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Using the snapshot method to delineate functional units on the basis of hydrochemical data for chemical mass balance modelling at the regional scale

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Spatial differences of catchment characteristics that are important for stream water quality are used to delineate functional units at the regional scale on the basis of hydrochemical data. Stream water chemistry data are obtained by a spatially intensive water quality monitoring methodology (Snapshot method). Nested catchments of various scales (1-692 km^2) are sampled in the low mountainous catchment of the Dill river (Hesse, Germany). A set of 26 stream water solutes is analysed by Inductively-Coupled-Plasma Mass Spectrometry (ICP-MS) and by ion chromatography.

The derivation of functional units is based on combining catchment-wide data of stream water chemistry and catchment characteristics, such as geology, soils, catchment area, land use, regolith cover, elevation and population. Multivariate statistical analysis is applied to derive the relationships between the catchment characteristics and stream water quality. Based on these results functional units with a uniform hydrochemical fingerprint are defined. In a further step, these functional units are used as end members in a tracer based mixing model. This mixing model is then used to calculate the proportionate contributions of the functional units to total discharge.