EGU21-14540
https://doi.org/10.5194/egusphere-egu21-14540
EGU General Assembly 2021

Improving the estimates of nitrate concentrations at subsurface drained agricultural catchment scale using a new conceptual water quality model

Julien Tournebize, **Samy Chelil**, Hocine Henine, and Cedric Chaumont
Univ Paris-Saclay, INRAE, HYCAR research Unit, ANTONY, France (julien.tournebize@inrae.fr)

The agricultural source pollution, such as nutrient and pesticides, affect the quality of surface water and groundwater. The agricultural nonpoint source pollution due to the excessive land fertilization is considered by researchers and governments as a concerning and sensitive issue. At the scale of agricultural catchments, the modeling of nitrate-leaching losses has been widely addressed in several studies. However, most of developed models require a large number of input data and parameters. Some of them include a complex process of biogeochemical nitrogen process or a full agronomic module and could be computationally time-consuming. Moreover, the quality of the input data makes the model calibration less efficient.

The objective of this study is to present a new conceptual and reservoir model (SIDRA-N), developed to better access the time-variation of nitrate concentrations [NO3-] at the outlet of subsurface drainage network. The model represent a simplified scheme of subsurface flow and nitrate transfer processes in the soil profile, between the drain and the mid-drain. The soil profile is decomposed into three interconnected compartments: the first compartment represents the rapid transfer of water and nitrate through the soil macroporosity; the two other compartments describe the progressive contribution of the horizontal transfer.

The input data to the nitrate module consists on the Remaining pools of Nitrate at the Beginning of Winter season (RNBW), introduced before the winter of each hydrological year. This value should represent all biogeochemical transformations of nitrogen and agricultural practices from previous crop. This variable can explain until 80% of the total nitrate flux exported yearly. Hence, SIDRA-N model requires only two input variables: the drainage discharge and the RNBW. A set of parameters was introduced to regulate nitrate fluxes and discharge transiting through compartments to the drain outlet.

Calibration and validation (C/V) procedures are fundamental to the assessment of the performance and the robustness of water quality models. In this study, the split sample test for the model calibration and validation (C/V) was carried out using data set from Rampillon study site (355 ha, data for 6 years), located East of Paris, in France. The C/V step was performed using high frequency observations (hourly time-step) of nitrate concentrations and drainage discharge. The results showed performance criteria of KGE greater than 0.5 and RMSE less than 5 mgN/l. These

results confirm the very good quality of simulations. Finally, a seasonal model calibration was implemented to observe the yearly parameter variability and ensure the model stability and consistency.