An overview of POI activities under the CREAMS/PICES program in 2006-2011

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CREAMS/PICES Advisory panel:

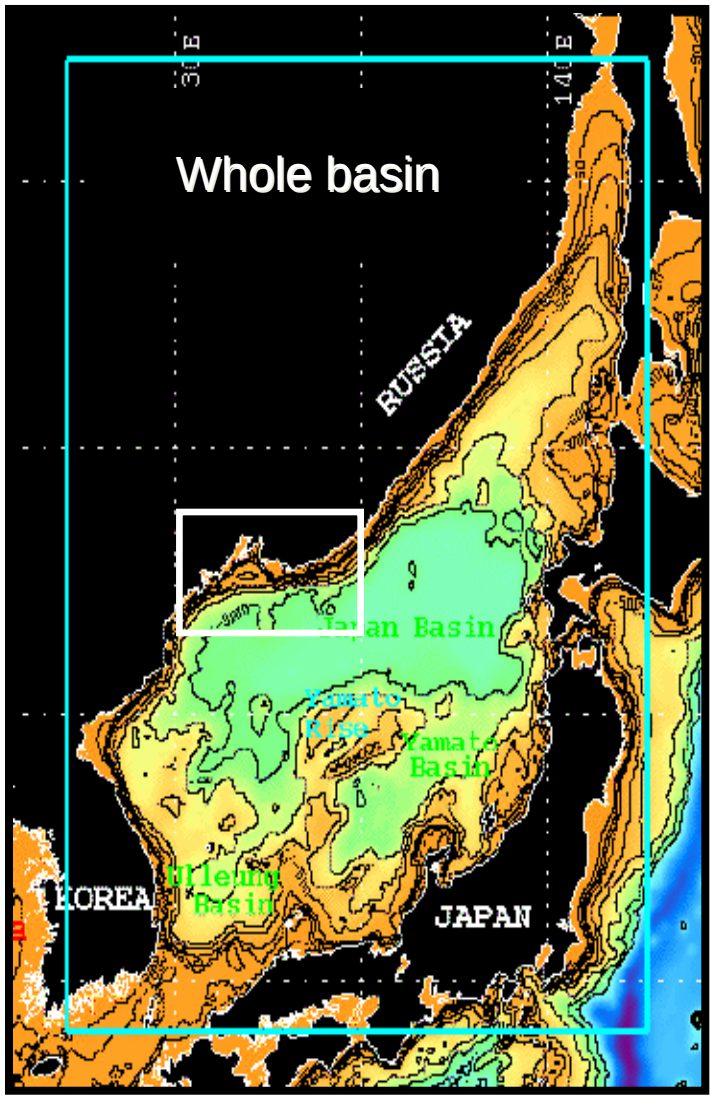
The goal: to initiate and oversee a research program to study and monitor a status and variability of the East Asian Marginal Seas and facilitate observations and data exchange in the area

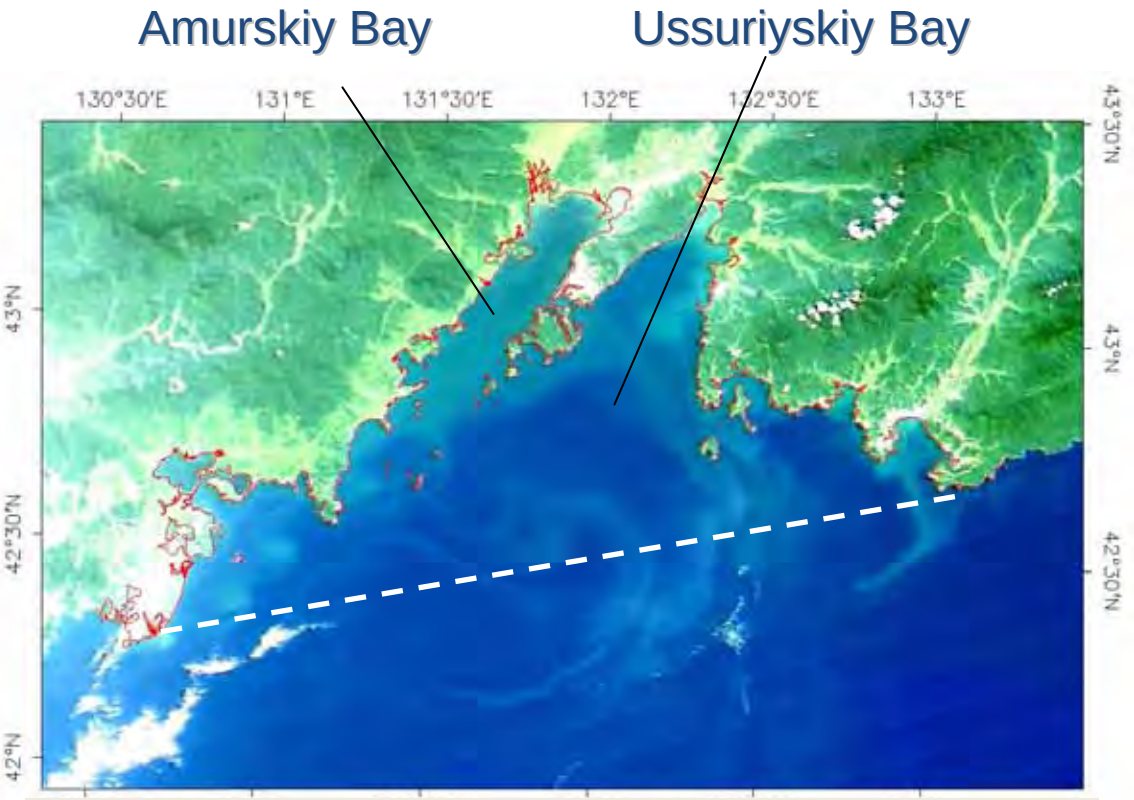
Implementation: through joint international and national projects

Main POI projects under CREAMS/PICES

- Monitoring for climatic changes: (water mass properties, primary production, deep and bottom water formation, etc.)
- Geochemical processes in bottom layer: oxygen depletion zone along continental slope
- Physical and hydrochemical drivers of coastal ecosystem dynamics (incl. PGB hypoxia formation, interaction of shelf and deep sea, Prymorye upwelling, etc.)

Study area





Peter the Great Bay and Primorye shelf area

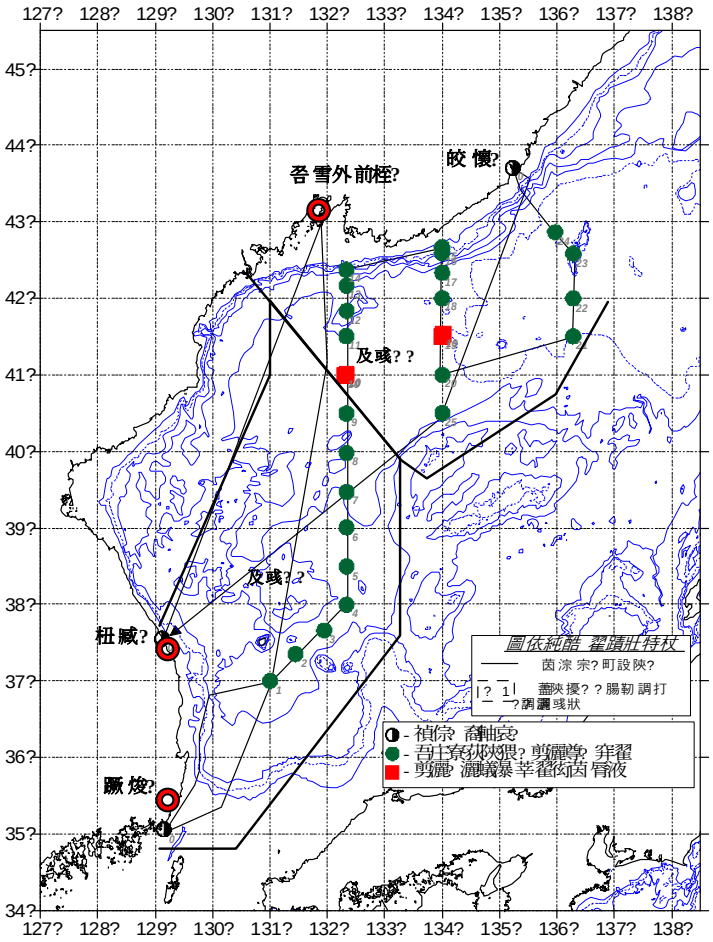
Cruises of 2007-2011 :

- Ga43 cruise (May 2007, jointly with Korean Univ.)
- La46 cruise (July 2009, jointly with Korean Univ.)
- Ga46 cruise (Feb-Mar, 2010, PGB winter processes)
- Ga47 cruise (May, 2010, bottom water renewal)
- KH-10-02 cruise (Jun-Jul, 2010, Asian GEOTRACES)
- La51 cruise (Aug, 2010, shelf/slope deep basin)
- La53 cruise (Oct, 2010, northern area)
- Ga52 cruise (Feb. 2011, PGB winter processes)
- Ga54 cruise (Oct. 2011, shelf mesoscale dynamics)

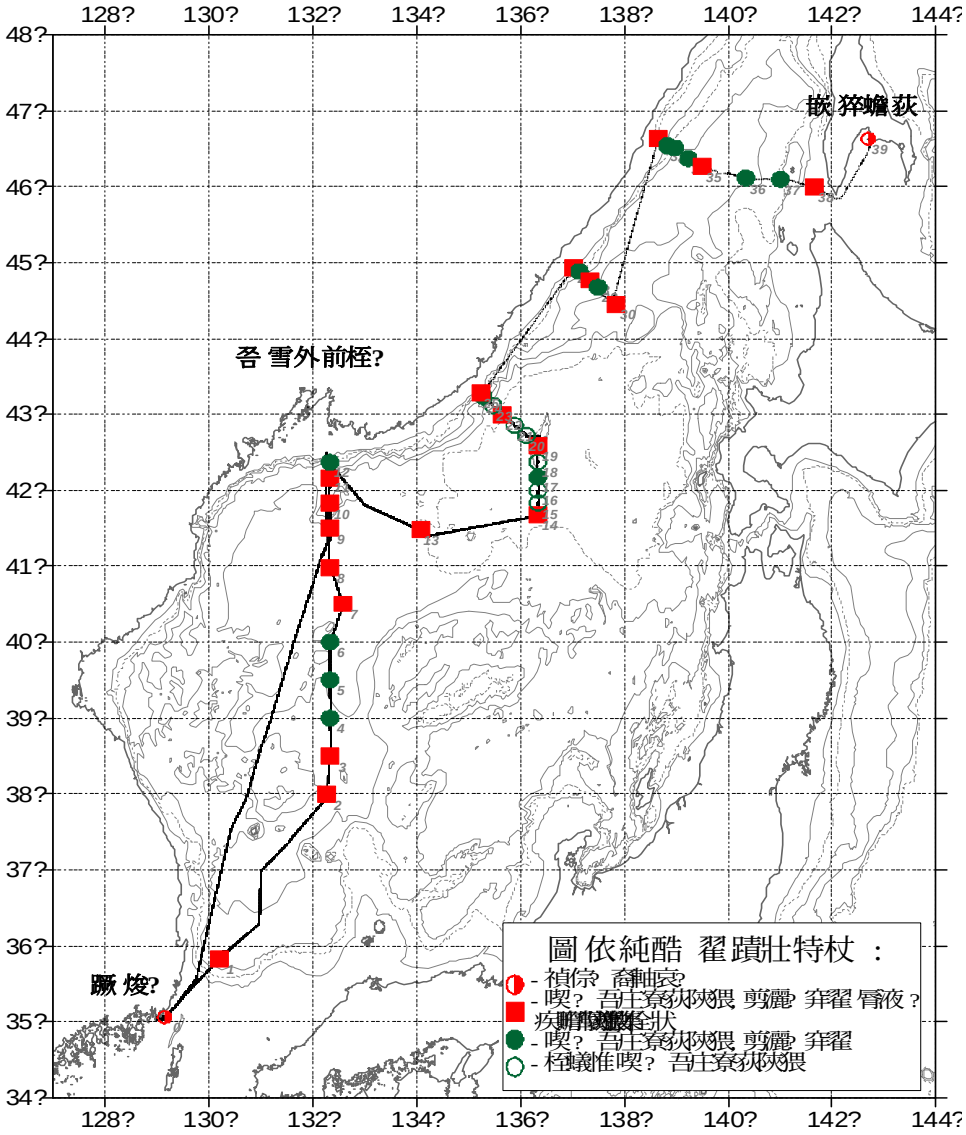
Joint Cruises under EAST-I program 2007, 2009

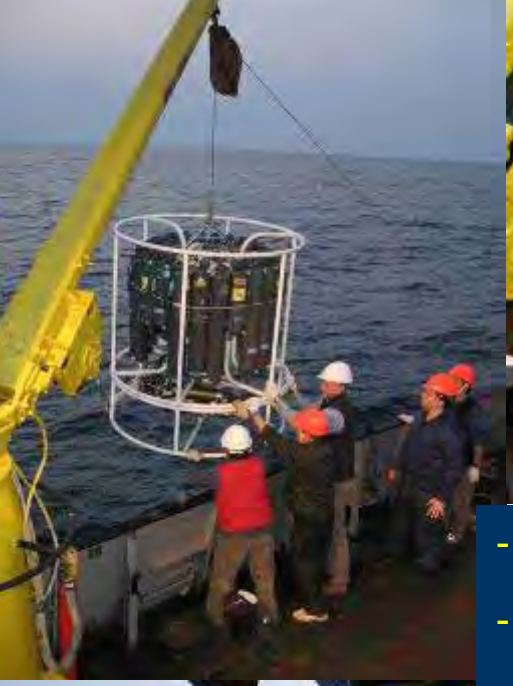
(continuation of collaboration with SNU and other Korean universities started in 2001)

R/V Professor Gagarinskiy, May 2007 (Ga43)



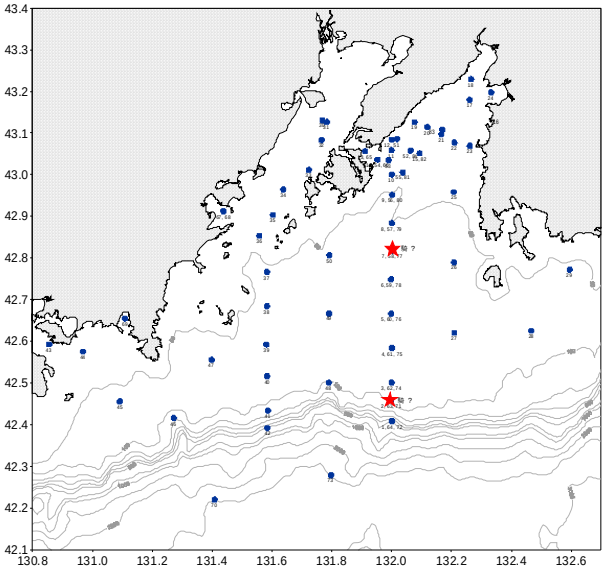
R/V Akademik M.A.Lavrentyev, July 2009 (La46)



