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r.massmov: a GRASS GIS module for landslide runout assessment in early warning monitoring systems

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In the last decades, early warning systems have become a precious support in hazard management by helping in reducing the possible damages caused by natural and anthropic hazards. Furthermore, in the last years, thanks to the rapid advances in science and technology a new concept of innovative early warning systems has been developed taking advantage of the decreasing costs of sensors and the wide diffusion and coverage of internet services (WFS, WMS, WPS, SOS, etc.). In this concept, simulation models can play an important role: in fact, by allowing the objective assessment of the location and intensity of a possible disaster, they can provide valuable information to support decision makers in taking timely and appropriate disaster responses.
r.massmov is a new GRASS GIS module for landslide runout simulation over complex topographies developed to meet the expectation of innovative early warning systems modeling services, identified by the authors through four key requirements: i) low simulation times, ii) geospatial capabilities, iii) three-dimensional analysis and iv) open source approach. The model, based on the combined use of shallow water equations and rheological formulas, is the result of a series of enhancements to the original Massmov2D code (Begueria et al. 2009) to significantly improve algorithms and computational times.
With this work the authors want to illustrate the main characteristics of r.massmov model: the governing equations, the input/output data, the algorithms and the results of the model application on a case study located in Tessin (Switzerland) that highlighted the effectiveness of the changes performed to the original code in terms of time performances. Furthermore, the authors want to present a set of GRASS GIS specific tools for r.massmov (r.massmov.sensitivity, r.massmov.calibration, r.ucode), developed to systematize and simplify model sensitivity analysis and calibration procedures.

References:
Begueria S, Van Asch T W J, Malet J P and Grondahl S 2009 A GIS based numerical model for simulating the kinematics of mud and debris flows over complex terrain. Nat Hazards Earth Syst Sci, 9, 1897-1909.