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Investigating the contributions of soil- and groundwater to high discharges in a first-order catchment in Luxembourg.

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The aim of this research is to gain better insight in the contributions of different runoff mechanisms to high discharges in a first-order catchment. These components can be distinguished with the help of chemical hydrograph separation. Especially, the variable chemical composition of "old water" is discussed in this research. The research has been carried out at the experimental first-order catchment of 2.7 km^2 called the Huewelerbach nearby Hovelange, Luxembourg. The research used 25 piezometers, 3 soil moisture sampling points, 6 nests of soil moisture sensors and a meteorological station on-site.

The contributions of the different discharge components in this first-order experimental catchment have been studied in two ways. First by examining the chemical composition of the soil- and groundwater over a period of 1 year. Secondly, by making a variable saturated groundwater model of the alluvial deposits besides the stream.

The analysis of the chemical composition of the soil- and groundwater showed a spatial heterogeneity in the chemical composition of the groundwater. It demonstrated also that the chemical composition of the groundwater depends on the groundwater level. Furthermore, the chemical analysis of soilwater samples from different depths showed that chemical composition of the soilwater varies with depth.

The modelling of the soil moisture dynamics can be used to determine the depth of the groundwater and the flow paths in the (un)saturated zone and thereby it can give an indication of the chemical composition of the soilwater that contributes to high discharges.

The conceptual model of the Huewelerbach demonstrates that the variable chemical composition of “old water” is caused by the variable chemical compositions of soilwater and groundwater. The non-constant chemical composition of soil- and groundwater makes it hard to use chemical hydrograph separation.