

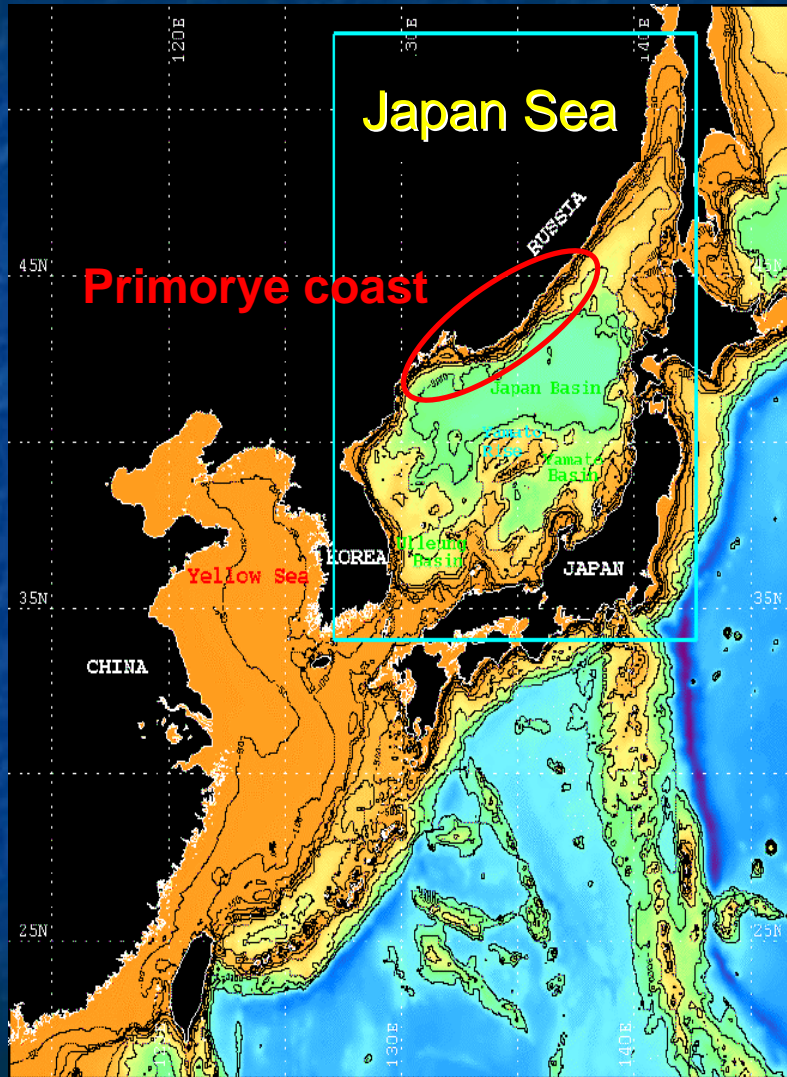
# Mechanisms of Fast Changes in Physical and Biological Fields along Primorye Coast in the Japan Sea

*V.Lobanov, V.Zvalinsky, P.Tishchenko, A.Salyuk,  
S.Ladychenko, S.Zakharkov and Shtraikhert*

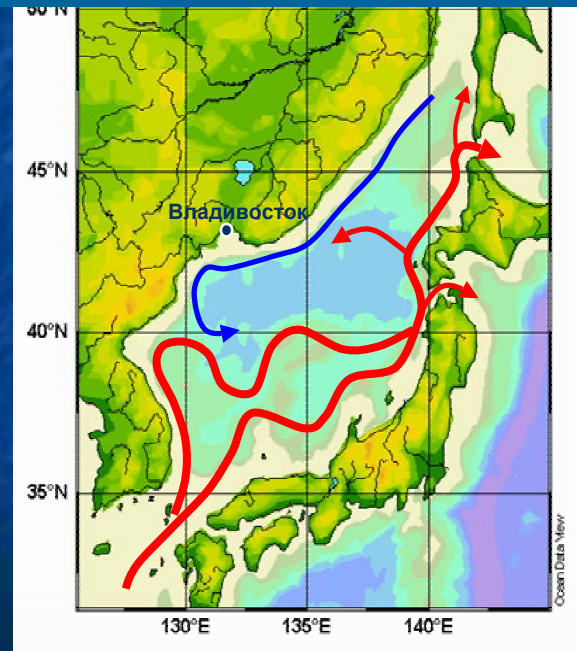
V.I.Il'ichev Pacific Oceanological Institute, Far Eastern Branch,  
Russian Academy of Sciences, Vladivostok, Russia



# Main geographic features



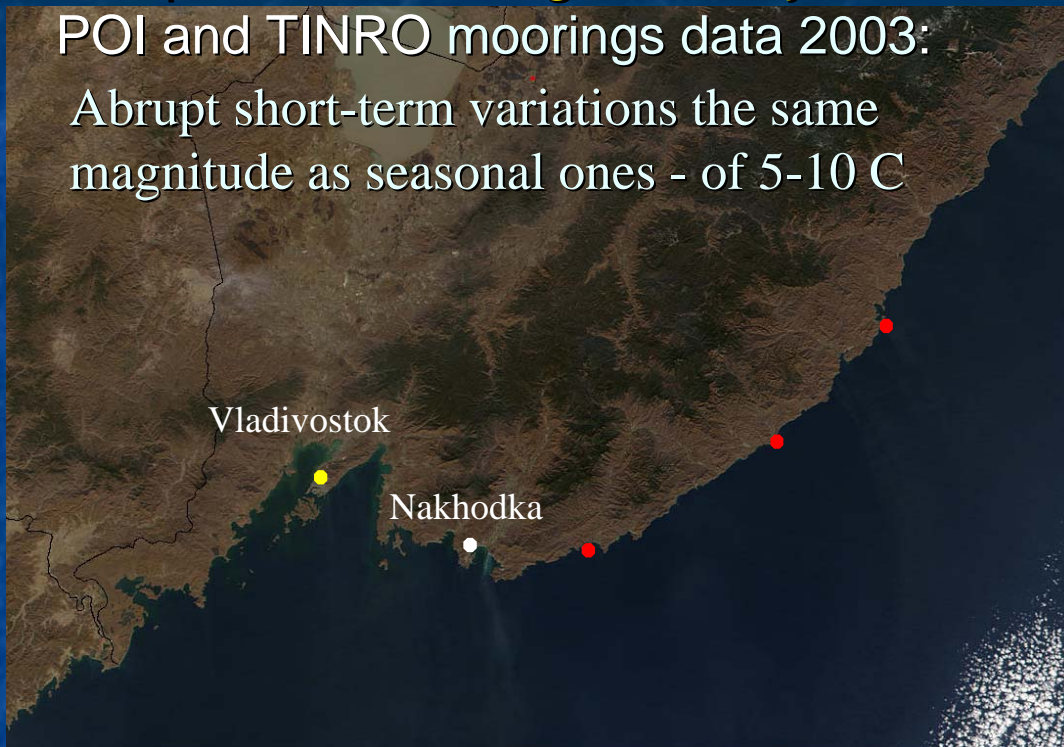
- Deep semi-isolated basin (3500 m), narrow shelf
- Along slope current, shelf waves, coastal eddies
- Monsoon winds, upwelling
- Strong seasonal variation of SST, SSS and stratification



