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TOWARDS OPERATIONAL OCEANOGRAPHY IN THE RUSSIAN FEDERATION

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Historical background of national ocean observations

The sea-borne ocean observations in Russia date back by two centuries. The highest oceanographic activities took place in 1970-1980. In 1990, the national oceanographic observation system was characterized by the following figures

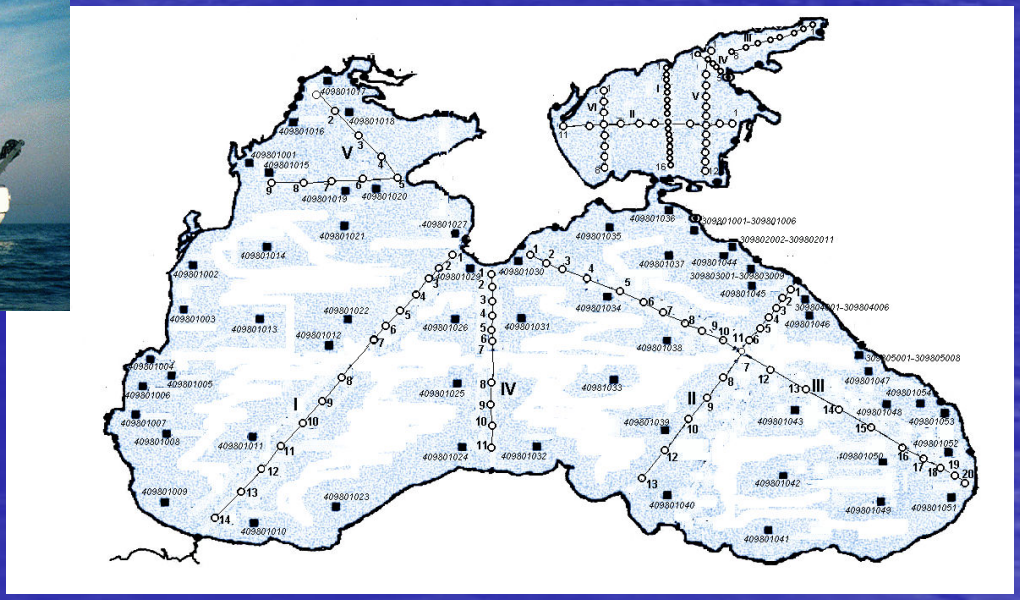
Ocean-going research ships, belonging to Hydrometeorological Service, Academy of Sciences, Ministry for Fisheries based in the ports of the Black, Baltic, White, Barents, Japan Seas and Pacific Ocean and operating worldwide - 34

Coastal and island hydrometeorological stations (meteorological, hydrological and sea level observations) - 305

Voluntary Observation Ships (meteorology) – 1200

Meteorological and oceanographic satellites – 4

Pollution monitoring stations in the coastal waters – 649 at 14 seas



Overview on national system for ocean observation: National policy and regulation

There are a number of national legal acts which envisage monitoring of the seas washing the coasts of the Russian Federation. Among them are the following:

- Federal Law "On Preservation of Environment"
- • Federal Law "On Hydrometeorological Service"
- • Water Code of the Russian Federation
- • Federal Law "On the inner sea waters, territorial sea and adjacent zone of the Russian Federation"
- • Federal Law " On Continental Shelf of the Russian Federation"
- • Federal Law "On Exclusive Economic Zone of the Russian Federation"

However acute financial shortages have so far prevented a full implementation of these legal acts as far as they concern monitoring of the seas.

Overview on national system for ocean observation: National policy and regulation: Financial and organizational frameworks

There are several governmental structures which are involved in ocean and marine observations:

- Russian Academy of Sciences
- Roshydromet
- Agency for Fisheries
- Russian Navy

Presently, there is only one nation-wide research program which deals with sea and ocean studies, entitled “The World Ocean”. However, the funding is too small for a large-scale ocean research to be conducted. Besides, the research vessels have grown old and outdated, the majority of them having been built in1970-1980ies.

Implementation of R&D and monitoring programmes:
Coastal Hydrometeorological Network

Totally, there were 226 hydrometeorological stations along the entire coast of the 14 seas washing the Russian Federation in 2011, an average number of stations per 100км of the coast length being 0.46.

At the seas of the Atlantic Ocean (Black, Azov and Baltic Seas) this number was three times larger (1.61) with the total number of coastal observation sites being 48 (44 in 2003) .

