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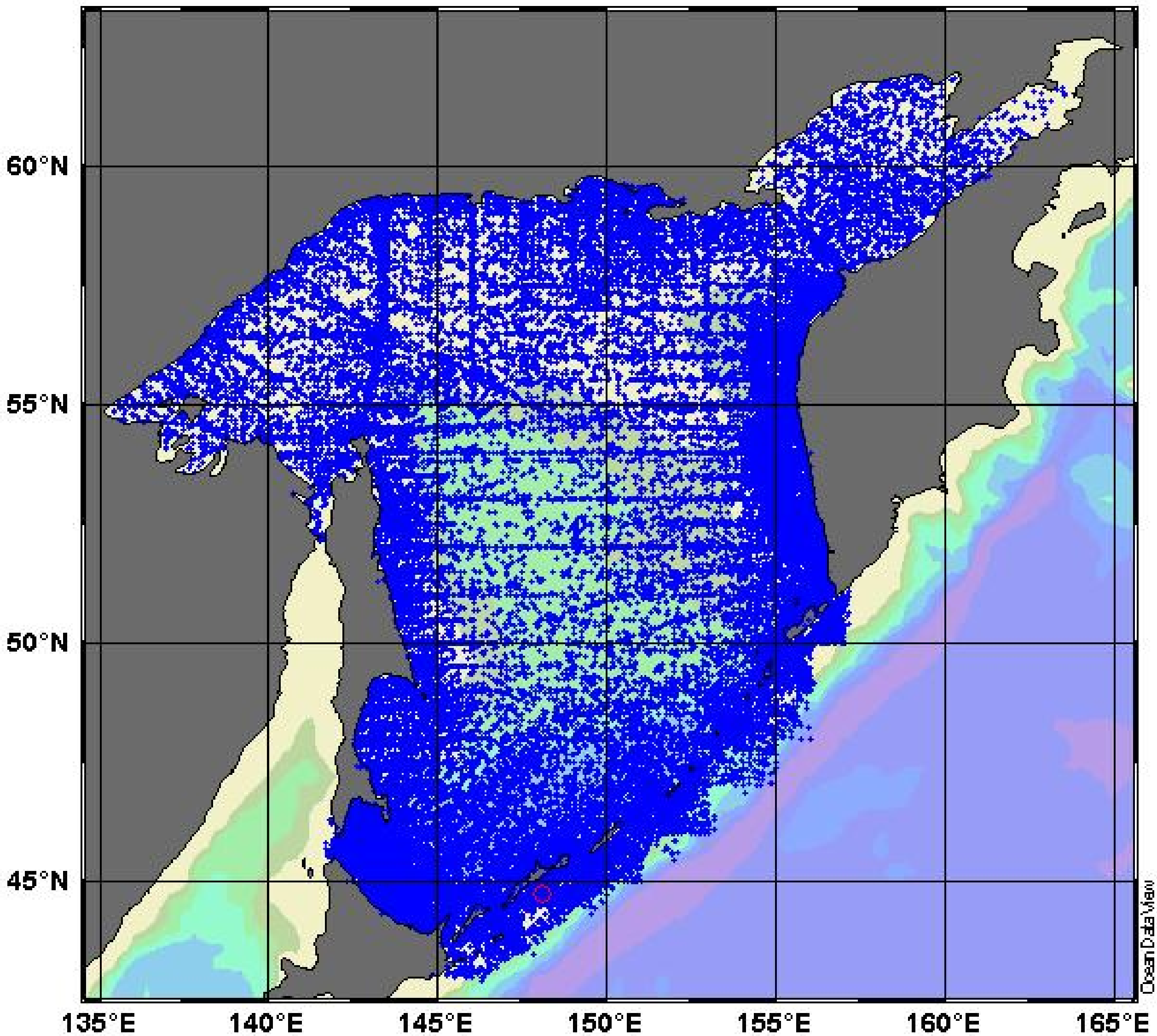
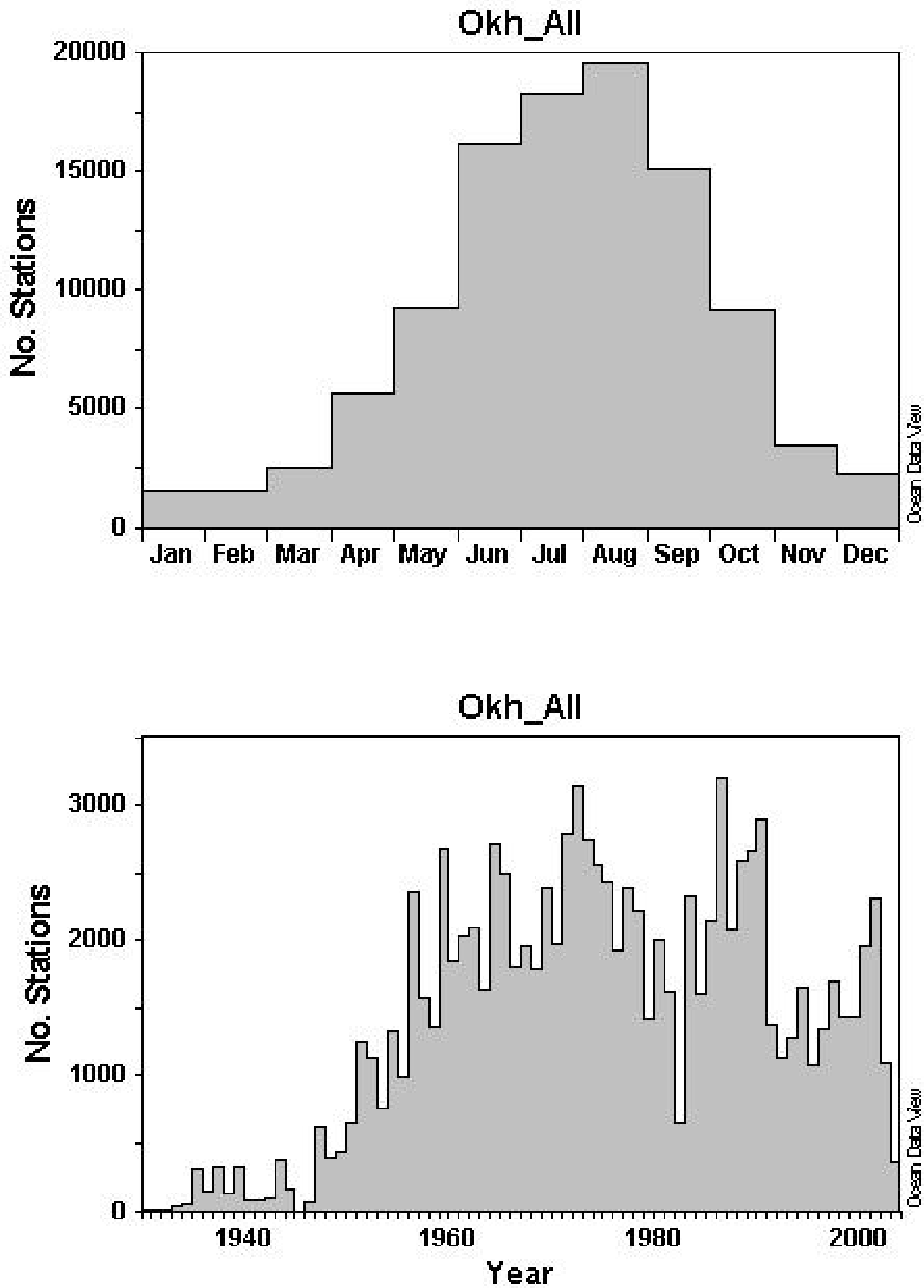
Typical distribution of interannual variations of water temperature in the active layer of the Okhotsk Sea and their possible prediction.