# Short-term variation of water temperature along Primorye Coast

POI and TINRO moorings data 2003:

Abrupt short-term variations the same magnitude as seasonal ones - of 5-10 C



Major impact on :

- Fishery and aquaculture (sea-urchin, laminaria, shell-fishes)
- Biodiversity
- Recreation and health etc.



30.08

18.10



# Objectives

to understand main physical processes responsible for abrupt changes of water circulation, stratification and biological parameters along Primorye coast in Fall season

## Data

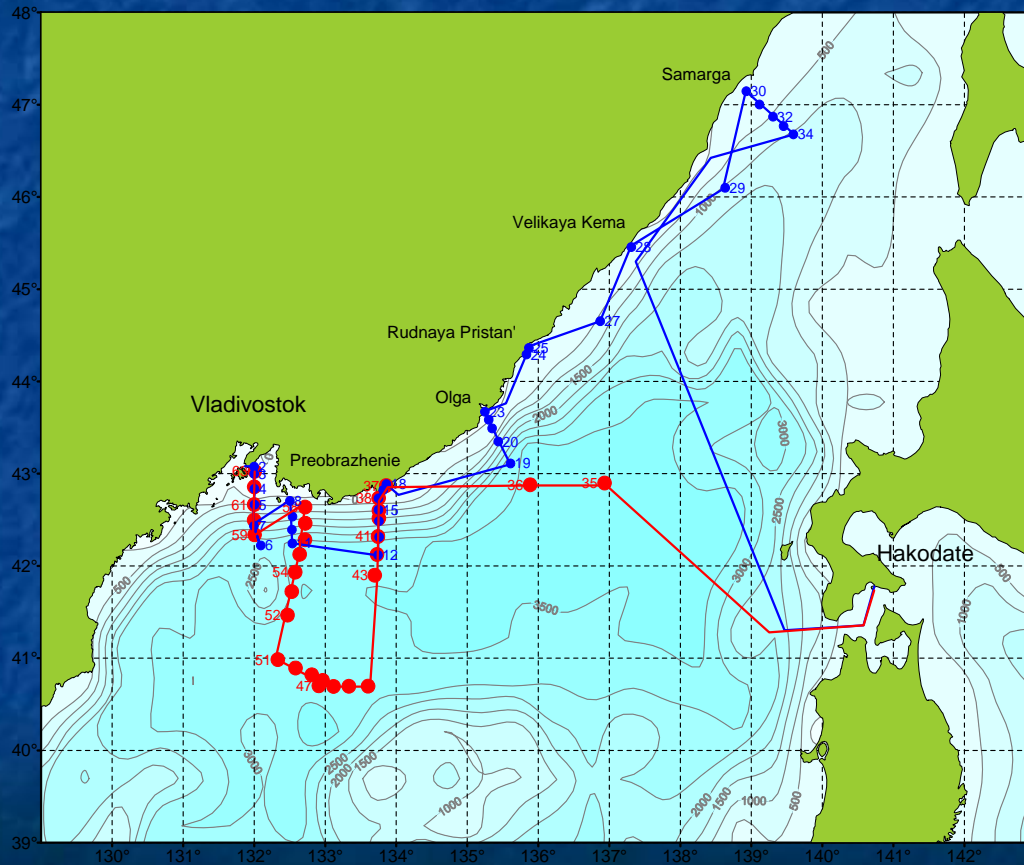
- two repeated ship surveys October 12-November 4, 2000 (CTD, chemical and plankton sampling)
- NOAA AVHRR infrared images
- SeaWiFS ocean color images
- hydrometeorological data

# PICES JES Cruise 2000

PICES JES Cruise 2000, *r/v Professor Gagarinskiy*

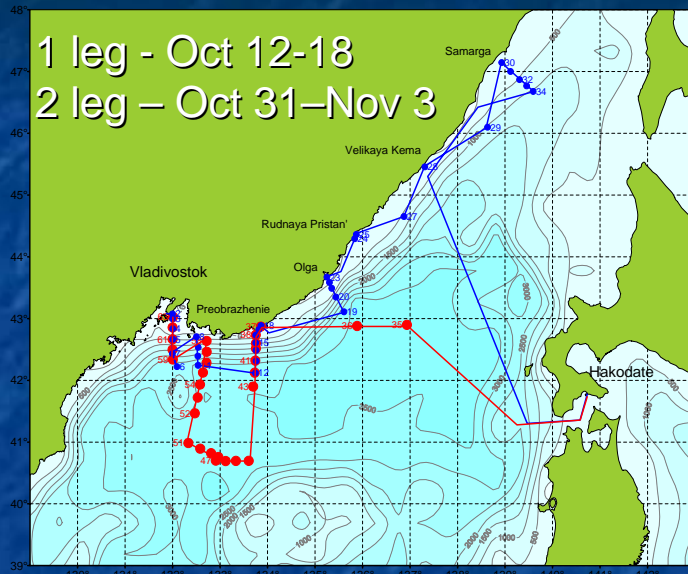
1 leg - Oct 12-18 (blue line)

2 leg – Oct 31–Nov 3 (red line)

