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On the use of geophysical information for distributed hydrological modelling in a mountain catchment

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For most hydrological model applications only very little information on the properties of the subsurface is available. Soil storage parameters are hence most often back-calculated from observed runoff. There is, however, the possibility to use geophysical investigations to get a better insight in the subsurface and gain valuable information for hydrological models. In case such investigations are available, they can be used as input information and one would expect that they facilitate the models parameter choice.
In the presented case study a spatially distributed hydrological model was used to simulate runoff generation and routing in a 5 km^2 alpine permafrost catchment in the Oetztal Alps, Tyrol, Austria. Detailed seismic refraction and ground penetrating radar investigations were performed to identify the spatial patterns of unconsolidated sediments where groundwater flow can take place. Seismic refraction and diving wave tomography together with temperature measurements were used to identify permafrost occurrence which influences the subsurface storage capacities. The first results of the study indicate that geophysical information vastly facilitates the identification of model parameters. Subsurface parameters are much better constrained and require little calibration compared to the use of observed runoff alone. While the effort for hydrogeophysical investigations is substantial, it does reduce the parameter identifiability problem of spatially distributed hydrologic models and helps to improve the understanding of subsurface processes.