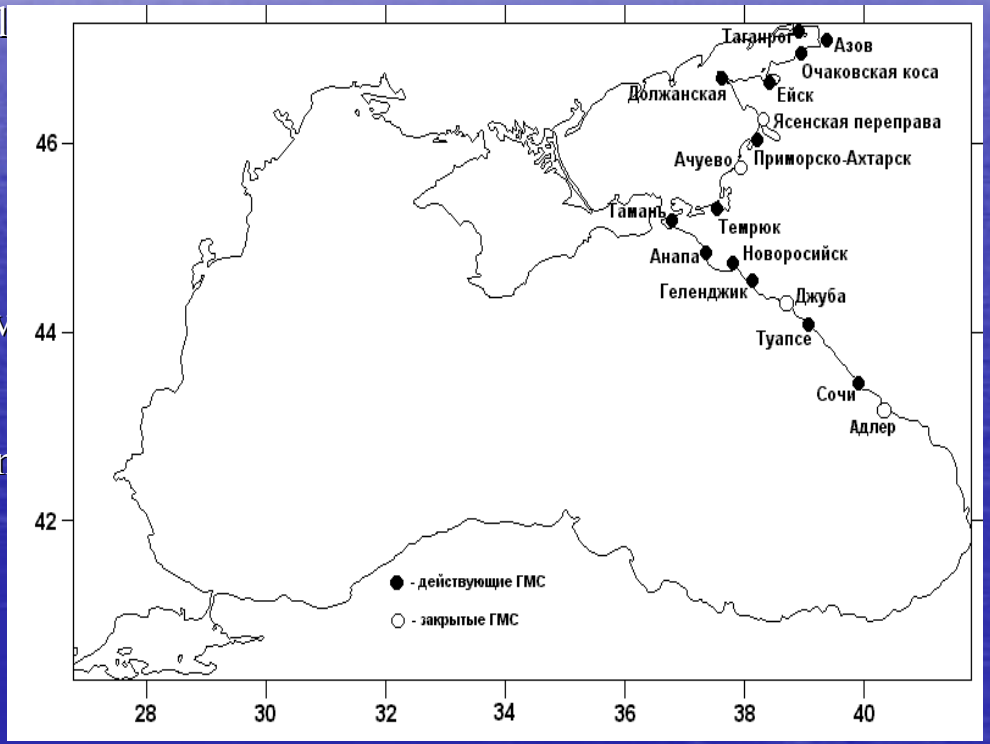


Figure to the right: Location of hydrometeorological stations on the Russian national coast. Open circles indicate closed stations

Implementation of R&D and monitoring programmes:
Coastal Hydrometeorological Network

The hydrometeorological stations perform observations of standard meteorological parameters and waves (4 times a day), sea level and water temperature (two times a day), salinity (once a day). The observations are made in accordance with the procedures outlined in " Guidelines for Hydrometeorological Stations and Posts ", issued and periodically revised by Roshydromet. The used procedures are in compliance with the relevant WMO standards. All hydrometeorological stations are attended by specially trained qualified observers.

All stations are equipped with the nationally-manufactured instruments. Wind is measured with wind vanes, readings of air temperature and humidity are taken in screens at 2 m above ground, air pressure measurements involve in-door mercury barometers, sea level is observed with scales, sea water salinity is inferred from conductivity. The majority of instruments have been worn out to a large extent.

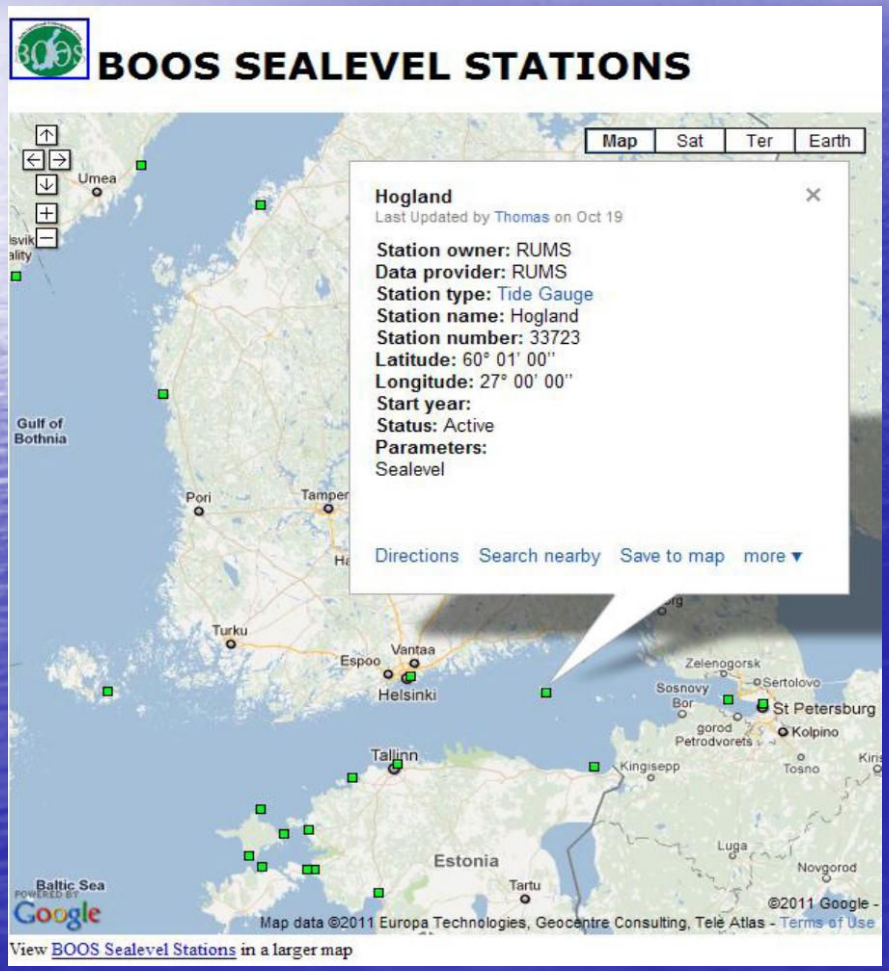
Implementation of R&D and monitoring programmes:
Real-time sea-level observations

