

A detailed map of the Japan/East Sea region, showing the Korean Peninsula, the Sea of Japan, and the surrounding landmasses of Russia, China, and Japan. The map includes numerous city names, geographical features, and depth contours. Overlaid on the map is a large white text box containing the title of the study. Below the title, a semi-transparent blue box contains the names of the researchers and their affiliations, along with an email address.

Merging Argo data and ship CTD observations to study mesoscale patterns in the Japan/East Sea

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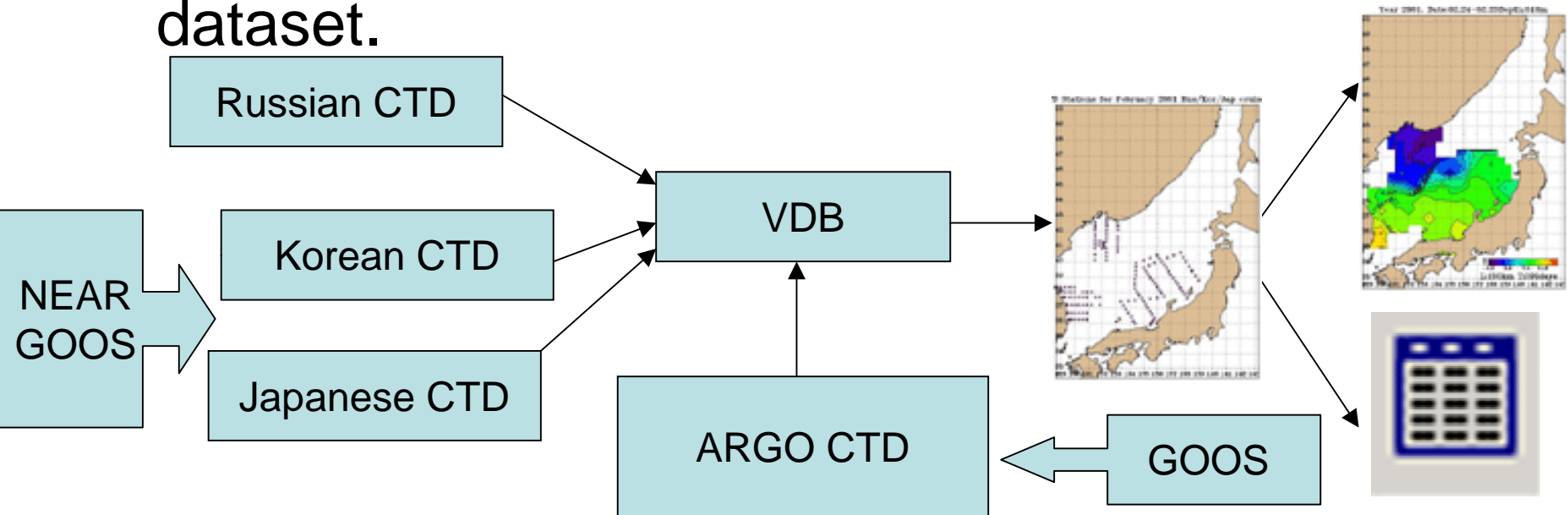
Introduction

This work describes:

- Technology of merging datasets of GOOS(NEAR-GOOS) and ARGO using the Virtual Database (VDB-technology)
- Examination of mesoscale structures pattern observed during 1999-2004 within Japan Sea basin
- Technique of remote detection mesoscale eddy at the East/Japan Sea basin.
- Future applications for obtained dataset

Development of oceanographic data assimilation technology for making comprehensive dataset of East Sea historical observations.

- Making quick selection of data sample from different databases/archives distributed worldwide have been a reason of using VDB-technology in the developing of comprehensive dataset.



Used sources of Data

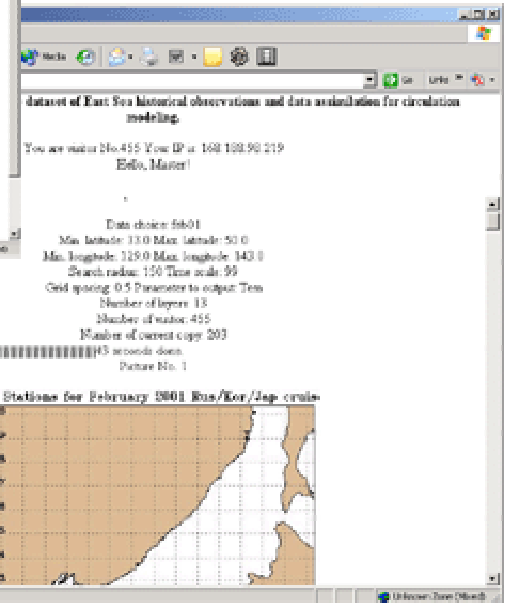
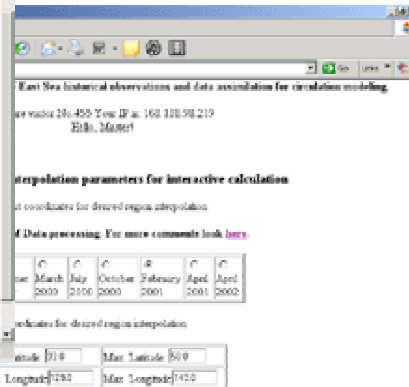
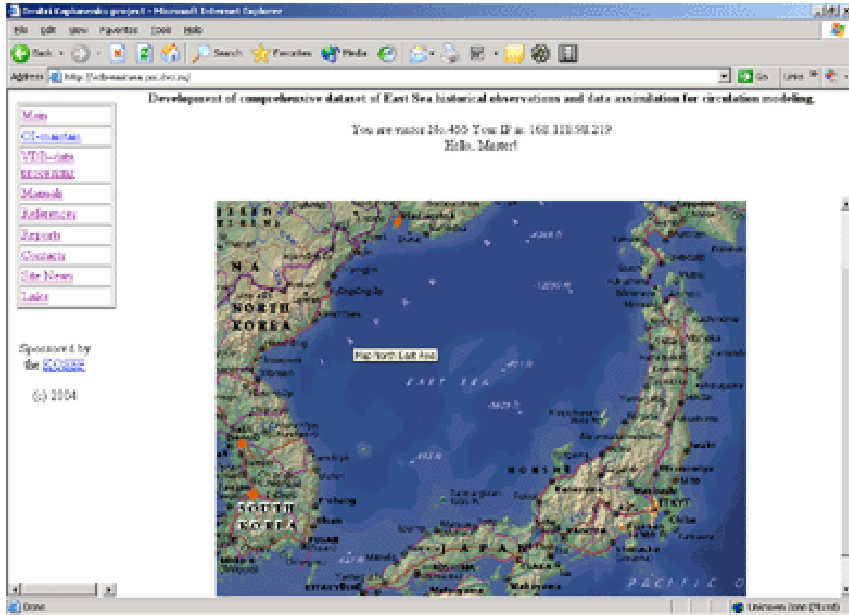
- Ship observations:
 - Russian: <http://www.pacificinfo.ru/>, <http://gis.poi.dvo.ru/>
 - Korean: <http://www.nfrda.re.kr/kodc/data/sodata/index.html>
 - Japanese: <http://jdoss1.jodc.go.jp/>, <http://near-goos1.jodc.go.jp/>
- ARGO observations:
 - GODAE centre: http://www.usgodaie.org/cgi-bin/argo_select.pl
 - Satellite:
 - New Generation SST (NGSST): <http://www.ocean.caos.tohoku.ac.jp/>
- AVISO altimetry: <http://www.aviso.oceanobs.com/duacs/>

Development software for combining data sample in a real time mode from different databases.

Technical features of VDB-implementation:

- **OS: Windows XP**
- **Web-server: Apache**
- **User-interface language programming: PHP 4.3**
- **VDB-engine: IDL – virtual machine.**
- **The current VDB-implementation is portable for running under UNIX-like systems**

Samples of web-interface



Main page

Parameters choice page

Result visualization page

Obtained data fields (static view)

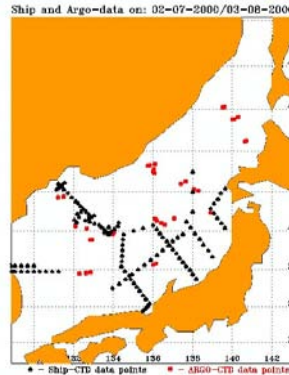
06-08/1999



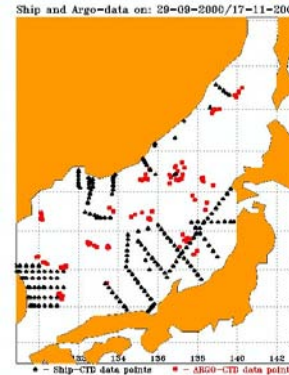
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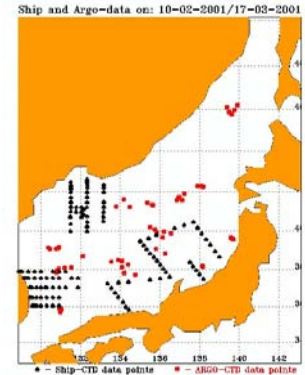
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02-03/2001



