Integrating SWAT+ hydrological modelling and remote sensing to estimate surface water balance and groundwater recharge in the High Atlas of Marrakech and the Haouz plain
(Oral)

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ABSTRACT

Groundwater resources are becoming increasingly vulnerable to human activities and climate change due to high water demand, intensive abstraction, and increased evapotranspiration associated with changes in precipitation amounts and patterns. This study aims to integrate the SWAT+ hydrological model and remote sensing datasets to estimate the groundwater recharge at the watershed scale. The SWAT+ is a revised version expected to improve the code maintenance and provide a better representation of the spatial units after the introduction of landscape units. In addition, the Remotely sensed approach based on Water Balance was used to compare with SWAT+ model. The study site is located in the Tensift Basin and focuses on four main sub-watersheds (N'fis, Rheraya, Ourika, Zat). The dominant land use types of the watershed are Grassland and Bare land. The inputs of the SWAT+ model were prepared using the SRTM30m digital elevation model (DEM). The improved maps of land use land cover from (ESA CCI LC) products were used to test deferent scenarios and their impact on the water balance. The soil characteristics are determined from FAO soil maps and the Harmonized World Soil Database and hydraulic characteristics are determined using the SPAW model. Daily rainfall is measured at gauge stations, and the meteorological variables such as daily wind speed, relative humidity, solar radiation, and temperature are collected within the watershed. The model was calibrated using daily stream flow data using Sequential Uncertainty Fitting (SUFI-2), which is one of the programs incorporated into R-SWAT interface. The annual recharge calculated through the physically-based SWAT+ model was compared to the estimated using a remote sensing-based water balance approach. For this latter one, the water balance elements were calculated using satellite-derived datasets from GPM (precipitation), SEBAL (actual evapotranspiration), SMAP (soil moisture storage change), and NRCS-CN (runoff). This method provides spatially distributed estimates of recharge and enables direct comparison with SWAT+ outputs. The integration of both modeling and remote sensing approaches enhances the understanding of recharge dynamics in semi-arid environments and supports the development of sustainable groundwater management strategies in the Tensift Basin.

Keywords: Groundwater Recharge, SWAT+, Remote Sensing, Water Balance, SEBAL, Semi-Arid region