



Benchmarking numerical freeze/thaw models

Wolfram Rhaak (1), Hauke Anbergen (2), John Molson (3), Christophe Grenier (4), and Ingo Sass (5)

(1) Darmstadt Graduate School of Excellence Energy Science and Engineering, Technische Universitt Darmstadt, Germany (ruehaak@geo.tu-darmstadt.de), (2) Frank GeoConsult GmbH, Hamburg, Germany, (3) Department of Geology and Geological Engineering, Universit Laval, Quebec, QC, Canada, (4) LSCE (Laboratoire des Sciences du Climat et de l'Environnement), Saclay, France, (5) Technische Universitt Darmstadt, Institute of Applied Geosciences, Chair of Geothermal Science and Technology, Darmstadt, Germany

The modeling of freezing and thawing of water in porous media is of increasing interest, and for which very different application areas exist. For instance, the modeling of permafrost regression with respect to climate change issues is one area, while others include geotechnical applications in tunneling and for borehole heat exchangers which operate at temperatures below the freezing point.

The modeling of these processes requires the solution of a coupled non-linear system of partial differential equations for flow and heat transport in space and time. Different code implementations have been developed in the past. Analytical solutions exist only for simple cases.

Consequently, an interest has arisen in benchmarking different codes with analytical solutions, experiments and purely numerical results, similar to the long-standing DECOVALEX and the more recent "Geothermal Code Comparison" activities. The name for this freezing/ thawing benchmark consortium is INTERFROST.

In addition to the well-known so-called Lunardini solution for a 1D case (case T1), two different 2D problems will be presented, one which represents melting of a frozen inclusion (case TH2) and another which represents the growth or thaw of permafrost around a talik (case TH3). These talik regions are important for controlling groundwater movement within a mainly frozen ground.

First results of the different benchmark results will be shown and discussed.