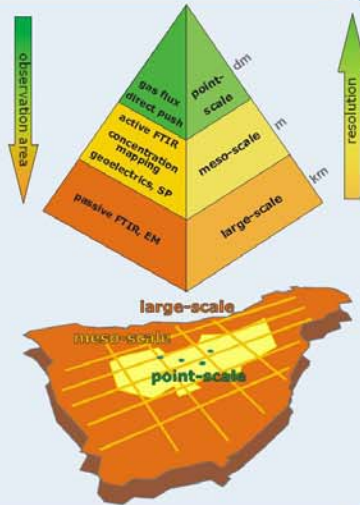


Geophysical Methods Combination for the Detection and Monitoring of CO₂ Degassing Sites at the Near Surface Using a Hierarchic Approach

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The Hierarchical Approach

- Aim:** detection, quantification and monitoring of potential carbon dioxide degassing sites
- Tools:** technologies from chemistry, hydrogeology and geophysics
- Approach:** mapping and monitoring areas of interest in different scales and resolutions depending on the degassing activity



Investigation Area



- Eger Rift area in Central Europe is part of the Cenozoic Rift system
- characterized by Quaternary volcanism, CO₂-rich mineral springs and mofettes, and the occurrence of swarm earthquakes



Mofette (cold, magmatogene CO₂-degassings) in the Eger Rift area (Czech Republic).

- the gas (up to 99,99% CO₂) ascents via tectonic fault zones directly from the upper mantle to the surface (Bräuer et al., 2008)
- CO₂ emanations are supposed to be connected with the swarm seismicity

Open for new investigation sites!

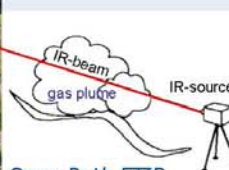
large-scale

A general overview to identify and describe the areas of interest can be obtained by using:

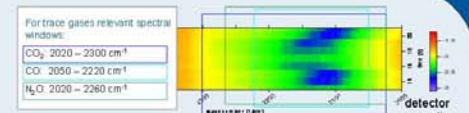
- airborne remote sensing**
 - delineation of vegetation anomalies
- passive Open Path FTIR spectroscopy**
 - detection, delination and qualitative monitoring of CO₂ degassing on areas up to 10 km²
- large-scale electromagnetic mapping**
 - rough characterization of geological structures



FTIR-detector (Bruker RAPID)

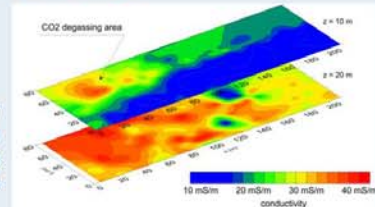


Open Path FTIR
passive = natural IR source
active = artificial IR source



Monitoring of the daily variation of spectral intensity as a function of the variation in atmospheric CO₂ concentration

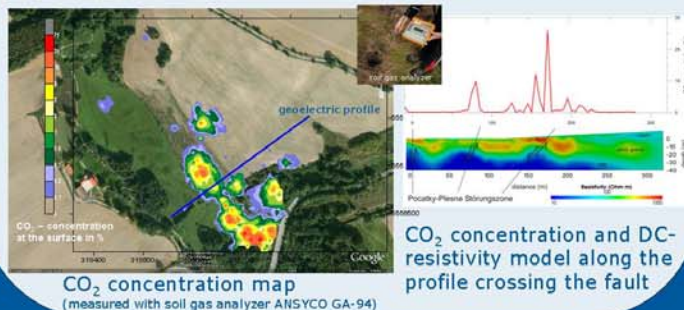
Electrical conductivity distribution in different depths measured with EM-34



meso-scale

Characterization of CO₂ degassing behaviour and delineation of structural features:

- active open path FTIR spectroscopy**
 - integral quantitative monitoring of CO₂ degassing along selected profiles with length up to 500 m
- near surface geophysics (gEOelectric, EMI, GPR, seismic, ...)**
 - detailed characterization of geological settings
- gas concentration measurements**
 - determination of near surface soil gas concentration



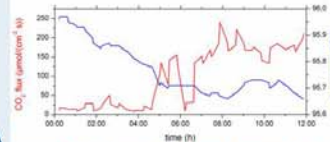
point-scale

High resolution information in localized areas:

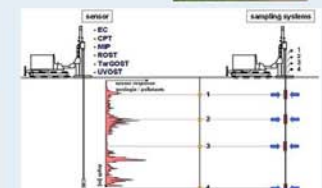
- gas flux monitoring**
 - observation of temporal variations in degassing rates
- direct push**
 - detailed investigations of petrophysical parameters of the sedimentary layers and gas / water sampling



LI-COR® LI-8100 CO₂ flux long-term chambers with the LI-8150 multiplexer



CO₂ flux in comparison to meteorologic conditions



Direct push technology with different sensors and sampling systems