Structure and variability of the upper layer of the Western Subarctic Gyre

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1. Characteristics of the oceanographic conditions of adjacent sea of Japan

   -Analysis of SST field of WNP-

2. Spatial and vertical structure of the Western Subarctic Gyre (WSG)

   -Oceanographic data from Salmon resource survey-

3. Variability of the WSG

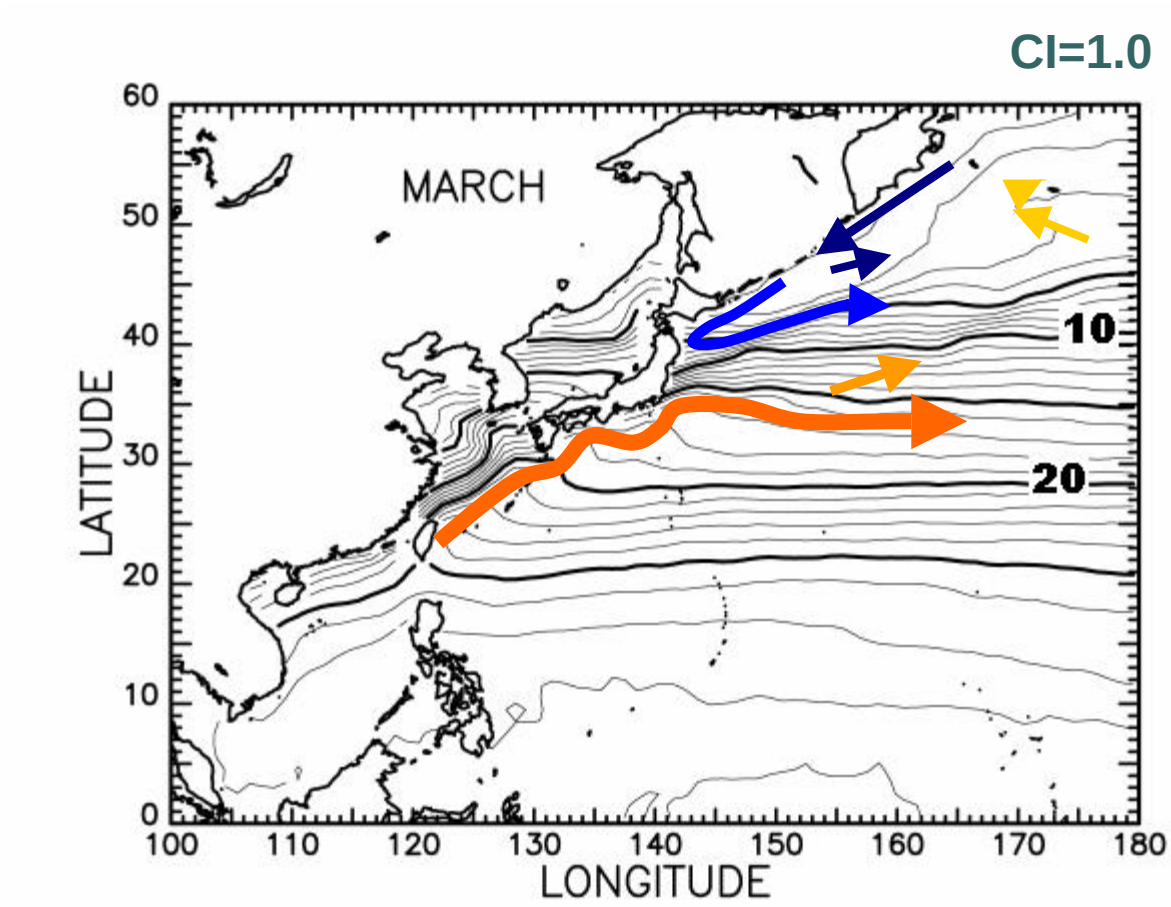
ANALYSIS of SST field in Winter

- We constructed the Map of climatology of SST for March by using the JMA analyzed data set for Western North Pacific
- 1(lat.)x1(lon.), 10day-mean, 54years (1950-2003)
- Intensive air-sea interaction in winter construct the basic state of the oceanographic conditions and SST field in the late winter (March) reflect the result of the interaction

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Climatology of March SST for 1950-2003



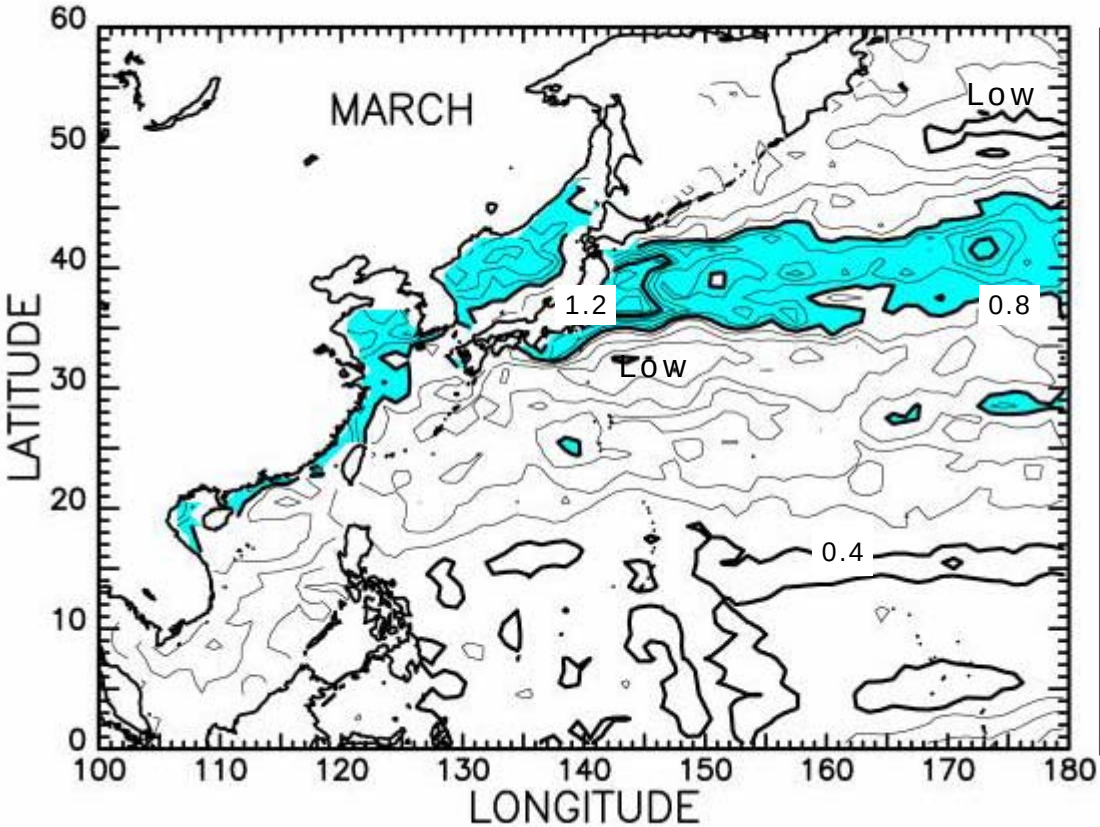
Strong Front systems are formed in the transition zone, east of Honshu.
The Geographical position of these fromts are stationary.

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Standard Deviation of March SST for 1950-2003

CI=0.2



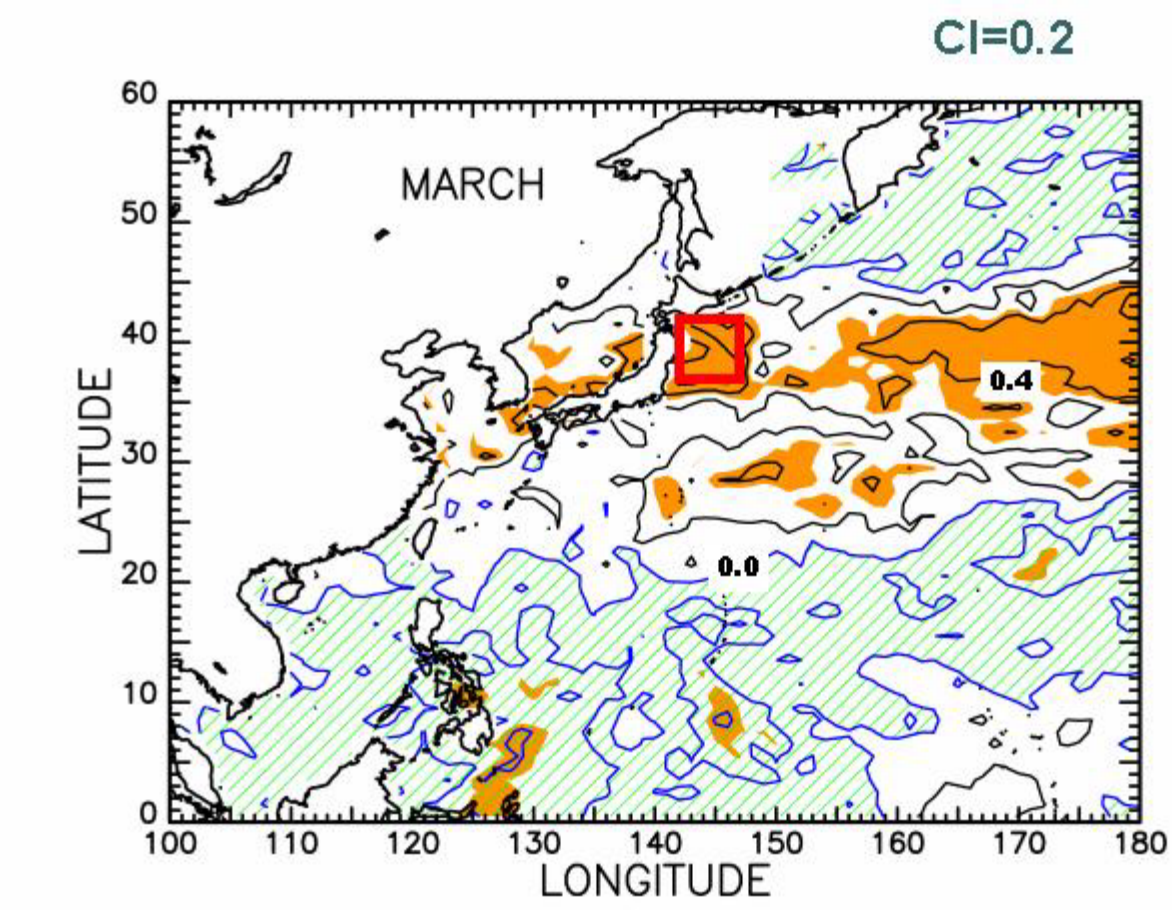
Large variability area extended in the transition zone.