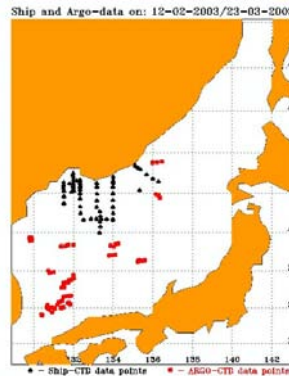
03-06/2001



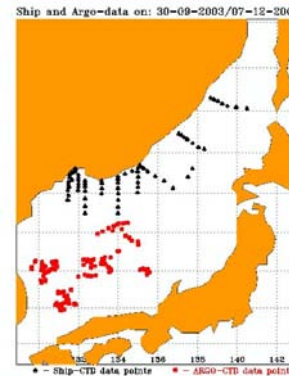
03-05/2002



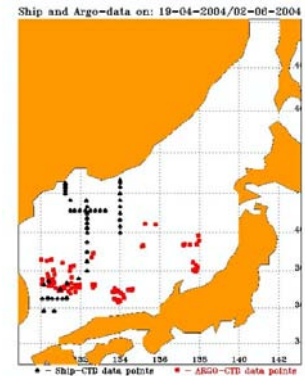
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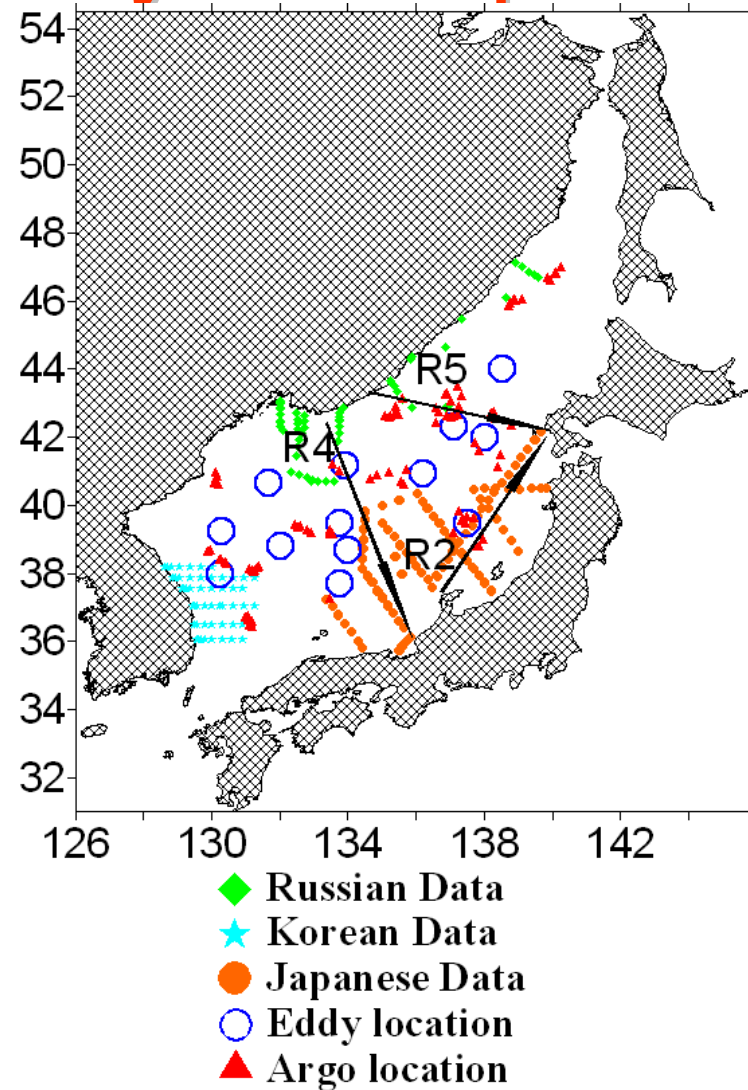
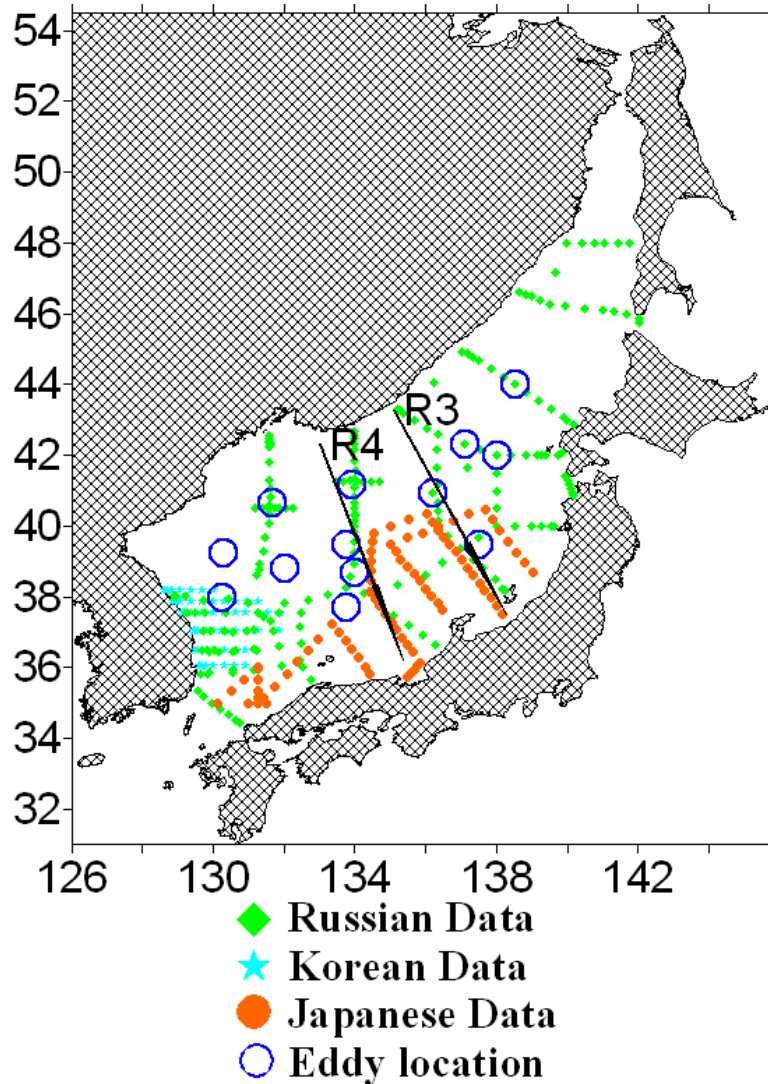
10-11/2003



