EGU General Assembly 2022
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This presentation participates in OSPP

Arctic cover seen as porous media : Numerical Assessment of Hydraulic and Thermal Properties of Cryptogamic Cover of Western Siberia

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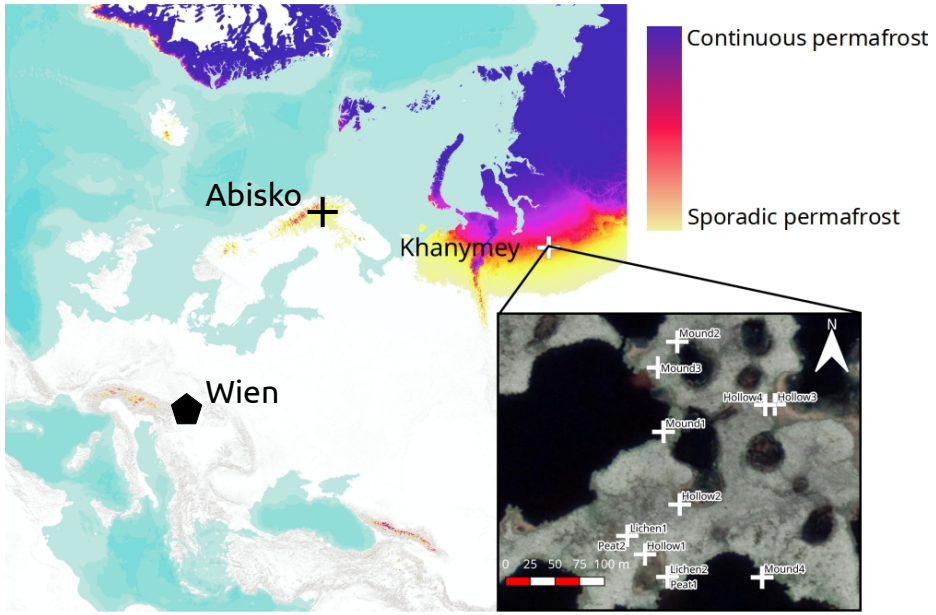
Outstanding Student Poster & PICO Contest

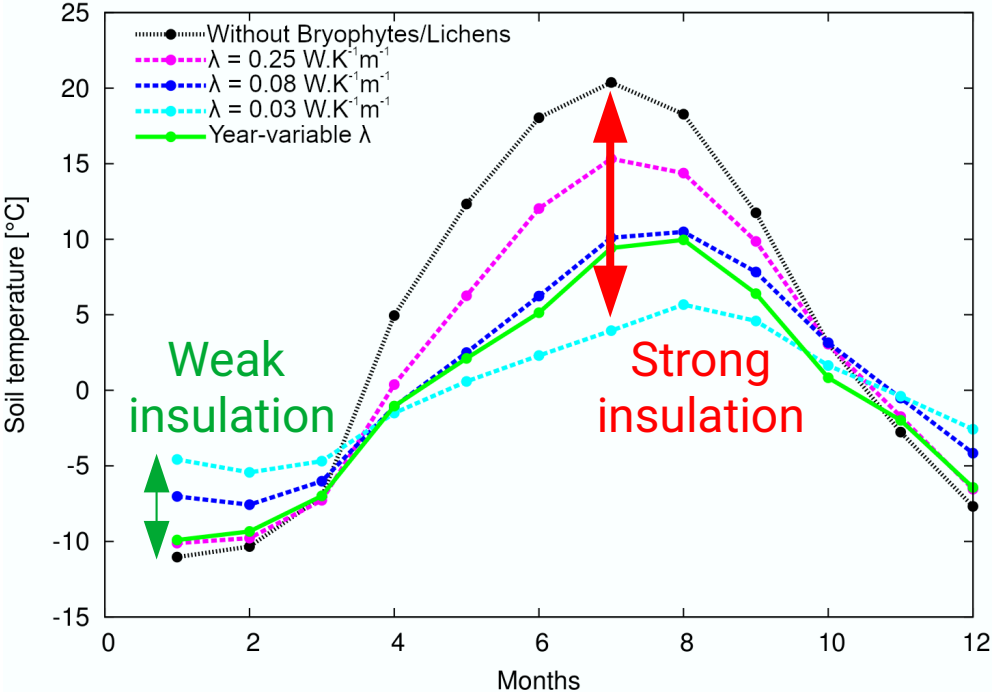
Abstract

A project of HiPerBorea

Cryptogamic cover and climate change



Study site location and permafrost extension map (Gruber, 2012)