The year-to-year variation at Center region of WSG and the Kuroshio recirculation area low

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Correlation Map for March SST OFF TOHOKU



The correlation pattern of the SST in the WNP are classified into two.

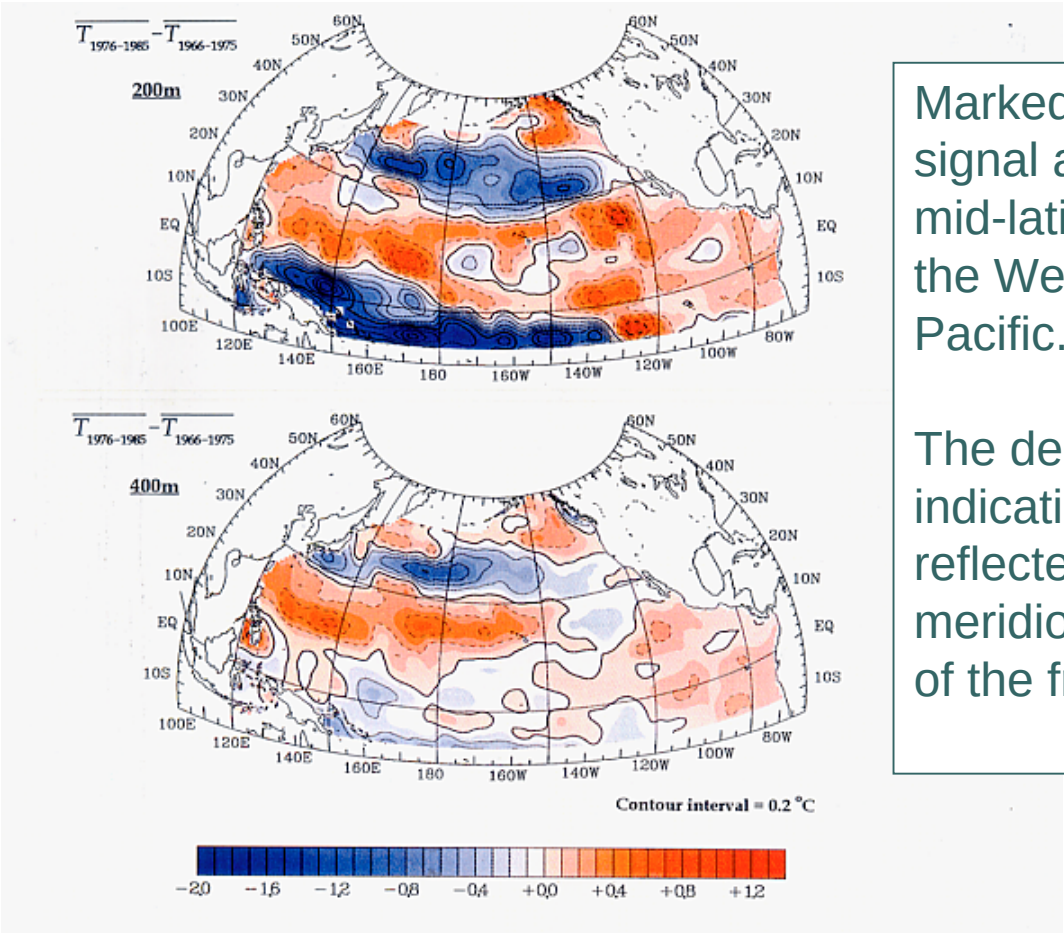
One is centered at the transition zone and the other is widely distributed pattern in the subtropical area.

Significant Positive correlations extend in the frontal area along the 35-45N (Centered at 40N)

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Subsurface temperature difference for the shift in the mid-1970's



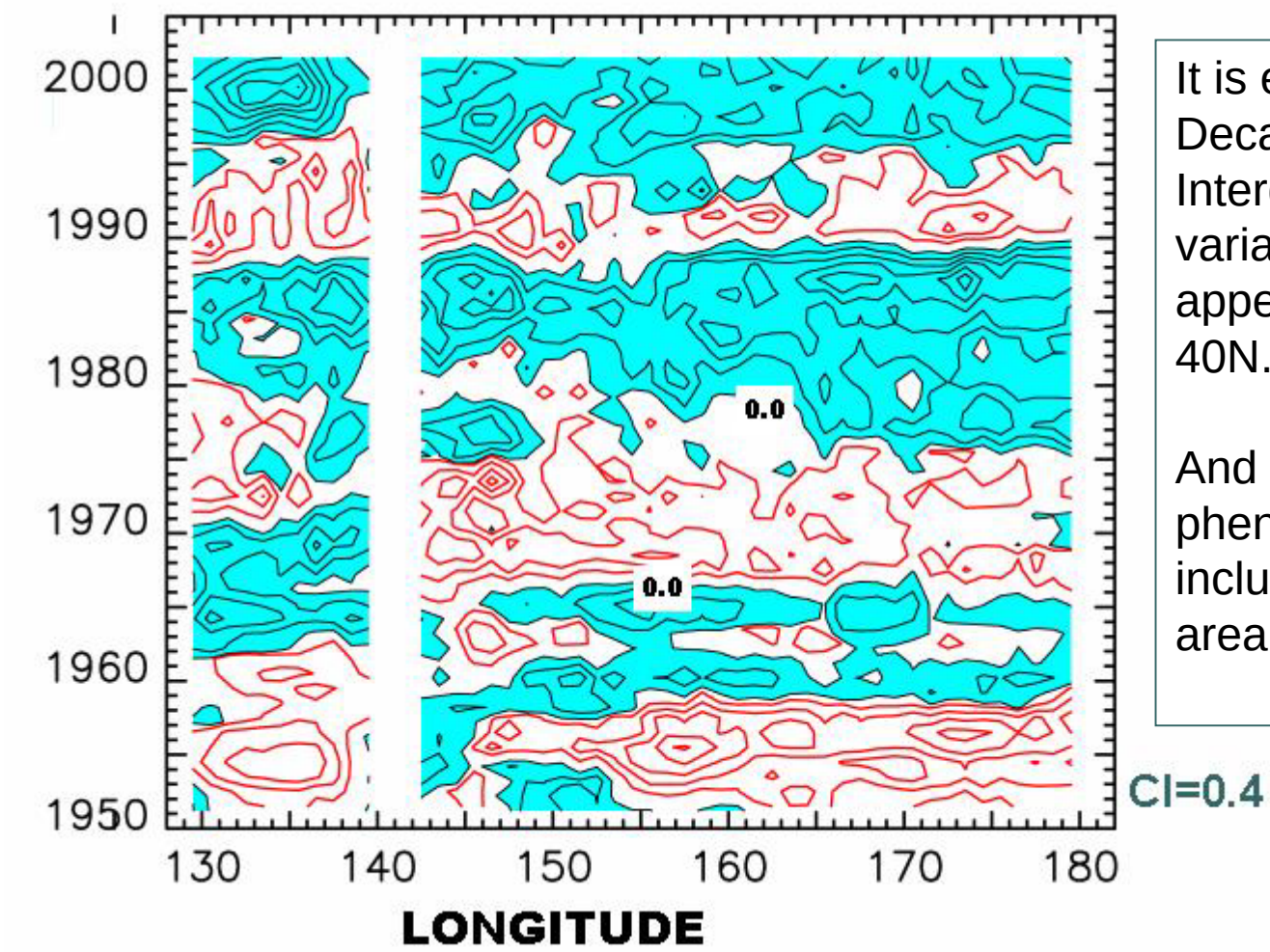
Marked interdecadal signal appeared in the mid-latitude area of the Western North Pacific.

The deep structure indicating the signal reflected systematic meridional movement of the front system.

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Time-Longitude section of March SST anomaly along 39-42N



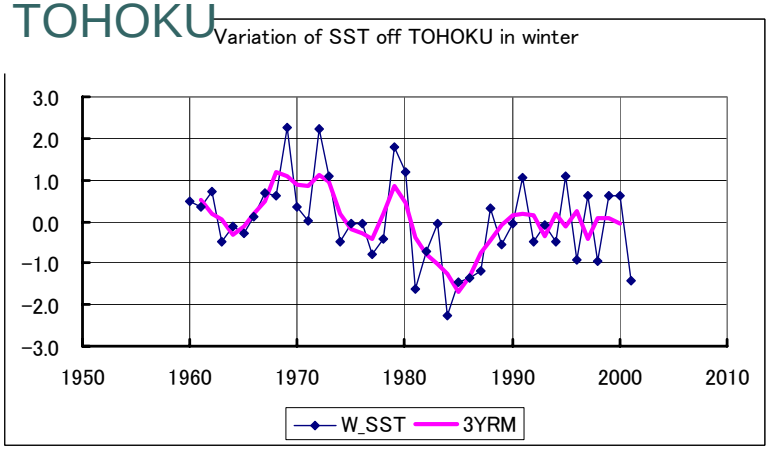
It is evident that the Decadal to Interdecadal variations concurrently appeared along the 40N.