- Three new Russian autonomous automatic stations measuring sea level, atmospheric pressure and air temperature were installed in 2008-2009 at Baltic Sea , Hogland Island and at Black Sea, Novorossiysk. The data from these stations are being transmitted via cell phone channels to the local Roshydromet offices in St-Petersburg and Port of Novorossiysk, respectively.

- Since April 2010 the digital sea-level data from the Hogland Island are being put into the Global Telecom Implementation of R&D and monitoring munication System of the World Meteorological Organization and assimilated in the Baltic GOOS sea-level model.

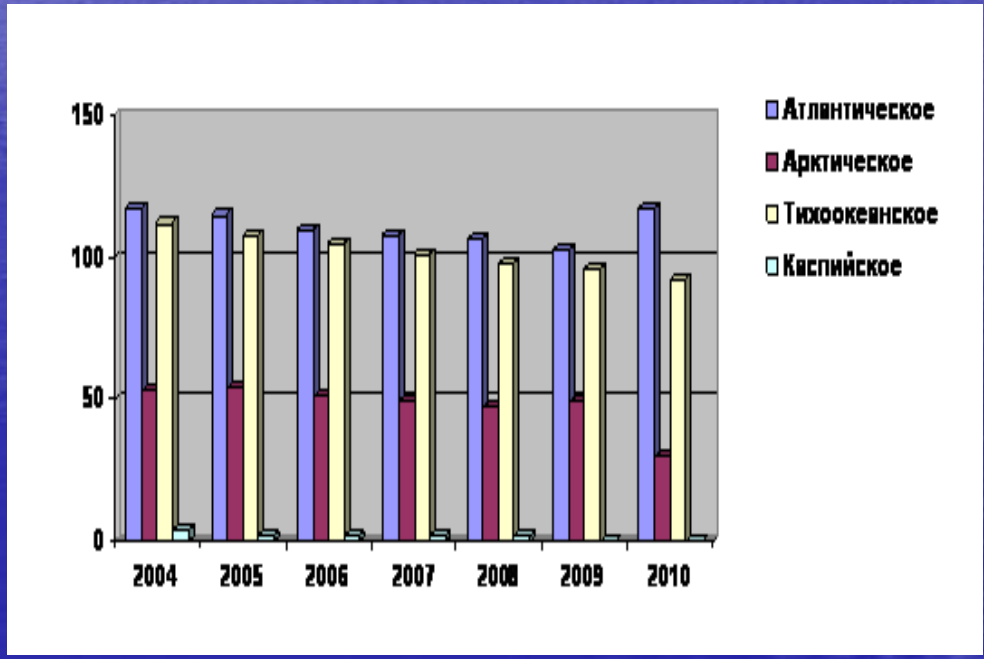
Implementation of R&D and monitoring programmes: Real-time sea-level observations

Geographic location (left) and general view of above-water part (right) of the automatic level measuring station at the Hogland Island



Implementation of R&D and monitoring programmes: VOS meteorological observations

- The total number of Russian VOS has declined from 1200 in 1990 through 286 in 2004 to 239 in 2011.
- Unfortunately, the VOS are generally of little use in covering the meteorological conditions in the marginal seas (like the Black Sea) because they cross them in less than 24 hours.



