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Metamodeling as a tool to size vegetative filter strips for surface runoff pollution control in European watersheds.

Claire Lauvernet (1), Rafael Muñoz-Carpena (2), and Nadia Carluer (1)
(1) Irstea (Cemagref), MALY, Villeurbanne, France (claire.lauvernet@irstea.fr), (2) University of Florida, Gainesville, USA

In Europe, a significant presence of contaminants is found in surface water, partly due to pesticide applications. Vegetative filter strips or buffer zones (VFS), often located along rivers, are a common best management practice (BMP) to reduce non point source pollution of water by reducing surface runoff. However, they need to be adapted to the agro-ecological and climatic conditions, both in terms of position and size, in order to be efficient. The TOPPS-PROWADIS project involves European experts and stakeholders to develop and recommend BMPs to reduce pesticide transfer by drift or runoff in several European countries. In this context, IRSTEA developed a guide accompanying the use of different tools, which allows designing site-specific VFS by simulating their efficiency to limit transfers using the mechanistic model VFSMOD. This method which is very complete assumes that the user provides detailed field knowledge and data, which are not always easily available. The aim of this study is to assist the buffer sizing by using a unique tool with a reduced set of parameters, adapted to the available information from the end-users. In order to fill in the lack of real data in many practical applications, a set of virtual scenarios was selected to encompass a large range of agro-pedo-climatic conditions in Europe, considering both the upslope agricultural field and the VFS characteristics. As a first step first, in this work we present scenarios based on North-West of France climate consisting of different rainfall intensities and durations, hillslope lengths and slopes, humidity conditions, a large set of field rainfall/runoff characteristics for the contributing area, and several shallow water table depths and soil types for the VFS. The sizing method based on the mechanistic model VFSMOD was applied for all these scenarios, and a global sensitivity analysis (GSA) of the VFS optimal length was performed for all the input parameters in order to understand their influence and interactions, and set priorities for data collecting and management. Based on GSA results, we compared several mathematical methods to compute the metamodel, and then validated it on an agricultural watershed with real data in the North-West of France. The analysis procedure allows for a robust and validated metamodel, before extending it on other climatic conditions in order to make the application on a large range of european watersheds possible. The tool will allow comparison of field scenarios, and to validate/improve actual existing placements and VFS sizing.