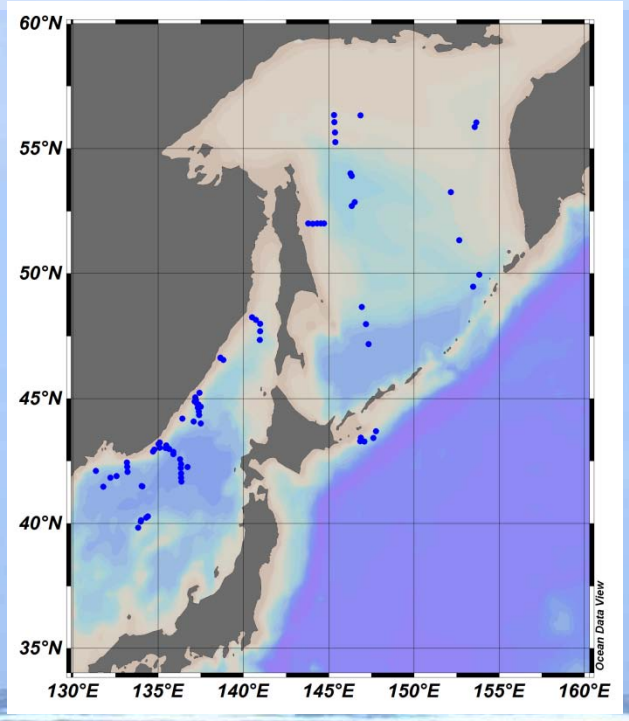
Vertical structure of dissolved oxygen and nitrates *in situ* profiles in the North-East Asian Marginal Seas



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- Region of surveys/data collection
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Why oxygen and nitrates?

MBARI ISUS V3

SBE 43, SeaBird Inc.

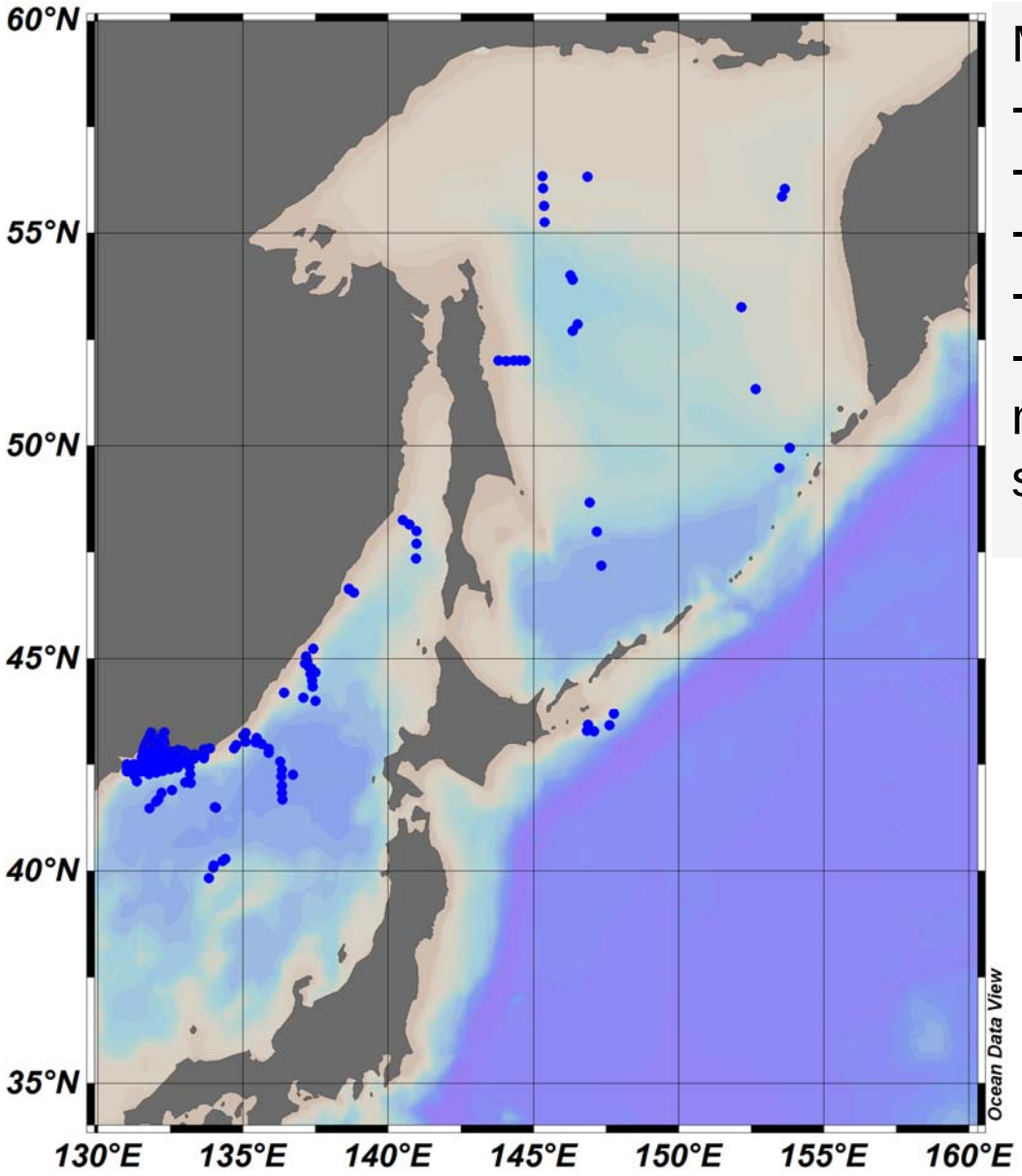
MBARI - Monterey Bay Aquarium Research Institute
ISUS – In Situ Ultraviolet Spectrophotometer