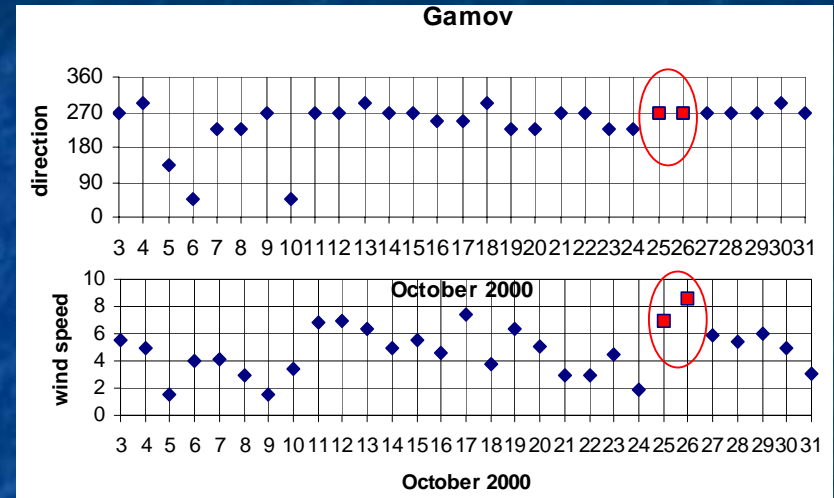


Measurements:  
CTD,  
DO,  
Nitrates,  
Nitrites,  
Phosphates,  
Silica,  
pH, Alkalinity,  
Chl-a, DF, PP,  
plankton

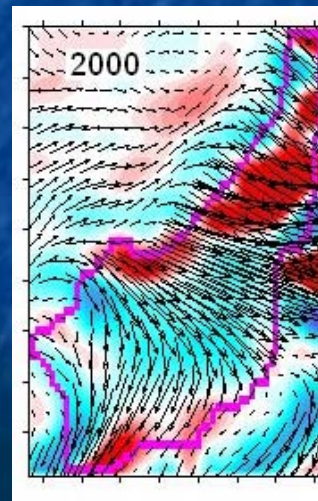
# Upwelling Winds



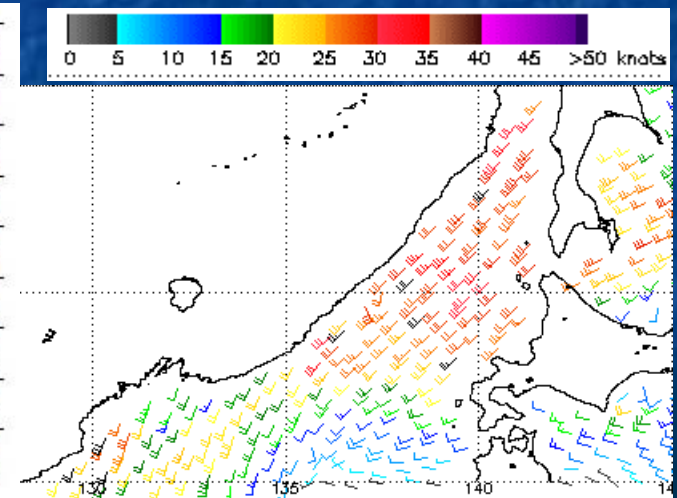
Coastal station



NCEP/NCAR Oct.

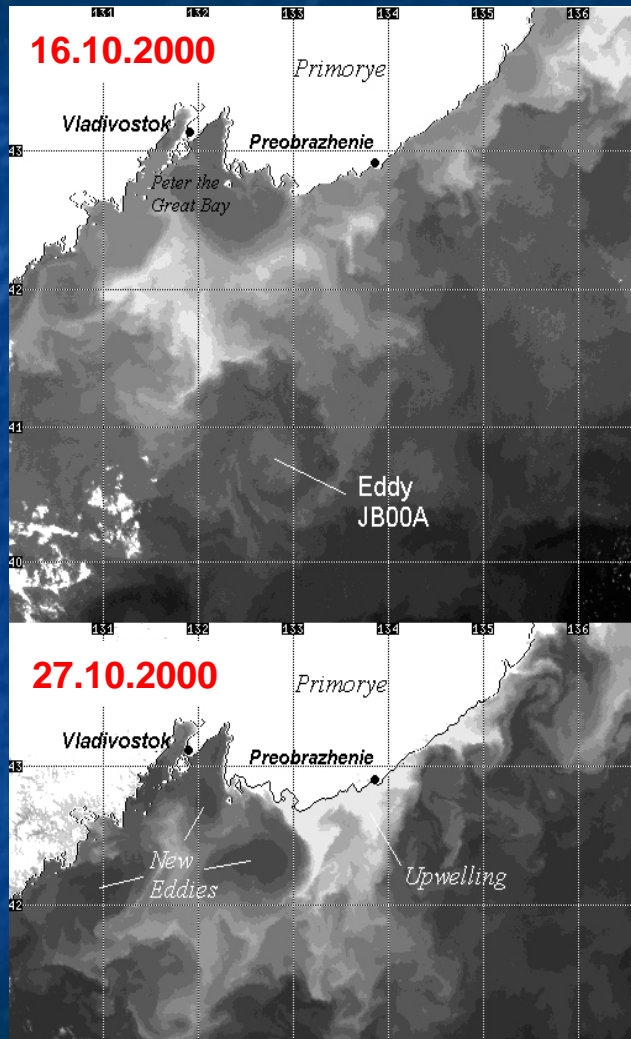


QuickScat



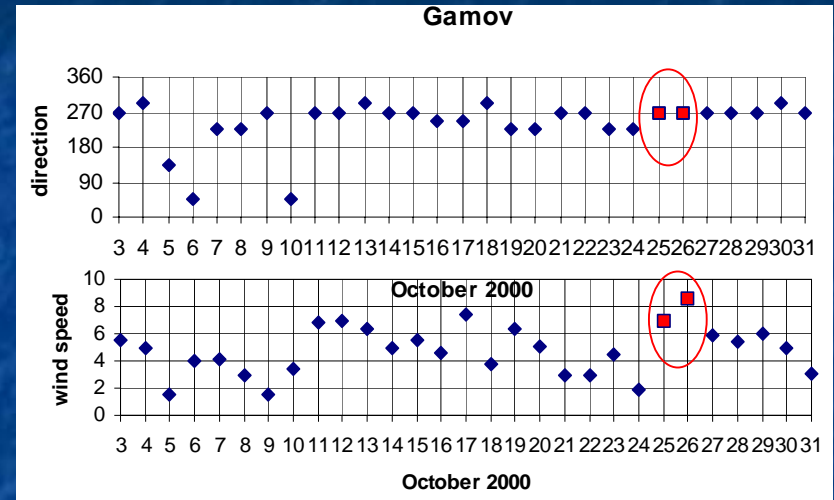


# SST Changes on Satellite Images

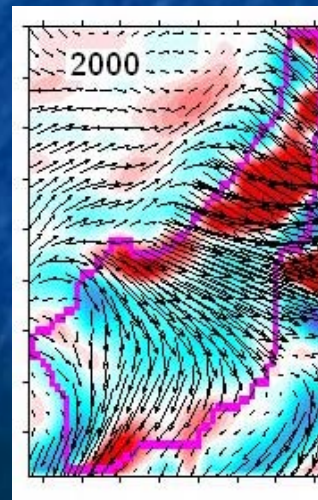


Formation of coastal eddies and upwelling event off Primorye on NOAA AVHRR infrared images

