DEVELOPMENTS AND CHALLENGES FOR OFFSHORE CO_2 STORAGE IN JAPAN

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2000- **Nagaoka Pilot Test**

Onshore: 10 kt

Pilot

Site : Nagaoka
Reservoir : Saline Aquifer
Formation : Sandstone
Injection : 2003.7～2005.1
Total CO_2 :10,400 ton

2010- Tomakomai Large-Scale

offshore: ＞100 kt/y

Demonstration

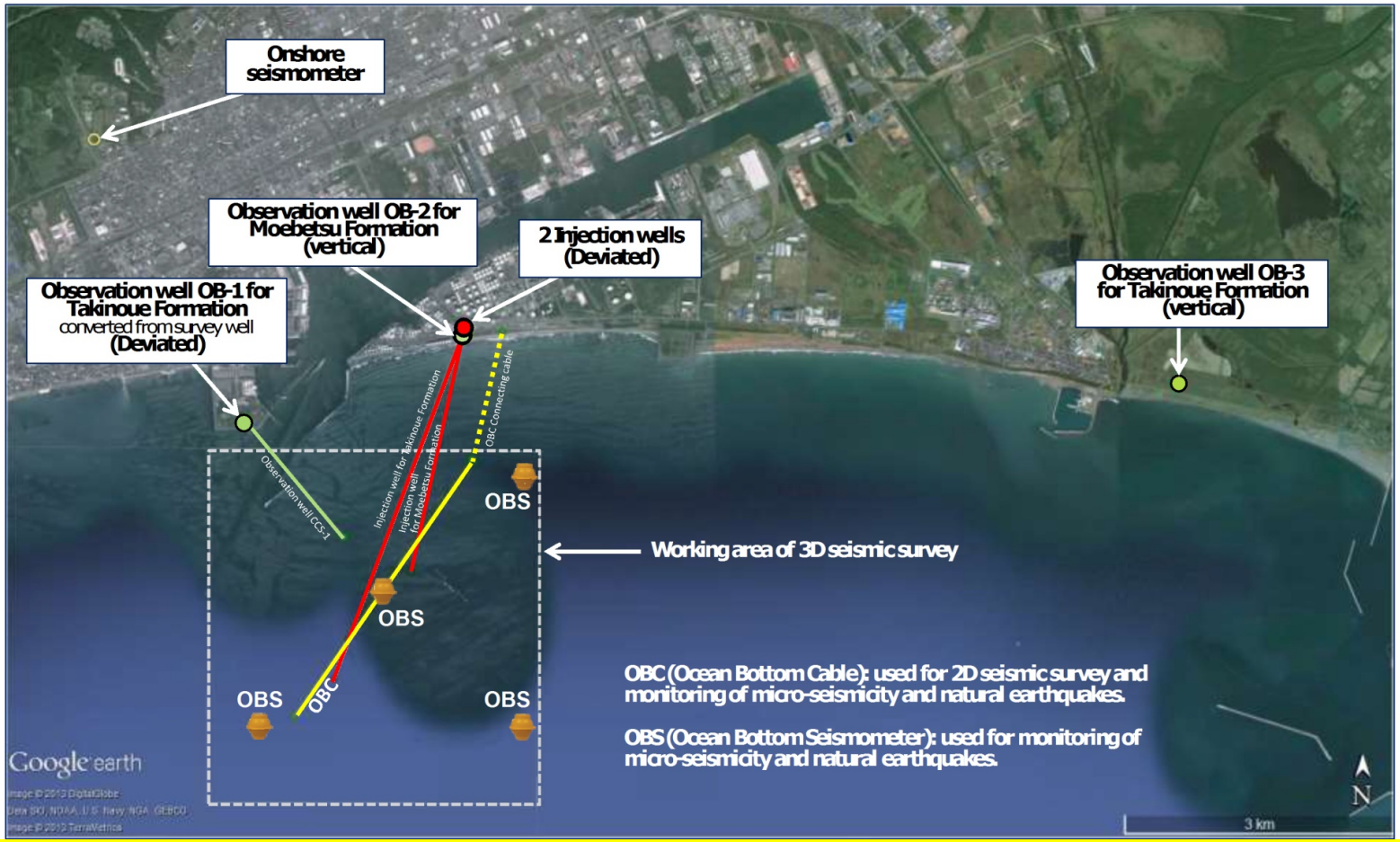
Site : Tomakomai
Reservoir : Saline Aquifer
Formation : Sandstone (shallow), Volcanic Rocks (deep)
Injection : 2016～2018
Total CO_2 : >300 kt (planned)

