



INTERFROST: a benchmark of Thermo-Hydraulic codes for cold regions hydrology

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Large focus was put recently on the impact of climate changes in boreal regions due to the large temperature amplitudes expected. Large portions of these regions, corresponding to permafrost areas, are covered by water bodies (lakes, rivers) with very specific evolution and water budget. These water bodies generate taliks (unfrozen zones below) that may play a key role in the context of climate change.

Recent studies and modeling exercises showed that a fully coupled 2D or 3D Thermo-Hydraulic (TH) approach is a minimal requirement to model and understand the evolution of the river and lake – soil continuum in a changing climate (e.g. Mc Kenzie et al., 2007; Bense et al 2009, Rowland et al 2011; Painter 2011; Grenier et al 2012; Painter et al 2012 and others from the 2012 special issue Hydrogeology Journal: “Hydrogeology of cold regions”).

However, 3D studies are still scarce while numerical approaches can only be validated against analytical solutions for the purely thermal equation with conduction and phase change (e.g. Neumann, Lunardini). When it comes to the coupled TH system (coupling two highly non-linear equations), the only possible approach is to compare different codes on provided test cases and/or to have controlled experiments for validation.

We propose here to join the INTERFROST benchmark exercise addressing these issues. We give an overview of some of its test cases (phase I) as well as provide the present stand of the exercise and invite other research groups to join. This initial phase of the benchmark consists of some test cases inspired by existing literature (e.g. Mc Kenzie et al., 2007) as well as new ones. Some experimental cases in cold room complement the validation approach. In view of a Phase II, the project is open as well to other test cases reflecting a numerical or a process oriented interest or answering a more general concern among the cold region community.

A further purpose of the benchmark exercise is to propel discussions for the optimization of codes and numerical approaches in order to develop validated and optimized simulation tools allowing in the end for 3D realistic applications.

A web site hosted by LSCE was created recently (wiki.lsce.ipsl.fr/interfrost/) to allow easy interaction or downloading. Future prospects will be envisioned including organization of specific meetings or conference sessions. This will provide the opportunity to propel networking among researchers, discuss the content of further phases of the benchmark (increase model or parameter complexity) and discuss strategies for project funding. Please consider joining the benchmark.