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Regionalization of dominant runoff generation processes by means of a statistical and a simple GIS-based approach

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The need for a better process understating to be used in hydrological modelling has been promoted vigorously, though, often these studies are limited to micro-scale basins (i.e. basins ranging in size from 1 km^2 to 10 km^2). A transfer of process information obtained in micro-scale basins to meso-scale basins (i.e. basins ranging in size from 10 km^2 to 1000 km^2) could therefore improve hydrological modeling at the latter scale.

In this study Dominating Runoff-producing Processes (DRPs) have been identified at the micro scale (Grundsgraben (9 km^2), and Schleidweilerbach catchments (4 km^2), Germany) by means of a field campaign with a view to regionalization. To model the DRPs of this basin two approaches have been followed: The first approach was a simplified derivation of runoff processes by means of a GIS, which used as input the permeability of the substratum in combination with the classification of the slope (MesoDRP). The second approach was statistical approach, where the permeability classification of the lithology and the derivates of the DEM are used as variables defining the different DRP areas. A canonical discriminant analysis builds the model for derivation of homogeneous dominating runoff-producing process areas (CDA-DRP).

The coincidence between the simplified GIS-derivation map (MesoDRP) and the reference map was at the Grundsgraben-basin 77%, in other 8 % they only differ at one

class. At the Schleidweilerbach the similarity between the simplified approach and the reference-map was 82% (and 6% differ in one class).

The classification with the statistical approach lead to a correct classification of 73% catchment of the area, with a misclassification of 27% of the catchment. But there are huge differences between the different runoff processes: eg. moderate sub-surface flow was well classified on 90 % of the mapped area, whereas slow sub-surface flow was only correctly classified on 37 % of its area.

Both models generated were applied to the Attert basin (250 km^2) in the Grand Duchy of Luxembourg for regionalisation. Both approaches gave good results in the micro- as well as in the meso-scale. However, the major problem of the first approach was the identification of the processes at the riparian zone and moreover, the scale (and quality) of the geological map put a severe hindrance on accurate identification of the processes. Concerning the second approach, the major problem was the wrong identification of two specific process groups yet during the building up of the model. These depended mainly on the explicit circumstances of slope and soil depth by with these processes was defined. Both approaches can be used for a first approximation of the spatial distributed definition dominating runoff processes at the meso-scale. The major benefit of the approaches is that they are not time consuming and are applicabel with an only weak data density and depth. However, a small field campaign to validate the results of the approaches remains mandatory as well as regional knowledge is needed for the definition of areas with insecure prediction of the DRP.