Volume amplification in debris avalanches induced by rainfall

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Keywords: *propagation, entrainment, spreading, forecasting, consolidation, mobility*

Abstract: *Debris avalanches propagate along open slope with large bed entrainment during the propagation stage. This is combined often with significant lateral spreading. As a result, impressive landslide scenarios are observed in the field, with volume amplification factors of some tens, from a small source zone to an overall large/dramatic propagation/deposition zone. This poses a challenge towards the correct classification of such phenomena (in terms of volume), and for their correct forecasting. A small triggering zone could the ideal target for active mitigation works, while passive mitigation works could be profitably applied inside the propagation zones. Indeed, both intervention strategies presuppose the very precise forecasting of the source, amplification and propagation zones. However, during propagation of debris avalanches strong consolidation of the moving material occurs – favoured by the combined effects of bed entrainment on the front and spreading on the lateral sides –. Thus, lateral spreading is controlled by flow velocity and mobility of debris avalanches in the piedmont zones is usually much shorter than flows of analogous/similar materials moving along channels. It means that forecasting could be: unconservative for the design of prevention/protection works (in the source/propagation zones) and too safe in terms of propagation (in the piedmont zones). Nowadays, various models are available to consider the combined effect of all the processes mentioned before. But still site-specific calibration and validation of the models are required, as a fundamental step.*