SBE 43 sensor is a Clark polarographic membrane type

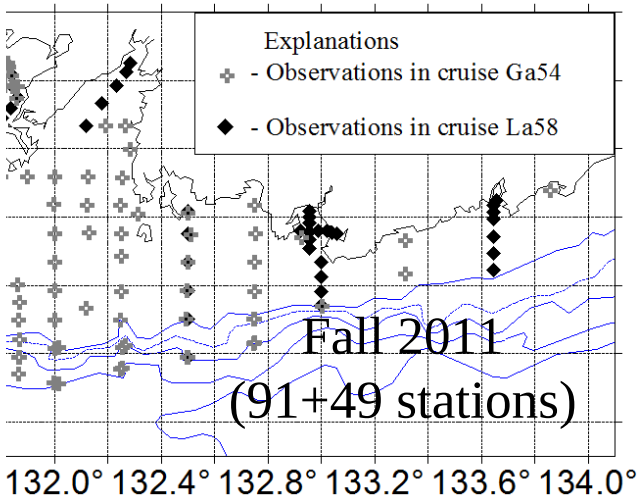
The nutrients content in the sea water and oxygen saturation is the one of the key-parameters demonstrated how the phytoplankton is supplied by food and how this food can be consumed with the water oxygination

To assess their affection a huge number of *in situ* measurements are needed. After the compact spectrophotometers have appeared it became possible To make these observation simultaneously