2020-

Practical Use

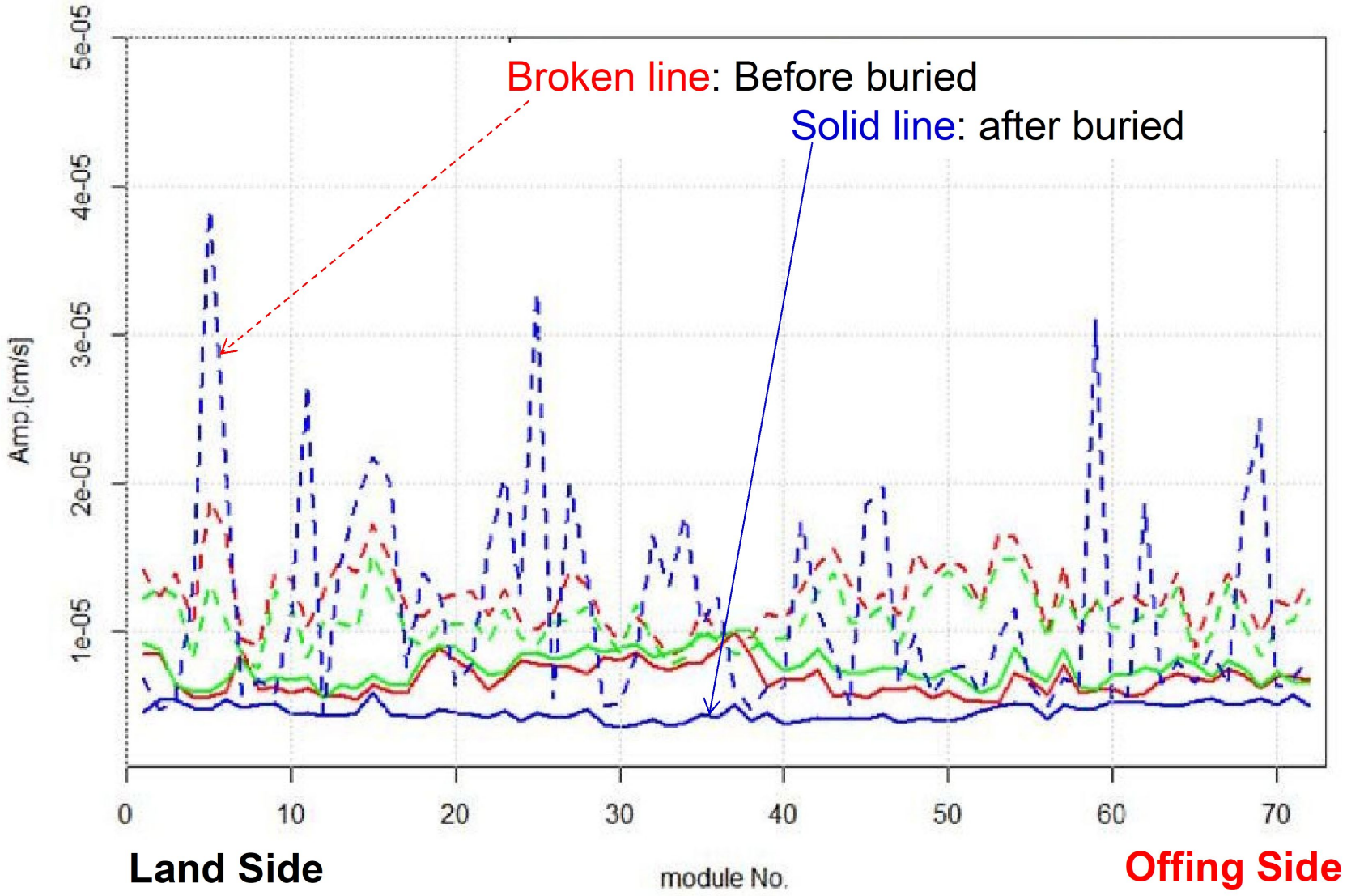
(1 million t/y)