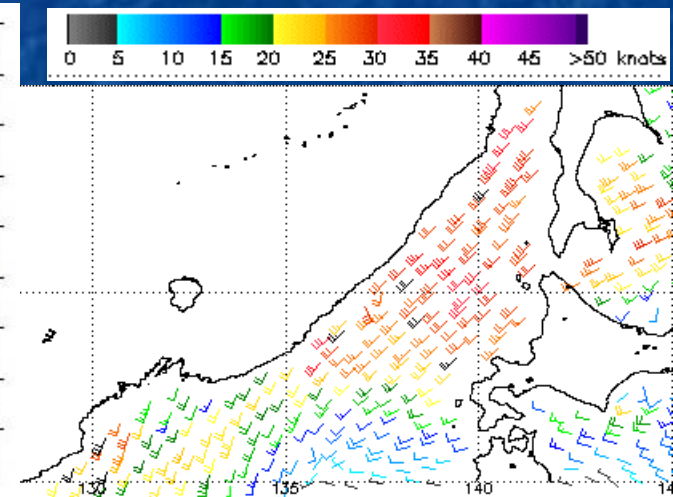
Coastal station



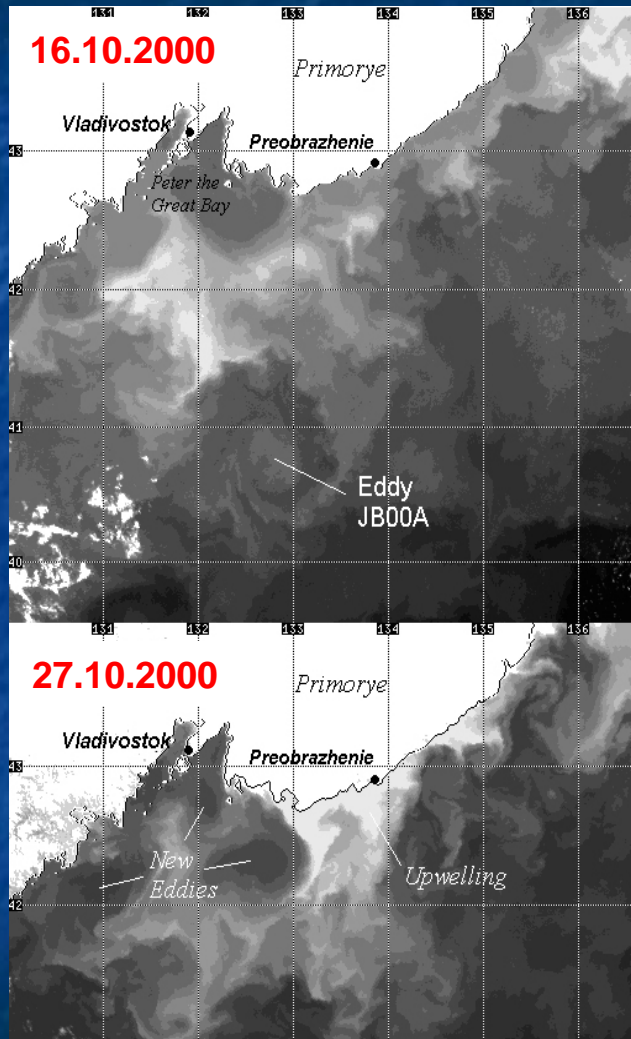
NCEP/NCAR Oct.



QuickScat

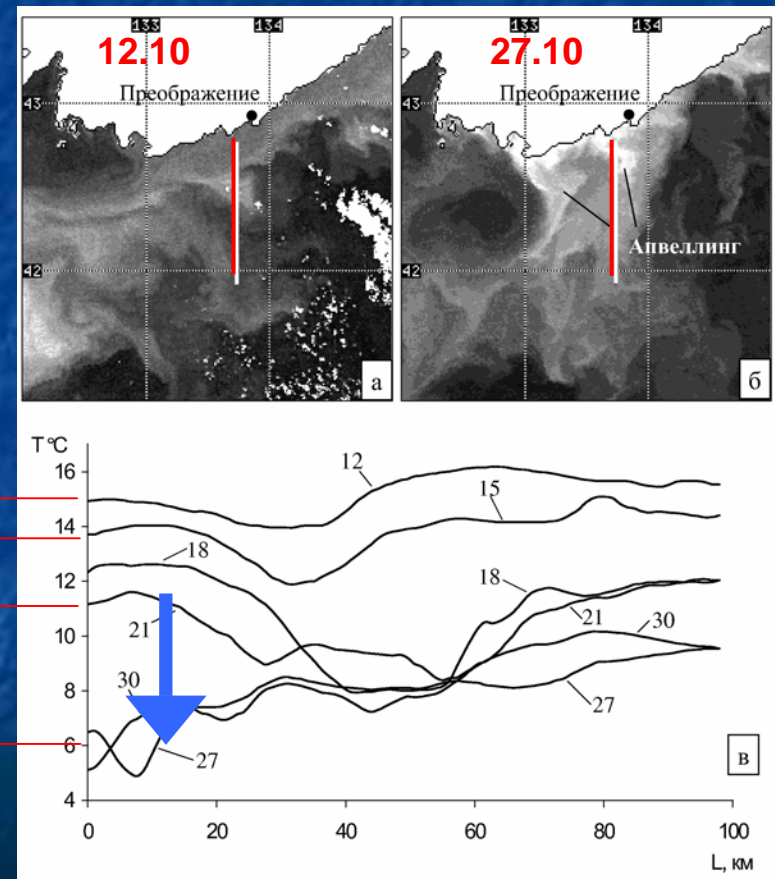


# SST Changes on Satellite Images



Formation of coastal eddies and upwelling event off Primorye on NOAA AVHRR infrared images