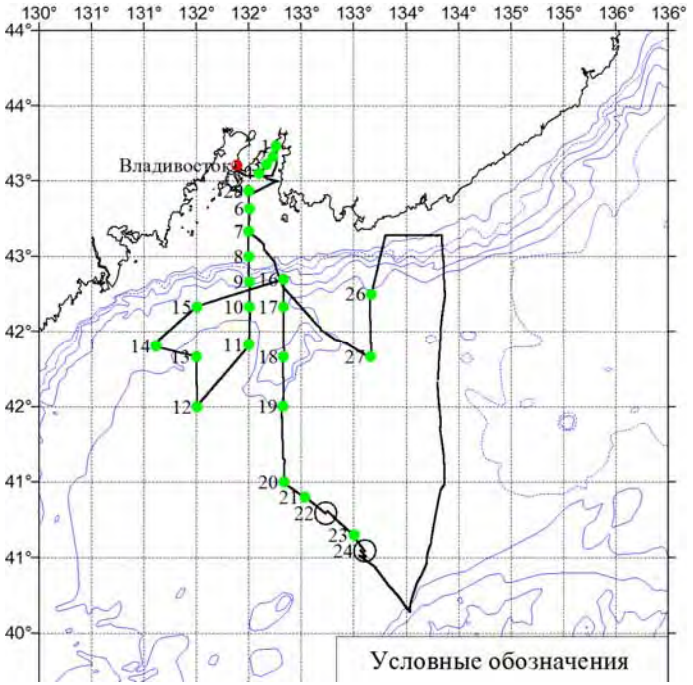


- CTD and bottle sampling
- Plankton nets
- Large volume sampling and filtration
- Underway measurements of T, S, DO, Chl-a, methane and pH
- Underway acoustic backscatter

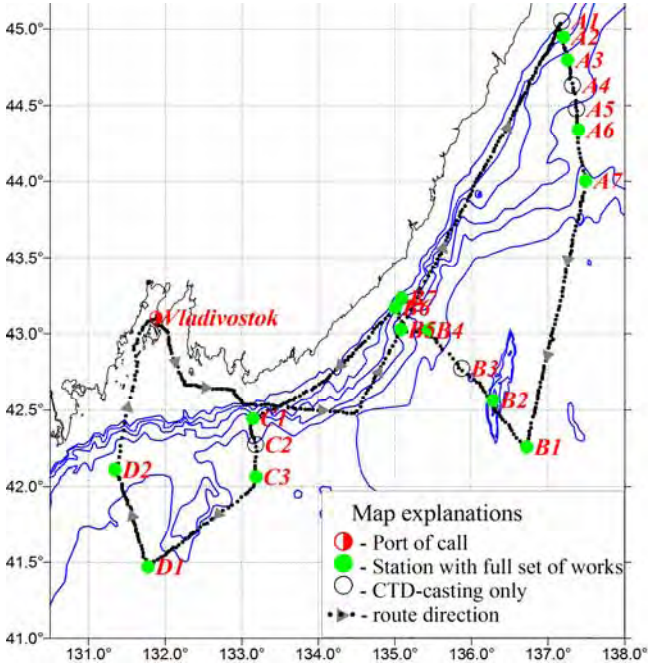
Japan Basin and PGB Surveys in 2010



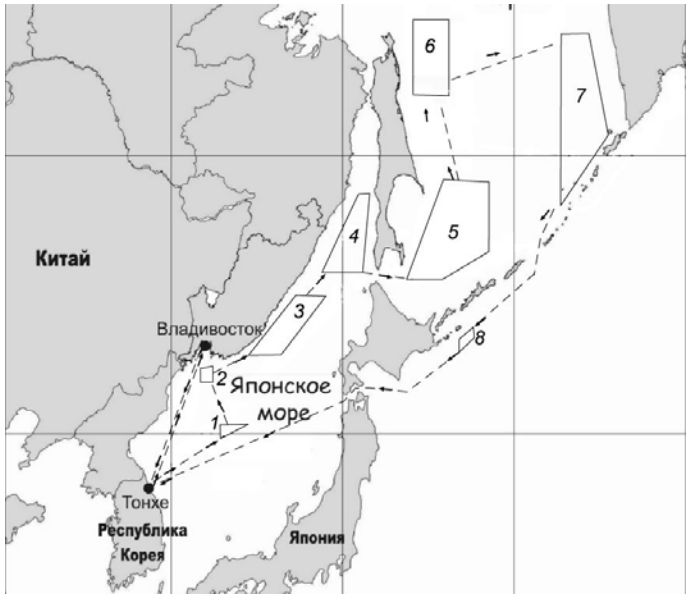
Ga46
Feb 27-
Mar 16



Ga47
May
5-13

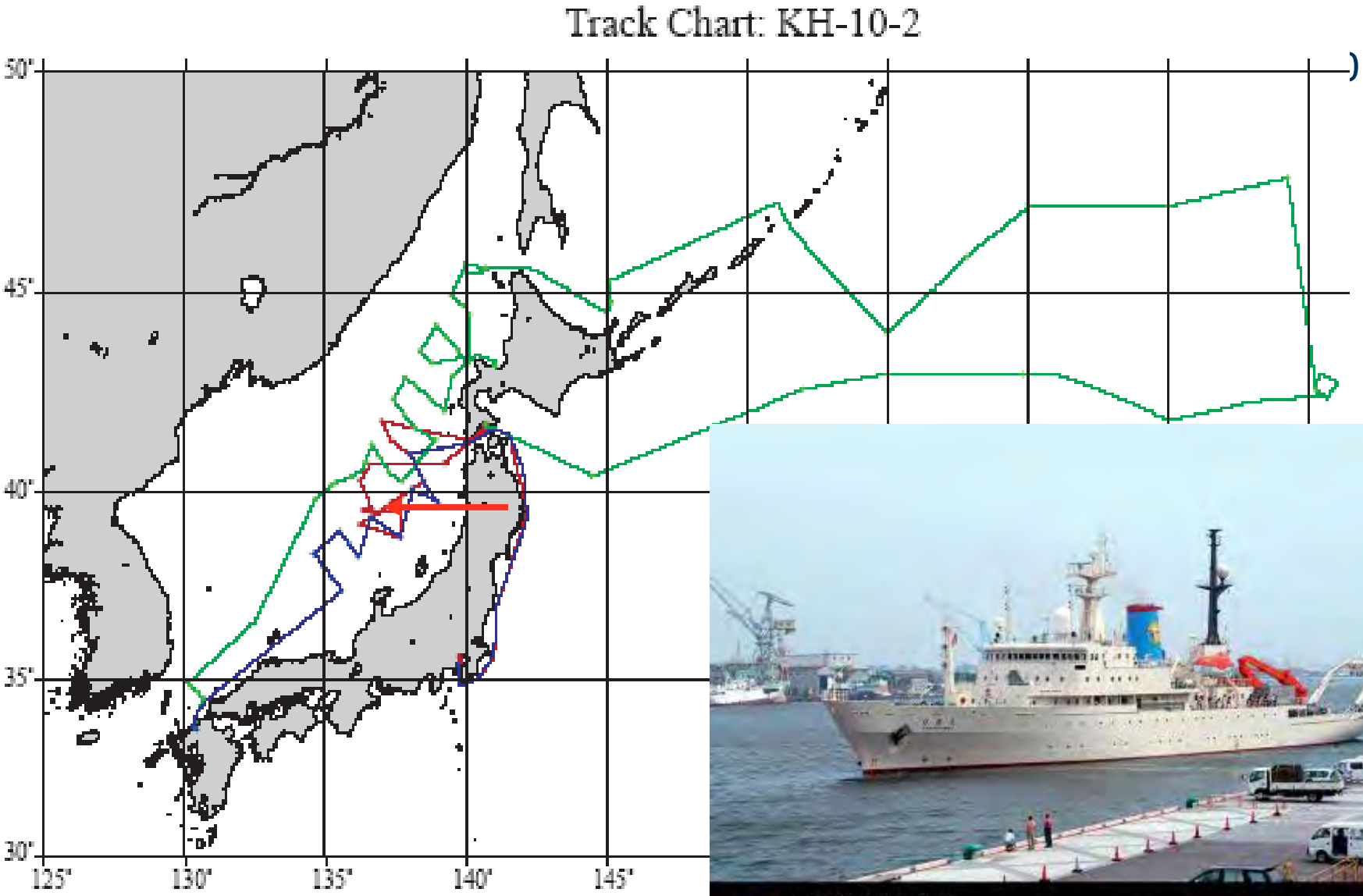


La51
Aug 10-
Sep 5



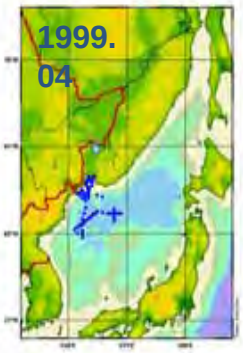
La53
Oct 24-
Nov 20

Asian GEOTRACES Cruise (T.Gamo and J.Zhang)
by R/V *Hakuho Maru, in June-July* 2010

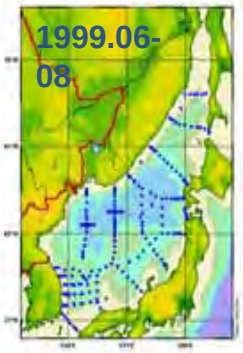


Pavlova et al,, 2011

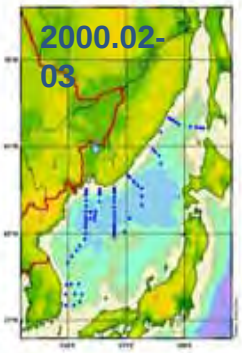
Series of surveys on deep and bottom waters 1992-2010