Layout of Monitoring Facilities



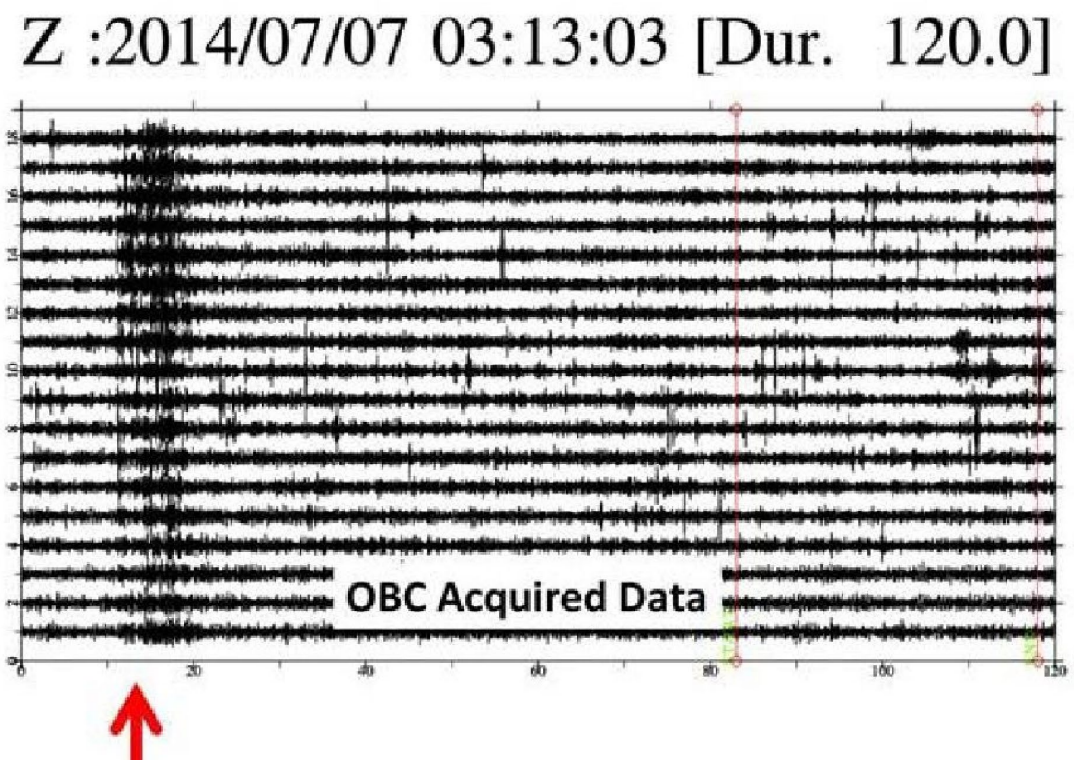
Ocean Bottom Cable for 2D Seismic and Microseismic Monitoring

