

# Coupling SWAT model and CMB method for modeling of high-permeability bedrock basins receiving interbasin groundwater flow

Senent-Aparicio J.

Alcalá F.J.

Liu S.

Jimeno-Sáez P.

This paper couples the Soil and Water Assessment Tool (SWAT) model and the chloride mass balance (CMB) method to improve the modeling of streamflow in high-permeability bedrock basins receiving interbasin groundwater flow (IGF). IGF refers to the naturally occurring groundwater flow beneath a topographic divide, which indicates that baseflow simulated by standard hydrological models may be substantially less than its actual magnitude. Identification and quantification of IGF is so difficult that most hydrological models use convenient simplifications to ignore it, leaving us with minimal knowledge of strategies to quantify it. The Castril River basin (CRB) was chosen to show this problematic and to propose the CMB method to assess the magnitude of the IGF contribution to baseflow. In this headwater area, which has null groundwater exploitation, the CMB method shows that yearly IGF hardly varies and represents about 51% of mean yearly baseflow. Based on this external IGF appraisal, simulated streamflow was corrected to obtain a reduction in the percent bias of the SWAT model, from 52.29 to 22.40. Corrected simulated streamflow was used during the SWAT model calibration and validation phases. The Nash-Sutcliffe Efficiency (NSE) coefficient and the logarithmic values of NSE (lnNSE) were used for overall SWAT model performance. For calibration and validation, monthly NSE was 0.77 and 0.80, respectively, whereas daily lnNSE was 0.81 and 0.64, respectively. This methodological framework, which includes initial system conceptualization and a new formulation, provides a reproducible way to deal with similar basins, the baseflow component of which is strongly determined by IGF. © 2020 by the authors.

Baseflow filter

Castril river

CMB method

Interbasin groundwater flow

SWAT model

Chlorine compounds

Groundwater flow

Hydrology

Mechanical permeability

Stream flow

Baseflows

Calibration and validations

CMB method

Groundwater exploitation

Interbasin groundwater flows

Methodological frameworks

Soil and water assessment tool

SWAT model

Groundwater

baseflow

bedrock

calibration

filter

groundwater flow

hydrological modeling

methodology

model validation

permeability

soil and water assessment tool

streamflow