

## How many data are necessary to make a suitable threshold for anomalous $p\text{CO}_2$ owing to $\text{CO}_2$ leakage?

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In Japan, the offshore storage of  $\text{CO}_2$  is regulated by Act on Prevention of Marine Pollution and Maritime Disaster, which requires monitoring to be able to detect  $\text{CO}_2$  leakage should it occur. If  $\text{CO}_2$  stored in deep geological formations leaks into the sea, carbonate variables in seawater such as pH, dissolved inorganic carbon, and partial pressure of  $\text{CO}_2$  ( $p\text{CO}_2$ ) would change. Hence, to find anomalous values of the carbonate variables can be a method of the marine monitoring. It is, however, difficult to judge whether an observed carbonate value is anomalous, because the natural variability of carbonate variables is relatively great. Actually, many data were judged as anomalous at Tomakomai CCS Demonstration Project, where  $p\text{CO}_2$  have been monitored, although  $\text{CO}_2$  leakage has never occurred. Although false-positives (natural variability misjudged as anomalous) themselves are unavoidable, there are also avoidable false-positives, some of which are caused by an unsuitable threshold based on insufficient baseline data. In this study, we studied how many data are necessary to make a suitable threshold. For this purpose, we analyzed quarterly data observed in a semi-enclosed bay, Osaka Bay, from 2002 to 2010. Using  $N$  ( $1 \leq N \leq 9$ ) years' data out of them, we calculated a threshold line based on a correlation between  $p\text{CO}_2$  and dissolved oxygen saturation, applied all the 9 years' data to the threshold line, and counted the number of data exceeding the threshold line, i.e. false-positives. We suggest that at least around 5 years' data are necessary to make a reasonable threshold line based on quarterly data.

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