Recent climatic changes in the Northwest Pacific

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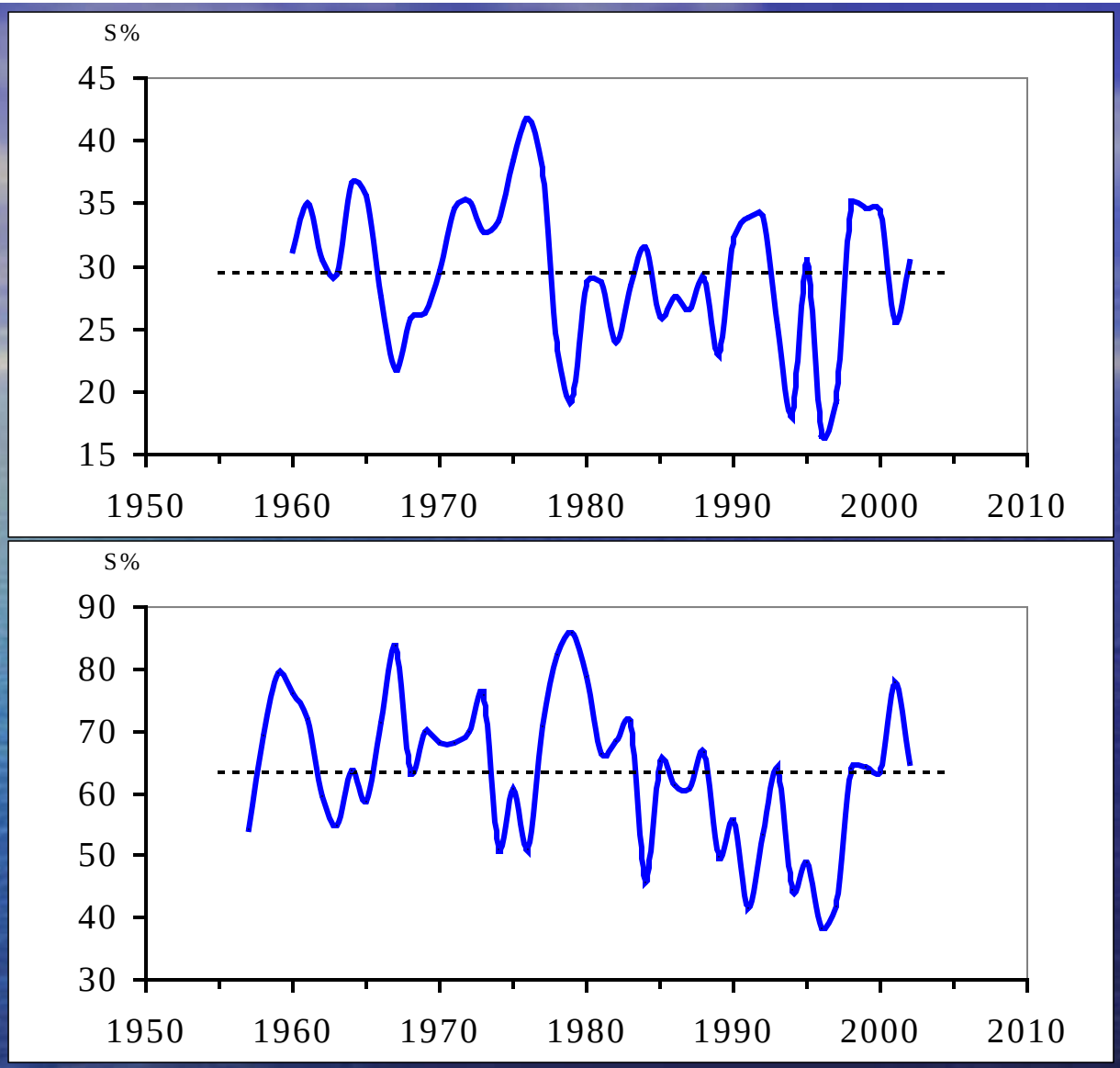
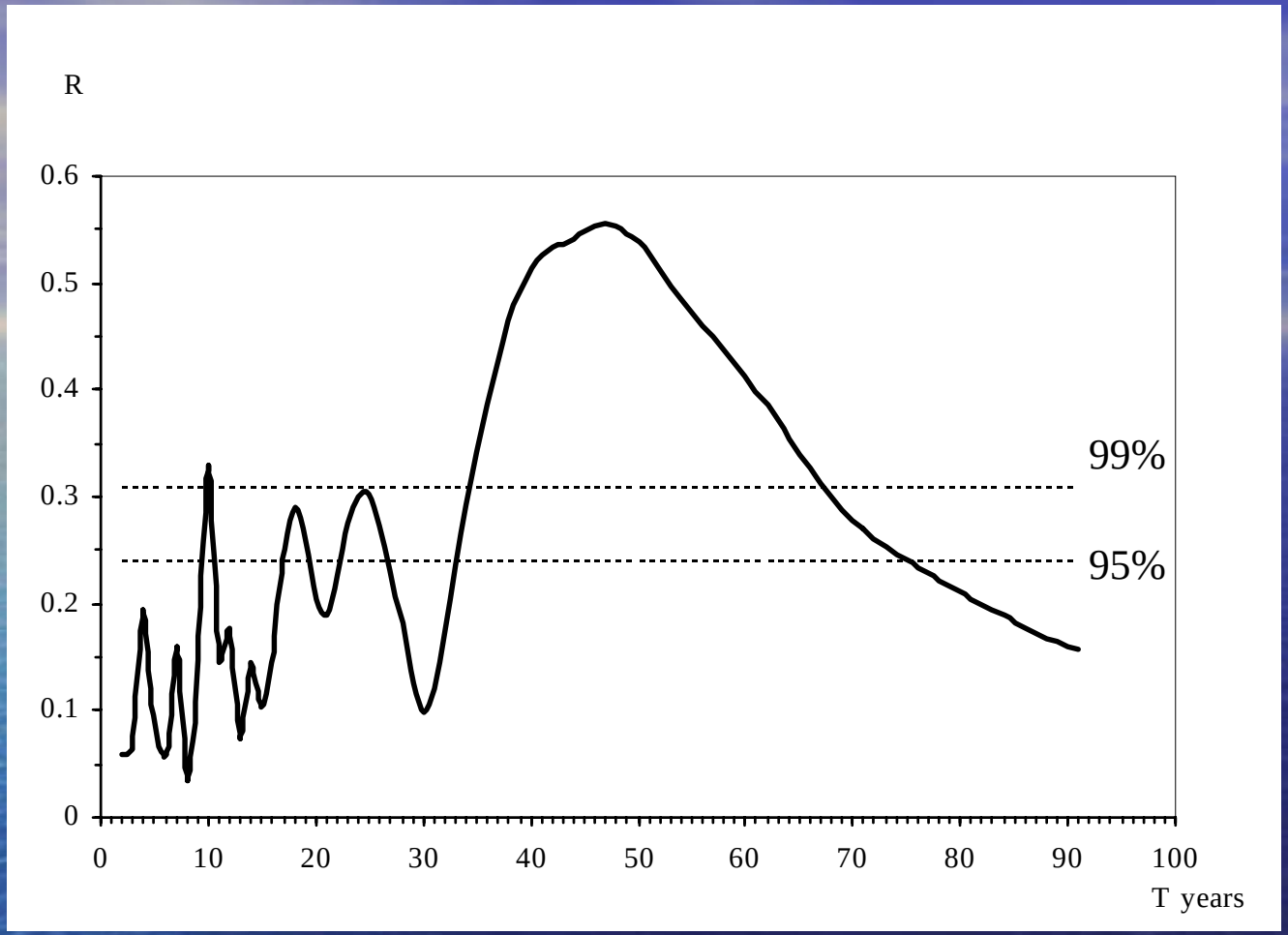
OUTLINE