05-06/2004



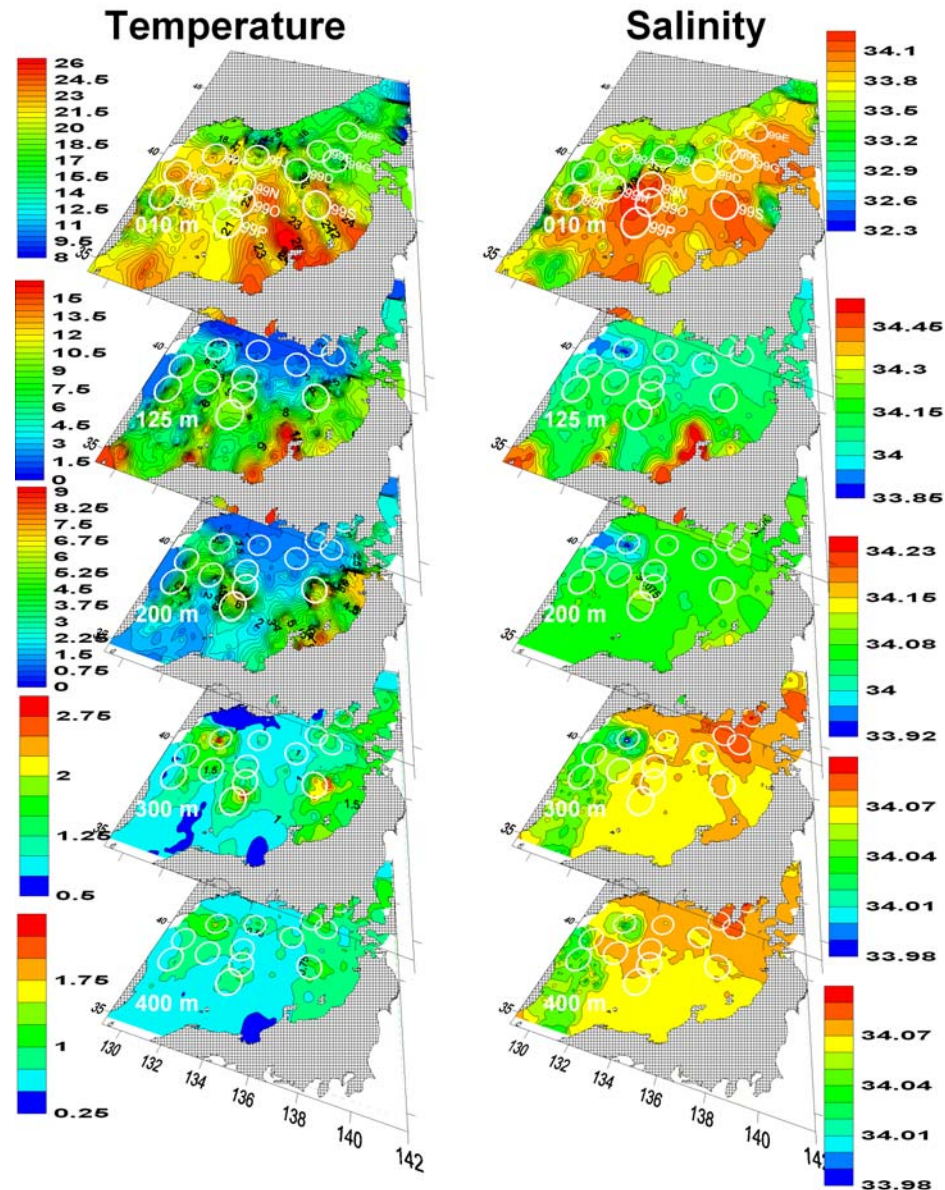
ARGO and CTD-surveys in Japan Sea



**Eddies locations: Inter Institution Regional Satellite Monitoring Center
NOAA AVHRR satellite infrared images**

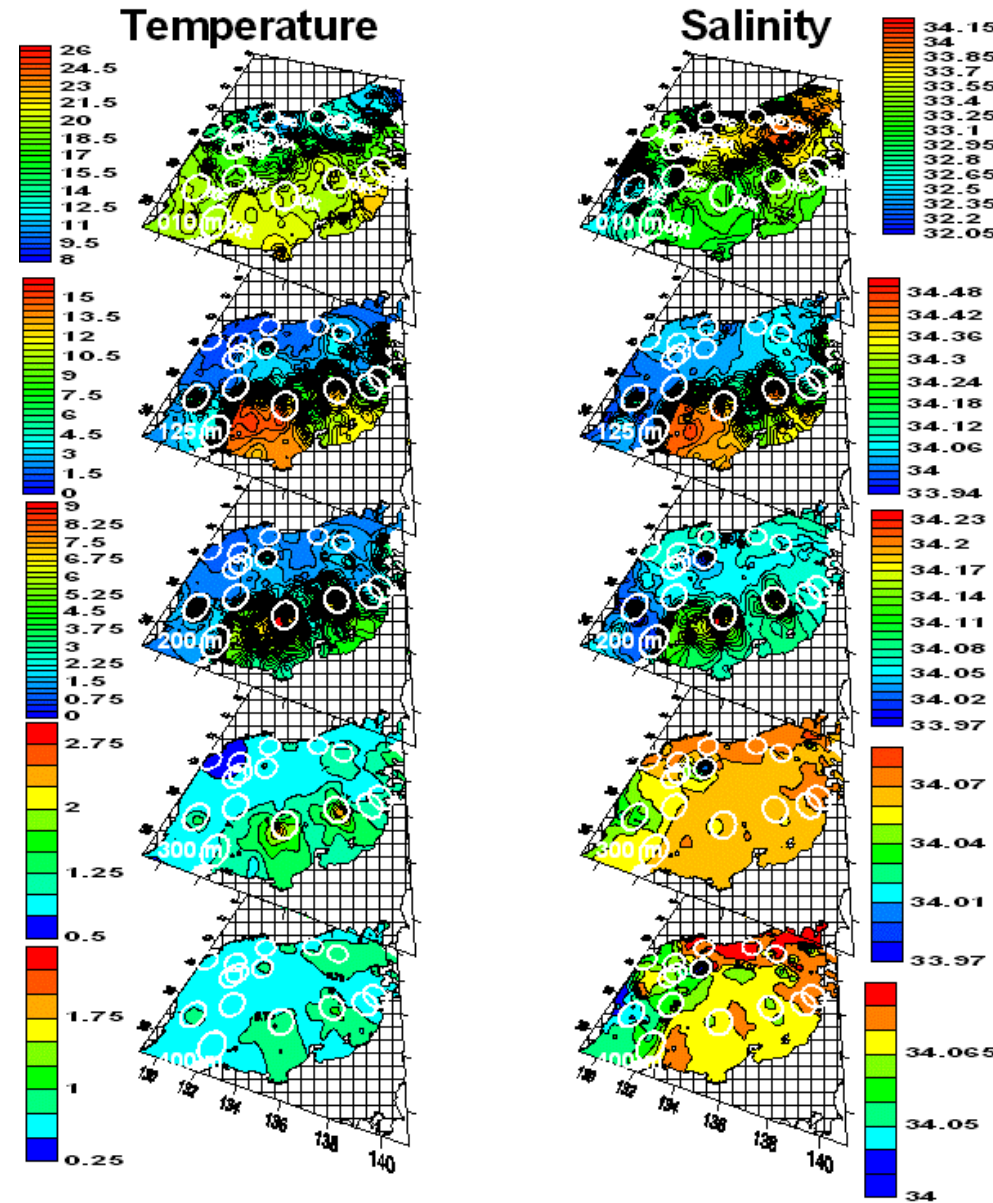
Mesoscale eddies location (Summer 1999)

- Using NOAA satellite infrared images and merged TOPEX/POSEIDON- ERS satellite altimeter data mesoscale eddy structure have been analyzed at the intermediate layer (white circles show location of mesoscale eddies).
- This page presents intermediate water structure for Summer of 1999 (temperature and salinity)
- Generally the interpolated fields' data anomalies correspond to observed from satellite eddies locations.



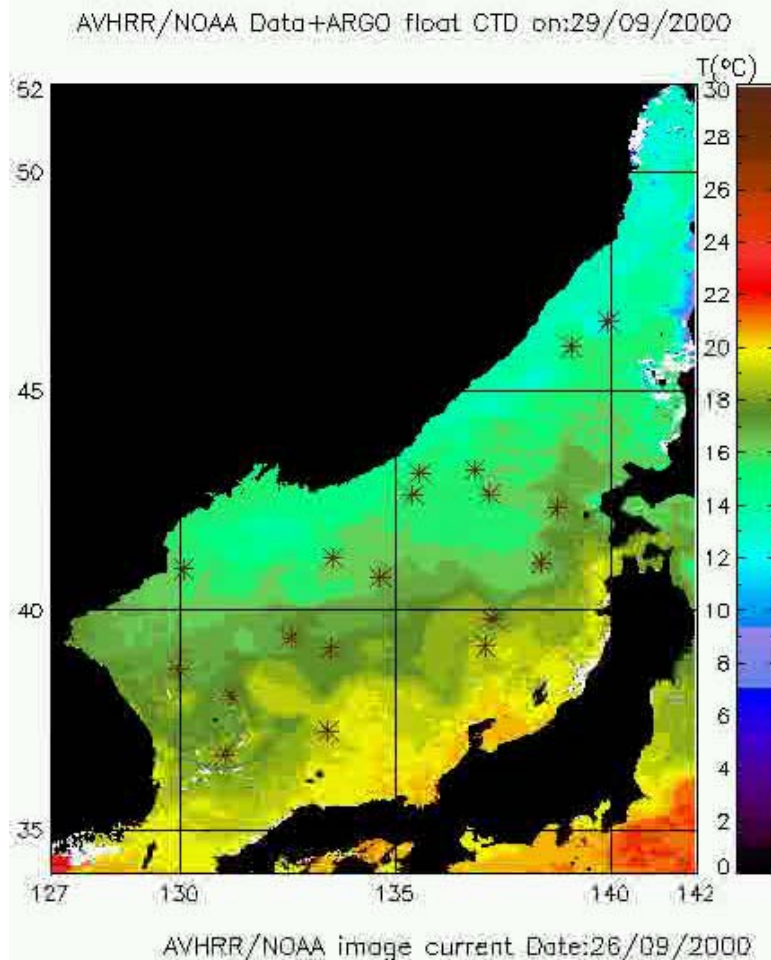
Mesoscale eddies location (October 2000)

- For October 2000 the similar result have been obtained - data anomalies correspond to observed from satellite eddies locations.
- Instead of sparse of ship survey using Argo data allows to reproduce general basin structure.

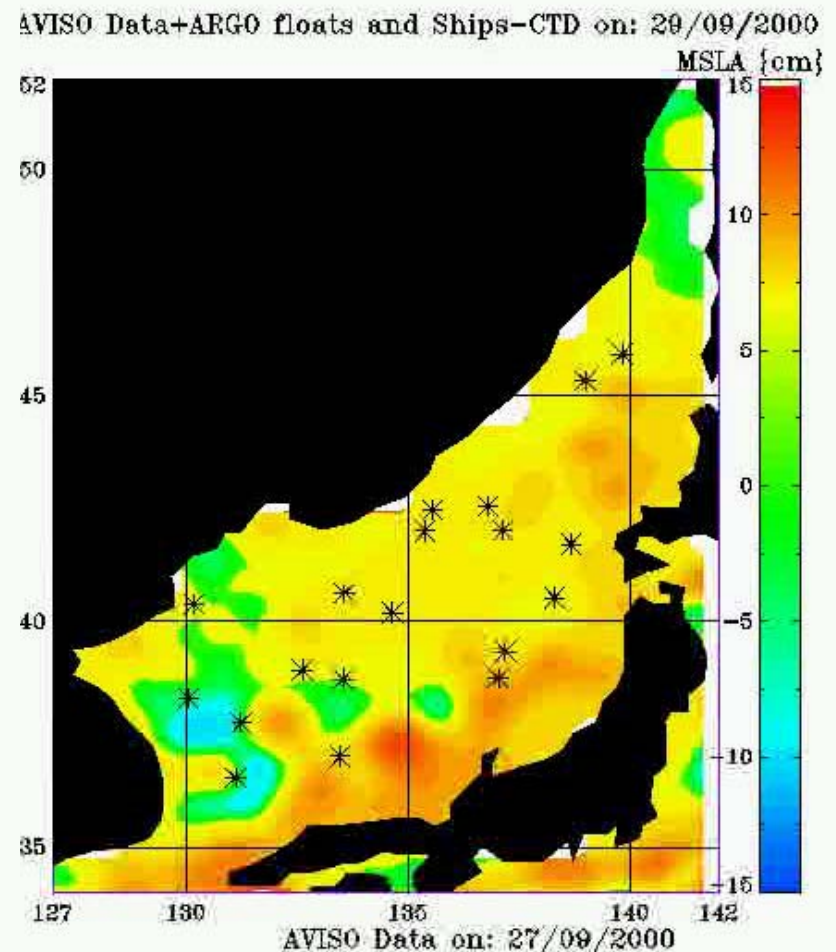


Merging with SST and Altimetry (continue)

SST on 10-11/2000



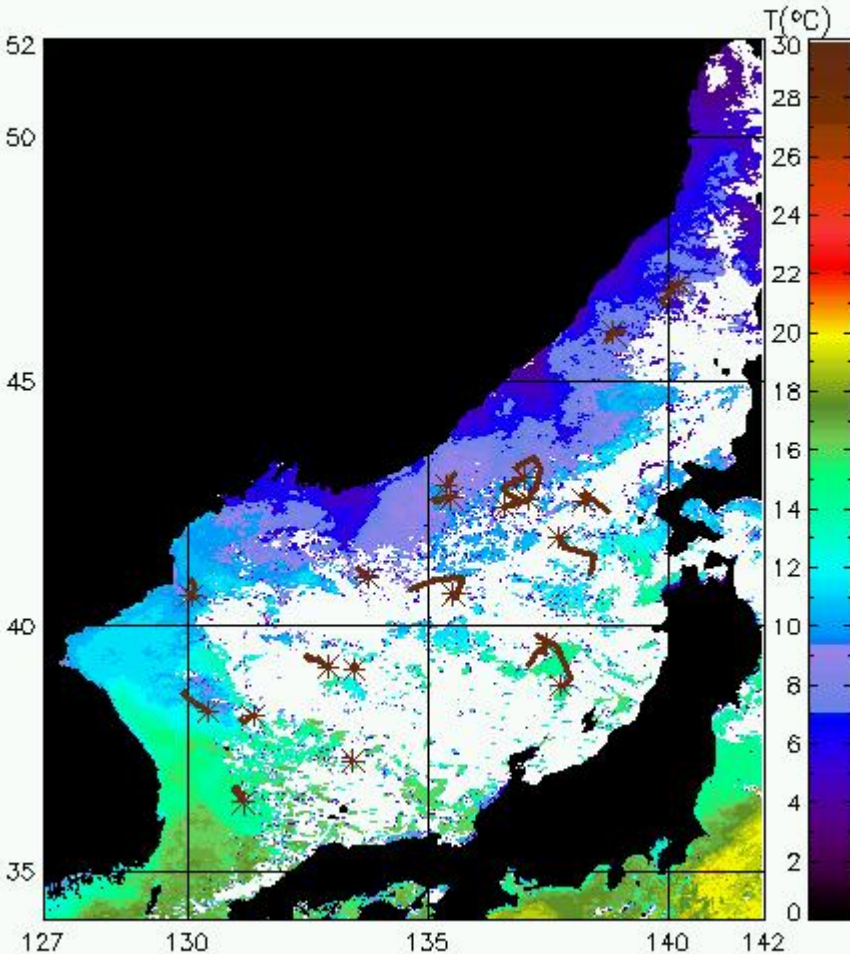
Altimetry on 10-11/2000



Merging with SST and Altimetry (continue)

