Bulgarian Academy of Sciences
Institute of Oceanology

NOMOS

Demand on science or science on demand

Atanas Palazov

HISTORICAL BACKGROUND OF NATIONAL OCEAN OBSERVATION

1910	Sea level - Burgas port
1928	Mechanical sea level recorders in Varna and Burgas
1932	Physical, chemical and biological observations
1938	Daily salinity coastal research on Varna bay
1947	Systematic hydro-chemical researches
1973-1976	First fixed platforms in Burgas and Varna bays
1977-1979	International coastal experiments “Kamtchia”
1983-1988	First automated coastal measurements - RB “Shkorpilovtci”
1989-1993	First CTD, GUILDLINE Model CSTD 8709
1991	Bulgarian Black Sea monitoring programme
1994	SBE 911 plus CTD with SBE 32 carousel
2003-2006	ARENA FP5 project – first Black Sea GOOS project
2006-2009	ASCABOS FP6 project – Black Sea VOS system
2006	GALATA platform weather and sea state observing system
2009	POMOS-Port operational marine observing system
2009-2011	Shkorpilovtci coastal station upgrade
2010-2013	BulArgo
2010-2013	MARINEGEOHAZARD project
2012	Sea level coastal stations upgrade – BulSeaL

NEED OF INTEGRATION

NOMOS – Why we need it?

To integrate national operational marine observing systems and to provide marine data and information needed for:

- Sustainable coastal zone development;
- Improved maritime traffic control;
- Improved port control;
- Improved disaster management – storms, oil spills;
- Civil protection;
- Support decision making for development of coastal infrastructure and tourism;
- Environmental research and protection;
- Sustainable development of fishery and aquacultures;
- To fulfill obligations connected with European maritime policy, Water framework directive, Black Sea convention and GOOS.

NOMOS

MAIN GOAL: To support sustainable development of the Bulgarian Black Sea coast and EEZ

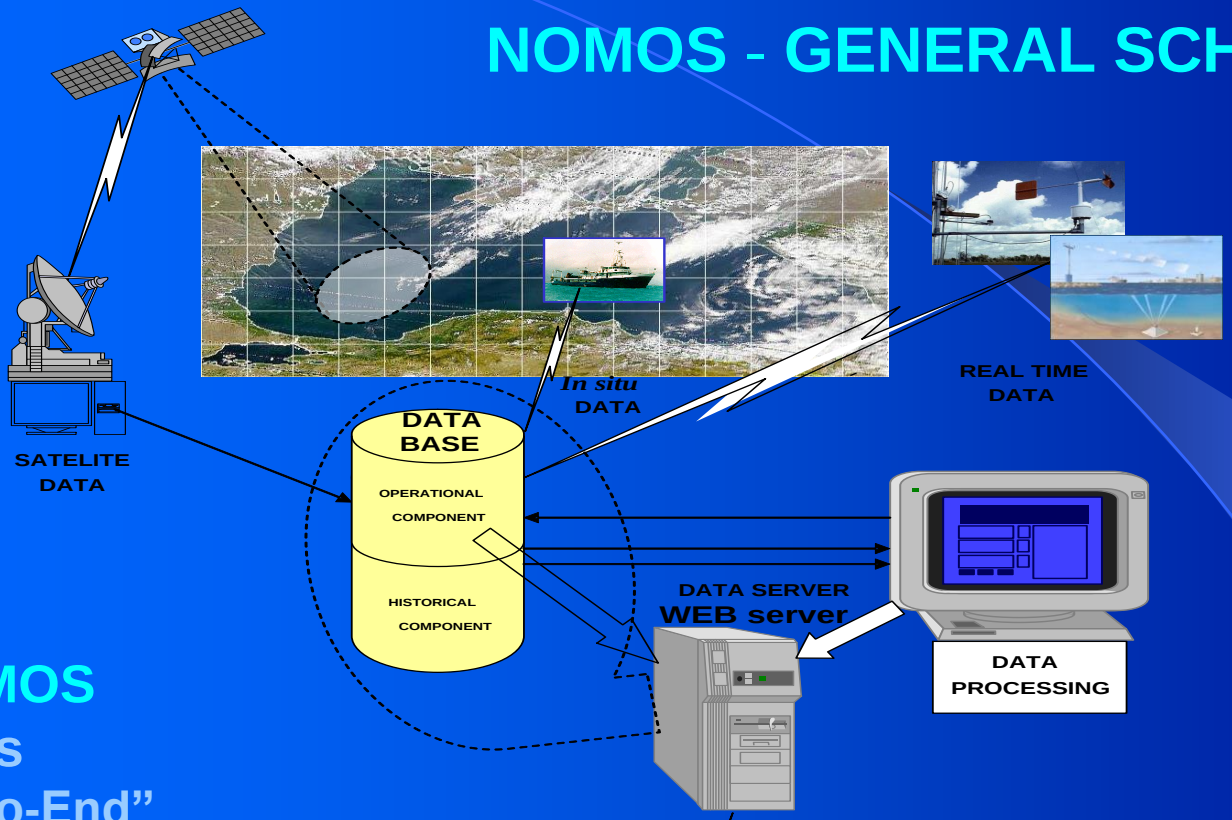
TASKS:

* To provide operational data
* To provide marine forecasts
* To provide operational information for the needs of:
  - National security
  - Civil protection
  - Search and Rescue
  - Government and local authorities
  - Port authorities
  - Shipping
  - Marine industry
  - Fishery and aquaculture
  - Tourist industry
  - Environmental protection
  - Coast protection
  - Oil spills combat
  - Other interested

NOMOS - DATA SOURCES

- Coastal stations
- Bottom stations
- Platforms
- Moorings
- Scientific cruises
- VOS programs
- FerryBox
- Small Ships Program
- Satellite observations

NOMOS - GENERAL SCHEME



NOMOS
is
"End-to-End"
Type SYSTEM

NOMOS
Is a
MIDDLE RANGE OBSERVING SYSTEM
[0(1000 km)], Covering all Bulgarian Black Sea coast with capability to be integrated with similar neighbouring systems

NOMOS – FIRST COMPONENTS

- POMOS – Port Operational Marine Observing System;
- GALATA - Galata platform weather and sea state observing system;
- SHKORPILOVTCI – Shkorpilovtci coastal research base;
- BulSeaL – Bulgarian sea level service;
- BulARGO – Bulgarian Argo program;
- BG monitoring program;
- MARINEGEOHAZARD.