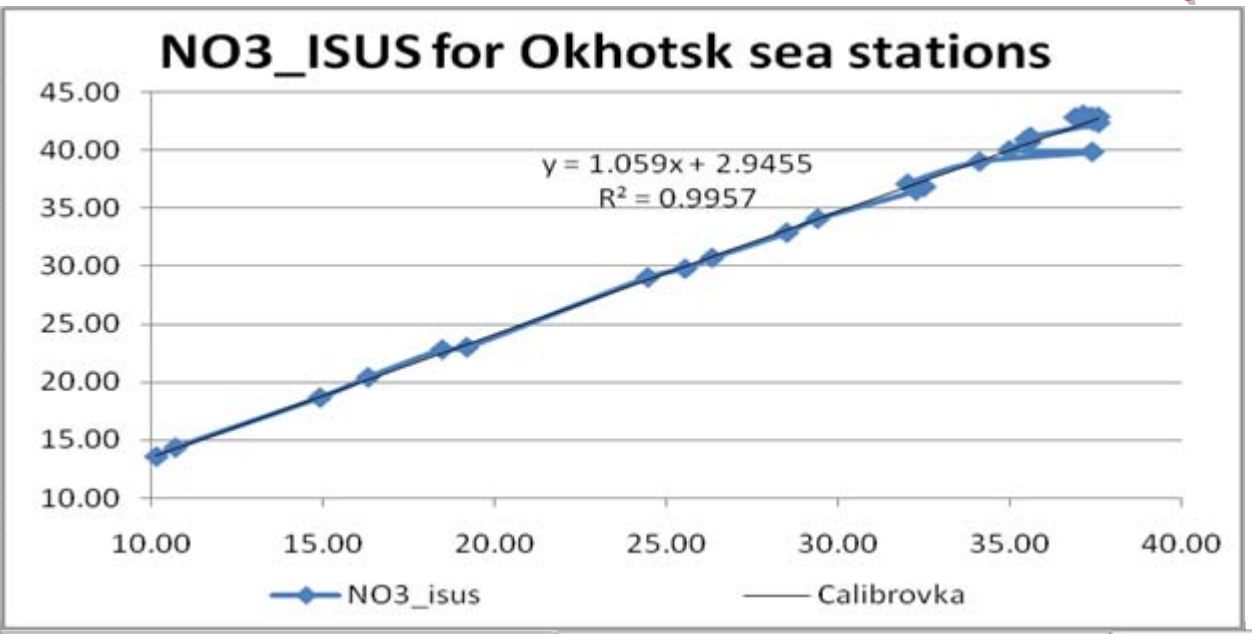
Region of surveys/data collection



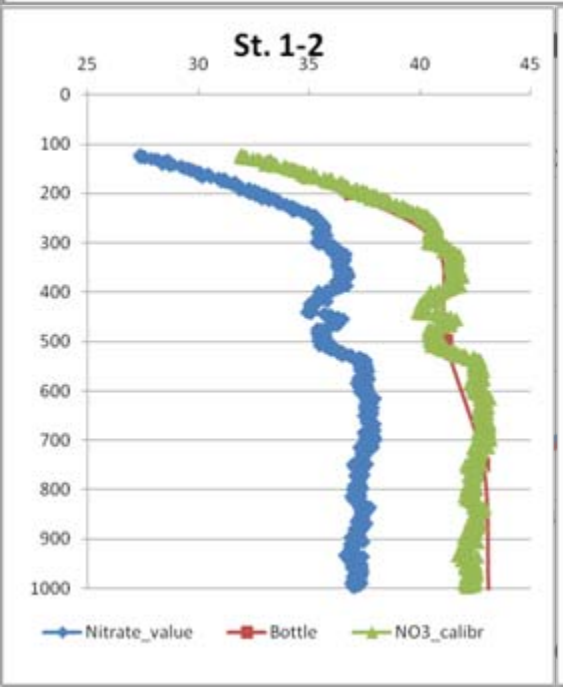
Measurements peculiarities:
-Coastal areas at continental slope;
-Using upcast vertical profiles;
-Winch speed 0.5 m*sec^{-1};
-Warm season for the Okhotsk sea.
- Warm and cold seasons of measurements in the Japan/East sea;

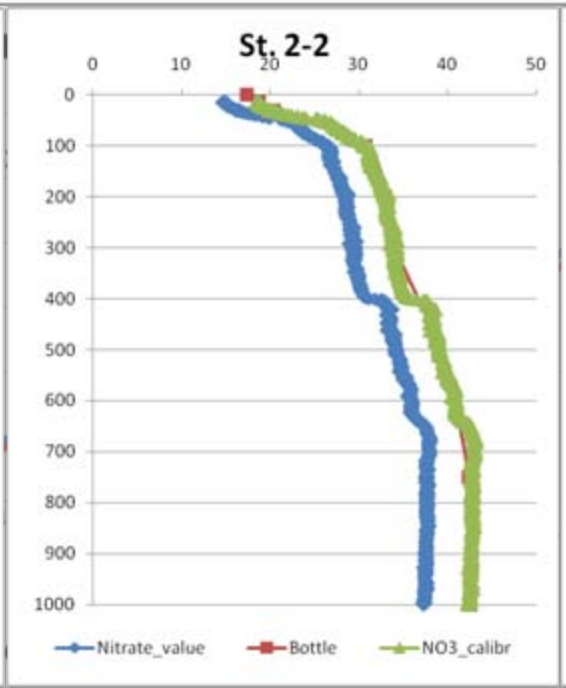


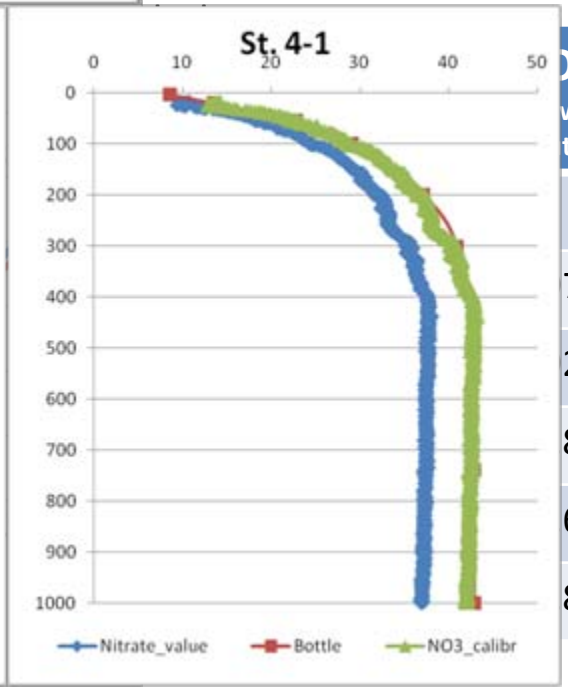
MBARI-ISUS calibration (Lab./Real cond.)



Calibration was made in Laboratory Conditions, using Solutions with the known NO3 Content: 0, 3.969, 9.924, 19.849, 29.614, 49.813 umol for each of them.
Every measurement was taken as mean value obtained during the 3 min. mesurement for temperature 25°C. Results of Calibration is shown it table







