

An option for marine monitoring at offshore CO₂ storage sites: observing pCO₂ in the sea

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Carbon dioxide (CO₂) capture and storage (CCS) is a promising option to reduce CO₂ emissions and consequently to mitigate global warming. Since reservoirs capable of storing CO₂ stably are selected, the risk of CO₂ leakage is extremely low. There is, however, concern that CO₂ might leak out. To verify that CO₂ is not leaking, as well as to detect CO₂ leakage if leakage occurs, monitoring is important. In offshore storage, since leaked CO₂ would go out into the sea out of the seabed, monitoring in the sea is necessary. However, there seems to be no monitoring method that is useful in all sea areas or for all situations. In the practical monitoring, it is necessary to combine a few methods according to the situation and the sea area. Partial pressure of CO₂ (pCO₂) in the sea is one of items to monitor since pCO₂ in the sea would increase by leaked CO₂. However, it is difficult to distinguish high pCO₂ values due to CO₂ leakage from those due to natural variability in some areas. In the present study, we discuss a method to assess anomalously high values of pCO₂ using not only pCO₂ but also dissolved oxygen. As an example, we analyzed data observed in Osaka Bay. We have shown that the method using both pCO₂ and DO is effective in the eastern (innermost) part, where stratification is relatively strong throughout the year. However, the method is less effective in the western part of Osaka Bay, where water is relatively well mixed vertically due to strong tidal currents. We have concluded that observing pCO₂ and assessing it based on both pCO₂ and DO is potentially a useful option for marine monitoring although this method is not effective in all sea areas.

Keywords: offshore storage, CCS, partial pressure of CO₂, dissolved oxygen, marine monitoring