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Hydrological and water quality processes simulation by the integrated MOHID model

Ane Epelde (1), Iñaki Antiguedad (1), David Brito (2), Jauch Eduardo (2), Ramiro Neves (2), Sabine Sauvage (3), and José Miguel Sánchez-Pérez (3)

(1) Dept. of Geodynamics, Hydrology and Environment group, University of the Basque Country , (2) MARETEC, Instituto Superior Técnico, Technical University of Lisbon, (3) University of Toulouse; INPT, UPS; Laboratoire Ecologie Fonctionnelle et Environnement (EcoLab)

Different modelling approaches have been used in recent decades to study the water quality degradation caused by non-point source pollution. In this study, the MOHID fully distributed and physics-based model has been employed to simulate hydrological processes and nitrogen dynamics in a nitrate vulnerable zone: the Alegria River watershed (Basque Country, Northern Spain).

The results of this study indicate that the MOHID code is suitable for hydrological processes simulation at the watershed scale, as the model shows satisfactory performance at simulating the discharge (with NSE: 0.74 and 0.76 during calibration and validation periods, respectively). The agronomical component of the code, allowed the simulation of agricultural practices, which lead to adequate crop yield simulation in the model. Furthermore, the nitrogen exportation also shows satisfactory performance (with NSE: 0.64 and 0.69 during calibration and validation periods, respectively). While the lack of field measurements do not allow to evaluate the nutrient cycling processes in depth, it has been observed that the MOHID model simulates the annual denitrification according to general ranges established for agricultural watersheds (in this study, 9 kg N ha-1 year-1). In addition, the model has simulated coherently the spatial distribution of the denitrification process, which is directly linked to the simulated hydrological conditions. Thus, the model has localized the highest rates nearby the discharge zone of the aquifer and also where the aquifer thickness is low.

These results evidence the strength of this model to simulate watershed scale hydrological processes as well as the crop production and the agricultural activity derived water quality degradation (considering both nutrient exportation and nutrient cycling processes).