WATER STRUCTURE AND CURRENTS IN THE NORTH-WEST JAPAN SEA IN MAY OF 1999

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Introduction

Over long period the radioactive wastes have being dumped in the Japan Sea. As the sea is comparatively isolated basin connected with surrounding areas by shallow straits the radioactive pollution has to accumulate in its deep waters. The study of concentration of radioactive pollution and its possible transport is actual for population of Japan, Russia and Korea.

Special measurements of radioactive pollution were implemented earlier in March-April of 1994 and in August-September of 1995. But in the expedition of Japan Institute of Atomic Energy (JAERI) in May – June of 1999 the oceanographic measurements together with measurements of radioactivity were made for the first time.

Data

In short period (4 days) the expedition of 1999 measured temperature, salinity (by CTD) and main chemical parameters of sea water (dissolved oxygen, pH, PO_4 and NO_2). Observation were made down to 3250 m at 12 stations. List of the stations is given in Table 1 and their distribution is shown in Fig. 1.

Table 1

List of CTD stations

Station	Date	Coordinates	Depth, m
10(E10)	May 28, 1999	41°15'N, 134°29'E	3562
11(E11)	May 29, 1999	41°15'N, 133°47'E	3525
12(G12)	May 29, 1999	41°15'N, 133°04'E	3484
13(F13)	May 29, 1999	41°15'N, 132°27'E	3433
14(F14)	May 29, 1999	41°00'N, 132°21'E	3420
15(F15)	May 30, 1999	40°36'N, 132°45'E	3428
16(F16)	May 30, 1999	40°13'N, 133°08'E	3311
17(F17)	May 30, 1999	39°50'N, 133°32'E	1200
18(F18)	May 30, 1999	40°04'N, 134°10'E	566
7(E07)	May 31, 1999	40°14'N, 134°35'E	839
8(E08)	May 31, 1999	40°26'N, 135°06'E	2544
9(E09)	May 31, 1999	40°50'N, 134°49'E	3344

Measurements of currents by current meters on anchored buoy and by PALACE drifters were carried out in addition. Two PALACE floats (number 284 and 285) were balanced to drift at 600 m level and to flow up at the surface every 10 days. During the lifting the floats sensors measured basic oceanographic parameters of sea water (temperature and conductivity). However the float N 285 had stopped at the surface after one cycle of observation only. Positions of oceanographic stations of PALACE float 284 are shown in Fig. 1.

Distribution of Water Characteristics at Some Levels

Distribution of temperature and salinity at the surface in winter (March 22 – March 28, 1999) and in spring (May 28-31, 1999) is presented in Fig. 2. Major features of temperature distribution in winter are North-western front (Danchenkov *et al*., 1997) and the belt of salty water along 42°N (Danchenkov & Aubrey, 1999).