➢Noise reduction after buried in seabed

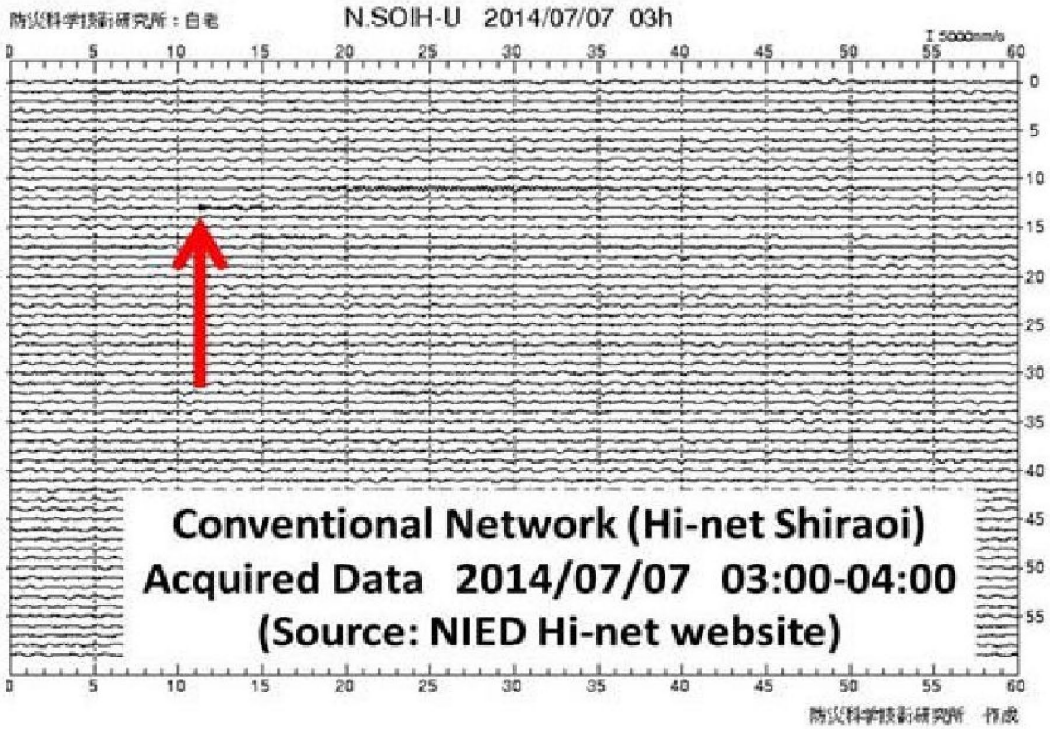


➢Detecting microseismic Events

OBC Acquired Data



Conventional Station



. Waveforms of a small natural earthquake recorded by the permanent OBC (left) and conventional seismometer (right).

EIA at the Tomakomai offshore project

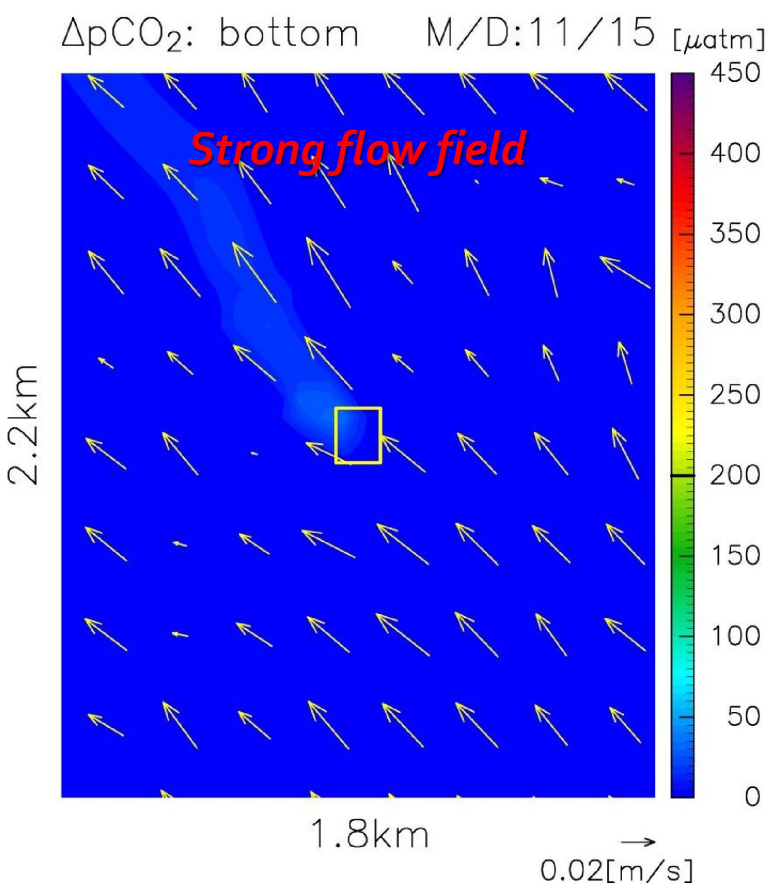
Act for the Prevention of Marine Pollution and Maritime Disasters