- ***Figure. Inter-annual dynamics of the number of the Russian VOS operating at the Atlantic (Атлантическое), Arctic (Арктическое), Pacific (Тихоокеанское) and Caspian (Каспийское) seas in 2004 – 2010.***

Implementation of R&D and monitoring programmes: VOS meteorological observations

The number of Russian VOS has declined from 1200 in 1990 through 286 in 2004 to 239 in 2011. Unfortunately, the VOS are generally of little use in covering the meteorological conditions in the marginal seas (like the Black Sea) because they cross them in less than 24 hours. The majority of VOS weather reports come from the ocean proper. The VOS metadata are annually reported to WMO and regularly updated in the WMO VOS Database

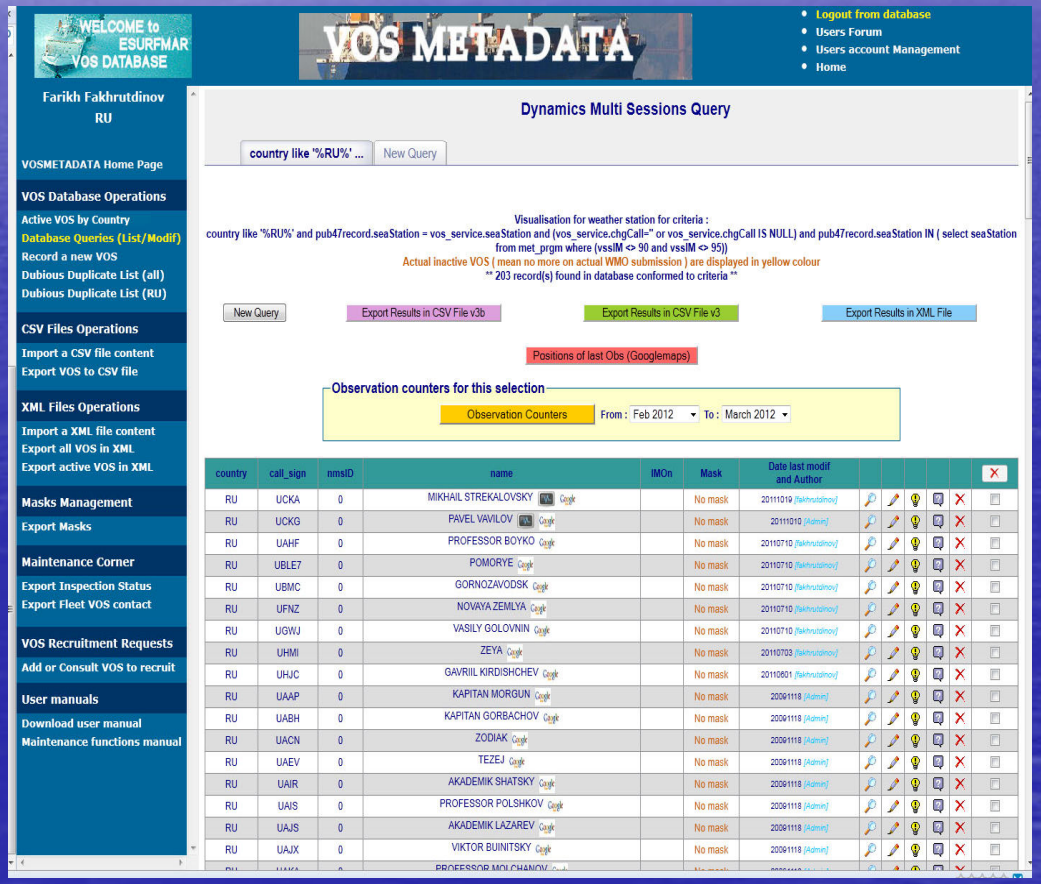


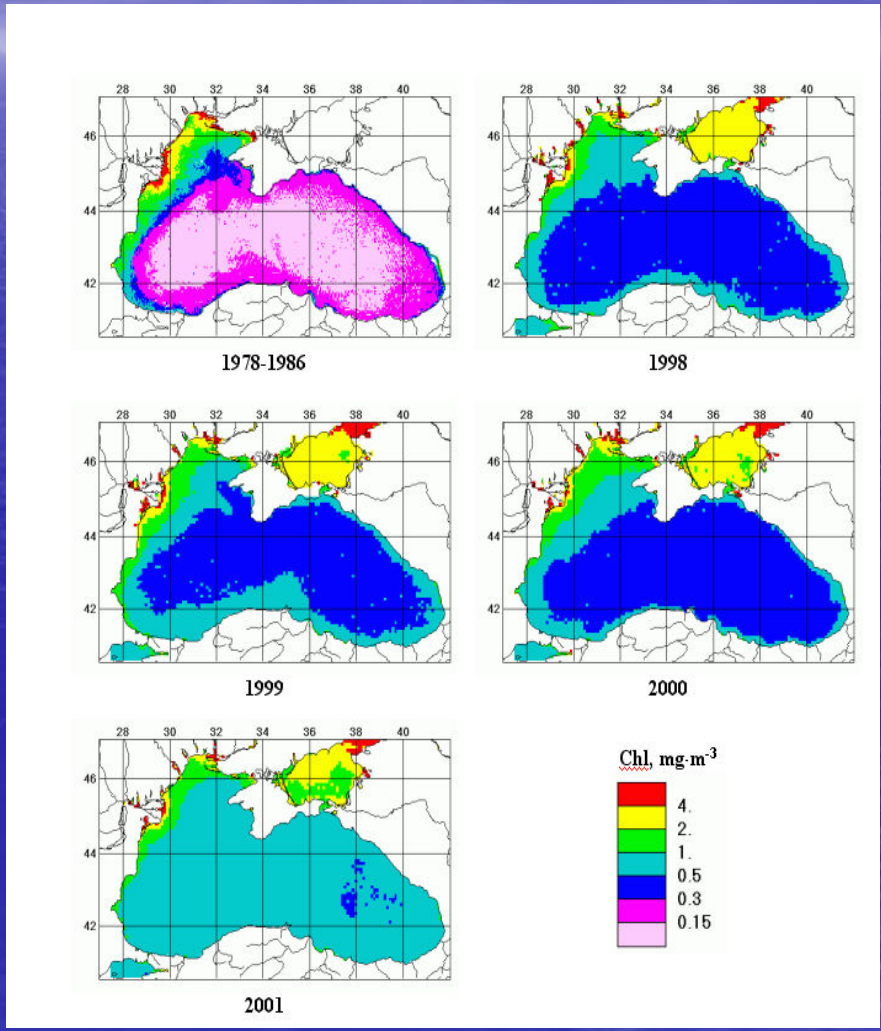
Figure to the right. Russian VOS metadata in the WMO VOS Database

Implementation of R&D and monitoring programmes: *Satellite Observations for research*

