Sense and nonsense of representing the root zone in global hydrological models

van der Ent, Ruud; Van Beek, Rens V.; Sutanudjaja, Edwin H.; Wang-Erlandsson, Lan; Hessels, Tim; Bastiaanssen, Wim; Bierkens, Marc

Publication date
2018

Document Version
Final published version

Published in
Geophysical Research Abstracts (online)

Citation (APA)
van der Ent, R., Van Beek, R. V., Sutanudjaja, E. H., Wang-Erlandsson, L., Hessels, T., Bastiaanssen, W., & Bierkens, M. (2018). Sense and nonsense of representing the root zone in global hydrological models. *Geophysical Research Abstracts (online)*, *20*, Article EGU2018-4975.
https://meetingorganizer.copernicus.org/EGU2018/EGU2018-4975.pdf

Geophysical Research Abstracts
Vol. 20, EGU2018-4975, 2018
EGU General Assembly 2018

Sense and nonsense of representing the root zone in global hydrological models

Ruud van der Ent (1,2), Rens van Beek (2), Edwin Sutanudjaja (2), Lan Wang-Erlandsson (3), Tim Hessels (4), Wim Bastiaanssen (4), and Marc Bierkens (2)

(1) Delft University of Technology, Water Management, Delft, Netherlands, (2) Utrecht University, Physical Geography, Utrecht, Netherlands, (3) Research Institute for Humanity and Nature, Kyoto, Japan, (4) IHE Delft Institute for Water Education, Delft, Netherlands

The storage and dynamics of water in the root zone control many important hydrological processes such as saturation excess overland flow, interflow, recharge, capillary rise, soil evaporation and transpiration. Consequently, the effect of the root zone parameterization on the runoff prediction of global hydrological or land surface models (hereafter, GHMs) can be quite large. Many studies have found that climate is the most important factor in explaining rooting depths of natural vegetation, and thus outweighs the importance of soil and vegetation type. Most GHMs, however, use only soil maps and look-up tables for root zone properties to parameterize the root zone. This is problematic, as the observations of the root zone may indirectly have some climate properties, but is still likely to contribute to errors as the data is scarce, often incomplete (i.e. not the entire vertical root profile), at the wrong scale (i.e. individual plant vs. ecosystem value vs. grid cell value), and it is uncertain which part of root zone is hydrologically active. Recent studies developed different optimization methods to a priori determine the root zone storage or rooting depth at the global scale. These studies also suggested that their values could potentially be directly exported to other GHMs.

In this study we test which root zone storage and rooting depth would be optimal for the global hydrological model PCR-GLOBWB. We want to answer the following questions:

• How much do the “best fit” root zone storages and rooting depths differ from each other with different model settings in PCR-GLOBWB?
• Are calibrated root zone storage capacities and rooting depths for PCR-GLOBWB similar to root zone storage capacities and rooting depths obtained by other global studies?

The optimal root zone parameters follow from taking the parameters that best reproduce the evaporative flux from a state-of-the-art ensemble of satellite remote sensing based gridded evaporation products. We find that the global spatial patterns of maximum root zone storage capacity are quite independent of other parameters in PCR-GLOBWB. These patterns are similar to the patterns found in recent global studies, but the absolute values are not. We believe that the future for GHMs lies in dynamically determining the root zone storage based on logical – climate based – optimization concepts that are tailor-made for each GHM independently.