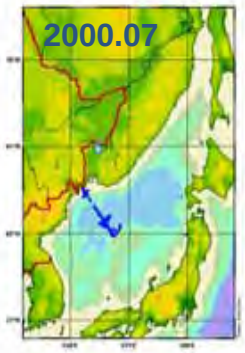
Go-32, Apr, 1999



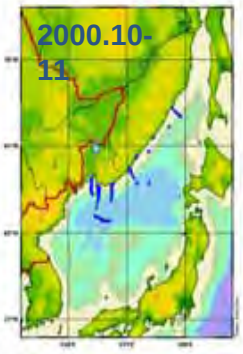
Kh-rev, 1999



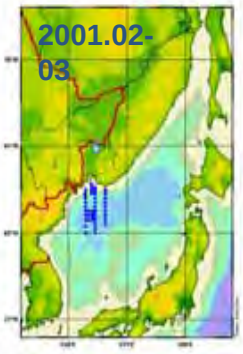
Kh-38, 2000



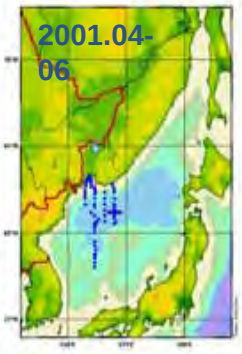
Ga-29, Jul, 2000



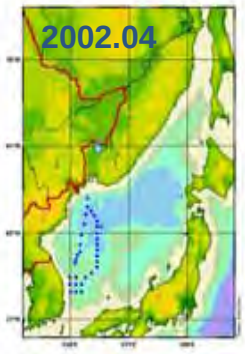
Ga-30, 2000



Kh-42, Feb, 2001



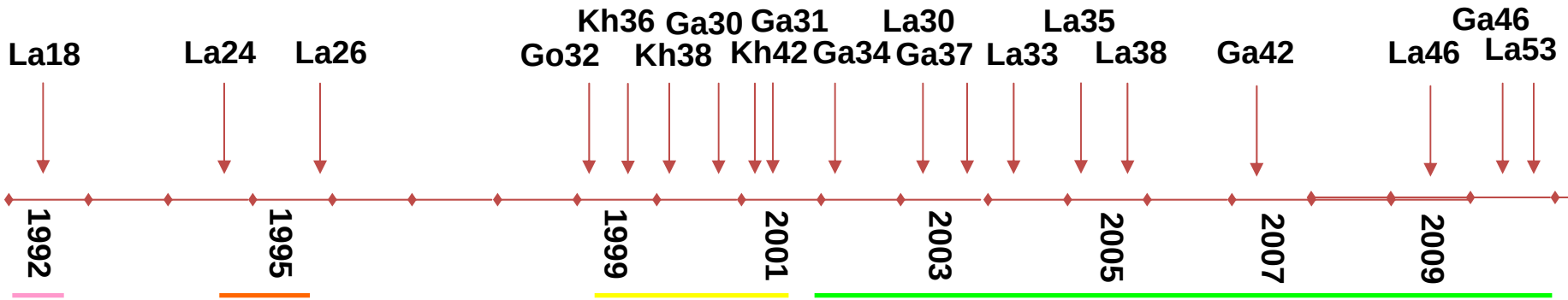
Ga-31, Apr-June, 2001



Ga-34, Apr, 2002

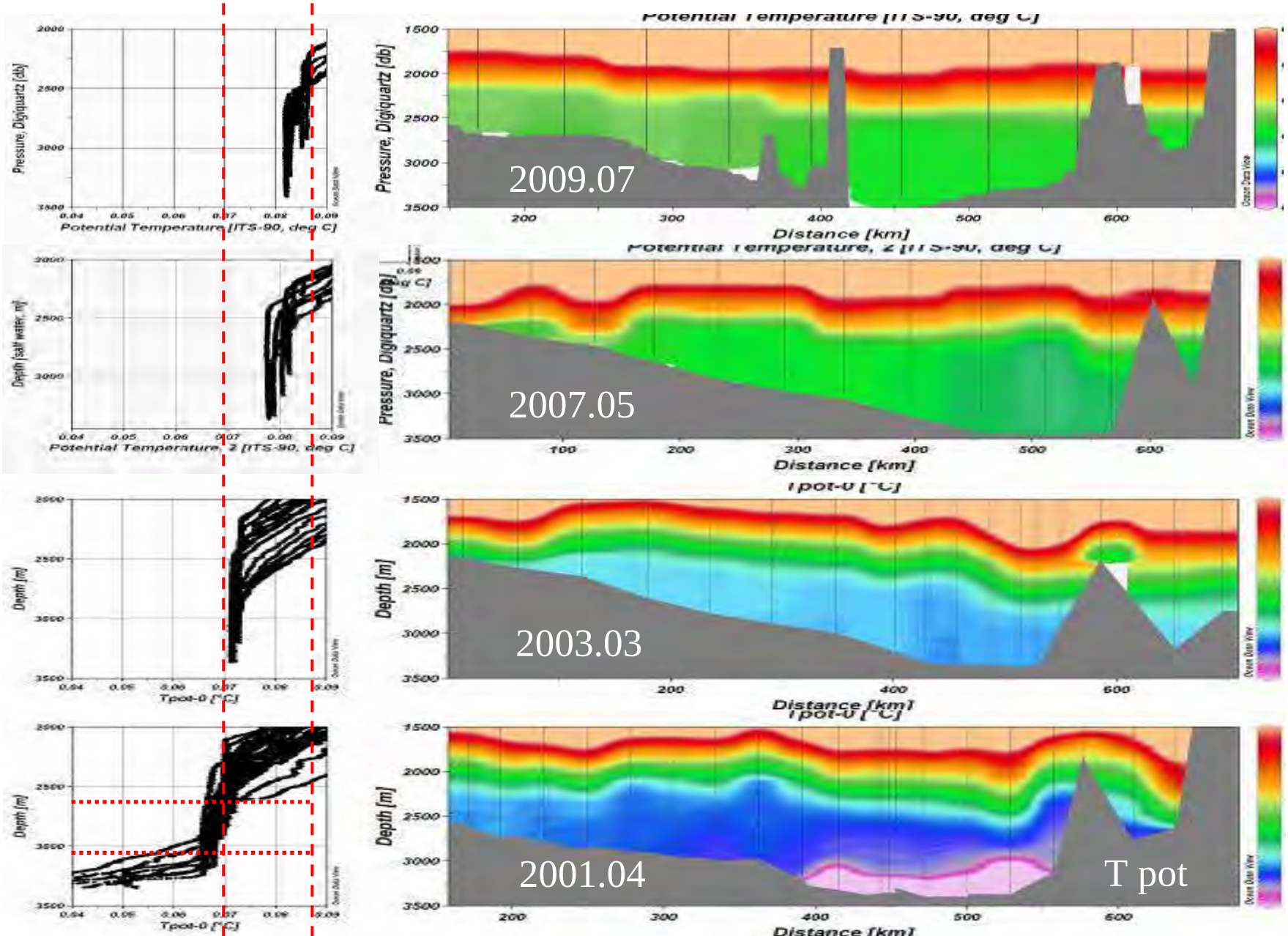
18 экспедиций в период 1999-2010

около 1300 станций до придонного слоя (>3000 м) с СТД-зондированием, отбором химических и биологических проб

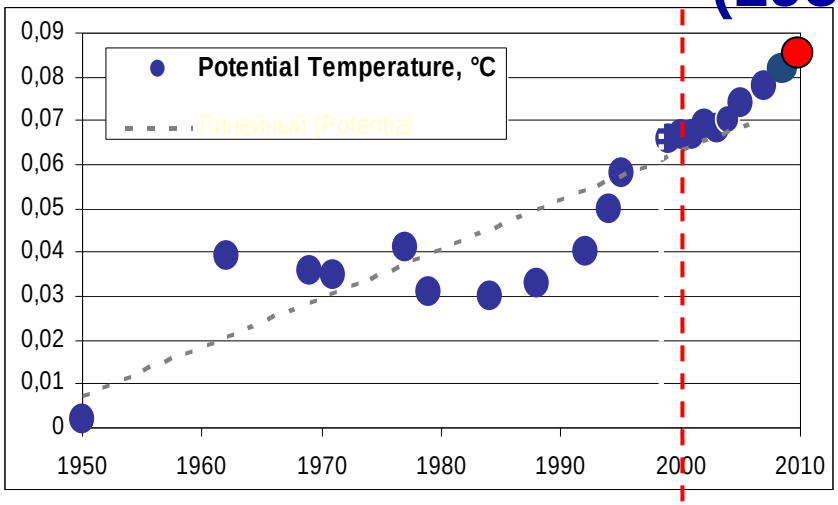


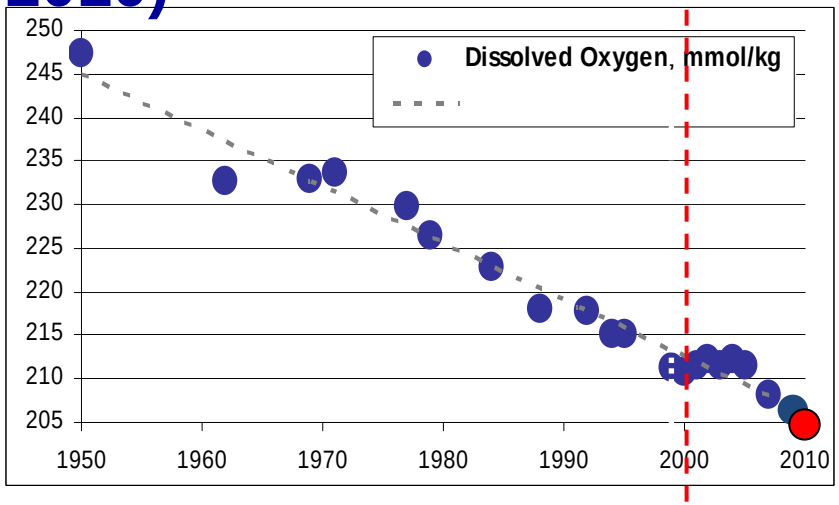
Warming trend of bottom water after 2001 ventilation

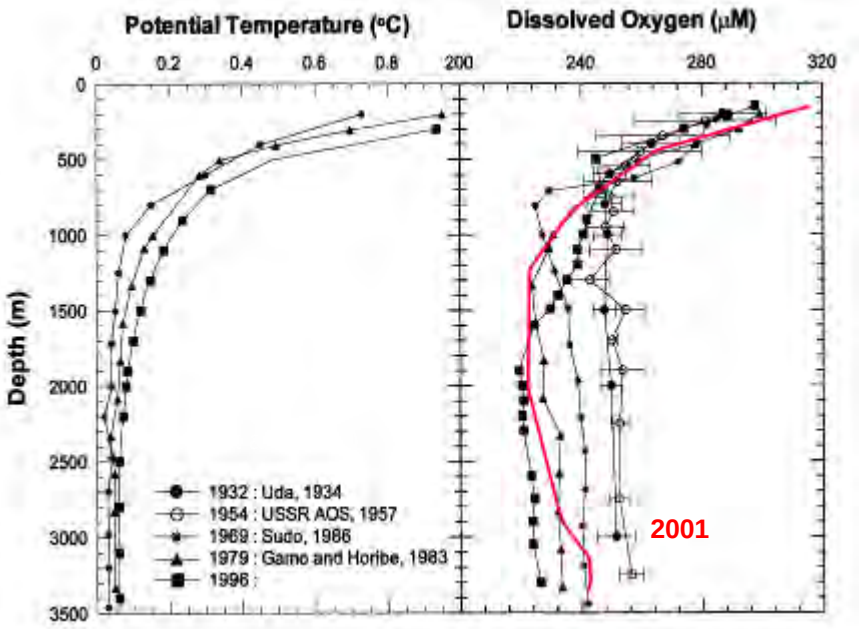
profiles and meridional section of potential temperature

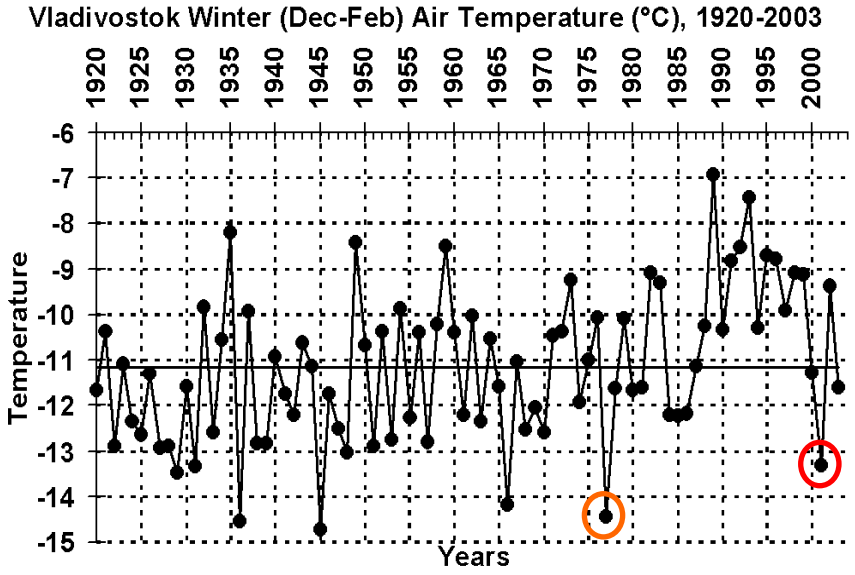


Warming and oxygen decreasing of bottom water (1950-2010)



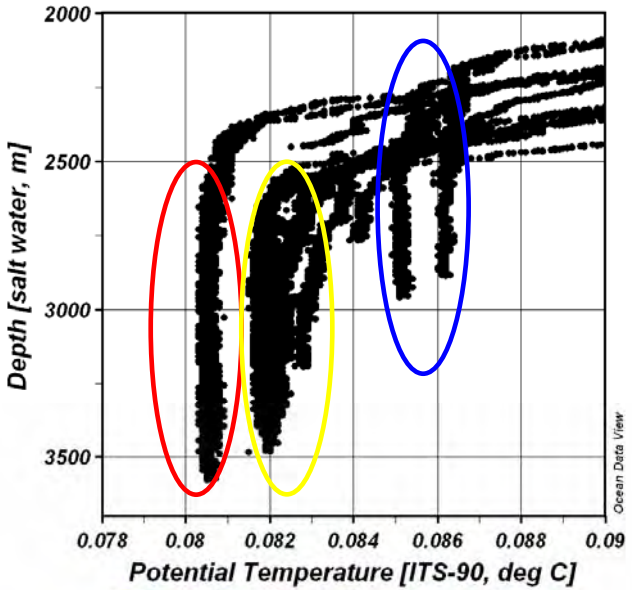


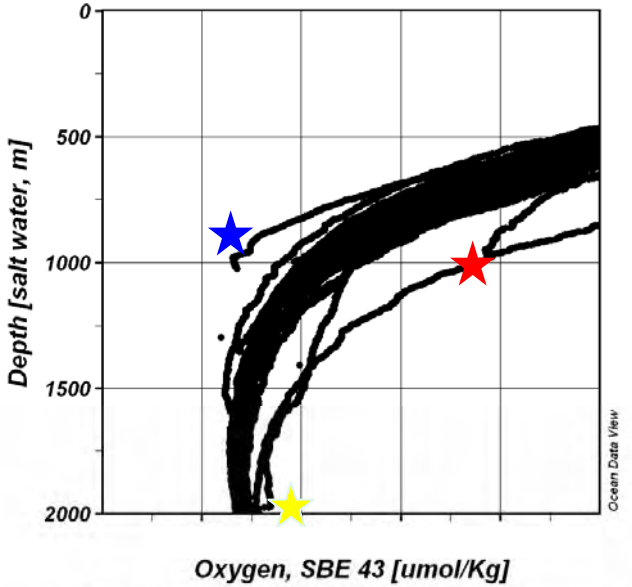


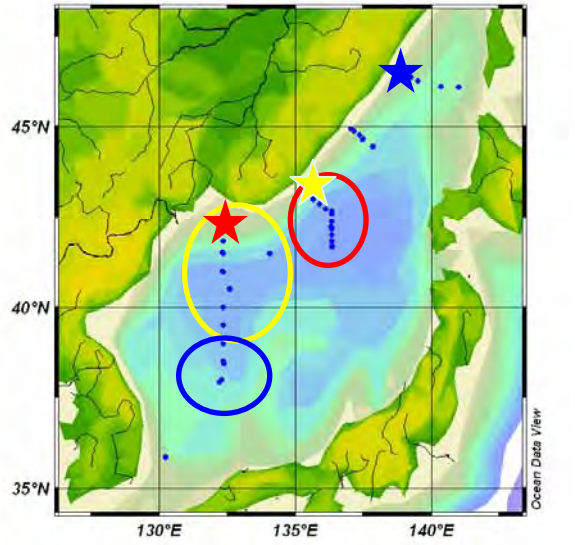


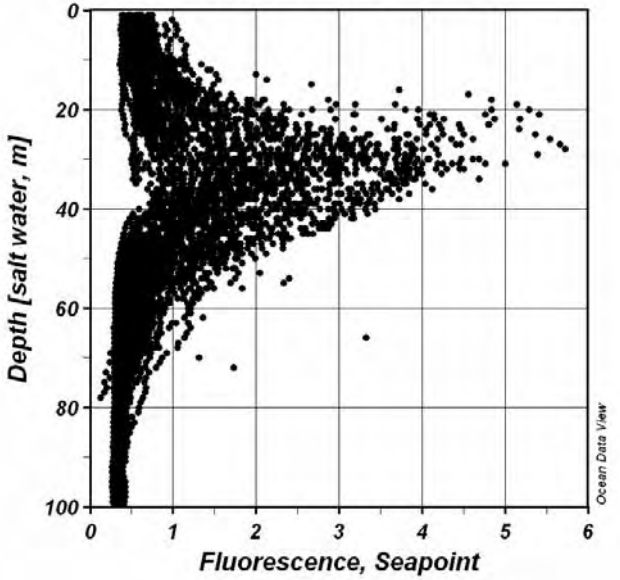
Тенденция роста температуры воды и понижения содержания растворенного кислорода донных вод, отражающая глобальное потепление климата, была прервана аномально холодной зимой 2001 гг., однако в дальнейшем режим ослабления вентиляции был восстановлен