Chlorophyll concentration inferred from satellite ocean-color data is widely accepted as an index of phytoplankton biomass and correlated with primary production. These data can be also used to trace mesoscale eddies rising from instability of sea currents. Long series of chlorophyll fields have be accumulated for Black and Baltic Seas in the Shirshov Institute of Oceanology, RAS.

Figure to the right:

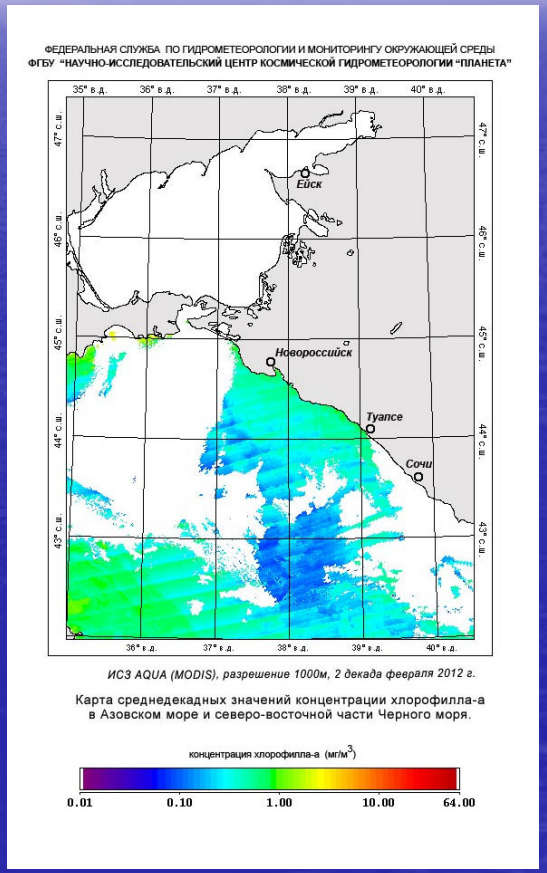
Inter-annual variability of the seasonal (May-September) chlorophyll concentration in the Black Sea in 1978-86 (by CZCS data) and 1998-2001 (by SeaWiFS data) calculated with the SIO/RAS algorithms.



Implementation of R&D and monitoring programmes: *Satellite Observations for routine monitoring*

The Russian Black Sea coastal water areas have been monitored based on the satellite data since mid-2000s. A monthly bulletin is being published describing the location of eddies, high turbidity zones, chlorophyll-abundant zones, oil spills on the sea surface.

