Geophysical Research Abstracts
Vol. 19, EGU2017-18675, 2017
EGU General Assembly 2017

Catchment-scale estimates of root zone storage capacity and their value for predictions under change

Markus Hrachowitz, Remko Nijzink, and Huub Savenije

Delft University of Technology, Civil Engineering and Geosciences, Water Resources Section, Delft, Netherlands (m.hrachowitz@tudelft.nl)

Over the past decades progress in the development of hydrological models was achieved. This is in particular true for the increasing acknowledgement of different error sources in throughout the entire modelling processes but also for finding ways to more plausibly constrain models. Although both aspects are of importance if more reliable predictions want to be achieved, they do not address what should be considered the main flaw in the majority of modelling approaches. Although, 40 years after the seminal work of Eagleson (1978) the importance of vegetation for hydrological functioning is well accepted, our modelling philosophy remains surprisingly mechanistic. Many models, in spite of being relatively good reflections of reality, merely provide us a description of the system at (or over) any given time interval, largely averaging out natural fluctuations of the system boundary conditions. These temporal snapshots completely ignore that the natural system is characterized by its ability to adapt to changing environmental conditions at a wide range of temporal and spatial scales, thereby altering the hydrological partitioning and path ways and thus the functioning of catchments. Examples include shrinking cracks in soils at short time- and small spatial scales; extension and contraction of root systems at medium time- and spatial scales; or soil/land formation processes at longer and larger scales. For many of these dynamic changes vegetation plays a partly and at least indirectly dominant role. One of these effects, the temporally changing root zone storage capacity was recently shown to be essentially a function of climate and vegetation type, as plant need to develop a root system that provides access to sufficient water to bridge critical dry spells. We could also show that there is compelling evidence that this parameter when estimated from climate data directly on the scale of modelling interest, carries more information than traditionally soil derived or calibrated estimates. In addition, our results suggest that, the root zone storage capacity can dramatically change after land use changes and that this change can be clearly identified in the climate data used to estimate this parameter. This offers a first step towards a time dynamic description of hydrological systems on the catchment scale.