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Heterogeneous solute transport in a tile-drained field

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Preferential flow and its diverse attributes: i) macropore flow; ii) fingered flow; iii) funnel flow, cannot be described by a single process hypothesis and are unpredictable from a priori analysis of field characteristics due to the inability of sampling methods to capture minute features triggering such flows. Most solute transport techniques are expensive and require extensive soil disturbance.
Moreover, solute transport in heterogeneous porous media cannot always be conceptualized as being either a convective–dispersive or a stochastic–convective process.
One approach to predict subsurface leaching could be the coupling of near surface measurements with a generalized transport model.
A steady state field tracer experiment was conducted on a tile-drained "Terra Rossa" plot located in Valenzano (Bari – Italy), to test whether TDR BTCs measured 1 m a part along a transect of 40 m can be used in such a way for accurate prediction of tile's BTC. A Generalized Transfer Function (GTF) (Zhang, 2000) was fitted to the observed concentration a three depths for each site along the transect to identify the transfer function parameters.
To account for vertical transport in the unsaturated zone and lateral divergence near the tile, these parameters were used in a 2D model (Utermann, 1990) to predict earlier breakthrough of tile flux concentration. The 2D model predictions of the flux concentrations were similar to the observed values, nearly reproducing the channel-like nature of solute flow.