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Debris flow susceptibility mapping – from analysis at basin scale to national scale mapping

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Debris flows occur in many regions all over Norway and pose a severe potential threat to inhabited regions. This contribution presents the current status of an approach for debris flow modeling at a regional scale. Within the framework of the production of a national debris flow susceptibility map, we are working on a modeling approach suitable for Norway with a nationwide coverage.

Debris flows initiate either in a stream channel or on open hillslopes. The complexity of the phenomenon and the variability of local controlling factors limit the use of process-based models for a nationwide susceptibility assessment. GIS-based approaches associating an automatic detection of the starting areas and a simple assessment of the debris flow spreading provide a substantial basis for a preliminary susceptibility assessment. We use an index approach framework for the discrimination of starting zones including topographic parameters extracted from a digital terrain model (DTM) at 10 m cell size, the lithological setting and the hydrological setting based on catchment areas. A probabilistic and energetic approach is used for the assessment of the maximum runout distances.

First simulations were run at different test sites in Norway. The model validations based on quaternary maps, orthophotos and field inspections show that the index approach and the runout modeling reproduce mapped debris flows with good accuracy when using DTMs with 5 to 10 m cell size. Using a 25 m DTM, many of the starting zones are missed, especially in open-slope topography. The results suggest a separate modeling of channel and open-slope topography processes, as they are influenced by rather different controlling factors and mechanisms. More parameter calibration will be performed at test sites in different geological and climatological settings to allow nationwide modeling.