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Interaction between soil formation and landslide occurrence

Tom Vanwalleghem (1), Hitoshi Saito (2), Yuichi Hayakawa (2), and Takashi Oguchi (2)

(1) University of Cordoba, Department of Agronomy, Área de Hidráulica, Córdoba, Spain (ag2vavat@uco.es), (2) University of Tokyo, Centre for Spatial Information Science, Tokyo, Japan

Many different models exist for landslide prediction. Possibly the parameter with the highest uncertainty in these models is soil depth. While most studies acknowledge its importance, few studies include spatial variability of soil depth in the predictions. In addition, in mountainous areas landslides are one of the main processes shaping the relief and therefore have a significant impact on the spatial distribution of soils. In this study, we model the interaction between long-term soil formation and landsliding. Soil formation from bedrock is modeled by a depth-dependent soil production function. Soil is then redistributed in the landscapes by water erosion processes and landslides. Factor of safety is calculated at each time step by using the dynamic soil thickness and rainfall. First, the model is evaluated by comparison of modeled soil depth with published field measurements (Iida et al., 1999). The relation between soil depth and topographical attributes, such as slope, curvature or compound topographic index show how including landsliding processes generates patterns of soil depth that reflect much better the observations than a simple model that only includes soil formation and water erosion. Finally, the model is applied to a study area in the Akaishi Mountains to model the occurrence of landslides in that area. Landslides were mapped by remote sensing between 1992-2002. It is shown how by taking into account the modeled soil depths, the prediction of landslide occurrence is improved over a model with spatially constant soil depth.