PORT OPERATIONAL MARINE OBSERVING SYSTEM

POMOS

2007 - 2008

POMOS

ORDERED by Bulgarian Maritime Administration

DESIGNED to provide weather and sea state operational information

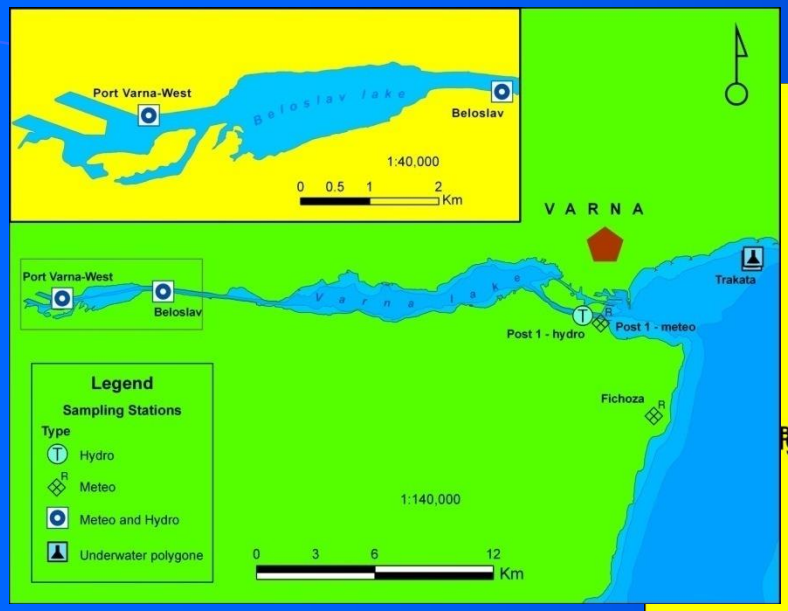
FOR THE areas of major Bulgarian ports

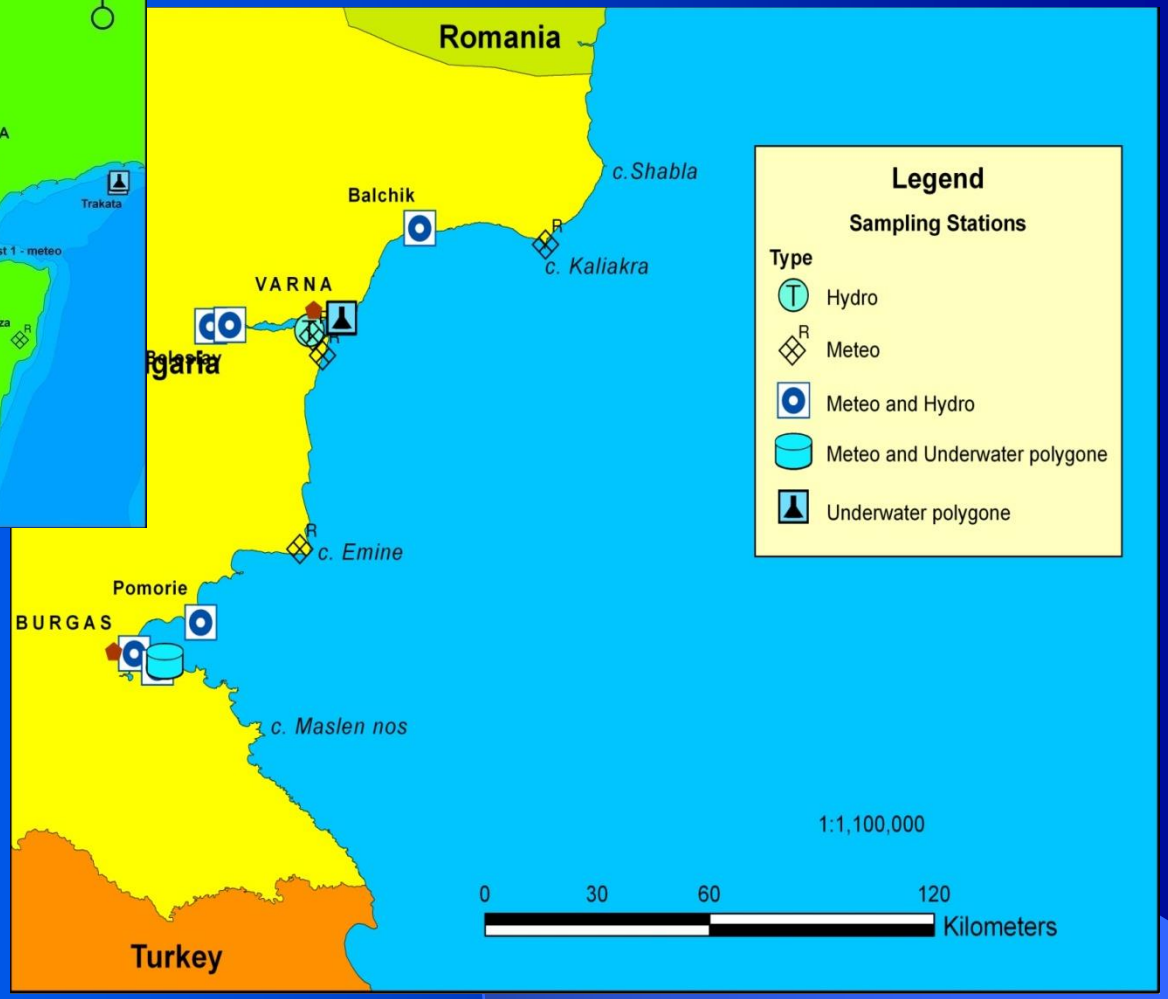
INTENDED to secure safety shipping in ports, canals and bays

