EGU24-11384, updated on 09 Mar 2024
https://doi.org/10.5194/egusphere-egu24-11384
EGU General Assembly 2024

Assessment of saturated hydraulic conductivity-depth relationships and extended soil column thickness in catchment hydrological modelling

Raul Mendoza [1,2], Albrecht Weerts [1,2], and Willem van Verseveld [2]

[1]Hydrology and Environmental Hydraulics Group, Wageningen University & Research, Wageningen, Netherlands
[2]Deltares, Delft, Netherlands

Reliable quantification of subsurface dynamics in catchment hydrological models largely depends on good estimates of soil hydraulic properties which influence subsurface runoff generation, flows and storage. In most hydrological modelling concepts, the saturated hydraulic conductivity (K_{sat}) is a key parameter that controls the vertical transfer of water through the soil layers and the lateral subsurface flow. K_{sat} values are derived from direct measurements, literature, or available soil datasets, most of which do not reach depths beyond 2 or 3 m. This is one of the common motivations for limiting the soil column to shallow depths in most catchment models. This study investigates the model schematization of K_{sat} in an extended soil column, where K_{sat} measurements are absent, and the ensuing impacts on catchment hydrological functioning. The motivation is to determine a suitable modelling approach for catchments with deeper soil columns to sufficiently capture the subsurface, including the groundwater, and the feedback with the surface.

Different K_{sat}–depth relationships were conceptualized and implemented in the distributed hydrological model wflow_sbm. Most wflow_sbm applications so far have used a standard soil column thickness of 2.0 m and an exponentially declining K_{sat} with depth. The different K_{sat} schematizations were tested in the Dutch-German catchment Vecht where the model soil column was extended to capture the groundwater system.

The results reveal the impact of an extended soil column and the different K_{sat} schematizations on catchment water balance, surface and subsurface flows, and water table depths. Varying changes were observed among the different K_{sat} schematizations but all produced generally good, and in some cases improved, model performance when compared with observations of river discharge and water table depth. The results demonstrate the suitability of extending the soil column and applying the different vertical K_{sat}–depth relationships in catchment hydrological models.

How to cite: Mendoza, R., Weerts, A., and van Verseveld, W.: Assessment of saturated hydraulic conductivity-depth relationships and extended soil column thickness in catchment hydrological modelling, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-11384, https://doi.org/10.5194/egusphere-egu24-11384, 2024.