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Quantifying the non-conductive Heat Transport in the Surface Layer of high alpine Rock Faces

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In alpine permafrost, especially in fractured rock faces, thawing processes and advective heat transfer are still not sufficiently understood, even though they are relevant for the stability of high-mountain infrastructure and can trigger rock fall. In consideration of this, the project PERMASENS investigates the influence of air and water movement on the subsurface heat transport in fractured and porous rock.

A first aim of this research project is to quantify the amount of non-conductive heat transport under different rock and temperature conditions. Thereto we compare model results of a one-dimensional heat conduction model with temperatures recorded at the surface and different depths in steep bedrock slopes. This comparison is done for time series, different measurements locations as well as for changing model parameters. The analysis of the calculated non-conductive heat flux can be used to estimate the temporal and spatial situations, in which other components of the heat transport, such as advective heat transfer in fluids trough fractures, are of a major importance.

Results permit us a more focused measurement design to record advective fluxes in the future work. The method developed for that purpose can additionally provide a mean to estimate the amount of energy fluxes, that are difficult to measure, in other topographic and lithological situations such as debris slopes or rock glaciers.