POMOS OVERVIEW

- 14 MEASURING SITES
- 45 INSTRUMENTS
- 14 WEATHER AND SEASTATE PARAMETERS
- 110 INDIVIDUAL MEASUREMENTS
- SYNCHONIOUS/ASYNCRONIUS REAL-TIME DATA ACQUISITION
- REAL-TIME DATA QUALITY CONTROL
- DATABASE DOUBLE SECURED DATA ACQUISITION/STORAGE
- INTRANET/INTERNET DATA ACCESS
- INTRANET SENSORS CONTROL
- POWER SUPPLAY CONTROL
- INTRANET SYSTEM MONITORING

POMOS - LOCATION





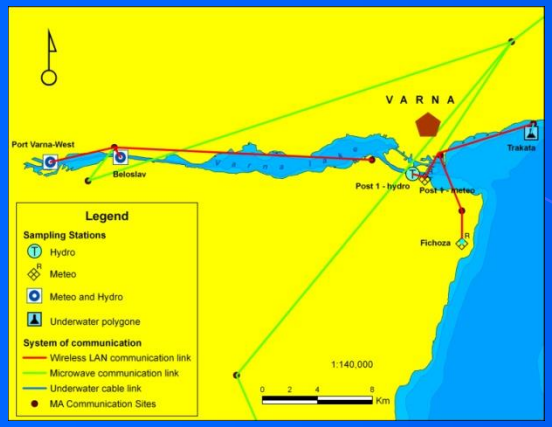
POMOS

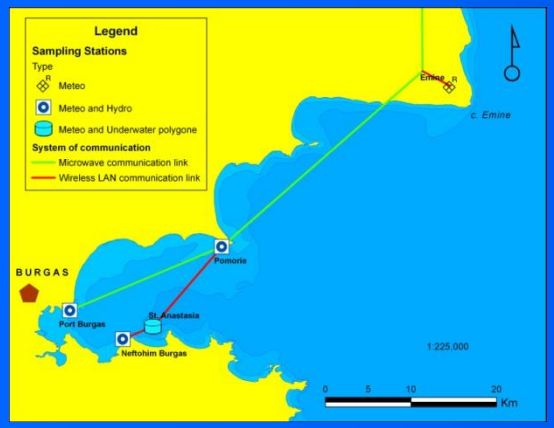
INSTRUMENT	PRODUCER	QTY
WXT520 Weather Transmitter	Vaisala	11
PWD 20 Visibility Sensor	Vaisala	4
S1074 Air Thermometer	Coastal Envi.	11
QMS 101 Pyranometer	Kipp&Zonen	3
Channel Master 300 kHz	RDI	2
Range Finder SM-094/10W	Miros	5
MicroCAT SBE 37-CM	SeaBird	7
Argoanut XR 750 kHz	Son Tek	2

PARAMETER	QTY
Wind speed	11
Wind Direction	11
Relative Humidity	11
Air Pressure	11
Air Temperature	22
Visibility	4
Solar Radiation	3
Water Temperature	9
Salinity	9
Sea Level	7
Current Speed	4
Current Direction	4
Significant Wave Height	2
Mean Wave Period	2

