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On the hydrological-hydraulic modelling of hillslope dry-stone walls

Chiara Perlotto, Tamara Michelini, and Vincenzo D'Agostino

University of Padova, Department TESAF-Land, Environment, Agricolture and Forestry, Legnaro, Italy (chiara.perlotto@studenti.unipd.it)

Terraces are among the most evident human signatures on the landscape as they cover large cultivated territories of the Earth. The importance of dry-stone walls to realize bench terraces has always played a key role in the management of the agricultural hilly/mountain areas. These works are generally built to allow tractors and ploughs to operate under acceptable conditions, to make human work in the slopes easy and comfortable, and to promote irrigation. Few studies in literature are available on rainfall-runoff transformation and flood risk mitigation in terrace areas. Then, research results in this field are still scarce. Bench terraces reduce the terrain slope and the length of the overland flow, quantitatively controlling the runoff flow velocity, facilitating the drainage and thus leading to a reduction of soil erosion. As to the hydrological response, a terraced slope should result in a reduction in the peak runoff at the toe of hillslope and in a delay in the passage of the peak flows. This fact occurs mainly due to the change of the original land topography.
The goal of this study is highlighting the benefit in terms of runoff reduction, which is provided by sequence of dry-stone walls under different space arrangements along the hillslope.
In particular, the FLO-2D model was recursively applied to a schematic hillslope simulating both the local variations of the hydrological soil characteristics and the morphological stepped profile of the bench terraces. The simulations have been carried out by varying the main parameters underlying the design of the terrace system (spacing, height and number of terraces). The results have shown an interesting clear linkage between the peak-discharge reduction of the overland flows and the area extent, which is consolidated by means of the dry-stone walls. The modelling outcomes well support and inform design criteria, cost-benefit analysis and the assessment of the functionality level of this historical consolidation system.