Press Release

GEOMAR
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Impact of CO_2 leakage through North Sea wells

Researchers are investigating the limits and possibilities of the submarine storage of CO_2

14.05.2019 / Kiel. **Realistic estimates show that global warming can only be kept below 1.5 or 2 degrees Celsius if carbon dioxide is actively removed from the atmosphere. Storage beneath the seafloor is an option that has been investigated intensively by an international team of scientists led by the GEOMAR Helmholtz Centre for Ocean Research Kiel. The results, opportunities and risks have now been published in the journal *International Journal of Greenhouse Gas Control.***

It is possible to reduce anthropogenic CO_2 emissions by separating CO_2 from flue gases and storing the captured CO_2 in geological formations. Negative emissions can be achieved by coupling biogas production with CO_2 separation and storage. Assessments by the IPCC show that these approaches are essential parts of the technology mix that is needed to limit global warming to less than 2°C. In Europe the largest potential to store CO_2 is located offshore in deep saline aquifers and other sub-seabed geological formations of the North Sea. However, more than 10 000 wells have been drilled into the seabed of the North Sea over the last decades to find and produce oil and gas. At many of these wells, methane gas from shallow biogenic deposits is leaking into the environment because the surrounding sediments were mechanically disturbed and weakened during the drilling process. CO_2 that is stored in the vicinity of these wells may leave the storage formation, leak into the North Sea and ultimately return into the atmosphere.

“We have performed a release experiment in the Norwegian sector of the North Sea to determine the footprint and consequences of such a leak”, explains Dr. Lisa Vielstädte from GEOMAR Helmholtz Centre for Ocean Research Kiel. She is lead author of the study which has now been published in the scientific journal *International Journal of Greenhouse Gas Control.* CO_2 gas was released at the seabed in 82 m water depth at a rate of 31 t yr^{-1} which is at the upper end of the range of methane emissions observed at leaky wells. The released CO_2 was tracked and traced using a remotely operated vehicle (ROV) equipped with chemical and acoustic sensors and additional measurements on board of Research Vessel Celtic Explorer. The experiment was conducted by GEOMAR as a contribution to the European project ECO_2 (http://www.eco2-project.eu/).

“Our data show that CO_2 gas bubbles were completely dissolved close to the seafloor”, Dr. Vielstädte points out. The pH value of ambient bottom waters was lowered from a background value of 8.0 to a more acidic value of 7.0 at the release site as a consequence of the dissolution process. “This bottom water acidification has detrimental effects on organisms living at the seabed”, Prof. Dr. Klaus Wallmann, from GEOMAR and lead scientist of the ECO2 project points out. “However, strong bottom currents induced a rapid dispersion of the dissolved CO_2 such that the area at the seabed where potentially harmful effects can occur is small”, according to Prof. Wallmann. The area where the pH lowering exceeds 0.2 units has a size of about 50 m^2.

“In conclusion, we can say that observations and accompanying modeling confirmed that leakage through wells may affect local ecosystems in the immediate vicinity of the well but has no detrimental large-scale effects on the North Sea ecosystem. Thus, we tentatively conclude that it is possible to store CO_2 safely in sub-seabed formations if the storage site is located in an area with a small number of leaky wells” Prof. Wallmann summarizes.

This month a second release experiment is conducted in the North Sea by the European project STEMM-CCS (https://www.stemm-ccs.eu/). Advanced sensors and monitoring devices will be used to track and trace the released CO_2 and study the environmental effects. These additional data will help us to further validate the performance of prospective storage sites in the North Sea and their potential contribution to climate change mitigation.

Reference

Vielstädte, L., Linke, P., Schmidt, M., Sommer, S., Haeckel, M., Braack, M. and Wallmann, K. (2019) Footprint and detectability of a well leaking CO_2 in the Central North Sea: Implications from a field experiment and numerical modelling. *International Journal of Greenhouse Gas Control*, **84**, 190-203.

Links:
https://www.geomar.de GEOMAR Helmholtz Centre of Ocean Research Kiel
https://www.stemm-ccs.eu/ STEMM-CCS Project
http://www.eco2-project.eu/ ECO2 Project

Images:
At http://www.geomar.de/n6515 images are available for download.

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