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Investigating the dispersivity to lateral observation scale-relationship with respect to correlation lengths of the appertaining porous media

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Predictions on solute transport through soil can only be successful if the transport properties of the bulk soil are known. At present, soil transport properties cannot be measured directly but have to be inferred from the shapes of breakthrough curves (BTC) obtained from tracer experiments. Apparent transport model parameters (e.g. apparent convection-dispersion equation (CDE) parameters, namely the velocity and the dispersivity) can be used to characterize the solute breakthrough. It is known that in macroscopically heterogeneous soils, the shape of BTCs depend on the lateral observation scale. It follows that information on the soil structure are contained in the function between lateral observation-scale (L) and apparent CDE-parameters. In this study, we investigate if correlation lengths of solute transport properties may be deduced from ERT-derived apparent dispersivities at different lateral observation scales. For this purpose, we make use of three numerical solute transport experiments through Gaussian distributed porous media, each with an individual correlation structure. In addition, virtual time-lapse ERT measurements are conducted and the results are inverted. Apparent CDE parameters are deduced from both, the transport simulations and the ERT image series. Finally, we apply an approach published in Koestel et al., (2009, Noninvasive 3-D Transport Characterization in a Sandy Soil Using ERT: 2. Transport Process Inference) to derive the dispersivity to L relationship for all breakthrough-cross-section for original and ERT-derived apparent dispersivities and compare the results to the correlation lengths used to construct the heterogeneous porous media.