

Physical erosion modelling of complex morphodynamics in the upper Val d'Orcia: a combination of EROSION 3D, UAV, SFM and CANUPO

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Throughout the Mediterranean Basin soil erosion is both a widely spread and a landscape shaping process. In order to increase the understanding of morphodynamics inside large Italian badland areas, so called Calanchi, the process based erosion model EROSION 3D was parameterized by artificial rainfall simulations, soil sampling and an UAV based high resolution digital elevation model. Vegetation structures were removed with the CANUPO-classifier in CloudCompare.

The rainfall experiments proved to be a convenient but costly tool for deriving the model input parameters. While building up the model, different composition of the inhomogeneous soil surface was considered. A diverse behavior against erosion by water was observed. The results showed that the deposition surfaces of rotational or translational slides, besides calanco depth contour, tend to degrade. Although these deposits present a comparatively low bulk density, they reduce the infiltration due to soil surface clogging and cause less erosion resistances. The differential consideration of erosion sub-processes turns out as particularly challenging. The simulation of a reference year showed an annual soil export from the catchment of 43 t/ha, which corresponds to an average surface lowering of 3 mm. Sheet erosion represents an amount of about 5% of the total erosion of badlands. Furthermore, infiltration depth, amount of runoff, sediment concentration, and grain size composition of the deposits were calculated. This study makes a contribution to the understanding of denudation processes in Calanchi badlands. The presented process-based modeling of badlands is contributing a new aspect to erosion research.