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Mass-conservative three-dimensional tracer distribution from Bayesian inversion of time-lapse GPR data

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Numerical inversion of time-lapse geophysical measurements is widely used to monitor the movement of contaminants and tracers through the subsurface. Yet, classical deterministic inversion typically suffers from relatively poor mass recovery and spread overestimation, and does not appropriately treat nonlinear model uncertainty. We have recently proposed a novel mass-conservative inversion methodology to reconstruct the three-dimensional tracer transport from geophysical data and provide accurate Bayesian estimates of model uncertainty (Laloy et al., In Review). Here we briefly describe the method, and discuss our last benchmark results to date using synthetic cross-hole ground penetrating radar (GPR) traveltimes of moisture plume targets with various levels of heterogeneity. For each test case, we also include comparison against both classical least-squares and compact, mass-constrained deterministic inversion results.