In our research we set the following objectives:

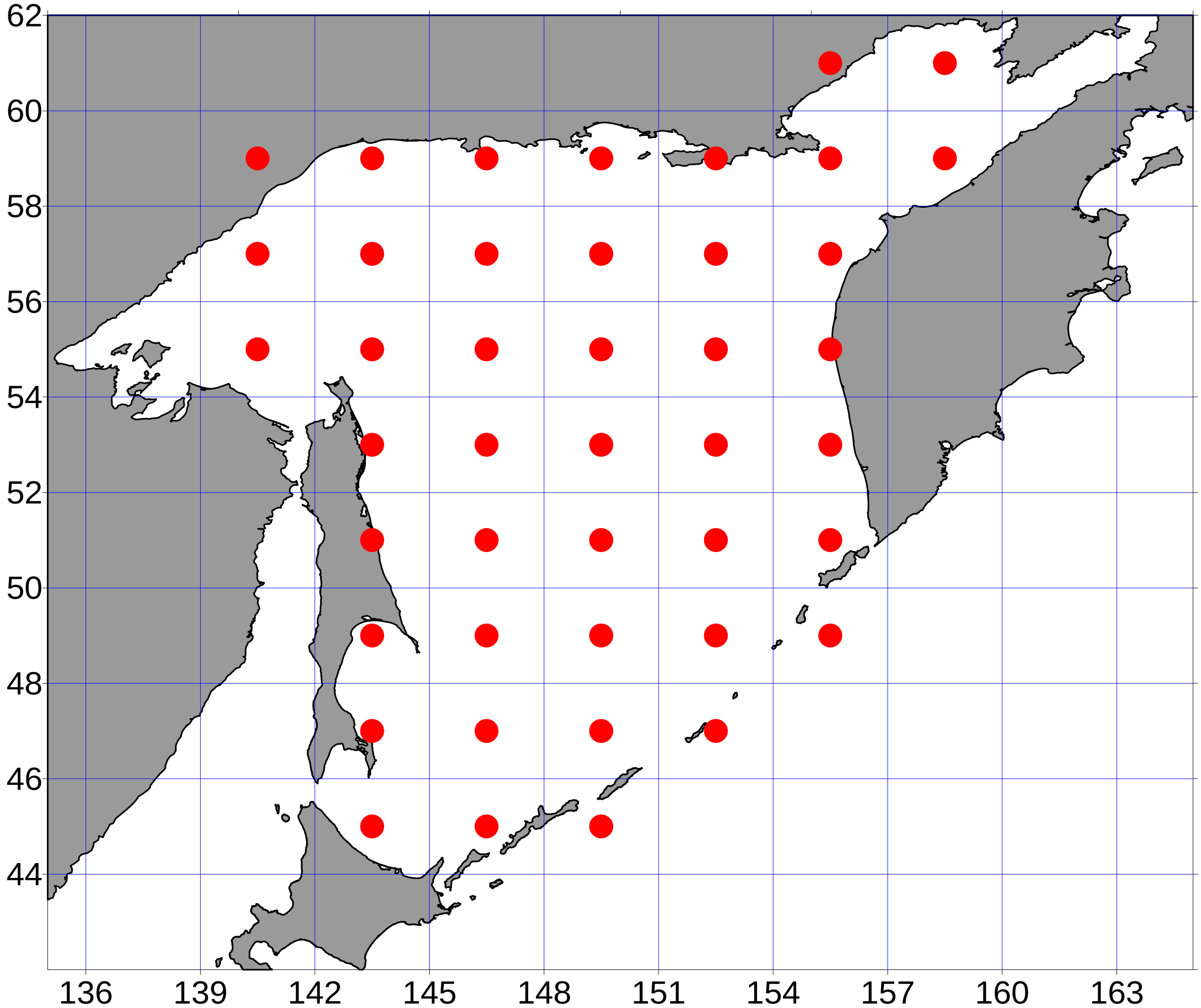
1. **To recover missing data in the annual water temperature fields;**
2. **To apply EOF-analysis to the generated fields and to analyze interannual variations of water temperature in the Okhotsk Sea;**
3. **To draw a typical distribution of water temperature in the Okhotsk Sea for cold and warm years;**
4. **To find possible relations between interannual variations of water temperature and atmospheric variability, ice conditions and biological organisms.**



