Contribution ID : 64

Hydrologic design and debris flow hazard assessment in an alpine region using JGRASS geomorphologic modules

Thursday 14 Sep 2006 at 09:45 (00h30')

The determination of the peak flow and the corresponding hydrograph for predefined return periods is of crucial importance in the common practice of public administration dealing with natural hazard and land use planning.

The availability of measured runoff data and past evidences are often very poor or even nonexistent. Therefore the estimation of design valued in vary small, steep and ungauged basins, prone to flash floods events with intensive sediment transport and debris flows remains challenging with considerable difficulties and uncertainties.

The existing link between basin morphology and hydrologic response provide since years a unique and coherent framework to improve the performance of predictive modelling in absence of direct data. The concept of Geomorphic Instantaneous Unit Hydrograph (GIUH) and its representation by means of the width function has been proposed by many authors and recently introduced as independent module in the JGRASS distribution.

An extensive study and a sensitivity analysis of the module have been carried out in different small catchments in Southern Switzerland, in which a hydrologic estimation of design flood was required.

The results show that the parameterization of the module, based on geomorphic assumptions and user skill, is able to produce reasonable results for design and land planning issues.

Furthermore, the application of a recently developed debris flow initiation criterion in steep torrents allowed extending the hazard analysis to these events and therefore establishing a coherent and general framework for further practical analysis and request.

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Session classification : Session 3 : GRASS Desktop

Track classification : GRASS

Type : Conference