

# CRYOLINK – Permafrost and seasonal frost in Southern Norway

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## CRYOLINK

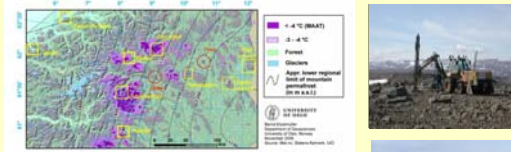
CRYOLINK will contribute to improve understanding of permafrost and seasonal frost in mountainous areas of southern Norway.

CRYOLINK aims to apply existing and develop new modelling tools to address the near-surface heat transfer processes and the temporal and spatial distribution and variability of ground temperatures, thaw and freeze depths.

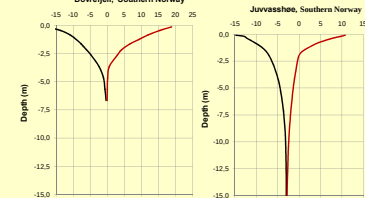
CRYOLINK will

- establish valid N-factors describing the influence of snow, vegetation and substrate for the near-surface energy exchange processes, by using new and existing temperature monitoring networks
- will use and further develop 1D and 2D transient heat flux models
- will use and further develop spatially distributed equilibrium and transient heat-flux models to produce fields of ground temperatures, depths of active layer thickness and seasonal ground freezing, as well as an assessment of thermal response to past and future climate change
- will communicate the results to the public through maps published in WEB-pages

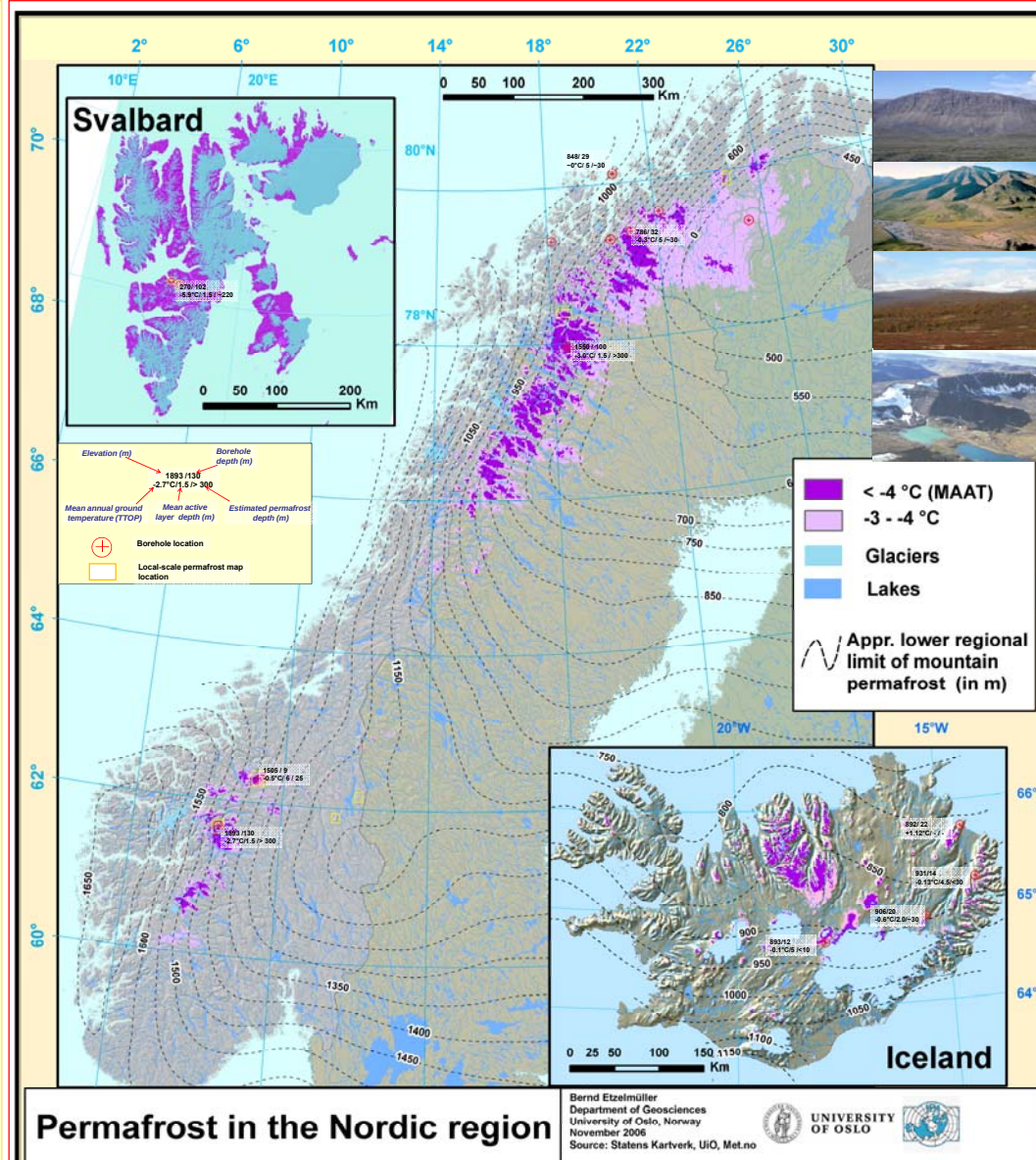
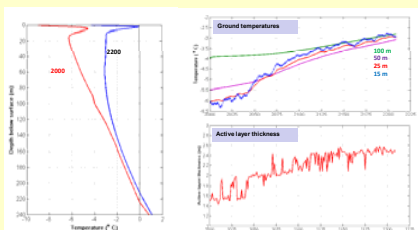
## Module 1 – Field data sampling, shallow bore hole monitoring and local scale modelling



