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A regional analysis of deep-seated large-scale slope deformations and related processes: Examples from Central Austria

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During the past decade the occurrence of deep-seated gravitational slope deformations (DGSDs) has been mapped in some parts of the federal state of Styria (Austria). The investigated area covers c.1,900 km^2. The DGSDs are a common phenomenon in glacially overdeepened sections of valleys located in crystalline bedrock of the Eastern Alps. In some regions, up to 70% of total slope areas indicate morphological characteristics of unstable slope conditions. The slope instabilities are primarily sagging-type movements. Relict as well as active forms can be distinguished. Most of the relict forms are attributed to paraglacial slope adjustment processes acting after glacier retreat in the Late Glacial period. Three general states of DGSDs, which differ in slope morphology as well as physical parameters, can be distinguished.

The data collected in the Niedere Tauern mountains (Austria) were analysed with respect to boundary conditions and controlling variables such as development state, geographical position, geomorphometric characteristics, lithology and tectonics. Most of the large features with an aerial extension of up to 12 km^2 represent relict states. They are bound predominantly to the slopes of the main valleys. These large-scale movements have ceased due to the filling of valleys by sediments resulting in the restabilisation of the mountain foot. Numerous minor forms between 0.03 and 2.9 km^2 could be identified in the side valleys. Such slope deformations are often representing mature or initial states with a higher degree of activity showing double ridges, clear scarps and fresh fissures of disruption indicating active mountain spreading. With respect to the geological situation, most of the mapped DGSDs are bound to mica schists but

they occur in gneissic, quarzitic and amphibolitic rocks as well. The main joint system turns out to be of morphogenetic relevance in all cases.

Because of the disintegrated bedrock and the high portion of debris there is a increased disposition of secondary erosional processes and mass movements in areas affected by DGSDs. The types of dominant processes depend on the state of development of the DGSD. For example: in marginal portions of some DGSDs an individual surface drainage network has been developed, forming chutes and gullies that terminate in huge debris cones at the base. Thus, the knowledge of the distribution and the state of development of DGSDs provides an important basis for risk management measures in affected areas. Illustrating this aspect, examples of DGSDs representing different stages of development with connected typical secondary erosional processes are presented.