Spatial distribution of oceanographic stations in the Okhotsk Sea (104631 stations from 1930 to 2004)



Temporal distribution of oceanographic stations.



Position of centers of trapeziums used for EOF decomposition of water temperature fields.

$$T_i = \frac{R_i}{Sr_i}\ , \quad \textbf{where} \quad Sr_i = \sqrt{\frac{(1 - r_i^{\,2})}{(N_i - 2)}} \qquad \textbf{(1)}$$

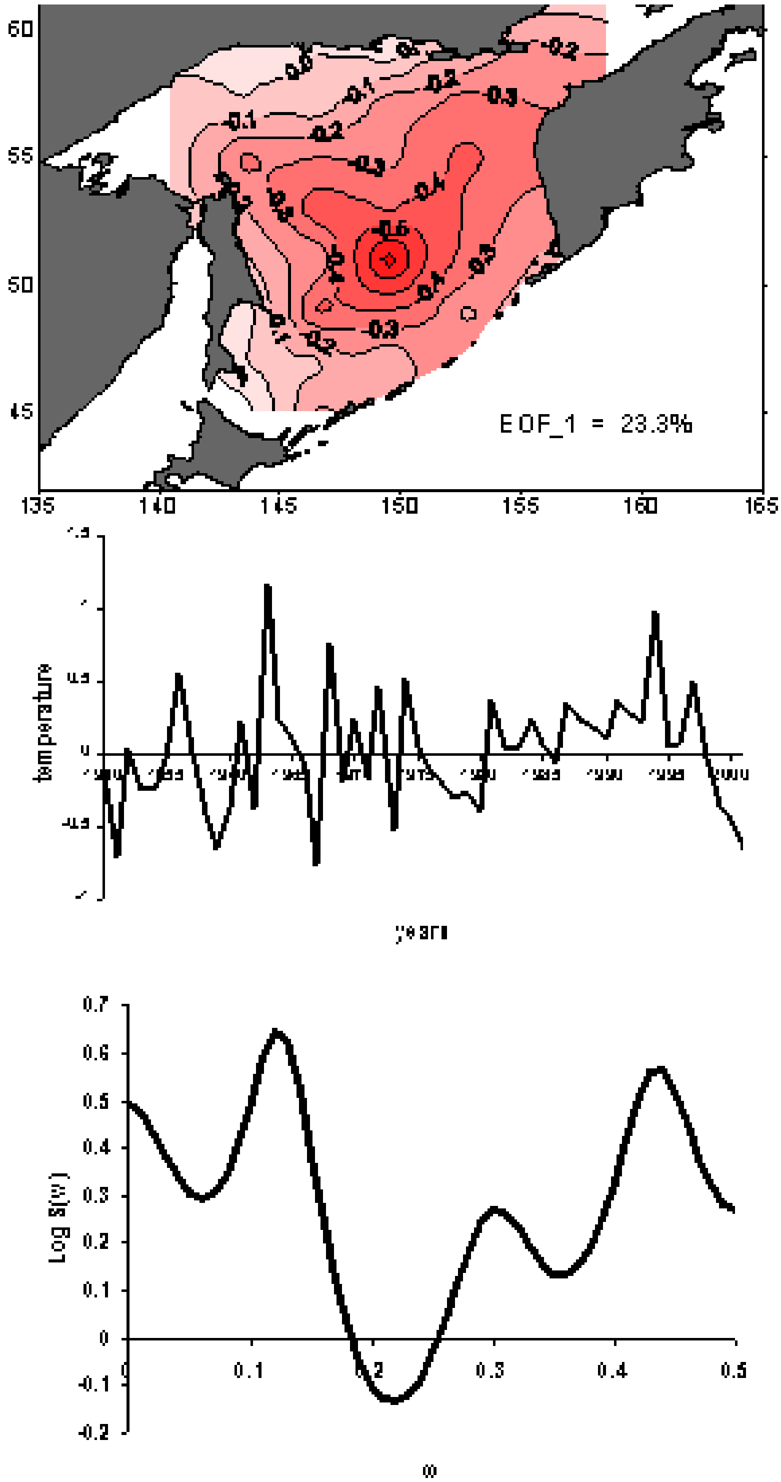
$$Y_i = A_0 + A_1 * X_i\ , \qquad \textbf{(2)}$$

