Applications of Collected Data from Argos Drifter, NOAA Satellite Tracked Buoy in the East Sea

Young-Sang Suh (yssuh@nfrdi.re.kr)

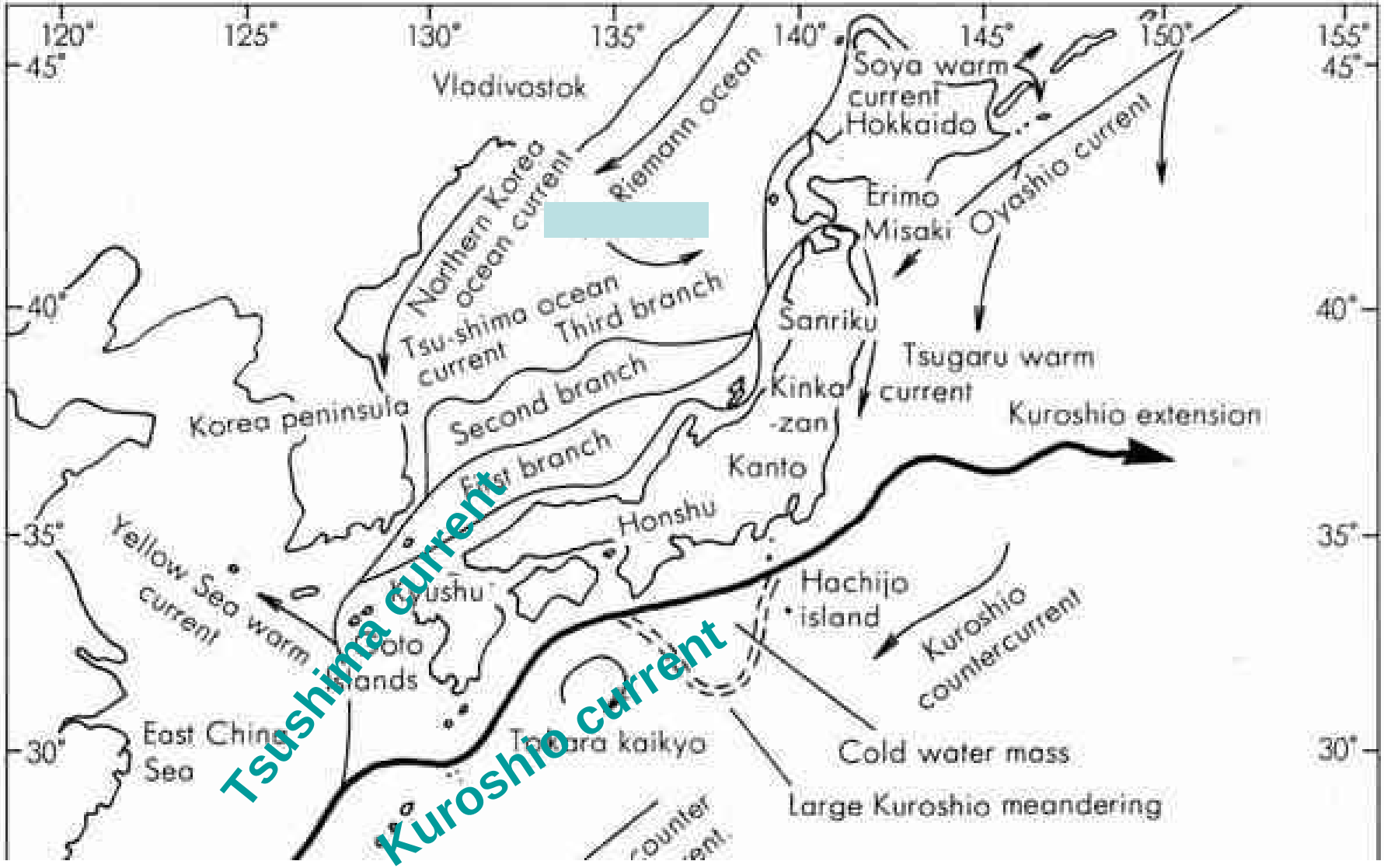
Ocean Research Team,
National Fisheries Research and Development Institute,
South Korea

Outline

- Study on recurring anti-cyclonic eddies using **satellite tracking drifter**, satellite ocean color and sea surface temperature imagery
- Temporal and spatial variation of the day-night difference in sea surface temperature derived from **Argos drifter**
- Future Study

Recurring Eddy in the East Sea

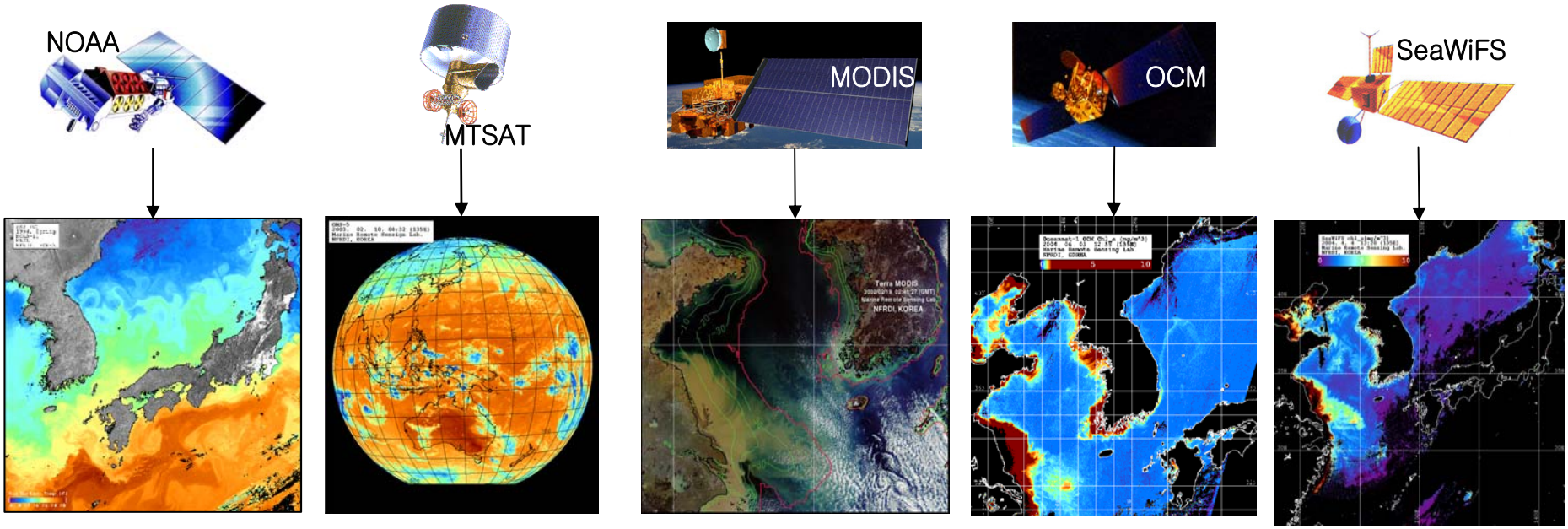
Ocean Currents



Real time information on SST from NOAA and MTSAT / Ocean Color from SeaWiFS, MODIS and OCM

Thermal observation

Ocean color observation



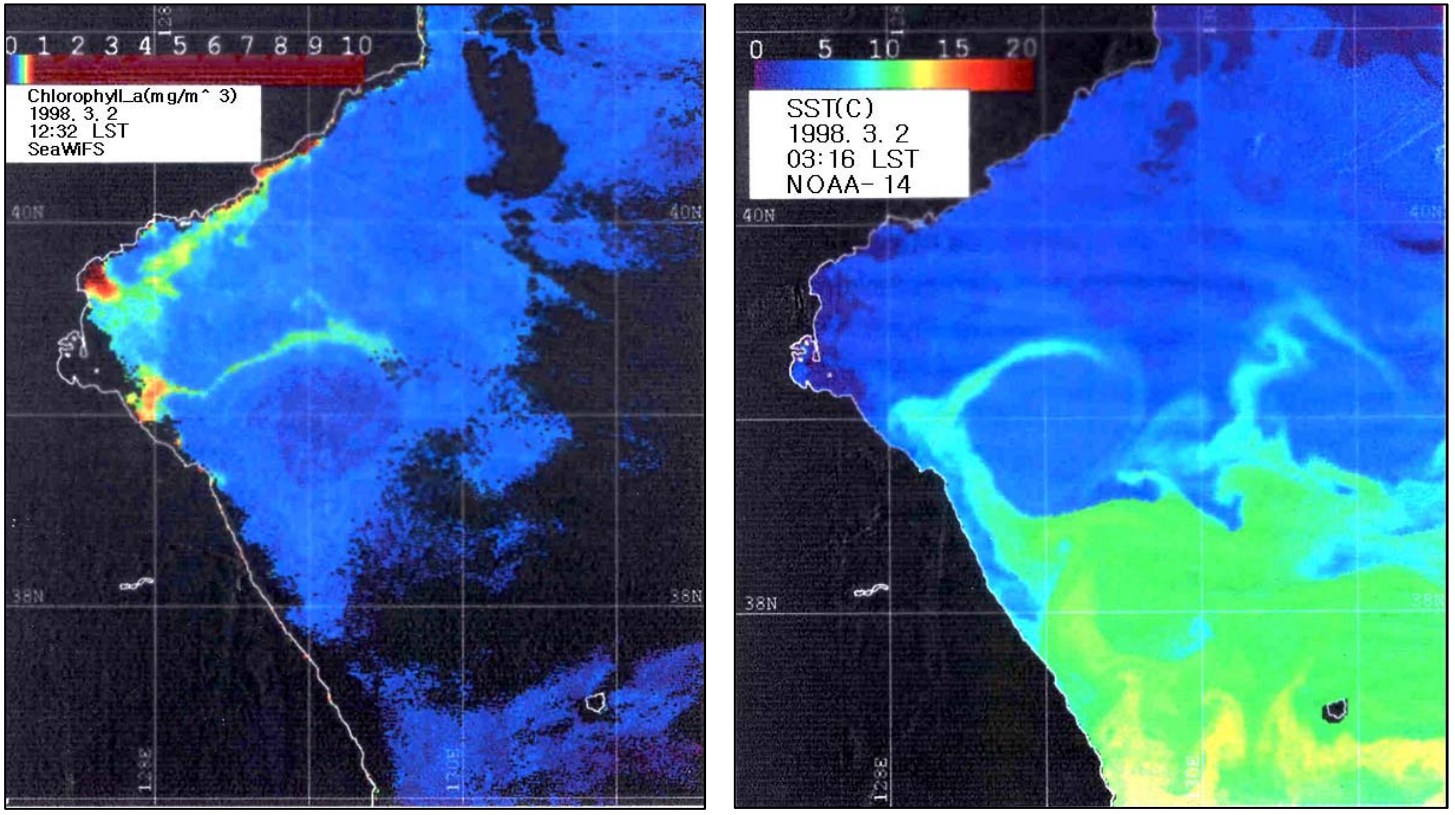
▣ Acquisition & Interpretation of remote sensing data for SST, ocean color, thermal front, chlorophyll-a, nighttime fishing boat etc.

▣ Service of these data on website

Surface chlorophyll-*a* distribution (a) determined with the SeaWiFS sensor and NOAA AVHRR SST distribution (b)

off the east coast of Korea on Mar. 2, 1998

(a) (b)



