Submitted Abstract

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Abstract

Water infiltration and circulation in frozen bedrock fractures may enhance heat transport from the surface to the permafrost body and play a role in rock slope failure. However, such processes occurring in steep rock slope permafrost are difficult to investigate because of their non-linearity and anisotropy.

In this communication, we will present recent developments conducted in the frame of the WISPER project (“Water and Ice related thermo-mechanical processes in the fractures of Steep alpine bedrock Permafrost”, funded by the French National Agency for Research).

The FeFlow® (DHI-WASY) software is used to model and study the coupled heat and mass transfer in a simple alpine geometry that typically represents steep rock slope affected by permafrost and seasonal freeze and thaw cycles at c.a.3500 m a.s.l. Using a synthetic annual forcing for rock surface temperature, several case studies are implemented to investigate the sensitivity of permafrost degradation to various fracture networks features: aperture and density, orientation, dip, shape, amount and seasonality of the input water flux. The thermal and hydrogeological variables (notably temperature fields, and hydrostatic pressure field, are compared to a base case without any fracture, in order to assess their sensitivity to the studied parameters.

A direct comparison between these simulations and field measurements is foreseen, to bring further constrain on the model settings, and ultimately to validate its outcome. These results will allow to better understand non-linear response of permafrost to climate signals and will bring new insights to understand steep rock slope destabilisation.

permafrost ; steep rock slope ; numerical modelling : hydrological processes ; sensitivity study