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Monitoring CO_2 gas-phase injection in a shallow sand aquifer using cross borehole GPR.

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An important issue that needs attention in designing effective storage schemes for CO_2 storage in deep geologic formations is risk assessment of potential leakage. Leaking gas may threat surface and groundwater sources as well as vegetation. We have designed an experiment where we were track the movement of an injected CO_2 gas-phase in an unconfined aquifer using cross borehole GPR. The first preliminary results from the pilot experiment will be presented here. The test site is located near in the south-western part of Denmark. The aquifer at the site is consists of fine to coarse glacial melt water sands, which are staggered in slightly tilted layers.
Gas was injected for 48 hours with flow rates of 5 l/min at the start of the experiment and up to 10+ l/min at the end of the experiment. The screen of the injection well is 10m below ground level or 8m below the water table. An array of four GPR boreholes is installed around the injection well. GPR-data were acquired in 1D and 2D configurations prior and during the injection.

The GPR data shows that in five out of six 1D-panels a plume develops at the depth of the injection screen and the same behaviour is seen in the 2D panels. The results suggest that the injected gas primarily spreads towards South-East. The geology consists of slightly tilting layers, which may cause migration of the gas plume along the interface of the coarse and fine sand and out of the monitoring area. These initial results confirm the notion that even little heterogeneity may have a significant effect on the gas migration pattern.