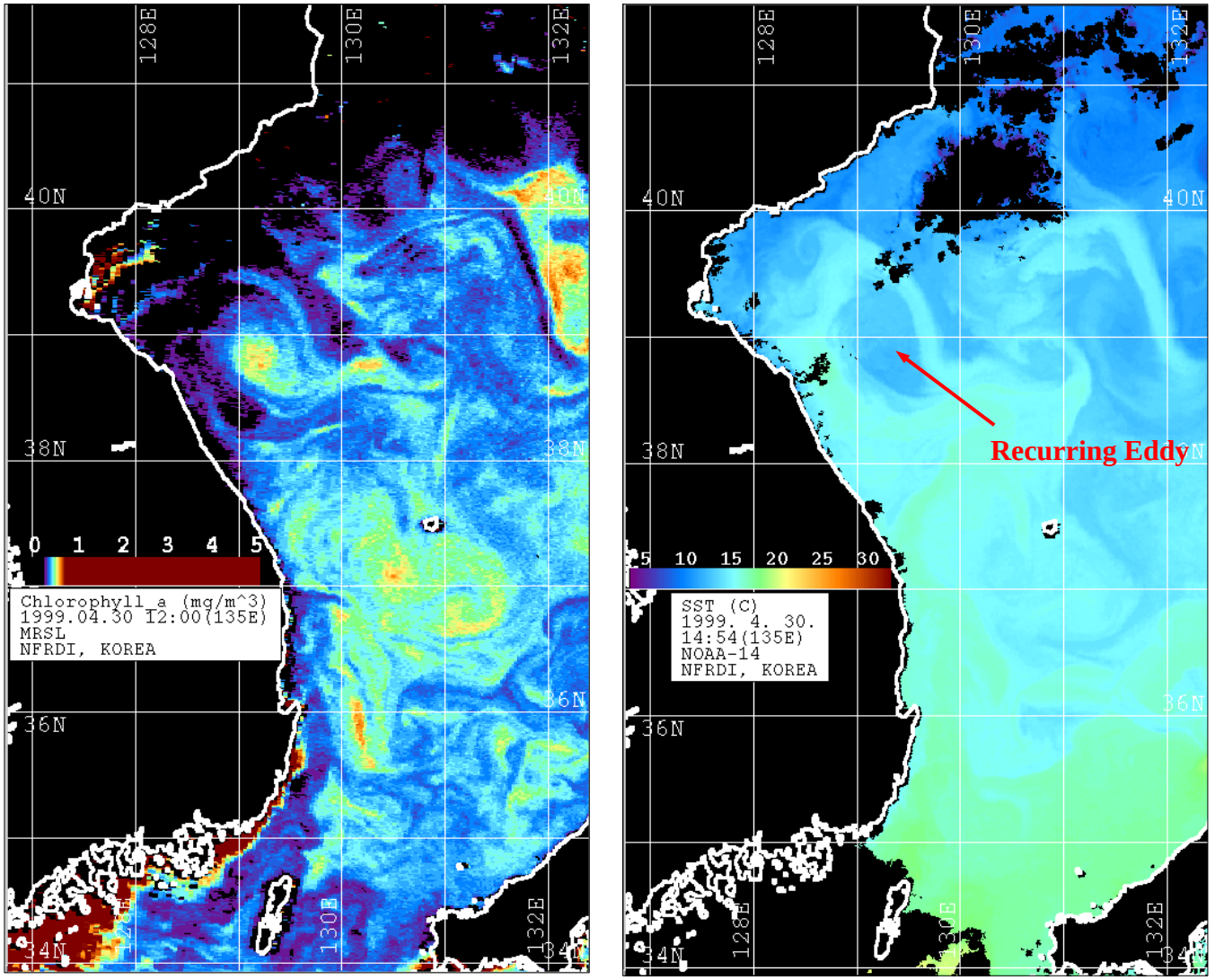
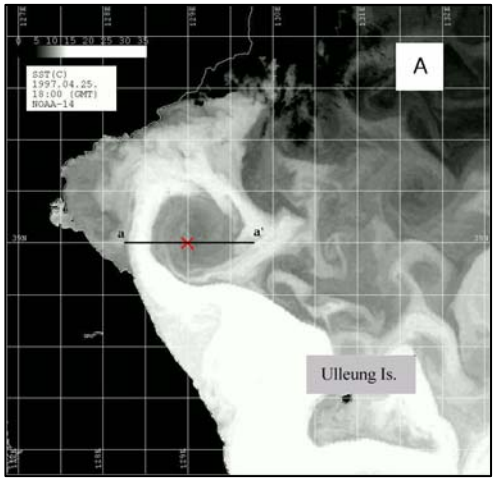
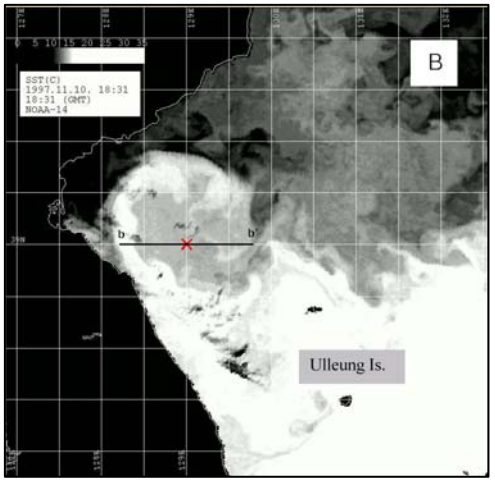


Fig. . Surface chlorophyll *a* distribution (a) from SeaWiFS sensor and NOAA AVHRR SST distribution (b) off the east coast of Korea on April 30, 1999 (Suh *et al.*, 2000) .





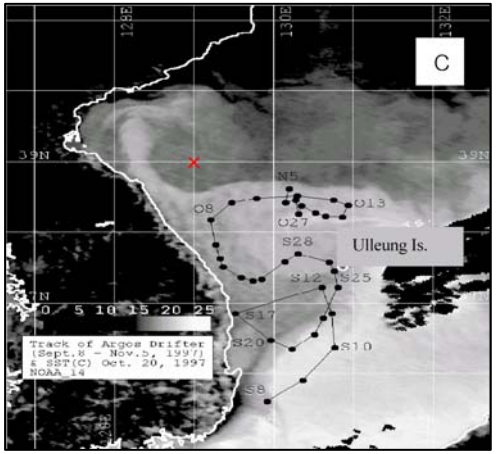


Fig. . NOAA-14 AVHRR Sea Surface Temperature(SST) structure off the east coast of Korea. A) April 25, 1997. B) November 10, 1997. C) Argos-tracked surface current drifter track for the period September 8(S8) - November 5 (N5), 1997. The drift track is superimposed on the SST image for October 20, 1997. The warm jet west of the KCCE on October 20, (C) strengthened in late October and eventually surrounded the KCCE by November 11 (B).(symbol × represents the center of eddy)

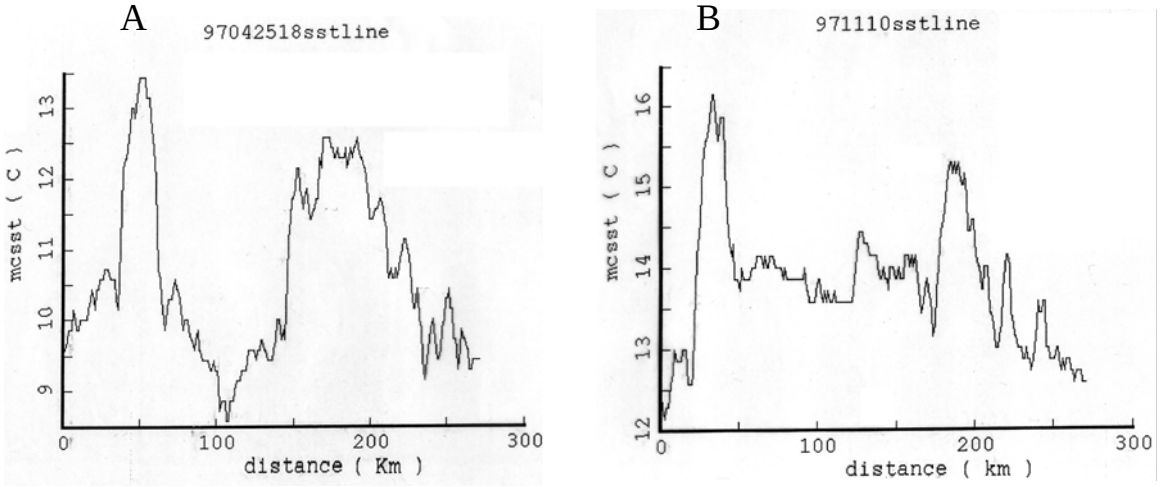


Fig. . The MCSST profile on the a-a'(A) and b-b'(B) line in Fig. A and B.

Recurring Anti-cyclonic eddy in the East/Japan Sea

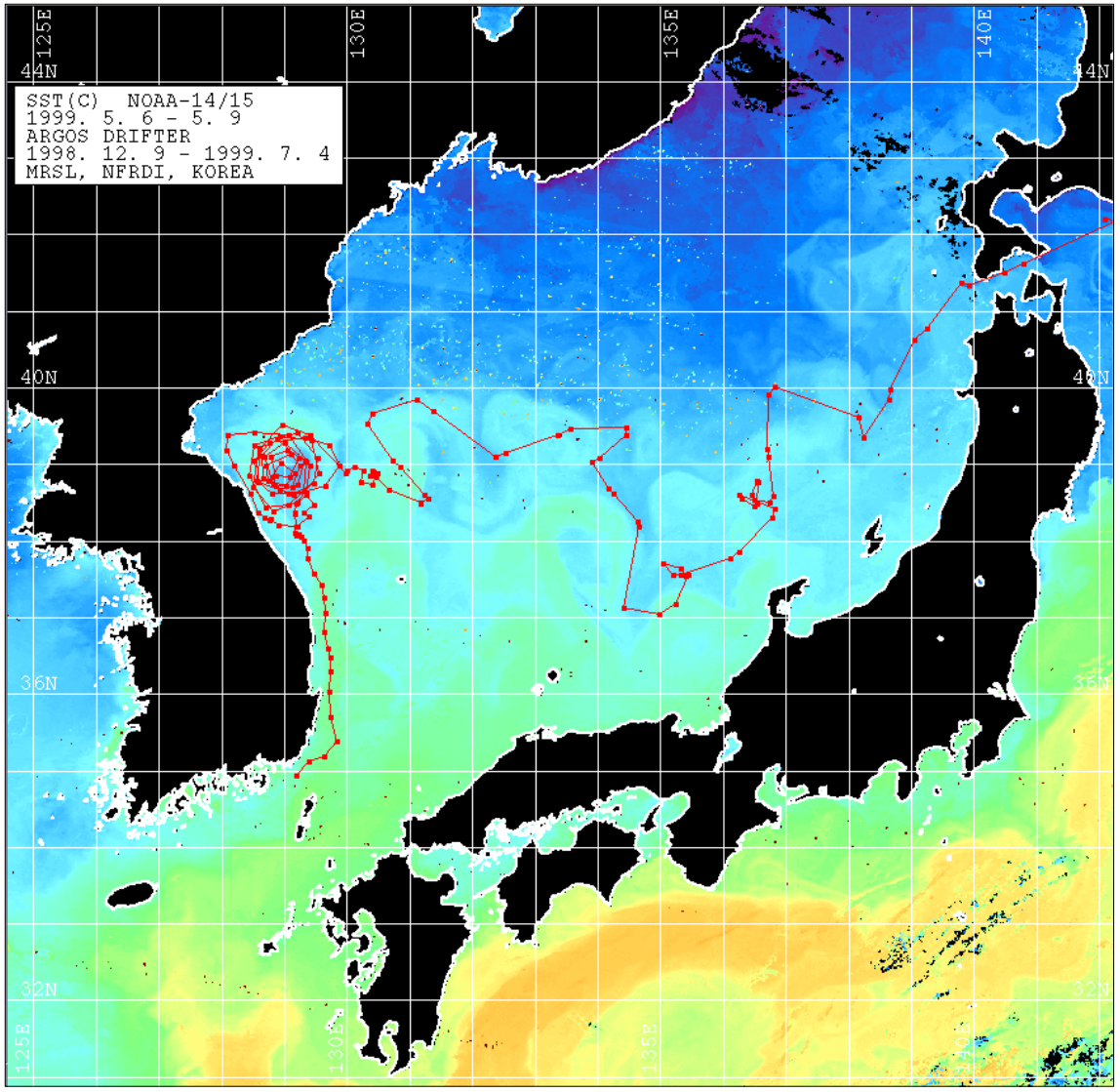


Fig. . NOAA-14 and NOAA-15 composite SST during 6th May - 9th May in 1999 for the East Sea. The trajectory of the ARGOS-tracked drift buoy is shown during December 9, 1998 - July 4, 1999 (Suh *et al.*, 2000) .

