



Long-term investigation of the hydrology in semi-forested catchments of the Swiss pre-Alps

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Most of the recent large flooding events in Switzerland have their origin in the sub-alpine zone where very heavy rainfall may occur and sediments and bedload material is released ready to be transported to the lowlands. In order to better understand and predict the hydrological response to extreme rainfall and to assess the role of the forest in that context the Swiss Federal Research Institute WSL and its predecessor institute has been conducting long-term investigations of the hydrology in semi-forested, sub-alpine catchments for more than a century. With this poster, we intend to provide an overview of the past long-term investigations in these experimental catchments and the most important lessons learned from these studies.

The longest time-series of measured runoff originates from the Bernese Emmental where WSL set up measurement stations in the fully forested Sperbel- and scarcely forested Rappengraben catchment as early as in 1903. In comparing the behaviour of two catchments forest influence on the water cycle was demonstrated. Whilst the data from the last decades is available in digital form, the digitalisation of the older data is still in progress. Recently, the Sperbelgraben-catchment has anew become a site of experimental investigation. After the destructive wind storm Lothar of December 1999 a nested approach was applied in the Sperbelgraben to evaluate the runoff behaviour at various scales and to estimate to what extent it is affected by deforestation. Results display a surprisingly small effect of storm damage on the runoff processes, mainly because the hydrologic function of the soil remained widely maintained despite some locally severe disturbances.

The forest impact on the hydrological response to heavy rainfall and snowmelt has been a major subject of interest also in other long-term studies at WSL. In southern

and western Switzerland three paired watershed studies were conducted for several decades: the Melera-catchment from 1934 to 1955, the Baye de Montreux catchment from 1934 to 1976, and the Schwarzsee watershed since the early 1950ties. In the course of time these experiments have developed from pure water balance studies to Ecosystem studies.

Most recently, three catchments of approximately 1-km² size with different fractions of forest coverage have been studied since the late 1960-ties in central Switzerland (Alptal). In addition to meteorological variables, snow and discharge, also runoff-water quality and bedload transport have been monitored in these catchments. Due to the prevailing wet clay soils originating from Flysch geology the effect of the forest in reducing peak runoff during severe rain storms is insignificant in this area.

A treasure of hydrological information has accrued during the past century in the above-mentioned experimental catchments. Today it serves as an invaluable verification material for numerical models. We summarize the presentation showing an example of a multi-criteria validation of a distributed hydro-meteorological model in one of the catchments.