SST on 10-11/2000

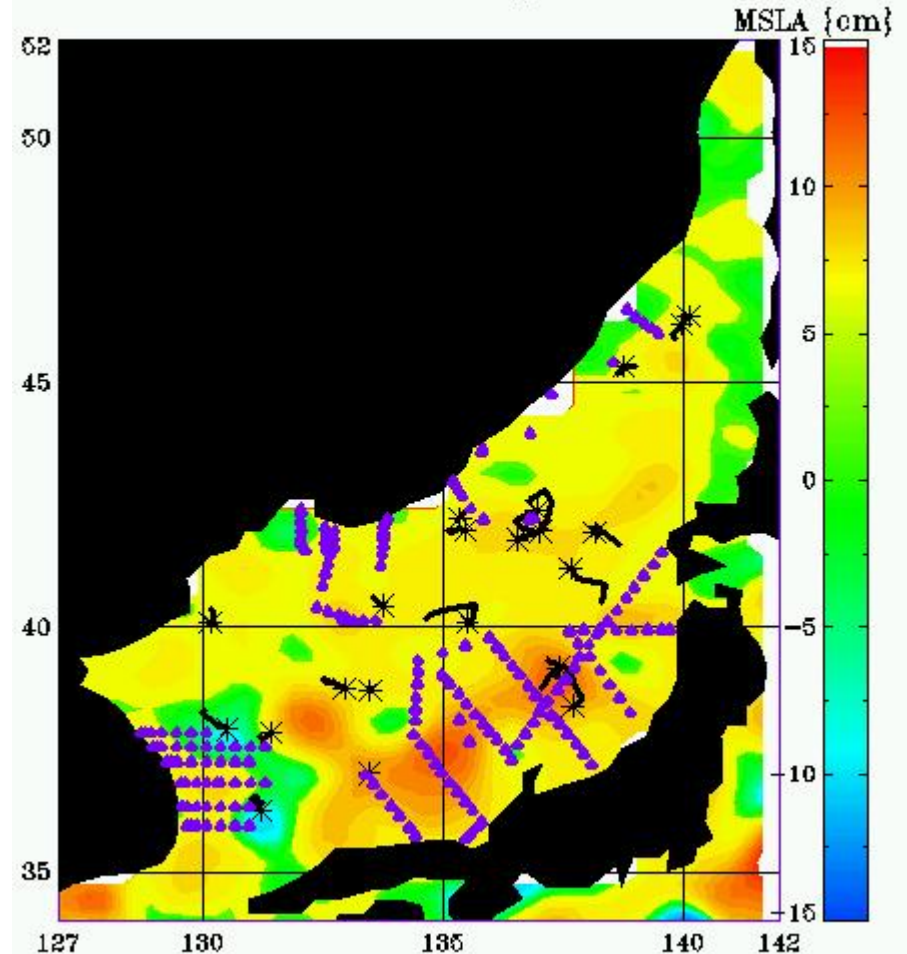
AVHRR/NOAA Data+ARGO float CTD on:17/11/2000



AVHRR/NOAA image current Date:16/11/2000

Altimetry on 10-11/2000

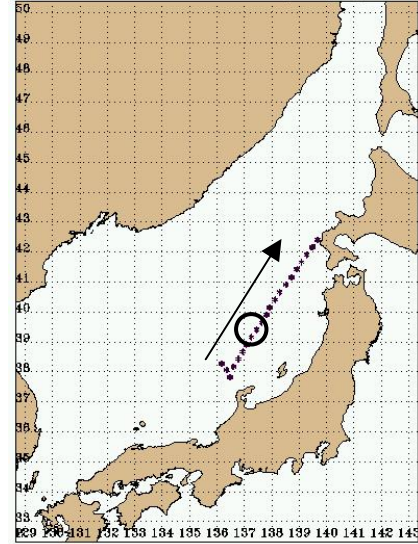
AVISO Data+ARGO floats and Ships-CTD on: 17/11/2000



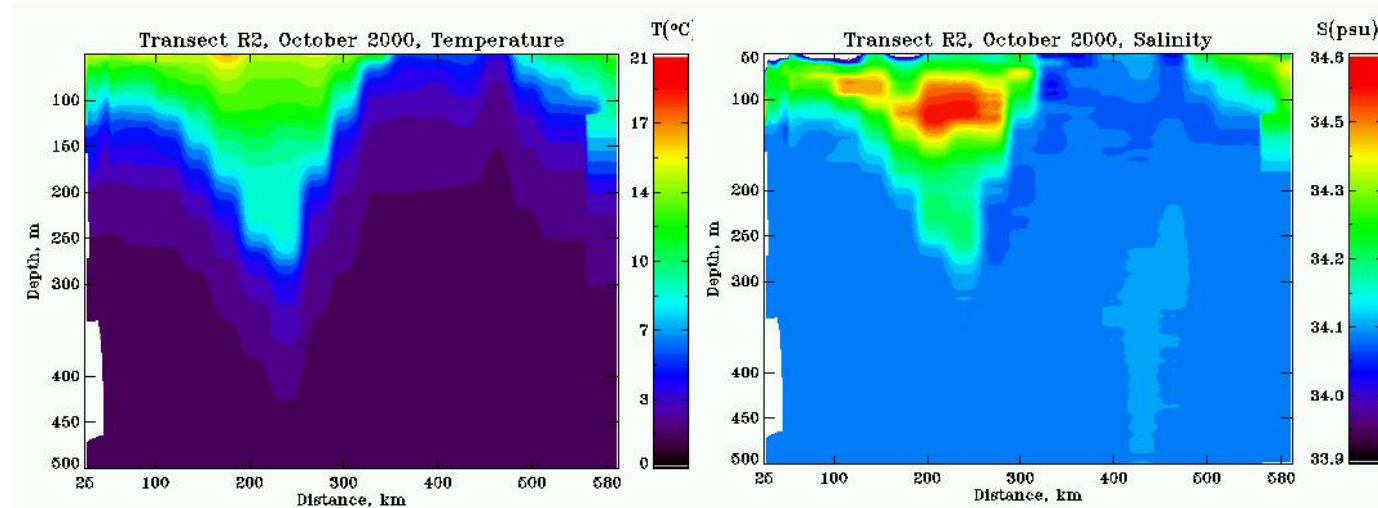
AVISO Data on: 15/11/2000

Transects through Eddies (October 2000)

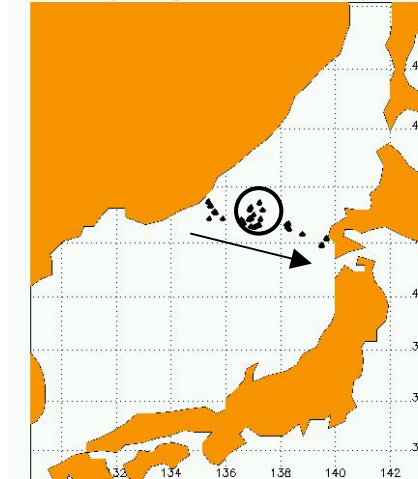
TD Stations for October 2000 Rus/Kor/Jap cruise



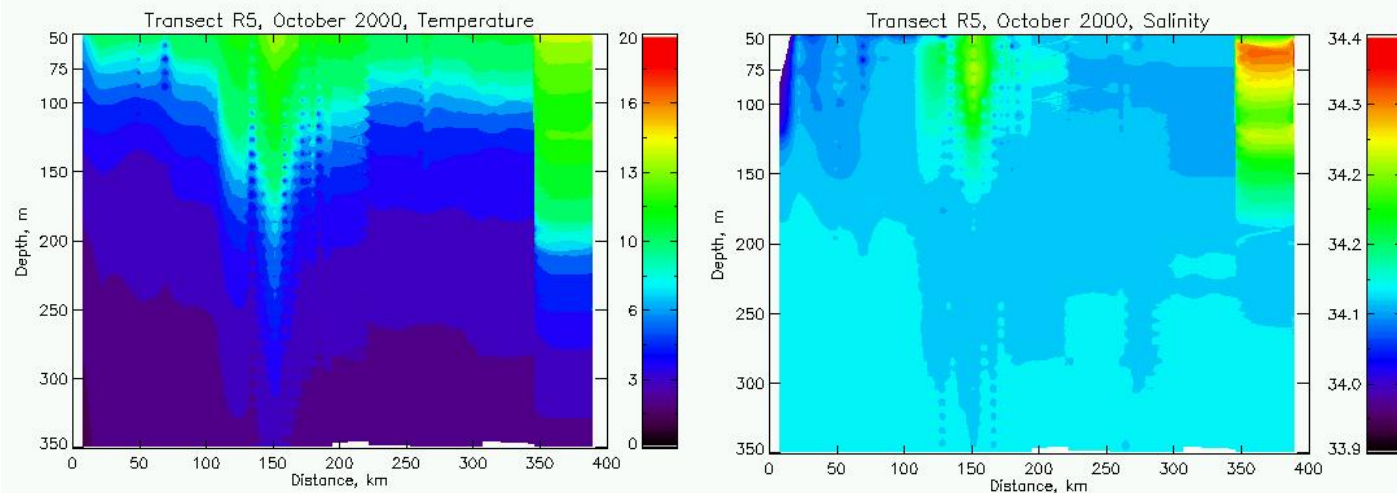
JMA Survey (JAPAN)



