Re-inspection of results for nonpoint source pollution processes in the research catchment Schäfertal / Lower Harz Mountains

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Introduction and Aims

The diffuse substance leaching from agricultural used areas affects the agricultural used areas themselves and also the surface and groundwaters in the surroundings. The aim of this work is to continue the investigations of runoff formation and the leaching of sediment and phosphor in the catchment area of the brook Schäfertal in a lower Harz mountains and to evaluate the current hypotheses of related leaching and transport processes.

Evaluation and result of the runoff formation process

The evaluation shows an runoff regime with a dominance of the winter month (Table 1). The high variability of the events can be attributed to snow melting, soil moisture and situations of frozen and unfrozen soils. Ground frost is only in exceptional cases the crucial factor for high floods. For that reason, the grain is the reason and crucial parameter for hydographs with untypical characteristics. High floods with unfrozen soils show, however, typical bimodal characteristics resulting from the periglacial soil complex (Fig. 2).

Material and Methods

The Schäfertal catchment has an area of 1.44 km² (Fig. 1) and is located in the eastern lower Harz mountains. 80 % of the area are hillsides with an slope of 6 % in mean. These hillsides are agricultural used. 20 % of the area are located in the floodplains and are pasturing areas. At an altitude of 396 m a.s.l. in the east of the area there is an weir which borders the catchment area.

Measurements during high flood events of the period 2001 – 2008 were investigated. The period 2001 – 2003 consists of 8 events and was the basis of former investigations, which resulted in hypotheses. Additionally, 13 events during the period 2004 – 2008 were evaluated to verify the former hypotheses.

Evaluation and result of the sediment transport

Sediment is transported mainly independently of the hydrological parameters. There is neither a correlation between sediment transport and runoff or maximum runoff (Fig. 3) nor a correlation of the sediment mass flux to the mentioned parameters.

Evaluation and result of the phosphorous transport

A uniform accumulation of phosphor can not be found in the Schäfertal. During the period 2001 – 2003 the mass flux is correlated with the location of the field which was fertilised. Fields which are located near the gauge „Messgarten“ provided a higher amount than fields which are more distant from the „Messgarten“. However, the values after 2004 do not approve this hypothesis. The ratio of sediment and phosphor does not correlate with the location of the fertilized field.

Fig. 1: Catchment area Schäfertal

Fig. 2: Typical bimodal hydograph

Fig. 3: Effect of hydrology on the sediment transport

Fig. 4: Hysteresis curves

From 2001 till 2003 there are 2 kinds of hysteresis curves, clockwise and anticlockwise. There was also a clear sediment source. After 2004 there are additional kinds of curves but no curves with antitockwise characteristics. Instead of that, chaotic characteristics (Fig. 4, centre) and curves with a high concentration peak (Fig. 4, right) can be found.

The variability of the curves is growing with the amount of high flood events. Thus, only very limited results can be found.

Fig. 5: Comparison of the mass fluxes

Fig. 6: Comparison of phosphor mass flux and crop rotation