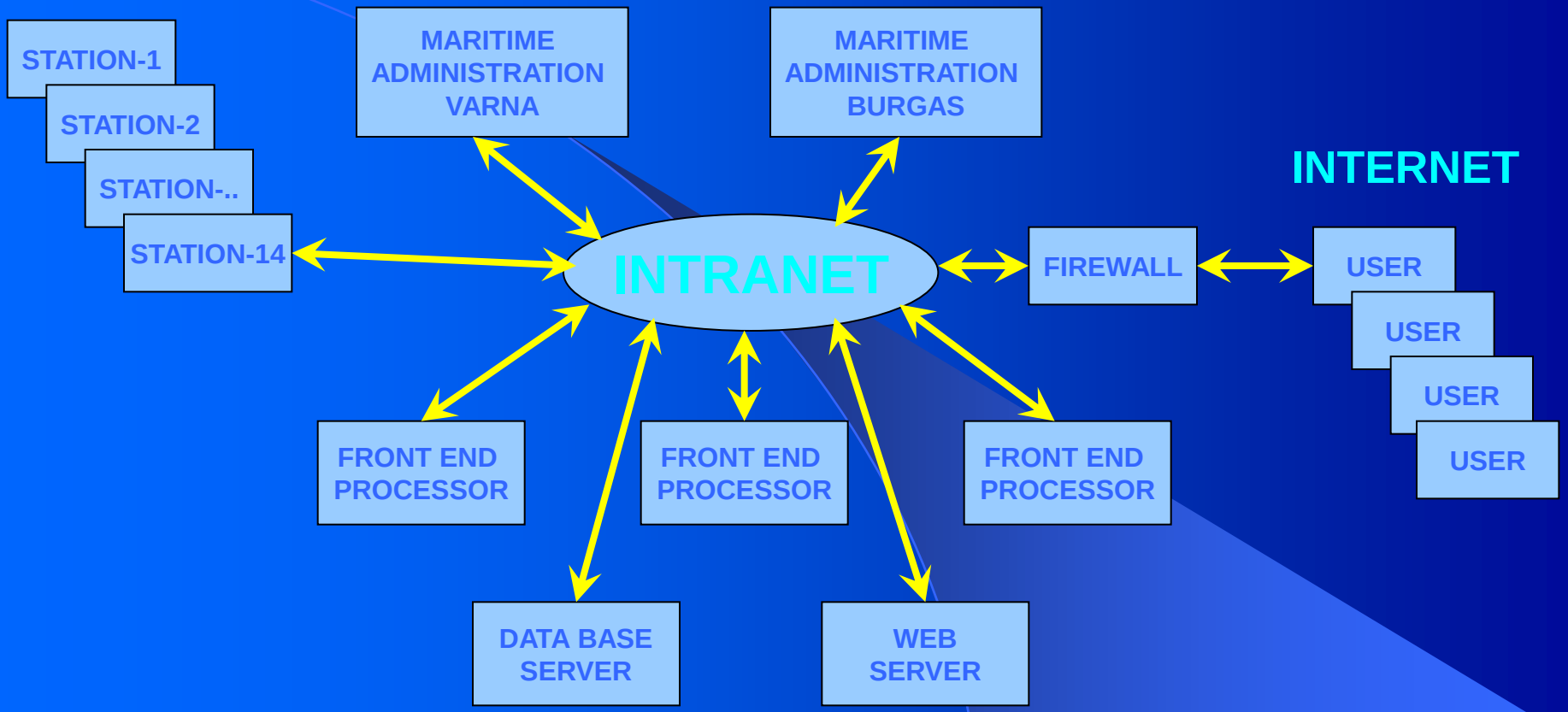
POMOS - SITES

POMOS - COMMUNICATION SYSTEM

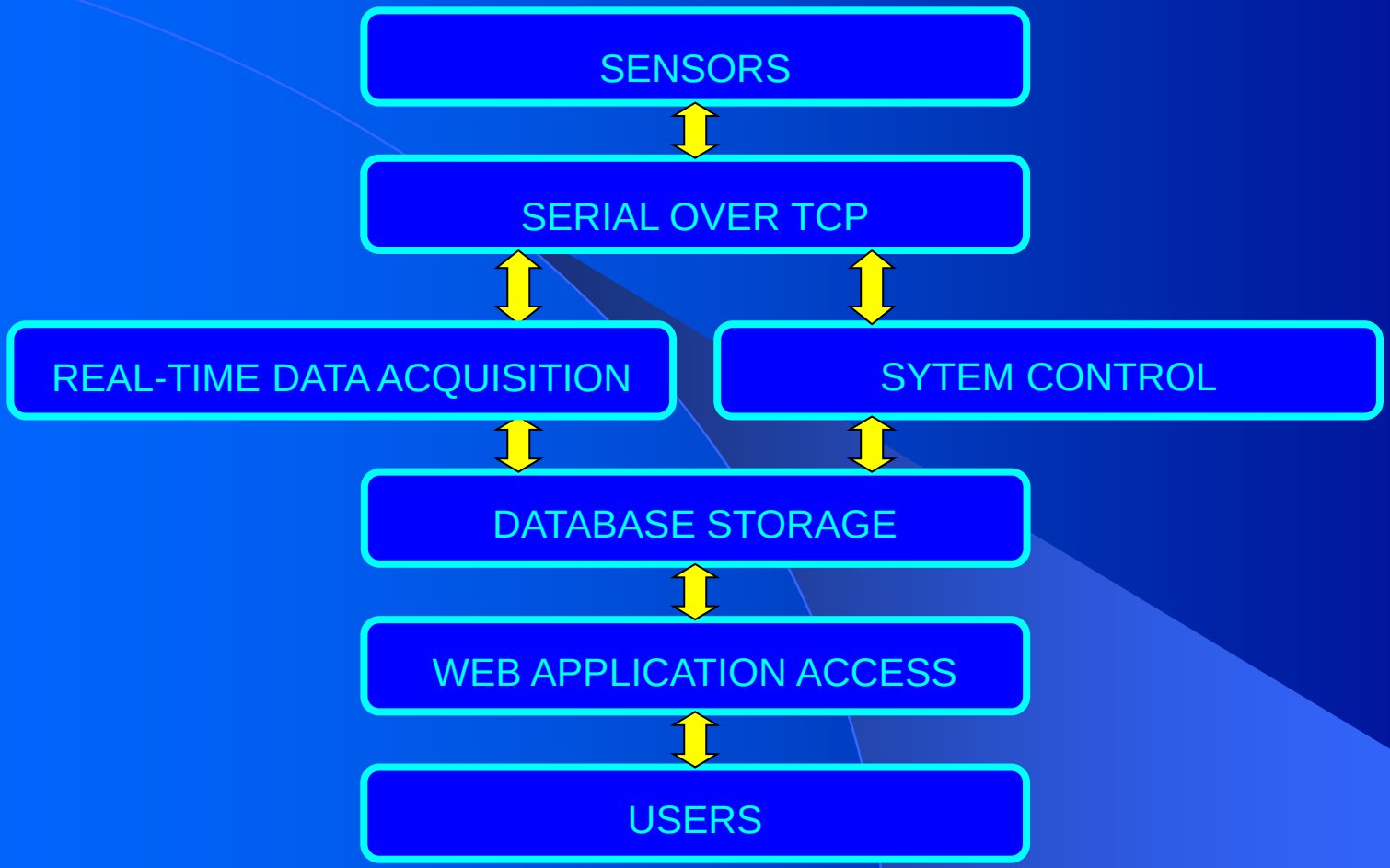




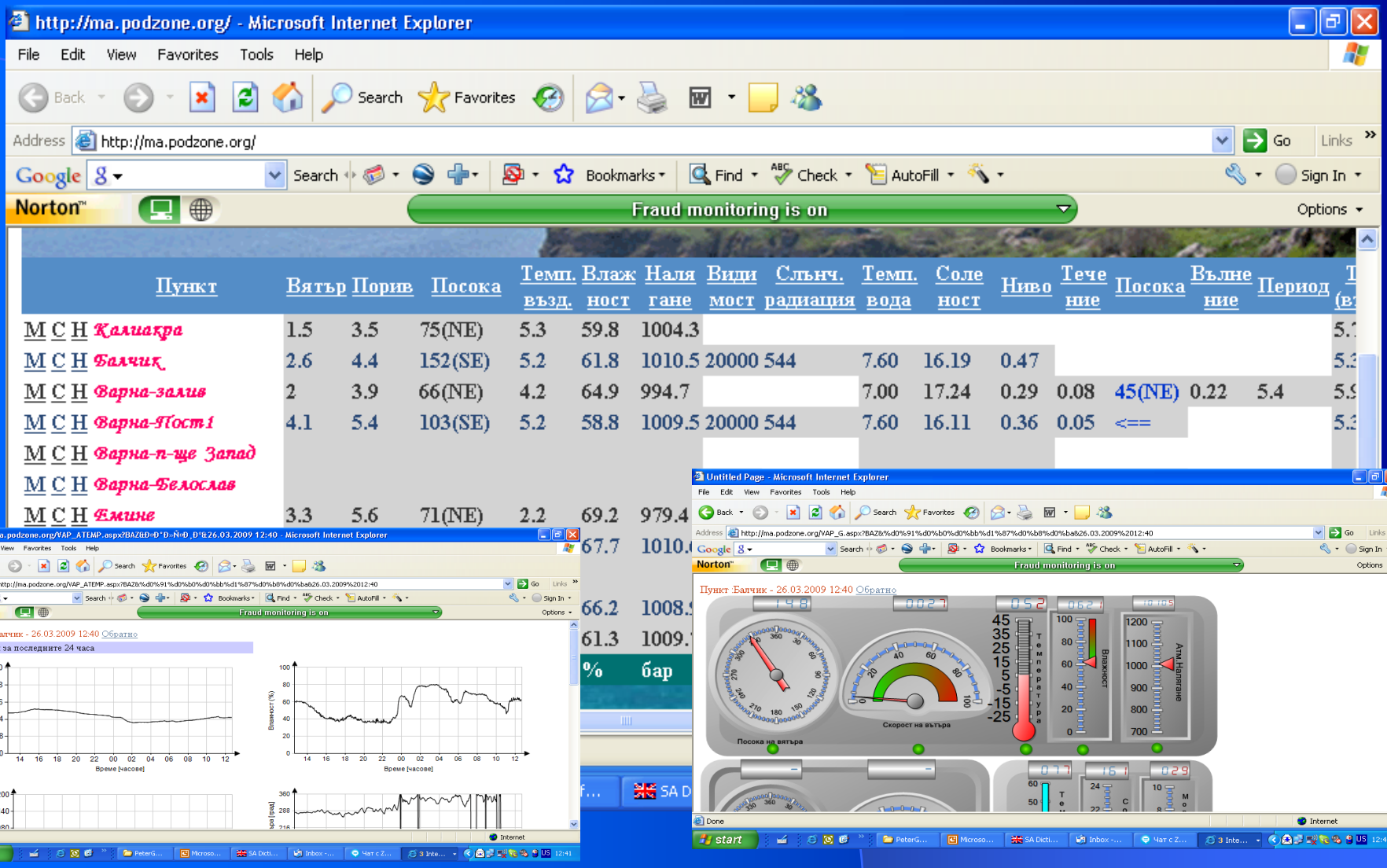
POMOS - SYSTEM ARCHITECTURE



POMOS - DATA FLOW



POMOS - USER INTERFACES



POMOS - VISIBILITY

СИСТЕМА ЗА НАБЛЮДЕНИЕ НА ПАРАМЕТРИТЕ НА МОРСКАТА СРЕДА

Ново! [**Whois** | **Traceroute**]

CountID : marad

URL: http://ma.io-bas.bg

Местоположение:
Unspecified

Категория: Природа и Екология

Дата: 04-Nov-2009 10:15

Часова зона: none

Регистриран: 04-Nov-2009 10:15

Последно посещение: 25-Dec-2011 15:24

Последна обработка: 25-Dec-2011 15:31

Година

Година	Уникални	Презарежд.	Общо	Нарастване	Графика
2009	3,521	1,326	4,847	n/a	
2010	36,602	13,675	50,277	+937.28%	
2011	5,432	1,956	7,388	-85.31%	
Прогноза	5,528	1,991	7,519	-85.05%	

Забележка: От март 2011 системата е преместена на друг адрес и статистиката не отчита обръщенията към новия адрес.