Transect from Ship and Argo-data on: 29-09-2000/17-11-20

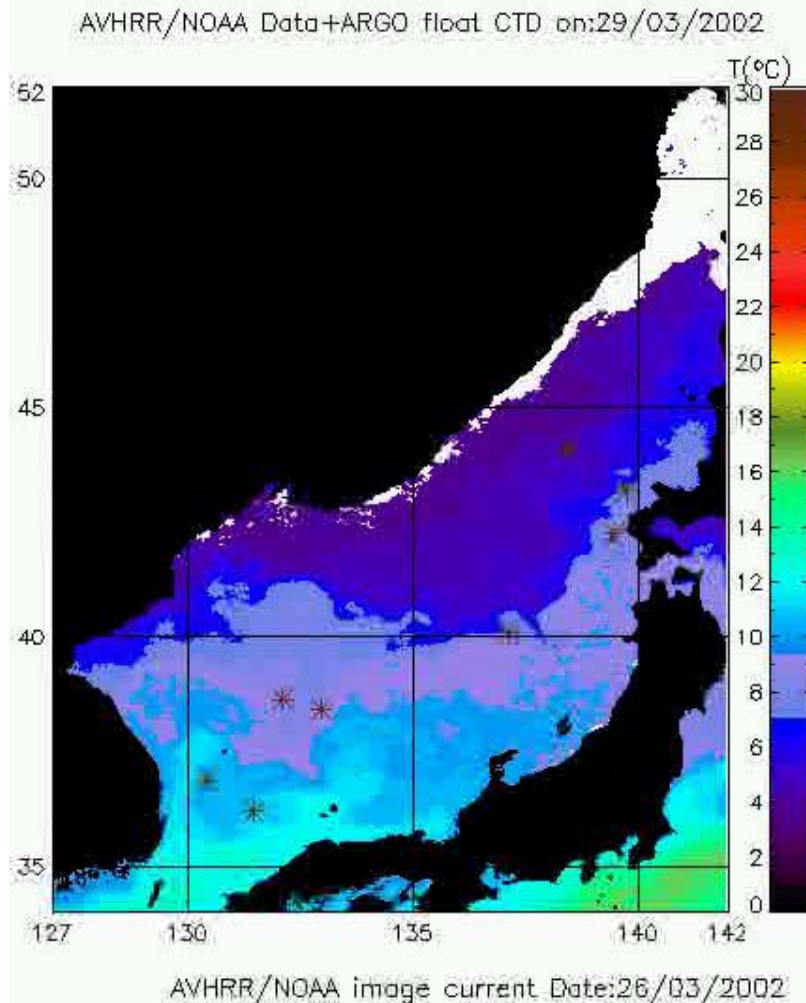


POI (Russia) Survey + ARGO + JMA Survey

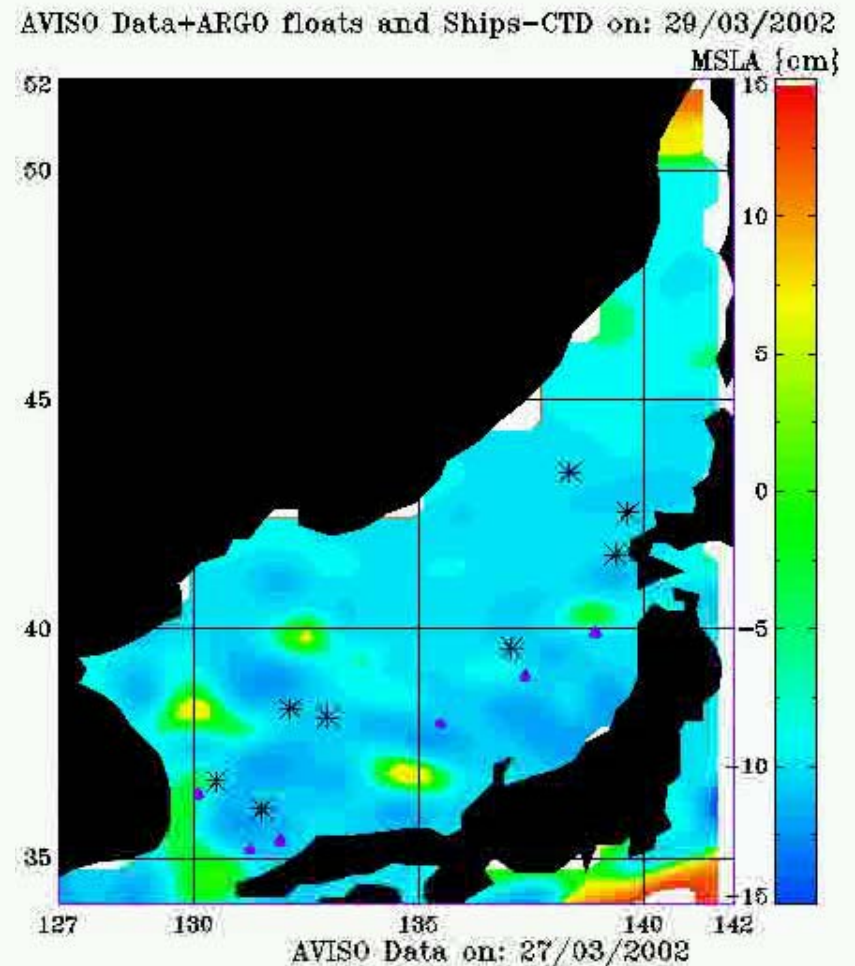


Examination dynamic properties of eddies

SST on 04-05/2002



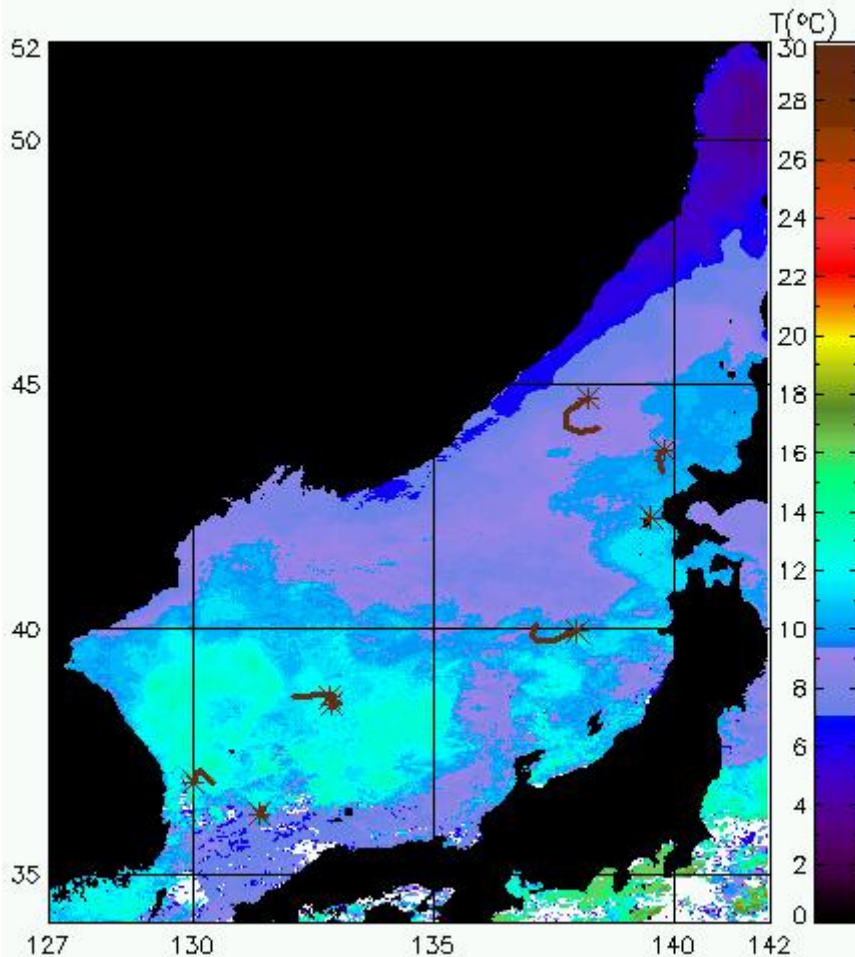
Altimetry on 04-05/2002



Examination dynamic properties of eddies

SST on 04-05/2002

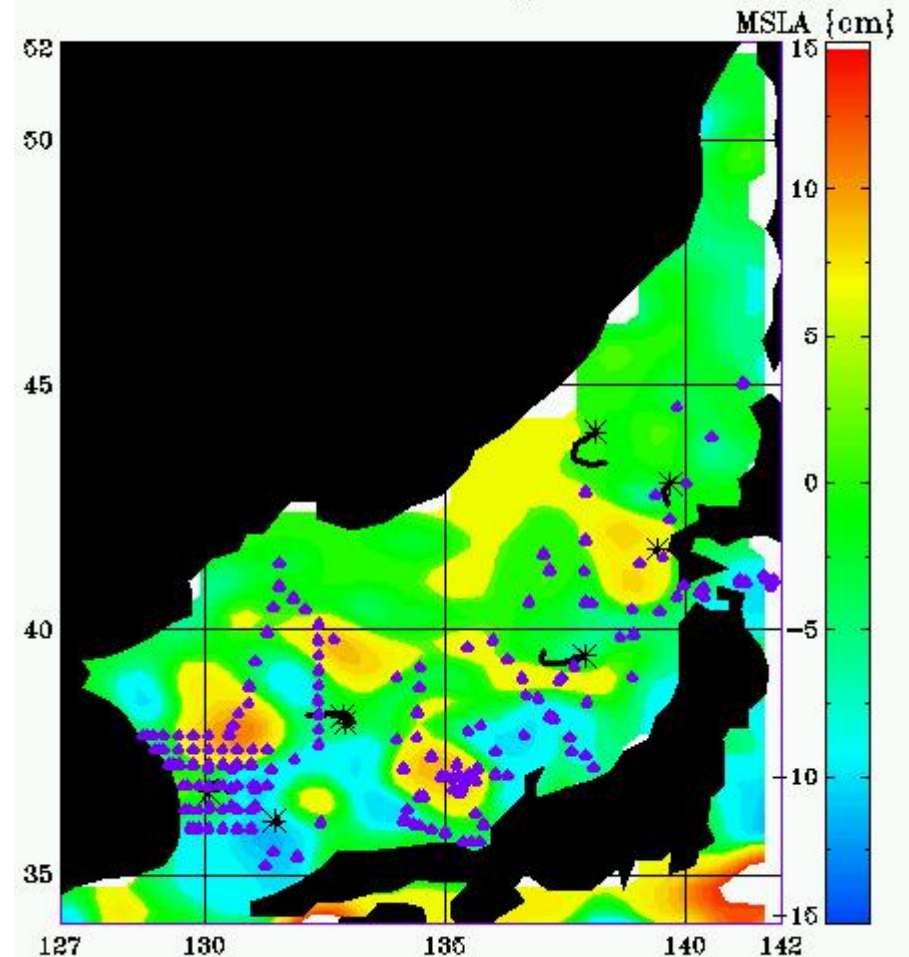
AVHRR/NOAA Data+ARGO float CTD on:09/05/2002