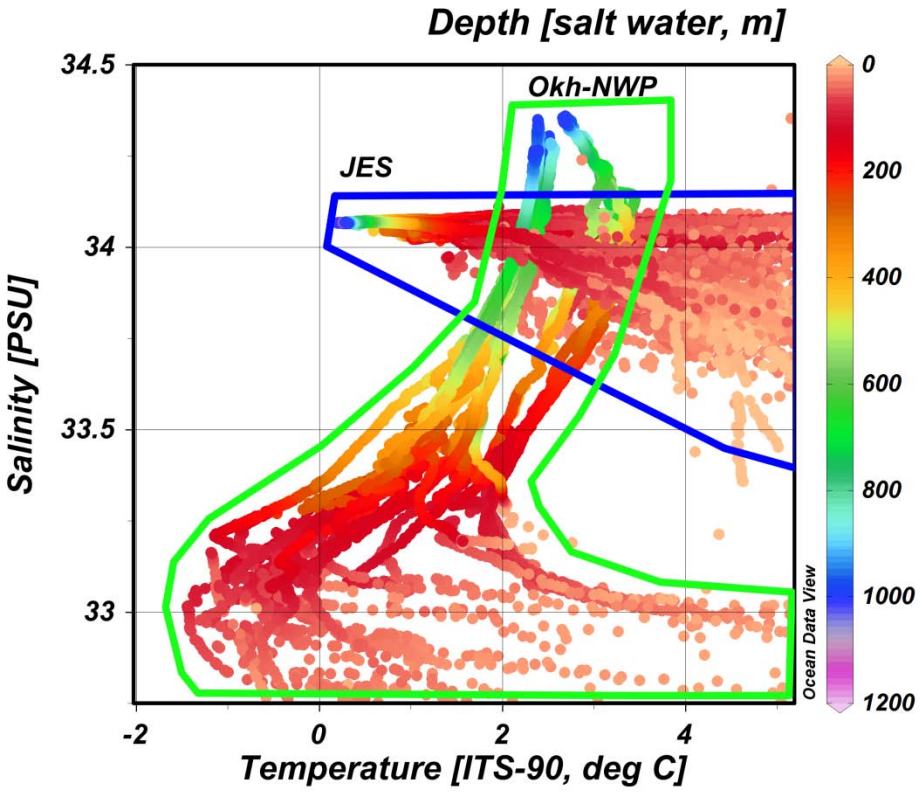
03 wn tion	NO3 calibrated ISUS
	0
7	3.84
2	10.13
85	20.25
61	29.60
81	49.62

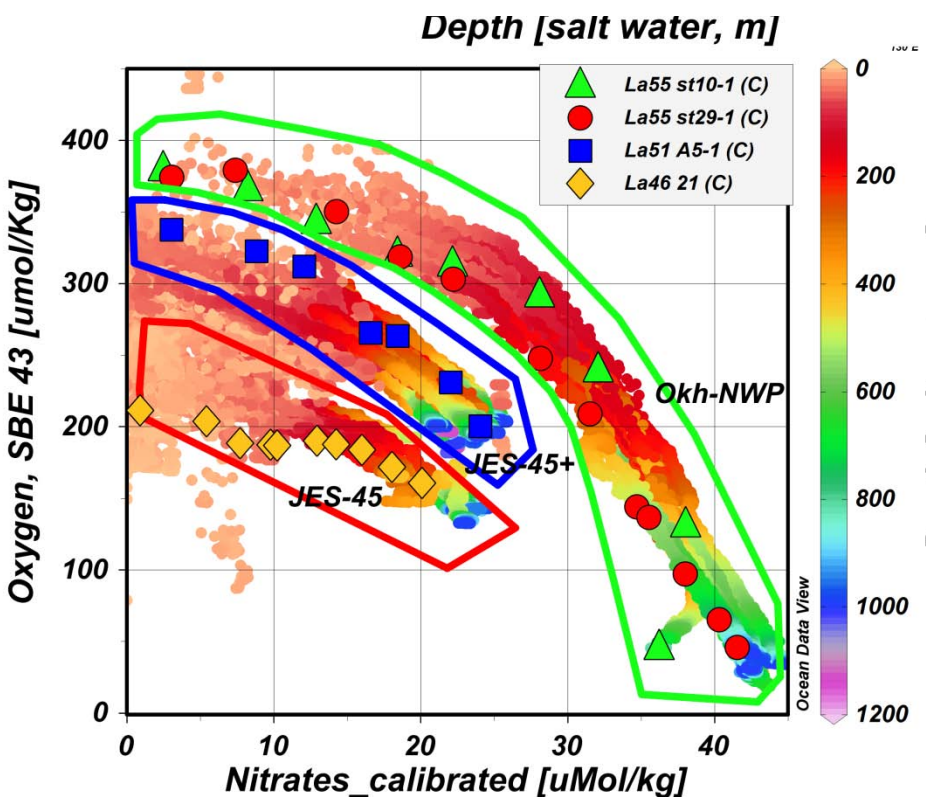
Results of measurements

- Using the NO_3 in situ data together with O_2 it is possible to classify water masses in addition to T-S classification

-The reason: water masses classification in the Japan/East Sea (e.g. Talley et al., 2006) using T-S and O_2 characteristics

T-S and O_2-NO_3 structures





– Using the O_2-NO_3 scale we have classified water masses in our research;