La46: Temperature, Dissolved Oxygen and Fluorescence

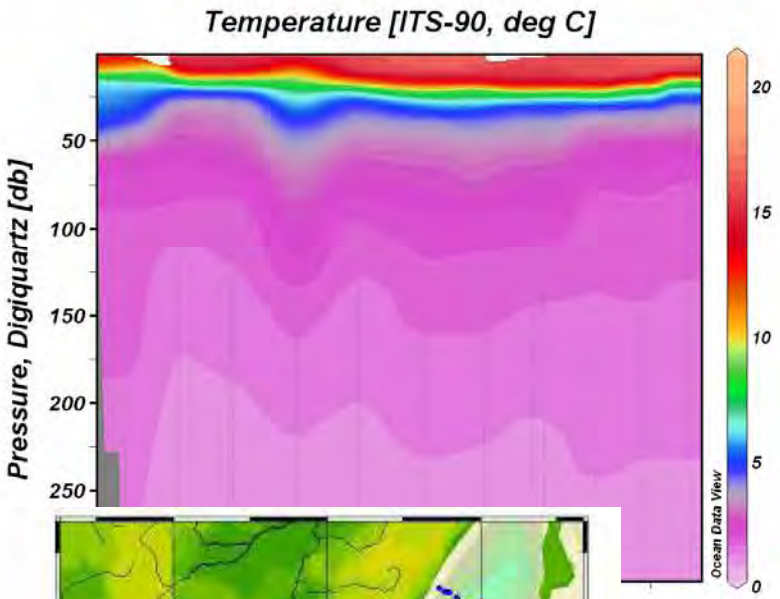


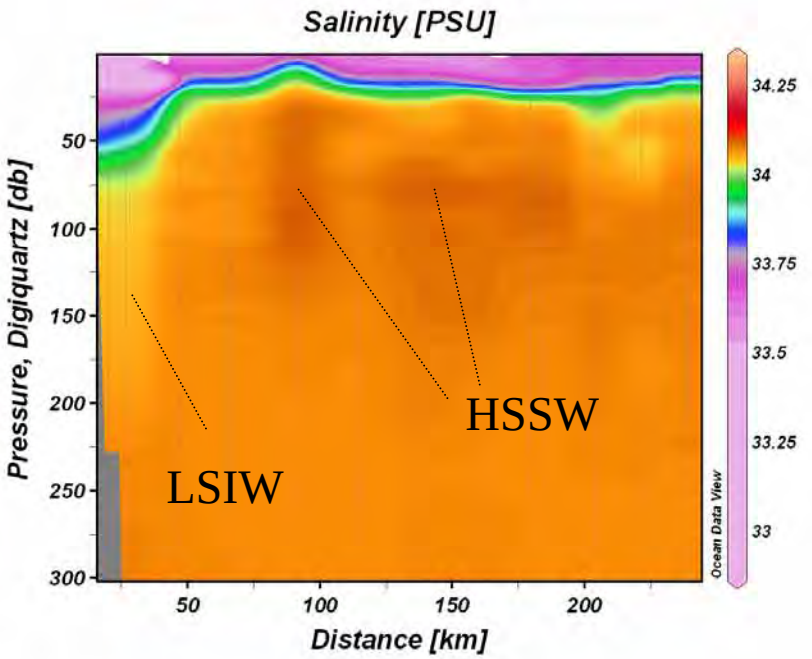


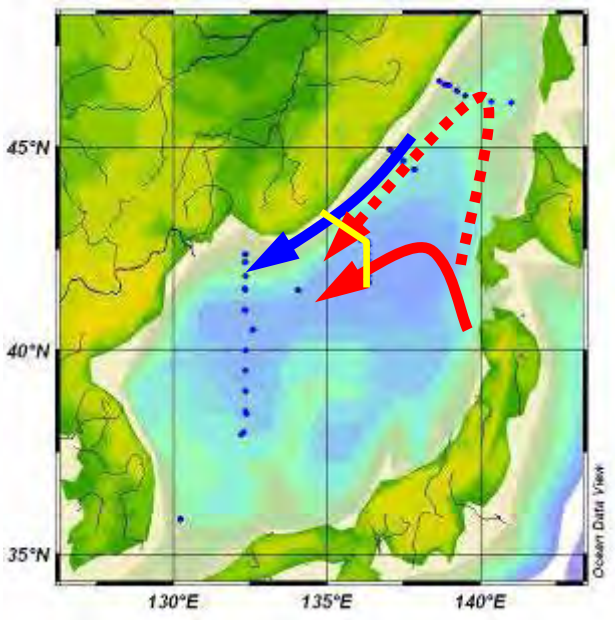


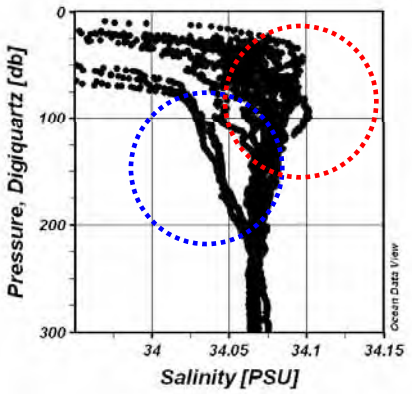


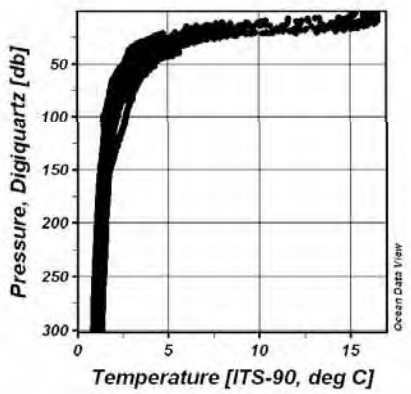
T, S structure across Primorye Current and EBTC









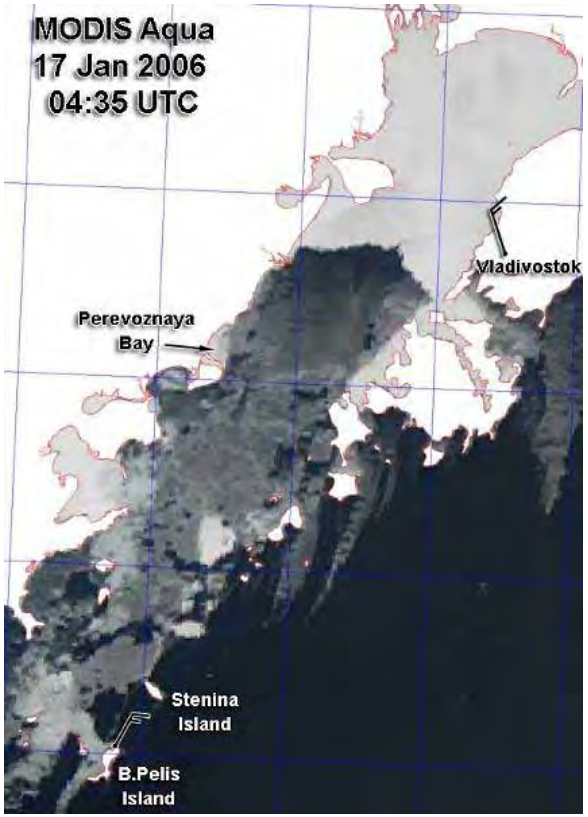


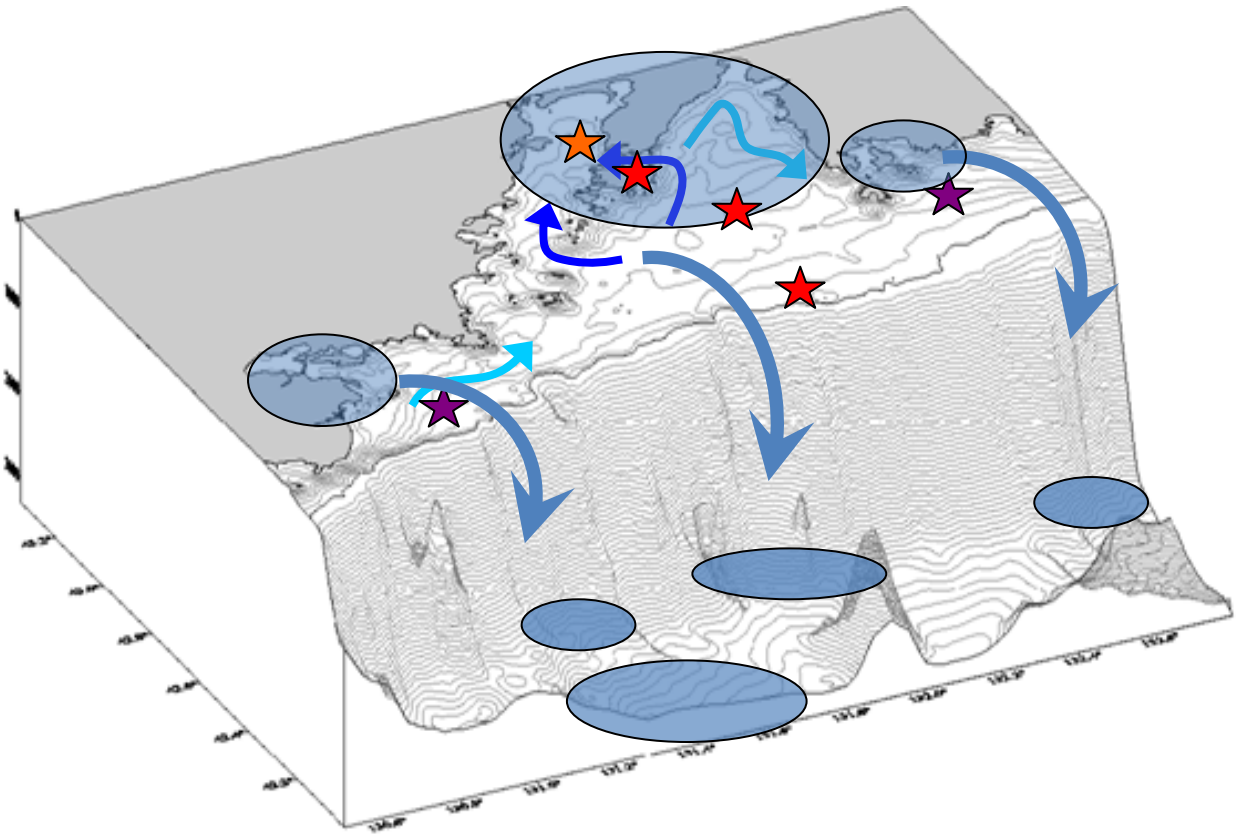
Kaplunenko D.

MBARI ISUS
Spectrophotometer

Brine rejection and slope convection at Peter the Great Bay:

High density water formation and ventilation of the deep and bottom layers of the Japan Basin : - where, when, what amount, how often?

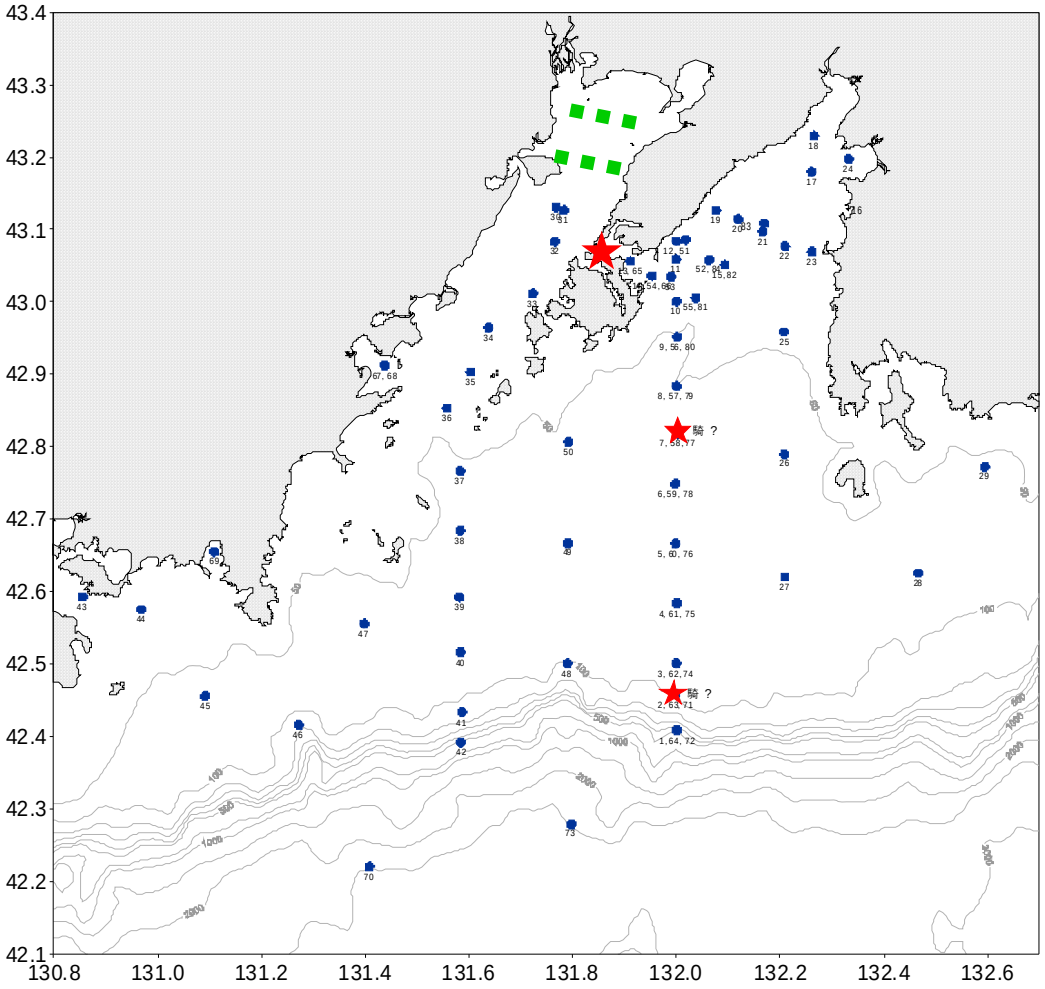




Интенсивность склоновой конвекции определяет скорость обновления придонных вод Японского моря и зависит от региональных климатических изменений. Теплые зимы последних лет ослабляют конвективные процессы и вентиляцию толщи вод Японского моря

PGB shelf area in winter 2010 and 2011

Leg 1: Feb 27- March 5, 2010 **Leg 2:** March 12-16, 2010



Leg 1: mooring deployment, survey (64 stations)

Leg 2: repeated section, slope and deep areas, mooring recovery (15 stations)

Observations:

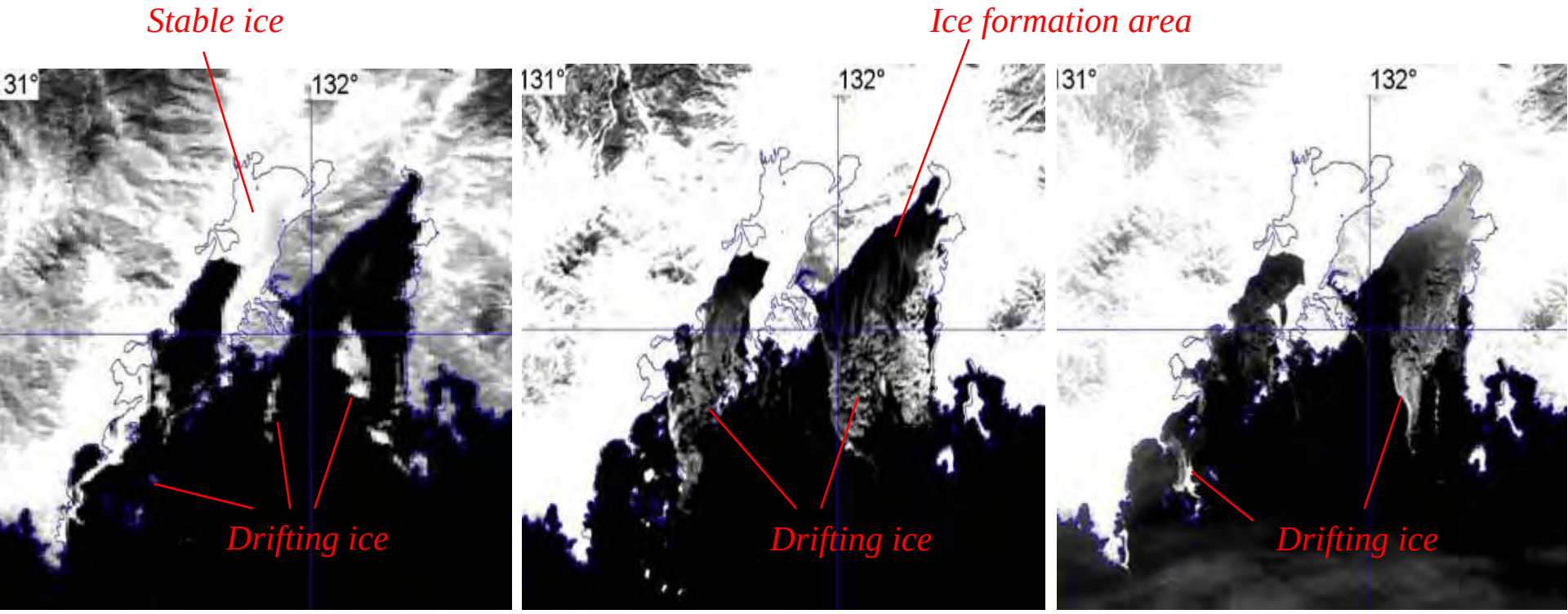
- **CTD:** SBE-19 with T, S, DO, Flu, Turb, PAR
- **Chemical sampling:** S, DO, N, P, Si, pH, Alk, Chl-a, CH4, DOC, POC, DOP, POC, biochemical components of organic matter
- **Remote bio-optical** measurements by laser beam
- **Moorings:** 3 sites
- **Observations from ice:** 16 st.

Major goals:

- formation and advection of PGB high density water
- shelf- deep sea interaction in winter
- sea ice impact on primary production

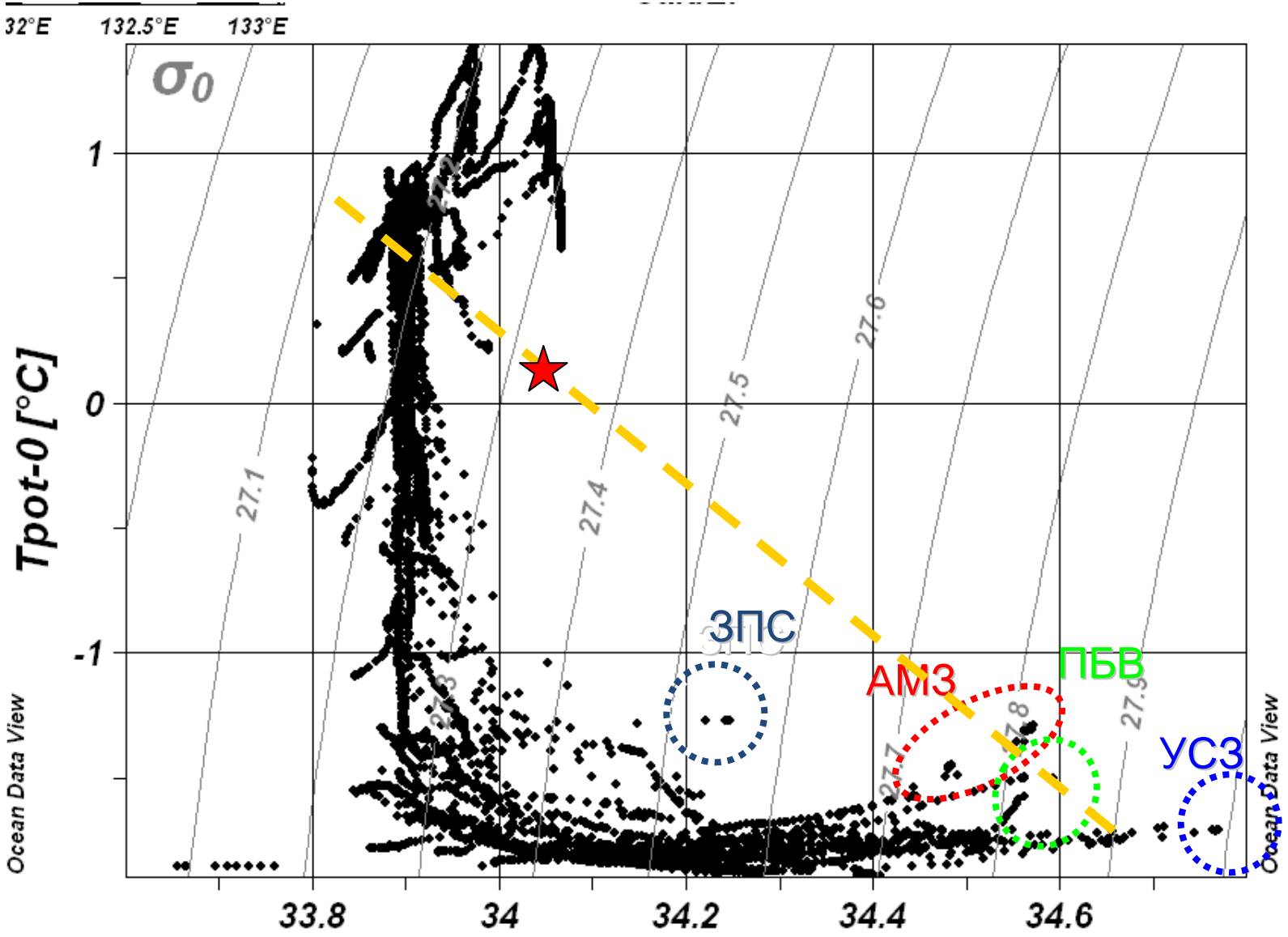
Sea ice in PGB on satellite images, 2010

Aqua, Lt_645 *A. Aleksanin (personal)*

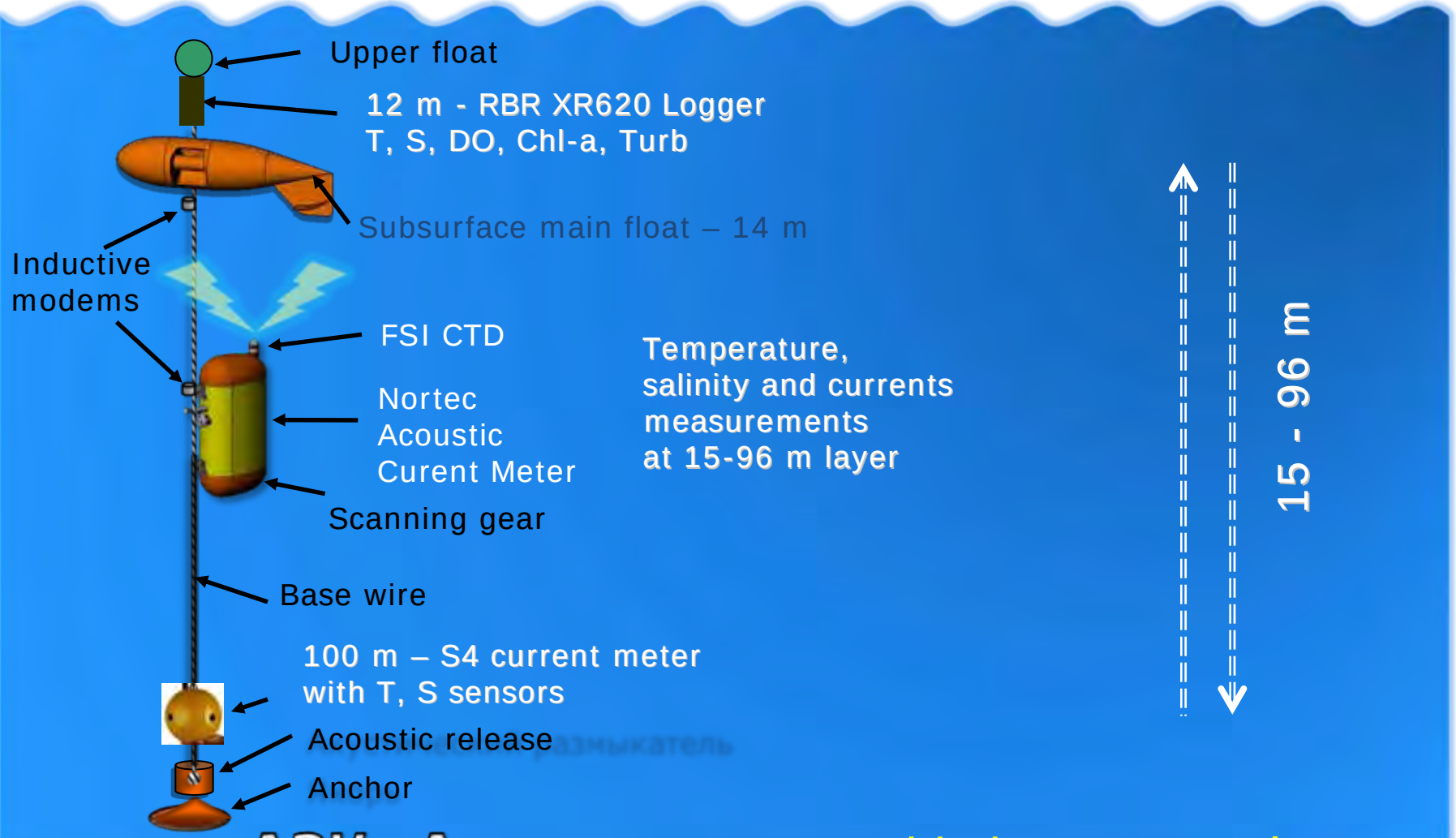


Feb 26 **March 3** **March 8**

T, S – diagram for winter 2010



Mooring A – outer shelf, scanning CTD

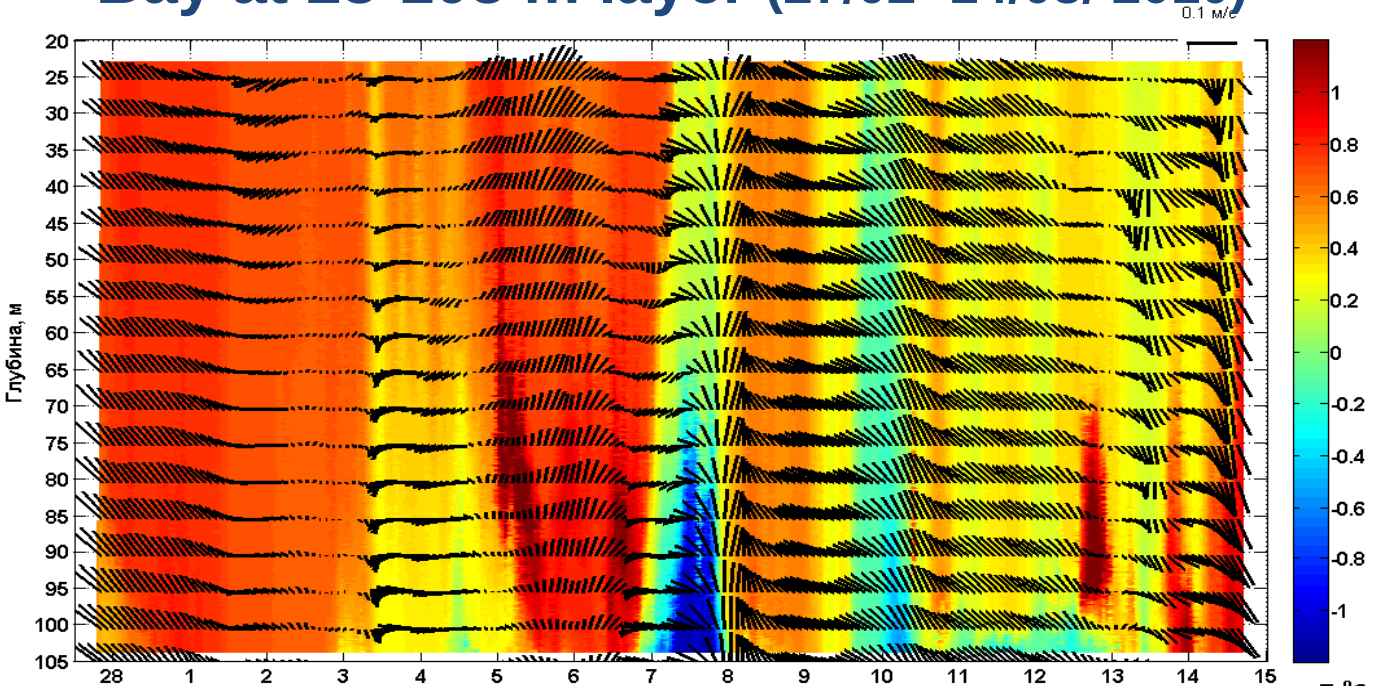


АЗК «Аквалог»