AVHRR/NOAA image current Date:06/05/2002

Altimetry on 04-05/2002

AVISO Data+ARGO floats and Ships-CTD on: 09/05/2002

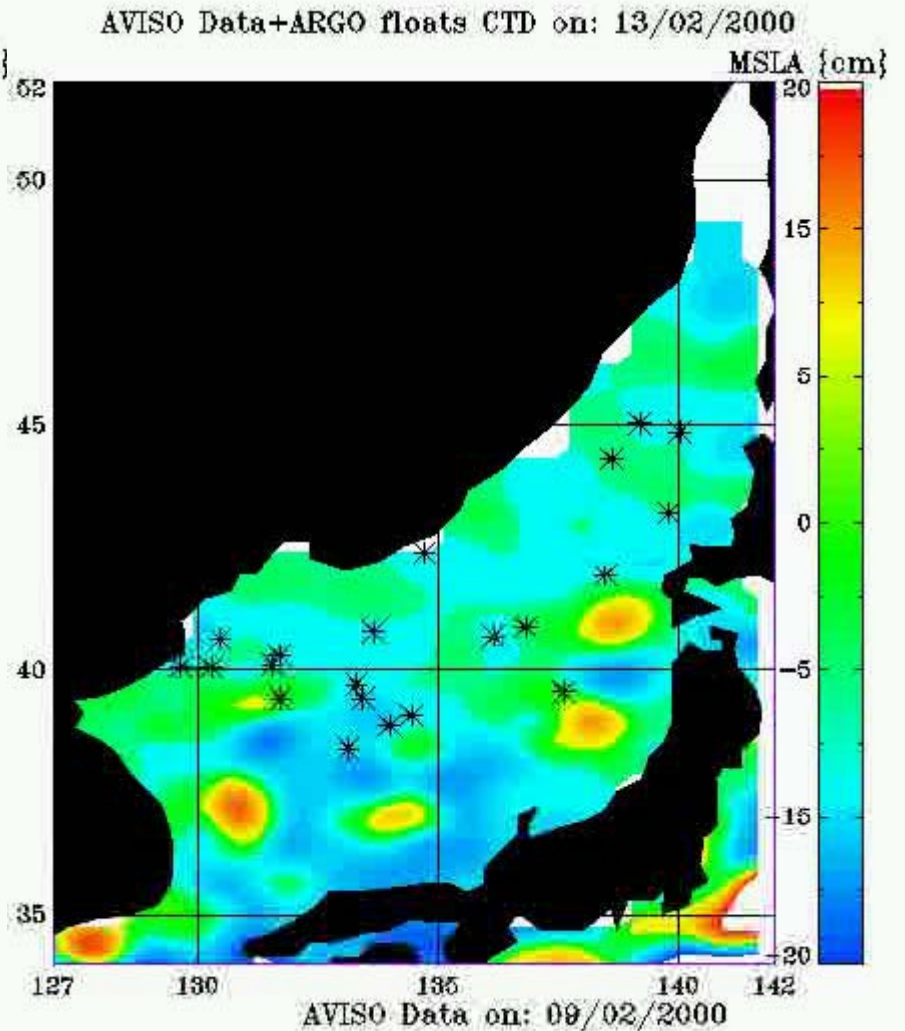
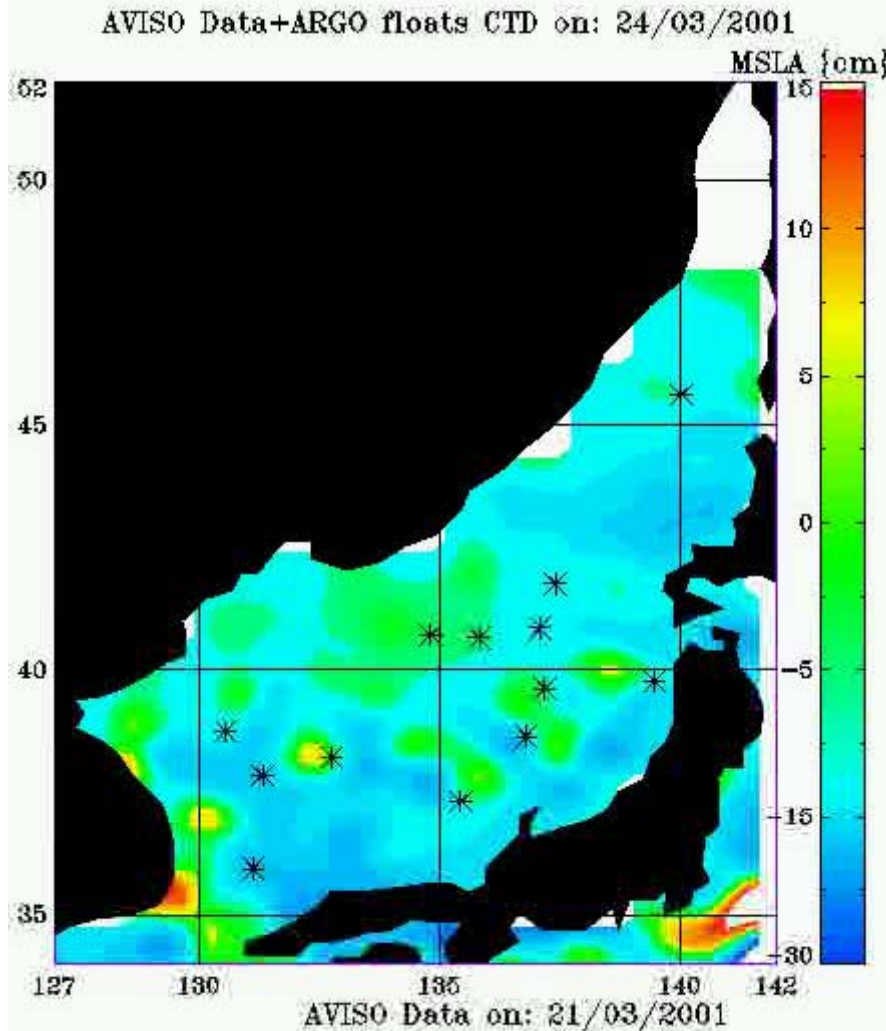