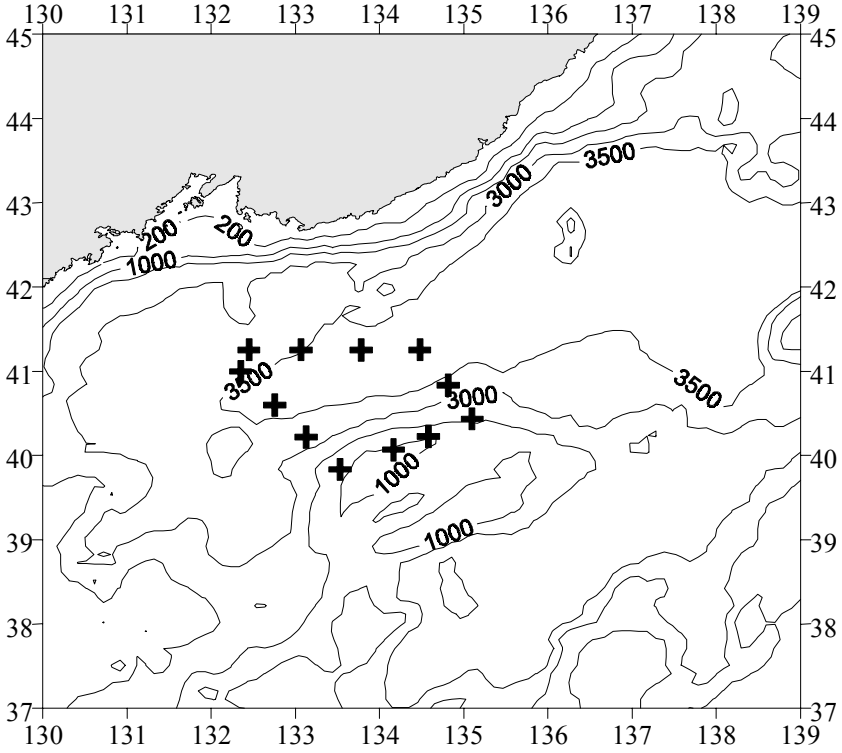

Fig. 1. Positions of CTD (rectangles) and PALACE (circles) stations in May of 1999

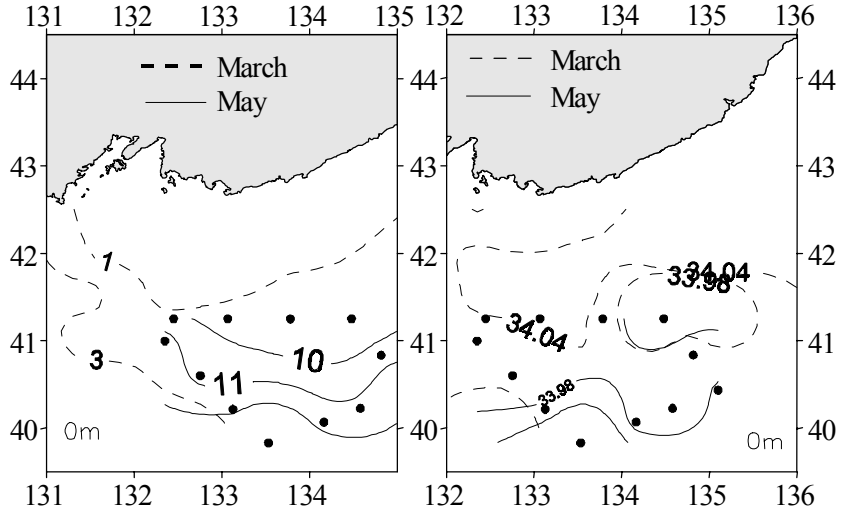

Fig. 2. Distribution of water temperature and salinity in winter (dotted line) and spring of 1999 at the surface

Northwestern front is a branch of Subarctic front that divides cold subarctic waters from warm mixed subtropical waters in upper 100 meters layer. It exists in May also (Danchenkov *et al*., 1997).

Inside the belt of salty and comparatively warm waters distributed as a branch of Tsushima Current from Hokkaido coast to the west toward the North-western front. It exists during most part of the year and can be traced from the surface (in winter) or 50 m level (in summer) down to 800 m. Probably salty water supplying by this branch takes part in process of deep water formation in area of Northwestern front.

In the end of May 1999 the Northwestern front was revealed on temperature and salinity fields down to 200 m. Front was traced in distribution of chemical parameters as well (Fig. 3).

A warm eddy (traced down to 500 m) with center above Yamato rise was found at the southern edge of the study area (Fig. 4).

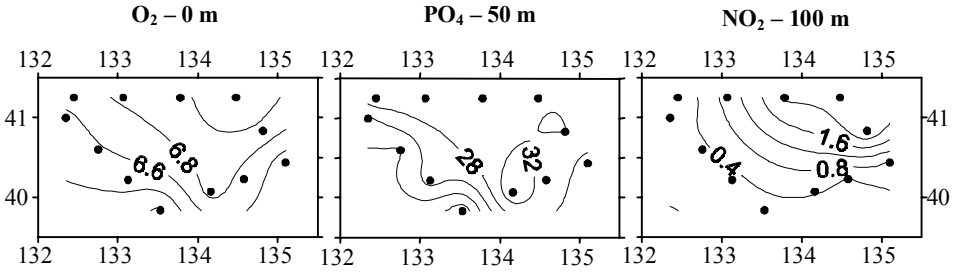

Fig. 3. Northwestern front revealed by distribution of dissolved oxygen (ml/l), PO_4 (μg/l) and NO_2 (μg/l) in May of 1999

