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Non-point-source groundwater vulnerability assessments at regional scale by coupling of GIS and transfer function

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Regional scale studies on groundwater vulnerability assessment of non point source agrochemical contamination suffer from either no evaluation of uncertainty in data output, in that of qualitative modeling, either from prohibitively costly computational efforts, in that of deterministic modeling. By contrast here is presented a GIS-coupled transfer function modeling approach for vadose zone pesticide leaching that:

a) is capable of solute concentration estimation at a depth of interest within a known error confidence class;

b) uses available soil survey, climatic, and irrigation information, and requires minimal computational cost for application;

c) can dynamically support decision making through thematic mapping and 3D scenarios

This result was pursued through 1) the design and building of a spatial database containing environmental and physical information regarding the study area, 2) the development of the transfer function procedure for layered soils, 3) the final representation of results through digital mapping and 3D visualization. One side GIS modeled environmental data in order to characterize, at regional scale, soil profile texture and depth, land use, climatic data, water table depth, potential evapotranspiration; on the other side such information was implemented in the up-scaling procedure of the Jury's

TFM resulting in a set of texture based travel time probability density functions for layered soils each describing a characteristic leaching behavior for soil profiles with similar hydraulic properties. Such behavior, in terms of solute travel time to water table, was then imported back into GIS and finally estimation groundwater vulnerability for each soil unit was represented into a map as well as visualized in 3D.