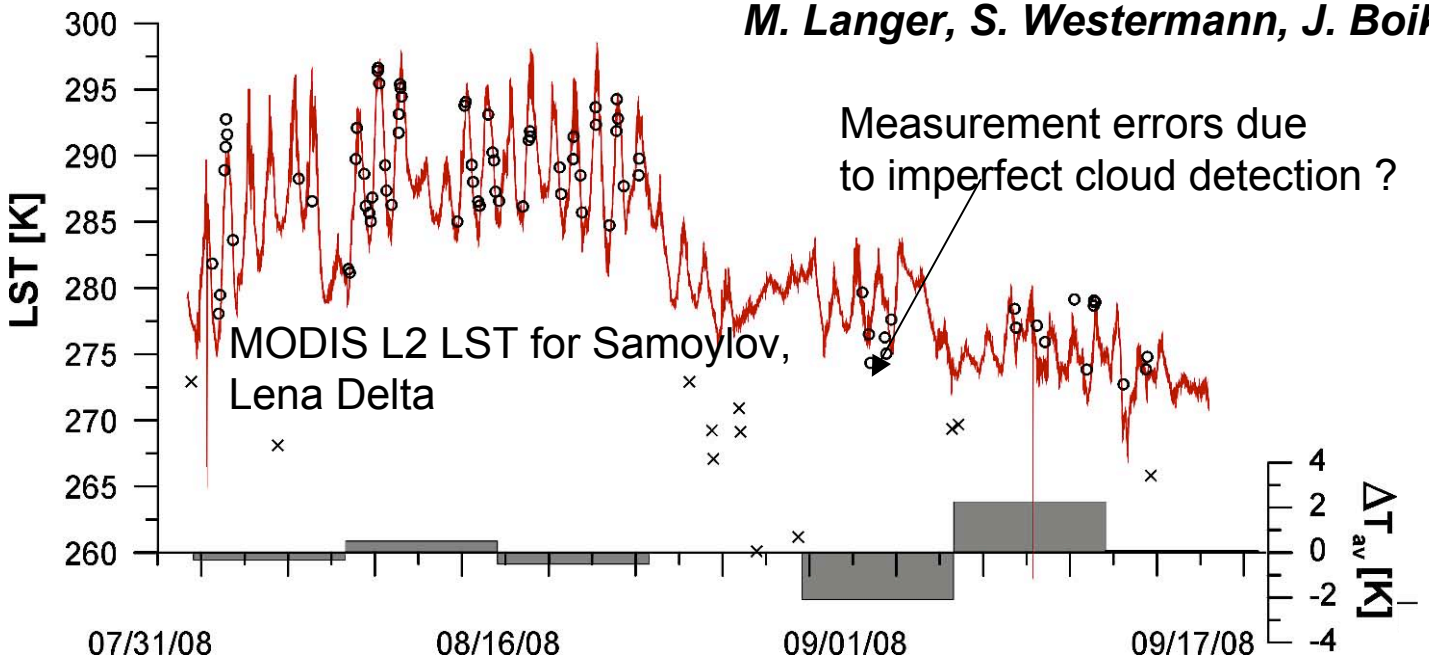
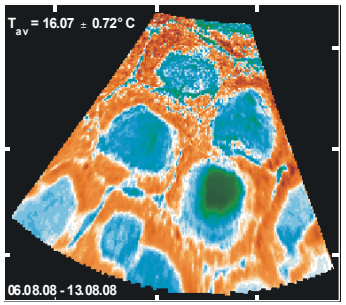
M. Langer, S. Westermann, J. Boike, subm. to RSE 2009





thermal camera Samoylov, Lena Delta

-ground truthing for MODIS LST data with upscaled thermal camera images

-improvements of MODIS cloud mask necessary to avoid significant negative bias of LST average values, especially during predominantly cloudy periods

-weekly averages of MODIS LST are reliable for predominantly cloud-free periods, but robust gap-filling techniques are indispensable during cloudy periods