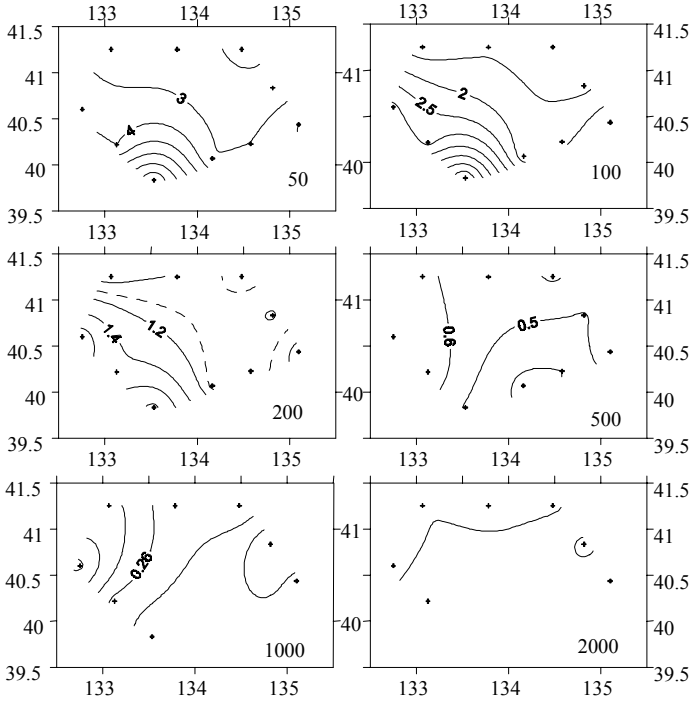

Fig. 4. Distribution of water temperature at 200 m, 500 m, 100 m and 2000 m

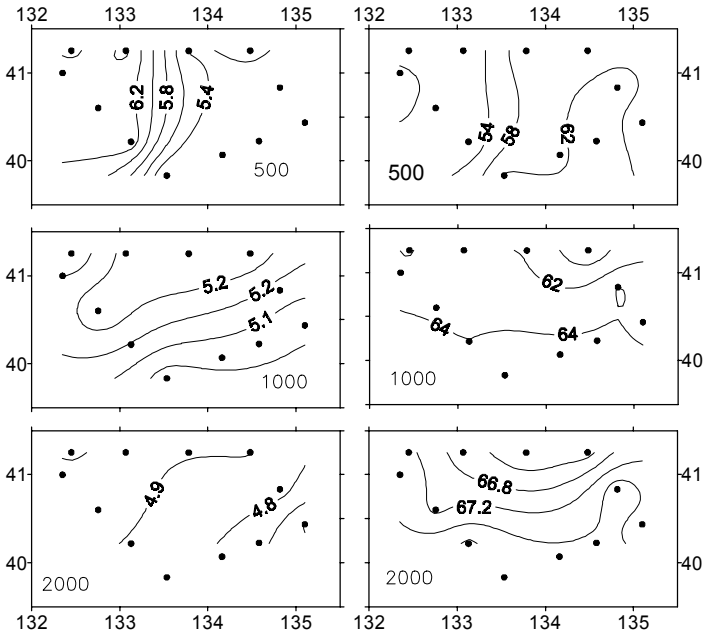

Fig. 5. Distribution of dissolved oxygen content (ml/l, left) and PO4 (μg/l, right) at 500 m, 1000 m, 2000 m.