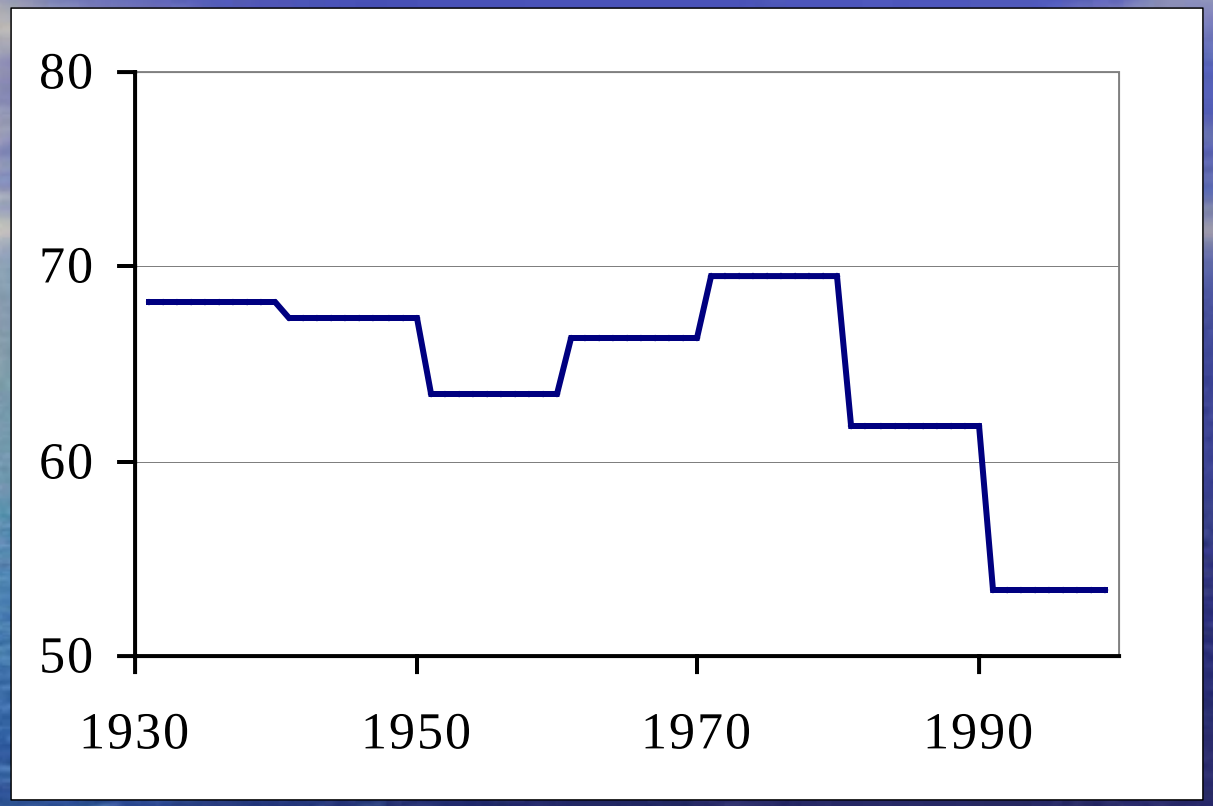
- Ice cover
- Water temperature
- Circulation
- Conclusions