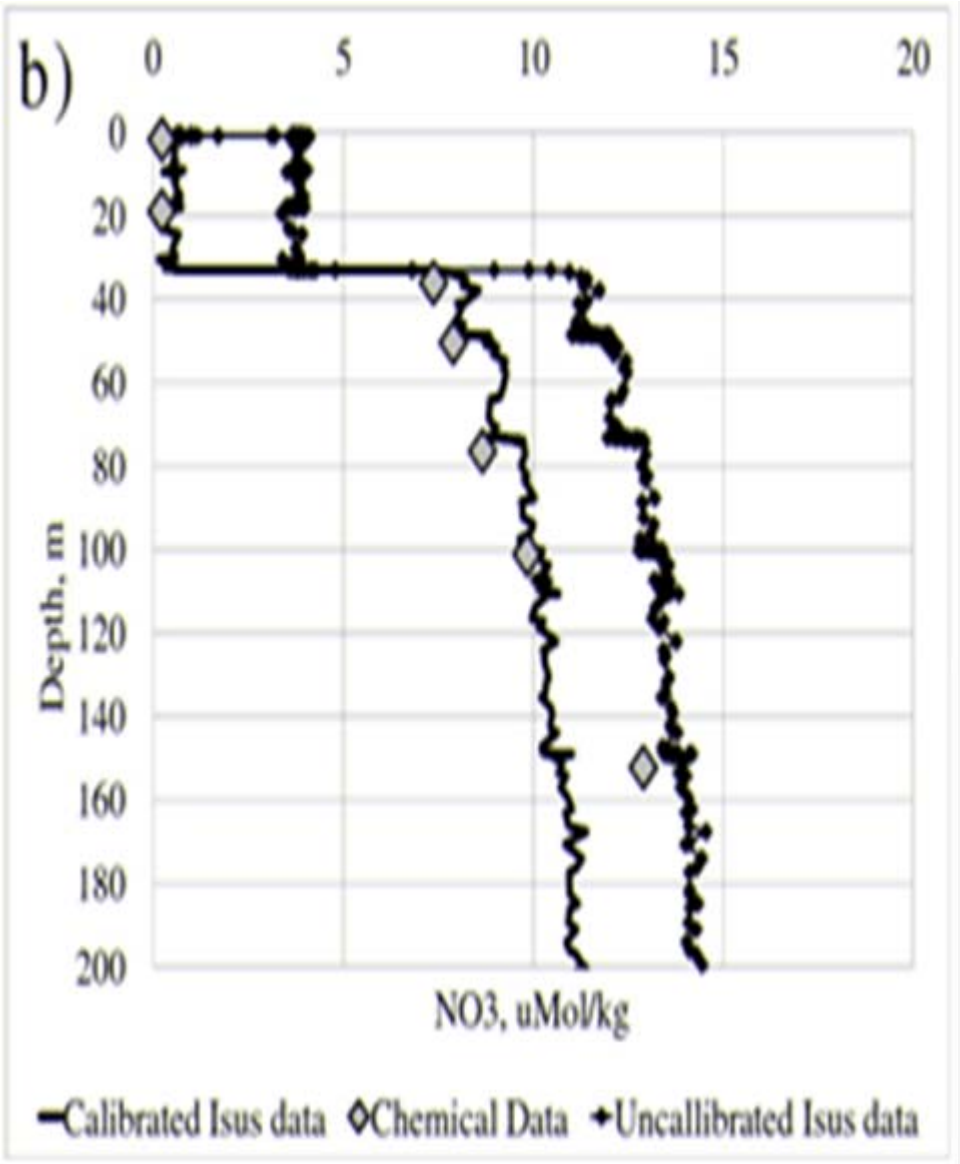
– There is a separation for the characteristics by the latitude 45N;

– For the Okhotsk sea and North-West Pacific two types of profiles was found;

Results of measurements

- What is stepped like structure?

What is step-like structure?



-The difference between measurement of ISUS and chemical analysis data could be the result of 'chronic undersampling of episodic processes' which have a place in sub-surface layer during the observation time;

