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Constraining time-lapse ERT inversions by hydrological point measurements

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Static and time-lapse ERT inversions suffer from resolution limitations and the non-uniqueness of the inverse problem. Especially for time-lapse data, the measurement error, its sources and its development over time are difficult to assess. Conservative assumptions about the error and strong regularization lead to underestimation of the time-lapse changes. For static ERT data, structural constraints and discontinuous regularization has been shown to improve inversion results.

Here, we test if hydrological point measurements of fluid conductivity can improve time-lapse ERT inversions. We use data from a CO_2 injection experiment in a shallow aquifer that was monitored using surface ERT. Water conductivity measurements are available at 30 locations on the main ERT profile.

We test different types of constraints for the resistivity models to the water conductivity and analyse its effect on the ERT inversions (e.g., data fit, convergence speed) and the images of the CO_2 plume (magnitude of change, size and shape of the plume).