where $A_0 = \bar{Y} - A_1 * \bar{X}$,

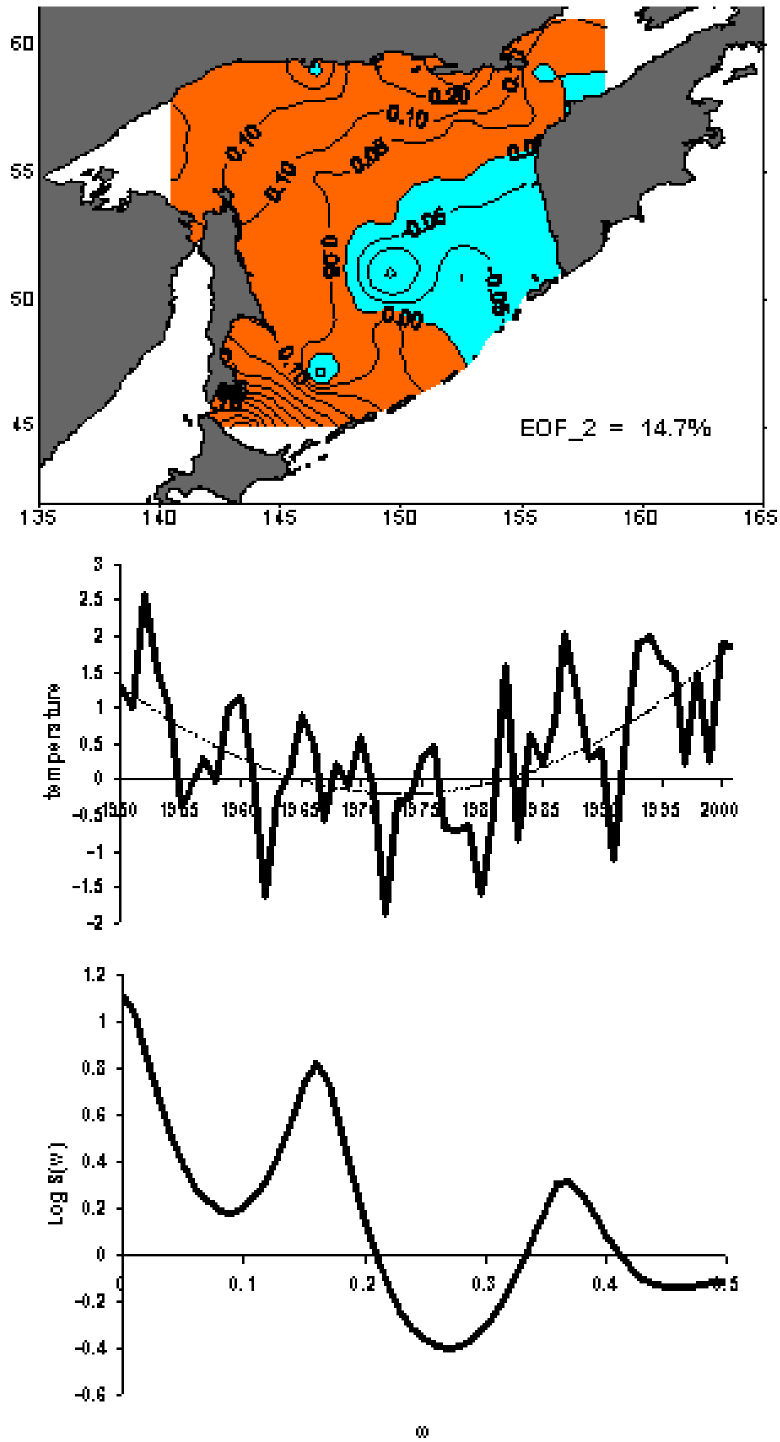
$$A_1 = \frac{(\overline{X * Y}) - (\overline{X}) * (\overline{Y})}{(\overline{X^2}) - (\overline{X})^2}$$

$$Y = \frac{\sum (Y_i * F_i)}{\sum F_i}\ , \qquad \textbf{(3)}$$

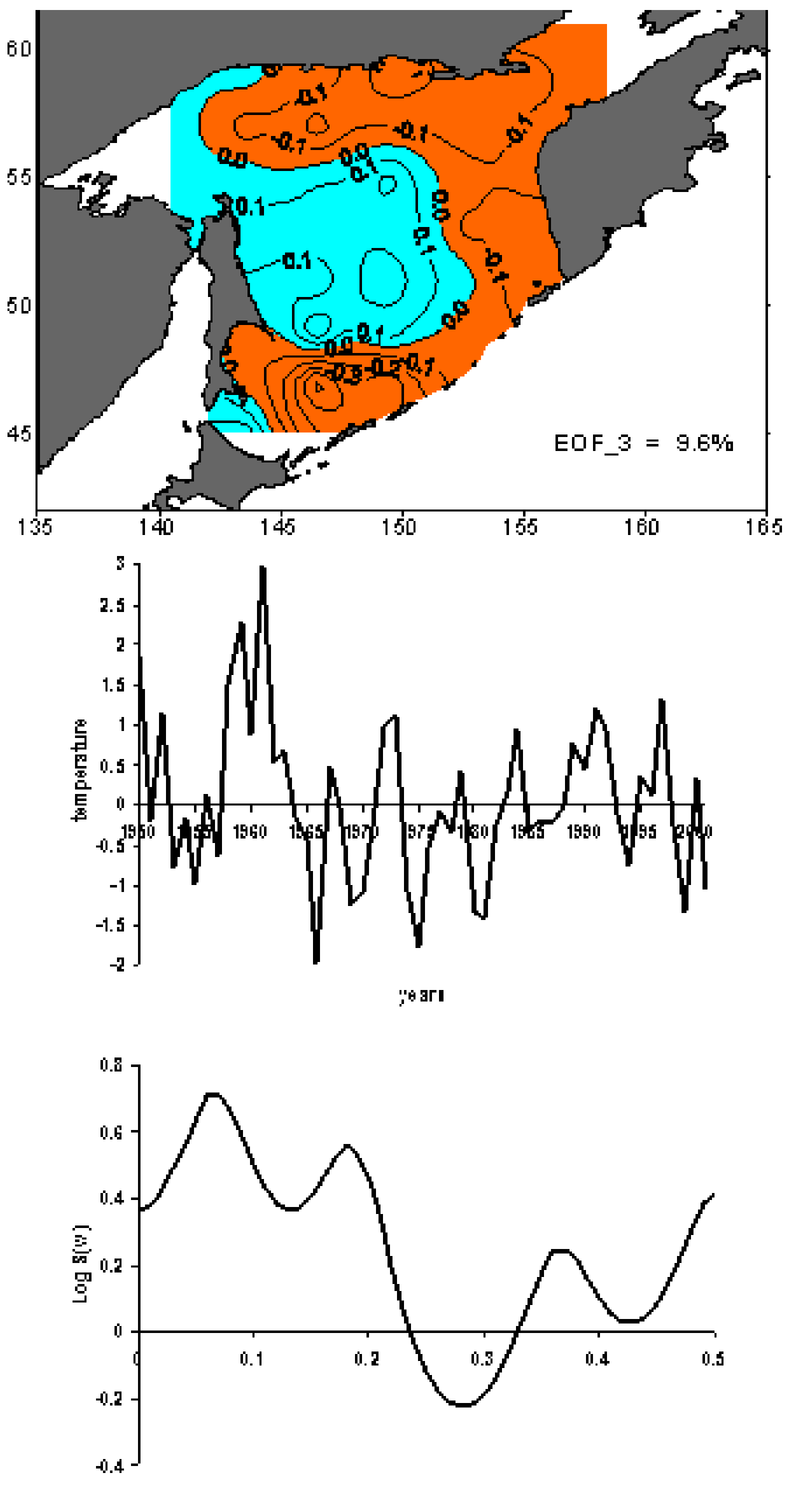
where $F_i = \dfrac{T_i}{\sum T_i}$.