Vertical Water Structure

TS-indexes for typical stations located south (station 17) and north (station 10) of Subarctic front are presented in Fig. 6. It is possible to pick out 5 water masses in a vertical water structure of the Japan Sea:

1) surface low salinity (25 °C, 33.4 psu);
2) surface and subsurface of high salinity (12 °C, 34.23 psu);
3) intermediate low salinity (4 °C, 33.92 psu);
4) deep (0.2 °C, 34.06-34.07 psu).

Intermediate water mass of low salinity is traced everywhere south of Northwestern front while water mass with high salinity was found only to the south of 40°N and to the west of Hokkaido. Fig. 6. *T*(*S*)-curves of 2 typical stations.

Core of deep water mass lies between 1000 m and 1200 m.

Currents and Water Transport

Scheme of PALACE float drift is presented in Fig. 7. The float has being drifting along southern edge of the Japan Basin and stopped at one of Yamato rises.

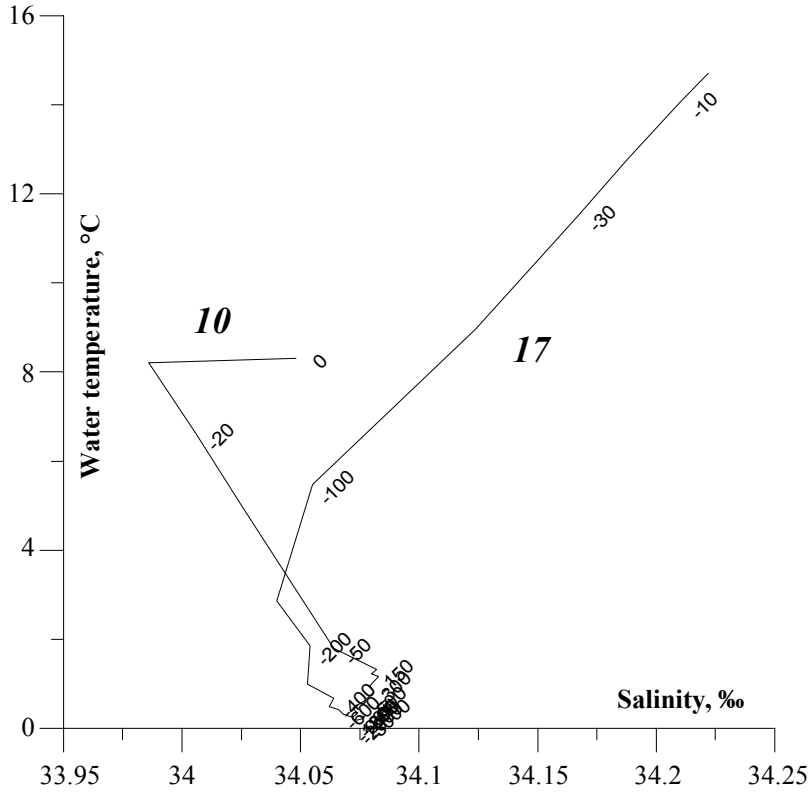

Fig. 6. T(S)-curves of 2 typical stations

Drift of other PALACE floats (on 800 m) shows deep water transport (from Tumangan estuary to Yamato rise) briefly coincided with position of North-west front – Fig. 8.

Trajectory of other PALACE floats balanced at 800 m depth shows deep water transport directed from Tumangan river mouth toward Yamato rise and coincided with a position of Northwestern front (Fig. 8).