- Wind induced upwelling
- Mesoscale eddies formation
- Fast cooling, convection

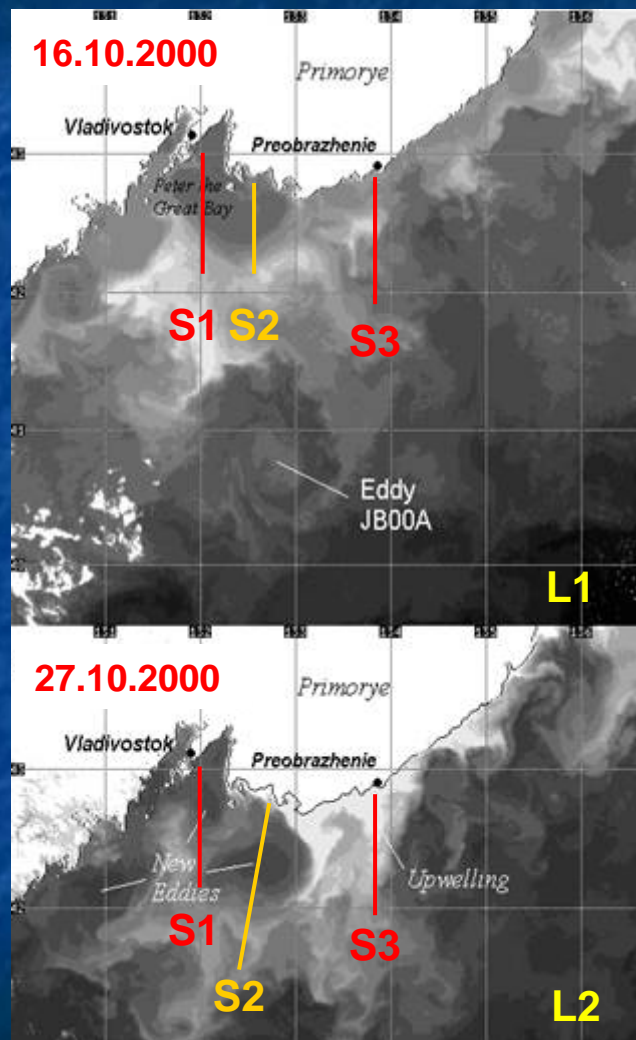


Slow decrease of SST on the shelf 12-21 and fast drop 21-27.10

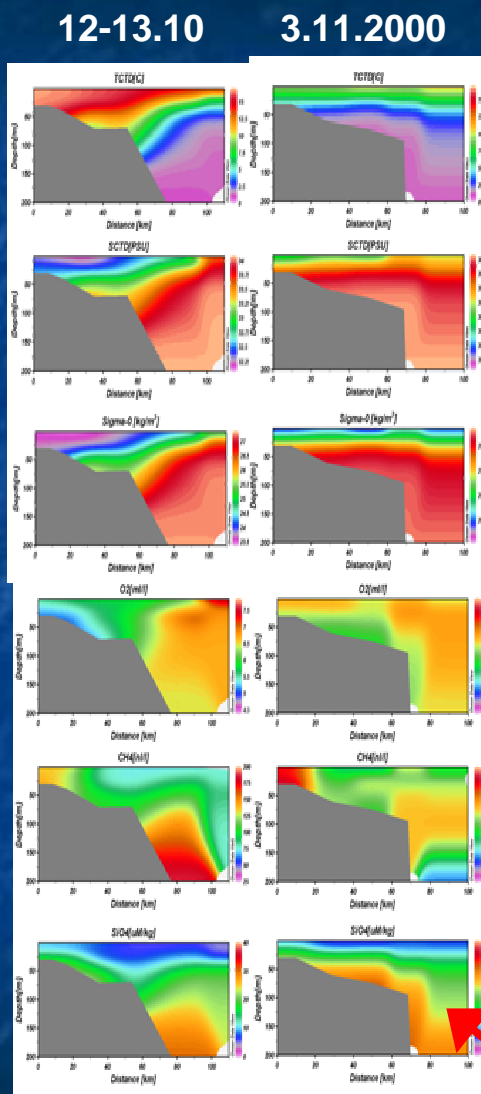


# Hydrographic sections:

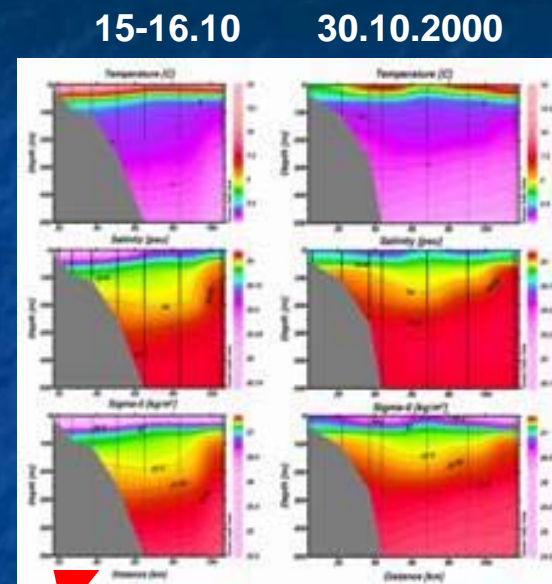
different changes in subsurface layers at coastal stations



Formation of coastal eddies and upwelling event off Primorye on NOAA AVHRR infrared images



Changes in T, S, density and nutrients along the sections S1 and S3 over 2-3 weeks period