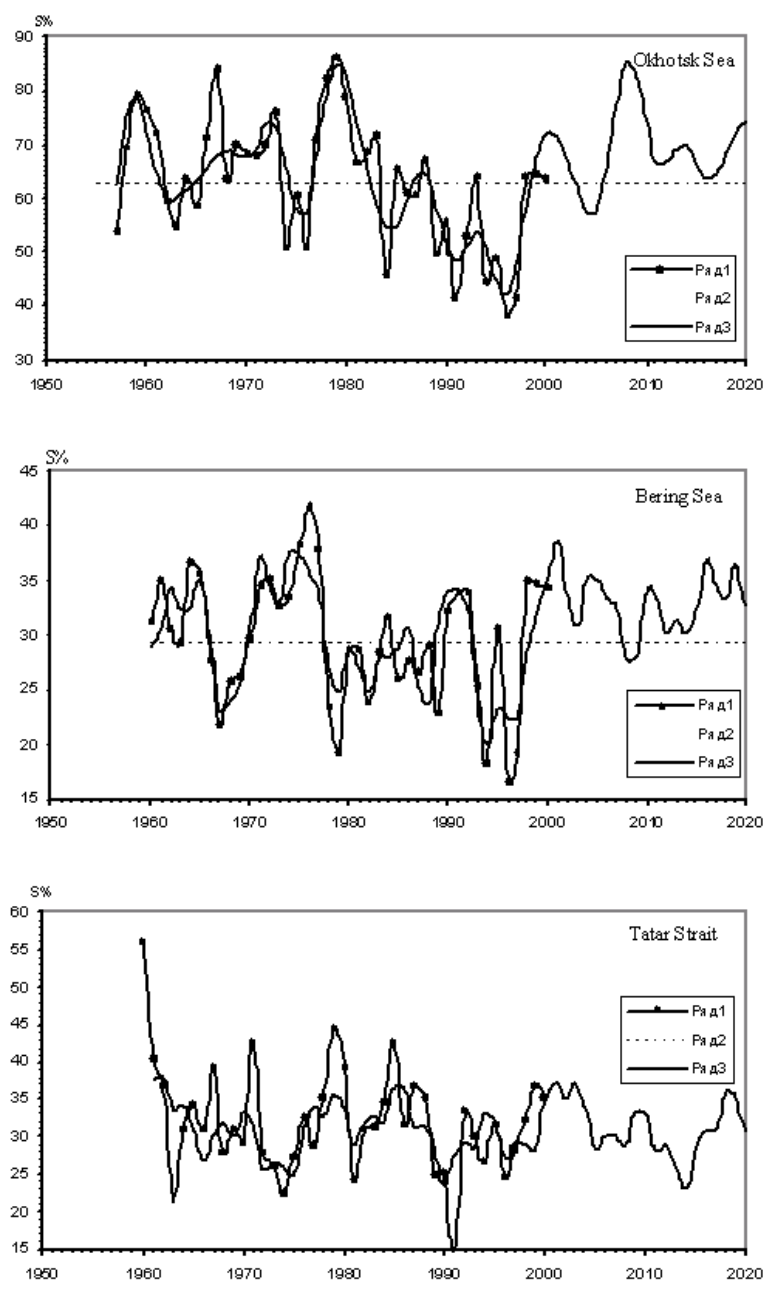
Changes in winter (January-April) ice cover area (% from the total sea area) in the Bering Sea (upper panel) and the Sea of Okhotsk (lower panel).



