Linking a Collaborative Platform and Multi-hazard Models to Support the Integrated Management of Extreme Events

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Extended Abstract

Field studies, Remote Sensing, Geographic Information Systems and process-based environmental models are increasingly used in combination for decision- and policy-making in integrated natural resources or natural hazards management. In particular the impact of extreme events on properties and processes of natural and managed ecosystems and its short- and long-term consequences have to be continuously assessed by a well coordinated interdisciplinary research and outreach approach. The communication between the various disciplines and stakeholders involved is therefore the most important key to a successful implementation of an integrated management plan.

The Geospatial Project Management Tool (GeoProMT) is a collaborative platform that enhances the communication of collaborative research activities in linking measuring, monitoring, modeling, and managing of natural properties and processes (Renschler and Namikawa, 2006). GeoProMT allows the involved multidisciplinary collaborators and their audience to effectively understand the spatial and temporal scales of extreme events and reduce the risks hazard risks. Extreme events as well as environmental or policy change, however, may change the scale of interest in assessing environmental processes to that extent that models are not applied at the scales for which they were created.

The design and successful implementation of the Geospatial Interface for the Water Erosion Prediction Project (GeoWEPP) at the watershed scale illustrates the challenges and solutions to build valid and useful assessment tools for cumulative watershed effects analysis (Renschler, 2003). GeoWEPP enables natural resources managers of agricultural, grassland, rangeland, and forests to assess the spatial and temporal scheduling of management activities. The GeoWEPP software also allows natural hazard risk assessment of multiple geohazards such as average precipitation events causing accelerated soil erosion after wildfires or extreme precipitation events of hurricanes causing massive erosion, large runoff and sediment yields.

The GeoWEPP model output can then be used as an input for the TITAN2D debris flow model (Patra et al., 2005). TITAN2D is a mathematical, deterministic, and dynamic model capable of simulating avalanches and debris flows triggered by volcanic, seismic or extreme precipitation events. A case study using a GeoWEPP-TITAN2D combined model approach illustrates the hazard assessment of multiple debris flows in a watershed affected by the extreme precipitation during a hurricane on June 27, 1995 in Madison County, Virginia (described in Morrissey et al., 2001; see also figure 1).

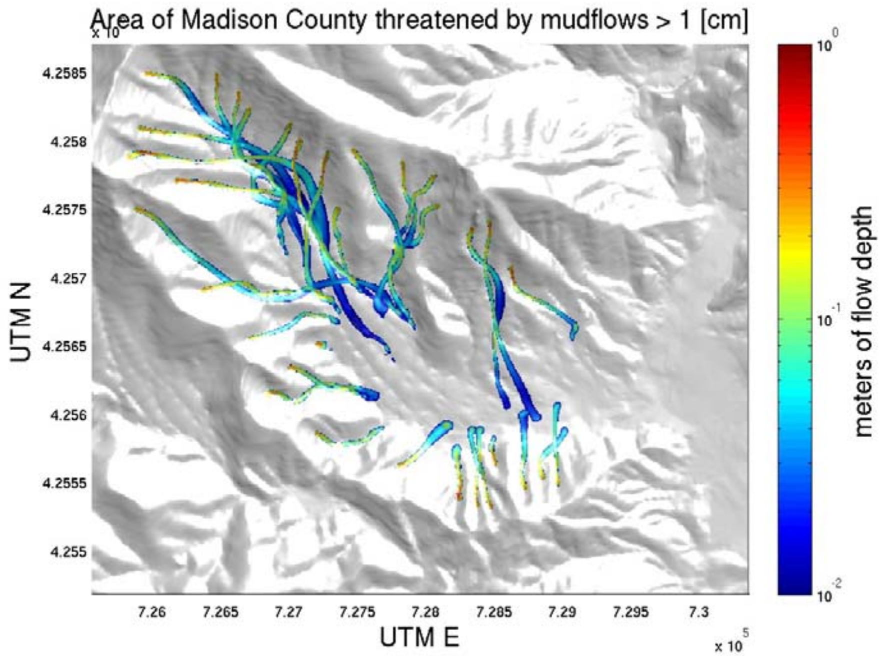

Figure 1: Multiple TITAN2D debris flows simulations based on surface runoff and sediment yields as model input produced by GeoWEPP (scenario uses an extreme precipitation event of 500 mm of rain received during a June 27 1995 hurricane event).

The combined use of GeoProMT, GeoWEPP and Titan 2D will enable the development of an Integrated Ecosystem Resilience Index (IERI) that includes quantifying the status, exposure and recovery of natural and managed ecosystems. Besides the resilience of ecosystems in a specific area, e.g. a watershed, the IERI approach is expandable to include other resilience aspects of a community living in this area, e.g. the resilience of the infrastructure, economic, and socio-cultural system of a watershed community. The goal of this project is the development of a conceptual framework for measuring, assessing, and monitoring the Watershed Community Resilience Index (WCRI), a toolkit that integrates quantitative and qualitative methods using spatial and non-spatial data to identify scientifically defensible indicators for community resilience, and an implementation plan that enables local and regional stakeholders to continuously monitor and enhance their resilience against episodic and slow-onset extreme events in watersheds.

References

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