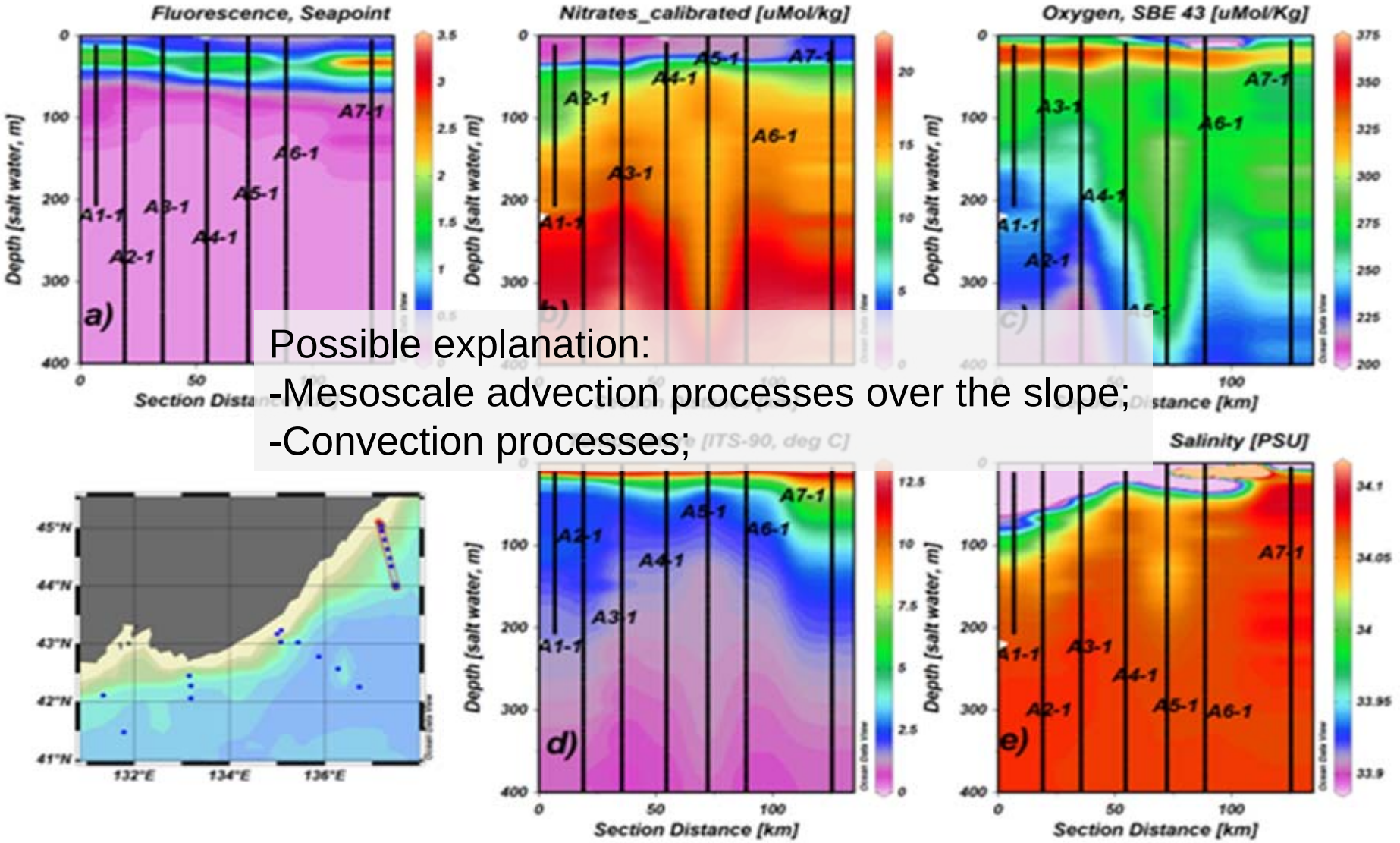
- Stepped-like structure can has a scale from tens to hundred meters;

Results of measurements

-Decreasing of O_2 concentration and increasing of NO_3 is a trivial fact for the deep stratified basins of sea water, but the presence of stepped-like structure was not reported before. Probably due to the small amount of observations.

-What is reasons of appearing these structures?

Observing mesoscale structure with step-like profiles NO_3-O_2



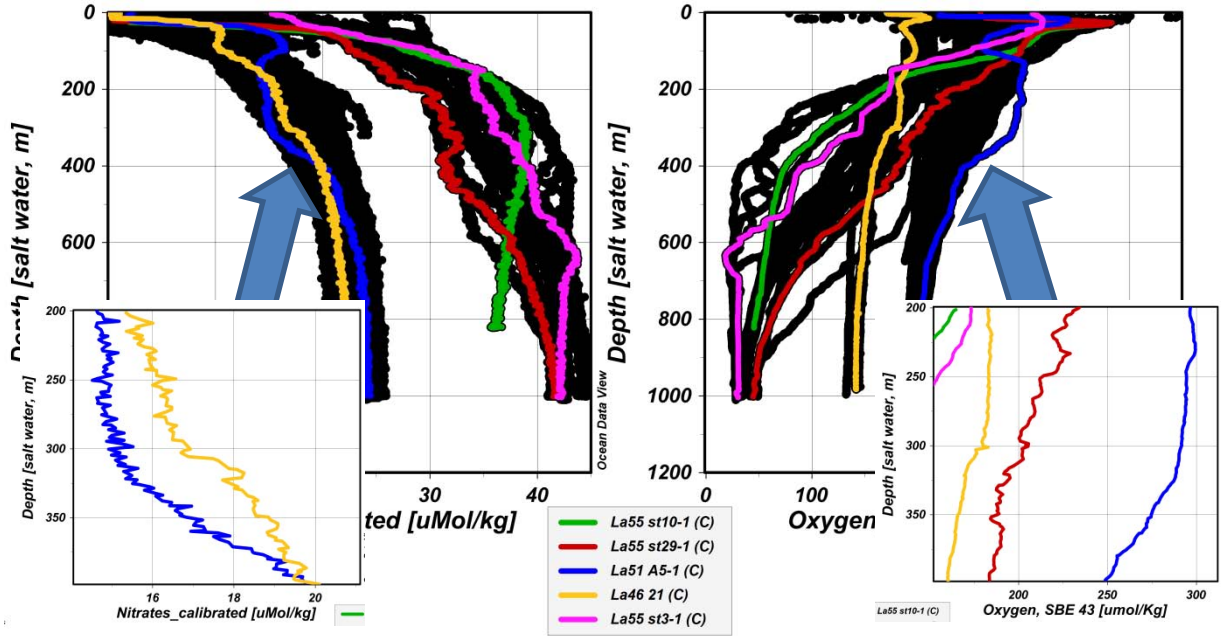
Possible explanation:
-Mesoscale advection processes over the slope;
-Convection processes;