Periodogram of ice cover of the Okhotsk Sea in March



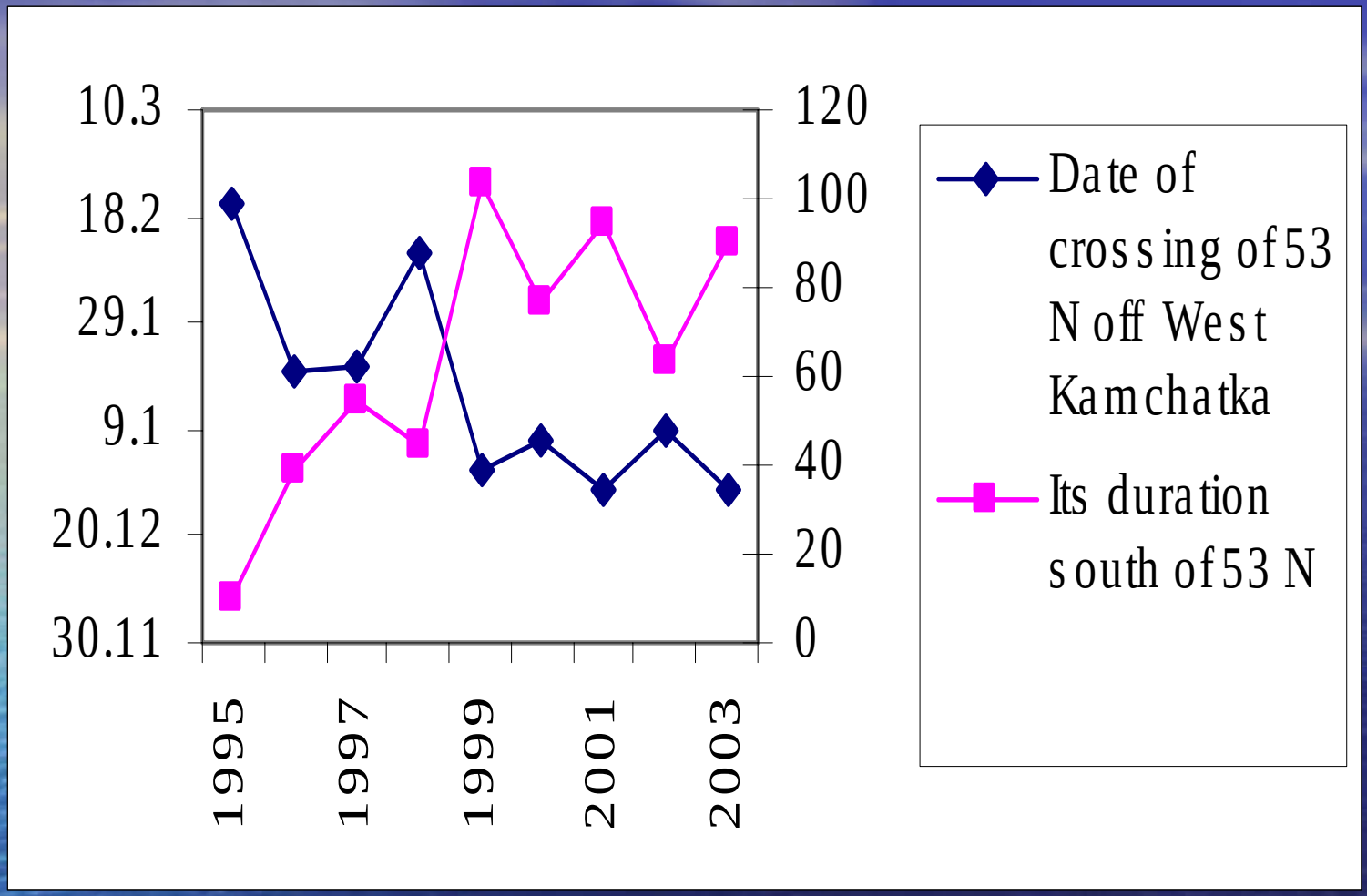
Ice cover area (% from the total sea area) in the Sea of Okhotsk averaged over decade.



Mean winter (January - April) ice cover (% to the total square of the Sea of the Far - Eastern Sea (1), mean multi-years value (2) and approximation of its variations by sum of harmonics (3).

