Geophysical Research Abstracts,
Vol. 11, EGU2009-9556, 2009
EGU General Assembly 2009

Comparing Point Count System and physically-based approaches to map aquifer vulnerability

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Pollution vulnerability maps of aquifers are an important instrument for land and water management. These maps are generally based on simplified Point Count System Models (PCSM), such as DRASTIC or SINTACS, without the use of physically based groundwater models, which may provide more accurate results. The present research aims at finding a trade-off between the accuracy provided by a physically-based model, which inevitably involves higher computational complexity and data requirements, and the coarser, albeit simpler and easy to implement, approach provided by an indicator based model such as one of the most important PCSM, the DRASTIC model (Aller et al., 1987). The alluvial aquifer of the conoid of the Reno River, extending from pedemountain hills of the Apennines chain towards Po plain, is one of the main sources of drinking water for the city of Bologna. The parameters considered by DRASTIC (Depth of water, net Recharge, Aquifer media, Soil media, Topography, Impact of vadose zone and hydraulic Conductivity) represent the main hydrogeological and environmental parameters that influence the pollution transport from the surface towards the groundwater. The real flow of the Reno aquifer, was then simulated by means of a finite element model (FEFLOW) that takes into account the physical processes of water movement and the associated transport of contaminant in the environment. The results obtained by the model have been compared with the DRASTIC vulnerability map. A preliminary analysis of the vulnerability map, based on chemical analyses of water, reveals that the concentration of Nitrates is actually higher in those zones where higher vulnerability values were found.