First EOF mode of water temperature fields decomposition (upper – spatial distribution, middle – temporal component, lower – spectral representation of a temporal component).



Second EOF mode of water temperature fields decomposition (upper – spatial distribution, middle – temporal component, lower – spectral representation of a temporal component).



Third EOF mode of water temperature fields decomposition (upper – spatial distribution, middle – temporal component, lower – spectral representation of a temporal component)

Normal years, if $/\Delta T/ < 0.674\sigma$, **(1)**

Where ΔT ***is the product of the first temporal and spatial functions of EOF decomposition of water temperature anomalies,*** σ ***is a standard deviation.***

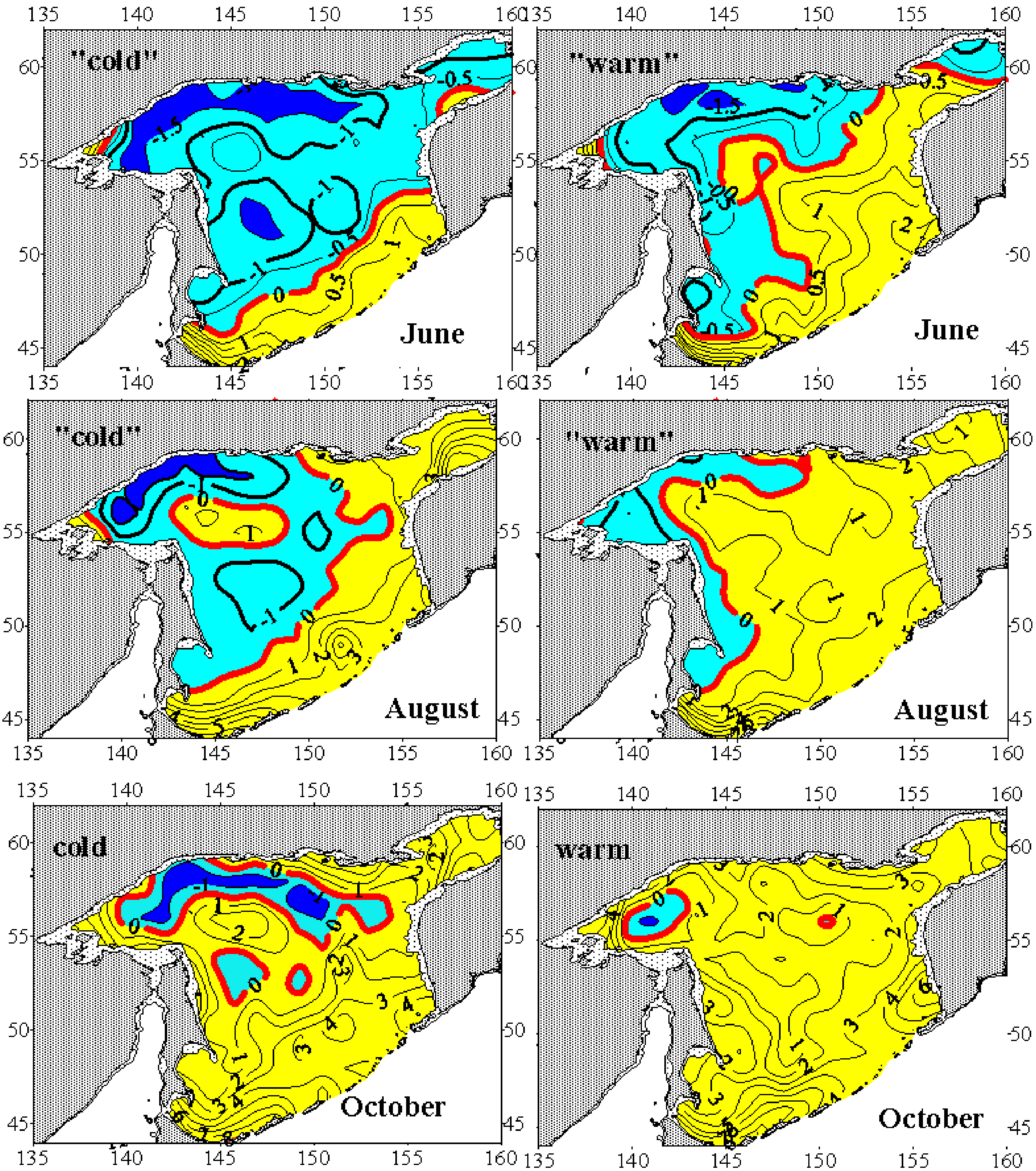
Cold years, if $\Delta T < -0.674\sigma$ **(2)**

