An Alpine-wide empirically-based permafrost distribution model

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Permafrost distribution modelling in highly populated mountain regions is an important task and several differing modelling approaches exist. Most permafrost models in the Alps are calibrated for a local region and only applicable for a specific area. For analyzing the permafrost distribution and evolution on an alpine-wide scale, one consistent model for the whole domain is needed, instead of differing and incomparable models.

We present a statistical permafrost model for the entire Alps based on permafrost evidences. The evidences were collected in the framework of the PermaNET project and contain different data (e.g.

rock glacier inventories, bore hole temperatures, ground surface temperatures).

Two models were developed, one for the debris covered area (debris model) and one for steep rock faces (rock model). In both cases the predictor variables are mean annual air temperature (MAAT) and potential direct solar radiation. For the debris model we use a logistic regression to predict the probability of active against inactive rock glacier. For the rock model a linear regression was used to model rock temperatures based on temperature loggers located in steep rock walls. To distinguish between those two surface characteristics a third model (surface type model) was developed, also based on a logistic regression. The final output product combines these three models and provides alpine-wide permafrost probabilities. In the future, interpretations guidelines will be devised to communicate model limitations (e.g.

thermal offset for the rock wall temperatures or the spatial displacement of the permafrost probabilities in the debris covered area due to movement of the rock glaciers) to potential users.