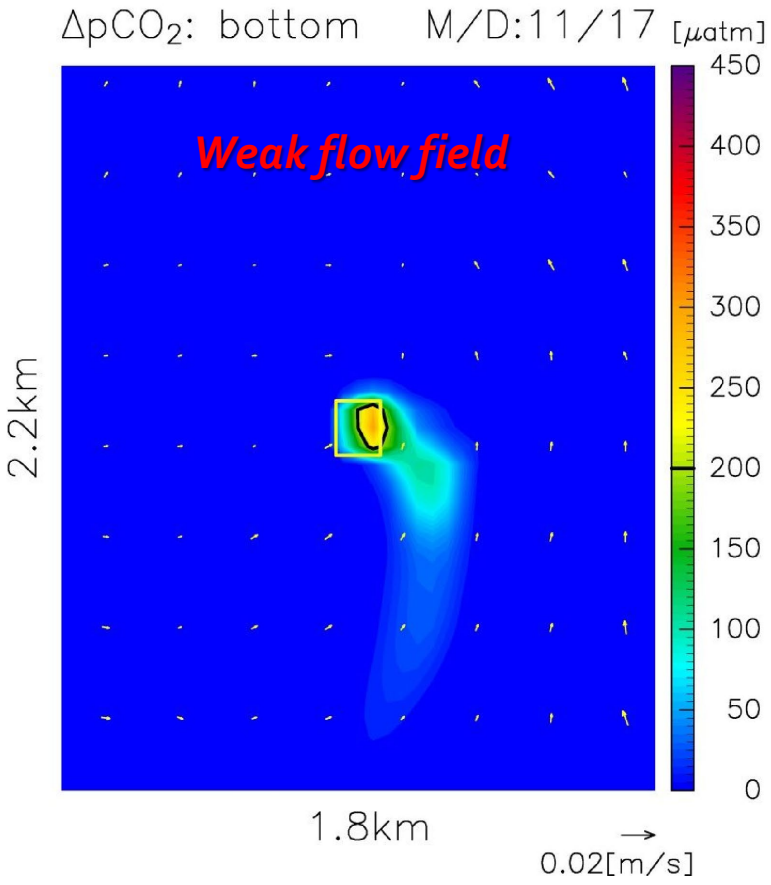
- **May 2007**: The act was amended for permit procedure on dumping CO_2 stream into sub-seabed formation.