Period of maximal ice cover in the Sea of Okhotsk from 1996 to 2000

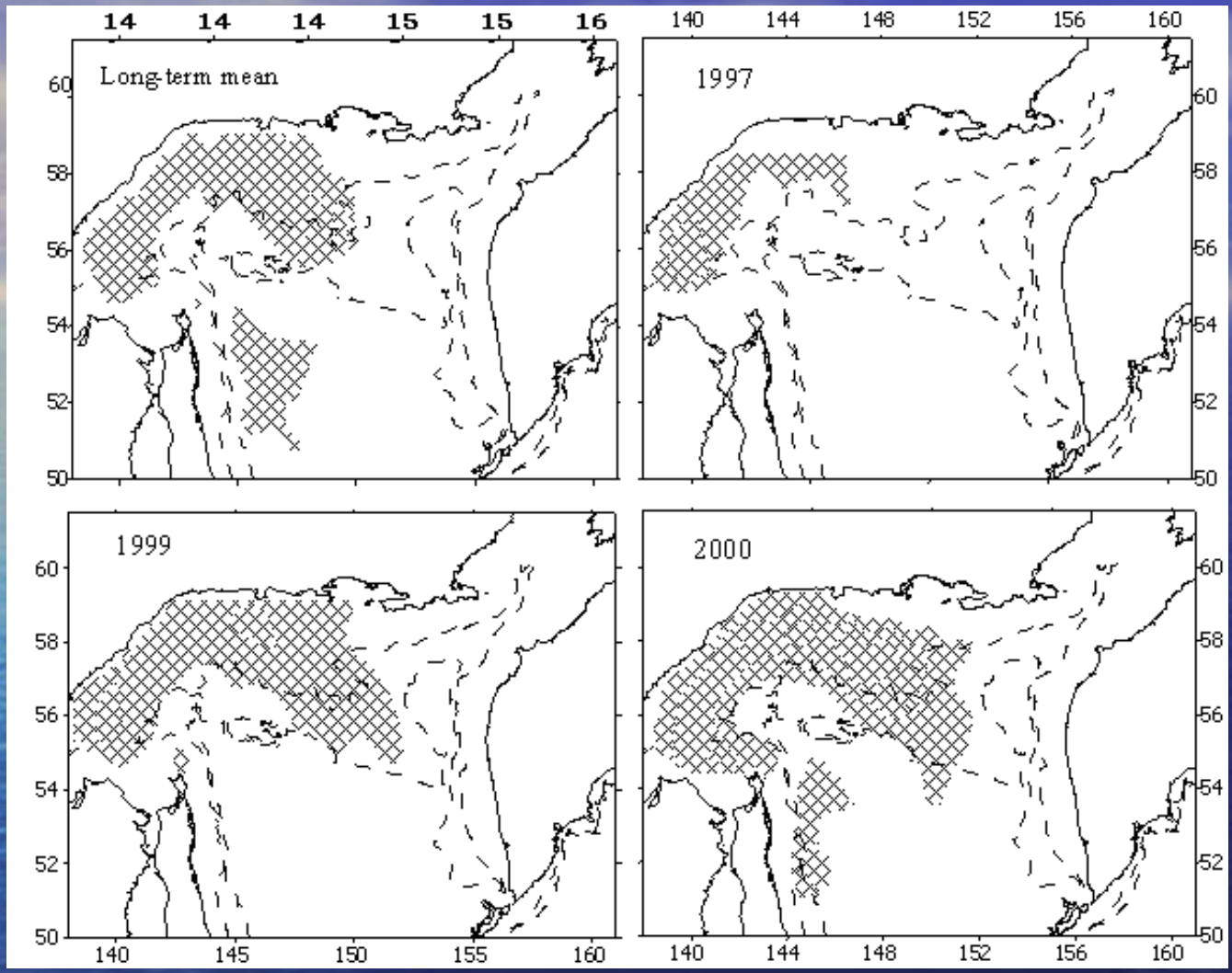
Years	1996	1997	1998	1999	2000
10-day period of maximal ice cover	3rd 10-day period of March	2nd 10-day period of February	1st 10-day period of March	3rd 10-day period of March	3rd 10-day period of March



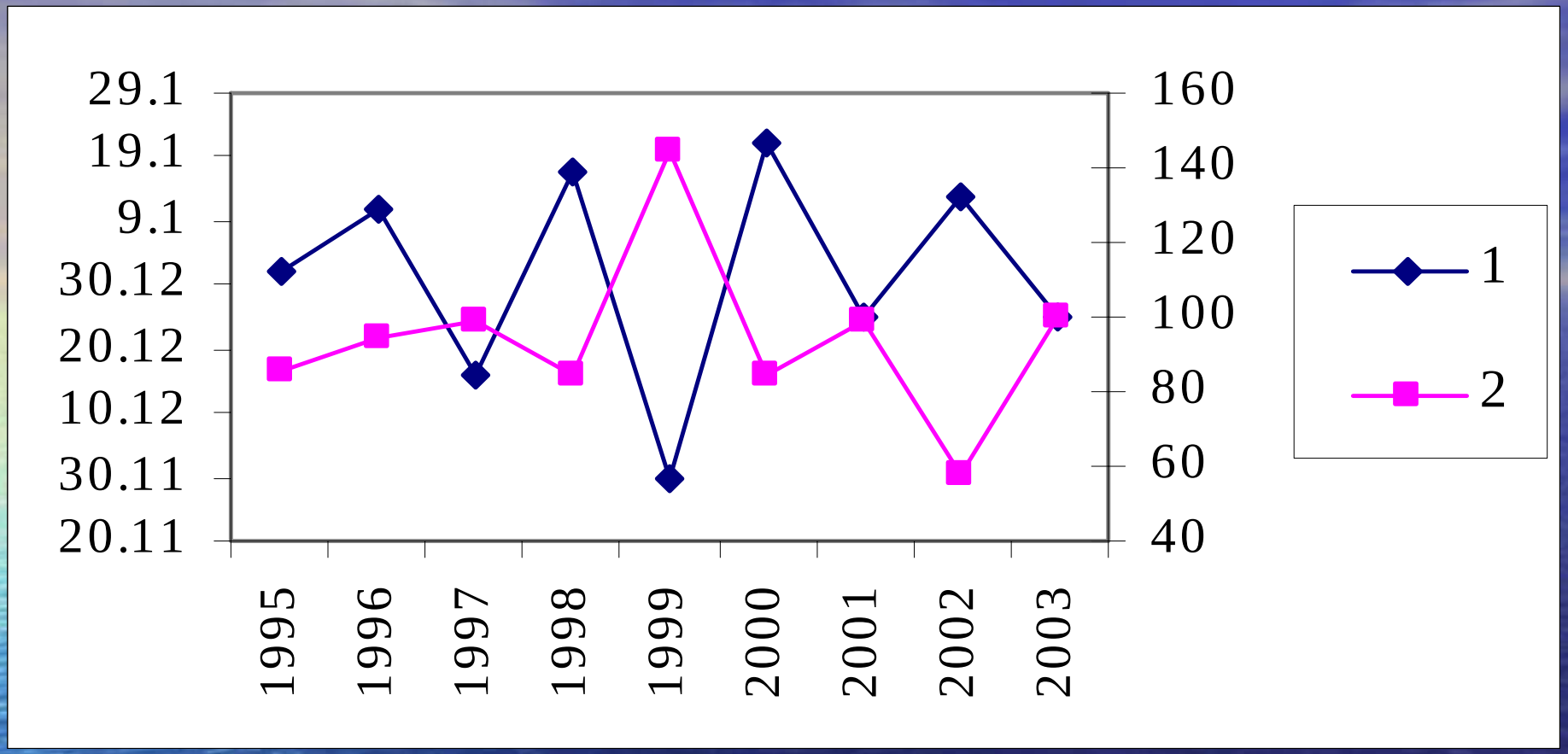
Characteristics of ice cover off West Kamchatka

