Geophysical Research Abstracts
Vol. 16, EGU2014-15667, 2014
EGU General Assembly 2014

Sensitivity analysis and metamodeling of a toolchain of models to help sizing vetetative filter strips in a watershed.

Claire Lauvernet (1), Dorothea Noll (1), Rafael Muñoz-Carpena (2), and Nadia Carluer (1)

(1) Irstea, UR MALY, Lyon-Villeurbanne, France (claire.lauvernet@irstea.fr), (2) Agricultural and Biological Engineering. University of Florida, 110570 Gainesville, USA

In Europe, environmental agencies do the finding a significant presence of contaminants in surface water, which is partly due to pesticide applications. Vegetative filter strips (VFS), often located along rivers, are a common tool among other buffer zones to reduce non point source pollution of water by reducing surface runoff. However, they need to be adapted to the agro-pedo-climatic conditions, both in terms of position and size, in order to be efficient. This is one of the roles of TOPPS-PROWADIS project which involves European experts and stakeholders to develop and recommend Best Management Practices (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 VFS by simulating their efficiency to limit transfers. It needs the user to define both a scenario of incoming surface runoff and the buffer zone characteristics. First, the contributive zone (surface, length, slope) is derived from the topography by a GIS tool, HydroDem. ; 2nd, the runoff hydrograph coming in the buffer zone is generated from a rainfall hyetogram typical of the area, using Curve Number theory, taking into account soil characteristics. The VFS's optimal width is then deduced for a given desired efficiency (for example 70% of runoff reduction), by using VFSMOD model, which simulates water, suspended matters (and pesticides) transfer inside a vegetative filter strip. Results also indicate if this kind of buffer zone is relevant in that situation (if too high, another type of buffer zone may be more relevant, for example constructed wetland).

This method assumes that the user supplies quite a lot of field knowledge and data, which are not always easily available. In order to fill in the lack of real data, a set of virtual scenarios was tested, which is supposed to cover a large range of agro-pedo-climatic conditions in Europe, considering both the upslope agricultural field and the VFS characteristics. These scenarios are based on: 2 types of climates (North and South-west of France), different rainfall intensities and durations, different lengths and slopes of hillslope, different humidity conditions, 4 soil types (silt loam, sandy loam, clay loam, sandy clay loam), 2 crops (wheat and corn) for the contributive area, 2 water table depths (1m and 2.5m) and 4 soil types for the VFS. The sizing method was applied for all these scenarios, and a sensitivity analysis of the VFS optimal length was performed for all the input parameters in order to understand their influence, and to identify for which a special care has to be given. Based on that sensitivity analysis, a metamodel has been developed.

The idea is to simplify the whole toolchain and to make it possible to perform the buffer sizing by using a unique tool and a smaller set of parameters, given the available information from the end users. We first compared several mathematical methods to compute the metamodel, and then validated them on an agricultural watershed with real data in the North-West of France.