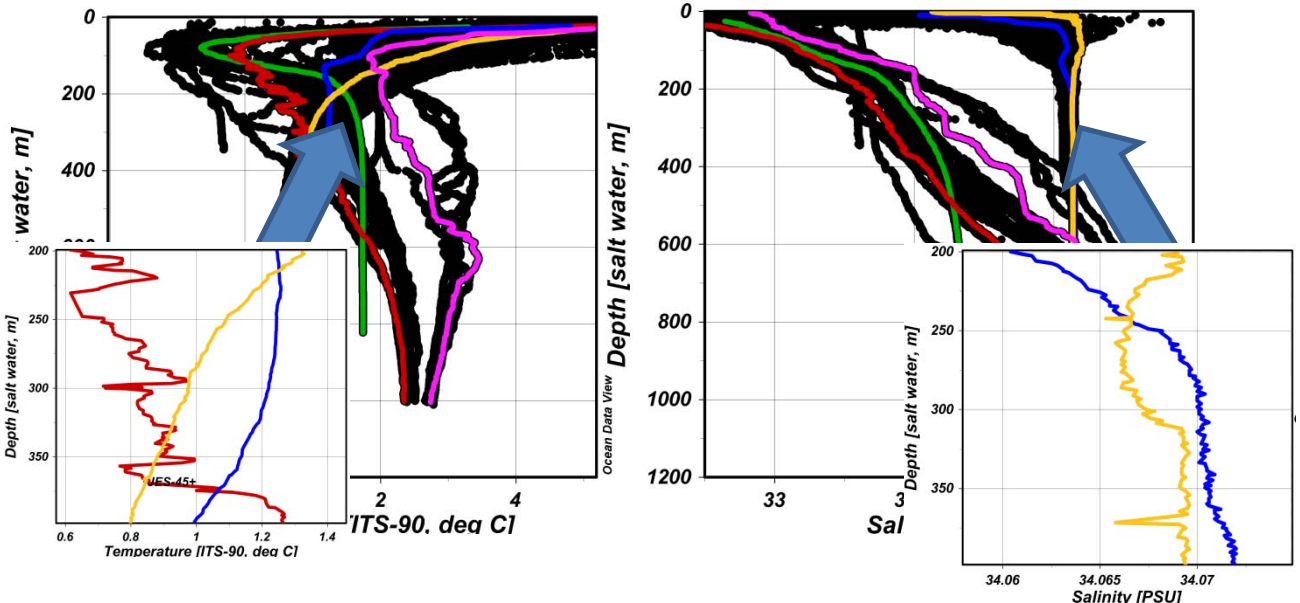
Results of measurements

Example of stepped-like structures.

Q: Do they coincide with T-S steps?

Vertical profiles NO_3, O_2, T, S





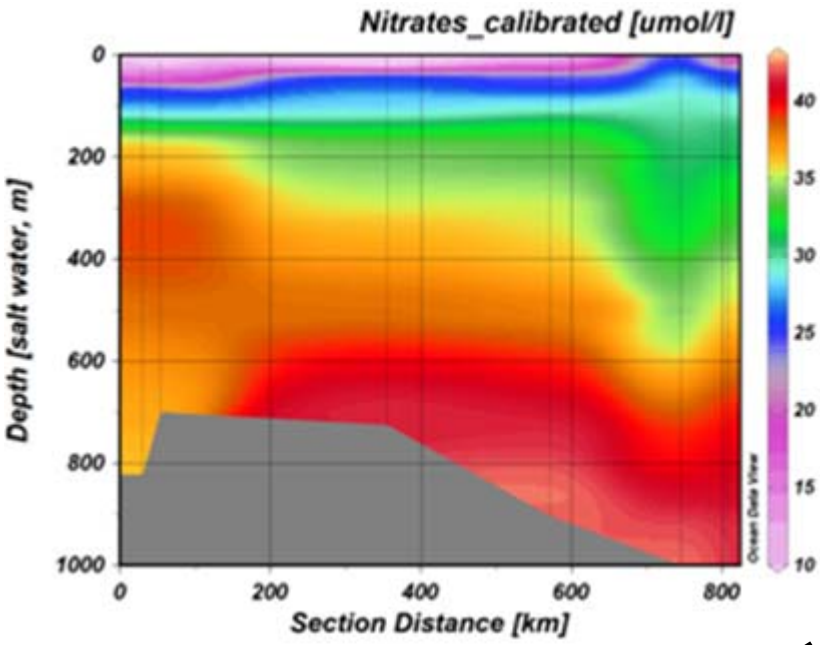
In case of Okhotsk Sea:
-NO_3-O_2 structures can coincide with T-S steps in case of water mixing in the insolated deep basin.

