



## **A new 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 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 required to understand and model the evolution of rivers and lakes in a changing climate.

However, 3D studies are still scarce while all numerical approaches can only be validated against analytical solutions for a purely thermic equation with 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 and propel discussions to try and improve the code performances.

We propose here a benchmark exercise, detail some of its planned test cases and invite other research groups to join. The benchmark will consist 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 will complement the validation approach. The benchmark is open as well to new or alternative 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 is under construction to allow easy interaction or downloading. Future prospects will be envisioned including organization of specific meetings or conference sessions. Please consider joining the benchmark.