Figure to the right: Average concentration of chlorophyll-a in the NE Black Sea during 10-20 February 2012 based on routine satellite monitoring by Planeta, Roshydromet

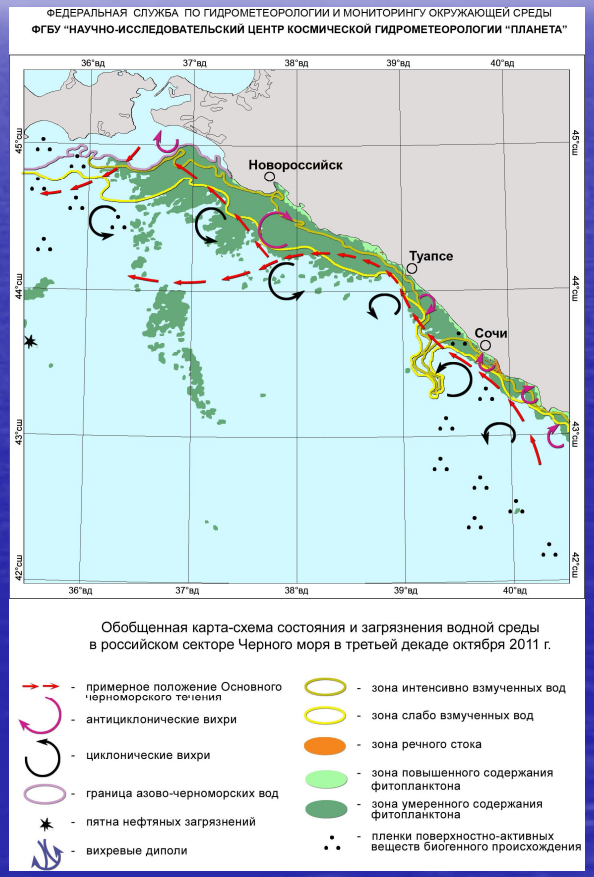


Implementation of R&D and monitoring programmes: *Satellite Observations for routine monitoring*

- *Figure to right. A summarised scheme of the state and pollution of the NE Black Sea surface on 20-30 October 2011 as inferred from Planeta routine satellite monitoring.*

- More data of routine observations can be found at

http://planet.rssi.ru/index1.html



Implementation of R&D and monitoring programmes:***Hydrochemical and pollution monitoring***

- There are hydrochemical and pollution monitoring stations in the coastal waters of the seas washing the Russian Federation.

- *Figure to the right. Location of the marine hydrochemical and pollution monitoring sites in the Russian Federation operated by Roshydromet on routine basis in 2011*

Implementation of R&D and monitoring programmes: *Satellite Observations for routine monitoring*

The water samples are taken 4 times per year from small boats. The water is analyzed for natural hydrochemical parameters (pH, dissolved oxygen, nutrients) and pollutants (petroleum hydrocarbonates, detergents, heavy metals). The data are exchanged internationally with other littoral states through the mechanism of regional Conventions on protection of the seas.

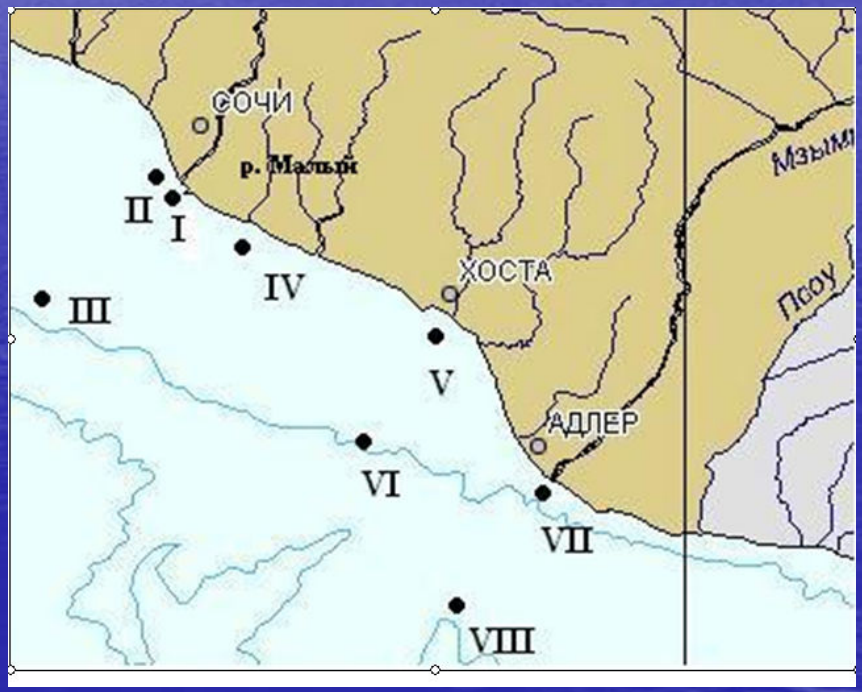


Figure to the right. Location of the hyrochemical and pollution monitoring stations in the Sochi-Adler area in the Black Sea

Future perspectives for operational Oceanography

Previously, the major source of oceanographic data was the ship-borne expeditions and surveys. Nowadays, with the severe financial cuts in place, these opportunities have almost come to an end.