AVISO Data on: 08/05/2002

Eddy and ARGO-motion

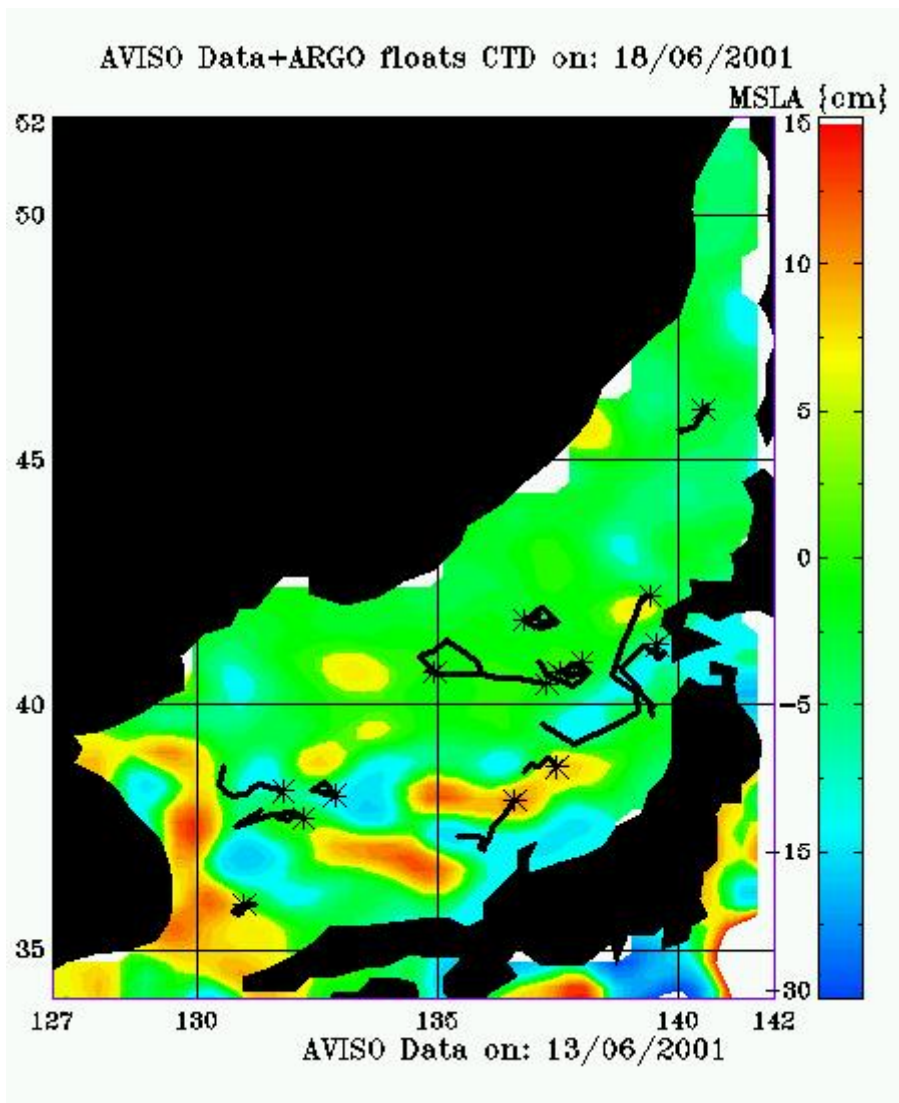
SST on 03-04/2001

Altimetry on 02-03/2000

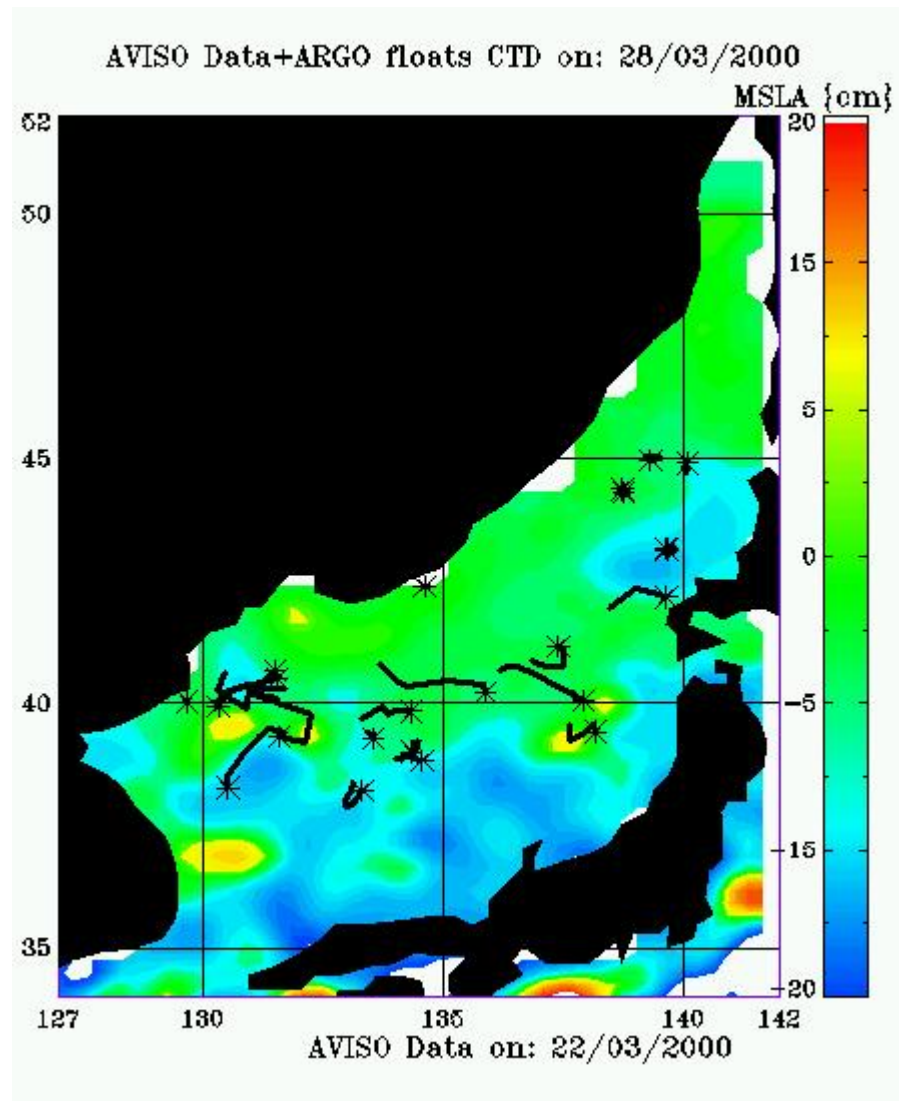


Eddy and ARGO-motion

Altimetry on 02-03/2000

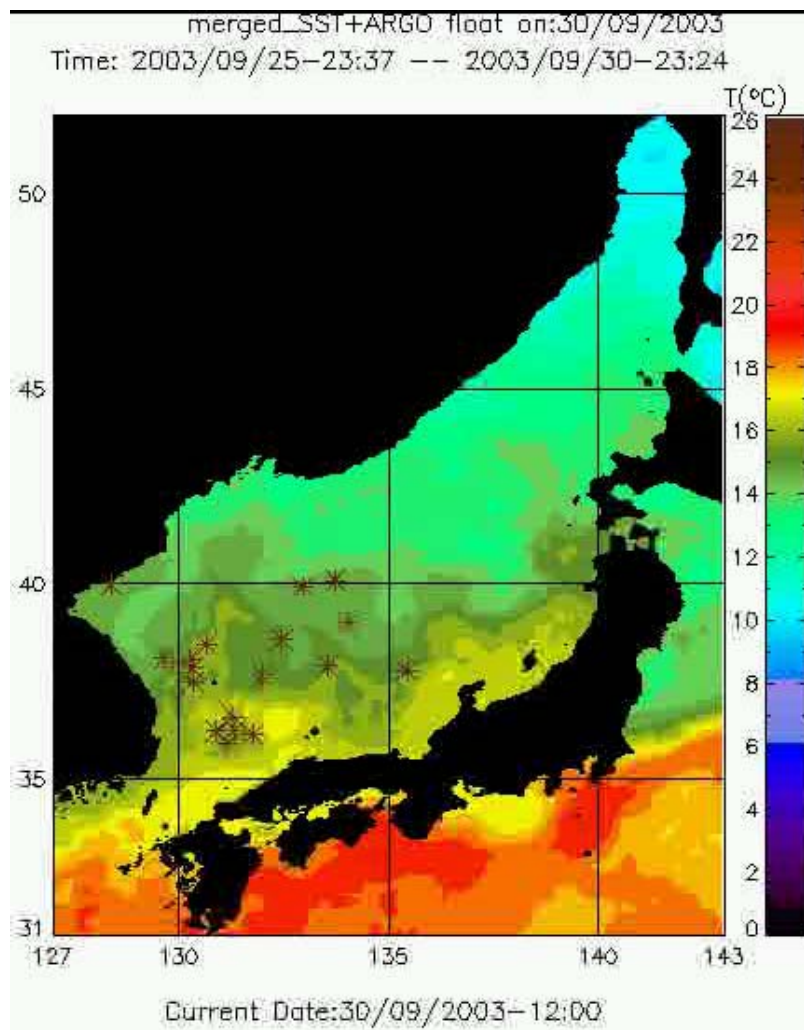


SST on 02-03/2000

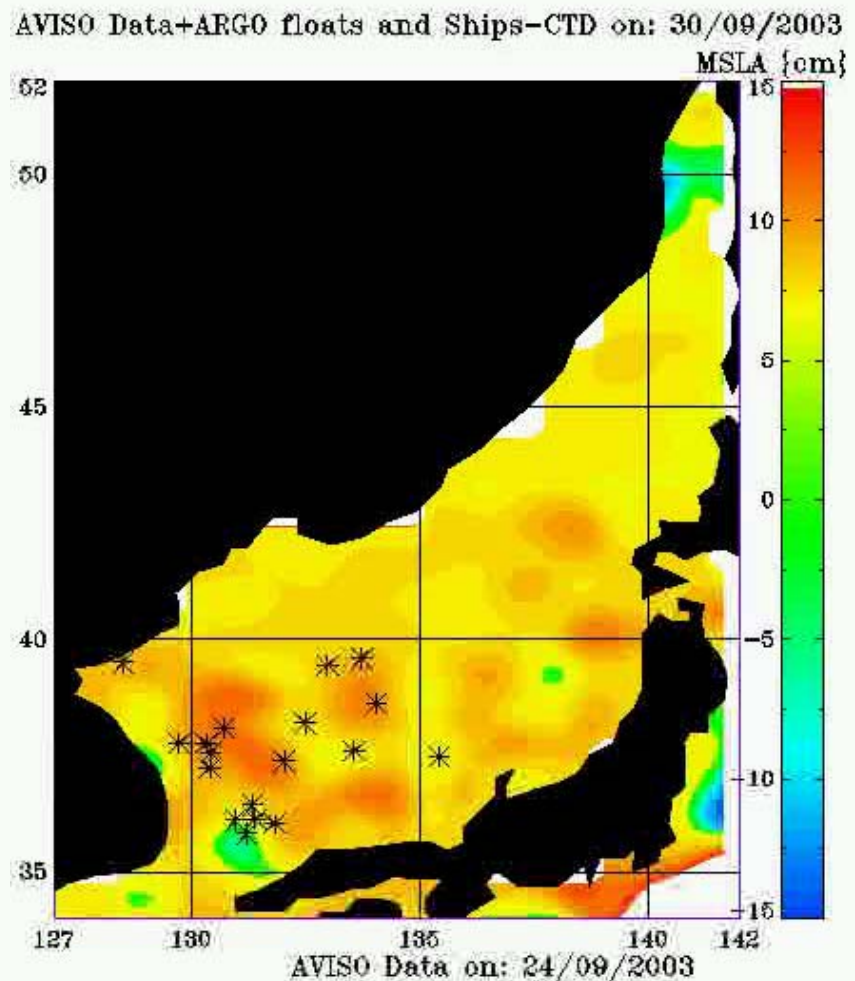


Eddy and ARGO-motion (continue)