Operator of Offshore CO_2 storage,

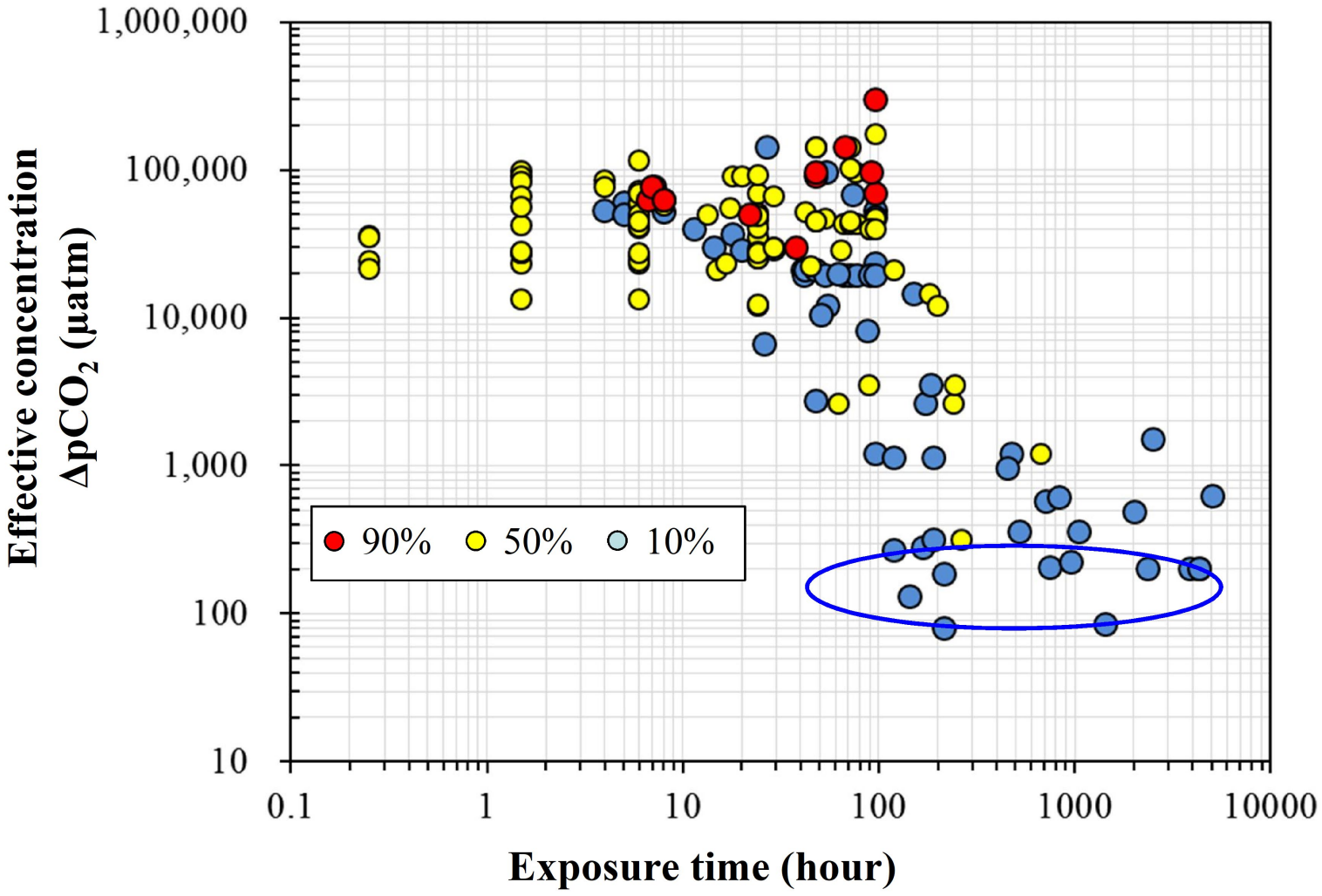
- Shall receive **permission** from environment minister.
- Shall implement **Environmental Impact Assessment**.
- Shall **monitor** surrounding sea environment.