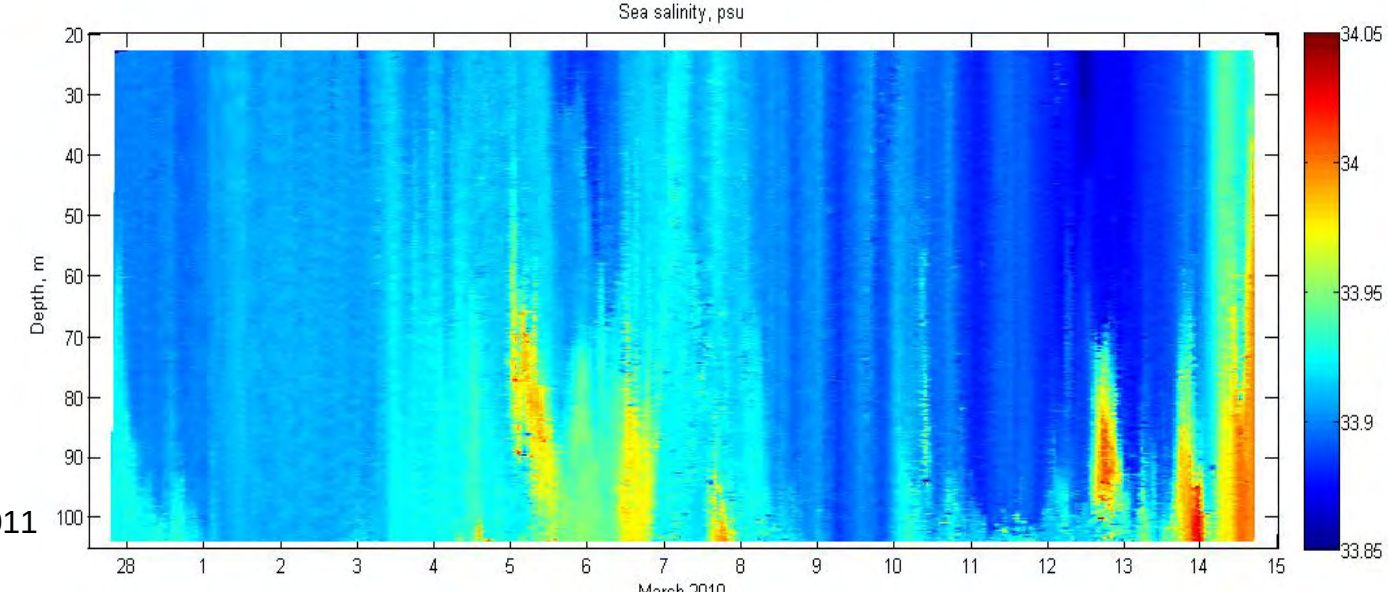
P.P. Shirshov Oceanol. Inst. RAS

T, S and Currents variability at the shelf of Peter the Great Bay at 23-103 m layer (27/02- 14/03/ 2010)

T

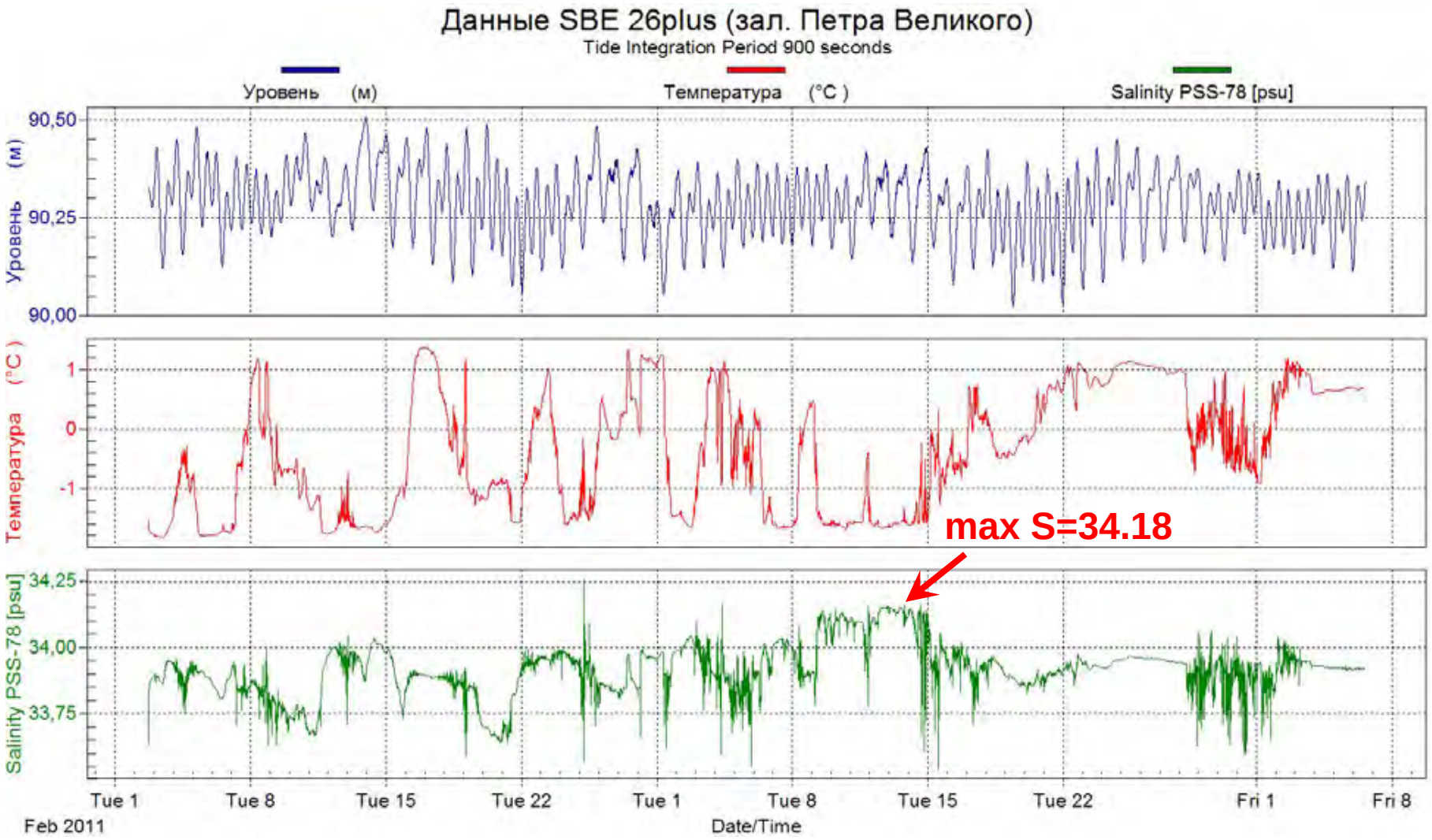


S

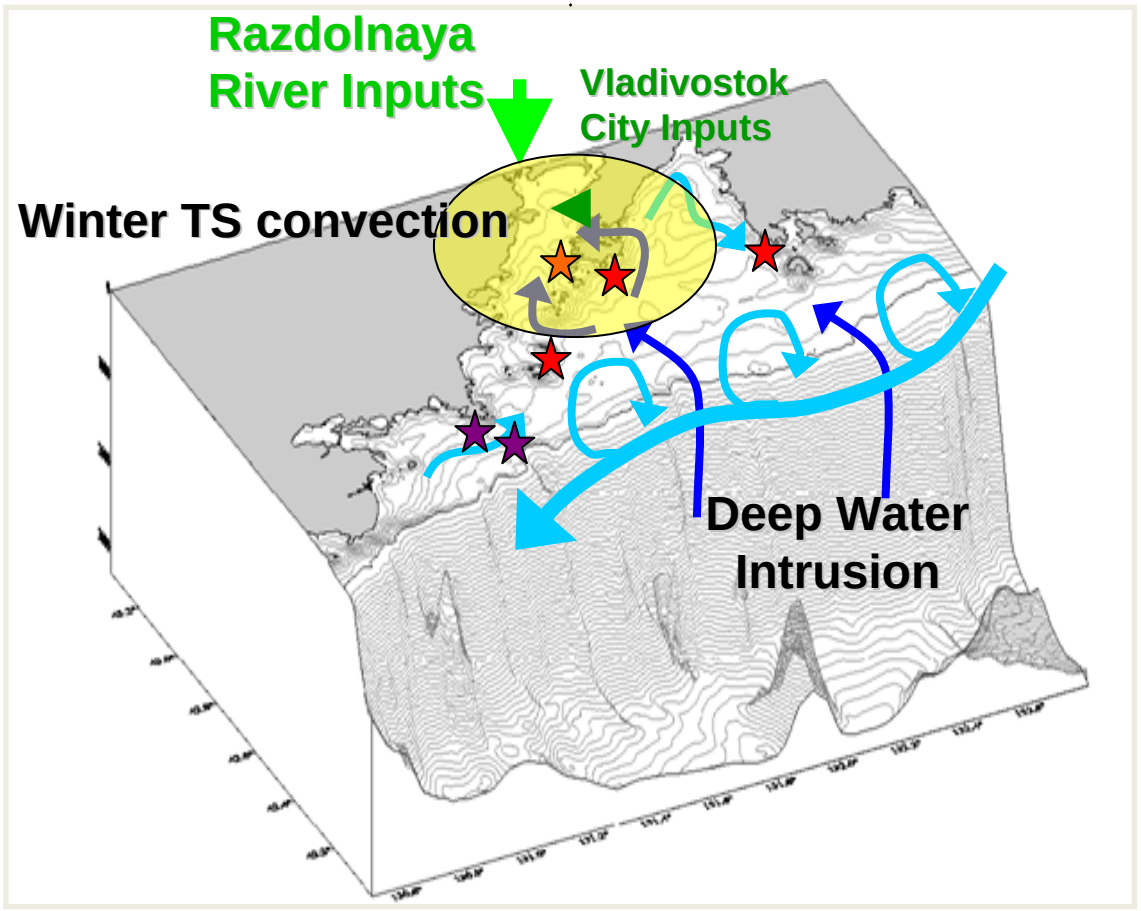


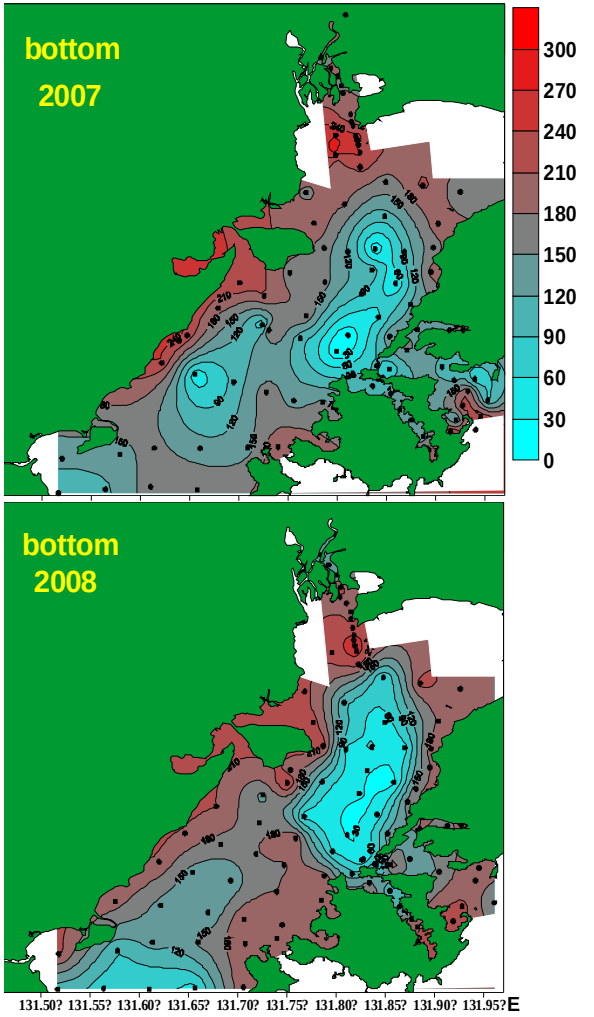
Ostrovskiy et al., 2011

2011 Mooring (Feb.2- Apr. 6)



Eutrophication and Hypoxia in Amurskiy Bay

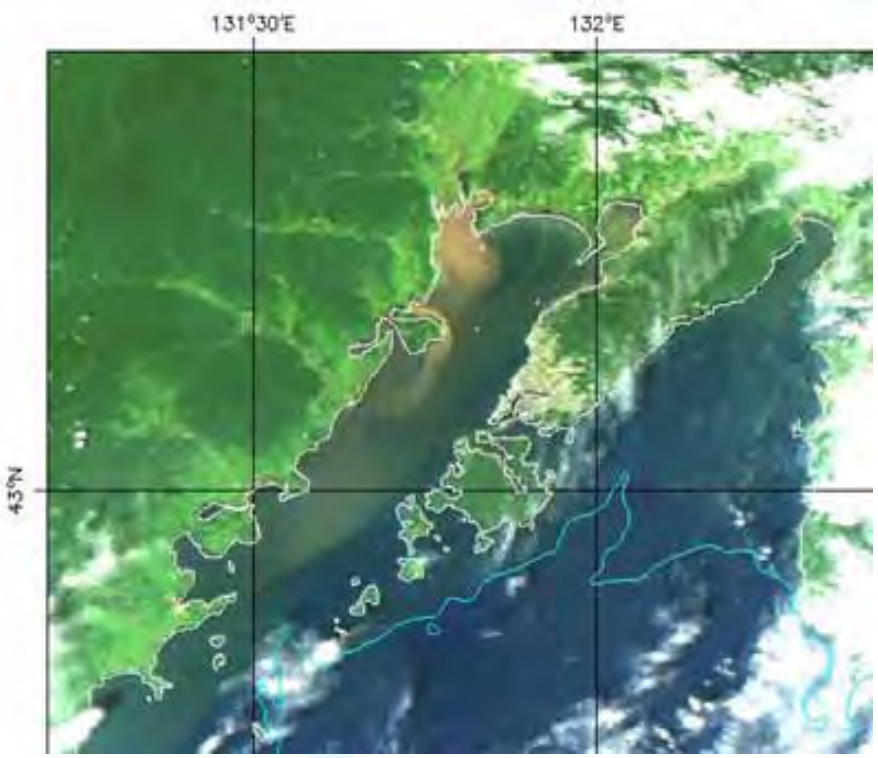




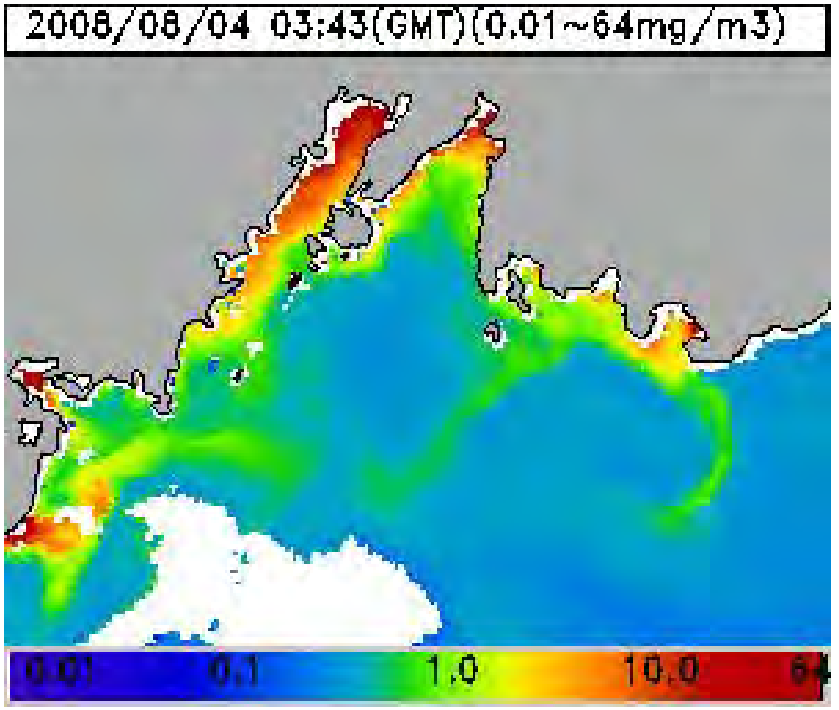
Strong hypoxia event off Vladivostok has being observed every summer since 2007