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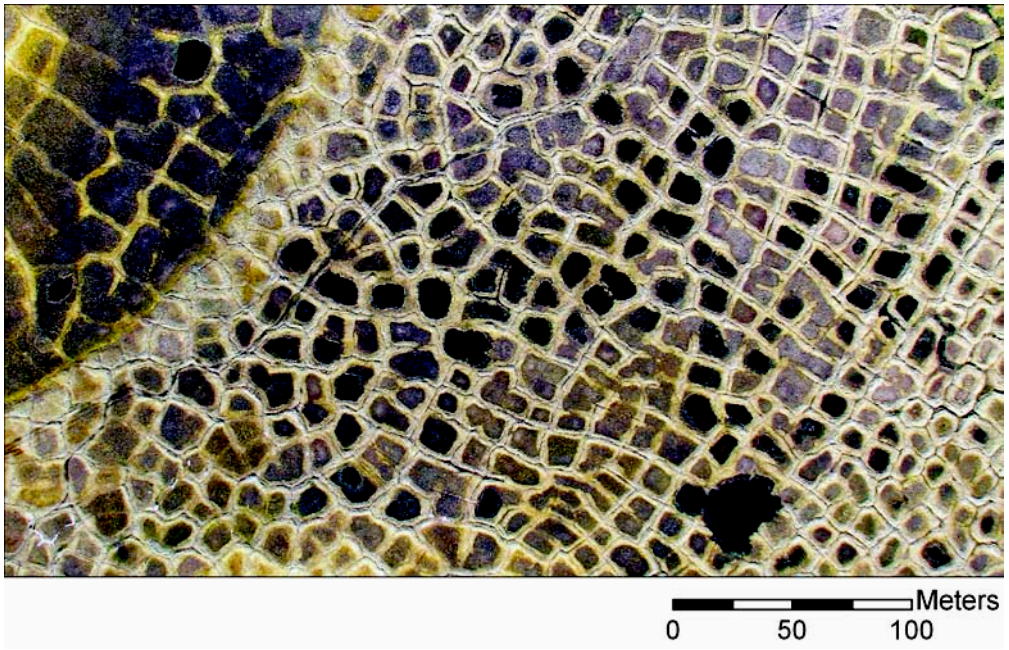
needs for upscaled information within the pixel

ponds & lakes
the water body ratio
in coarser-scaled RS data
needs to be known
to understand the physical
and bio-physical properties



zoom into orthophoto mosaic, Samoylov Island

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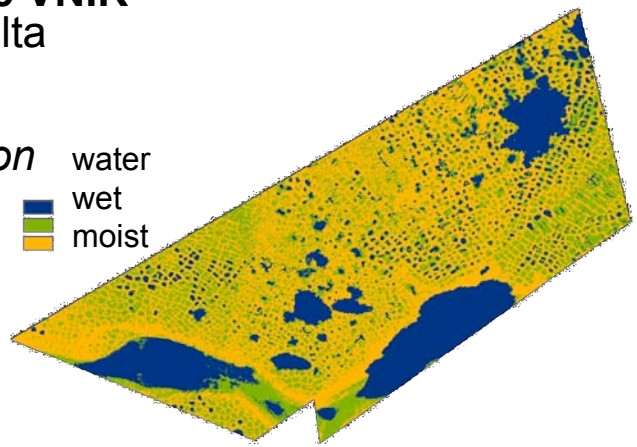
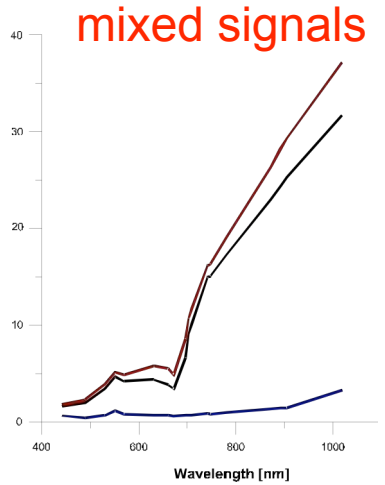
multi-temporal airborne VNIR
Samoylov, Lena Delta