JSBACH Model with variable thermal conductivity λ
(adapted from Porada et al., 2016)

Main energy driver : Evapotranspiration
Launiainen et al., 2015

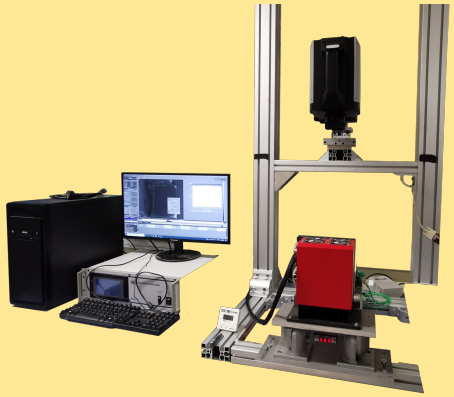
Hydraulic & Thermal properties assessment

Coupled Experimental & Numerical setups

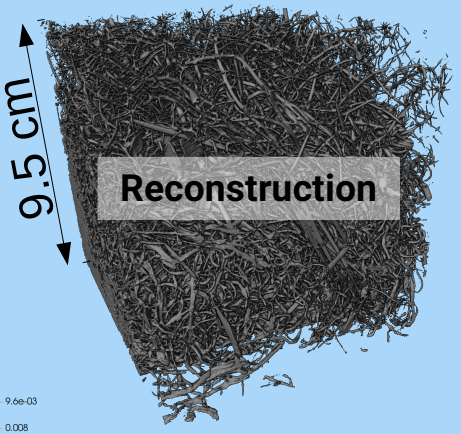
HiPerBorea

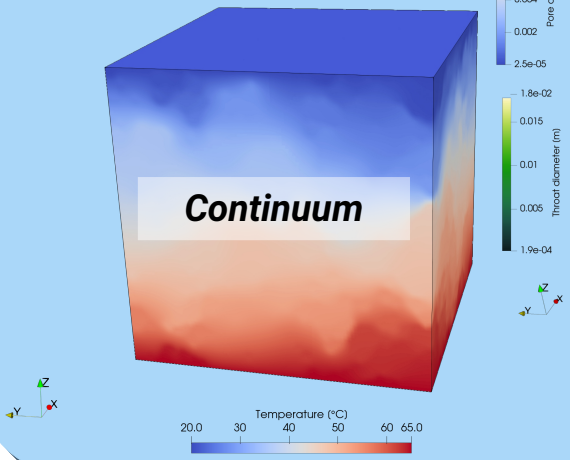
Experimental setups

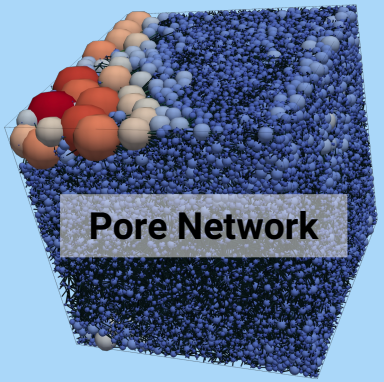
X-ray Computerized Tomography (X-CT), IMFT