Warm years, if $0.674\sigma < \Delta T$ **(3)**

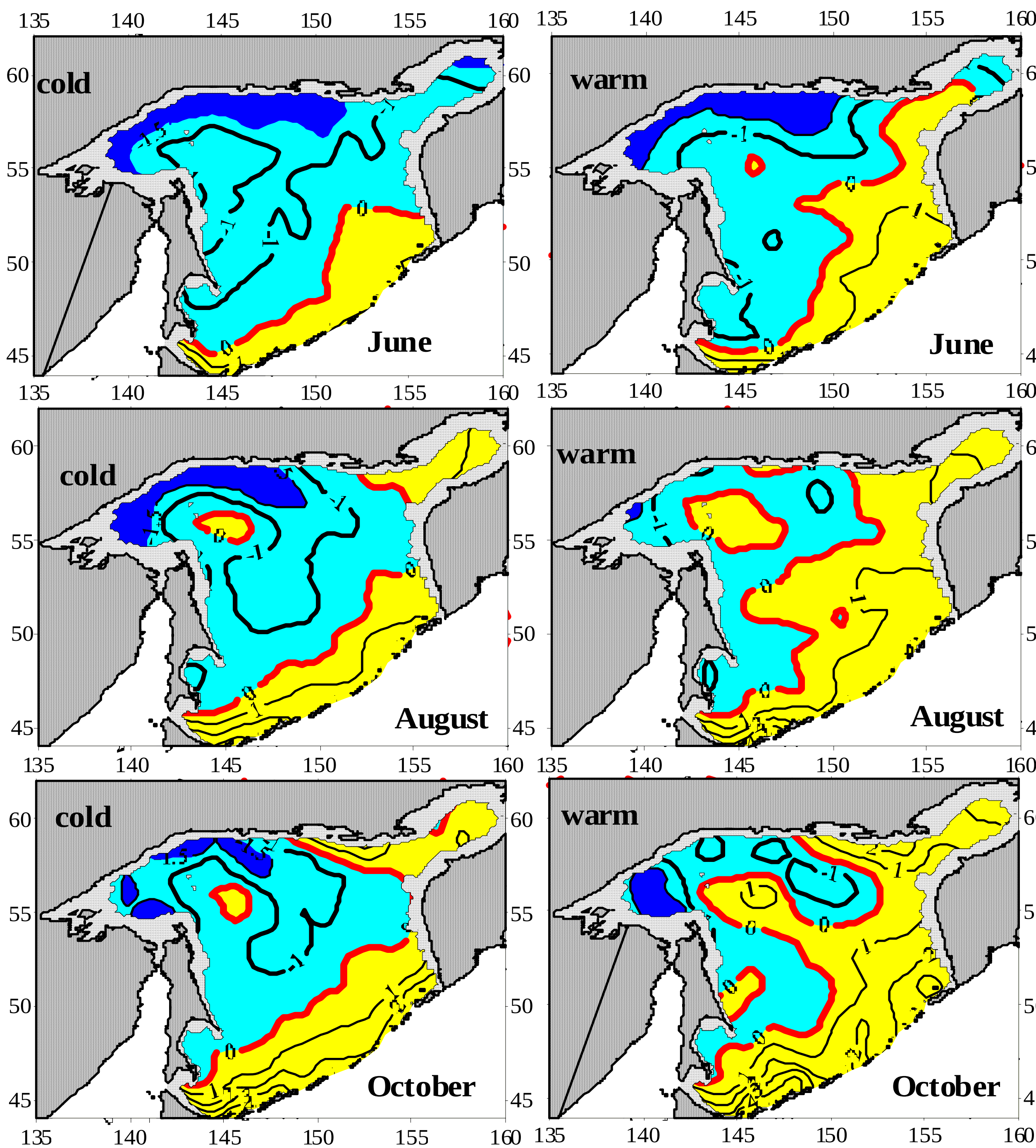
Warm years:
1956, 1961, 1963, 1964, 1968, 1974, 1981, 1984, 1987, 1991, 1994, 1997.

Normal years:
1950, 1952, 1953, 1954, 1957, 1960, 1962, 1965, 1969, 1970, 1971, 1975, 1979, 1980, 1982, 1983, 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1995, 1996, 1998.