For this reason, we have to rely on coastal observation sites (observing sea level, waves, water temperature and salinity) and satellite data which have to be adjusted against the ground truth.

To obtain more or less continuous oceanographic fields under these circumstances, progressively more emphasis is being laid on modeling and operational model-based technologies using surface meteorological fields as atmospheric forcing and assimilating scarce available observation data.

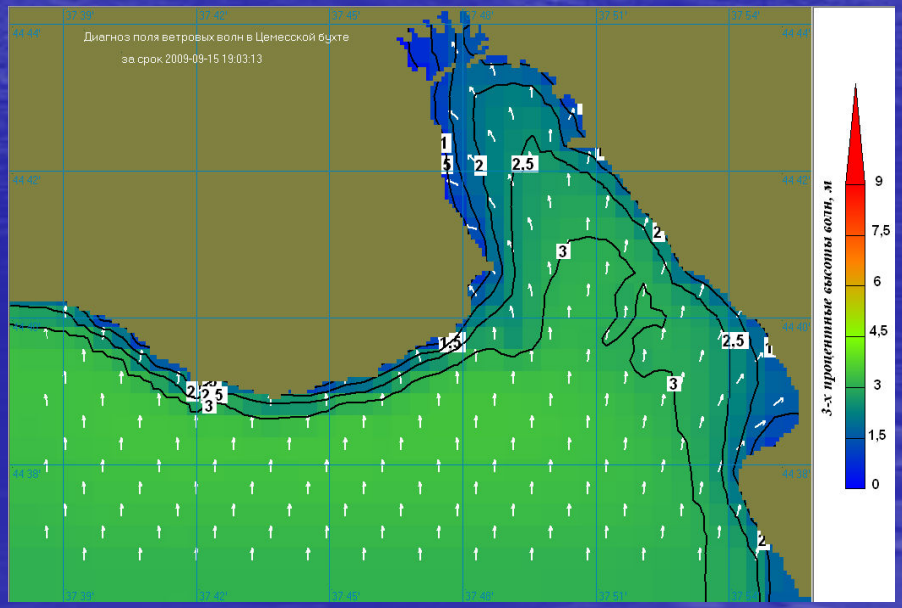
Future perspectives for operational Oceanography

This approach considers the observation network not independently but as an integral part of observing - and - computing systems whose output data serve as a basis for monitoring marine conditions , especially at the marginal seas.

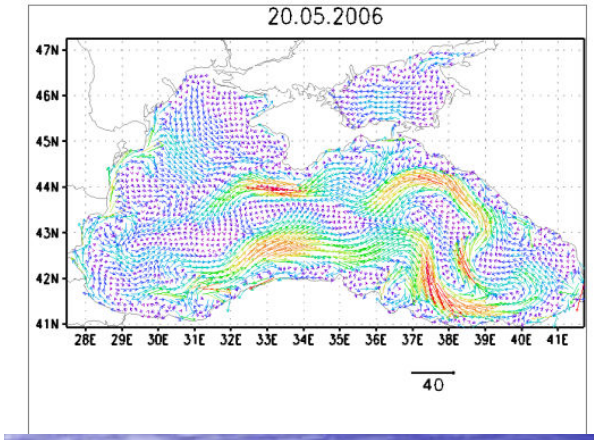
Presently, efforts are made to develop a monitoring and forecasting system yielding oceanographic fields (waves, sea currents, temperature) inside and in the vicinity of the Tsemes Bay near the port of Novorossiysk.

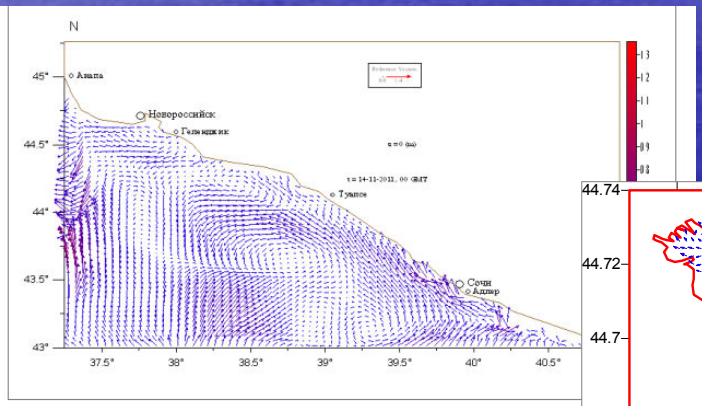
This system is meant to facilitate the ship arrivals and departures at the port area and includes a number of automatic coastal meteorological stations, two sea-level automatic stations and a stationary buoy at the port roadstead assisted by a numerical model with a spatial resolution of several tens of meters .

