

Detection method of anomaly using relative index of spatial variations of DIC for CO₂ leakage monitoring on CO₂ sub-seabed storage

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When CO₂ is stored in sub-seabed geological formations in Japan, marine monitoring is mandatory to detect CO₂ leakage as soon as possible should it occur. In the Tomakomai CCS Demonstration Project, a threshold line based on a negative correlation between partial pressure of CO₂ (pCO₂) and dissolved Oxygen saturation in seawater is used to detect an anomalously high value of pCO₂, which is suspected to be a sign of CO₂ leakage. However, these indexes had large fluctuation and caused several pseudo-anomalous errors in the project. Dissolved CO₂ in seawater dissociate into H₂CO₃, HCO₃⁻ and CO₃²⁻. The proportion of H₂CO₃ which is correspond to pCO₂ is less than 1 % among total dissolved CO₂ (DIC) in seawater. If CO₂ leak into seawater, pCO₂ reflects the leaked CO₂ but is affected by various factors; e.g. water temperature, pH, and total alkalinity. However, the amount of leaked CO₂ is summed in DIC itself. Accordingly, we try to assess the CO₂ leakage using DIC. In this study, we propose the new index using the spatial variations of DIC. This index has suitable for the monitoring not in the injection phase but also in the post-injection period, because the index eliminates the interannual variation including the decadal increases of atmospheric CO₂, and also the intra-annual fluctuation resulted from the seasonal change.

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