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Development and evaluation of different conceptual model structures for the Soil and Water Assessment tool

A. van Griensven (1,2)

(1) UNESCO-IHE, Core of Hydrology, Delft, Netherlands (a.vangriensven@unesco-ihe.org), (2) Vrije Universiteit Brussel, Department of Hydrology and Hydraulic Engineering, Brussels, Belgium

The Soil and Water Assessment Tool is a widely used tool that has a comprehensive representation of a large number of river basin processes. For that reason, SWAT has been widely used to support river basin management. One of the weaker parts of the module is the groundwater component. The following limitations have been identified:
(1) The groundwater is stored in shallow groundwater elements below the Hydrological Response Units. Since these elements do not have a position in the landschape, it is not possible to implement a real groundwater model where flow is steered by the difference in groundwater heads.
(2) There is a limited interaction between the soil profile and the shallow aquifer. When the aquifer level rises, it is not moving into the soil profile,
(3) The deep groundwater body is 'black hole' in the model. All water that is sent to the deep aquifer becomes unavailable the model (except for irrigation). However, it reality, deep aquifer volumes may still be able to recharge to the river.
The following modifications are presented:
(1) A deep aquifer storage element has been created at sub-basin scale. This reservoir may move downstream sub-basins (following the routing configuration) whereby part of the water feeds the downstream deep aquifer, while another fraction may discharge into the downstream river.
(2) The variable source concept has been implemented into the SWAT codes by linking the shallow water table to the soil profile. In such a way, the soil profile may get saturated by water from down upwards when the shallow groundwater rises.
(3) Different landscape structures are identified (floodplain/hillslope/top) and water is routed from one to the other.
The modifications are evaluated by means of the analysis of the pareto-front that is formed by multi-objective evaluations for different gages in the catchments and by means of remote sensing data.