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A new method to quantify the area impacted by sub-surface drainage network in wetlands.

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Wetlands are known to provide specific biodiversity and ecosystem services such as flood and water quality regulation.. During the last decades, numbers of natural wetlands have been drained and most of them converted into agricultural areas. The agricultural drainage network (tile pipe, collector or ditch) in wetlands modify the hydrological behavior and its ecological functions. The French water law, in application of the EU 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 to be submitted to ecological compensation.
The aim of this study is to develop a new method for assessing the real extension of a drainage system in wetlands in order to support water policy action for general wetland case. To reach this objective, we have to assume that the relatively complex transient hydrological functioning of water table fluctuations can be simplified to an equivalent steady state representation based on average hydrological behavior.
The main parameters, to be set up, of this equivalent regime are the average recharge rate, the most frequent water table depth and the amplitude of water table fluctuations. The amplitude of the water table fluctuations is determined from the cumulative frequency curve of the water table depth. This amplitude represents the difference between the cumulative frequencies of 20% and 80% of the water table depth. These parameters are defined based on groundwater measurements from 125 piezometers installed in different wetland types distributed on 52 sites at French level. In the first step, a frequency analyses and PCA analysis have been applied to define the functional relationships between the different types of wetlands and the indicators of water table fluctuations. This analysis showed that the amplitude of water table fluctuations allows a functional classification of wetland depending on the type of groundwater supplying the wetland, contributing to define boundary condition of the wetland. In the second step, a numerical simulations using HYDRUS-2D model were used to determine the mean groundwater recharge to be used to describe the mean wetlands behavior. The simulation results, in steady state regime, showed that the recharge rate representing the most frequent water table behavior is close to the mean precipitation during winter period. In conclusion, this study identified the conditions of steady-state simulation describing the mean behavior of water table in wetlands impacted by sub-surface drainage.