



A new flexible model structure for the open source spatially distributed hydrological model WetSpa

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Recent developments in hydrological models are often dealing with model complexity. Digital data, remote sensing derived maps are now available and need to be fully incorporated into calculations. Improved computational capability is leading research towards more and more complex tools, therefore keeping up with technological developments is becoming a challenge. Many models are today available to describe in details particular hydrological processes but the analysis of water movement at catchment level requires the integration of several domains. For all this reasons flexibility and ease of integration are important requirements for the hydrological models of tomorrow. To this end, we considered the spatially distributed hydrological model WetSpa (Water and energy transfer between Soil plant and atmosphere) and we modified its structure and language. The goal of this research was to provide a reliable open source tool for hydrological studies which is at the same time flexible, easy to use and to couple with new or existing external models. The new structure of the model is modular and written in Python language. Every physically-based process (such as interception, runoff, infiltration, etc.) is coded in a separate module and the modules exchange data during running time through a modeling framework prototype. The user can select which processes will be simulated and the spatial and temporal resolution of each module separately, while the framework takes care of the order of calculation and of data exchange (i.e. no need for pre- and post-processing). The new structure allows the user to modify the model complexity according to data availability and case specific requirements in a straightforward way. Moreover different formulations of the same hydrological process can be easily tested as the modules have a standard and interchangeable format. Furthermore, the model was successfully coupled with other (non-)open source software such as the groundwater flow model MODFLOW and a dynamic land use change model. The new WetSpa model is therefore much more suited for future developments and to support researchers in their hydrological questions.