And short time scale phenomena are also included in the coastal area.

1.Characteristics of the oceanographic conditions of adjacent sea of Japan

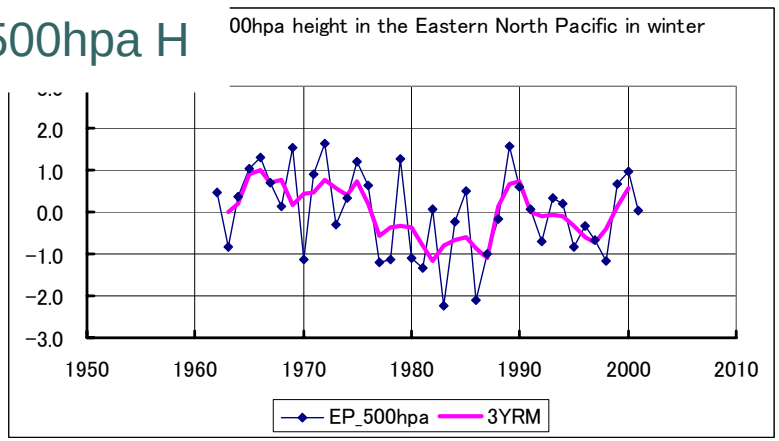
ANALYSIS of SST field in Winter

SST off TOHOKU

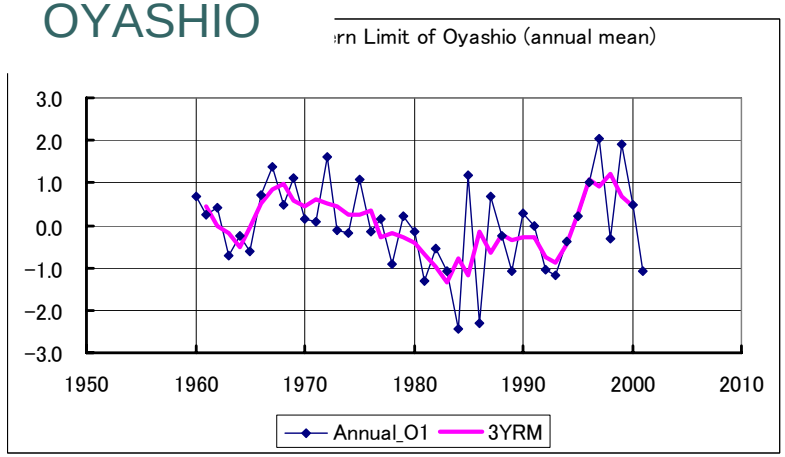


Time series of SST in the winter off TOHOKU, annual mean southern limit of Oyashio, areal average of 500hpa height in the Eastern North Pacific. Interdecadal scale variations are dominant.

EP 500hpa H



OYASHIO

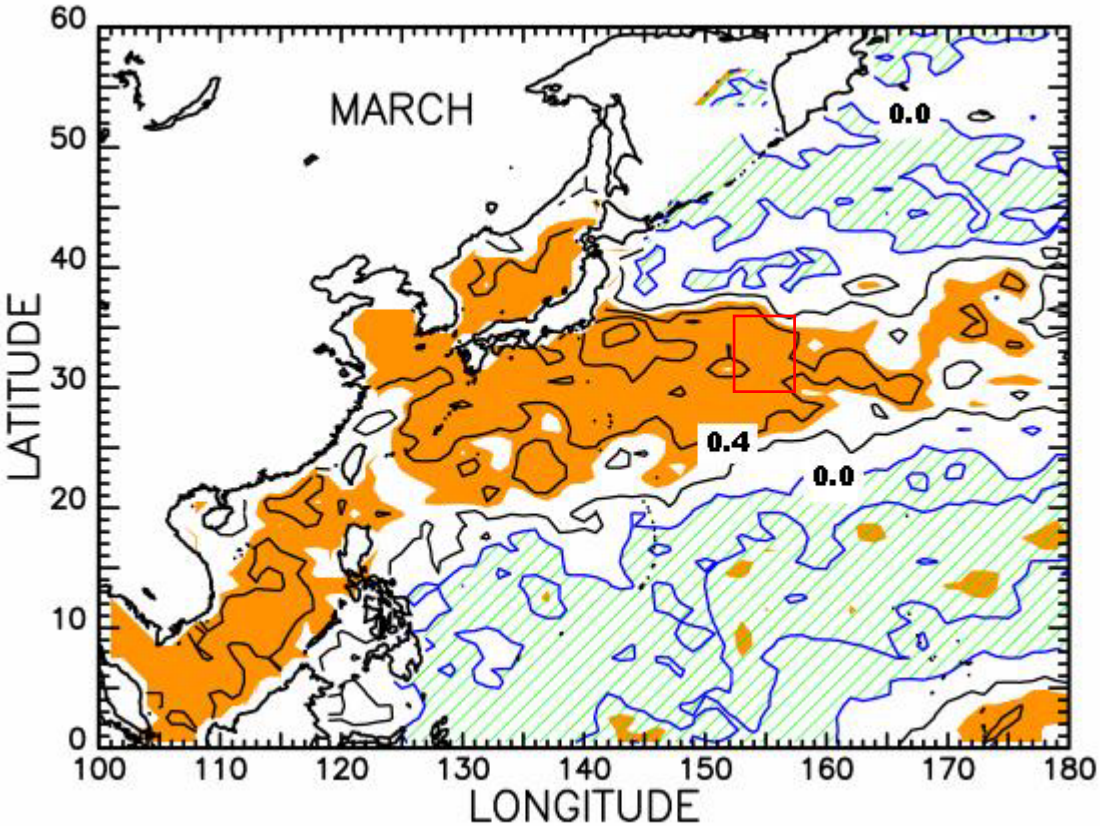


1.Characteristics of the oceanographic conditions of adjacent sea of Japan

ANALYSIS of SST field in Winter

Correlation Map for March SST OFF NOJIMASAKI

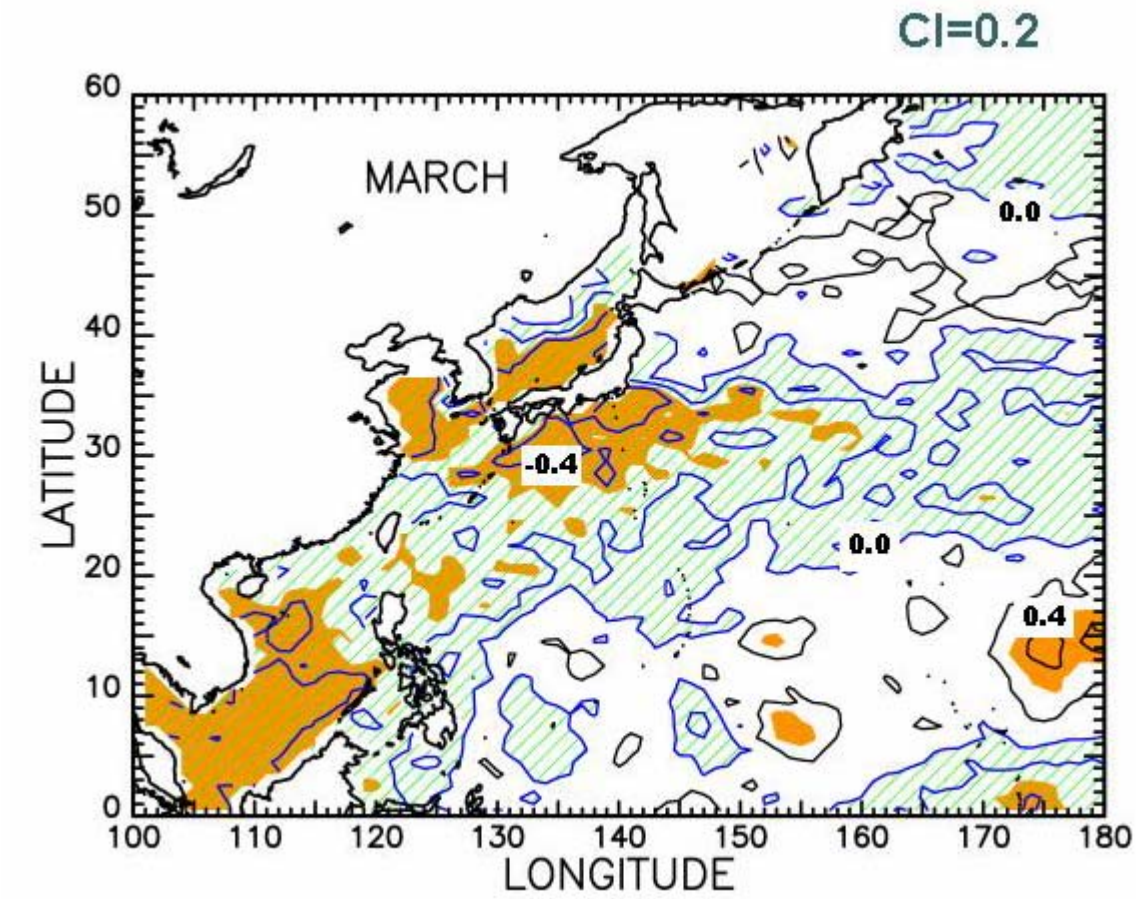
CI=0.2



Significant Positive correlations widely distributed in the kuroshio recirculation area and Japan sea, Yellow sea and South China sea.

