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Reconstruction of the pre-glacial Alpine topography to address the glacially-induced modifications

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We use numerical modeling to investigate the effects of glaciation on a pre-existing topography. The specific case of the European Alps is addressed through the preliminary reconstruction of the pre-glacial Alpine topography. Assuming constant concavity and erodibility as well as erosional steady-state, the stream power law is used to reconstruct the Alpine topography prior to onset of glaciation. Subsequently, a glacial erosion model (ICE-CASCADE) is applied to obtain information about the glacially induced modification of this fluvial topography. We make model-based predictions of sediment production, mass redistribution and morphologic evolution. We present the possible evolution of the pattern of glacial erosion through time, when topography is subject to different tectonic and climatic conditions. Our results provide an insight into the formation of valley overdeepenings during extensive glaciation and show how glacial action affects the concavity of the steady-state topography.