GALATA PLATFORM WEATHER AND SEASTATE OBSERVING SYSTEM

2006

GALATA PLATFORM

- is a fixed, unmanned, earth gas production platform, owned and operated by a private gas company Melrose Resources Sarl

LOCATION

- western part of the Black Sea
- on the Bulgarian shelf
- South-east of the city of Varna - 26 km
- depth - 34 m

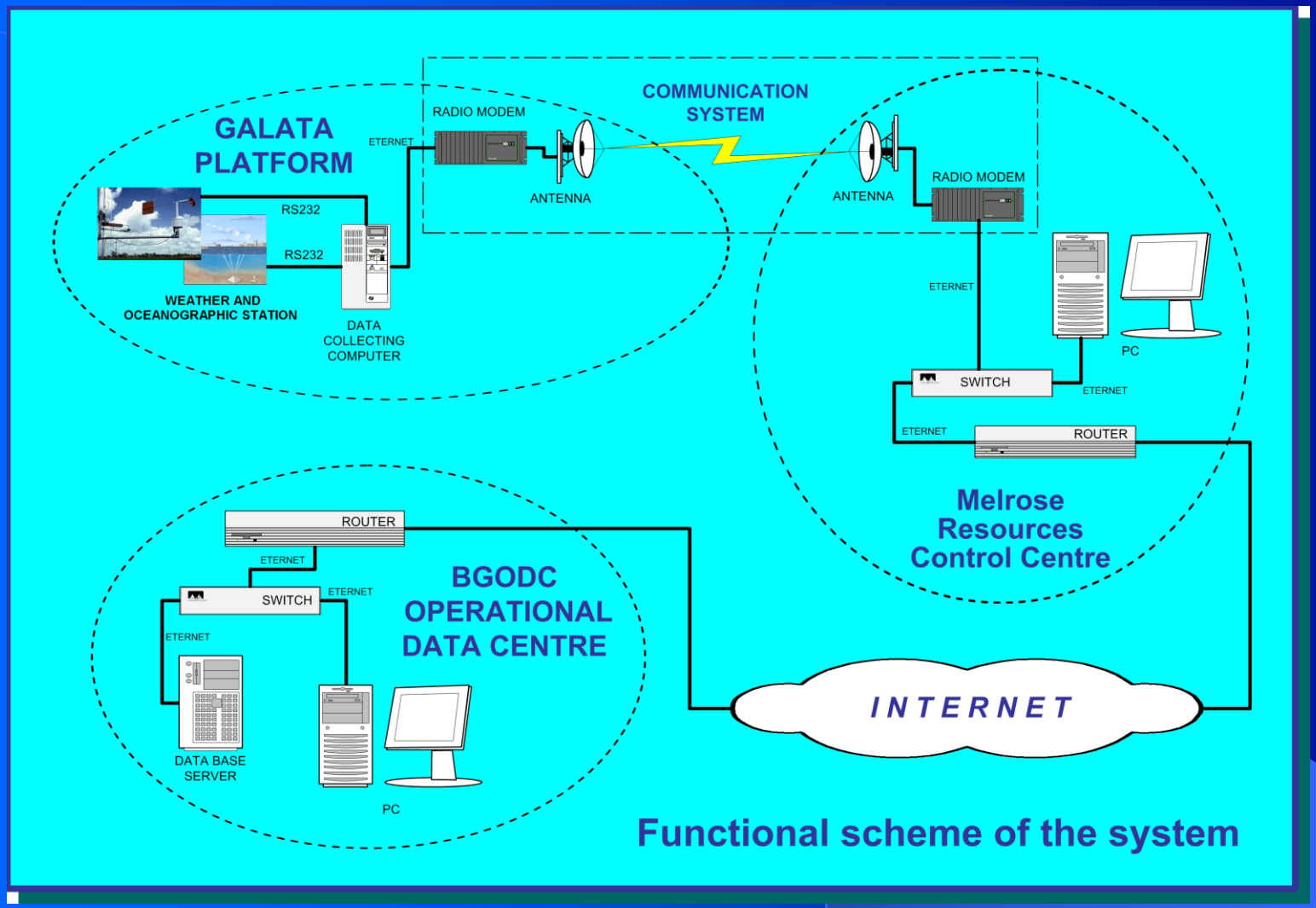
THE PLATFORM

THE PROJECT

- The project was carried out in the frame of public-private cooperation between the Institute of Oceanology – Bulgarian Academy of Sciences and Melrose Resources Sarl.

- THE GOAL: To establish a source of open sea real-time in-situ operational data

OBSERVING SYSTEM



Sensors installed

Meteorological sensors:	Oceanographic sensors:
1. Wind Speed 2. Wind Direction 3. Air Temperature 4. Relative Humidity 5. Air Pressure 6. Net Radiation 7. Visibility	1. Dissolved Oxygen 2. Conductivity 3. Turbidity 4. Water temperature 5. Fluorometer 6. Temperature String-10 7. Doppler Current Sensor 8. Wave & Tide Recorder

