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Virtual laboratory for the study of transport processes in surface waterflows

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The equations involved in the study of transport processes depend on the spatial and temporal scale of the study and according to the required level of detail can become very difficult to solve analytically. Besides, experimentation of processes with any transport phenomena involved is complex due to their natural or forced occurrence in the environment (eg. Rainfall-runoff, sediment yield, controlled and uncontrolled pollutant loadings, etc.) and the great diversity of substances and components with an specific chemical behavior. However, due to the numerous fields of application of transport phenomena (basic and applied research, hydrology and associated fluxes, sediment transport, pollutant loadings to water flows, industrial processes, soil and water quality, atmospheric emissions, legislation, etc.), realistic studies of transport processes are required.

In this context, case study application, an active methodology according to the structural implications of the European Higher Education Area (EHEA), with the aid of computer tools constitute an interactive, instantaneous and flexible method with a new interplay between students and lecturers. Case studies allow the lecturer to design significant activities that generate knowledge in the students and motivates them to look for information, discuss, and be autonomous.

This work presents the development of a graphical interface for the solution of different case studies for the acquisition of capacities and abilities in the autonomous apprenticeship of courses related to transport processes in Environmental Hydraulics.

The interactive tool helps to develop and improve abilities in mixing and transport in surface water related courses. Thus, students clarify theoretical concepts and visualize processes with negative effects for the environment and that therefore, can only be reproduced in the laboratory or in the field under very controlled conditions and commonly with tracers instead of the real substances. The tool can be used for different case studies in terms of processes involved, governing variable, initial conditions, etc. (eg. Accidental spill of a conservative pollutant from a factory in a river stretch that constitutes a source of drinking water for a town downstream) and can be used as a virtual laboratory for the analysis of the influence of the different variables and parameters of the process. Thus, autonomous apprenticeship is fostered and therefore, the development of personal abilities and the analysis and summary of information related to the case study is stimulated.