Geophysical Research Abstracts
Vol. 12, EGU2010-13402, 2010
EGU General Assembly 2010

Five perspectives on ranking two severe flash flood events in Switzerland

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In June 2007 the atmospheric conditions above Switzerland were characterized by flat pressure gradients that triggered several stable and spatially limited convective rainfall events. We analyse two such events, which are particularly well documented. The studied sites are the Langeten catchment in Canton Berne and the Einsiedeln region with the Alp and Minster sub-catchments in the Canton Schwyz in Switzerland.
The events have been analyzed from five different perspectives: a) Estimation of the economic value of the damages on the basis of the Swiss flood and landslide damage database; b) Analysis of the daily, hourly and 10-minutes precipitation with extreme-value statistics (GEV); c) Analysis of the hourly and 10 minutes discharge rates from nested basins with GEV; d) GEV analysis of sediment transport in the Erlenbach basin using Geophone data. e) Hind casting the events with the hydrological model PREVAH using operationally available quantitative precipitation estimates from both pluviometers and weather radar.
For all time series analysed with GEV the two events rank amongst the most severe in their respective regions, and were responsible for the highest damage costs. The estimated return periods for the event in the Langeten catchment were > 100 y for the 10 minute runoff and 70 y for daily precipitation. For the Alp catchment the return periods were estimated to 70 y for 10 minute runoff, 35-40 y for 10 minute precipitation and 55 y for sediment transport. The results illustrate known problems with extreme value analysis, such as the occurrence of threshold processes in runoff generation.
Hydrological prediction of flash flood events can be improved if weather radar observations are used to constrain the precipitation events. However, the quality that can ultimately be achieved depends on the extent of the thunderstorm, and on the spatial and temporal resolution of the radar measurements. A possible route for improvements may lie in the combination of radar and ground-based observations.
Flash floods are still insufficiently understood and documented. To optimize flood hazard mitigation and aid decision makers, we call for a Europe-wide flash flood atlas and data base.