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Application of Monitoring Methods for Remote Detection of Atmospheric CO_2 - Concentration Levels during a Back-Production Test at the Ketzin Pilot Site

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Reliable detection and assessment of near-surface CO_2 leakages from storage formations require the application of various monitoring tools at different spatial scales. Especially, tools for atmospheric monitoring have the potential to detect CO_2 leakages over larger areas ($>$ 10,000 m^2). Within the framework of the MONACO project ("Monitoring approach for geological CO_2 storage sites using a hierarchical observation concept", Geotechnologien project funded by BMBF 03G0785A), an integrative hierarchical monitoring concept was developed and validated at different field sites with the aim to establish a modular observation strategy including investigations in the shallow subsurface, at ground surface level and the lower atmospheric boundary layer.

The atmospheric monitoring methods applied in the case of the CO_2 back-production experiment at the Ketzin pilot site comprise point sensors to observe the near-surface CO_2 concentration, micrometeorological approaches using Eddy Covariance (EC) measurements and ground-based optical remote sensing techniques based on open-path Fourier-transform infrared (OP FTIR) spectroscopy.

The back-production test was performed in October 2014 and a total amount of 240 tonnes of CO_2 were safely back-produced via one well from the CO_2 storage reservoir over a two-week period. The main aims of the atmospheric monitoring were a) the observation of the gas dispersion in the lower atmosphere, b) the determination of maximum CO_2 concentration values and c) identification of the main challenges associated with the monitoring of point source leakages with the proposed methodological set up under typical environmental conditions.

The presentation will give a short introduction into the ground-based atmospheric monitoring approach and will show results obtained during the back-production field experiment. As a main result, the combination of methods was validated as suitable approach for continuous monitoring of the atmospheric CO_2 concentration. However, the data clearly demonstrate that especially meteorological conditions have to be taken into account for the industrial automation of atmospheric monitoring and the determination of detection thresholds. Increased atmospheric CO_2 concentrations could reliably be detected with the applied monitoring methods during calm weather conditions. In contrary, windy situations cause a rapid dilution of the vented CO_2 resulting in no increased atmospheric CO_2 concentrations levels determined with all these methods even in the vicinity of the CO_2 vent-off stack.