Geophysical Research Abstracts
Vol. 14, EGU2012-11018, 2012
EGU General Assembly 2012

Measuring, mapping and modeling deep subsurface stormflow contribution to the dampened flood response in a mountainous catchment

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Magnitudes of extreme flood events in steep mountainous catchments show much variation in terms of peak specific discharge. This can be considered as a variation in dampening of the flood response and is generally attributed to difference in catchment storage. Particularly in large mountainous catchments where floods are caused by longer periods with low intensity precipitation, sometimes thresholds are observed above which the very extreme flood discharges are much stronger than expected from extreme value statistics on smaller floods. Therefore, complementary methods for estimation of unprecedentedly large floods are wished for. For this estimation, it is critical to understand where in the catchment the storages are, and how much the drainage from these storages could contribute within the timescale of a flood event. Whereas geomorphological maps may provide good information about where the areas with large storage potential are, the question of how much the drainage from these storages could contribute to the flood discharge needs more research.

The mountainous, 109 km^2 Schaechen catchment is a good example of the aforementioned problems and research was started to investigate the deep subsurface stormflow contribution of typical geomorphologic formations with large storage potential; talus slopes, moraines and the thick soils found on creeping landmasses. In order to understand how fast these areas are drained, discharge measuring stations and rain gauges have been set up at spring and headwater scales. At the creeping landmass slope, additional data has been obtained with piezometers in the soil and underlying bedrock, measurements of natural tracers and sprinkling experiments.

These measurements allowed to identify differences in drainage characteristics and guided improvements in the mapping procedure of dominant runoff processes as originally developed by Scherrer and Naef (2003) and Schmocker-Fackel *et al*., (2007). In the new mapping scheme, the areas with large storage potential are delineated and it is tried to classify the deep subsurface drainage processes according to their reaction time.

In order to evaluate the advantages of the new mapping procedure, the process based rainfall-runoff model Qarea is supplemented with a new module for drainage of deep storages. It is tried to infer the structure and parameterization of this module from the obtained soft data and resort to step-wise calibration on the various observed discharges at headwater and catchment scale if this is required for parameter identification.

References:

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