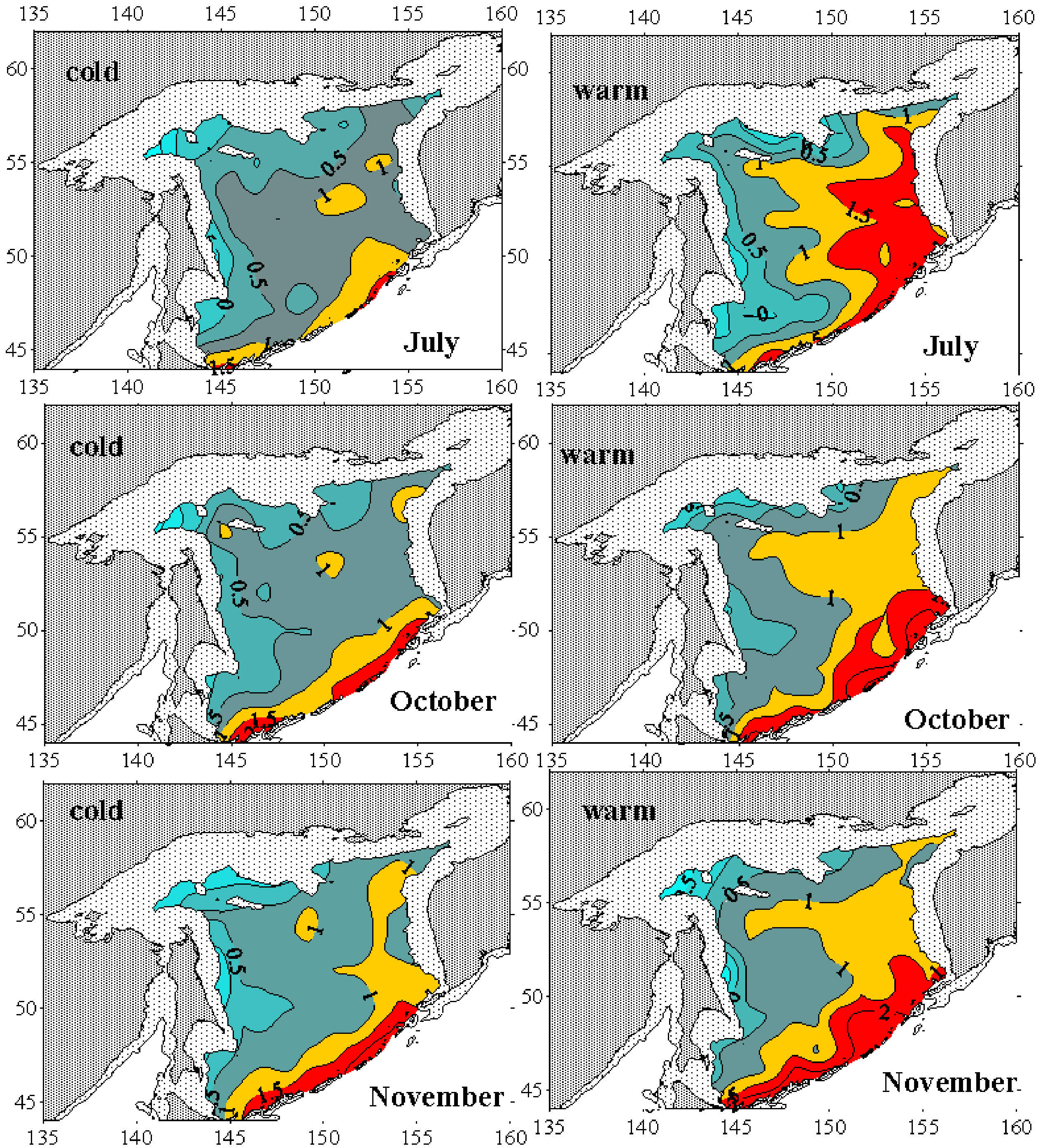
Cold years:
1951, 1955, 1958, 1959, 1966, 1967, 1973, 1976, 1977, 1978, 1999, 2000, 2001.



Typical distribution of water temperature at 50 m depth in warm and cold years.

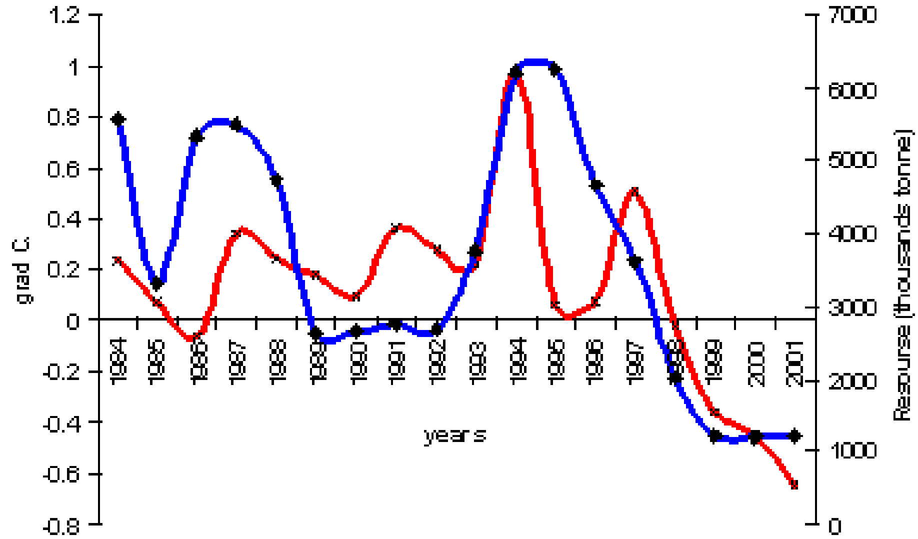


Typical distribution of water temperature at 100 m depth in warm and cold years.