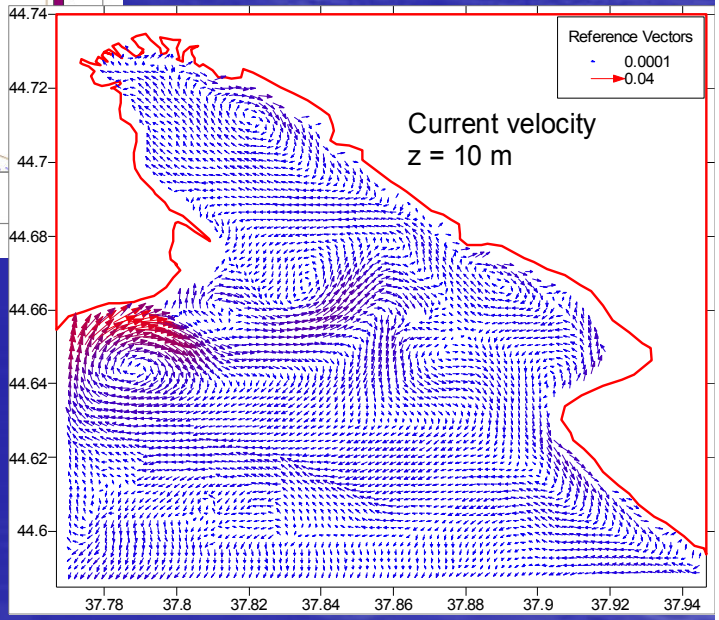
Future perspectives for operational oceanography: using real-time wind data from coastal sites and wave buoy data for diagnosis and nowcasting of wind wave heights and travel direction in Novorossiysk Bay



Future perspectives for operational oceanography: using real-time surface meteorological fields of high resolution (about 15 km) and real-time wind data from coastal sites for diagnosis and nowcasting of currents in the Black Sea basin (res. 5 km, left) , NE Black Sea (res. 1 km, center) and Novorossiysk Bay (res. 100 m, right)

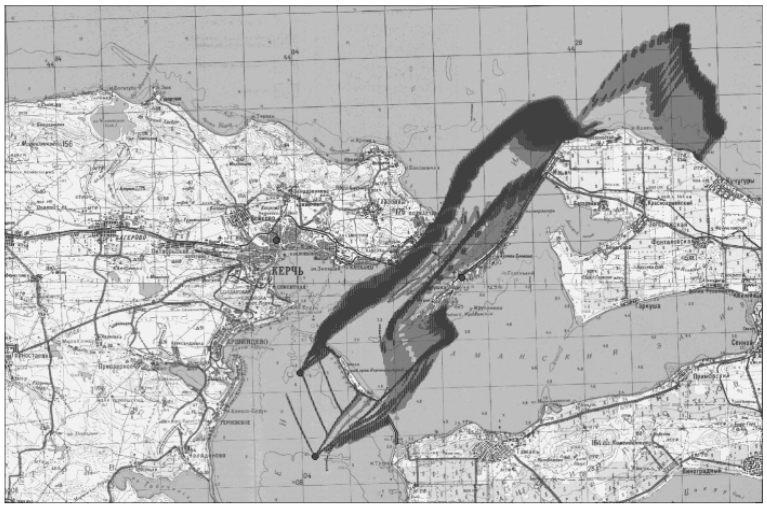




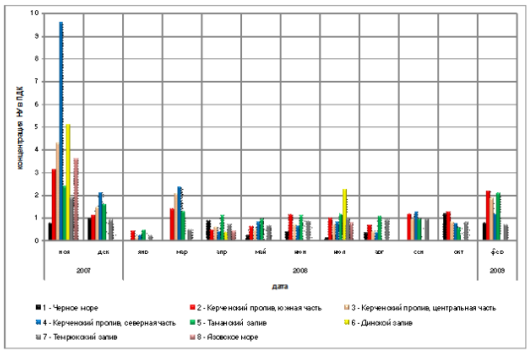


Modeling Marine Oil Spills: Two sequence of two snapshots of the oil spill in the Port of Tuapse as resulted from SPILLMOD output

Monitoring of mazut spill in the Kerch Strait on 11 November 2007 based on SPILLMOD modeling (left) and pollution in-situ observations (right)



Evolving oil spill as predicted by SPILLMOD



Dynamics of average total petroleum concentration (in portions of Maximum Allowable Concentration) in Nov 2007 – Feb 2009 in various areas of the strait proper and the adjacent areas


Thank you