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Using CT Determined Heterogeneity for 3D Modeling of Soil Water Flow

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This contribution aims at assessing the effect of different spatial-averaging/node-reduction procedures, used to process the CT-determined voxel information, on the resulting simulated soil water fluxes. An attempt is made to estimate the threshold value of the involved averaging voxel/node distance at which the reduced CT data preserve sufficient amount of information about the soil heterogeneity for the consequent numerical experiments. Highly heterogeneous sandy loam soil from Korkusova Hut was subject to CT imaging with the resolution of 0.4 mm in horizontal plane. Two major node reduction techniques were proposed: (i) spatial averaging, and (ii) voxel omitting procedure. The three-dimensional distribution of the CT-derived porosity within the sample was than used for numerical modeling. Porosity distribution within the sample was employed for the calculation of the distribution of scaling factor for hydraulic conductivity. Water flow through the heterogeneous soil sample was simulated by 3D model based on Richards' macroscopic concept. The results show that the spatial averaging and/or voxel omitting procedure affect simulated water flux densities noticeably. Generally, reducing the CT-acquired information in model input weakens the impact of heterogeneous structures and thus provides less realistic description of the flow in the soil under the study. In our particular case, it seems that voxel omitting procedure still carries substantial amount of information about both the original spatial dependence and the pore size distribution. The research is funded by the Ministry of Environment of the Czech Republic, project No. VAV650/05/03 (Labe IV).