	Sea of Okhotsk					Bering Sea				
	1997	1998	1999	2000	2001	1997	1998	1999	2000	2001
January	+	-	-	-	-	+	+	-	-	-
February	+	-	-	-	-	+	+	+	+	-
March	+	+	-	-	-	+	+	+	-	-
April	+	-	-	-	-	+	-	-	-	-
May	+	-	-	-	-	+	+	-	-	-
June	+	+	-	-	-	+	-	-	-	-
July	+	+	-	+	-	+	+	-	+	-
August	+	+	+	+	-	+	+	-	+	-
September	+	+	+	+	-	+	-	-	+	-
October	+	+	+	+	-	+	+	+	+	-
November	+	-	+	-	-	+	+	-	-	-
December	-	-	+	-	+	+	+	-	-	-
Year	+	Mean	Mean	-	-	+	+	-	Mean	-

Signs of sea surface temperature anomalies in the Okhotsk and Bering Seas in 1997-2001.



Distribution of subsurface waters with T< -1°C in the core of the Cold Intermediate layer in the Sea of Okhotsk in September



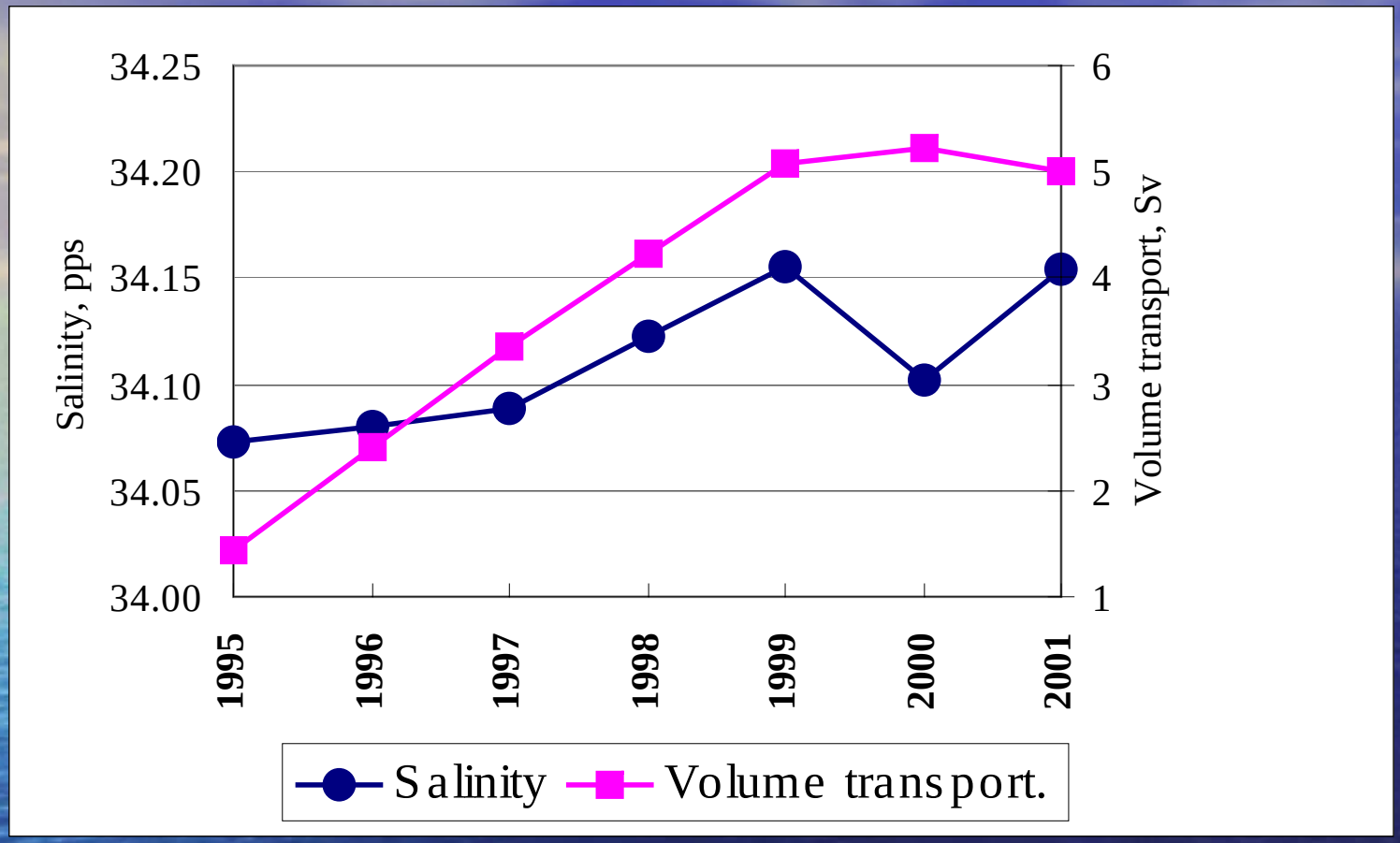
Date of sea surface cooling below 0 C in the area of Lopatka cape(1) and duration of period with temperature below 0 C in the same area (2)