ΔpCO_2 predicted in two flow fields at same leakage rate

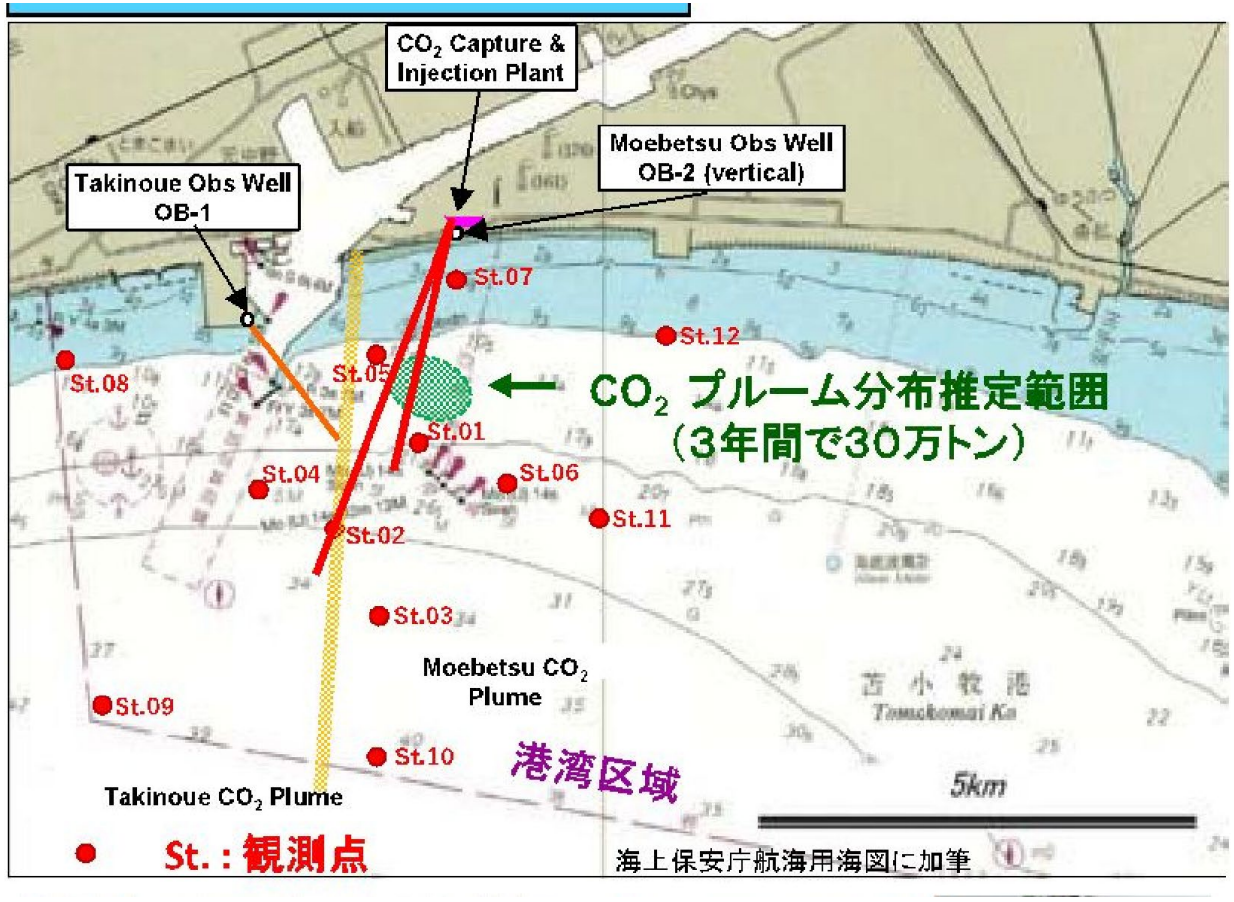


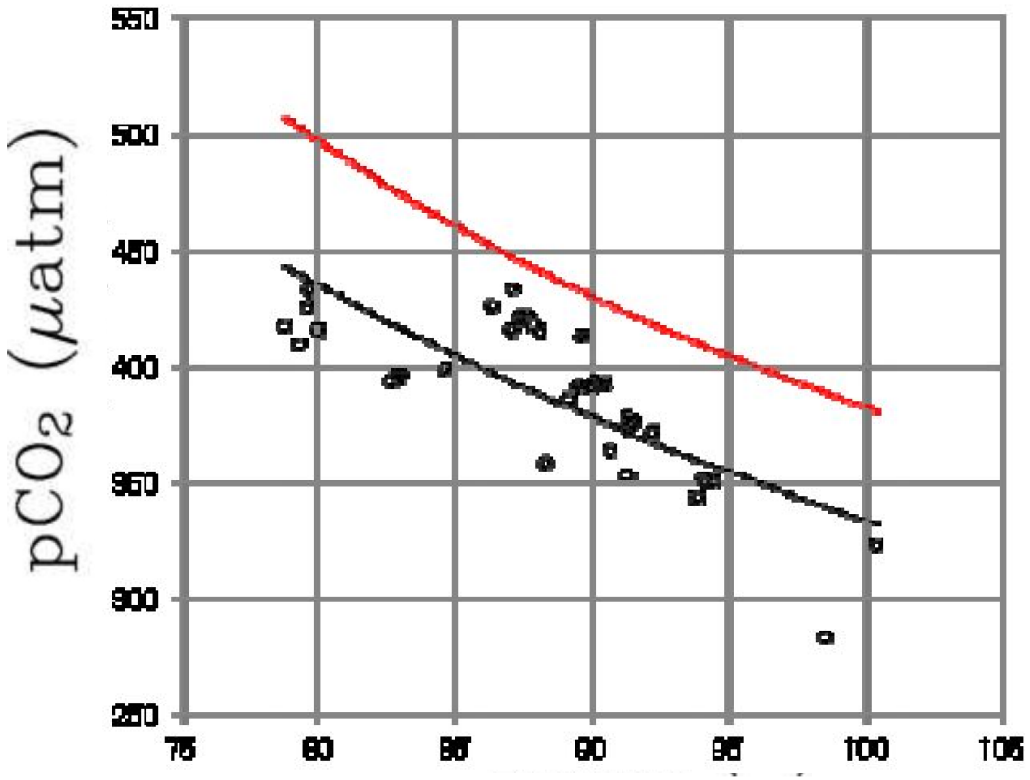


Threshold for Ecological CO_2 Impacts Estimated from a Biological Impact Database



