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RCM based scenario simulations of potential changes in surface and ground temperatures of steep high-mountain rock walls

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The thawing of mountain permafrost due to changes in the atmospheric condition can have a severe impact on slope stabilities leading to rock falls or debris flows. The locating of potentially sensitive areas at present and in the future is thus an urgent need, especially in densely populated mountain areas such as the European Alps.

The energy-balance model TEBAL simulates surface and ground temperatures of rock walls in complex topography and is driven by daily meteorological time series. In order to perform permafrost scenario simulations, sensitivity study can be achieved ad hoc e.g. by simply increasing the air temperature by several degrees C. However, such simple scenario approaches do not plausibly represent changes in the atmospheric condition. Furthermore, surface and ground temperatures in high-mountain environments are determined not only by air temperature but to an important part also by net solar radiation, which is in addition modified by the topography. The only tool allowing projections of potential climatic changes on a physically consistent basis are General Circulation Models (GCMs), in mountain topography preferentially Regional Climate Models (RCMs). Therefore, by using two different approaches (called 'delta' and 'bias') we have applied the output of three different RCMs (CHRM, RegCM, HIRHAM) each driven by the same GCM (HadAM3H) as forced by two different SRES scenarios (A2, B2) to the model TEBAL. These RCM runs have all been performed within the project PRUDENCE.

We have calculate and analyzed the range of possible changes in surface and ground temperature for single points in different topographical situations (i.e. elevation, slope, aspect) of a steep rock face at the location of Corvatsch (Upper Engadine, Switzer-

land). Furthermore, we have analyzed the added value of using RCM based scenario time series compared to ad hoc studies.