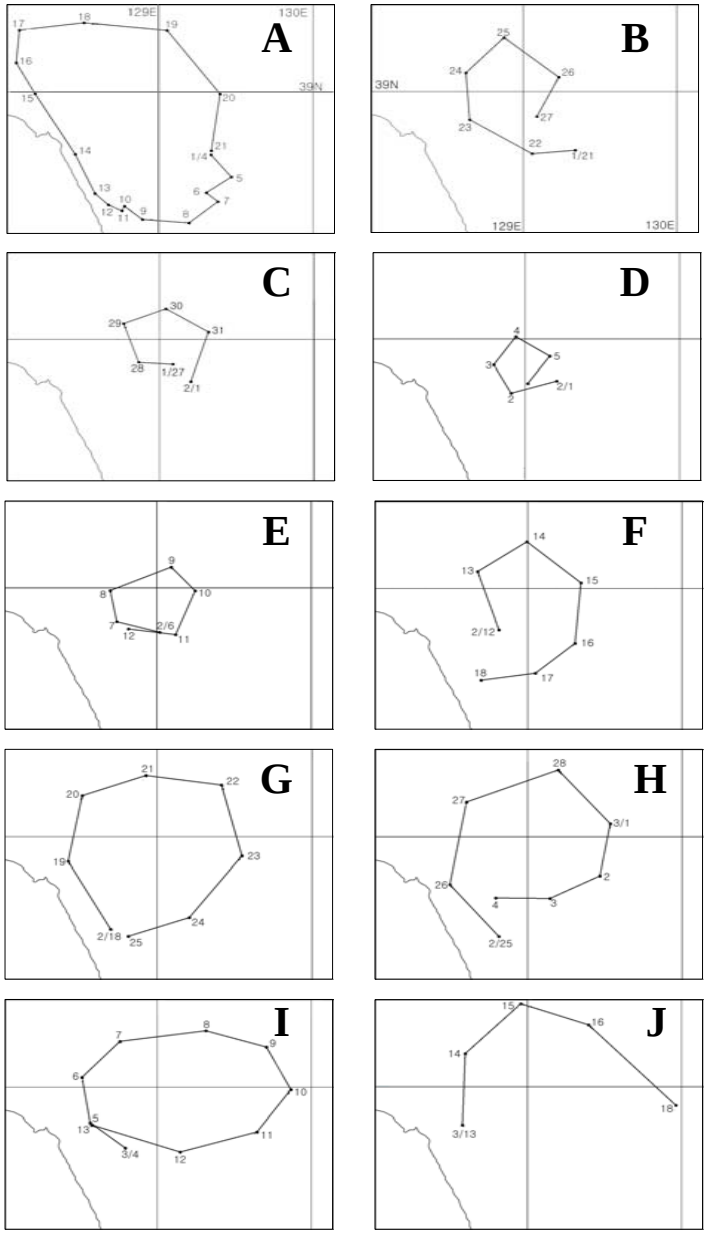
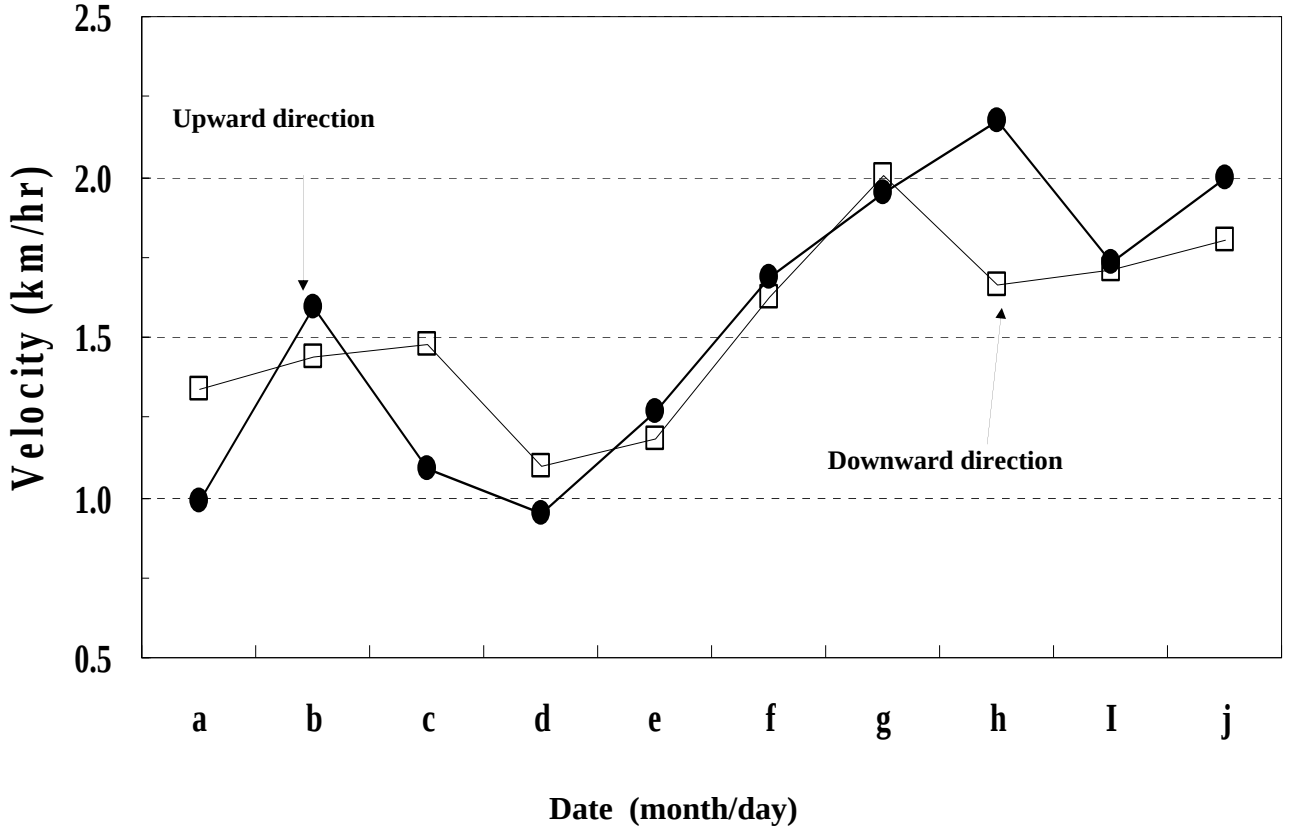
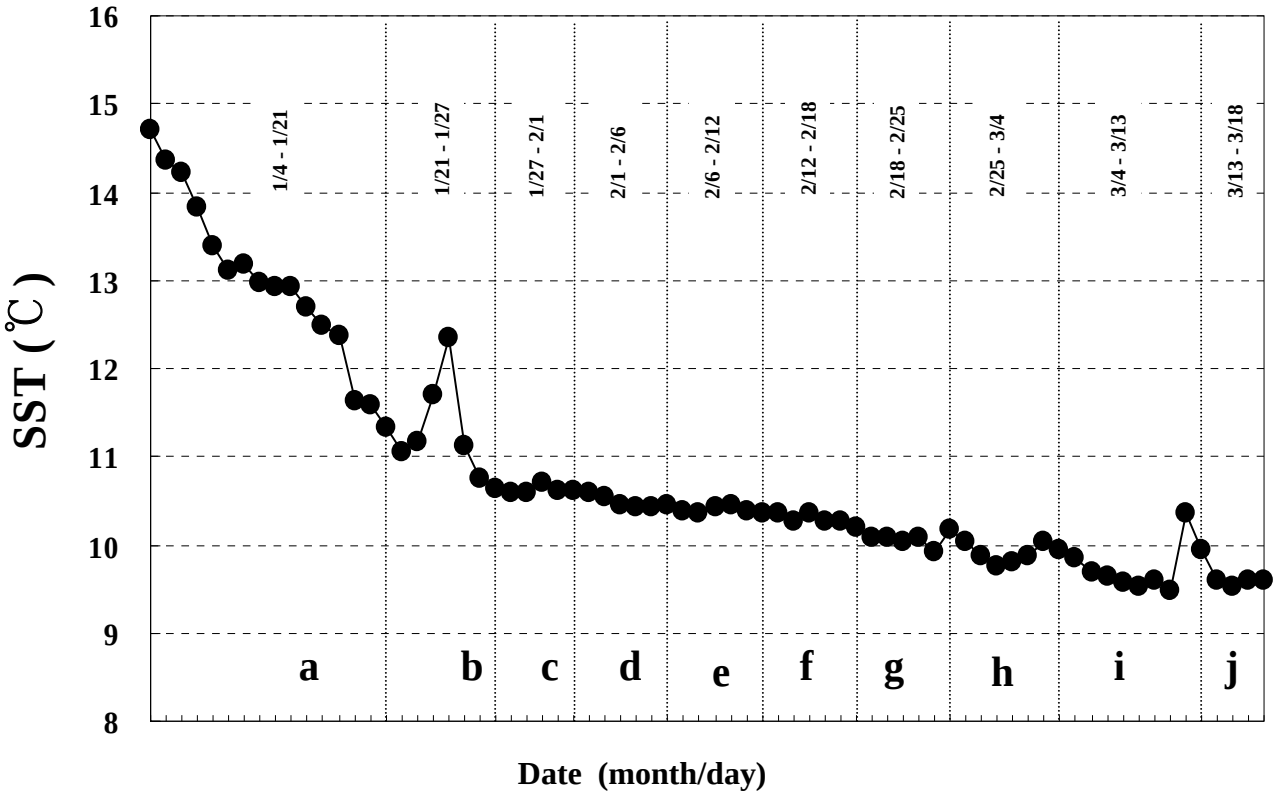


Fig. . The tracks of ARGOS drifter during the January 4, 1999 - March 18, 1999 revealed how the buoy follows the recurring eddy (Suh *et al.*, 2000).

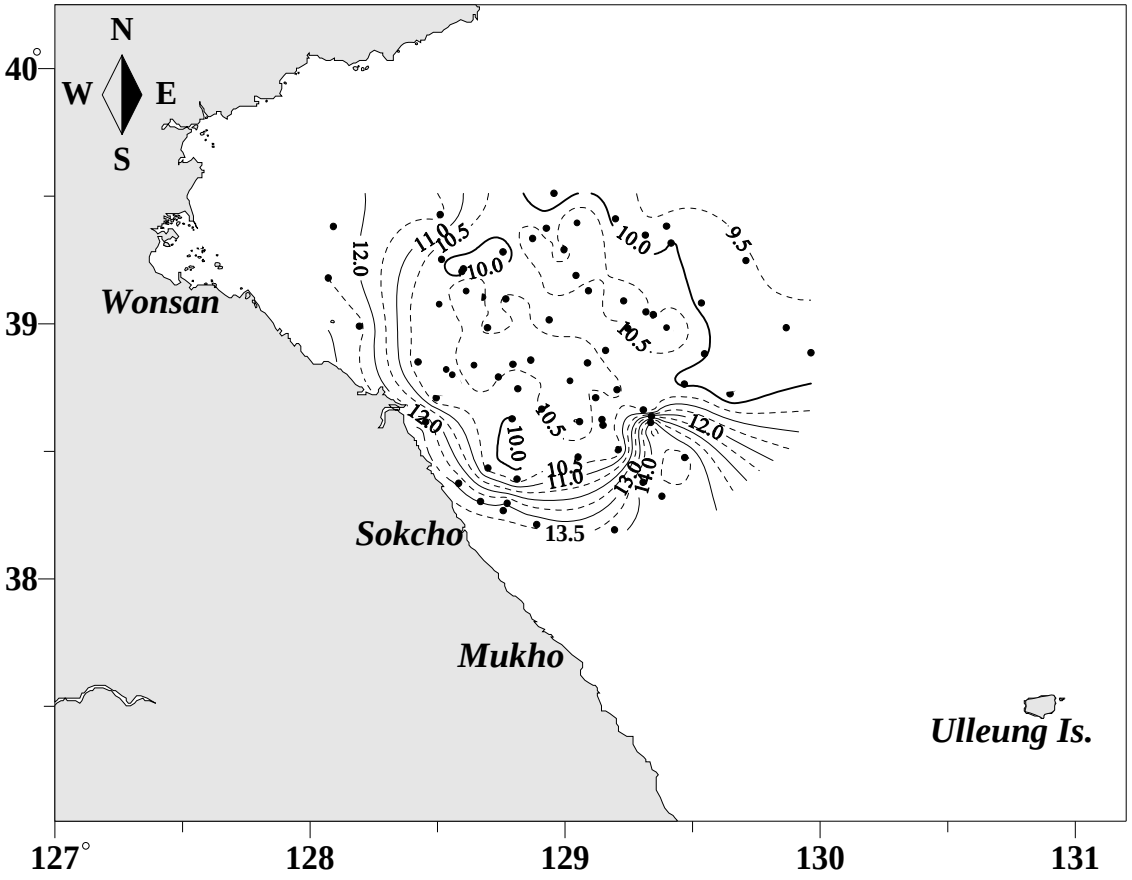
Velocity of the upward (**northward**) and downward (southward) movements of the ARGOS buoy in the recurring eddy region



The SST measured by the ARGOS drifter trapped in the recurring eddy off Wonsan bay in the East Sea from January 4 to March 18, 1999



Distribution of SST measured by Argos drifter off the Wonsan bay in the East Sea from January 4 to March 18, 1999



