

Optimizing model-based computations of water budgets by providing land use dependent model input through remote sensing techniques

Considering actual climatic and land use changes the problem of available water resources or the estimation of potential flood risks gain eco-political and economical relevance. Adequate assessments, thus, require precise process-based hydrological knowledge.

Spatially distributed hydrological modelling enables a both abstractive and realistic description of hydrological processes, and therefore contributes to the understanding of the hydrological system's responses. Referring to the example of the mesoscale Ruwer basin (a tributary to the Mosel river), a modified version of the distributive modelling system PRMS/MMS (Precipitation Runoff Modeling System/Modular Modeling System) is applied to calculate spatially and temporally explicit water budgets. To achieve modelling results as precise as possible, integration of detailed land use information (spatial distribution of the existing land use classes, crop- and site-specific growth patterns) is necessary. This information is derived here by analysis of multitemporal, geometrically and radiometrically pre-processed Landsat TM-data. This enables separation of different land use classes and differentiated quantification of the leaf area index (LAI). The LAI is estimated by a spectral unmixing approach using statistically optimized endmember sets, referring to the example of winter grain and grassland plots. As a result, numerical inputs (coefficients for calculating evapotranspiration, interception storages) and extracted non-numerical (classified) information can be provided for hydrological modelling.

The version of PRMS applied in this study allows important land use terms to be parameterized in high temporal resolution. Using model input derived from the available satellite data, simulation results are obtained that prove to be realistic compared to gauge data and with respect to their spatial differentiation. Results differ significantly from those obtained by using parameters from literature or by experience without distinguishing specific and site-dependent growth patterns. It can be concluded that the quality of modelling results notably improves by integration and quantitative analysis of remote sensing data; thus, these methods are a significant contribution to physically-based hydrological modelling.