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Let's Solve Water

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Oceanography • SeaGuardII • Smart Sensors • Sensor String

CCS: Efficient Underwater Leakage Detection Combining SeaGuard and Multivariate Statistical Methods

Carbon Capture and Storage (CCS) below the seafloor has been suggested as a method to reduce the increase of CO2 in the atmosphere. To evaluate the risks and potential ecological impact of this type of storage, realistic field trials are crucial.

In a United Kingdom funded research project named QICS (Quantifying and Monitoring Potential Ecosystem Impacts of Geological Carbon Storage), a controlled sub-seabed CO_2 release was conducted in a Scottish Bay to simulate and study the effects of CO_2 leakage.

A multiparameter SeaGuard platform deployed for a total of about 10 weeks played an essential role in developing methods to detect leakage from the release site and to calibrate a hydrodynamic circulation model. The instrument was equipped with sensors to measure pCO_2, O_2, Salinity, Temperature and Currents.

Fig 1: SeaGuard deployed in QICS project at epicenter during a period of CO2 release. Bubbles were normally only visible during low tide. They dissolve as they rise and are never visible at the surface.
Photo courtesy of Henrik Stahl, Zayed University, UAE.

Realistic field trials are crucial to evaluate the potential ecological impact of Carbon Capture and Storage.

Emissions from CO_2 release seeping out from the sediment were heterogeneous and often difficult to separate from natural CO_2 variations. Applying multivariate statistical methods to analyze data from many simultaneous factors turned out to be an efficient method to distinguish between deliberate release and natural variations. For more information see Atamanchuck et al. 2015.

Based on the findings in QICS and other projects and our experience to develop and manufacture low power, high quality sensors and multi-parameter platforms, we suggest our SeaGuardII platform logging two sensor strings simultaneously for this type of projects. For better coverage one string (e.g. 100m long) is placed along the bottom and the other in the water column above the instrument, which is also equipped with an acoustic profiling sensor and a wave/tide sensor. This instrument can be set up to deliver data in real-time via cable or acoustic modem.

Applying multivariate statistical methods to analyze the data is an efficient approach to distinguish between deliberate release of CO2 and natural variations.

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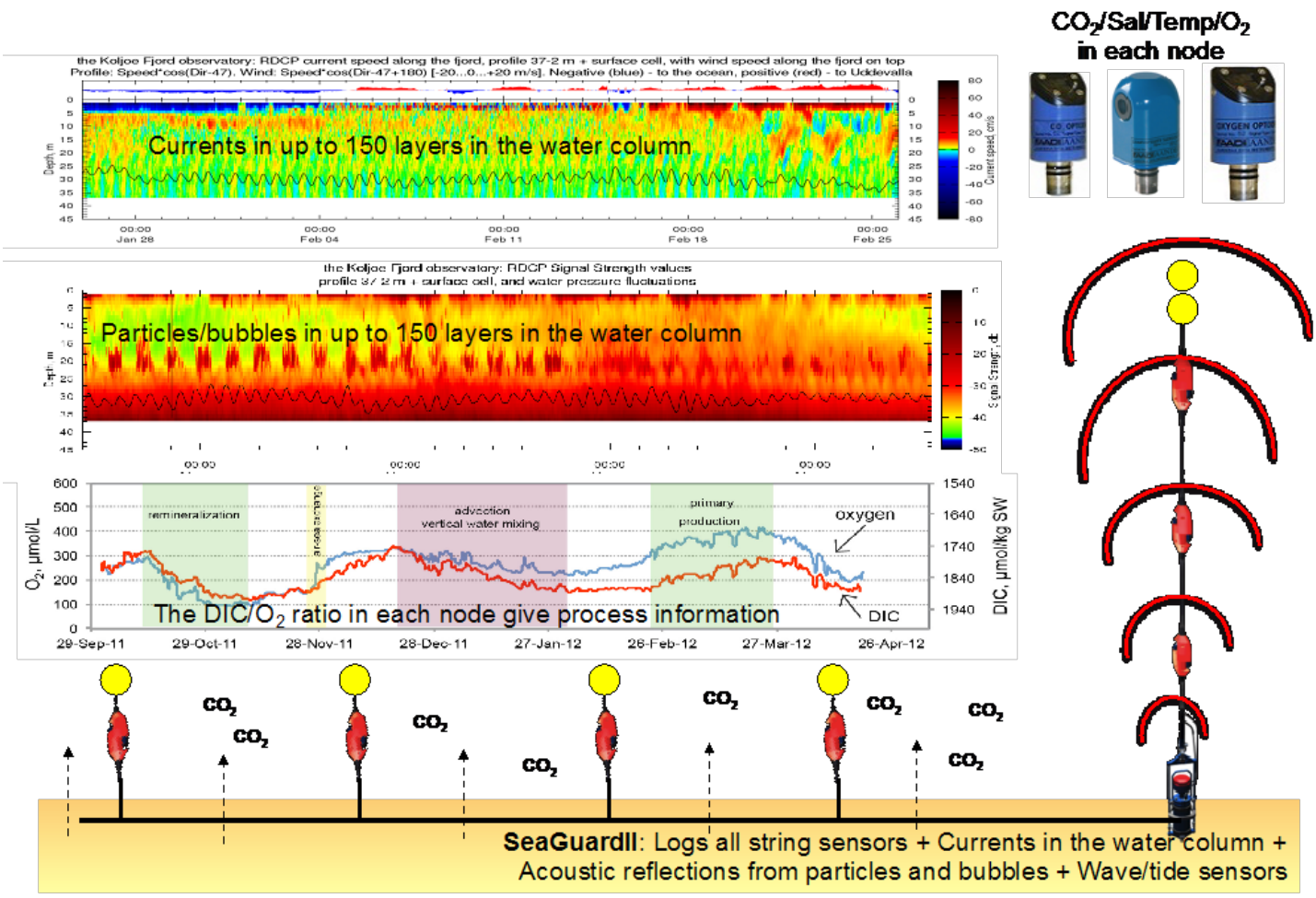

The acoustic profiling sensor can measure currents and particles/bubbles in up to 150 layers in the water column above.

In most marine environments, salinity is closely coupled to alkalinity and the relation between the two can be established from water samples. By combining pCO2, salinity/alkalinity, oxygen and temperature in each node, an understanding of the carbonate system and the ongoing processes (man-made or natural) can be obtained.

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