Mean water temperature in the layer 50-200 m on the West Kamchatka shelf in April

Years	Mean	1996	1997	1998	1999	2000
Temperature	0.06	0.40	1.13	0.01	- 0.25	- 0.28

Mean water temperature in the layer 50-200 m on the NW Sea of Okhotsk shelf in May-June

Years	1996	1997	1998	1999	2000
Temperature	- 0.45	- 0.12	- 0.72	- 0.94	- 0.98

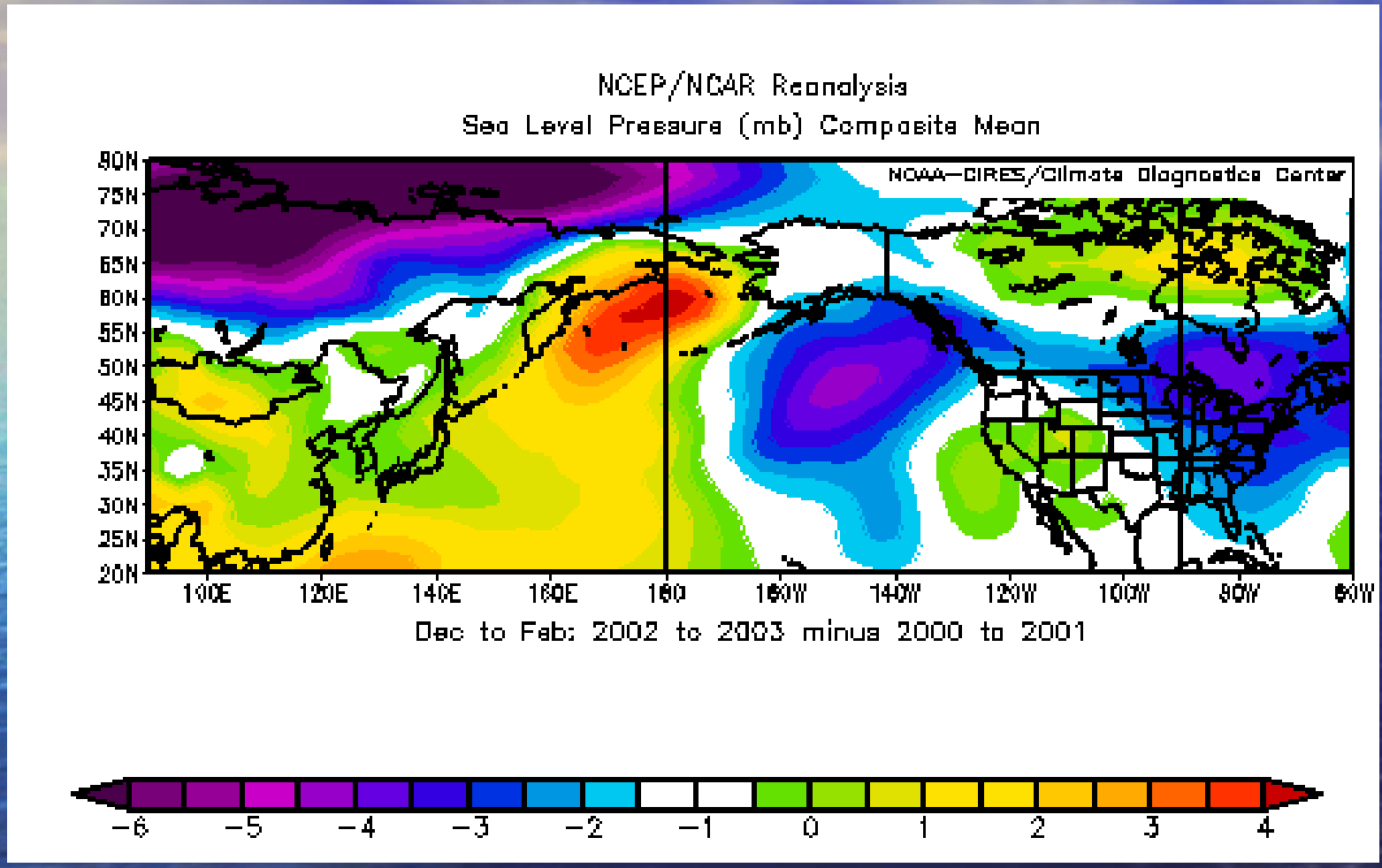


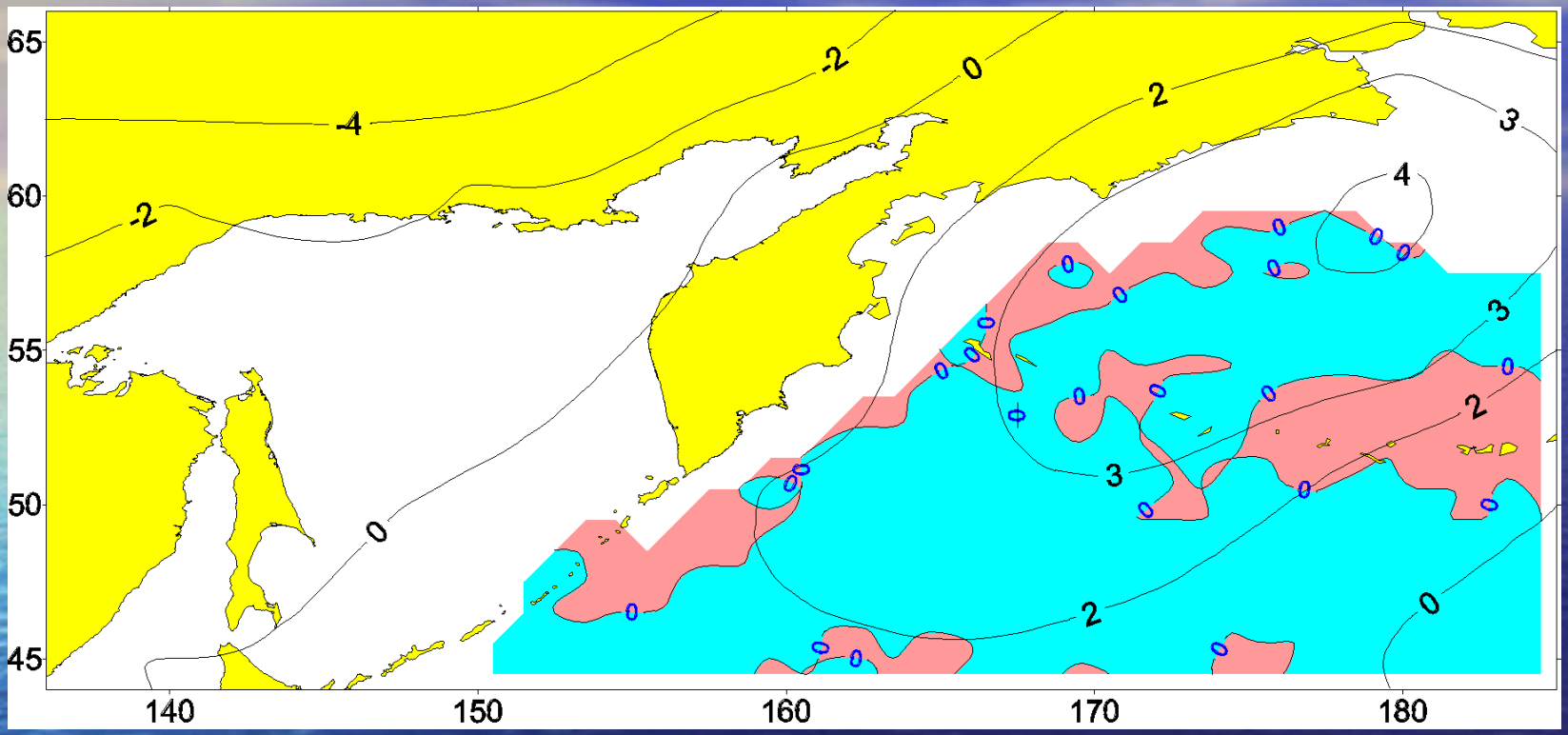
Changes in volume transport of West Kamchatka Current and salinity in the 500-1000 m layer in the Sea of Okhotsk.

It may be proposed that the heat loss in the surface layer in cold years is compensated partly or completely by strengthening of inflow of Pacific waters, while in warm years the situation is quite opposite. This allows to keep the salt and heat balance in the sea at the stable level that is important for sustainability of the Okhotsk Sea ecosystem.

Bering Sea

- Decrease in water temperature in the near-bottom layer (by 1.5-1.8 C from 1997 to 1999)
- Water temperature in WIL above normal
- Salinity of Intermediate Waters below normal
- Lessening of circulation evidenced by decrease in volume transport of Kamchatka Current in the 0-500 m layer
- Role of IL in volume transport increased (in 1999 85% of volume transport in the 500-1000 m and 15% in the upper 0-500 m layer)


NCEP/NCAR Reanalysis
Sea Level Pressure (mb) Composite Mean
NOAA–CIRES/Climate Diagnostics Center
80N
75N
70N
65N
60N
55N
50N
45N
40N
35N
30N
25N
20N
100E
120E
140E
160E
160
160W
140W
120W
100W
80W
60W
Dec to Feb: 2002 to 2003 minus 2000 to 2001
−6
−5
−4
−3
−2
−1
0
1
2
3
4



Differences in mean winter
SSTA(Jan-Apr) and SLPA (Dec-Feb)
between 2002-2003 and 2000-2001

Conclusions:

- Outbreaks of polar air masses became more frequent
- Negative SSTA especially in the cold period of year
- Duration of the cold season increased
- Ice cover of Far East Seas became more extensive
- Strengthening of water exchange with Pacific in the Sea of Okhotsk
- Intensification of volume transport in the western Bering Sea in IL