USING HYDRUS-2D SIMULATION MODEL TO STUDY ONE-DIMENSIONAL FLUXES OF WATER AND SOLUTE IN A SOIL COLUMN

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Long term applications of treated wastewater in the soil can produce accumulation of the metals normally transported with the water, whose increasing concentrations can become toxic for crops development and human health (Chang et al., 1992). The movement of heavy metals in the soil depends on many factors, i.e. pH, clay content, organic matter and cationic exchange capacity. As a result of irrigation application of treated wastewater into the soil, the organic matter can be degraded in soluble organic CO$_2$, low molecular weight acids, residual organic matter as well as inorganic constituent (Boyd et al., 1980). The consequence of such decomposition is to facilitate the release of heavy metals in the soil solution. The chemical and physical interactions between treated wastewaters and the soil can modify the parameters characterizing the processes of water and solute transport in the soil. Moreover, different solute mobility parameters can be responsible of the formation of accumulation zones in the soil profile or, on the other hands, of the facilitation of the contaminants transport towards higher depths (Coppola, 2002). The processes of transport of pollutants, their diffusion and interaction with the soil has not been completely clarified and could be deepened by means of experimental tests. Numerical models, if opportunely calibrated with experimental data, can be used as instrument to forecast the diffusion of contaminants in the soil. HYDRUS-2D numerical code (Simunek et al., 1999) can effectively represent an useful tool for simulating and analyzing the variations of water content in the soil profile as well as the concentrations of metals during wetting or drying processes, when poor quality waters are used for irrigation. In order to verify the possibility of using HYDRUS-2D to study the transport processes of metals in the soil, data collected during experiments carried out into a saturated soil column (30 cm-height and 25 cm-diameter) equipped with tensiometers, solution extractors and TDR probes places to different depth from the soil surface, were used. Four extractor of soil solution and four TDR probes were installed respectively to the depth of 3.5 cm, 8 cm, 16 cm, the 24 cm. Simulations were carried out considering the one-dimensional constant flux obtained with a uniform distributed water source placed on the soil surface. The comparison between experimental and simulated data allowed to verify the suitability of the model to correctly forecast the concentration of applied solutes at the different soil depth.