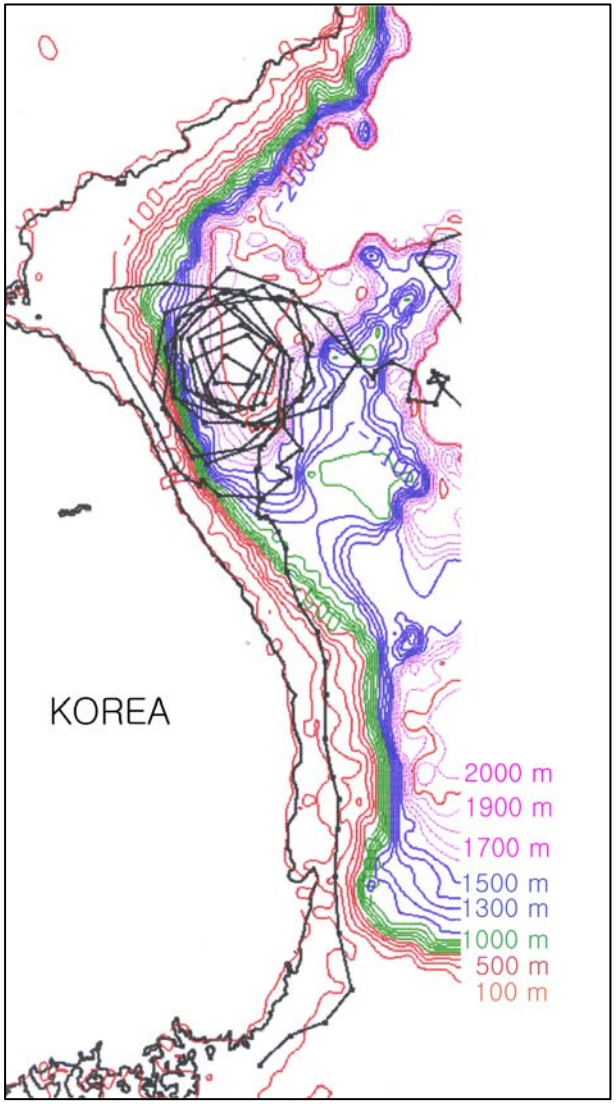
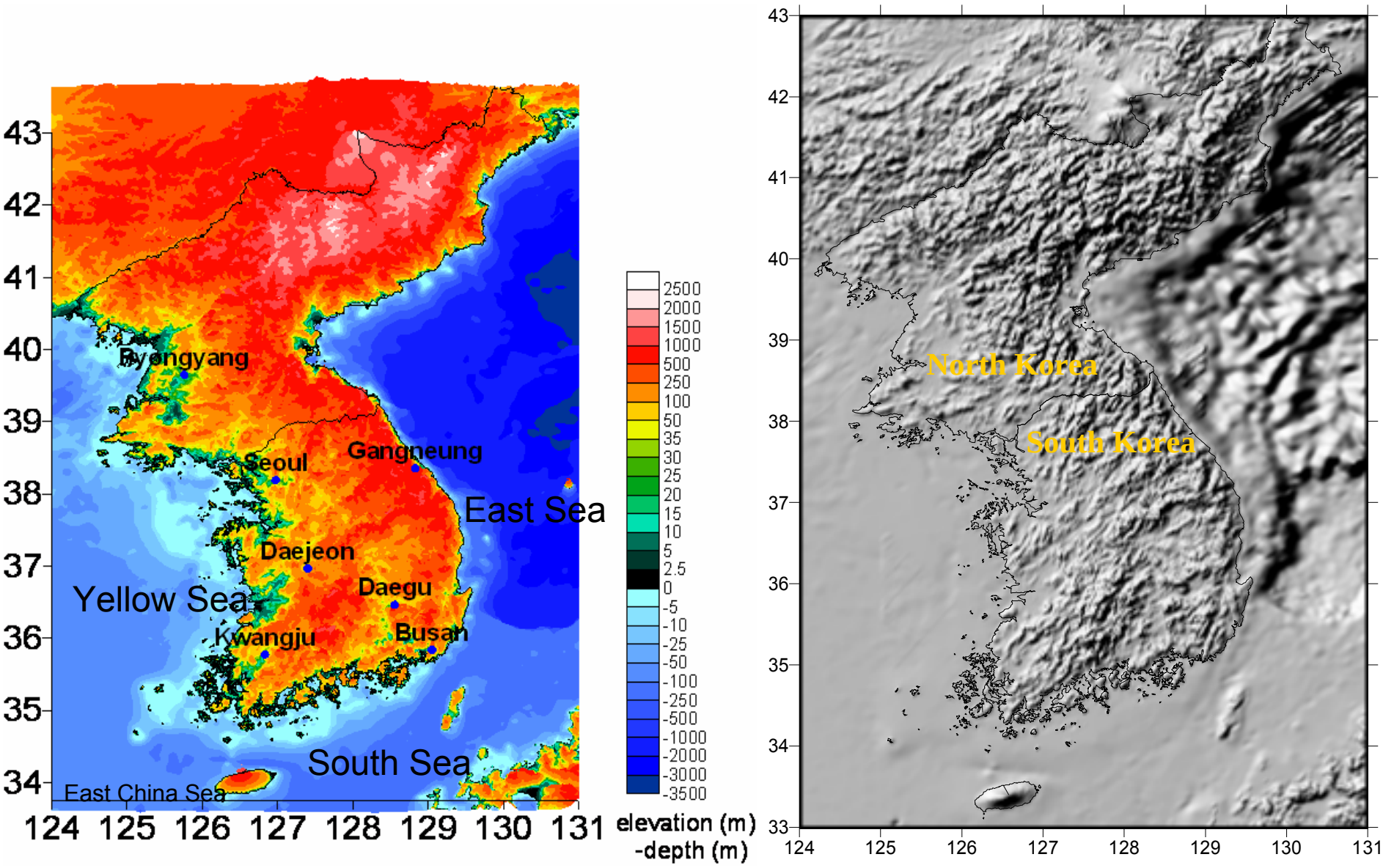
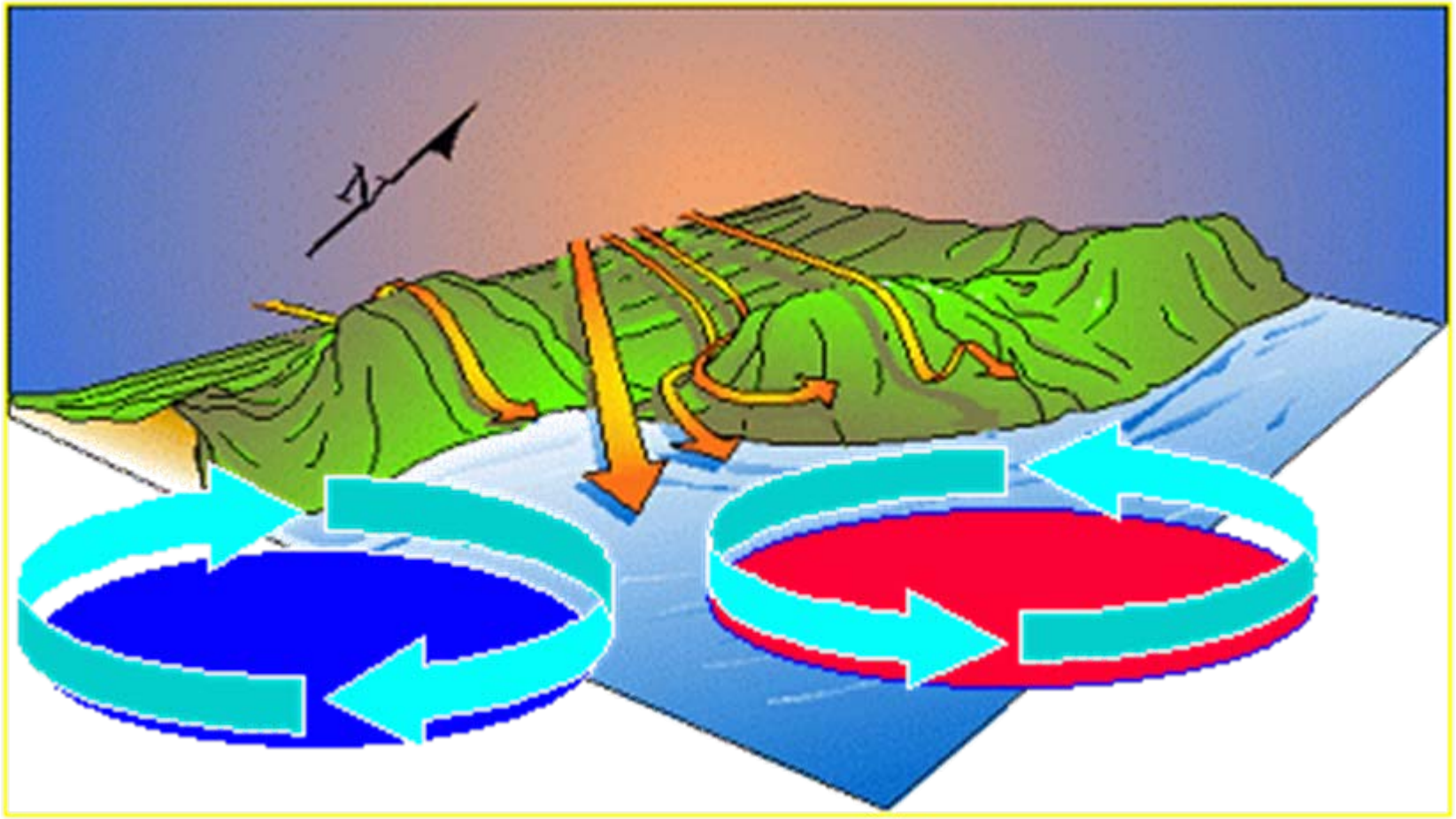


Fig. . Comparison between the recurring eddy and the bottom topography near the Wonsan bay of the East Sea. A basin of approximately 1500m depth is centered at 39.25N and 129.25E.


Pyongyang
Seoul
Gangneung
Daejeon
Daegu
Busan
Kwangju
East Sea
Yellow Sea
South Sea
East China Sea
North Korea
South Korea
2500
2000
1500
1000
500
250
100
50
35
30
25
20
15
10
5
2.5
0
-5
-10
-25
-50
-100
-250
-500
-1000
-2000
-3000
-3500
elevation (m)
-depth (m)
124 125 126 127 128 129 130 131
33 34 35 36 37 38 39 40 41 42 43

Northwesterly Monsoon



Delta Temp. at 20-cm depth between day and night

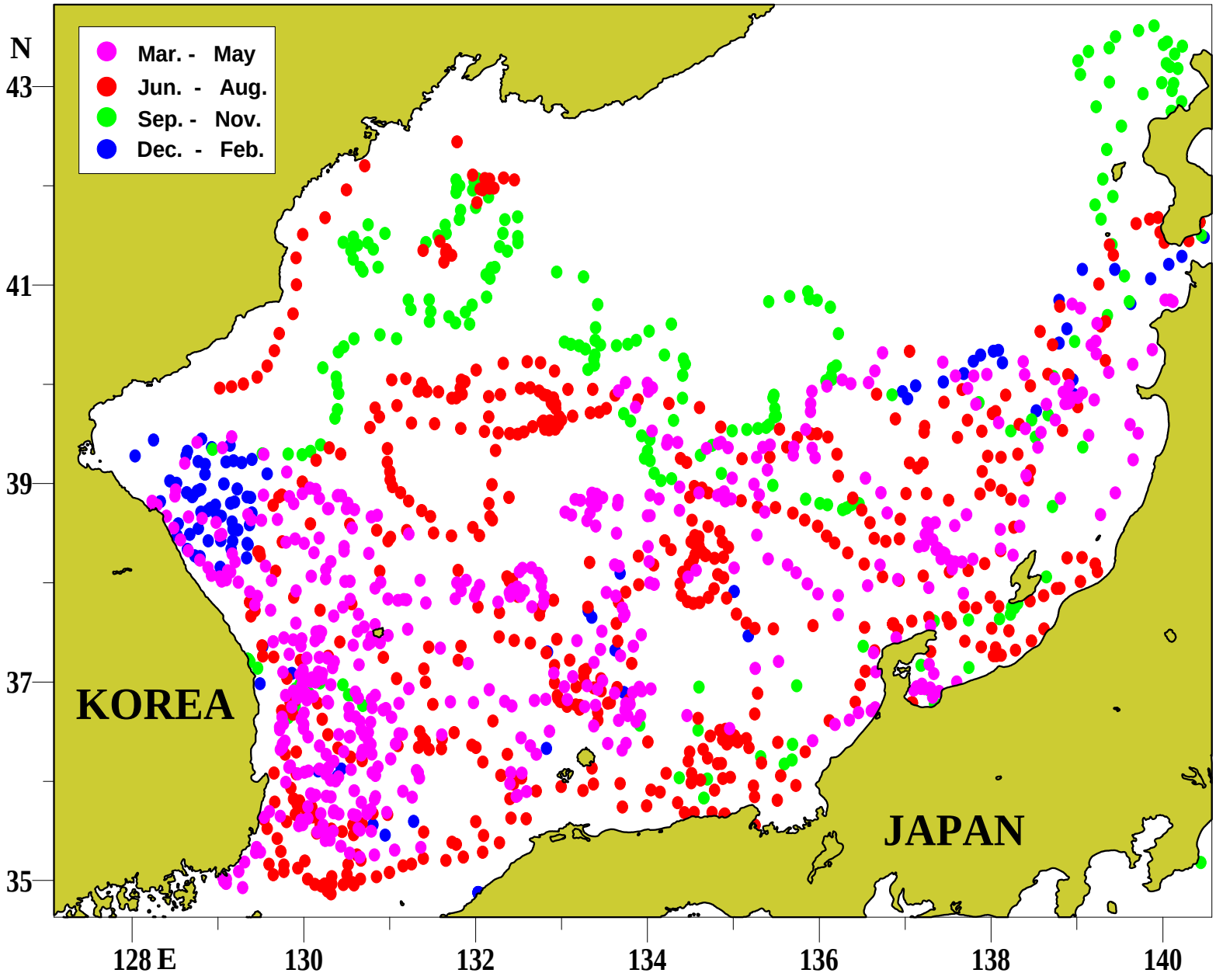


Fig. . Distribution of the daily position of ARGOS drifter buoys in the East Sea during 1996 – 1999 (Suh et al., 2001) .