ANALYSIS of SST field in Winter

Correlation Map of MOI vs March SST



Same pattern of the SST correlation pattern for off Noima-saki is obtaind in correlation map with MOI.

The pattern is thought to be formed corresponding to the east Asian wintertime monsoon.

One dimensional process is importanto.

The Western Subarctic Gyre

- Fluctuation of the oceanographic condition of adjacent sea of Honshu show the close connection to WSG on the interdecadal scale.
- Therefore, we should clarify the structure and variability of WSG in detail from the view point of coastal area.
- Japan Fisheries Agency maintained the monitoring network in the WSG for salmon resource for many years from 1950’s to present.
- We are analyzing the the subsurface temperature data set collected by the network for the purpose.

Monitoring Newtwork

- 1956-present
- Observations by Training Vessels and Research Vessels.
- Data from commercial vessel are also included.
- 165E and the date line monitoring initiated early 1990's
- 165E: Hokko Maru (1992-2000)
- The date line: Wakatake Maru (1991-present)

2. Spatial and vertical structure of the WSG

Monitoring Network

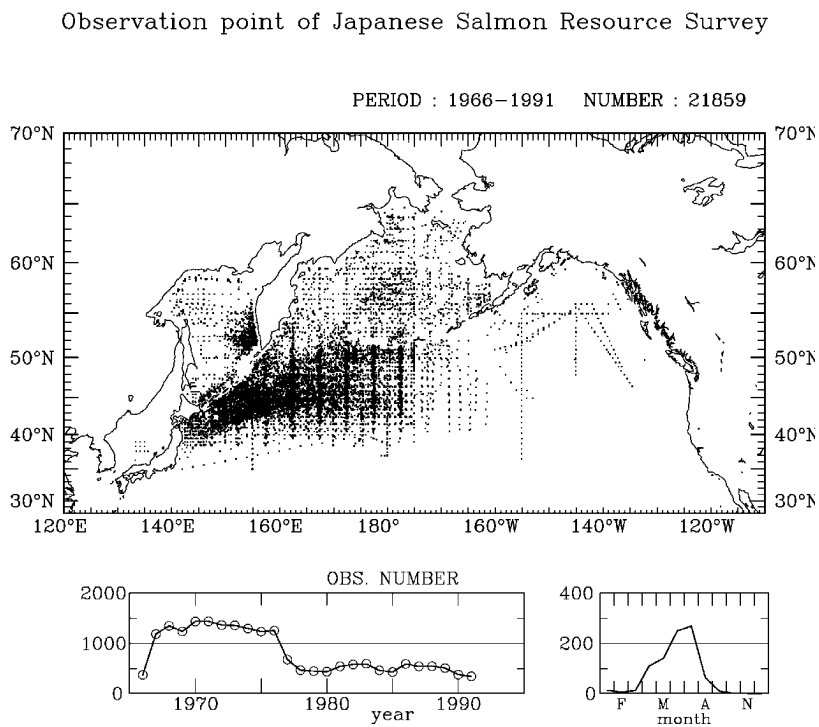
1991-PRESENT Jun-Jul

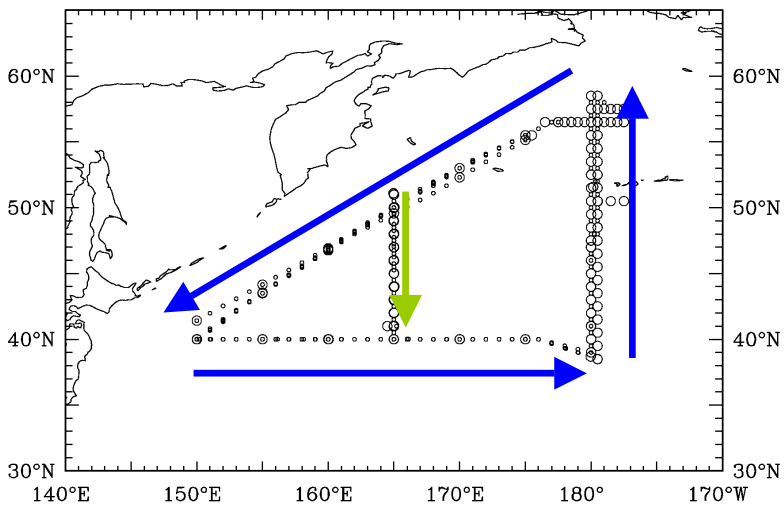
Wkatake-Maru

1992-2000 Jul.

Hokko-Maru 165E

1966-1991

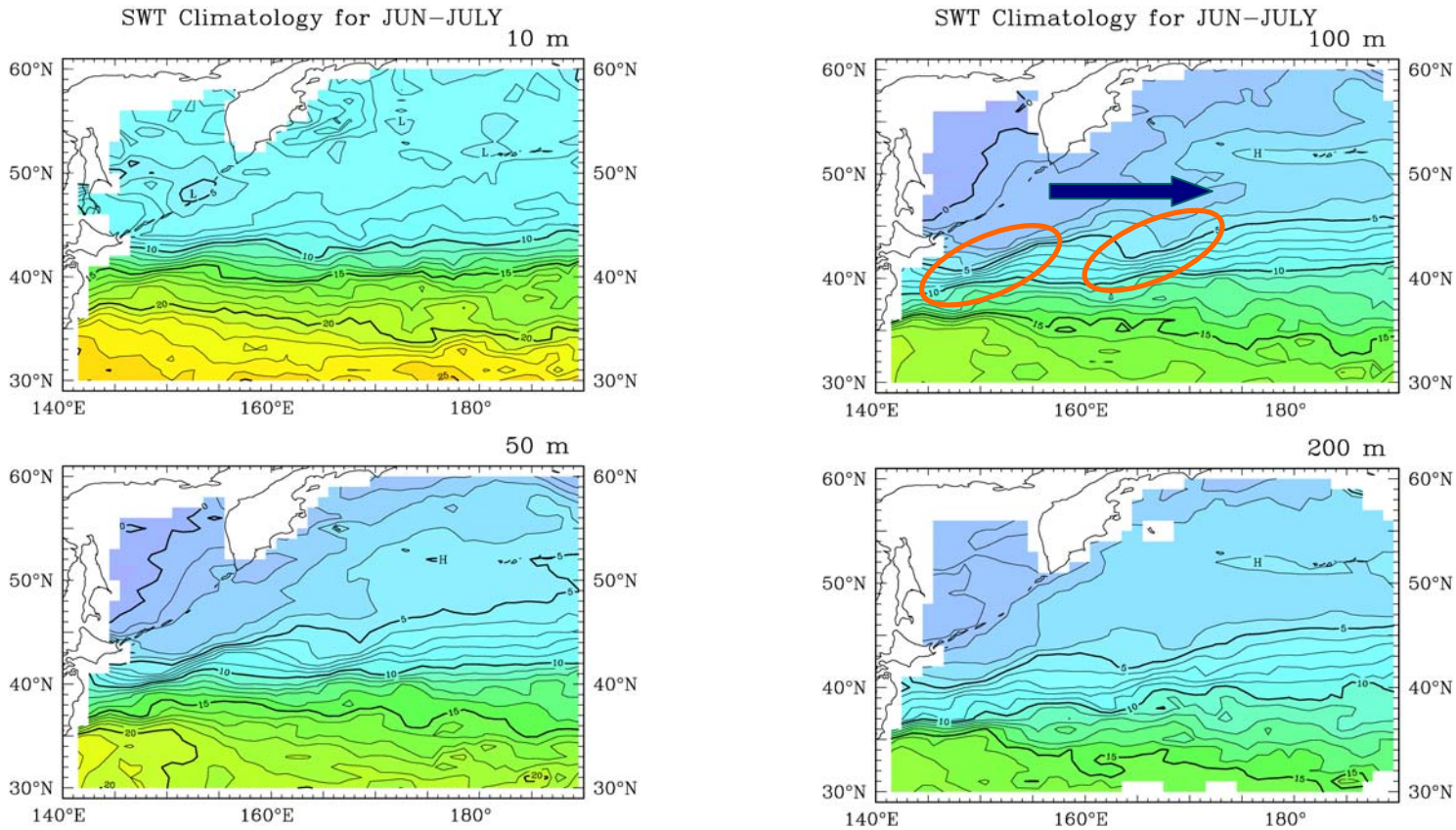




*data for the period 1956-1965 was discovered and will be available in the near future

