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A conceptual module for simulating vertical and lateral water fluxes through multi-layered soils by wetting fronts for a fully distributed catchment model

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Many modelling approaches for the simulation of the soil water balance have been developed during the last decades. Their process description ranges from physically-based approaches, mostly using the Richards equation, to more or less conceptual implementations using storage approaches. The vertical discretisation of the soil zone in the different approaches is also very variable. Some use wetting fronts, some differentiate several horizons, some considers the soil as one or two storages. The spatial and temporal scale of the different methods depends on the process description and the availability of physical parameters and driving data. The highly complex and physically based approaches are mostly limited to single hillslopes or small test catchments whereas the more conceptual ones can be used for larger meso scale catchments or macro scale river basins.

The development, implementation and application of a soil water module, which can be classified as a conceptual approach with a reasonable physically basis, for the application in micro to meso scale catchments was the goal of the presented study. The prevailing conditions were: (1) vertical and lateral soil water fluxes should be simulated, (2) the module should be applicable with the distribution concept of physiographical Hydrological Response Units, (3) the soil should be differentiated into several horizons depending on the physical soil properties.

The resulting conceptual HSM module, developed for the fully distributed hydrological catchment modelling system J2000, works with wetting fronts driven by physical soil characteristics. Thereby, neither limits for the numbers of parameterised soil layers and modelling units nor for the number of calculated wetting fronts exist. The

module allows also the reproduction of macro porosity, has low computational requirements and a manageable set of calibration parameters, and it can be run both in a daily or hourly temporal resolution.

The general concept of the HSM module together with applications in a small test catchment and validation by FDR/TDR measurements will be presented.