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Analyzing rainfall-runoff characteristics in an upland river: How to predict transport of agrochemicals in stream water

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The rapid agricultural development from traditional to market-driven production and the growth of population in the mountainous regions in northern Thailand is accompanied by increasing input of agrochemicals to the ecosystem. The agrochemical losses to aquatic systems directly affect the water quality in the lowland. To study the impact of land use changes on agrochemical losses the SWAT model (Soil and Water Assessment Tool) is used to simulate the transport of agrochemicals driven by different discharge volumes and land use scenarios.

The focus on the present work is a first step towards model development. Rainfall-runoff characteristics were analyzed for flood peaks, travel time and the response time of the area on different rainfall intensities.

The Mae Sa watershed is located in the mountainous region close to Chiang Mai and has a total area of 77 km^2. It is characterized by steep slopes and narrow sub-basins with mainly mixed evergreen forests and deciduous forests. The cultivated areas are dominated by flower and vegetable production with a growing amount of greenhouses. Discharge is measured at three locations using ultrasonic sensors. Rainfall is measured at twelve locations distributed over the whole area and along different elevation bands.

The rainfall data were analyzed for intensity and duration and the relation to the discharge. The hydrographs were analyzed for peak flow and volume, delay time and time lag between two gauging stations. Single events show an average time lag between the upper and lower station of 162 minutes. Rainfall-runoff in the upper basin can be related with $R^2 = 0.86$. Other relations such as between rainfall intensity and discharge volume could not be clearly indicated. Runoff concentration time for the upper basin is estimated as 110 minutes for the up-stream gauge and 210 minutes for the outlet. Even though there is a quick response to rainfall preliminary results show that preconditions of the system control transfer time of flood peaks and response time more than single events. The results are used to relate the transport of agrochemicals in the stream to peak flow conditions and therewith estimate the travel time to the lowland.

At a later step, concentrations of agrochemicals in collected water samples will be linked with the discharge volume. Furthermore a hydrograph separation will be carried out using data on hydrochemistry, electrical conductivity and temperature. With these data, it will be possible to identify preferential flow paths relevant for transport of agrochemicals.