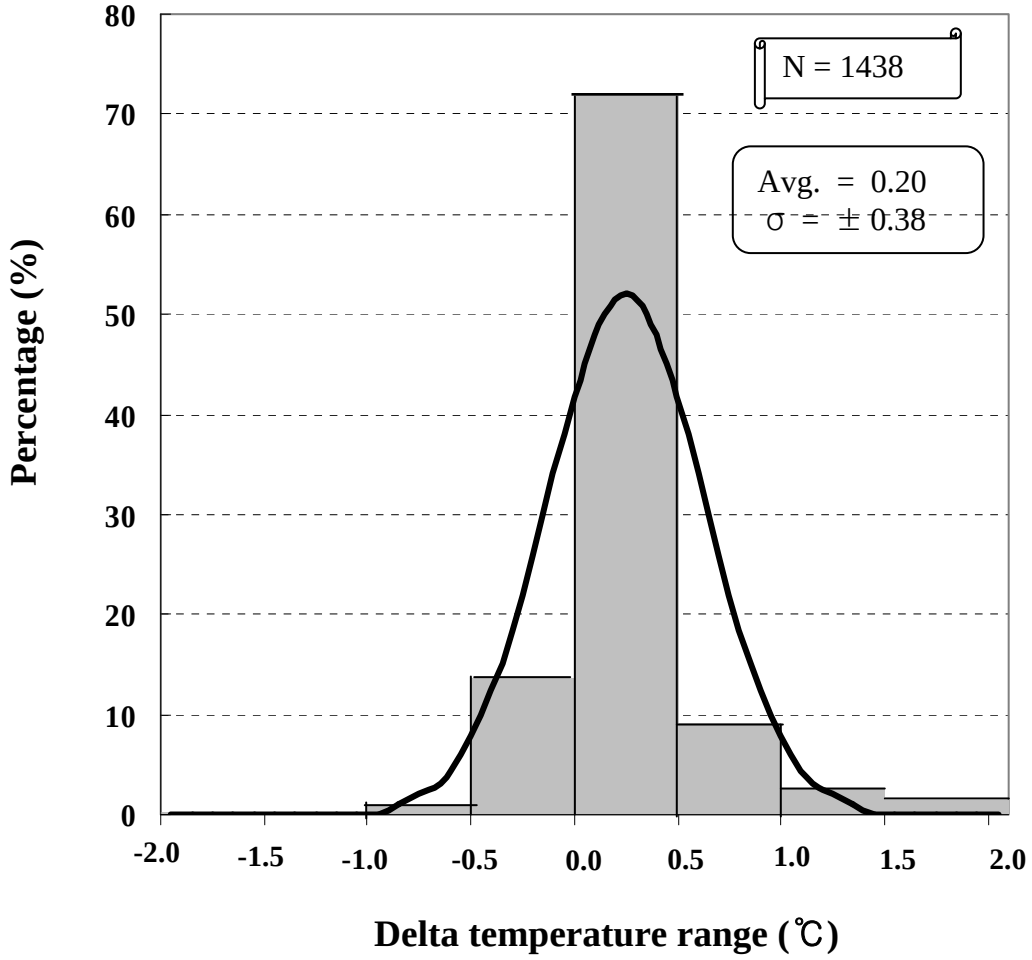


Fig. 2-2-2. Frequency distribution of the daily sea surface temperature differences between daytime and nighttime in the East Sea during 1996 - 1999.

Table . Seasonal variation of the difference in sea surface temperature between daytime and nighttime in the East Sea

Season / Range (℃)	Spring (Mar. – May)	Summer (Jun.- Aug.)	Autumn (Sept.- Nov.)	Winter (Dec.- Feb.)
−2.0≤ Δt <−1.5	0.18	0.18	0.25	1.10
−1.5≤ Δt <−1.0	0.18	0.18	0.51	0.00
−1.0≤ Δt <−0.5	0.72	0.54	0.51	2.21
−0.5≤ Δt < 0.0	11.75	20.00	7.11	13.81
0.0≤ Δt < 0.5	72.51	63.93	78.68	76.24
0.5≤ Δt < 1.0	8.86	11.96	8.88	4.42
1.0≤ Δt < 1.5	3.25	2.50	2.79	1.10
1.5≤ Δt ≤ 2.0	2.53	0.71	1.27	1.10

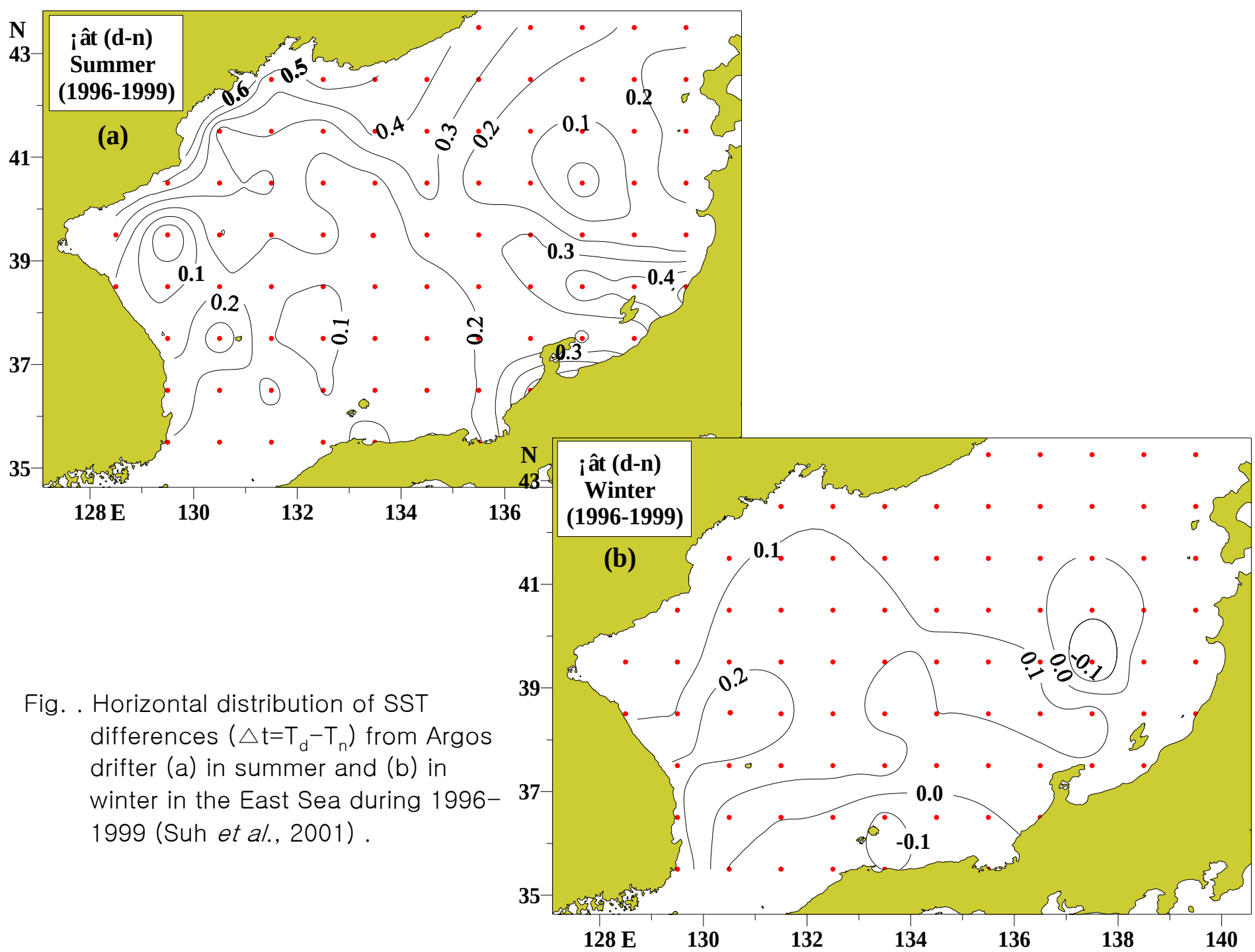


Fig. . Horizontal distribution of SST differences ($\triangle t=T_d-T_n$) from Argos drifter (a) in summer and (b) in winter in the East Sea during 1996–1999 (Suh *et al.*, 2001) .

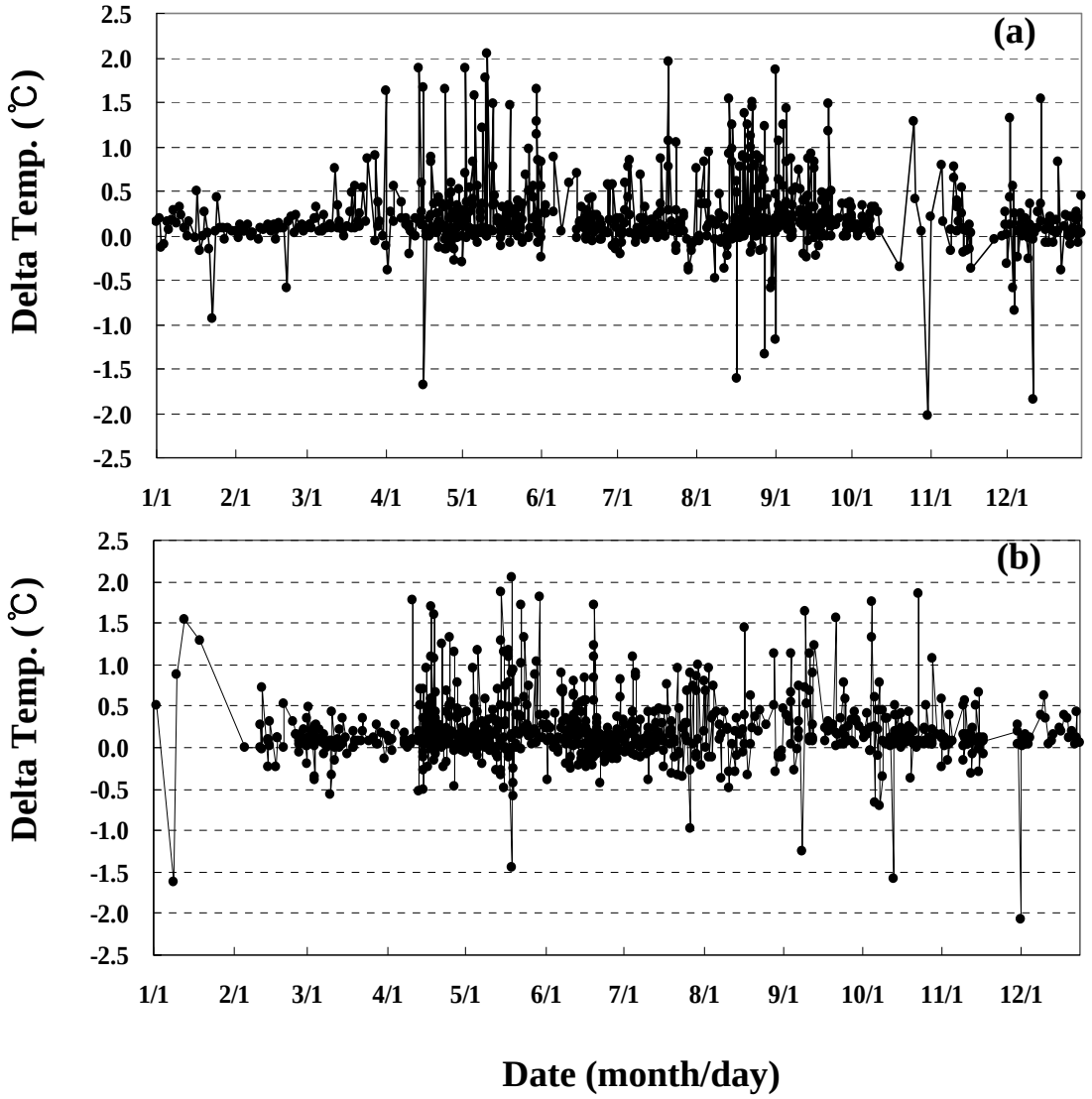


Fig. 2-2-4. Distribution of the daily sea surface temperature differences between daytime and nighttime in the northern(a) and southern(b) part of 38˚N in the East Sea.

