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One year continuous soil gas monitoring above an EGR test site

Markus Furche, Stefan Schlömer, Eckhard Faber, and Ingolf Dumke
Federal Institute of Geosciences and Natural Resources (BGR), Hanover, Germany (markus.furche@bgr.de)

Setup and first results of an ongoing research activity are presented, which is funded by the German Geotechnologien program within in the joint project CLEAN (CO2 Large Scale Enhanced Gas Recovery in the Altmark Natural Gas Field).
The task is to establish several soil gas monitoring stations above a partly exhausted gas field in the Altmark which will be used for an enhanced gas recovery (EGR) test by injecting CO2 into the reservoir. The aim is to optimize the monitoring technique including automatic data transfer and data exploitation and to understand mechanisms of natural variations of soil gas concentrations in the specific area. Furthermore the suitability of these measurements as a contribution to leakage detection shall be evaluated.
A network of 13 gauging stations for the measurement of CO2 is working continuously for about one year. They are spread over an area of 8 x 3 km and are situated in direct vicinity of existing deep boreholes as the most likely locations for possible leakage. In addition one station is placed far outside the gasfield as a reference point. The technique applied to measure soil gas concentrations uses a gas stream circulating in a tube going down a shallow borehole where the circulating gas is in contact with the soil gas phase via a gas permeable membrane. Above surface, moisture is removed from the gas stream before it reaches several gas sensors for CO2. Besides these, several other parameters are determined as well, e.g. soil moisture and soil temperature, water level, gas flow and gas moisture. In addition a meteorological station gives information about precipitation, air humidity, temperature and pressure, global radiation, wind direction and velocity in the area.
Data are continuously collected by dataloggers at each station (5 minutes interval), transferred via GSM routers to the BGR server in Hannover and are stored in a specially designed database. The database does not only contain the measurements but also information about hardware configurations at the stations, maintenance carried out and special events which might have influenced the results. An interactive database application has been developed to allow versatile graphical output and statistical processing of the collected time series.
On a large scale CO2 concentrations show natural seasonal variations with higher values during summer (July to September) and lower values during winter. This behaviour is expected and mainly caused by temperature dependent activities of bacterial CO2 production. Absolute concentrations however vary extremely between different locations. While several stations show more than 10% CO2 during summer, others stay below 0.1% at the same time. The conclusion is that individual baselines at all sites for a sufficient time without CO2 sequestration are necessary.
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