Geophysical Research Abstracts,
Vol. 11, EGU2009-5297-1, 2009
EGU General Assembly 2009

Mapping and regionalization of dominant runoff processes - a GIS-based and a statistical approach

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In this study two approaches are presented to identify dominant runoff processes (DRP) with respect to regionalization. The results of the developed approaches are maps, which identify dominant runoff processes. These maps represent a spatial distribution of the hydrological behaviour of the soil during prolonged rainfall events.

The approaches have been developed in the micro-scale experimental Zemmer basin and validated in the meso-scale Südeifel basin (both located in Germany). The first approach (GIS-DRP) combines the permeability of the substratum, land-use and slope of the basin in a GIS-based analysis. The second approach (CDA-DRP) makes use of a discriminant analysis of the physiographic characteristics of the basin and links these to a GIS analysis. The application of both approaches still requires a small field campaign to test their results. Subsequently the approaches were compared with each other to decide which approach is suited better to reflect the results of the original method of Scherrer and Naef (2003) in a micro-scale and a meso-scale basin.

The net results were two maps indicating DRP for the micro-scale Zemmer basin (9 km), which were then compared to an existing DRP map of the Zemmer basin. Both approaches provided satisfactory results when compared to this existing DRP map. The GIS-DRP approach was strongly linked to the geological conditions of the basin while the CDA-DRP approach revealed a strong dependence on the topography. Applied in the meso-scale basin Südeifel (42 km), both approaches produced acceptable results. Therefore, the impermeability of the substratum and the topography of the basin could thus be used as suitable parameters for generating dominant runoff processes.

However, the GIS-DRP approach is preferred to the statistical CDA-DRP approach when accuracy, data input and calculation time are concerned. The GIS-DRP approach could serve well as an addition to the original method of Scherrer and Naef (2003) to identify dominant runoff processes in micro- and meso-scale basin; especially in those areas where the information is lacking to apply the original method.

Hence, the preferred DRP-GIS approach was applied again in an additional meso-scale basin (Attert basin, Grand Duchy of Luxembourg, 250 km). This map will be used next in a subsequent study to investigate whether the integration of dominant runoff processes maps with hydrological models allows the improvement of simulation results.