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Ice-age effects on radioactive waste disposal in Switzerland

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The National Cooperative for the Disposal of Radioactive Waste (Nagra) is in charge of developing deep geological repositories in Switzerland. This also includes proposing sites for such repositories and performing analyses of the long-term safety that they can provide. As part of these safety analyses the geomorphological evolution of the landscape has to be evaluated for a time horizon of one million years for the disposal of high level waste. One of the relevant aspects concerns the effects of "deep glacial erosion". This term refers to the origin of deeply incised troughs and overdeepened valleys beneath glaciers that extended from the Alps far into the Alpine foreland and covered the midland areas of northern Switzerland (Swiss Plateau) with hundreds of meters thick ice several times during the Quaternary. As the climate in northern Switzerland in the time period of concern (1 Ma) is expected to continue to oscillate between glacial and interglacial periods, the question as to when, where and how often future glaciations can lead to deep glacial erosion is of great importance for the siting and long-term safety of radioactive waste repositories.

In this contribution we give an overview of ice age conditions in Switzerland and the results of a specific workshop held in Switzerland in April 2010 aimed at evaluating the state-of-the-art of modelling glacial erosion as a means for developing a better understanding of the subglacial processes governing landscape evolution in the Alpine foreland of northern Switzerland in past as well as future cold environments. While the three-dimensional coupled ice-flow/sediment models that have been developed during the last decade significantly contribute to a better understanding of the spatial and temporal role of glacial erosion, further advances are desirable in the incorporation of more appropriate physics and boundary conditions. Basal processes including glacier hydrology, ice-bed interaction, sliding, sediment transport and interaction with permafrost remain incompletely understood and require considerable additional model development to be usefully incorporated into comprehensive coupled models. In this respect, glacier hydrology was particularly acknowledged as being important for realistic simulations of ice dynamics and erosional processes.