2008-08-09
surface classification



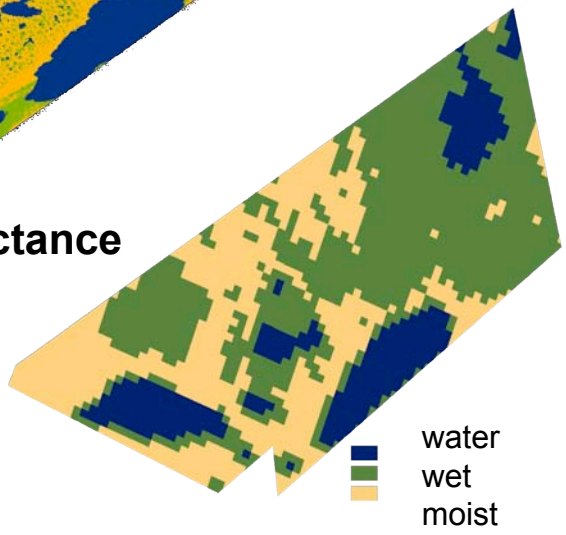
S. Muster, M. Langer, J. Boike, AGU C51C-4901

CHRIS Reflectance
water, wet, moist



multi-temporal hyperspectral VNIR reflectance CHRIS/Proba
Samoylov, Lena Delta

2008-07-23
surface classification



water body ratio influences bio/geo/physical parameters

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Welcome to the Website of the Project

DUE PERMAFROST

http://www.ipf.tuwien.ac.at/permafrost/

ESA DATA USER ELEMENT (DUE) Permafrost :

Earth Observation monitoring system of

permafrost extent, change,

related products

(local, regional, panscale)

supporting the **GCOS** &
permafrost monitoring activities
of national and intergovernmental bodies and scientific groups.

<u>based on mostly existing satellite products
of permafrost indicators and parameters used for modeling</u>

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DUE Permafrost: June 2009 – Nov 2011

- consortium:

Lead: Annett Bartsch

Vienna University of Technology, Austria

soil moisture, freeze/thaw, WEBGis

University of Waterloo, Canada

surface temperature

Friedrich Schiller University Jena, Germany

Land cover, vegetation

Gamma Remote Sensing, Switzerland

DEM, subsidence, EO Permafrost Information System

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User interaction together with **IPA**, **validation of RS products**

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required RS services and products

developed <u>with active participation of Users</u>

ground based measurements <u>provided by Users and networks</u>

validation of services <u>with active participation of Users</u>

*To identify conditions, for which the products are **invalid/valid***
*To provide an estimation of **'environmental' or 'thematical' accuracy***
To lend confidence in their scientific utility

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Core User Group:

AWI Potsdam, Germany

GSC, Earth Sciences Sector, Canada

Permafrost Laboratory, UAF, Fairbanks, USA

IARC, UAF, Fairbanks, USA

Lomonossov University, Moscow, RU

Melnikov Permafrost Inst., Yakutsk, RU

HOKUDAI, Hokkaido, Japan

State Hydrological Institute, St. Petersburg, RU

Max Plank Institute MPI, Jena, Germany

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associated users:

- *circumarctic ACCO-Net Group*
- *Arctic and Antarctic Inst. AARI, St. Petersburg, RU*
- *Otto Schmidt Laboratory OSL, St. Petersburg, RU*
- *University of Vienna, Ecosystem Res., Austria*
- *Senckenberg Inst., Weimar, Germany*
- *University of Hamburg, Klima Campus, Germany*
- *HGF GeoResearch Centre Potsdam GFZ, Potsdam, Germany*
- *HGF GKSS Inst., climate models, Germany*
- ***ongoing process***

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Input, harmonization, validation of existing EO products

Surface Temperature - MODIS, ENVISAT AATSR

Surface moisture; freeze/thaw –microwave RS

Snow from ESA GLOBSNOW
(coordinator: FMI Finnish Meteorological Inst.)