**S3:** Upwelling and convective mixing off Preobrazhenie (134E)

$\Delta T, ^\circ\text{C}$	S1	S3
10 m	3.5	5.2
50 m	9.6	0.5

**S1:** Intrusion of deep sea water onto the shelf of Peter the Great Bay

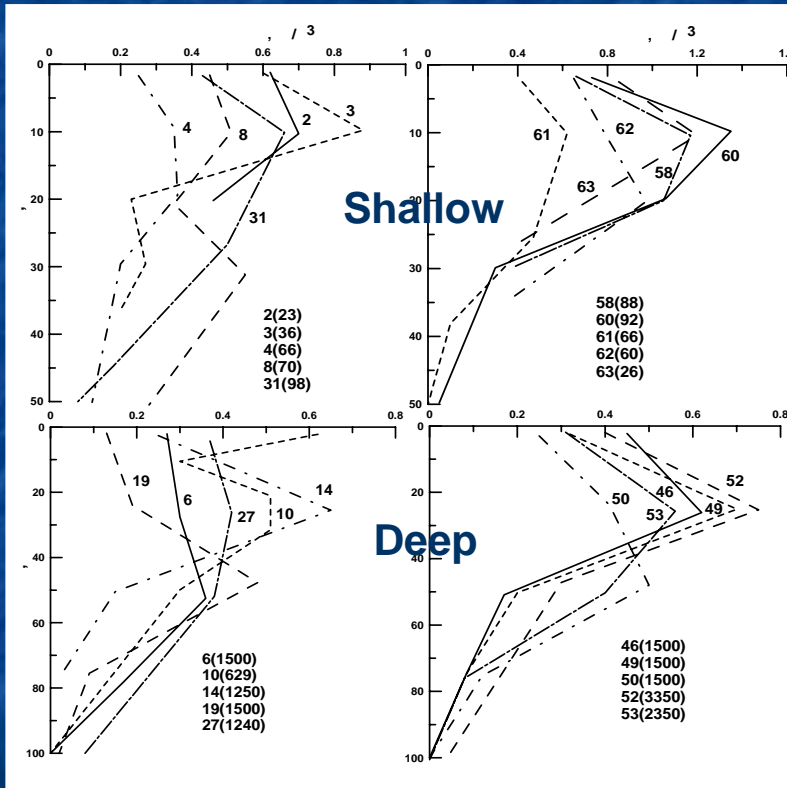
# Chl-a and Primary Production

Chl-a – filtration and spectrometer;

Photic layer depth – Secchi disc;

PP – radiocarbon marker, PP- calculated on Chl-a, DF, Asn, FIn, PAR (Zvalinsky et al., 1988, 2002);

Nutrients, pH, Talk (pCO<sub>2</sub>, DIC)



**L1**

**L2**

Vertical profiles of Chl a – increase and deepening of max at shallow stations

	Shallow		Deep		Total
Leg	L1	L2	L1	L2	L1+L2
Chl (mg/m <sup>3</sup> )	0.47	0.77 164%	0.37	0.43 116%	0.45
Chl (mg/m <sup>2</sup> )	15.0	21.4	18.5	22.7	19.5
Range	8 – 22	13 – 28 143%	13 – 28	12–30 123%	8 – 30
Daylight, (hour)	11.1– 10.8	10.1 – 10.0	11.1 – 10.7	10.2 – 10.0	11.1 – 10.0
PAR (mol/m <sup>2</sup> d)	28 – 27	23 – 22	28 – 26	23– 22	28 – 22
PP(mgC/m <sup>2</sup> d)	268	370	356	377	325
Range	120- 400	240–420 138%	250–450	210–520 106%	120– 520

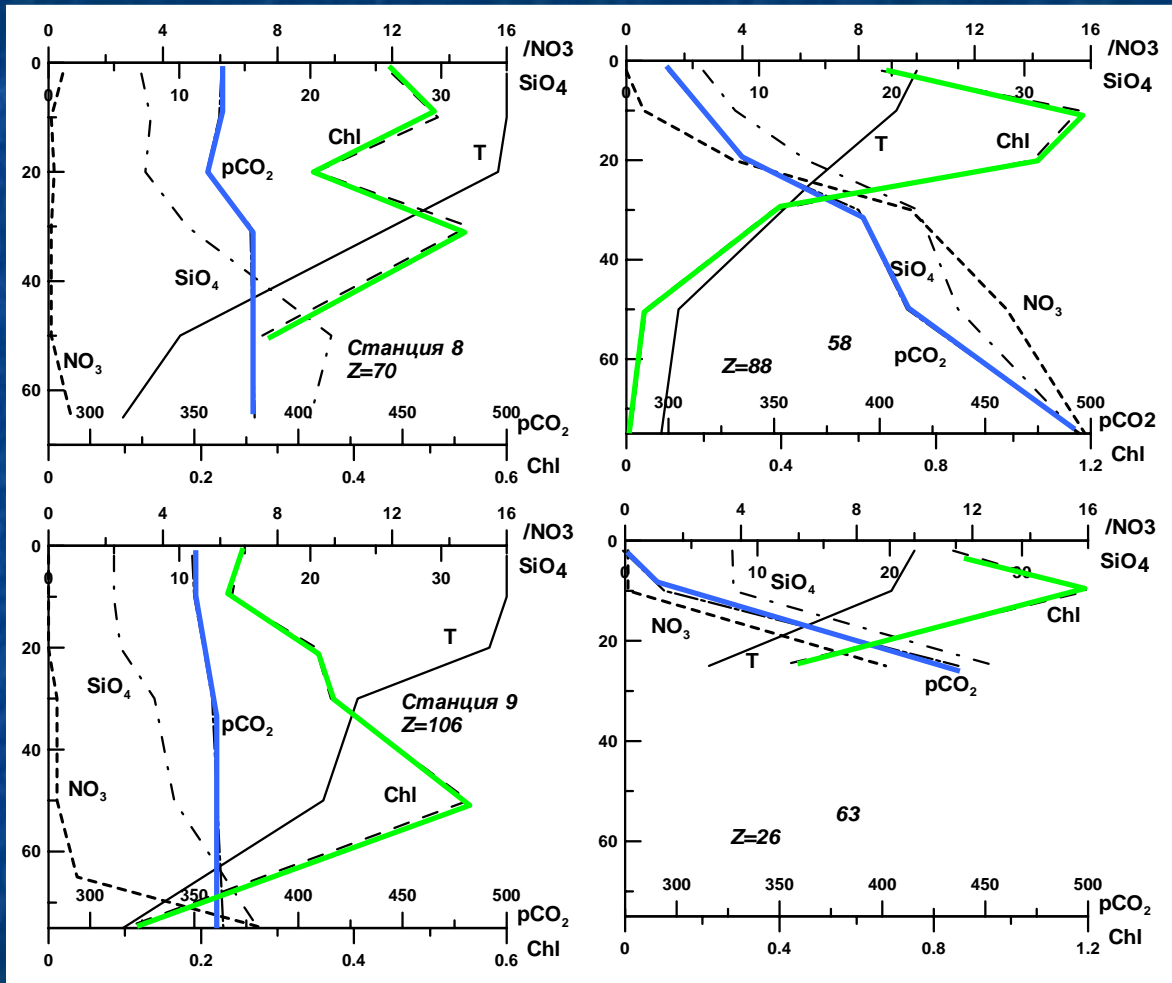
**Increase of Chl and PP between L1 and L2 by ~40-60% in the shelf area**