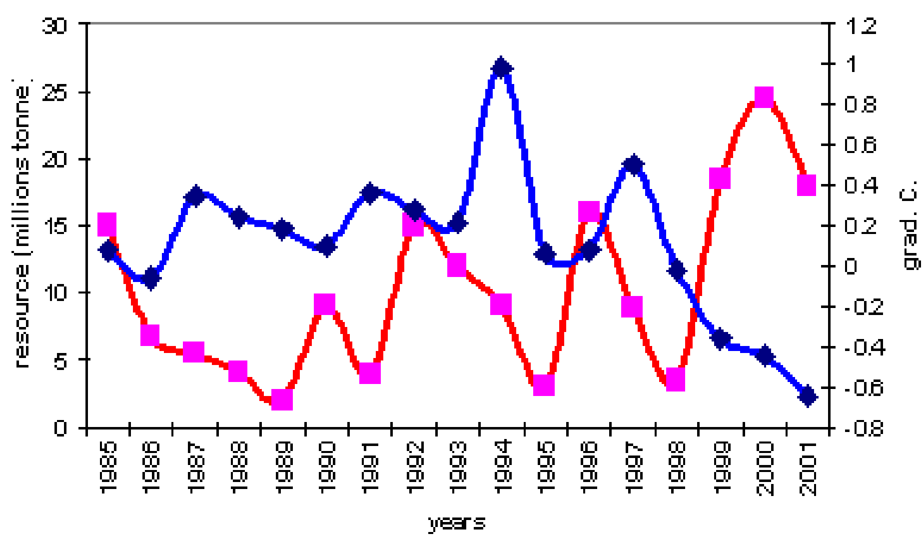
Typical distribution of water temperature at 200 m depth in warm and cold years.

Variability of resource of Walleye Pollock (blue line) and of the water temperature (contribution of V1) (red line) in the West Kamchatka region



R = 0.63, R(95%) = 0.48.

Variability of resource euphausiids (red line) and water of the temperature (blue line) in the north-eastern part of the Okhotsk sea



R = - 0.53, R(95%) = 0.47.

Possible predictors:

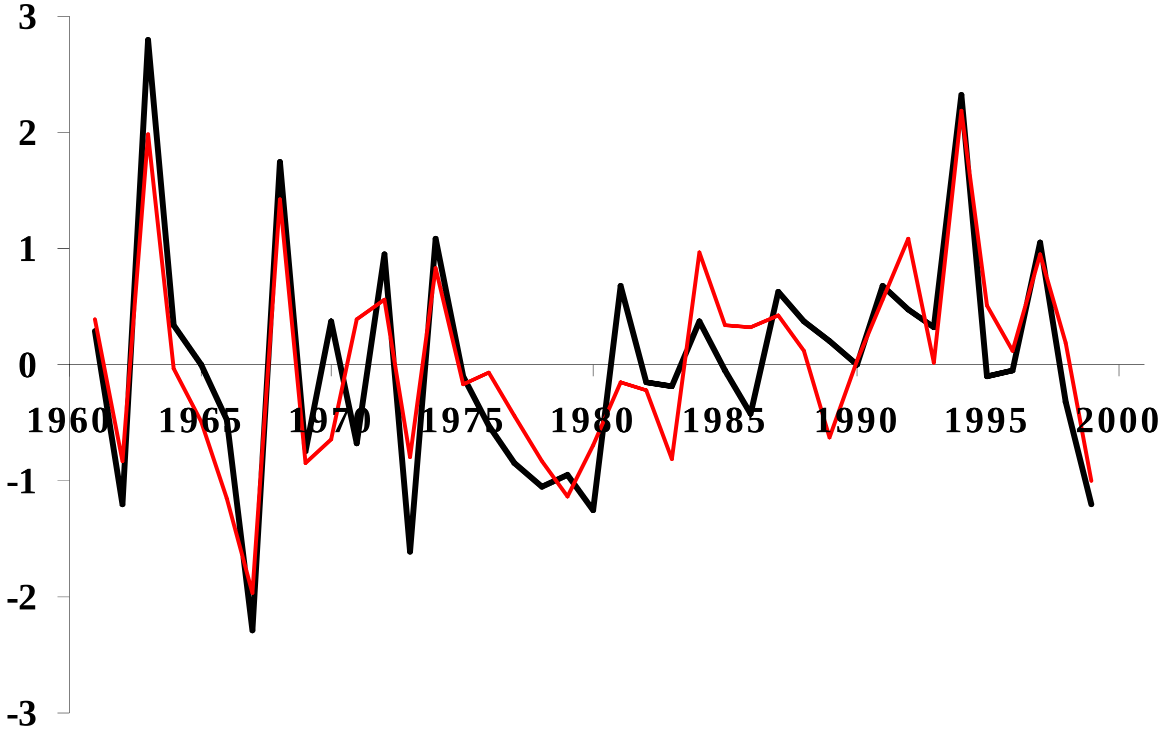
1. **Parameters of macroscale climatic changes in the Northern Hemisphere atmosphere (circulation indices, features of centers of action, EOF decomposition of air temperature and atmospheric pressure fields);**

2. **Parameters of macroscale climatic changes in the active layer of the Pacific Ocean (EOF decomposition of SST and surface heat balance fields);**

3. **Ice concentration and locations of ice edge in the Okhotsk Sea;**

4. **Surface water temperature near the central and northern straits of the Kuril ridge.**

Influencing factors were presented in the form of temporal series of a various length, being monthly and 10-day discreet.



R = 0.86, R(95%) = 0.32.

Initial (shown in black) and recovered (shown in red) curves of interannual variability of the Okhotsk Sea water temperature.

Regression equation predictors:

- **1. Distance from the northern islands of the Kuril Ridge to the ice edge toward Kashevarov bank during March 11-20;**

2. Temporal coefficient of the third mode of EOF decomposition of atmospheric pressure fields in February;

3. Sea surface temperature at the forth Kuril strait in February;

4. Temporal coefficient of the second mode of EOF decomposition of air temperature fields in March;