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A new method to quantify the proportion of the wetland area impacted by an artificial drainage system in hydromorphic soil

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Wetlands are known by their specific biodiversity and their ecosystem services such as the contribution in flood control, groundwater recharge and wastewater treatment. During the last decades, numbers of natural wetlands have been drained and most of them converted into agricultural areas. The French water law, in application of the European water framework directive aims at protecting the natural wetlands and proposes policies to regulate the implementation of agricultural drainage systems in wetlands. The policy is based on thresholds of wetland impacted area by the implementation of the drainage system.. Due to its lateral action on the groundwater, the impacted area of the drainage system can be larger than its strict geographical extension.

The aim of this study is to develop a new method for assessing the actual extension of a drainage system for appropriate and equitable application of the water law in case of suspected infraction to the law. We only present here the technical aspects of the method, which also has to be robust, reliable and easily usable by water police constables. To reach this terms of reference, we assume that relatively complex transitory phenomena of the fluctuations of a water table can be simplified to a steady state representation. The study follows a methodology based on numerical simulations using HYDRUS-2D model which was validated in transitory regime using an experimental data set carried out at Cétrais study site (Loire-Atlantique, France). Due to short period of the available data, we used long period rainfall data to simulate the behavior of the water table on the long term. Then, simulation results were used to make a frequency analysis of groundwater table level fluctuations at different distances from the ditch. We used presence rate of 20 % (equivalent to 73 days per year) to determine the representative groundwater table level that will be used for the steady state equivalent behavior computation. From that we obtained a representative mean annual functioning of the wetland of Cétrais. The results are presented as a set of charts. These charts easily assess the influenced area for different wetlands hydrological functioning, drainage systems, soils types and initial water table level. In term of perspective, the developed method will be tested and performed for different wetlands types existing in France using the data from the French piezometric network.

Key words: wetland, drainage impact, drain, drainage modeling, HYDRUS-2D.