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Estimation of flow and transport parameters by numerical simulation of tracer tests in a 2d vertical circulation flow field

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Vertical circulation flow fields in groundwater could be established by a groundwater circulation well (GCW). Such flow fields are artificially induced by a well with at least two screen sections one for injection and one for extraction. GCWs have been developed as an in-situ technique used for the remediation of volatile contaminants in groundwater. Recently, they have been used also for the injection of nutrients and co-solvents for enhanced groundwater remediation. Furthermore, this technique has used for aquifer characterization in several cases. The hydraulics of such circulation flow fields are determined by strongly non-uniform flow even in homogeneous aquifers. This strongly non-uniform circulation flow introduces additional dispersion effect to a tracer break through apart from the aquifer dispersivity. The analysis of tracer experiments in a circulation flow field induced by a GCW is presented. The tracer was injected at only a certain part of the GCW injection filter defining a certain stream tube. The tracer break through was observed at several sampling points within the circulation flow field and at the extraction filter that has been divided into several segments. From these results the shape of the stream tube could be derived. By calibration of a numerical model using MODFLOW/MT3D the major aquifer and transport parameters could be estimated. The obtained parameter values were compared with the values that were assumed a priori for the experimental set-up.