Geophysical Research Abstracts
Vol. 14, EGU2012-8252-2, 2012
EGU General Assembly 2012


# Comparison of the results of different scale hydrogeological models on a terraced slope of Valtellina (Northern Italy)

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The aim of this work was to understand and reproduce the hydrological dynamics of a slope that is terraced by dry-stone retaining walls. At first, the processes of interest were analyzed with a classical 2D unsaturated-saturated finite elements analysis, reproducing the geometry of a single terrace. In a second moment, a raster analysis at the slope scale was performed.
The studied slope is located in Valtellina (Northern Italy), near the village of Tresenda, and in the last 30 years it experienced several soil slip/debris flow events that in 1983 caused 18 victims. Direct observation of the events of 1983 permitted to recognize the principal triggering cause of these events in the formation of an overpressure at the base of a dry-stone wall, that caused its failure.
Using field tests and monitoring activity as input and calibration data respectively, the 2D model is able to explain the mechanisms of rainfall infiltration that can lead to the formation and evolution of a perched groundwater table at the contact between the bedrock and the walls backfill soil. Once calibrated and validated the model has been used to investigate the influence of different parameters on the studied processes, such as walls height, bedrock slope angle, and changes of both isotropic and anisotropic saturated hydraulic conductivity of soil and wall. From this sensitivity analysis, one of the most interesting results is the ability of the model to well differentiate the behaviour of a well maintained wall with an higher hydraulic conductivity than soil, from a poorly maintained wall that has lost part of its drainage capacity. In fact, only in this latter circumstance significant pore-water pressures can form at the base of the retaining structure.
Moving the problem to the slope scale, although the used raster-model takes into account both the unsaturated and saturated components of flux as the 2D model, it is less precise in the description of the processes involved in the formation of the perched groundwater table. Nevertheless, the raster model is able to identify preferential infiltration zones. Moreover, it is rather precise in the prediction of the maximum groundwater levels, furnishing a valid input for a successive distributed stability analysis, that can be useful for civil protection purposes.
The two models are complementary. The distributed model alone does not permit to well understand the role of all the parameters involved in the processes analyzed, while for a profitable predictive use of the acquired knowledge the 2D model needs to be assisted by the raster one.