Thermal camera acquisition chain







Numerical setups

Hydraulic properties : numerical setups

Thermal properties : numerical & experimental setups

Reduction of artifacts & coupled validation are possible

Uncovering hydraulic properties

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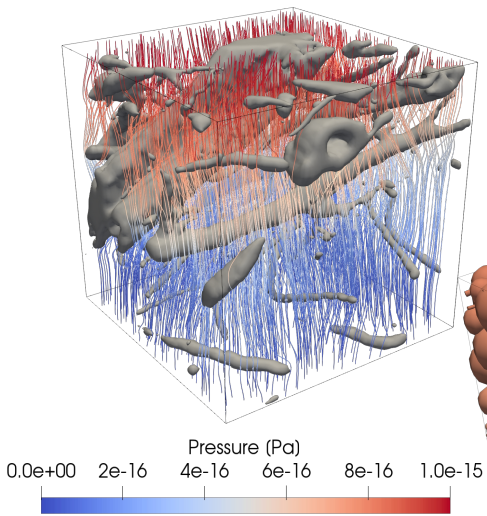
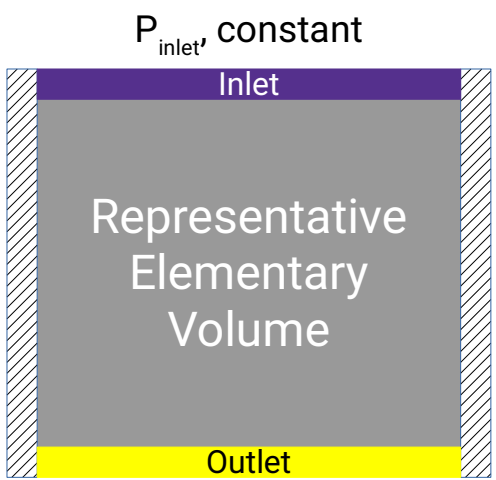
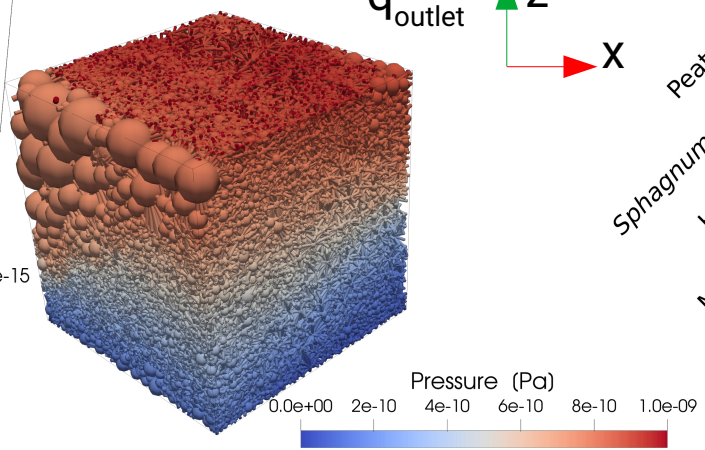
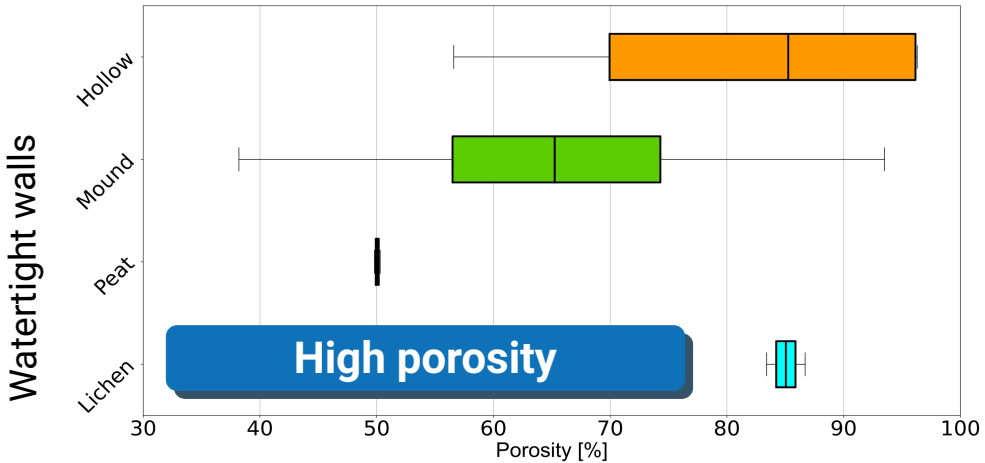
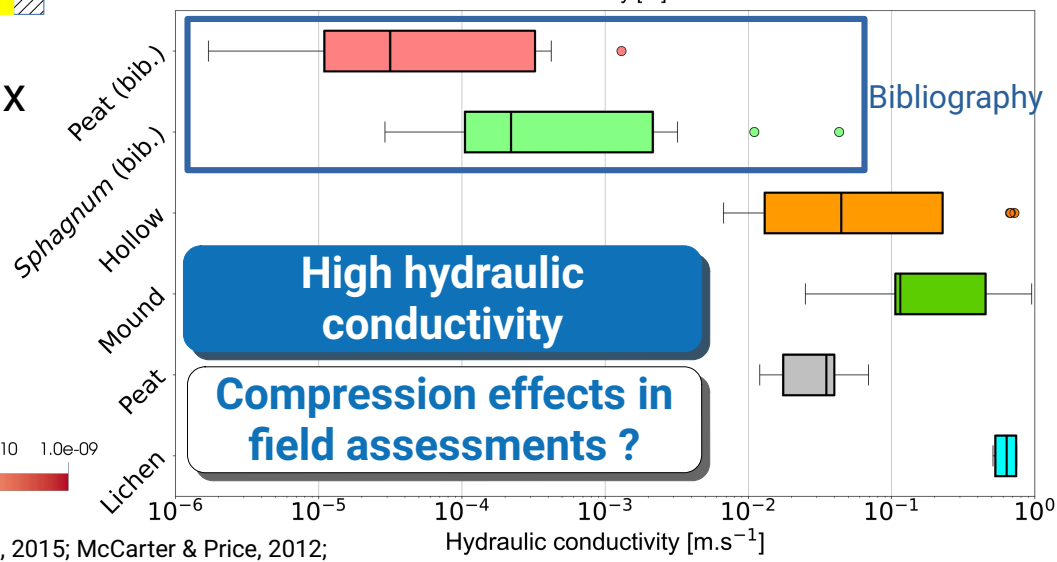
DNS for porosity-homogeneous samples, PNM for the others