Tishchenko et al., 2008, 2011

Eutrophication and Hypoxia in Amurskiy Bay



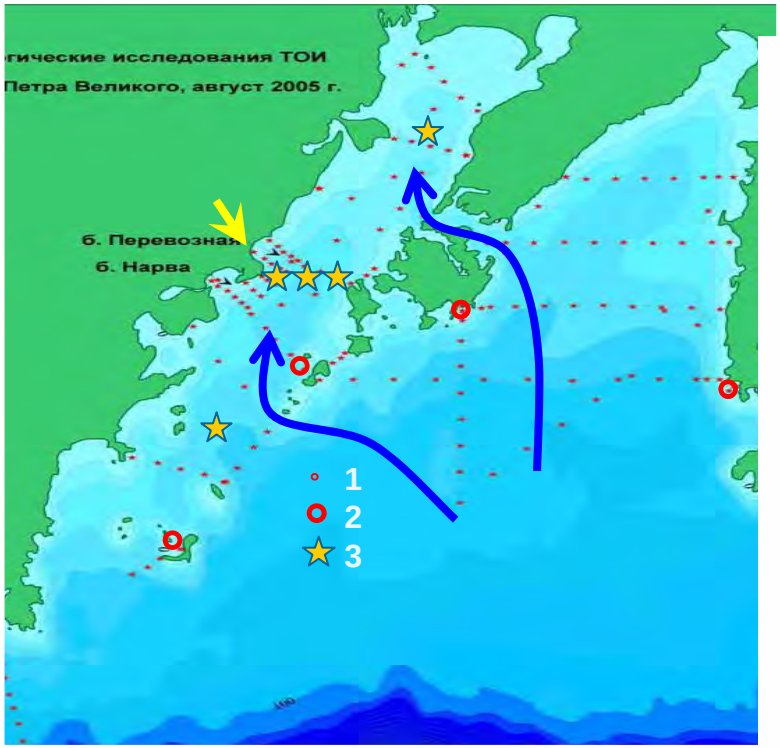
(a)



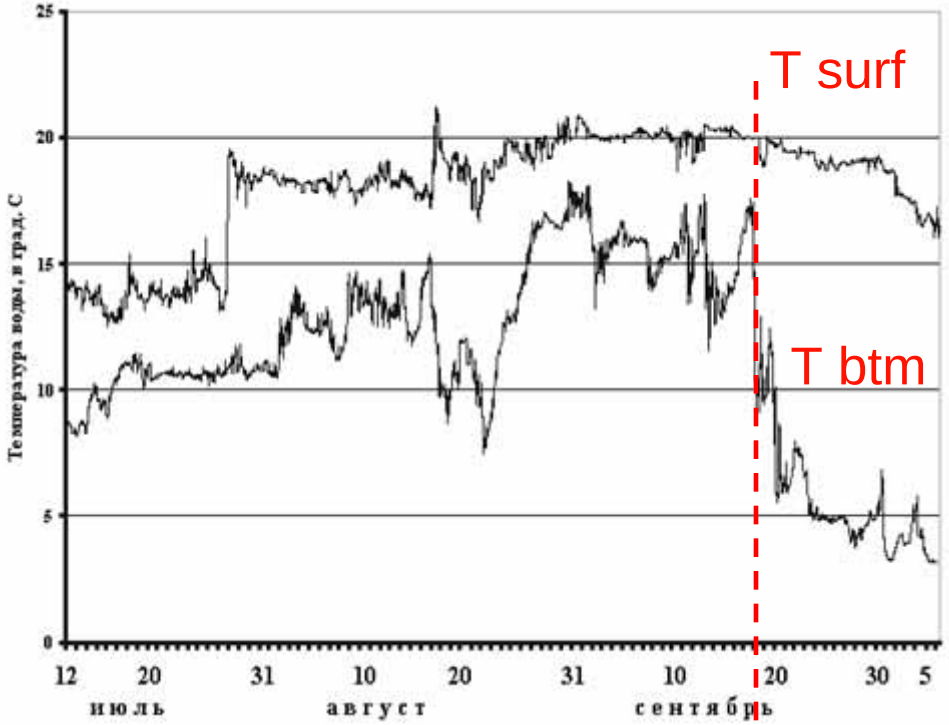
(b)

Рис. 7. Спутниковый снимок MODIS показывающий высокое содержание взвеси от реки Раздольной (a) и затем высокую концентрацию хлорофилла (b) в Амурском заливе в летний период

Advection of deep sea water onto the shelf of PGB



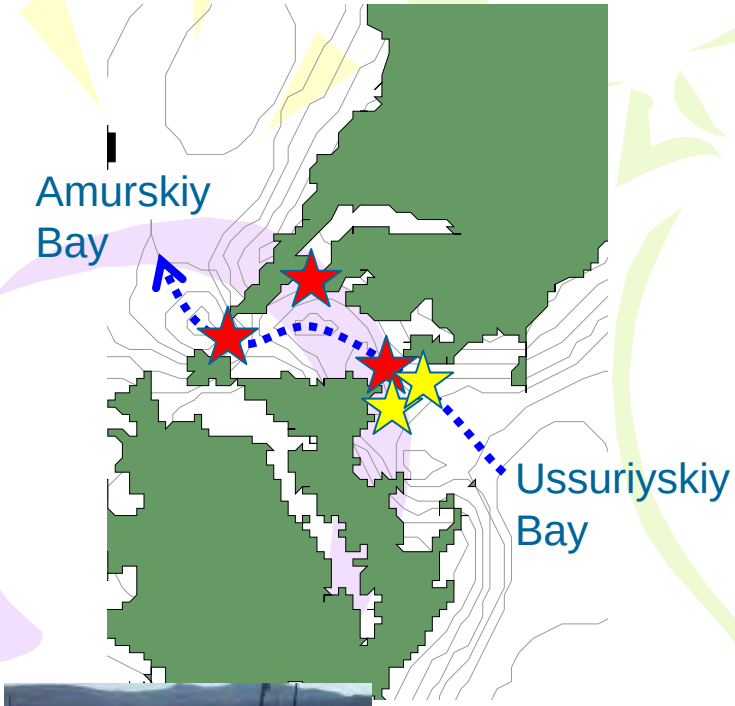
Water temperature in the Amursky Bay at 5 m and 26 m from July 12 to October 5, 2005

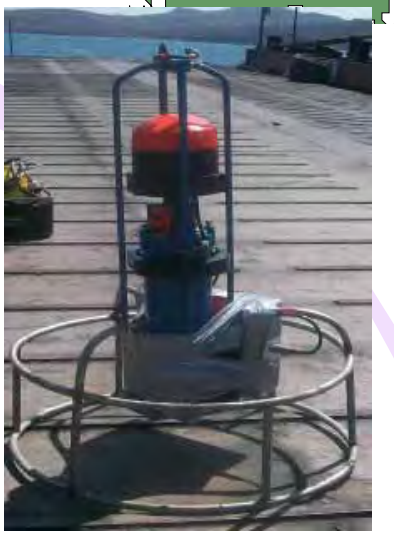


Проведенные в 2005-2007 гг. измерения течений показали, что вторжения морских вод в придонном слое достигают полуостровава Песчаный и эффективно вентилируют воды Амурского залива в осенне-зимний период

18 Sept

Bosfor Vostochniy Strait: Water Exchange Between Ussuriyskiy and Amurskiy Bays (23.07-14.09. 2009)





RDCP-600

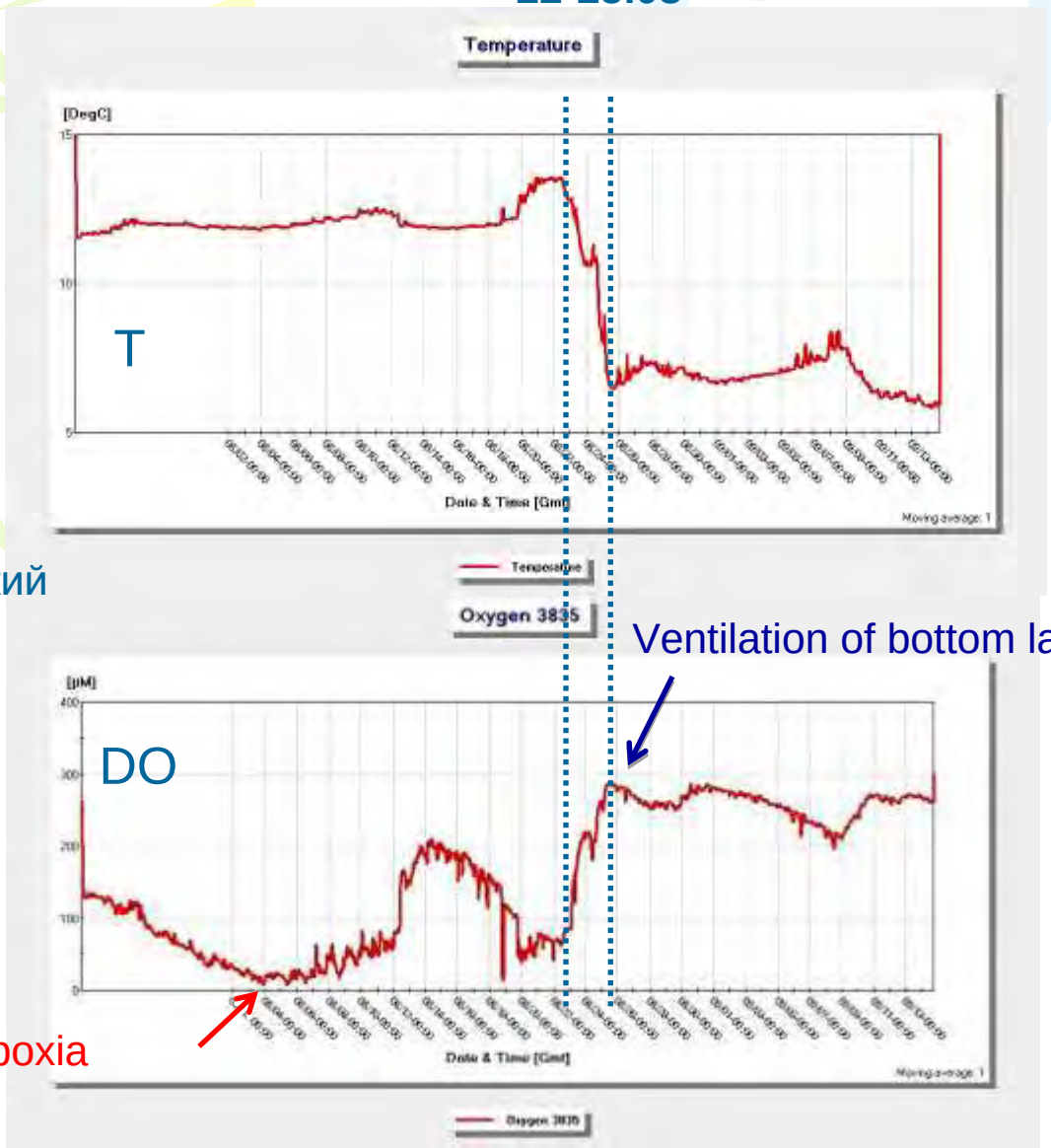
H = 20 - 40 m

№	Период	Место	Продолжительность
1	16.06-26.10.09	Токаревский прол.	132
2	14-22. 09.09	м. Назимова	8
3	28.10-22.11.09	б. Золотой Рог	26
4	4-20.06. 10	м. Назимова	15
5	4-20.06. 10	м. Назимова	15

Bosfor Vostohchny Strait: Formation and abrupt removal of hypoxia (23.07-14.09. 2009)