Spatial structure

Climatology for Jun-Jul subsurface temperature field

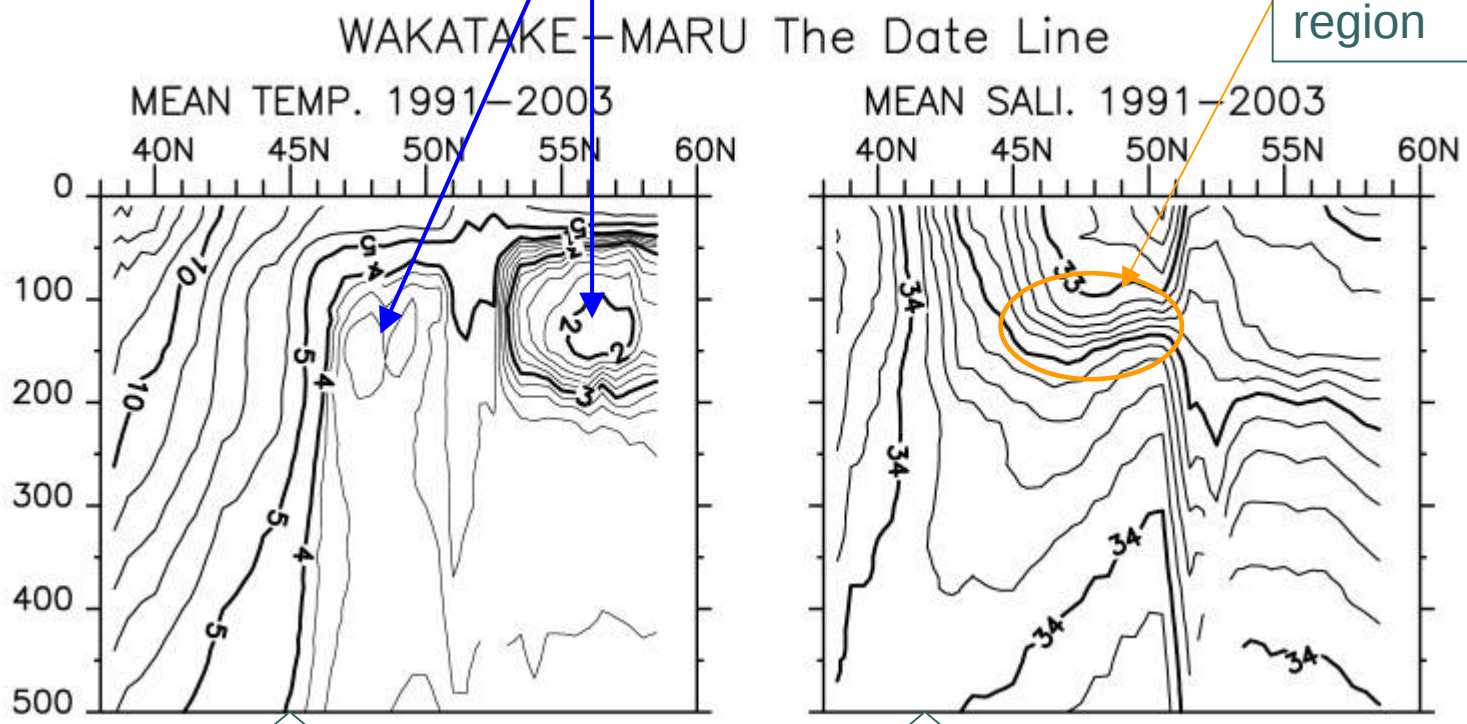


Mean section The Date Line

June-July

Temperature Minimum Layer

Strong halocline in the ridge region



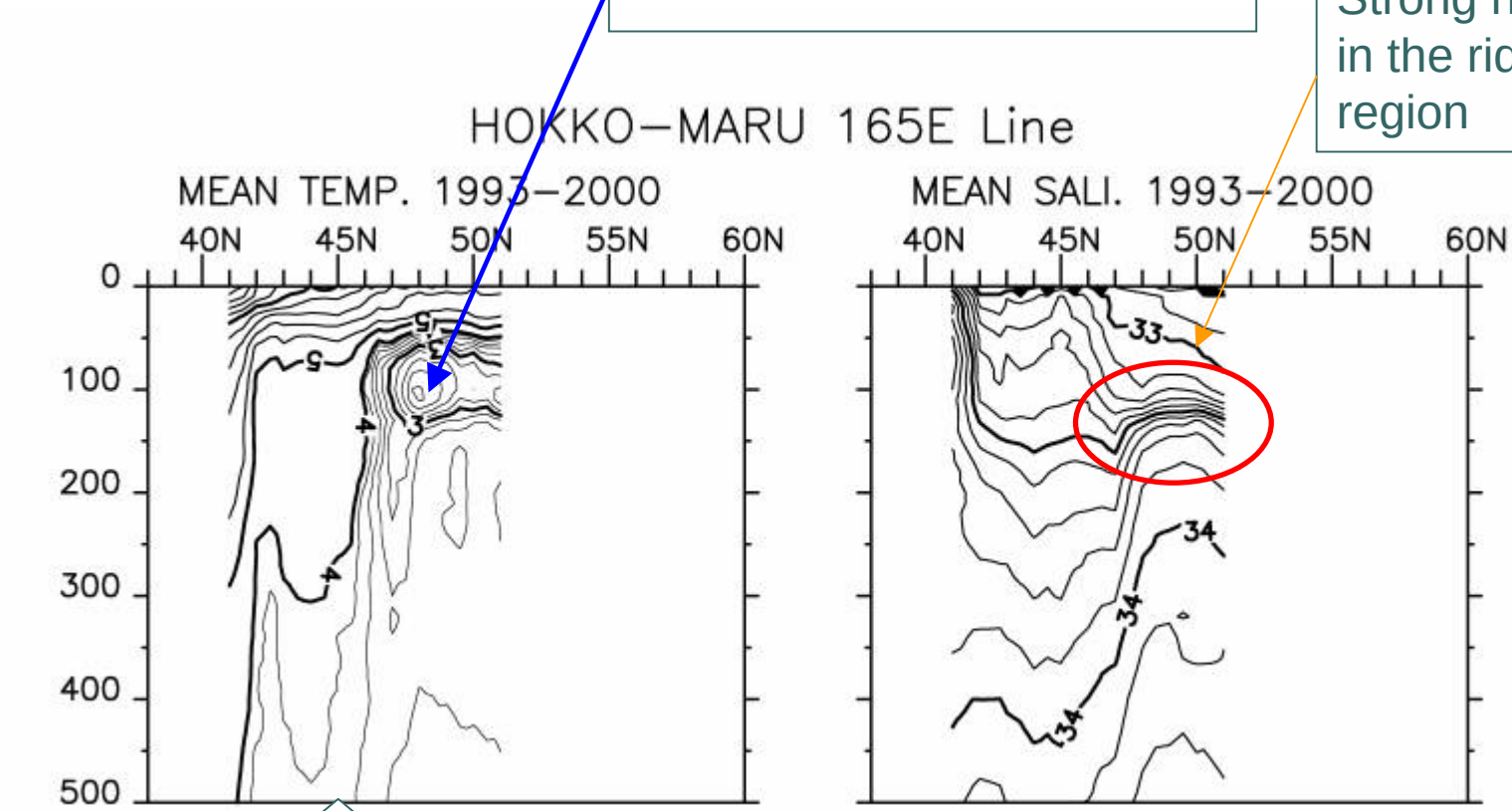
SF

SB

Mean Section 165E, July

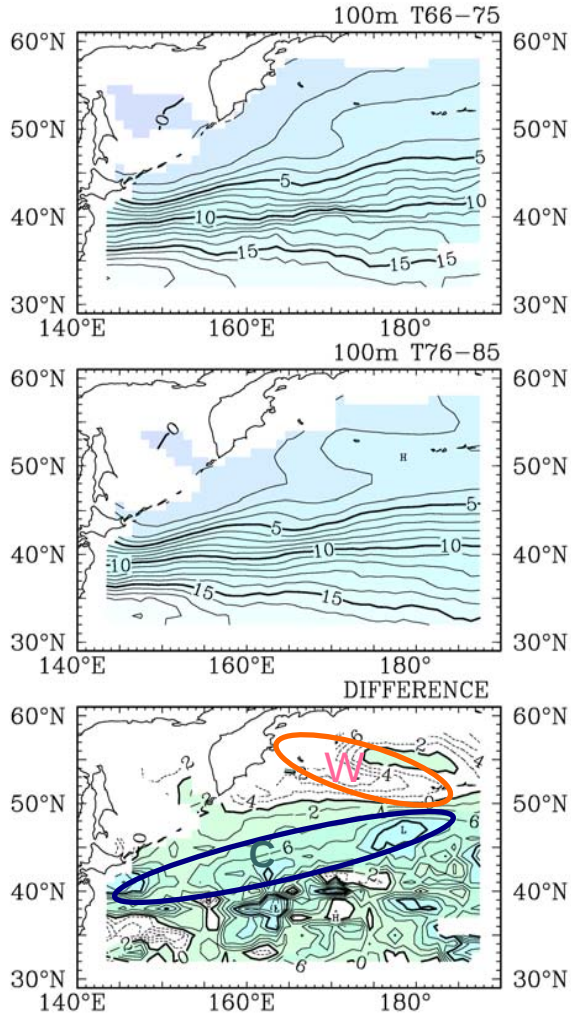
Temperature Minimum Layer

Strong halocline in the ridge region



SF

Interdecadal Variation



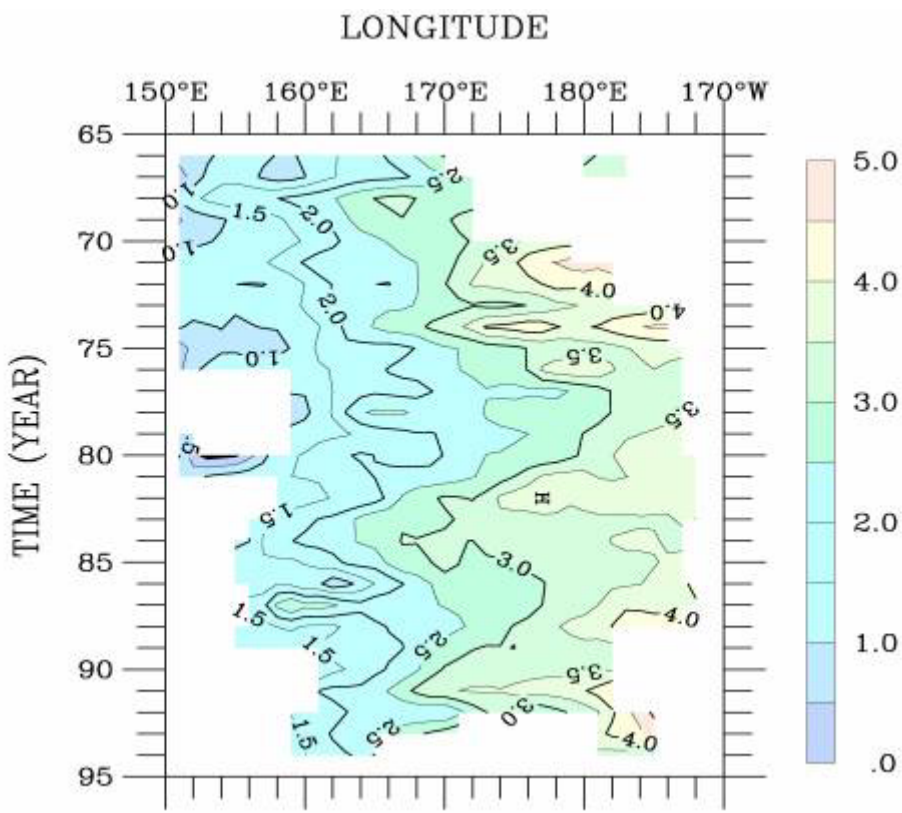
The differences of decadal mean temperature at 100m depth is shown.