RT1 is responsible for the field instrumentation and data sampling. Focus is the acquisition of additional high-quality data for addressing the surface and thermal offset processes, and deriving valid factors for the transfer functions used in the equilibrium models. The core of the field instrumentation will be shallow bore holes drilled along a cross-section from the valley to the mountain top, in different topographic and geological settings.



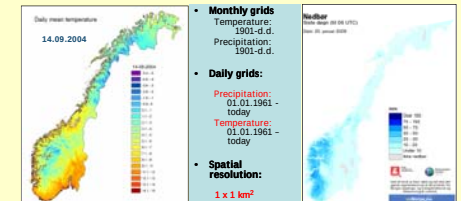
## Module 2 – Local-scale numerical modelling (1D, 2D)



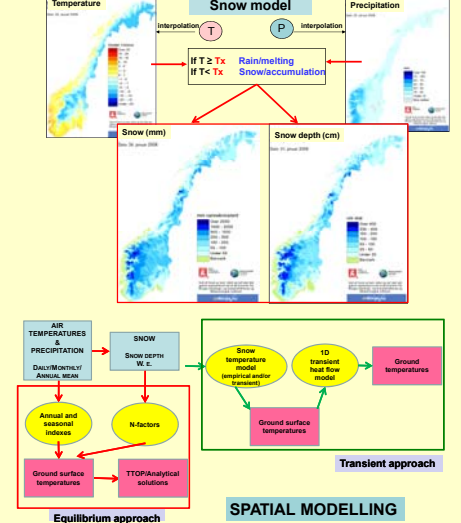
Simulations of the transient distribution of subsurface temperatures will be carried out using physically-based 1D and 2D transient heat flux models, under development at UiO. We have a fully developed 1D model available, capable of modeling ground temperatures forced by annual, monthly or daily ground surface temperature input values. The model solves the heat flux equations and takes latent heat due to freezing/ thawing into account. The model domain is prescribed in terms of water content, soil density, geothermal heat flux, thermal conductivity and heat capacity.

## Module 3 – Regional-scale numerical modeling

Gridded temperature and precipitation data



The derivation of snow and soil property factor ( $N_f$ ,  $N_t$  and  $R_k$ ) spatial fields is the first step, by quantifying the temperature buffering effect of the snow cover (surface offset) driven by a snow model (SMM, NVE/Met.no). Thawing  $N$ -factors and the influence of vegetation will be addressed by comparing the gridded air temperatures with measured ground surface temperatures. Basic data will be available concerning the geology, vegetation and soil in *Norge Digital* (digital database of Norway about environmental variables). The distribution of block fields, which are important because of cold air ventilation, will be mapped by conventional satellite-based image classification using Landsat VII images. As a second step, we will apply an *equilibrium-based spatial model*. We will use the SMM to estimate mean snow depth, water equivalent and duration to derive  $N$ -factor fields. As a third step a transient heat-flow model will be applied for each grid cell.



## National and international collaboration

Project home page: [www.geo.uio.no/cryolink/](http://www.geo.uio.no/cryolink/)

Department of Geography, University of Ottawa: Prof. A.G. Lewkowicz  
University of Ottawa, <http://www.uottawa.ca/welcome.html>  
Geography: <http://www.geography.uottawa.ca/>

University of Alaska, Fairbanks: Prof. V. Romanovsky  
University of Alaska Fairbanks, <http://www.uaf.edu/>  
Geophysical Institute, <http://www.gi.alaska.edu/>  
Permafrost Laboratory, <http://www.gi.alaska.edu/snowice/Permafrost-lab/>