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Hydrochemical Observation and Analysis of Streamflow Composition in a Mountainous Agricultural Watershed in a Subtropical Region

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Abstract

Population growth causes an increasing pressure on natural resources in the mountainous regions of northern Thailand. To extend crop production to the whole year and to secure yield, a lack of soil fertility is compensated by increasing amounts of agrochemicals. These agrochemicals might be lost to aquatic systems, posing a risk to environment and human beings. The purpose of this project is to identify preferential flow paths during rainfall events at the catchment scale and to study the impact of land use changes on the fate of agrochemicals by using the SWAT (Soil and Water Assessment Tool) model. The Mae Sa watershed is located close to Chiang Mai (Thailand) and has a total area of 77 km^2. It is characterised 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. Discharge was measured at three locations equipped with ultrasonic sensors. Rainfall was measured at fourteen locations distributed over the whole area, including two weather stations. During single events water samples were taken from stream water, soil water, surface runoff and rainfall to assign a hydrochemical fingerprint of each component. Electrical conductivity (EC) was measured during rising and falling limbs of the hydrograph and water samples were analysed for the main ions and will form the base of a hydrograph separation. The EC values could be successfully applied for hydrograph separation, whereas ion analysis brought up difficulties in distinguishing the different runoff components due to low concentrations of the single components. Tropical soils in general show a low concentration of ions and preceding rainfall amplifies this effect by washing out the ions. The baseflow component dominated two events with 68 and 62 %. A third event showed a slightly lower fraction of event water (54 %). Pesticide concentration during the third event was measured and will be combined with the information drawn from the hydrograph separation. The results will help to improve the understanding of pesticide transport to the stream during single events.

Keywords: Flow components, hydrograph separation, pesticide transport, pesticides

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