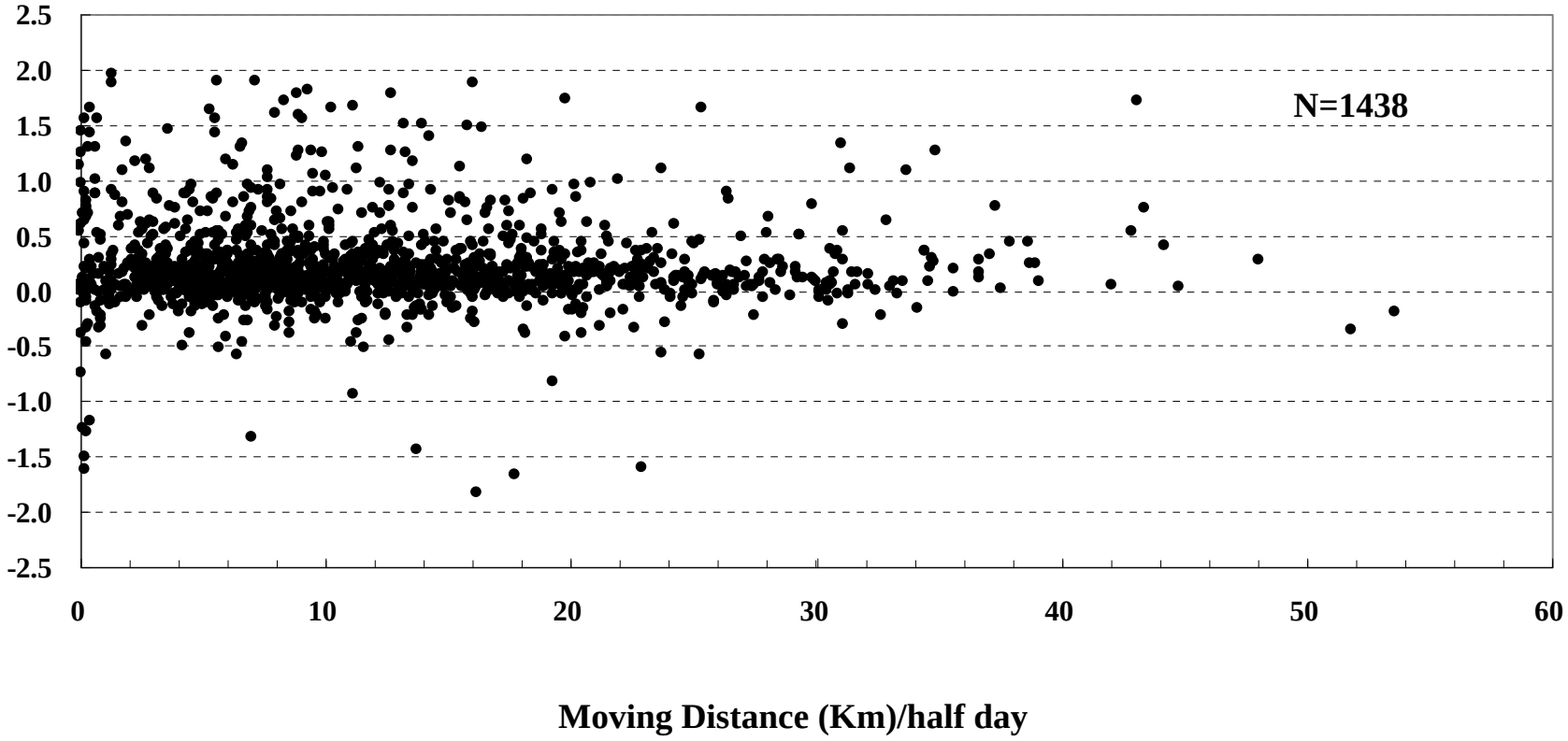


Fig. Relationship between the SST differences ($\triangle t=T_d - T_n$) and the half-day moving distance of Argos drifter buoy (Suh et al., 2001).

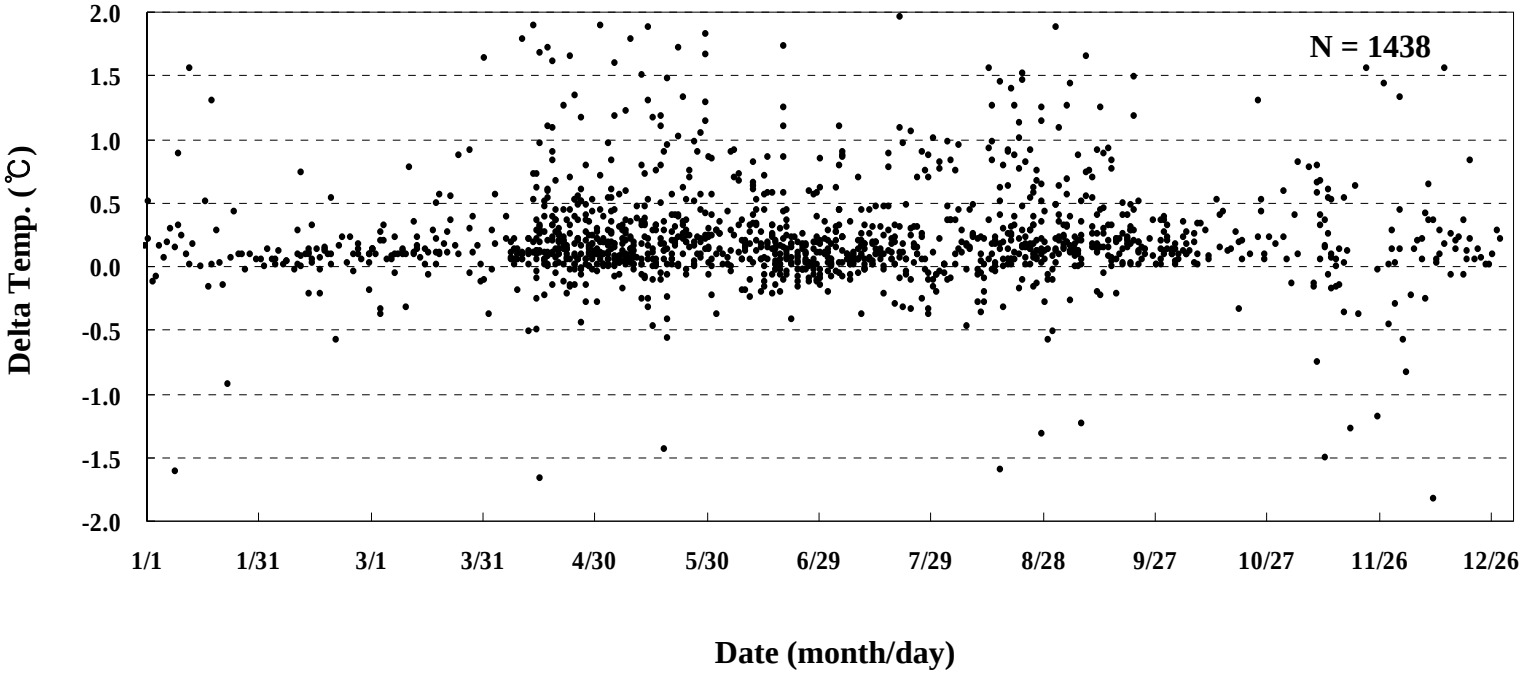
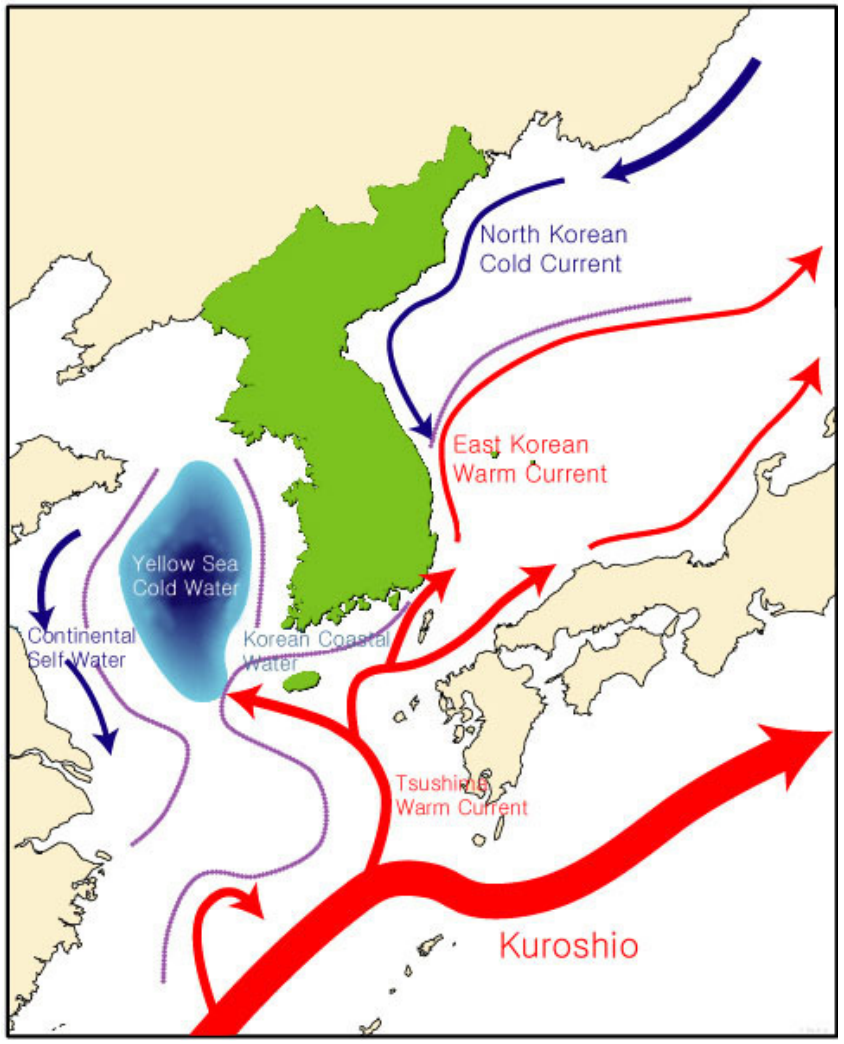


Fig. . Seasonal variation of the differences in sea surface temperature between daytime and nighttime from Argos drifter in the East Sea during 1996-1999.

