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Monitoring CO₂ leakage sites on the ocean floor Natural gas seeps help develop surveying strategies

21 August 2019 / Kiel. The storage of carbon dioxide (CO₂) below the seafloor is one of the measures considered by the Intergovernmental Panel on Climate Change (IPCC) as a potentially significant tool to limit climate change. However, so far there are no proven methods to monitor potential CO₂ leaks under water over large seafloor areas. With the help of natural gas seeps off the coast of Italy, researchers at the GEOMAR Helmholtz Centre for Ocean Research in Kiel have now developed models that could help in the planning of leakage monitoring. The study has been published in the international journal *Environmental Science & Technology*.

The goals of the Paris climate protection agreement can hardly be achieved with the reduction of greenhouse gas emissions alone. The Intergovernmental Panel on Climate Change (IPCC) is therefore discussing additional measures to reduce the concentration of greenhouse gases in the atmosphere. For example, carbon dioxide produced during the combustion of fossil fuels could be captured or removed directly from the atmosphere and subsequently stored in deep geological formations. The Norwegian company Equinor (formerly Statoil) has been operating such a carbon capture and storage facility since 1996. About one megaton of CO₂ is injected yearly into a layer of sandstone beneath the North Sea. However, reliable ways of effectively monitoring gas leaks from such undersea storages are still being discussed.

In this context, researchers at GEOMAR Helmholtz Centre for Ocean Research Kiel investigated natural volcanic carbon dioxide seeps off the coast of Italy. Based on the results of these investigations, they have developed models that can be used to monitor the safety of future submarine CO₂ deposits. The study has been published now in the international journal *Environmental Science & Technology* of the American Chemical Society (ACS).

The storage of carbon dioxide in layers of rock beneath the seabed poses a lower risk to humans than storage below land. If gas escapes from the seabed, it dissolves in the seawater. However, it can lower the pH there and damage the local marine ecosystem. "At present, there is no established method to locate such carbon dioxide leaks and determine the total amount of gas released when the leaks extend over several hundred square meters of the seabed," says Dr. Jonas Gros of GEOMAR, lead author of the new study. He and his colleagues therefore investigated changes in the pH value in the vicinity of natural carbon dioxide seeps near Panarea, a small island off the coast of Northern Sicily.

During diving operations and with the help of ship-based instruments, they collected gas and water samples close to the seeps. The team used these data to test a computer model they had developed to predict pH changes in seawater due to carbon dioxide leakage. Simulations showed that over 79% of the released carbon dioxide already dissolves within four meters from the seabed.

The team also found that the model was able to predict a pattern of pH variation in the waters around the gas seeps that was comparable to the measured sensor data. "The new model can thus serve as a guideline for strategies for routine monitoring of CO₂ storage in the seabed and for estimating the effects of carbon dioxide emissions on the local marine environment," stresses Dr. Gros.

Reference:

Gros, J., M. Schmidt, A. W. Dale, P. Linke, L. Vielstädte, N. Bigalke, M. Haeckel, K. Wallmann, S. Sommer (2019): Simulating and quantifying multiple natural subsea CO₂ seeps at Panarea Island (Aeolian Islands, Italy) as a proxy for potential leakage from sub-seabed carbon storage sites. Environmental Science & Technology. <https://doi.org/10.1021/acs.est.9b02131>

Please note:

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Links:

www.geomar.de GEOMAR Helmholtz Centre for Ocean Research Kiel

Images:

At www.geomar.de/n6654-e images are available for download.

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