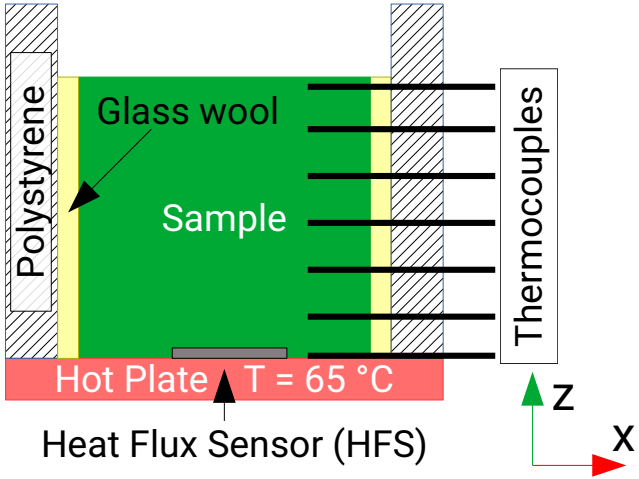




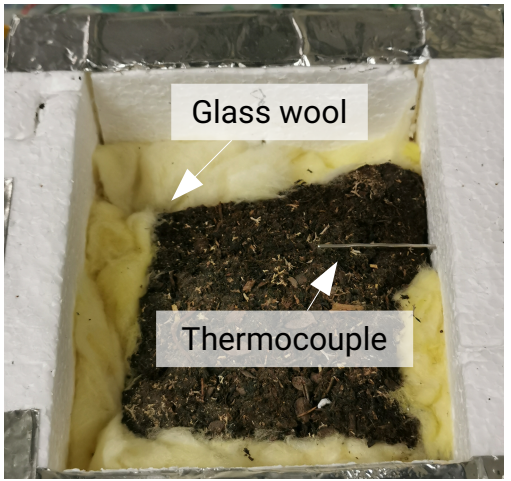


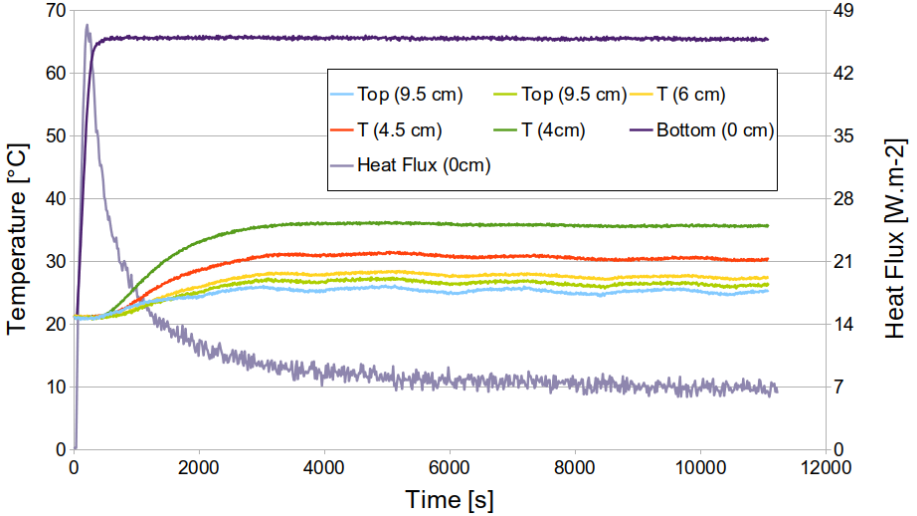
Conductivity values: Golubev et al., 2021; Weber et al., 2017; Crockett et al., 2016; Hamamoto et al., 2015; McCarter & Price, 2012; Price et al., 2008; Quinton et al.,2000; Päivänen et al., 1973

Experimental thermal properties assessment

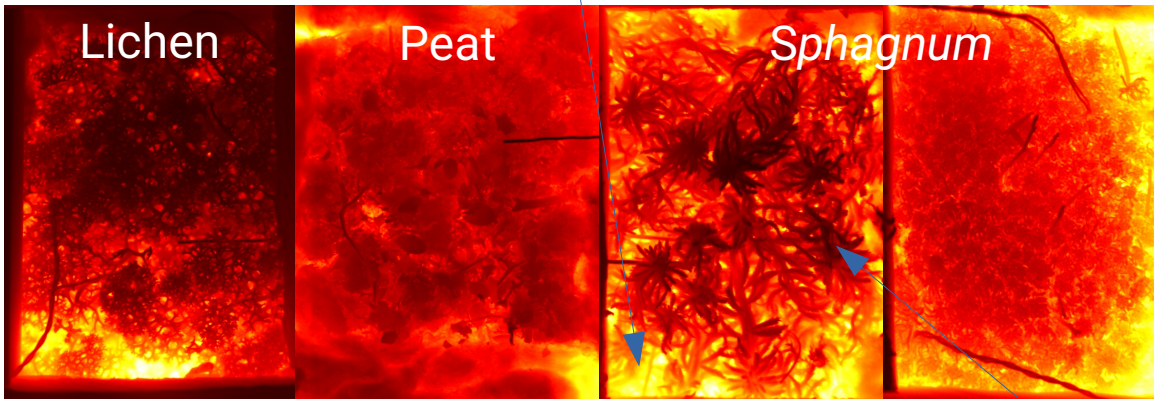


Experimental setup





Temperature profiles at different depths during a constant heating at 65 °C



Thermal images of each studied sample type

Strong insulation properties, low thermal diffusivity

Quantification of α, λ and Cp to come

Outlook: Coupling with numerical simulations

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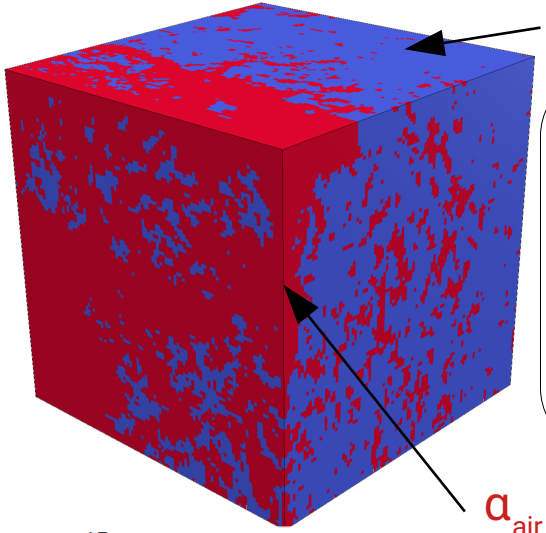