Challenges: CO_2 Leakage Detection at Tomakomai



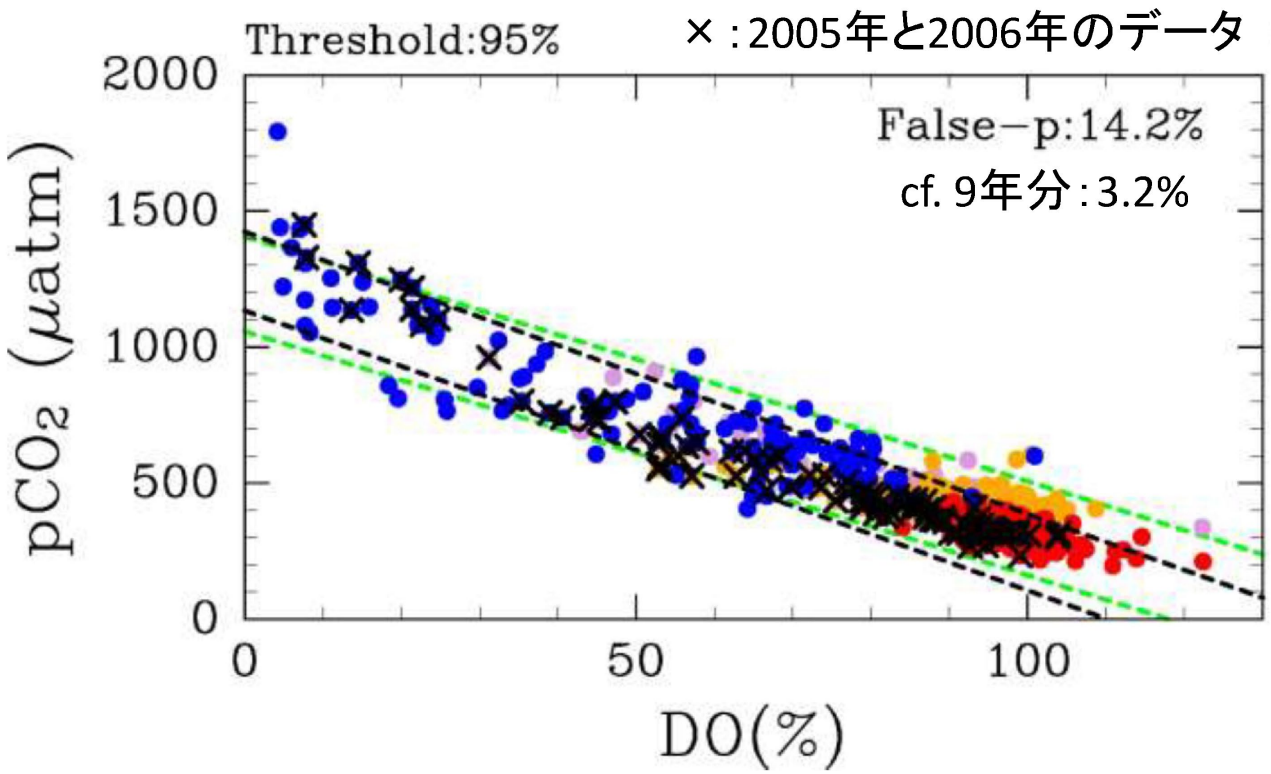


Water sampling: Spring, Summer, Autumn and Winter

PCO_2 vs DO: Baseline for leakage detection

Deep-focused Monitoring（*Early Warning* of Unexpected Migration），

Shallow-focused Monitoring（CO_2 *Leakage Detection*）



DO: dissolved oxygen (溶存酸素)

(Hannis et al., 2017)

Shallow-focussed: To detect CO_2 leakage in the sediment or sea bed emissions – *that could pose a health and safety threat or environmental impact.*

Deep-focussed: To give early warning of unexpected migration – *that could compromise the greenhouse gas mitigation function of the storage.*

謝 辞

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