# Chl-a, pCO<sub>2</sub>, Nutrients

L1

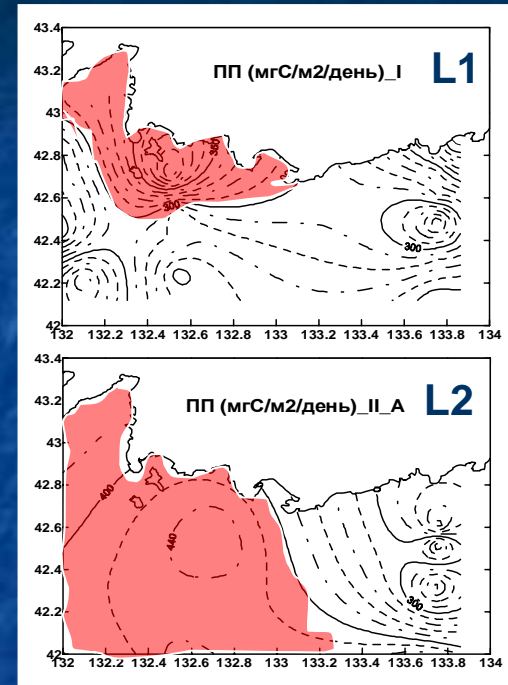
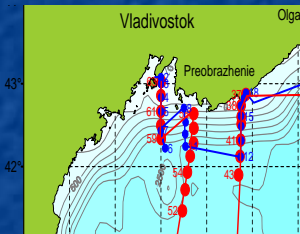
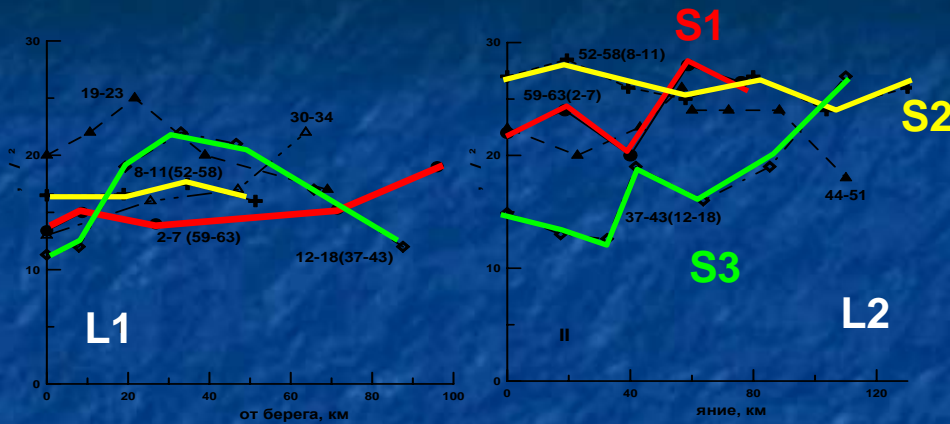
L2



- Gradual increase of nutrients by L2 caused by weakened stratification and uplift of pycnocline
- L1: PP was limited by low nutrients, esp. Nitrates
- pCO<sub>2</sub> profiles: increased production in upper layer and destruction in lower layer on L2

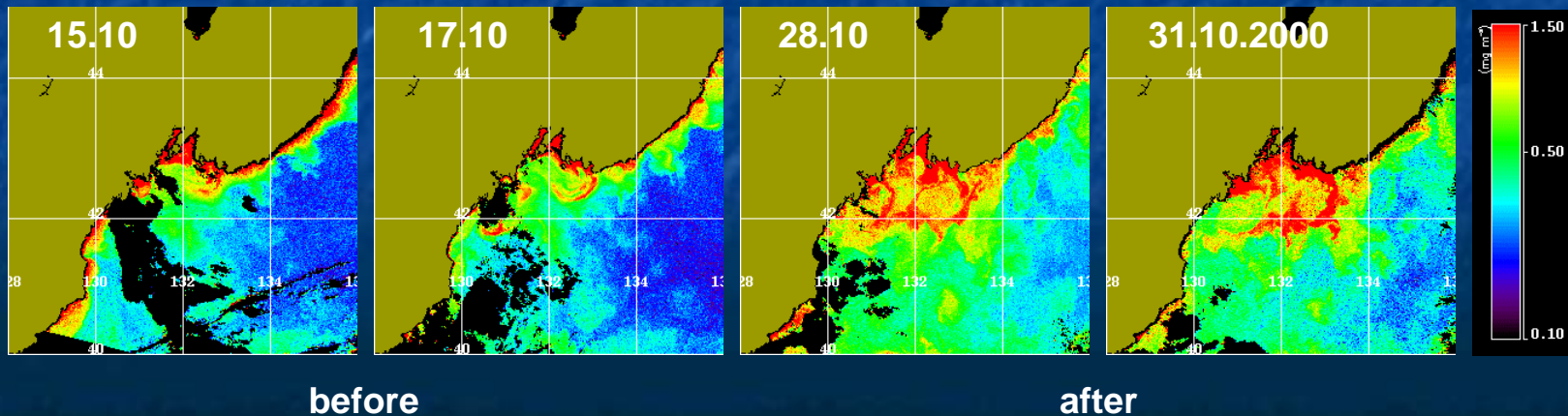
Vertical profiles of T, pCO<sub>2</sub>, NO<sub>3</sub>, SiO<sub>4</sub> and Chl a for some stations before and after upwelling