$\alpha_{peat} = 4.10^{-7}\ m^2.s^{-1}$

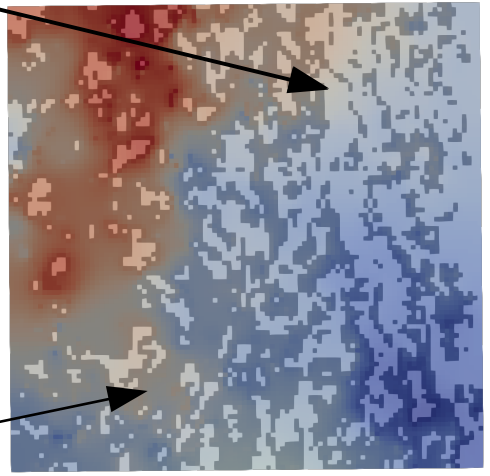
+10 °C difference for a given depth

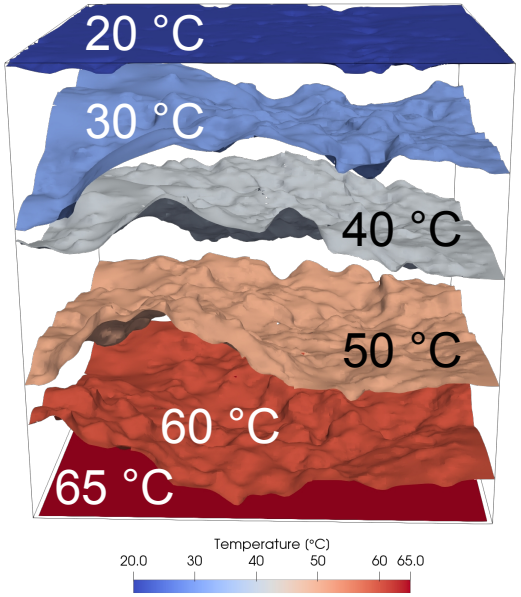
↓

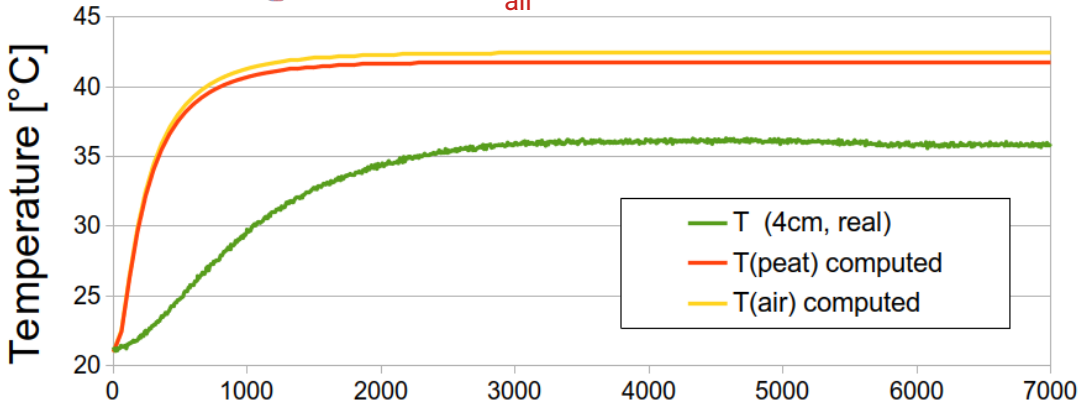
Same as IR camera

$\alpha_{air} = 2.10^{-5}\ m^2.s^{-1}$

Surface temperatures at *z* = 4cm and thermal isotherms at thermal equilibrium







Comparison between computed and measured temperatures

Hydraulic & Thermal properties for variably saturated porous media

High Performance Computing at catchment-scale including cryptogamic cover

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Sharing is encouraged

Thank you for your attention !

contact: simon.cazaurang@imft.fr

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