S1906. Numerical assessment of thermo-hydraulic properties of Sphagnum moss, lichen and peat from a permafrost-dominated Arctic wetland.

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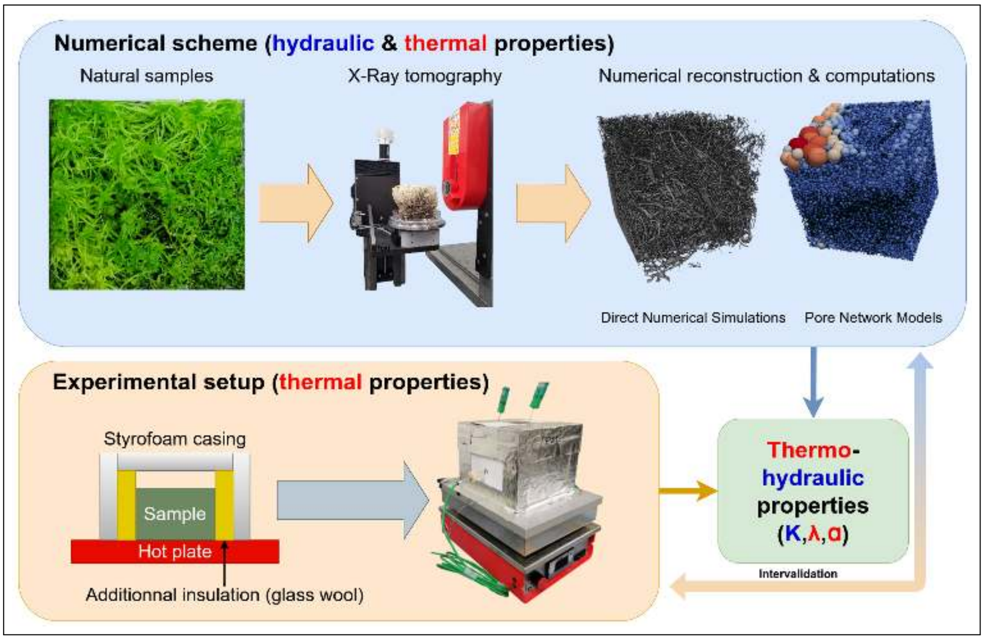
Boreal regions dynamics are strongly driven by perennially frozen soil (permafrost) physical properties. Sphagnum moss, lichen, and peat are widely present in these regions, forming a complex biological patchwork covering millions of km^2. In such regions, energy and mass transfers mainly occur via evapotranspiration, involving both vegetation's hydraulic and thermal properties.

The latest IPCC reports show that arctic regions are highly vulnerable to climate change. Therefore, a thorough study of arctic vegetation cover's thermo-hydraulic properties is needed to create a numerical model of this biological boundary layer. In this work, arctic vegetation cover is pictured as a complex fibrous porous media. Based on this assumption, some methods used for porous media properties' assessment (upscaling, representative elementary volume and homogenization) are developed hereafter.

To this end, 12 dried samples extracted from Khanymey Research Station (Western Siberian Lowlands) are studied in conjunction with their X-ray tomographical reconstructions. These samples consist of eight Sphagnum moss samples, two lichen samples and two peat samples.

First, a Representative Elementary Volume study associated with Direct Numerical Simulations is carried out to quantify porosity and hydraulic conductivity. For non-homogeneous samples, numerical simulations are made on generated pore network models. Then, thermal diffusivity and thermal conductivity are assessed using two techniques: signal and image processing results based on a modified Guarded Hot-Plate Method and direct numerical simulations associated with a pore network modeling.

Results validate the assumption to consider this vegetation cover as a porous media. Some Representative Elementary Volumes are found for most samples concerning porosity and for homogeneous samples for hydraulic conductivity. For thermal properties, ongoing studies confirm strong insulation capabilities, joining previous conclusions made in the literature. Further work will be devoted to quantify the coupling between water content and state inside these peculiar biological porous media with their hydraulic and thermal properties.


Numerical scheme (hydraulic & thermal properties)
Natural samples
X-Ray tomography
Numerical reconstruction & computations
Direct Numerical Simulations
Pore Network Models
Experimental setup (thermal properties)
Styrofoam casing
Sample
Hot plate
Additionnal insulation (glass wool)
Thermo-hydraulic properties (K,λ,α)
Intervalidation