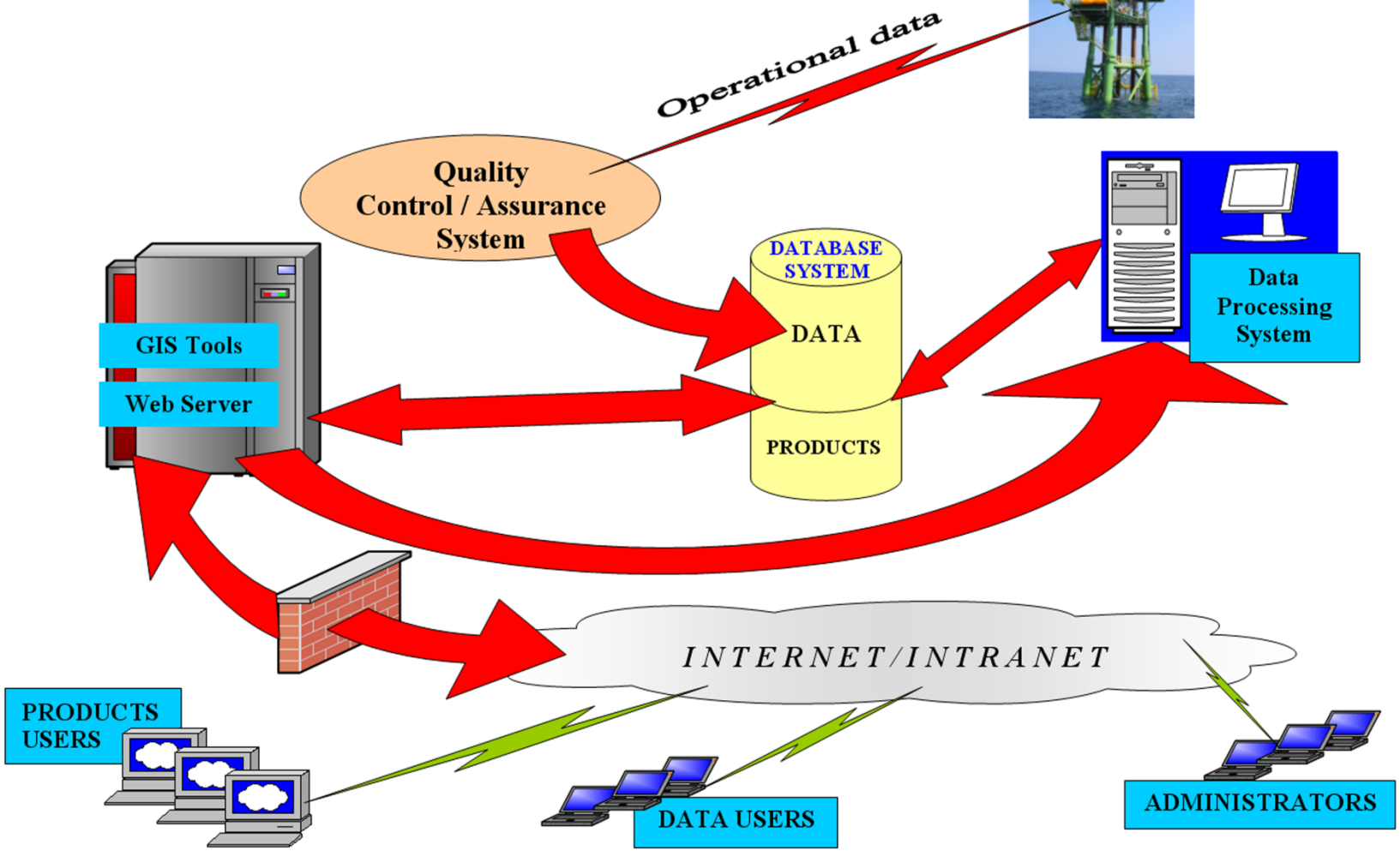
24 sensors

31 major oceanographic and meteorological parameters

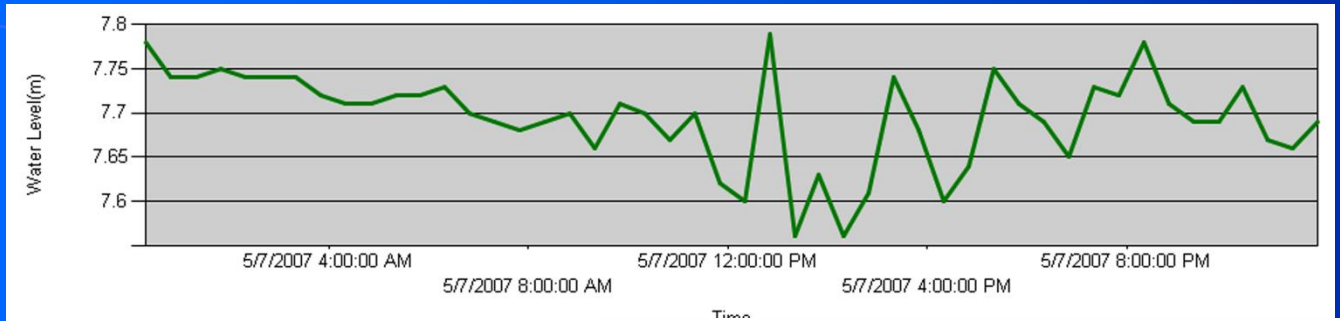
Measured parameters

Meteorological parameters:	Oceanographic parameters:
1. Wind Speed 2. Wind Gust 3. Wind Direction 4. Air Temperature 5. Relative Humidity 6. Air Pressure 7. Net. Radiation 8. Visibility	1. Dissolved Oxygen 2. Conductivity 3. Turbidity 4. Water temperature-3 levels 5. Chlorophyll 6. Water Temperature Profile – 10 levels 7. Surface Current Speed 8. Surface Current Direction 9. Sea level 10. Significant wave height 11. Maximum wave height 12. Mean zero crossing period