Future Study

Identifying migration routes of pelagic fishes

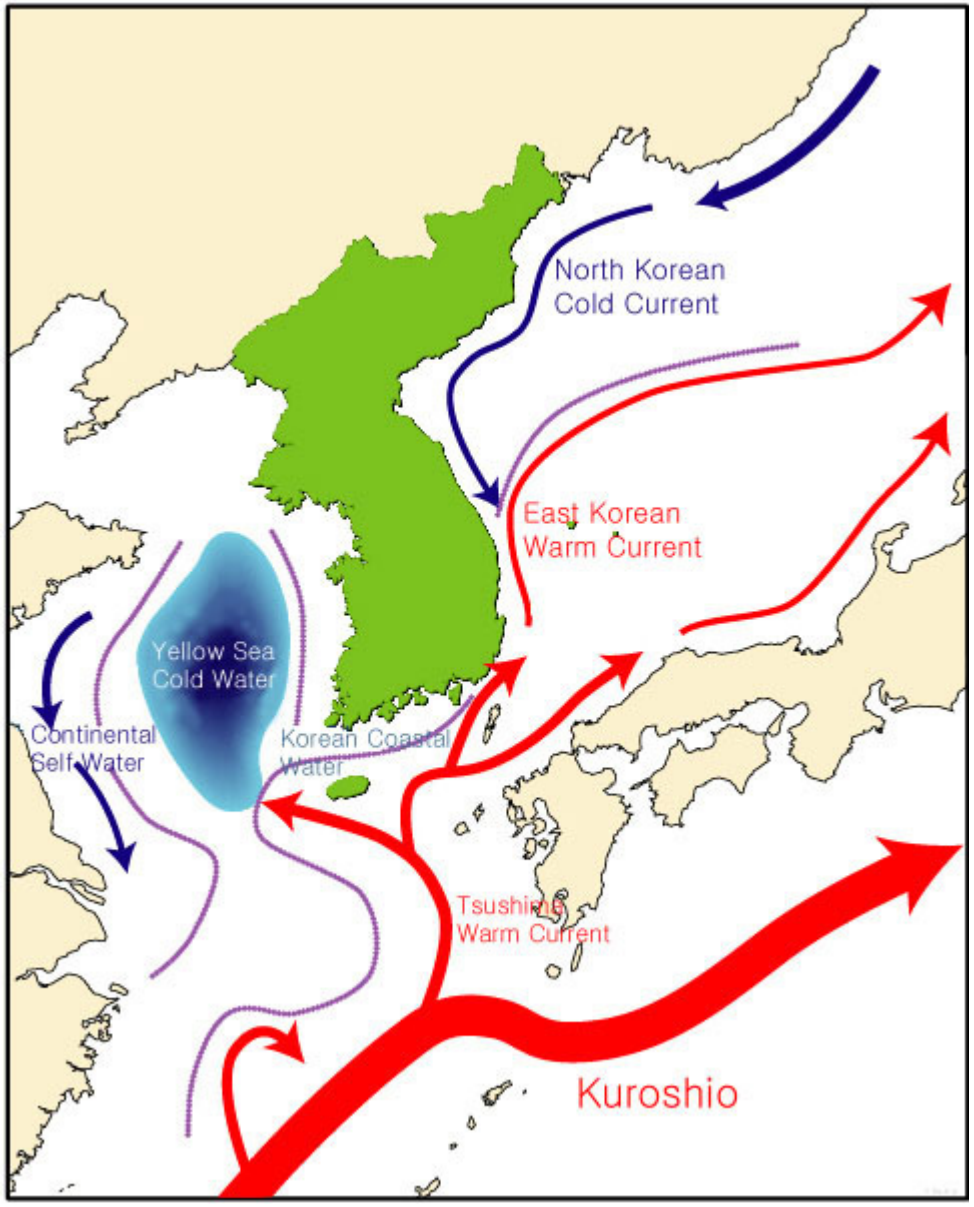


Jack mackerel

Pacific saury

Anchovy

Major Currents around the Korean Peninsula



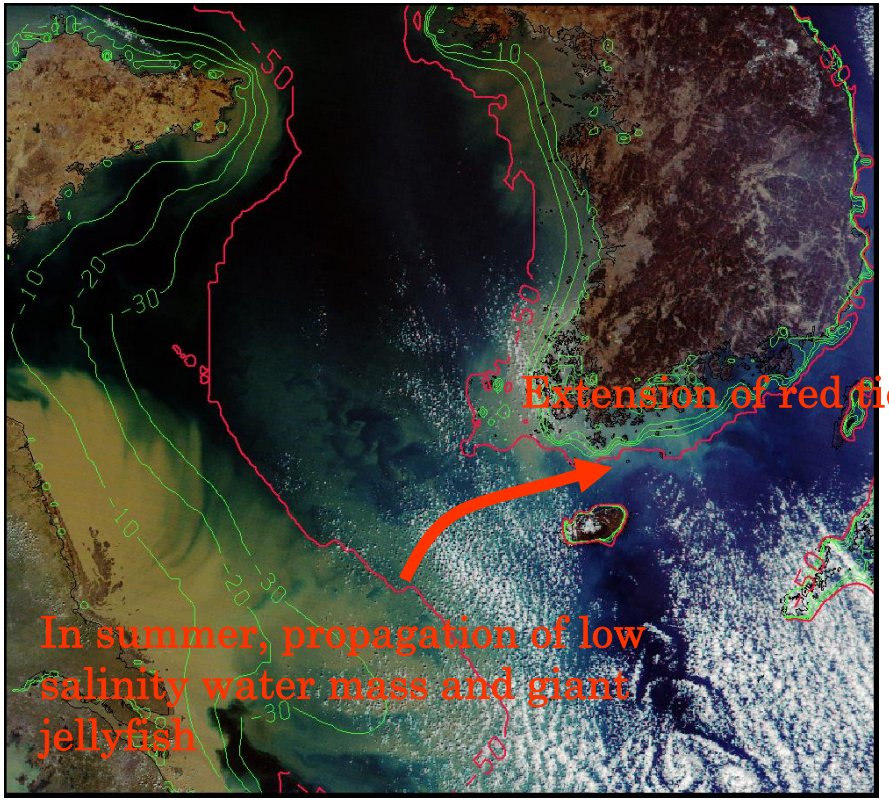
Scientific Targets

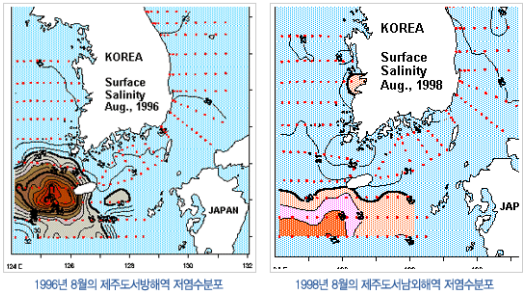
√ Transport of giant jellyfishes originated from the East China Sea

√Propagation of low salinity water mass discharged from Yangtze River in summer

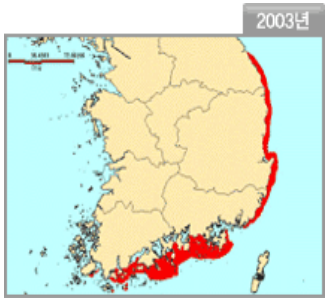
√Outbreak of harmful algal bloom (HAB) that occurs and extended along the coastline every summer.

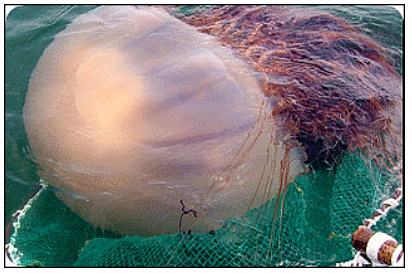
√ For better prediction the behavior of low salinity water mass, giant jellyfish and HAB, high-frequency monitoring in the South Sea of Korea is required.





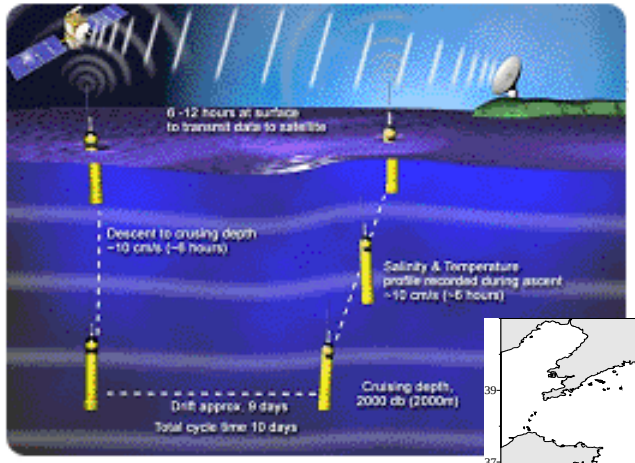
1996년 8월의 제주도서방해역 저염수분포 1998년 8월의 제주도서남외해역 저염수분포

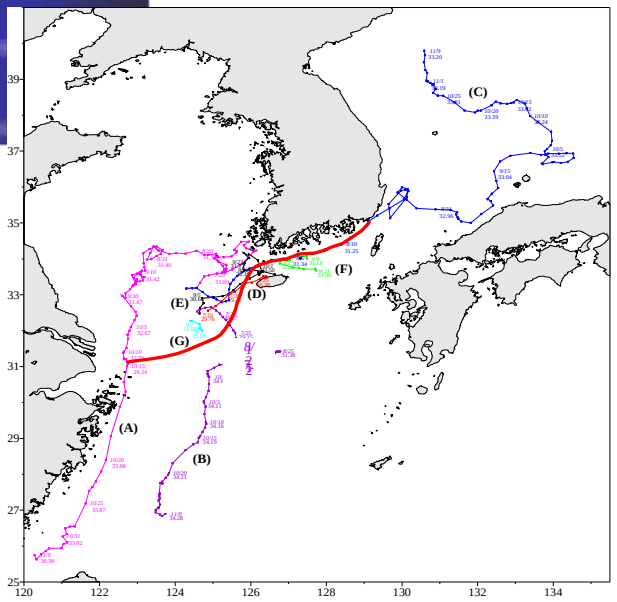


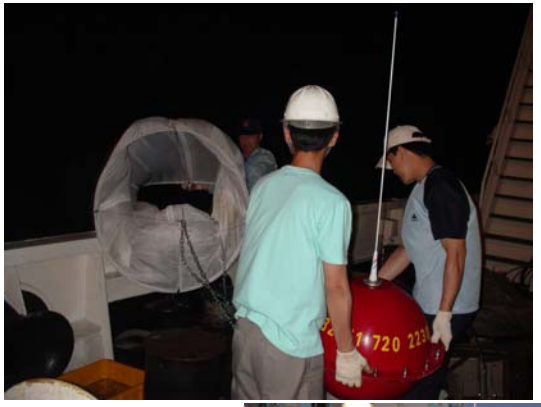


Ongoing Oceanographic research related with Climate Change at NFRDI

Deployed surface tracking buoy and ARGO buoy







Mechanism of cold-water occurrences in the eastern coast of the Korean Peninsula during summer

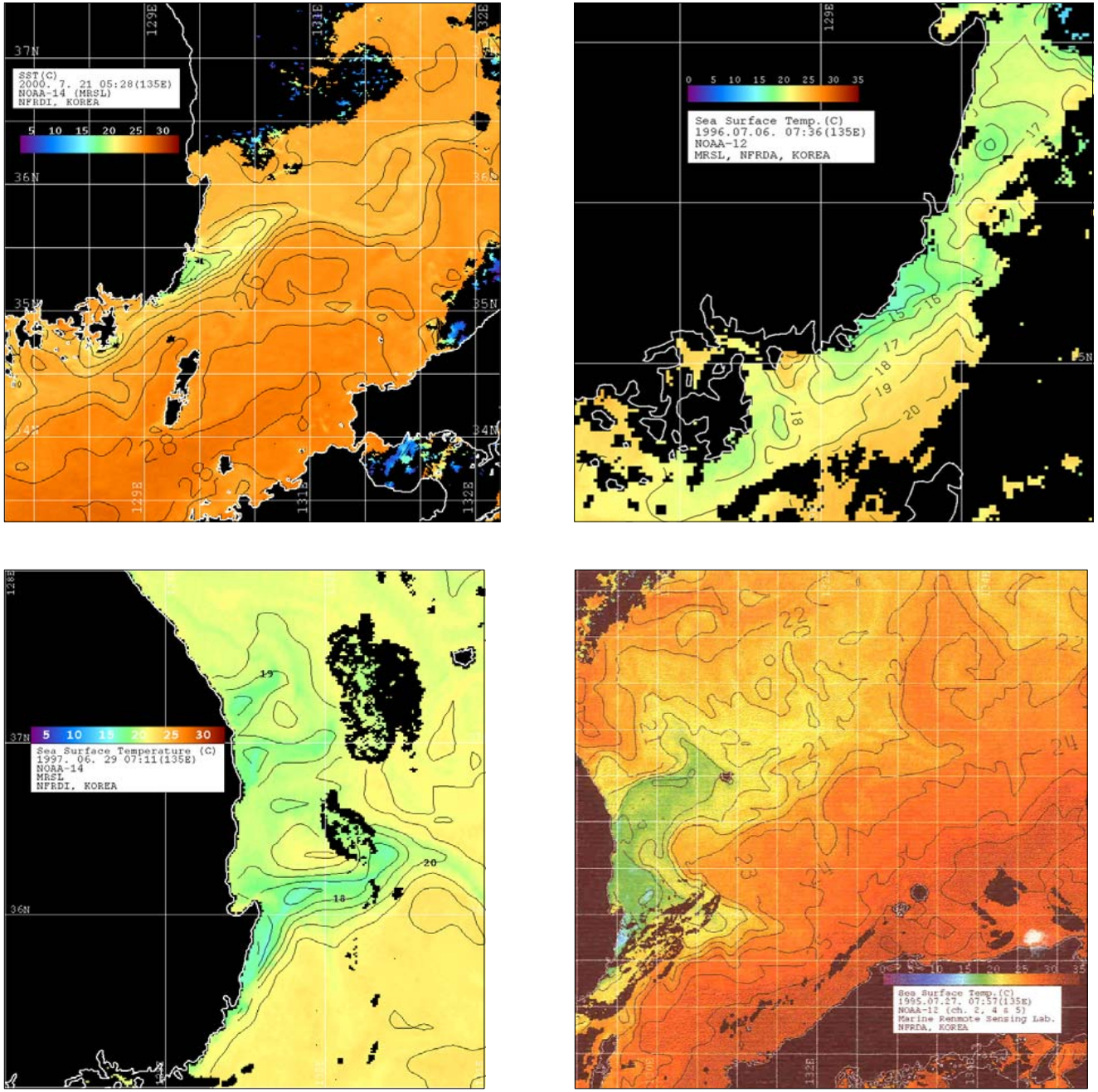


Fig. . Distribution of cold water temperature derived from NOAA satellite (Suh *et al.*, 2001).

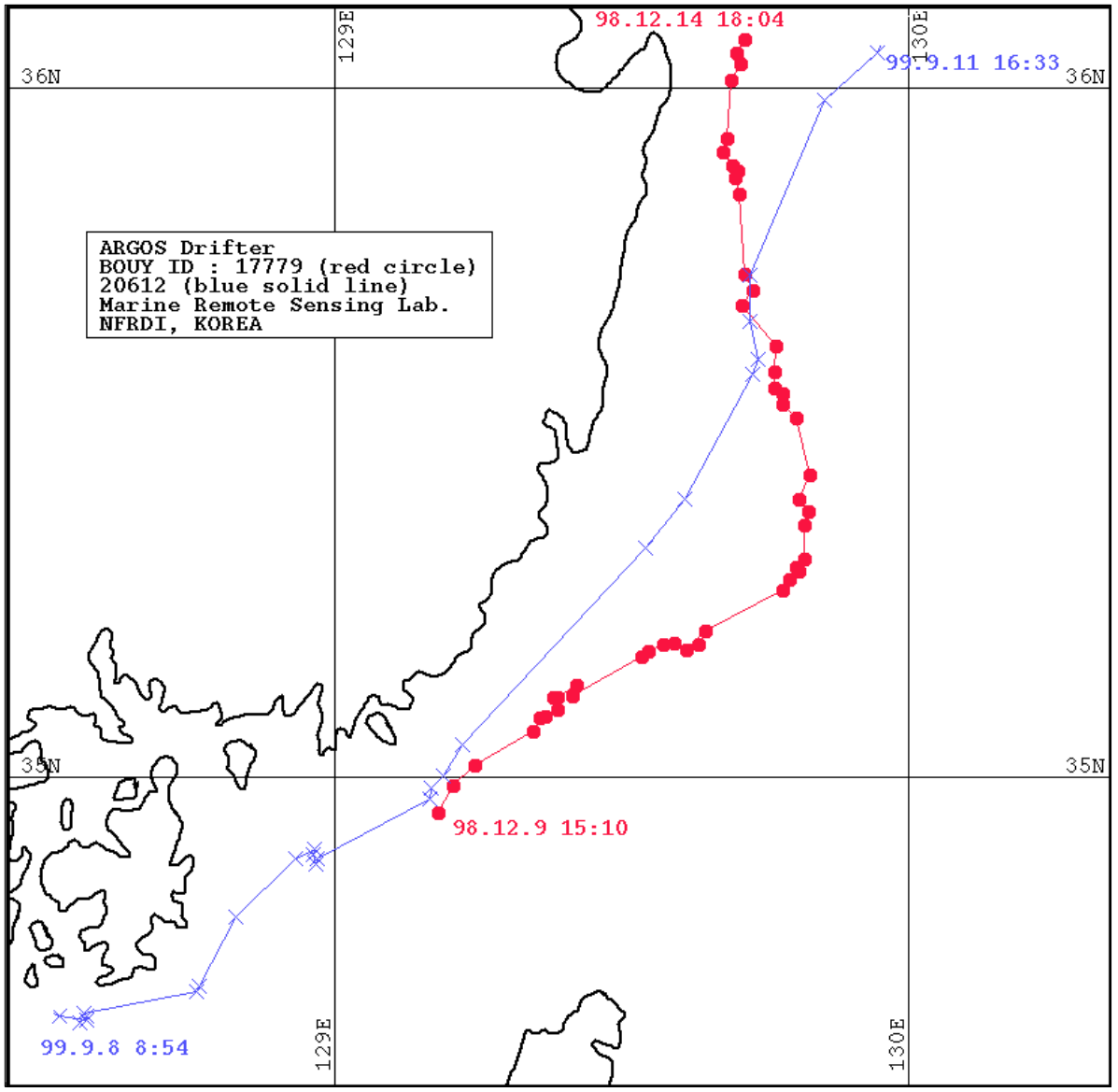


Fig. . Trajectory of the ARGOS drifters along the southeastern coast of Korea during Dec. 9-14, 1998 and Sept. 8-11, 1999 (Suh *et al.*, 2001).