SST on 10-11/2003

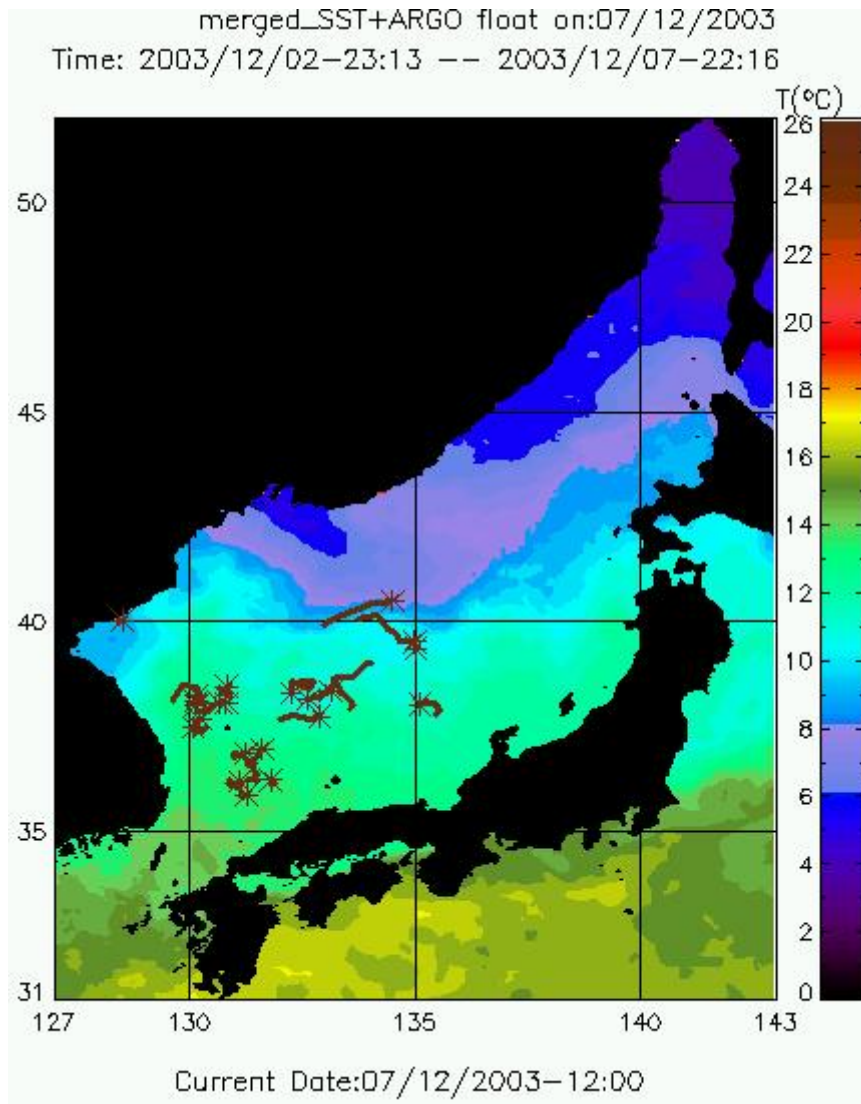


Altimetry on 10-11/2003

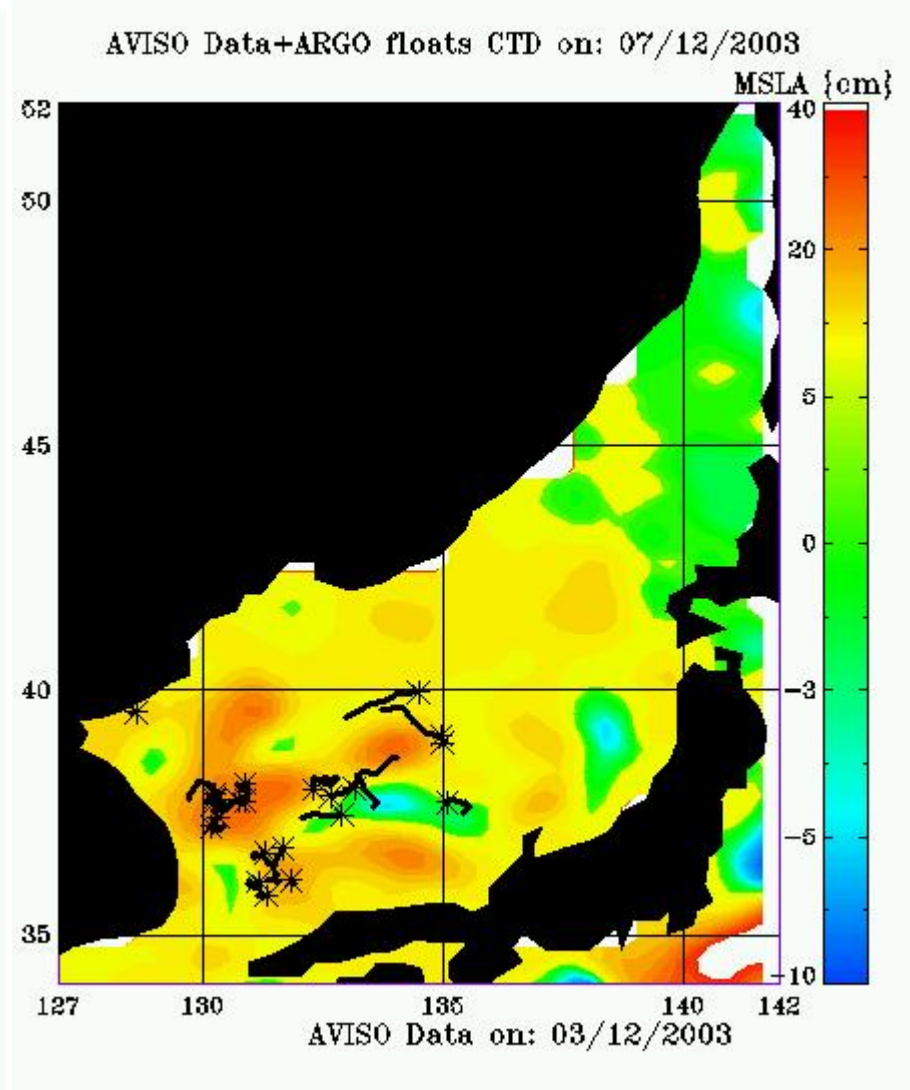


Eddy and ARGO-motion (continue)

SST on 10-11/2003



Altimetry on 10-11/2003



Results and Conclusions

- The tool for merging data from NEAR-GOOS and ARGO data archives have been created.
- Obtained fields provide information about mesoscale structure within basin scale for 1999-2004.
- Interpolated fields' data anomalies correspond to observed from satellite eddies locations. That confirm appropriateness of merging chosen datasets.



Thank you for
your attention!

List of Comments

Slide 1

Dear colleagues let me introduce to you our work concerned with the continuous mesoscale structure studies within Japan Sea basin. Usually the basin of Japan Sea is taking into account as the well known with the good known hydrological structure and scheme of currents. But this could be right if consider annual mean or month mean scale. The situation for exploring the interannual variability within whole basin scale is not so obvious. The sea is divided on national economic zone between Russia, Japan and both Korean states. So if we have some information for Russia, Japan and Republic of Korea, we don't have any information in open sources about any hydrographic works from the Republic of Northern Korea. And when we consider the mesoscale structure on the area of whole Japan Sea this could be a problem. Thus the ARGO-project in the Japan Sea gave the many benefits in the study of mentioned problem for all countries of the basin. The first 30 drifters there have been deployed in the summer of 1999. They worked about 2 years and gave the good support for the researches dedicated to mesoscale structures.

Slide 2

The main goal of this work is to show how we unified the datasets of countries NEAR-GOOS participants, which is actually the part of GOOS system. And also to show what's new brought in this dataset by the ARGO-data obtained during 1999-2004 years. From other hand we will try to describe how we work under studying of mesoscale structures within the basin of Japan Sea using different kind of satellite data for detection of eddies and estimation of its properties.

Slide 3

The pure VDB-technology is a technique of forming integrated database from the sources of data distributed at different locations. These sources could be or may not be a regular bases or archives of necessary information. Hence the sample of using such technology could be a metasearch engine at Internet or the systems of electronic commerce. Our implementation of VDB is a web site contained engine for optimal interpolation hydrological fields from the in situ data. The difference with the regular database that we use original format of data provided by the owner of archive, but not create the own database. So if the owners update information on his site our data will be also updated.

Slide 4

The basic sources what we used in our research is shown on that page. The information ship observations obtained from the sources of Russian, Korean and Japan. The owners

of Russian Pacific Oceanological Institute, Korea Ocean Research and Development Institute and Japan Oceanographic Data center. The ARGO-drifters data have been taken from the database of Global Ocean Data Assimilation Experiment (GODAE).

Slide 7

On this page the basic datasets is shown. We can provide the data for twelve different casts made during 1999-2004 years. Using the VDB-technology we can provide the optimally interpolated gridded data with the different resolution scale. Optimal interpolation for static view is provided online. Other kind of data is available offline yet. On last three pictures provided only data from Russian cruises and ARGO-drifters. Unfortunately the Korean and Japanese data for this time period is not available yet.

Slide 8

The ability to explore mesoscale eddies within large space scale (until 50 miles in diameter and more) appeared after the opening of Inter Institution Regional Satellite Monitoring Center. Using these data (NOAA AVHRR satellite infrared images) allow starting specialized cruise at summer 1999 on the R/V 'Roger Revelle' and R/V 'Professor Khromov'. During this cruise the whole basin of the Japan Sea was covered by the net of stations with the special attention to the eddies. Also the first ARGO-drifters have been deployed there. For example I also provide here the picture with casting during the next year 2001 when the casting through the whole basin was not available. As you can see, every country made their observations in correspondent economic zone, but the red triangles of ARGO can provide information about the blanked spaces. This shows that if you want to see interannual variability within the basin scale you should make the cruise through the whole sea or use all available data from different databases.

Slide 9

As the first experience we made horizontal fields of distribution T,S-characteristics through the whole basin for every merged dataset and separately for the specialized cruise of 1999. We use standard depths of 10, 125, 200, 400 m. Generally the interpolated fields' data anomalies correspond to observed from satellite eddies locations. Here I show picture for cruise of 1999. Here we show result of optimal interpolation for survey 1999. The eddies locations marked by white circles. So generally data anomalies correspond to observed from satellite eddies locations.

Slide 10

As the first sample of using ARGO data for merging ship-ctd survey we would like to show results for October 2000. So here the similar result have been obtained - data

anomalies correspond to observed from satellite eddies locations. Instead of sparse of ship survey using Argo data allows reproducing general basin structure.

Slide 11

Now this page shows an interesting case coincidence observation point made from ship in Russian cruise and two ARGO-drifters within one eddy in the northern part of the sea. Sometimes the drifters were deployed to eddies knowingly but this case looks like an accident. So here we have ability to examine eddy conditions using 3 different type of data (ship, drifters, satellite images). As the background for this survey you see the data of New Generation SST by Hiroshi Kawamura and Sea Level Anomaly (MSLA) obtained from a complete reprocessing of TOPEX/POSEIDON, Jason and ERS-1/2 data. Using these data we could obtain some additional information about eddies behavior in the Japan Sea.

Slide 13

On this page we show assessing vertical water structure properties with transects made by the regular and ARGO-data. The black arrows show the direction of transects. The transect below, was made mostly due to the presence of ARGO-data. The suggestions about the size of eddy in this case were possible only due to the presence of ARGO.

Slide 14

At the end of my report I would like to show some peculiarities observed by us during the considering additional information on SST and Altimetry. Using of such data allows exploring dynamic properties of water motion characteristic on interannual scale. This page demonstrates ability on using drifters' motion tracking on the eddy detection. Near the eddies detected from the satellite situated some small eddies which dynamic characteristics was obtained from ARGO-data. Such eddies are presented at the south and in the northern part of the sea.

Slide 16

Also we picked up from our surveys two the longest survey, which was made during, mentioned years, considering only the trajectories of ARGO-drifters inside Japan Sea basin. This page demonstrates some features of their trajectories during this time periods. As it known the drifters are moving on the depth about 800 meters. But as it seen from picture these trajectories is close to altimetry and sst anomalies which seen from satellites. As we can suggest this fact is concerned with the eddy motion inside the Japan Sea basin.

Slide 17

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Slide 18

These last pages demonstrate one of the last from our surveys in the Japan Sea. As you can see and as I told already in the start of my presentation there is some delaying with the data distribution from the Korean and Japanese datacenters. So if we trying to obtain the features of mesoscale eddies structure within the full Japan Sea basin it is possible now only due to using the ARGO-data base.

Slide 19

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Slide 20

Finally as the result of our work we could provide a tool unifying the data of ship observation for exploring and obtaining hydrographic fields on the area of Japan Sea dedicated to exploring the mesoscale structure within basin scale. It provides information about cruises of last 5 years dedicated to the study of eddy activity and allows examine eddy motion with a new helpful array of ARGO-drifters data. The hydrographic fields filled and augmented by the ARGO-data represent quite well basin scale and in some case mesoscale features. This allows tracing seasonal and interannual variability and evolution of eddies structure.

Slide 21

So this is all material, which we have planned to present. Thank you very much for your attention to our presentation.