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Why do steep alpine catchments often react delayed to heavy rainfall?

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Flood runoff is surprisingly low in many steep alpine catchments and, contrary to the popular perception they often react delayed to heavy rainfall. Where are the large volumes stored? When the storage volumes are filled up, storm runoff increases strongly. The method described below allows identifying delayed reacting alpine catchments, susceptible to this threshold behaviour.

Maps of dominant runoff processes (DRP) are well suited to identify the reaction of a catchment to heavy rainfall. A decision scheme was developed to determine the DRP automatically, using high resolution data of soils, geology, land use and topography. This method, originally developed for catchments in the Swiss Plateau, was applied to four alpine catchments. In three of them, soil parameters like soil depth and the soil water regime had to be derived from high resolution geological, land use and topographical information with an additional decision scheme, as no soil maps were available.

The volume runoff coefficients for the flood event of August 2005 were estimated with the DRP-maps and compared to measured volume runoff coefficients. The reaction of three catchments could be reliably identified. Two of them are dominated by impermeable formations like flysch, marles or schists. They contributed fast to runoff formation. Large storage bodies like moraines, talus, rockfall deposits or karstified limestone formations led to a delayed reaction in another catchment. However, one catchment reacted much slower than estimated. There, water seems to infiltrate into finely fissured rocks like sandstone, limestone or granite with a relatively low, constant

flow rate, continuously draining the geological and soil storages lying above.