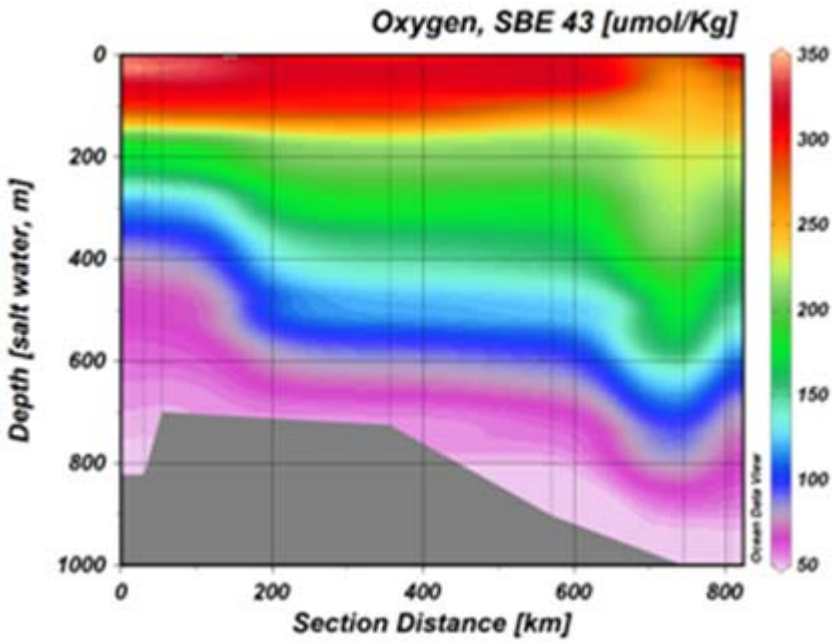
In case of East/Japan Sea:
-Difficult to prove due to small variations of T-S within deep layers

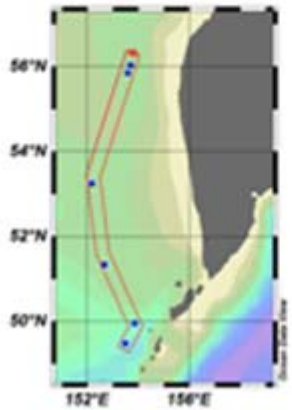
Odd O_2-NO_3 structures in the Okhotsk sea

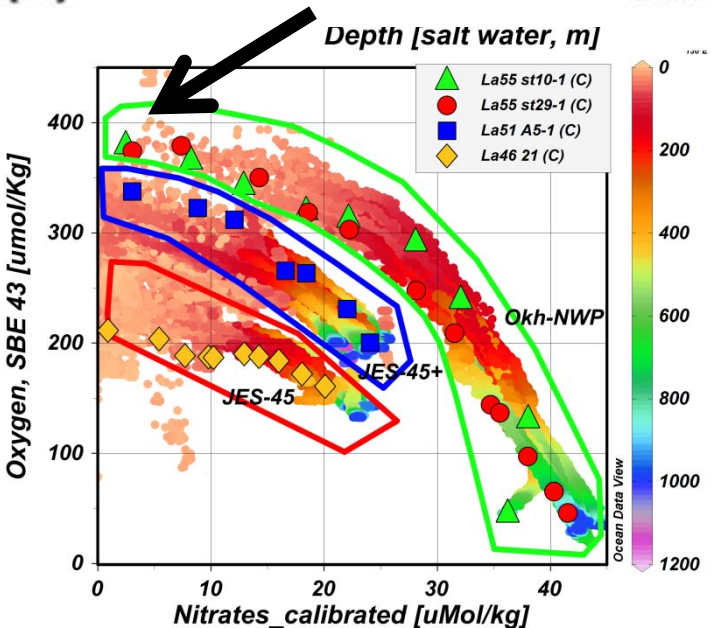
Q. Why NO_3 decreases at the depth together with the O_2?

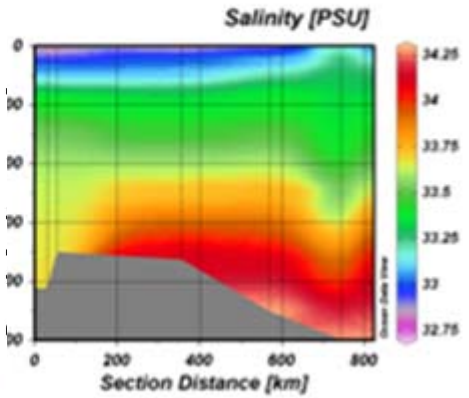
Anomalous NO_3 profiles in the Okhotsk sea











Outlines

- The conducted researches of 2009-2011 allow us to classify vertical structure of water masses within the scale of saturation O_2-NO_3 *in situ* measurements which was proved by the discrete chemical data;
- In case of presence of mesoscale advection processes over the slope or convection processes these vertical profiles can have a step-like structure;
- In case of Okhotsk sea it was proven that these steps coincide with the steps of T-S structures if they caused by water mixing (subduction) in the insolated deep water basin;
- Due to special mixing processes odd vertical structures of O_2-NO_3 is possible (decreasing of both characteristics with the depth);

감사 합니다!

Thank you for your attention!