GLOBSNOW

Terrain
ASTER DEM–regional evaluation, national DEMs, regional SAR-DEM subsidence: new application for tundra & wetlands

Landcover & Disturbances
ESA Glob-Projects
+ SAR product ‚peatlands'

GLOBCOVER GLOBCARBON

Birgit Heim, birgit.heim@awi.de
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Integration of CAVM

Partner JENA *will construct harmonized ESA Glob-Vegetation Products (according the LCCS terminology) for the pan-permafrost areal domain (includes boreal regions)*

→ *1.: ESA DUE vegetation products: LCCS vegetation map (global classes), disturbances, 300 - 500 m res.*

can we exchange with you and produce in addition

→ *2.: Arctic vegetation products with LCCS class polygons assigned to CAVM physiognomic vegetation units?*

(as part of the AWI engineering)

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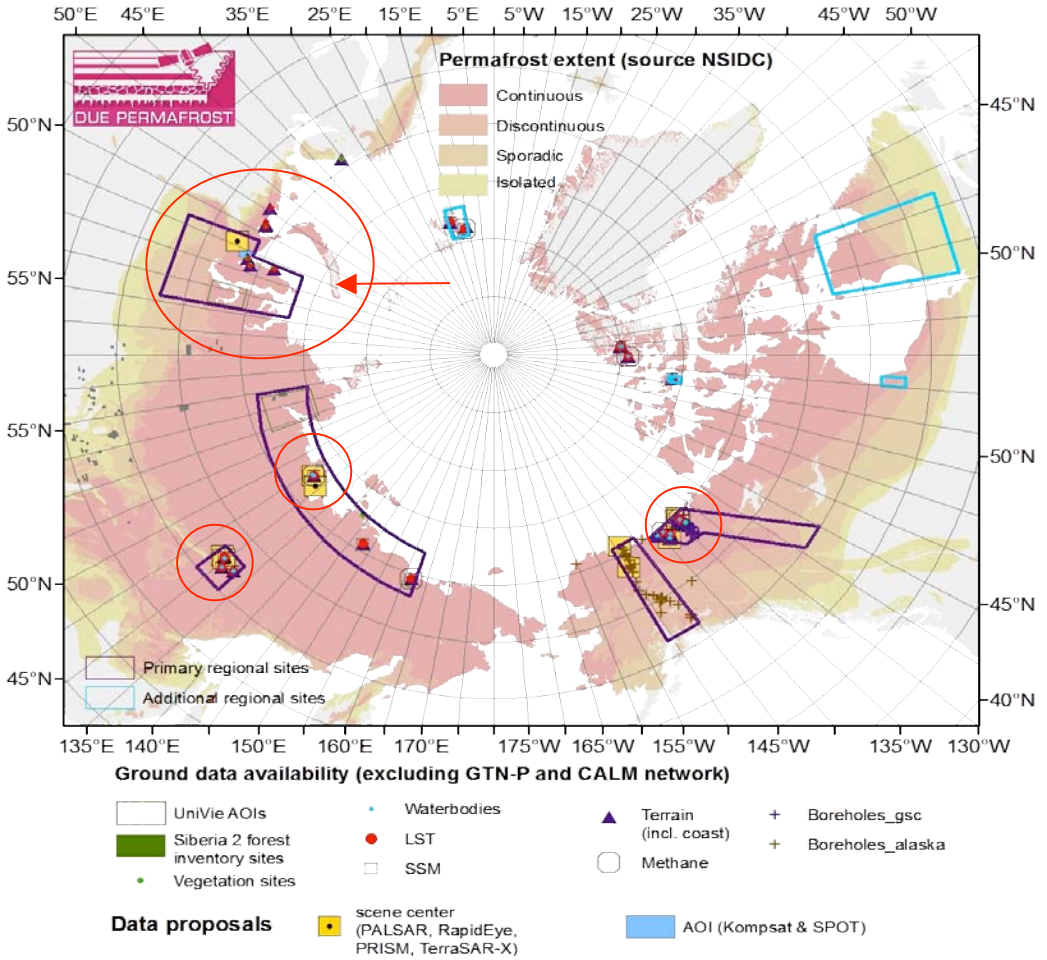
pan-permafrost areal region

and

regional service case regions

[blue squares]

(availibility of ground data and RS products; high User interest)



