

Can a GIS toolbox assess the impact of oil spills?

Paloma F. Valdor, Aina G. Gómez, Víctor Velarde, Araceli Puente, José A. Juanes.

Environmental Hydraulics Institute "IH Cantabria", Universidad de Cantabria, C/Isabel Torres No. 15, Parque Científico y Tecnológico de Cantabria, 39011 Santander, Spain

Phone + 34 942 20 16 16

fernandezvp@unican.es

In this contribution, a methodology to assess the impact of oil spills by using Geographical Information System (GIS) techniques is presented. Traditionally, environmental risk assessment on aquatic systems has been mainly focused on point contaminant sources. Numerical models have allowed interpreting, simulating and predicting responses of aquatic systems to these contaminant sources. Nevertheless, diffuse contaminant sources, such as oil spills, usually present a lack of information, making the use of numerical models an arduous, and sometimes impossible, task. To overcome these inconvenients, several authors have implemented the response-distance method. Radial proximity, assuming linear agent dispersion, has been widely used, ignoring environmental variability and agents' characteristics.

The developed methodology assesses the affected area of an oil spill, it is calculated considering three processes: i) an initial area in function of quantity discharged and product density; ii) the spreading process having into account the quantity discharged, product density and the simulation time; iii) transport and fate of oil spill by using a conservative particle tool and computing the dispersion of virtual particles at given environmental hydrodynamic currents. To automate and simplify the process to obtain immediate and homogeneous results without miscalculation errors, a user-friendly toolbox has been developed in ArcGIS (10.1) (SPILL toolbox), using Python and ArcGIS scripting library to build a non-ambiguous geoprocessing workflow. SPILL toolbox has been extensively tested by applying it to oil facilities at Tarragona harbor (NE Spain). Affected areas calculated using SPILL toolbox have shown a very good correspondence with results obtained by means of a calibrated 2D transport numerical model.

We can conclude that the methodology to assess the impact of oil spills constitutes an advanced, precise and detailed procedure, being suitable for the management of this type of activities at any aquatic system. The use of GIS techniques allows to consider aspects from agent and environmental characteristics. Results provide spatial variation of impacts, essential data for a cost-benefit management.

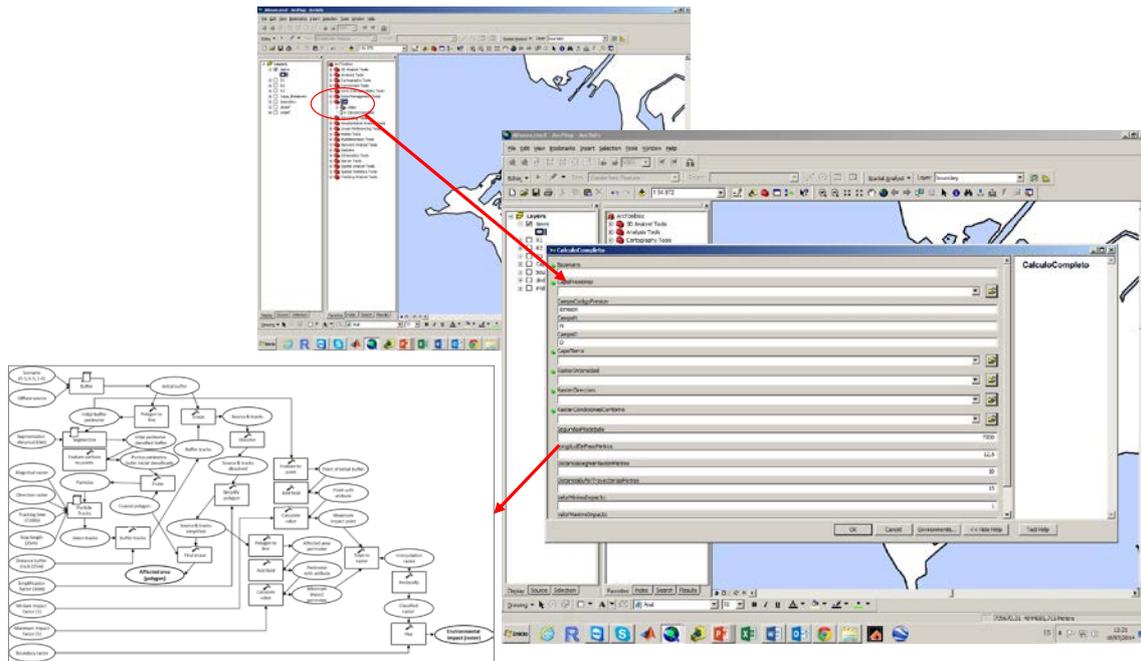


Figure 1. SPILL toolbox screenshots and graphical representation of its model builder.