Cooling in the southern boundary region and warming in the Alaskan stream region of WSG was occurred.

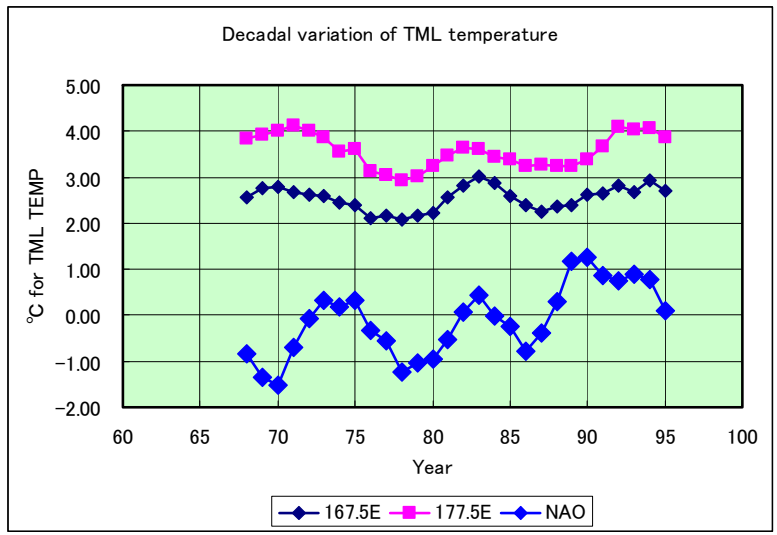
This change reflected the strengthening of the WSG after the mid-1970's

Decadal Variation

Time-Longitude section of 100m temperature along the 48N



Decadal variation of 100m temperature at 167.5E and 177.5E along the 48N

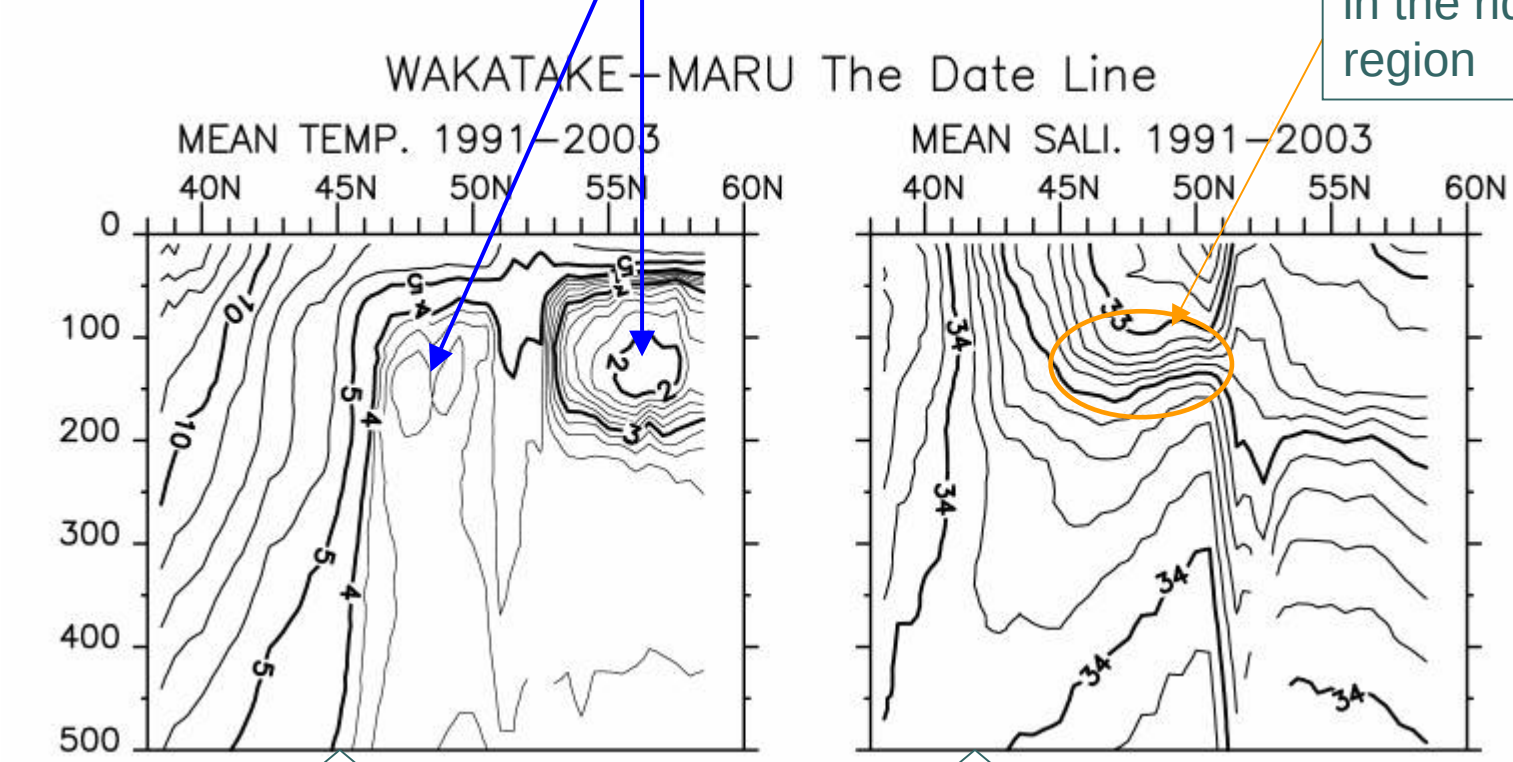


Decadal variation is dominant in the TML variation and some relationships with atmospheric variation were suggested

