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Assessing nitrate, carbon and sediment fluxes by coupling SWAT and RIVE models : the case of Vienne watershed (France)

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Modeling is a useful tool to study water and biogeochemical cycles in the environment and how they are controlled by human activities. The SWAT model (Soil and Water Assessment Tool) is a semi-distributed hydro-agro-environmental model physically-based and successfully applied in many places of the world, that simulates the transfer of biogenic elements from land to river at the scale of watersheds. It takes into account natural and anthropogenic factors that influence biogeochemical cycles. We used this model to quantify spatial and temporal dynamics of nitrogen, organic carbon and suspended sediments in the medium-sized agricultural Vienne watershed (France). We coupled SWAT with the mechanistic ecological RIVE model to improve the representation of biogeochemical in-stream processes. Improvements by this coupling concern the no calibration requirement for simulating water quality, the consideration of autochthonous organic matter and the calculation of the nutrient fluxes across the sediment–water interface. Such a model with a holistic approach allowed to understand the interactions between the compartments of a whole watershed and to map water quality along the watershed. Understanding the functioning of this anthropo-hydro-system leads to evidence hot spots and hot moments of ecological functions in land and in-streams. As a perspective, those results would permit to identify regulating zones of these fluxes and thus functional areas to protect and/or restore.