# Chl-a and Primary Production



Chl a – SeaWiFS data

Primary Production in a photic layer

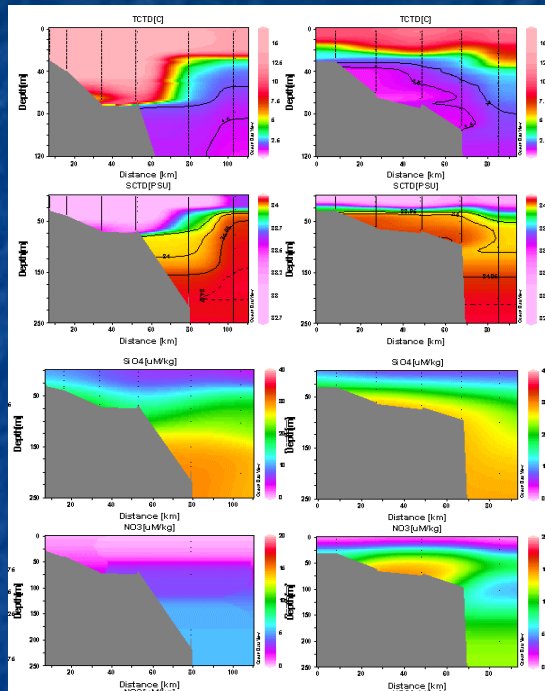




# Changes in water mass structure and stratification: upwelling, eddies and convection

S1

S3

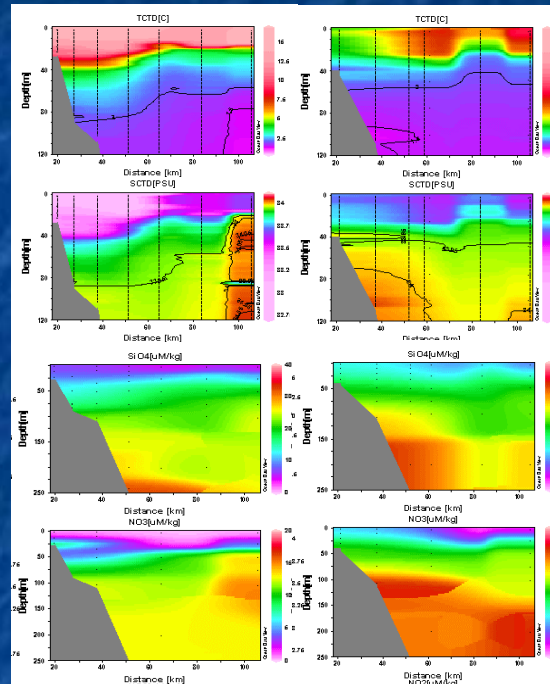


before

after

Intrusion area, wide shelf:

- Uplift of pycnocline
- Mixing of upper layer
- Nutrients supply
- Decrease MLD



before

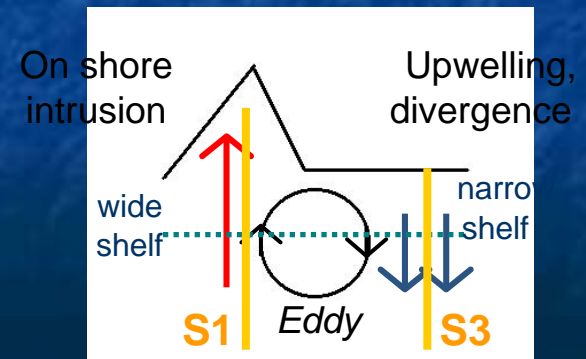
after

Upwelling area, narrow shelf:

- Vertical mixing
- Decrease stratification
- Nutrients supply
- Increase MLD

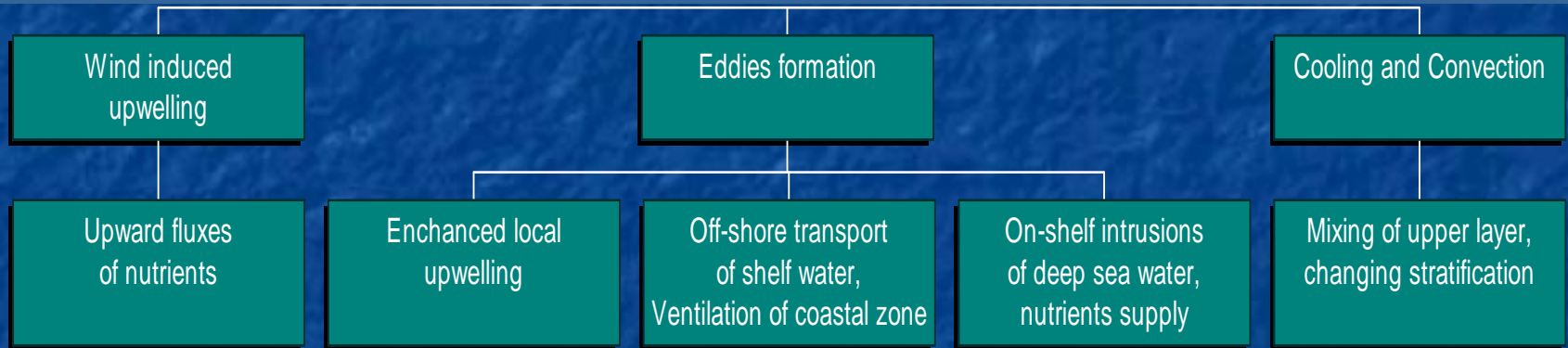
$\Delta T, ^\circ\text{C}$	S1	S3
10 m	3.5	5.2
50 m	9.6	0.5

MLD, m	S1	S3
L1	55	30
L2	35	35



# Conclusion

1. The major processes responsible for abrupt changes of physical and biological parameters of the Primorye coast in Fall season are:



2. These may have both positive and negative impact on ecosystem
  - enrichment processes (mixing, upwelling, etc.)
  - concentration processes (convergence, frontal shear, water column stability, etc.)
  - processes favoring retention within (or drift toward) appropriate habitat.
  - abrupt decrease of T during spawning period – mortality of laminaria seeds and sea urchin larvae
  - enhanced cross shelf transport – dispersal of larvae off the shelf, decrease of future stocks.



A scenic landscape photograph showing a coastline. In the foreground, a lush green forested hillside slopes down towards the water. The middle ground features a small, rocky island with a few trees, situated in a calm bay. The background shows the vast blue ocean meeting a clear, light blue sky at the horizon. The text "Thank you!" is overlaid in the center of the image.

Thank you!