The Date Line, June-July

Temperature Minimum Layer

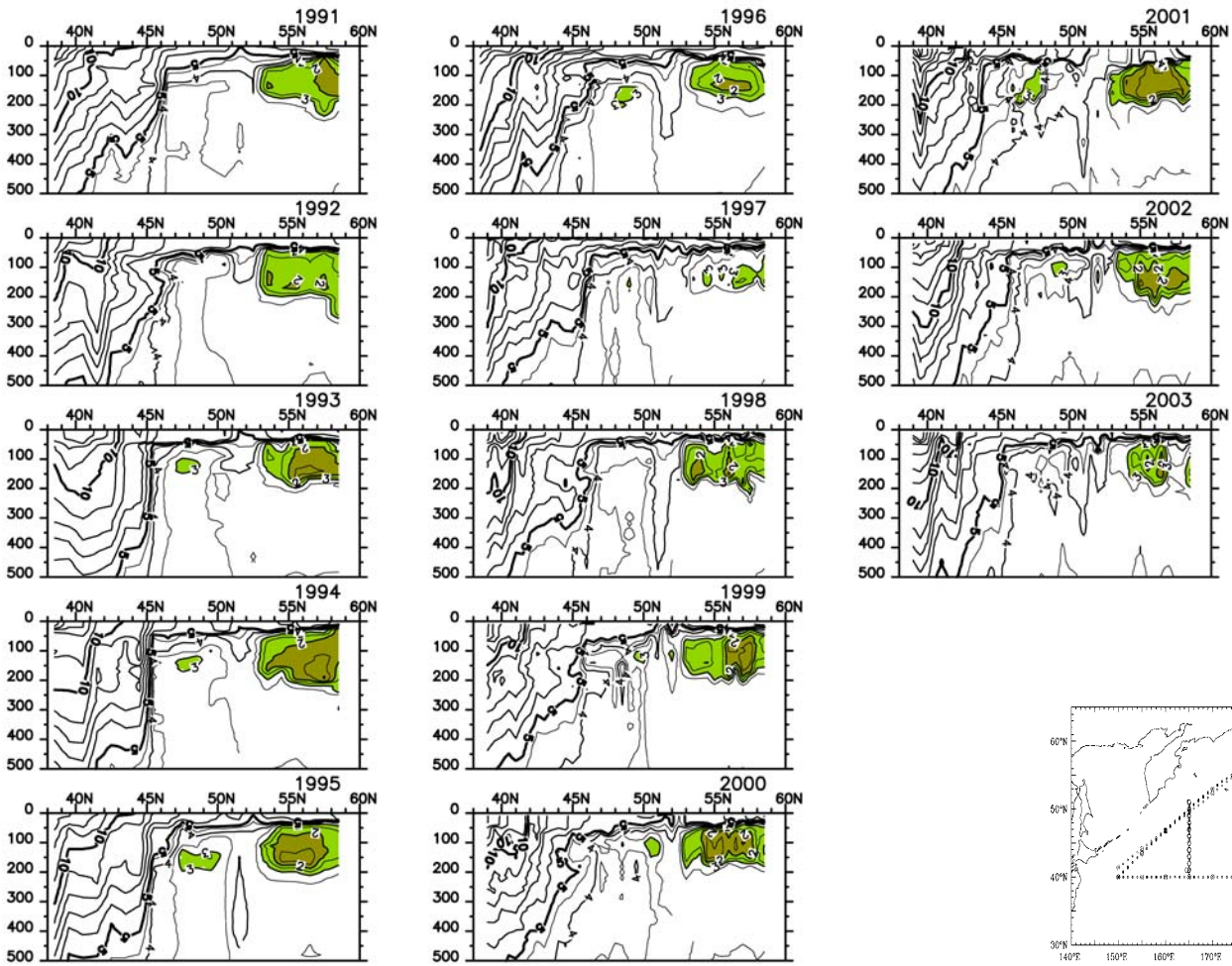
Strong halocline in the ridge region

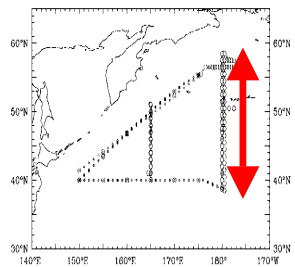


SF

SB

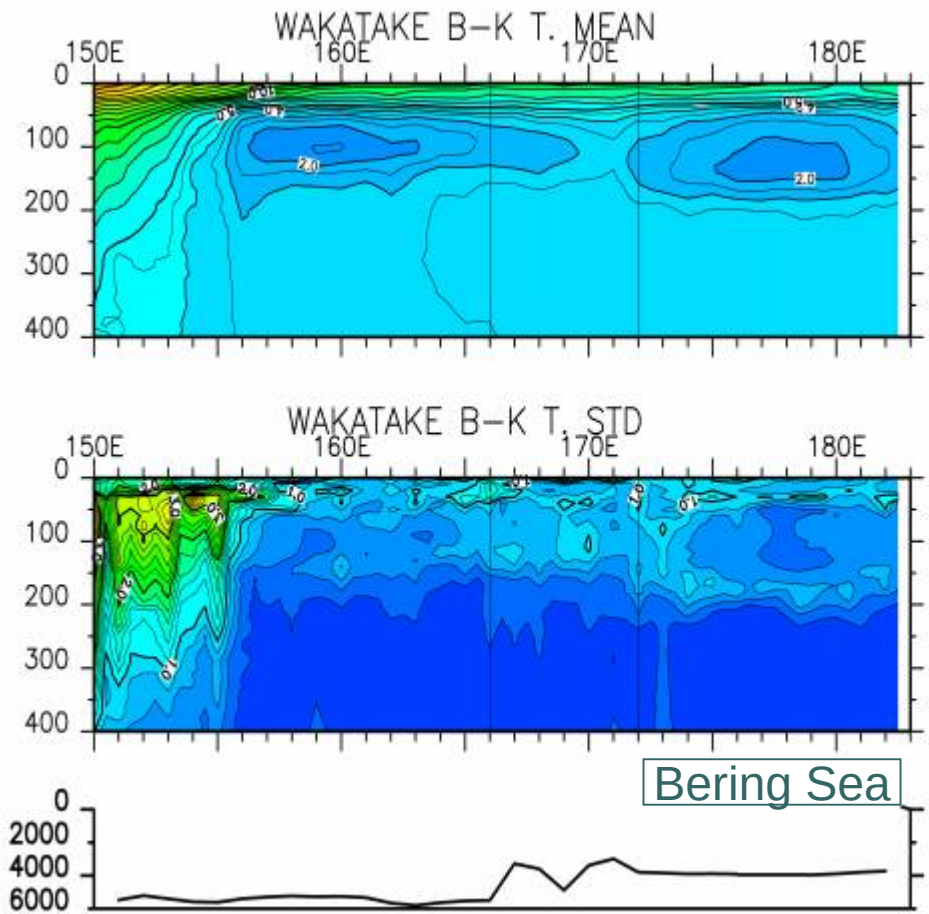
Year-to-Year Variation of TML in the Date Line , June-July

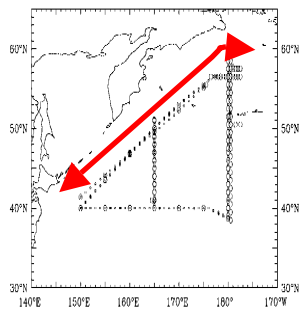




Mean Temperature Section

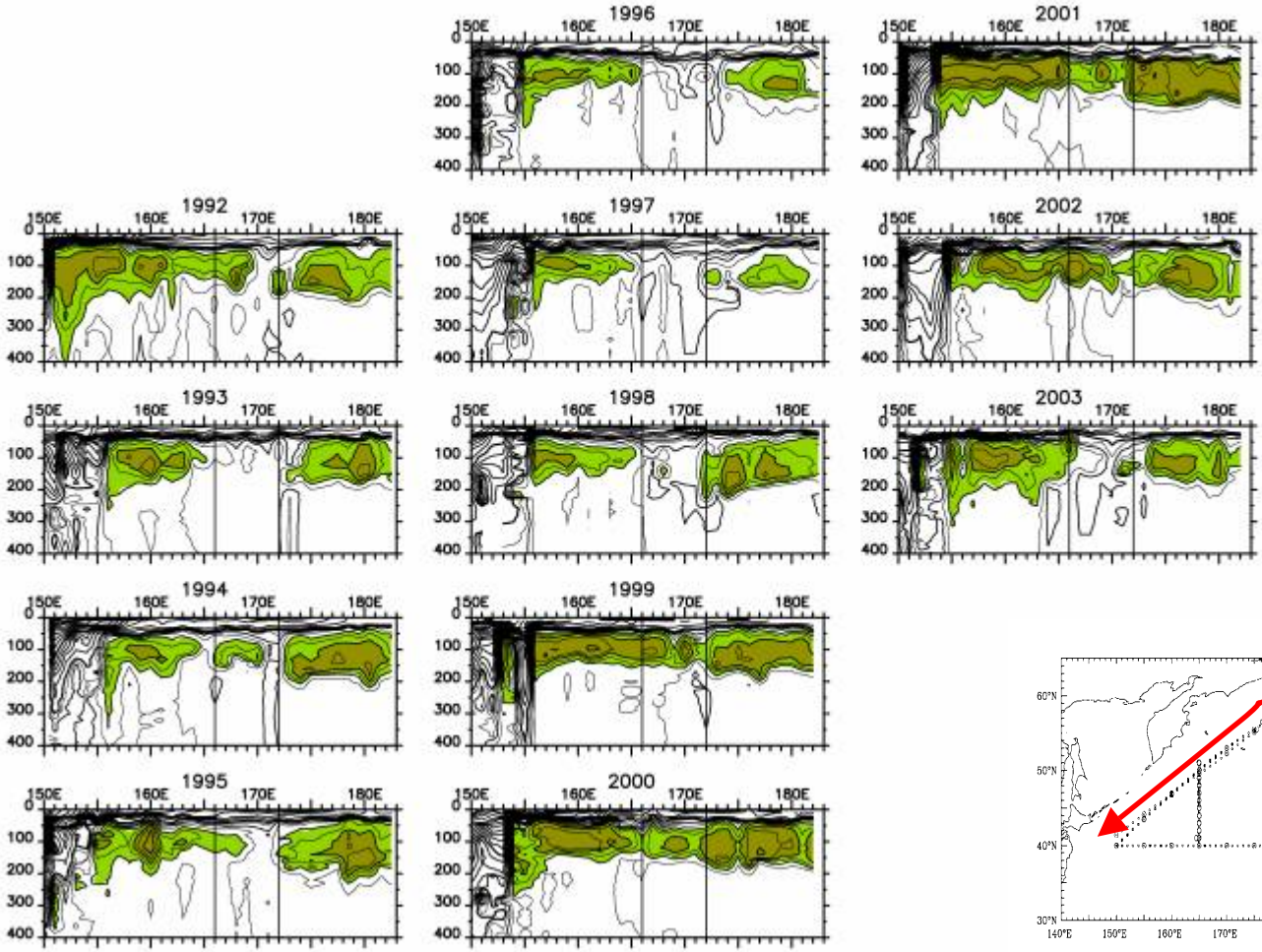
Bering Sea - east of the Kuril islands,July