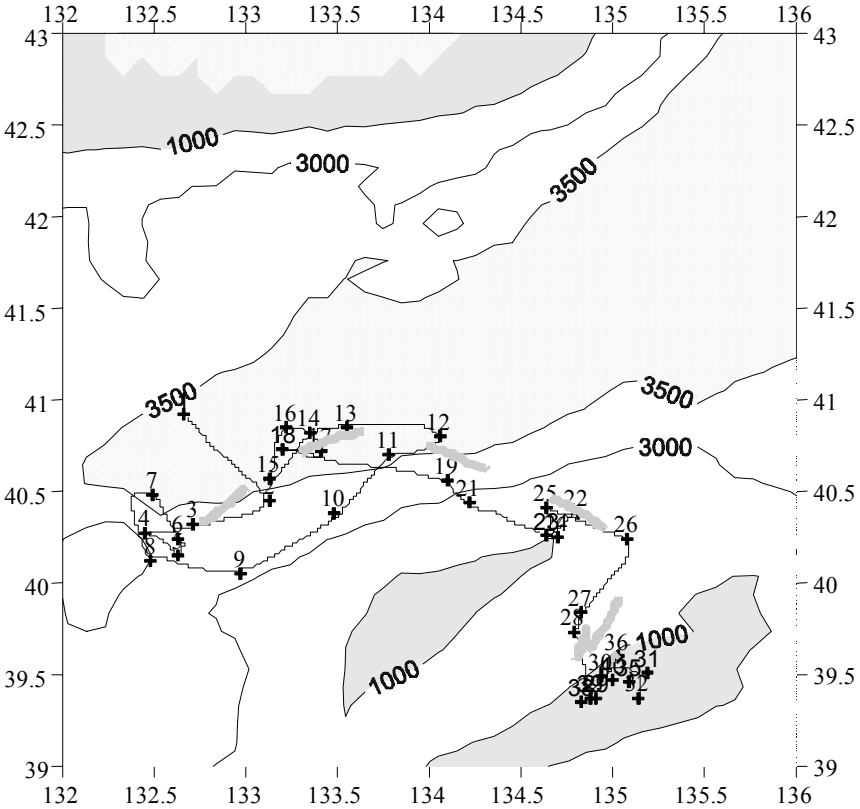

Fig. 7. Trajectory of PALACE float N 284 drift from June 1999 till December 2000 at 600 m

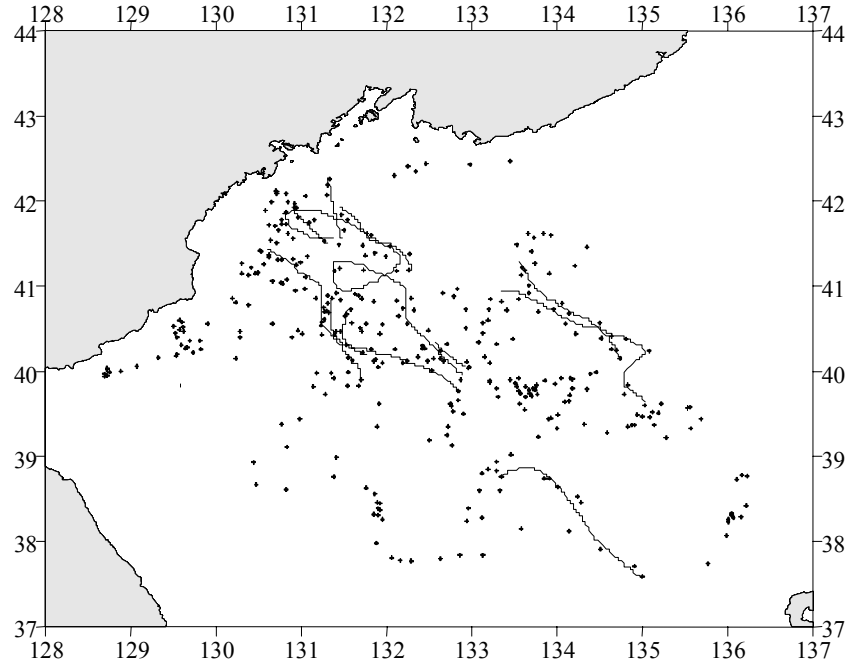

Fig. 8. Trajectories of PALACE floats drift in the Northwest Japan Sea in 1999-2000

References

1. Danchenkov M.A. & Aubrey D.G. 1999. Large-scale meander of Tsushima current as possible source of JSPW // Proc. CREAMS'99. Fukuoka. Japan. P. 23-26.
2. Danchenkov M.A., Nikitin A.A., Volkov Yu.N. & Goncharenko I.A. 1997. Surface thermal fronts of the Japan Sea // Proc. CREAMS'97. Fukuoka. Japan. P. 75-79.