H=48 m
RDCP-600

22-25.08



Inter-annual Variability of the Advection Scenario

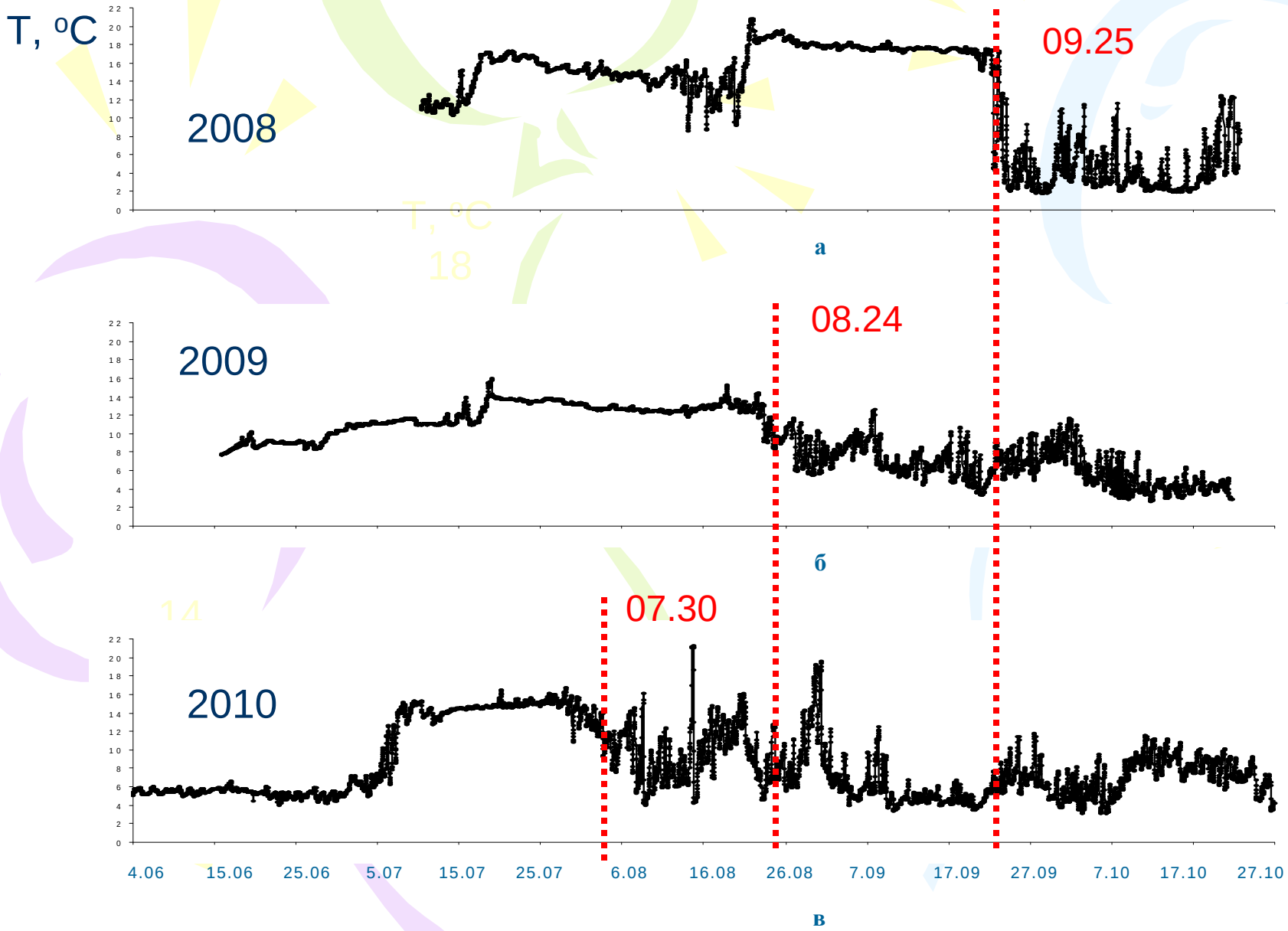
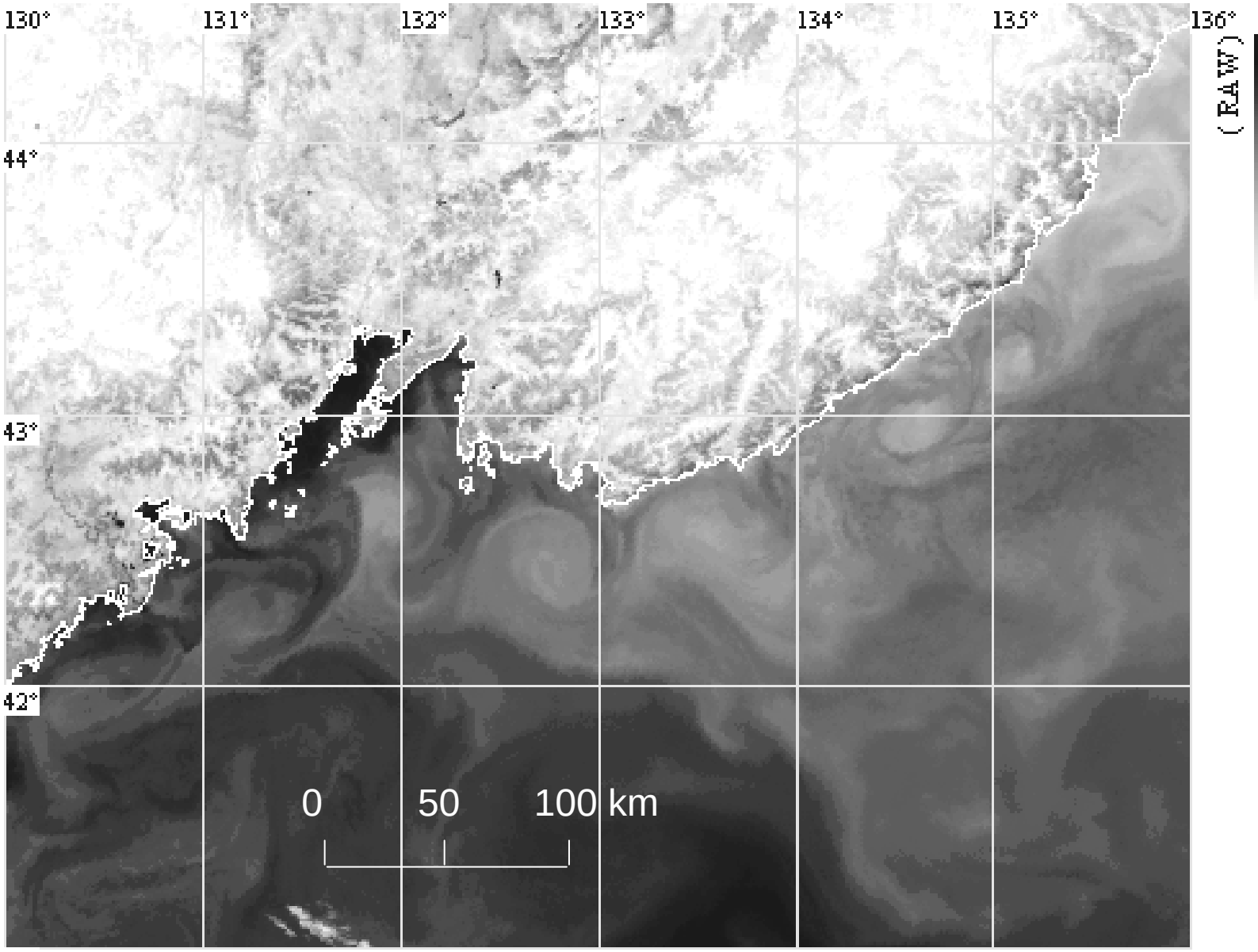
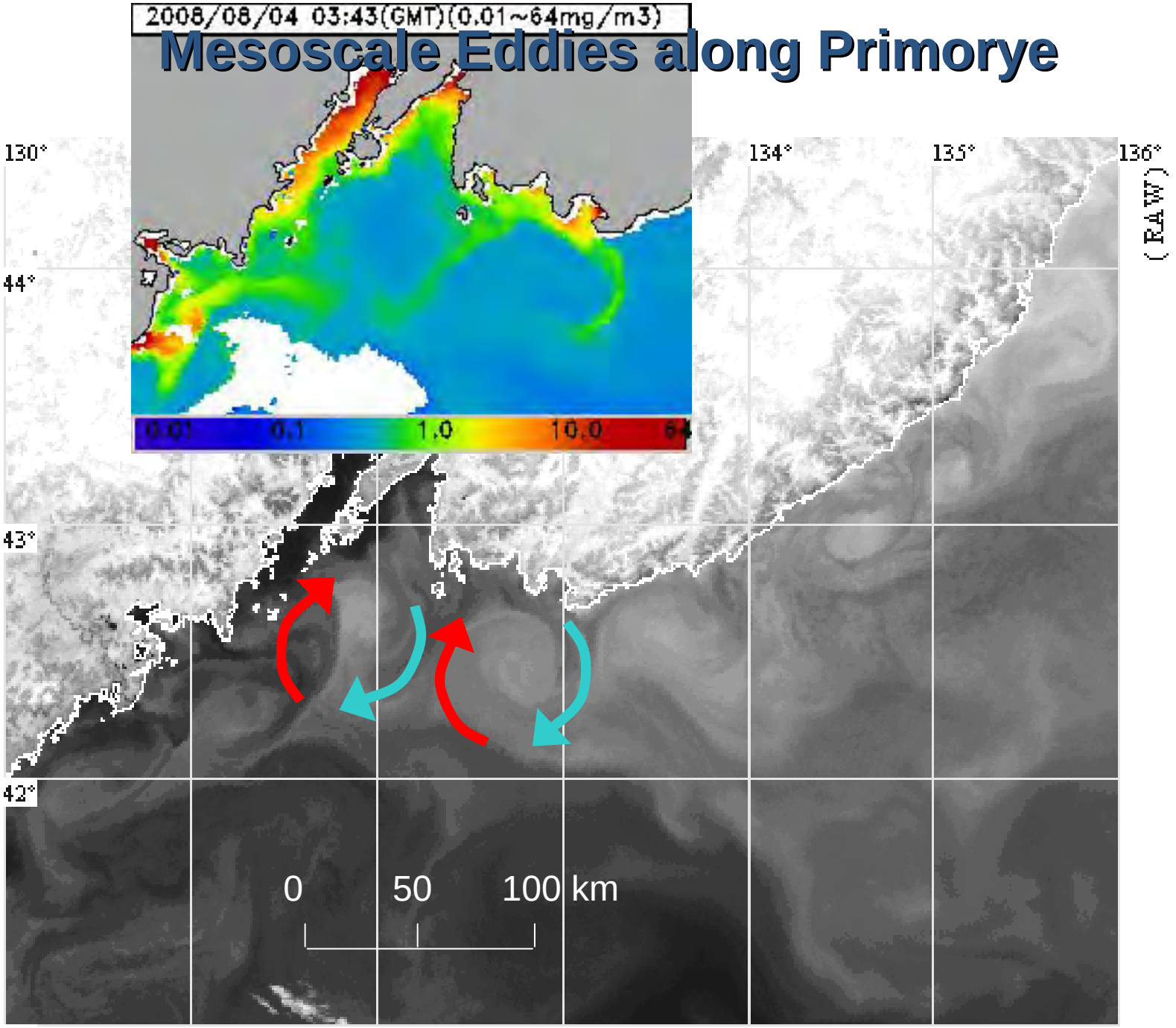


Рис. Изменение придонной температуры воды (H=21.5 м) в южной части пролива Старка (42. 57.02 с.ш., 131. 48.19 в.д.): а - 2008 г., б – 2009 г., в – 2010 г..

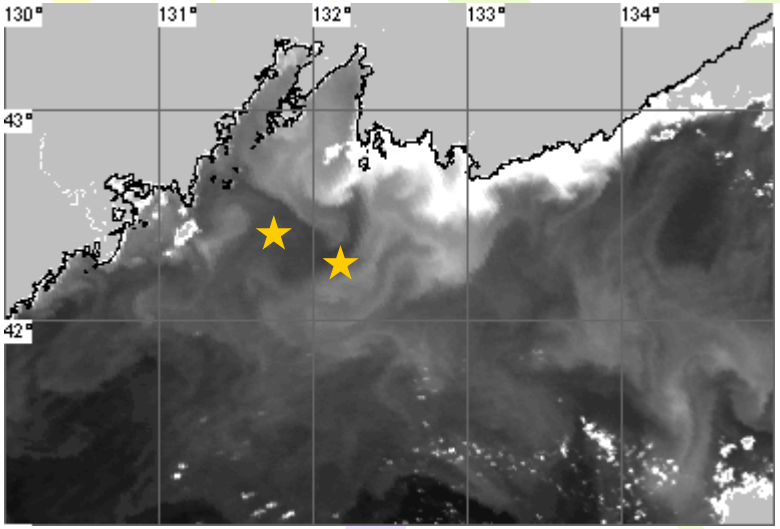
Mesoscale Eddies along Primorye

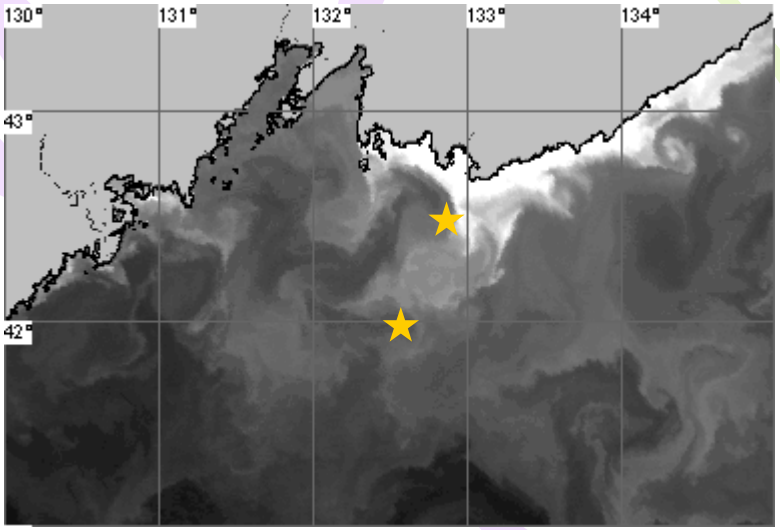


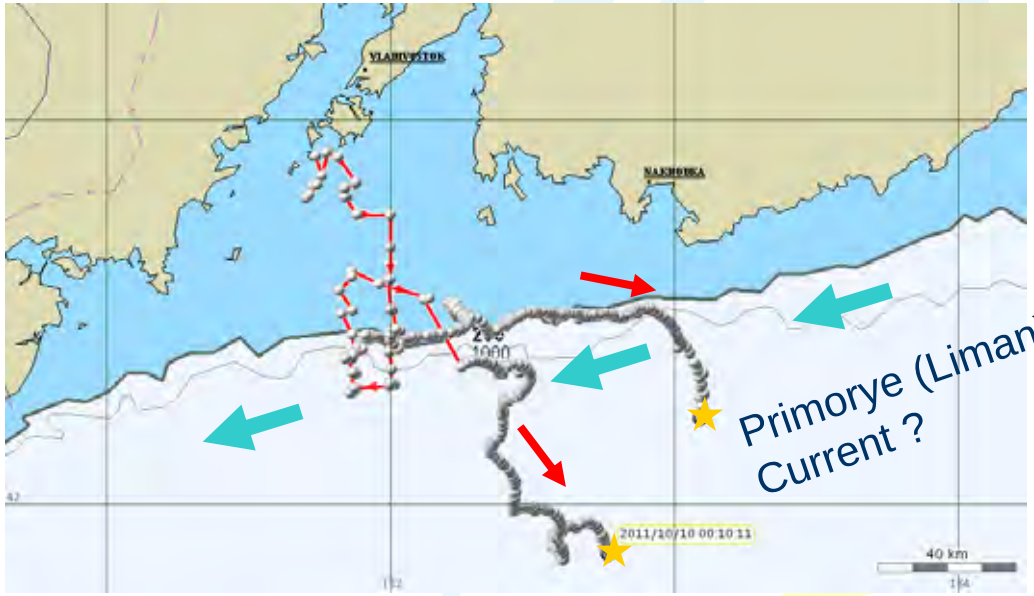
Mesoscale Eddies along Primorye



Eddy tracks of two surface drifters 2-10 Oct. 2011







- no flow to the SW (Primorye Current)

- strong mesoscale water dynamics along the slope in Fall season

-formation of NW branch of subarctic front (Danchenkov, 2001; Trusenkova, 2008)

Conclusion

1. A comprehensive oceanographic data set is collected during cruises under the CREAMS/PICES program (physical and biogeochemical parameters).
2. Continuing trend of bottom water warming and decrease of oxygen is confirmed. The trend has a spatial diversity.
3. No more significant ventilation of bottom waters by slope convection was observed since 2001.
4. High level of eutrophication of Amurskiy Bay (upper Peter the Great Bay) and hypoxia formation was found.
5. Intensive mesoscale water dynamics off Primorye area in fall season is confirmed.
6. Advection of deep sea water along the shelf is important mechanism of ventilation and removal of hypoxia.