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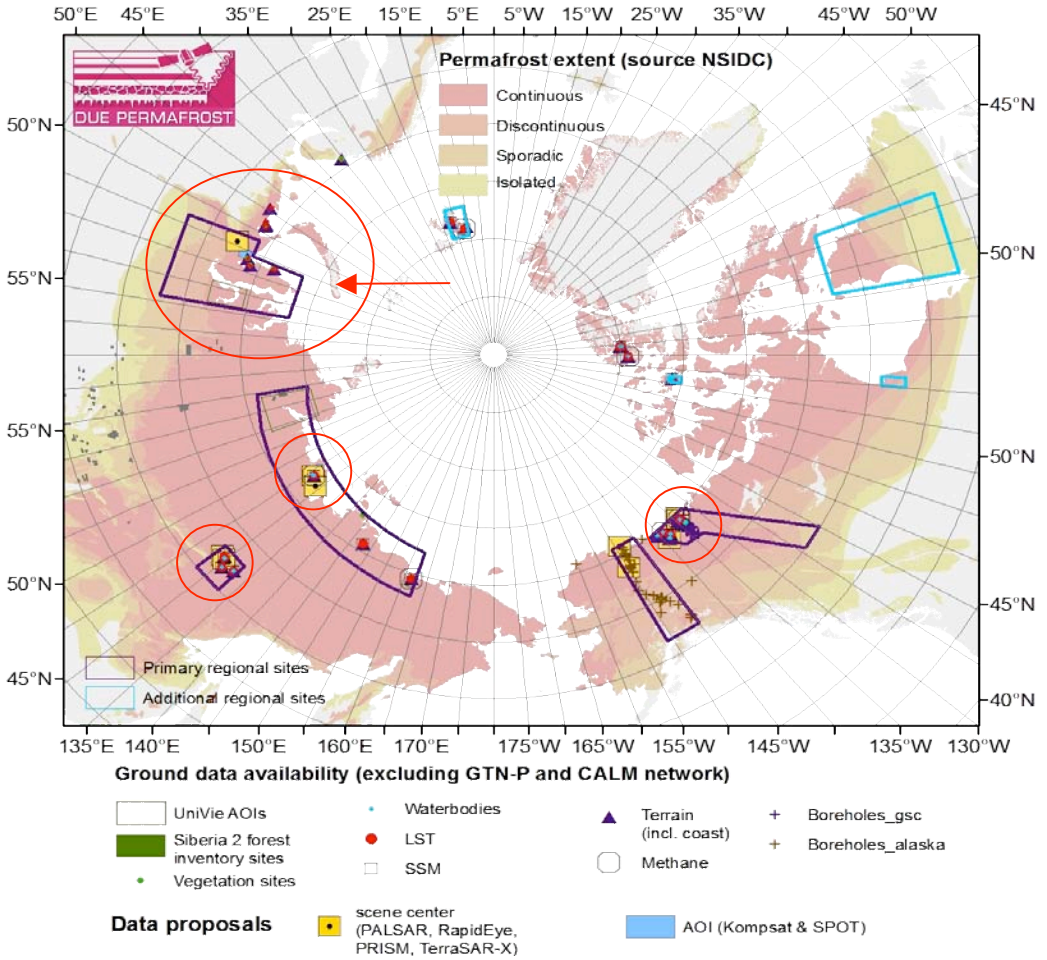
model requirements

we need to prepare secondary products

e.g. GIPL permafrost model: thermal conductivity of surface materials in thawed/frozen state

we need to generate additional gridded fields for service case regions

e.g. GIPL and permafrost-including climate models: soil properties highly important



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model requirements

as part of the AWI – USER engineering
start in April 2010 for the GIPL permafrost model (UAF Alaska):

→ *preparation of gridded input data (secondarily derived parameters mostly from vegetation, additional pedogenic information, ...)*
for the regional areal domains

can we exchange with you for
- *the YAMAL peninsula regional domain?*
- *the circum-arctic CAVM areal domain in terms of secondarily derived parameters from vegetation?*

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please feel invited to the

1rst ***DUE PERMAFROST*** *User Workshop in Vienna on 2/5/2010 (Sunday before EGU week)*

http://www.ipf.tuwien.ac.at/permafrost/

-> mail to Annett Bartsch ab@ipf.tuwien.ac.at

experience and exchange is welcome

THANK YOU

Birgit Heim, birgit.heim@awi.de
Alfred Wegener Institute for Polar and Marine Research

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