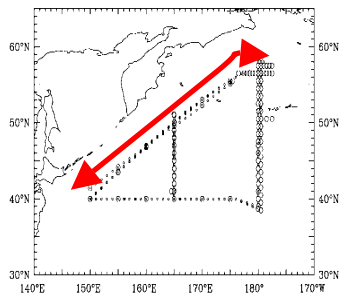




Year-to-Year Variation of TML

Bering Sea - east of the Kuril islands, July

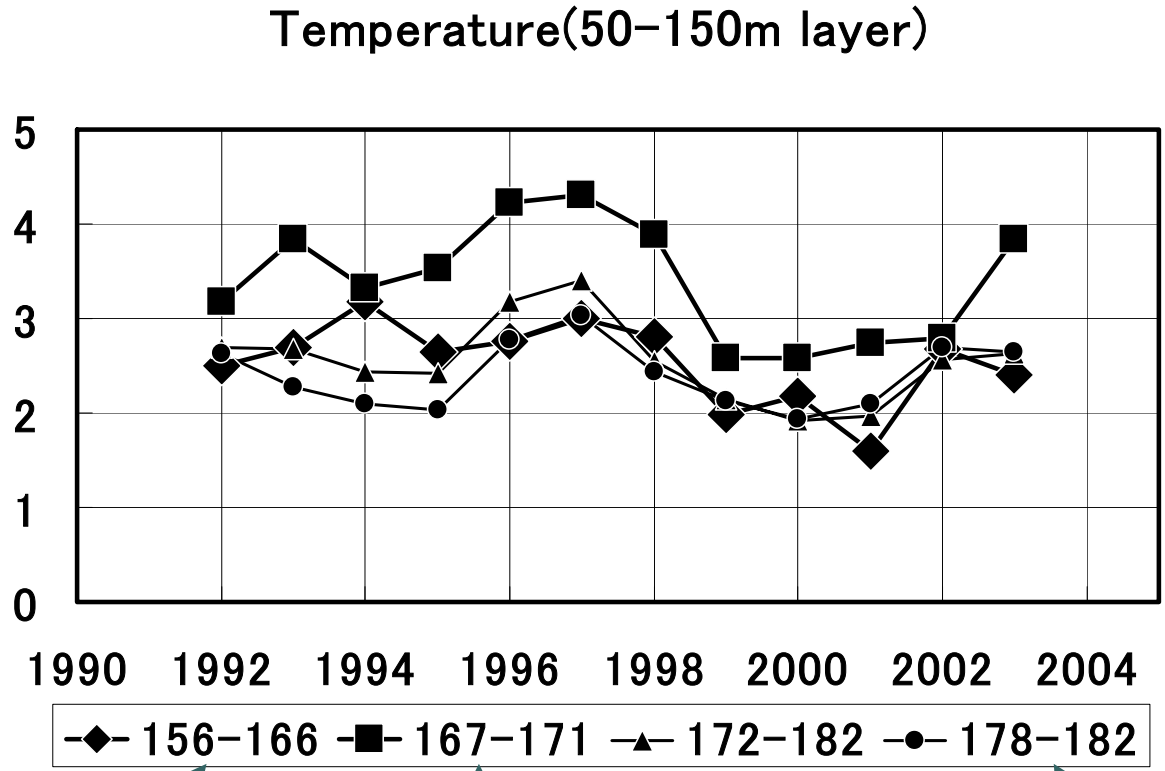




Year-to-Year Variation of TML

Bering Sea - east of the Kuril islands, July

Year-to-Year variation of temperature of TML



East of the kuril islands

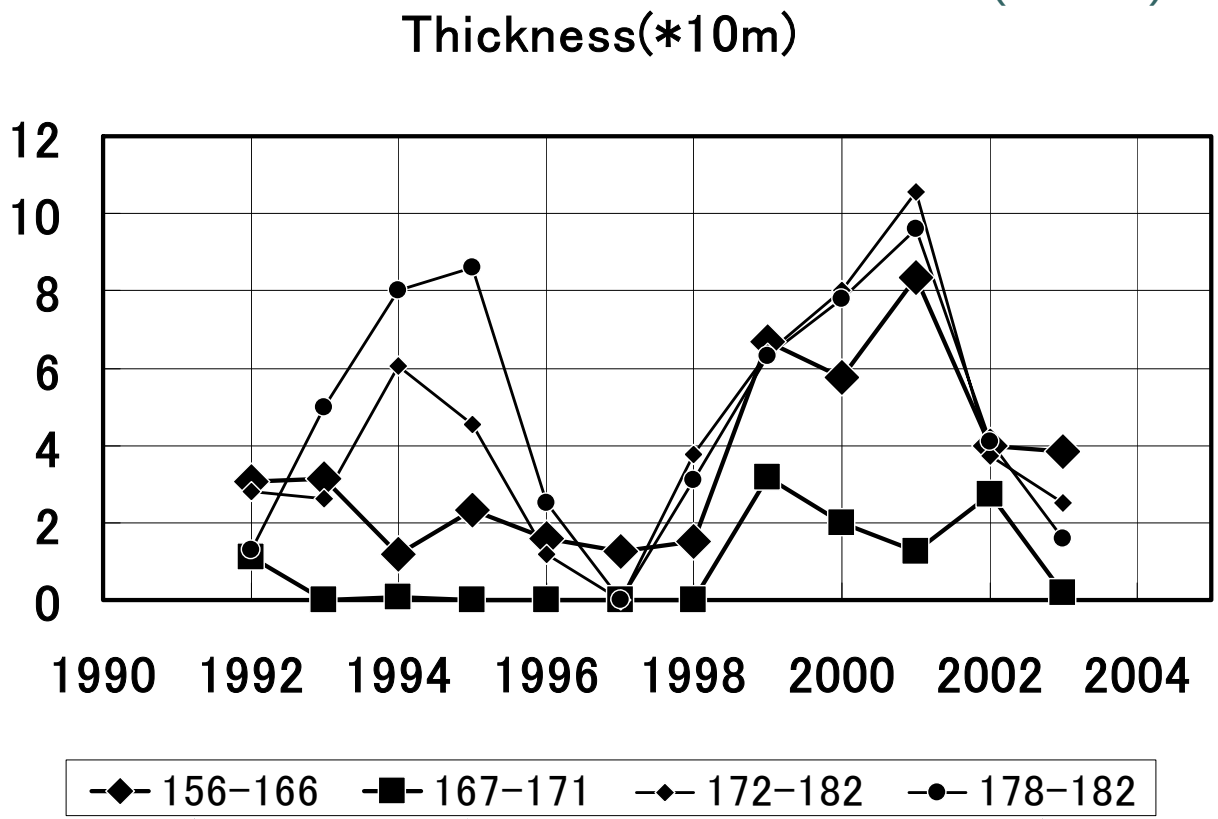
Aleutian islands

Center region of the Bering sea

Year-to-Year Variation of TML

Bering Sea - east of the Kuril islands, July

Year-to-Year variation of thickness of TML (<2.0℃)

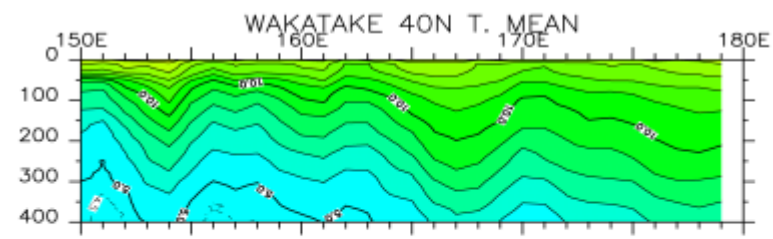


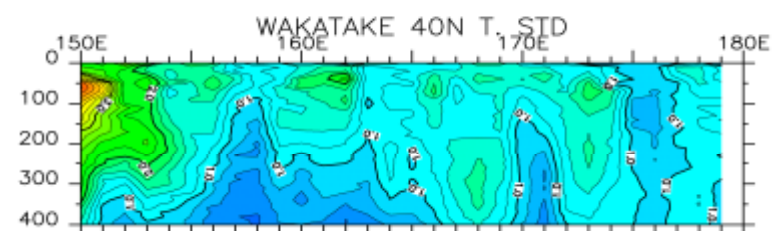
East of the kuril islands

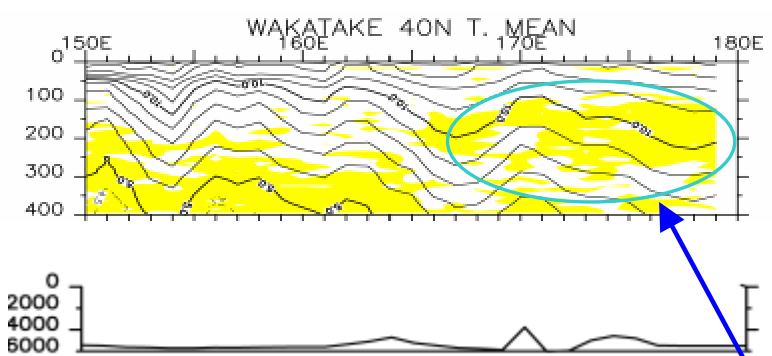
Aleutian islands

Center region of the Bering sea

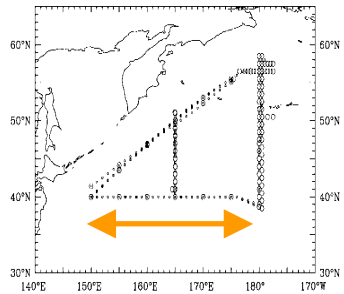
Temperature section along 40N
Wakatake-maru



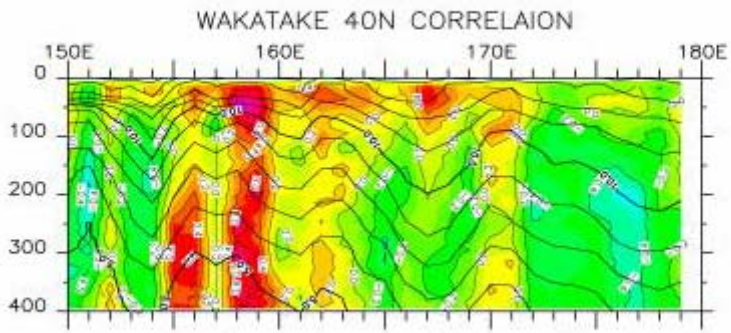




CMW



Relationship between summer (May-July) SST variation off tohoku and 40N section (June) for 1992-2003.



Summary for variability

- SST variations of WNP have two dominant pattern, and the transition zone pattern indicates the connection between the adjacent sea of japan and WSG.
- Oceanographic conditions around Japan has close connection with WSG on interdecadal time scale
- WSG changes on decadal(7-10year) and Interdecadal time scales.
- It is a future subject to investigate the influence of WSG variations on decadal time scale to adjacent sea of Japan.