$$\Phi = \frac{\zeta + f}{H} = \text{Constant}$$

Φ : Potential vorticity

ζ : Relative vorticity $(\partial v/\partial x - \partial u/\partial y)$

f : Coriolis parameter ($2\Omega \sin\phi$)

H : Height of water column (m)

Calibration and Validation

of Satellite Data

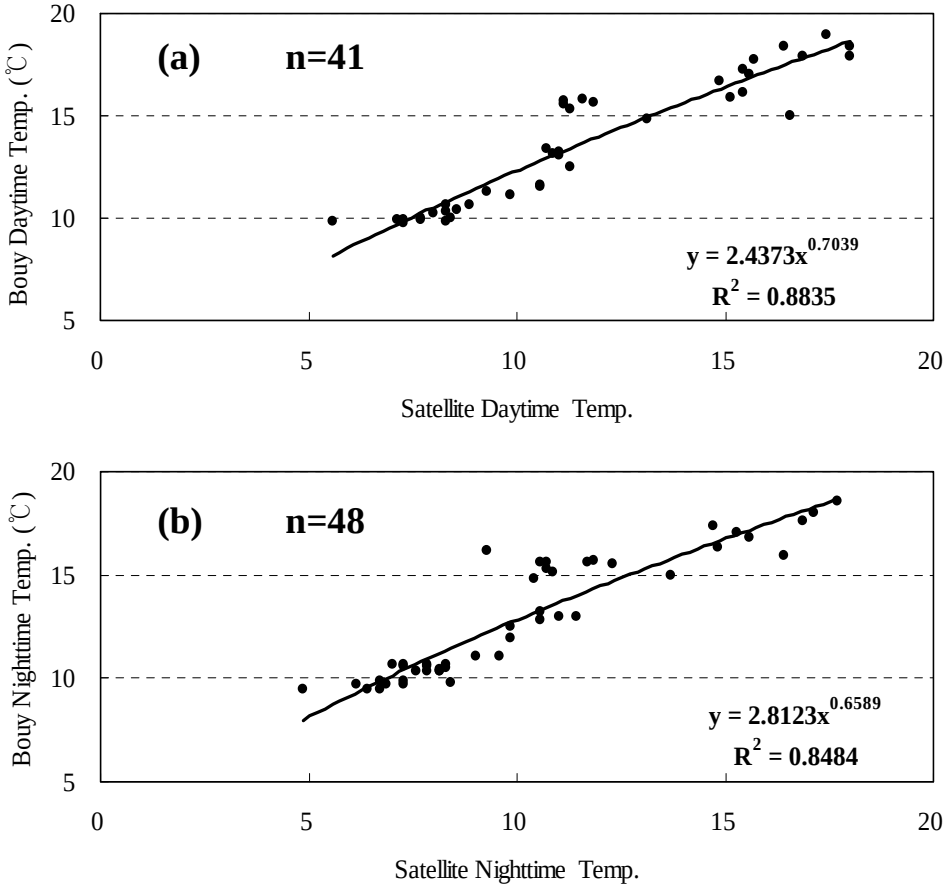
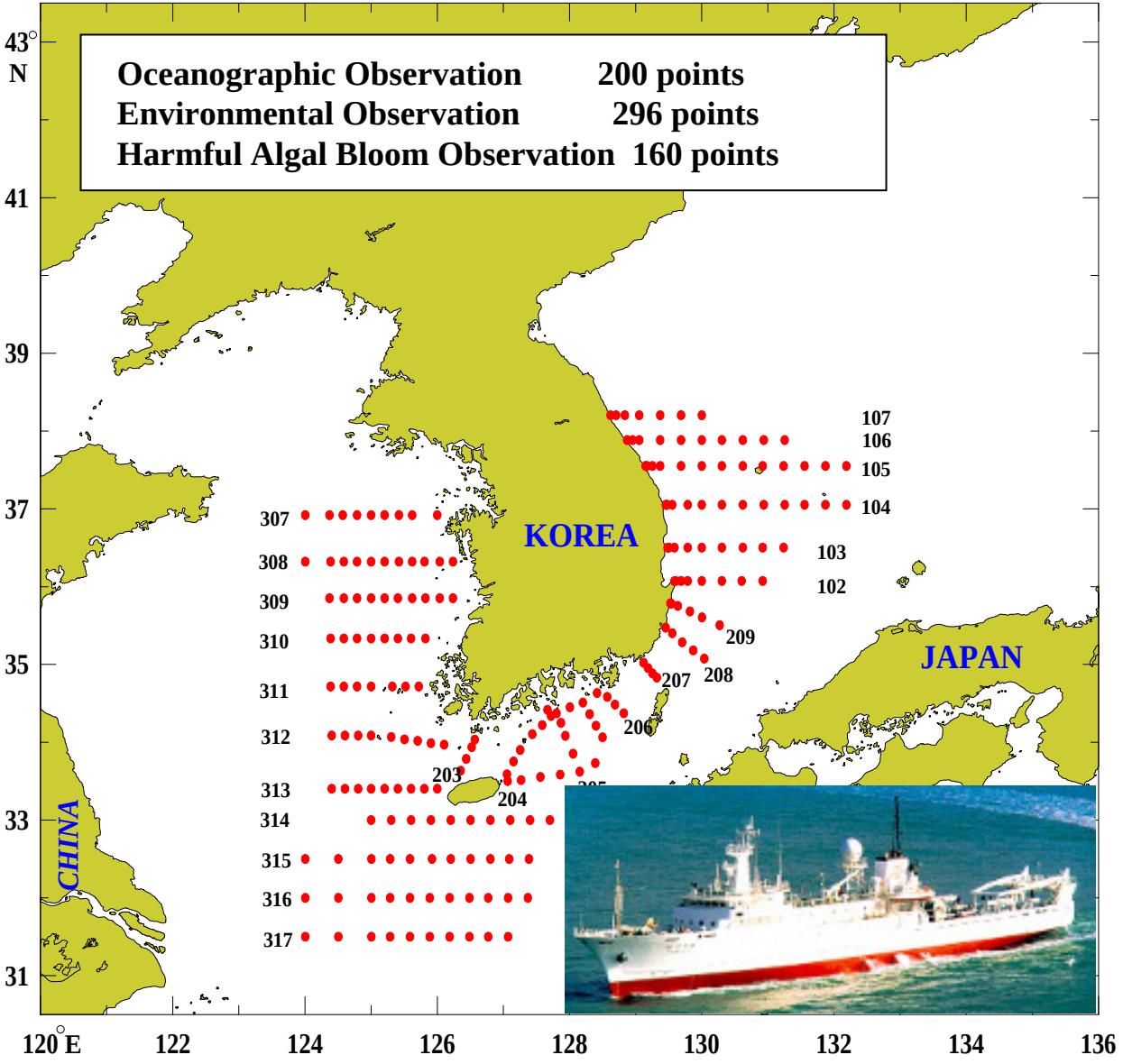


Fig. 2-2-9. Scatter plot and correlation equation between temerature from ARGOS drifter buoy (ID : 17779) and sea surface temperature from NOAA-14 satellite at daytime(a) and nighttime(b) for December 9, 1998 - March 30, 1999.

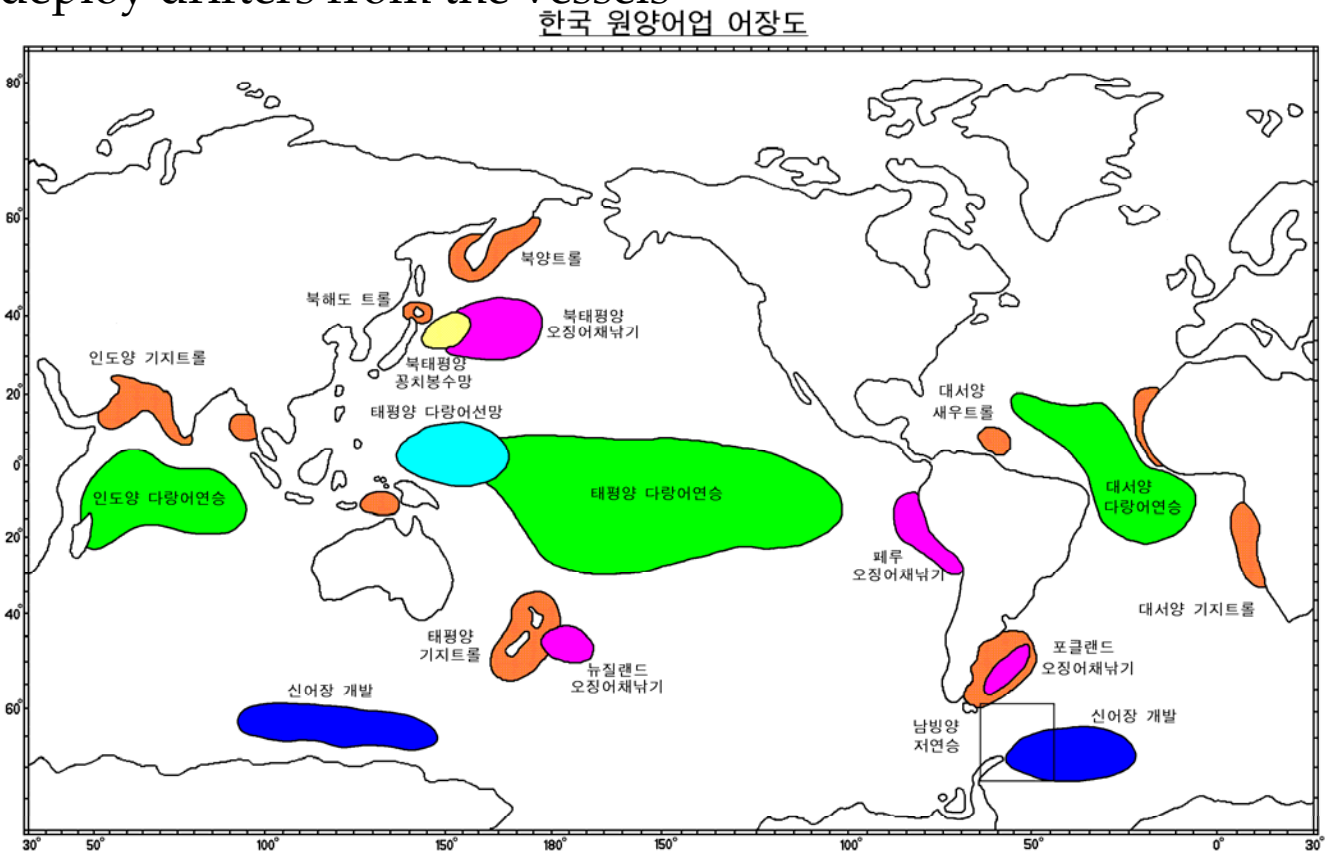
Existing Korean infrastructure for Deploying Satellite -Tracking Drifters in the Future

NFRDI's Ocean Observations System



Korean Fishing activities in the World Ocean

- NFRDI controls ca. 400 long-distance Korean fishing vessels
- We can deploy drifters from the vessels



Tuna purse seine Tuna longline Squid Jigging Trawl

Saury Stick-held dip net New fishing ground

Reference

Suh Y. S., L. H. Jang and J. H. Kim, 2000. Study of a recurring anticyclonic eddy off Wonsan coast in northern Korea using satellite tracking drifter, satellite ocean color and sea surface temperature imagery. J. Korean Remote Sensing, 16(3):211-220.

Suh Y. S., L. H. Jang and D. K. Lee, 2001. Temporal and spatial variation of the sea surface temperature differences derived from Argos drifter between daytime and nighttime in the Whole East Sea. J. Korean Remote Sensing, 17(3):219-230.

Suh Y. S. and J. D. Hwang, 2005. Study on the cold mass occurrence in the eastern coast of the Korean peninsula in summer. Journal of the Environmental Sciences, 14(10):945-953.

Thank you very much

for your attention!