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Application of SWAT Model in Eco-hydrological Assessment of the Clariano River / Vagheei, Hamed; Vezza, Paolo; Palau-Salvador, Guillermo; Boano, Fulvio. - (2019), pp. 118-118. ((Intervento presentato al convegno The 2019 International SWAT Conference tenutosi a Vienna nel July 15-19, 2019.

Availability:

This version is available at: 11583/2909186 since: 2021-06-23T19:20:15Z

Publisher:

SWAT

Published

DOI:

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Application of SWAT Model in Eco-hydrological Assessment of the Clariano River

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Abstract

Water resource challenges are increasing as a result of environmental deterioration. The degradation of ecosystems by human activities such as agriculture, deforestation and urbanization is a major threat today which puts pressures on water resources. Among various water related issues, the deterioration of water quality is a serious worldwide challenge. Pollutants from cities and factories, sediments resulting from farming, the clearance of forests and building roads, sewage and runoff from farmlands as well as wastewater treatment plants (WWTPs) effluents can contain nutrients and toxic chemicals which have negative impacts on aquatic ecosystems. Unfortunately, it is still difficult to quantitatively determine the impacts of water quality changes on aquatic communities. The present research activity aims to investigate aquatic ecosystem responses to water quality deterioration using the Clariano River (Spain) as case study. The Clariano River, which is located in the Jucar River Basin in Valencia, suffers from various sources of pollution including WWTPs, agriculture, livestock and industrial activities as well as septic tanks and cesspits. As a consequence and according to available data, the river faces low water quality and the loss of biodiversity in some parts. In the present study, hydrological modeling of the Clariano River Basin was performed using the Soil and Water Assessment Tool (SWAT). SWAT-CUP was also used to calibrate and validate the SWAT model. The simulation was performed for the years 2002 to 2017, of which the first three years were considered for warming up the model. The 8-year period (2005-2012) was selected as calibration period, and the 5-year period (2013-2017) was considered as validation period. The results indicate a very good performance of SWAT model in streamflow simulation with R^2 and NSE values of higher than 0.8 for both calibration and validation periods. In the following step, nutrients movement along the river will be simulated using the SWAT model to assess if SWAT model is a suitable tool for simulation of nutrients transportation along the Clariano River, as well. Finally, the results of SWAT simulation will be evaluated to have a better understanding of possible relations between river streamflow, nutrients and biodiversity.

Keywords

Eco-hydrology, water quality, aquatic ecosystem, water resources management, SWAT, Clariano River