Geophysical Research Abstracts
Vol. 13, EGU2011-9878-1, 2011
EGU General Assembly 2011

A statistical model derived from a physical-based model for assisting local decision makers in potential flood situations in small, flash-flood-prone mountain catchments.

Jan Schwanbeck and Rolf Weingartner

University of Bern, Oeschger Centre for Climate Change Research and Institute of Geography, Bern, Switzerland (jschwanb@giub.unibe.ch)

Decision making during flood situations is particularly challenging in small, flash-flood-prone mountain catchments with quite short times of concentration. Hydrological models driven by weather forecasts, which have a lead time of several hours, may be helpful in this case as time for prevention can be gained. However, the spatial and quantitative accuracy of such a meteorological forecast, especially rainfall data, usually decreases with increasing lead-time. In addition, rainfall-runoff models of small catchments are highly sensitive to imprecision in areal rainfall due to the restricted surface area. As a consequence, decisions on flood alerts should rather be based on short-term meteorological weather forecasts, on nowcasts or even on real-time measurements of rainfall, which is transformed into runoff by a hydrological model. To benefit from a best possible meteorological forecast while simultaneously retaining sufficient time for alerting and for prevention, the hydrological model should be on one hand time efficient and on the other suitable for application by local authorities.

To fulfil these requirements, we propose a statistical model consisting of a set of scatter-plots relating areal precipitation to peak flow and also taking into account further decisive parameters such as storm duration, distribution of rainfall intensity in time as well as the catchment's antecedent moisture conditions. A deterministic hydrological modelling system provides the multivariate dataset needed for the statistical analyses and modelling. After calibration and validation, the modelling system is employed to simulate repeatedly the runoff response for a five-day period in summer with gradually altered previous moisture conditions and systematically modified rainfall event properties, i.e. rainfall intensity and duration. These properties cover and even exceed the range of observed values. In the statistical model, however, the extrapolated values are explicitly stated to be less confidential.

The final aim of this project is to provide a methodology for a decision support tool, which enables local authorities to base their decisions on the most recent rainfall data as well as additional information of rainfall data uncertainty. Strengths and weaknesses of the proposed approach are discussed in a case study. The findings of this case study will lead to further improvements of the proposed approach.