EGU21-12618, updated on 05 Dec 2022
https://doi.org/10.5194/egusphere-egu21-12618
EGU General Assembly 2021

Assessing a seasonal calibration approach for a small forest catchment in a Mediterranean region North Central Portugal

Svenja van Schelve[1], Diana C. S. Vieira[1], Jan J. Keizer[1], Martinho António Santos Martins[1], and Anne-Karine Boulet[2]
[1]Centre for Environmental and Marine Studies (CESAM), Department of Environment and Planning, University of Aveiro, Aveiro, Portugal.
[2]Centro de Estudos de Recursos Naturais, Ambiente e Sociedade (CERNAS), Escola Superior Agraria de Coimbra, Coimbra, Portugal.

Hydrological modeling is nowadays a widely used decision making tool to predict watershed behavior in forest areas. A commonly used processed based watershed model is the Soil and Water Assessment Tool (SWAT). SWAT provides comprehensive forest management operations and offers a diversity of adjustable input parameters to simulate complex processes inside a catchment. Nevertheless, one well-known obstacle of SWAT is the poor model performance during dry periods, characterized by low discharge and/or a dried-out catchment, causes by a possible seasonal dependency of input parameter related to climate conditions. Model predictions inherently goes along with uncertainties, linked to a diversity of unknown input parameters and assumptions. Therefore, to minimize model predictions uncertainties the use of an appropriate calibration technique is indispensable. During a conventional calibration process with SWAT model, inputs do not consider seasonal variabilities, by generally using a single parameter set for simulating discharge in a catchment. Although some studies have shown, a significant improvement while using different parameter sets, according to a wet or dry season [1, 2]. However, there is still a knowledge gap in applying such season-based calibration approach, namely under which conditions such approach could improve model predictions. The aim of this study is to determine the parameters which seem to have higher influence under seasonal climate conditions in contrast to season independent parameters, in a semi-managed eucalyptus forest catchment in North Central Portugal. We will use different parameter sets according to a wet and dry period, to improve the discharge simulation and make a model performance more robust. Further to optimize different model scenarios, such as transport processes, that depending on seasonal flow regimes. The climate of the study area is a warm- summer Mediterranean climate dominated by dry, warm and long summers. The hydrological dataset used for the calibration and validation period comprises the hydrological years 2010 to 2016, with a local metrological dataset and discharge measurements from the outlet of the catchment. Global sensitive analysis (GSA) is performed with the Fourier Amplitude Sensitivity Testing (FAST) in SWATplusR [3], for following defined cases, (i) over the complete data period (conventional), (ii) the wet and the (iii) dry season dataset. Whereas for the calibration and the validation period, the dataset is divided by a 4-year calibration and a 2-year validation period. Respectively, a conventional and a season-based

calibration is done while using SWATplusR. The GSA results show that the most influencing parameters for the conventional dataset are the curve number (CN2) with a sensitivity of 0.65, followed by the available water capacity of the soil layer (SOL_AWC) with a sensitivity of 0.008. When using the dry season dataset the sensitivity of the CN2 parameter decreases by a factor of 0.45 and SOL_AWC increases by a factor of 5, confirming the hypothesis of an input dependency on seasonal climate conditions.

[1] Zhang, D. et al., 2015. https://doi.org/10.1016/j.ecolmodel.2015.01.018
[2] Muleta, M.K. et al., 2012. https://doi.org/10.1061/(ASCE)HE.1943-5584.0000421
[3] Schürz, C., 2019. doi: 10.5281/zenodo.3373859