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Quantifying the effect of biomass and its change on landslide activity at regional scale

Stefan Steger (1), Thomas Glade (1), Markus Hollaus (2), Norbert Pfeiffer (2), Thom Bogaard (3), Rens van Beek (4), and Rainer Bell (1)

(1) University of Vienna, Department of Geography and Regional Research, Vienna, Austria (stefan.steger@univie.ac.at), (2) Department of Geodesy and Geoinformation, University of Technology, Vienna, Austria, (3) Faculty of Civil Engineering and Geosciences, University of Technology, Delft, The Netherlands, (4) Faculty of Geosciences, University of Utrecht, Utrecht, The Netherlands

Landslides of the slide-type movement represent potentially damaging phenomena for residents, their properties and infrastructure all over the world. The causes of these geomorphic processes are manifold as multiple interacting natural and anthropogenic factors influence their occurrence. Numerous studies reveal that human induced land cover changes, such as deforestation or afforestation, highly influence the stability of a slope. As forest stands can be managed directly by humans, an in-depth evaluation of the processes that define stability under forested and non-forested conditions appear crucial in order to develop sustainable avoidance strategies for large areas.
The main objective of this research is to simulate and quantify the effects of forest related biomass and biomass changes on slope stability at regional scale. The procedure consist of combining vegetation related parameters derived from 3D airborne laser scanning (ALS) point clouds with a spatially distributed physically based hydro-mechanical slope stability model. The study area ($\sim$15km^2) is located in Vorarlberg (Austria) where highly detailed geocoded ALS point cloud data is available for the years 2004 and 2011. Furthermore, an additional ALS flight is planned for the year 2015/2016. Forest related information (e.g. biomass, stem volume, vertical layer structure, understory) will be directly computed on the basis of the 3D cloud data. In-situ assessments of vegetation related parameters will be carried out to establish empirical linkages between ALS derived information and stability influencing parameters (tree allometry). Partial deforestation and/or afforestation will be simulated by gradually adapting the respective point cloud data densities. Subsequently, all this information will be implemented into the dynamic hydro-mechanical slope stability model Starwars/Probstab that allows to quantitatively assess geomechanical and hydrological effects on landslide activity. The results of this research will provide detailed information on the spatial and temporal variability of future landslide activity for different environmental scenarios and allow a better understanding of interdependencies of different processes. Finally, an improved spatio-temporal prediction of the effects of forest management on landslide activity is expected.