DATA MANAGEMENT SCHEME

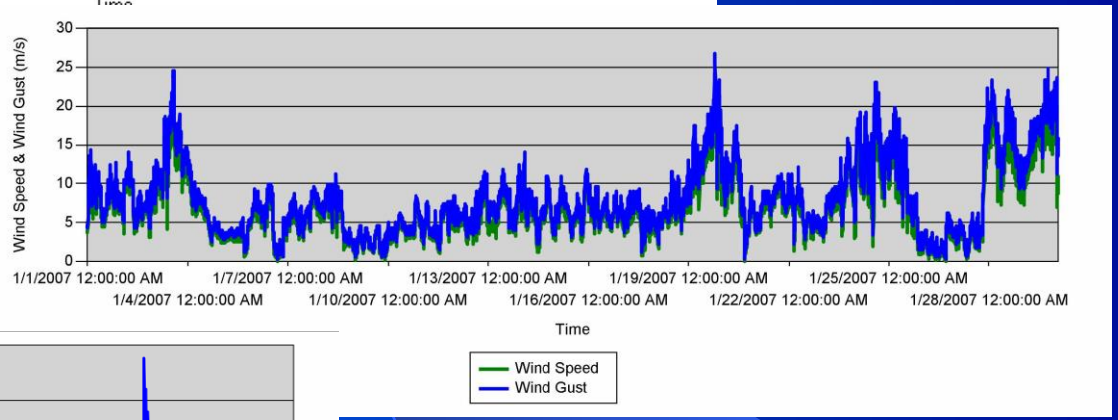


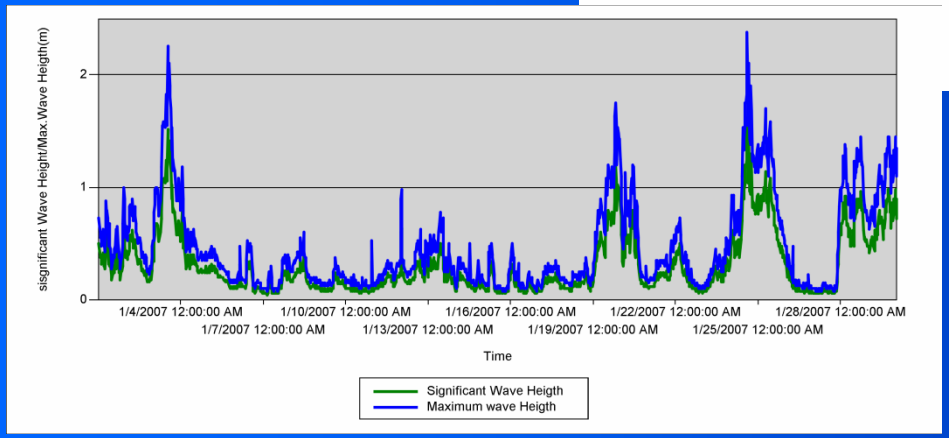
DATABASE and REPORT SERVER



Sea level

Winds





Waves

DATA DISSEMINATION

The project

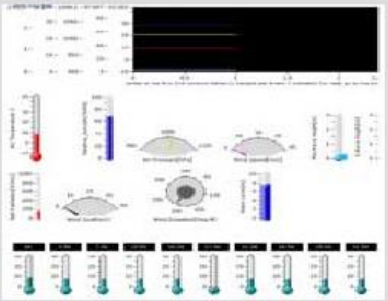
The **SeaDataNet project (2006-2011)** is constructing a standardized distributed system for managing the large and diverse data sets collected by the oceanographic fleets and the new automatic observation systems. By use of standards for communication and new developments in information technology, the 40 in-situ and satellite marine data platforms of the partnership are providing metadata, data and products as a unique virtual data centre

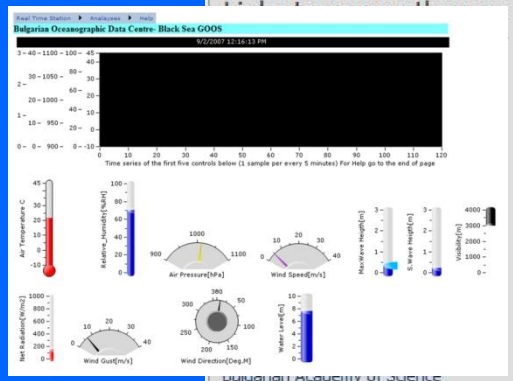
Bulgarian National Oceanographic Data Centre

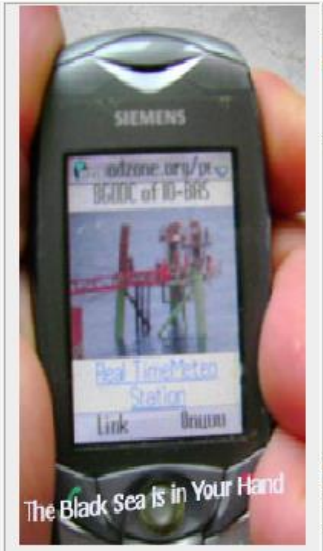
BGODC

serves as a local portal for the national and international exchange of oceanographic data.

WEB Real Time Panel







To test our databases enter with user: **demo** and password: **demo_centre** into our **IO-BAS Report Server**

The main objectives of **BGODC** are:

- to acquire the marine data sampled by Bulgarian institutes and agencies, archive it and maximize its utilisation by promoting data exchange on a national and international level
- to meet Bulgarian's international data exchange obligations according to the resolution of the Intergovernmental Oceanographic Commission (IOC), and under the SEADATANET, ASCABOS and ARENA Projects regarding monitoring of the Black Sea

The heart of the Data Centre architecture is the Report Server , a Web-based middle-tier layer that receives incoming report requests, generates, renders, and delivers reports.

Commercial use:

Time: 6/18/2007 13:19:38

METEO	DATA
Wind Speed [m/s]	2.41
Wind Gust [m/s]	2.80
Wind Direction [Deg.M]	174.04
Air Temperature [Deg.C]	24.48
Relative Humidity [%RH]	61.34

SHKORPILOVTCI

2009 - 2013

Research base "Shkorpilovtci" OPEN 1983

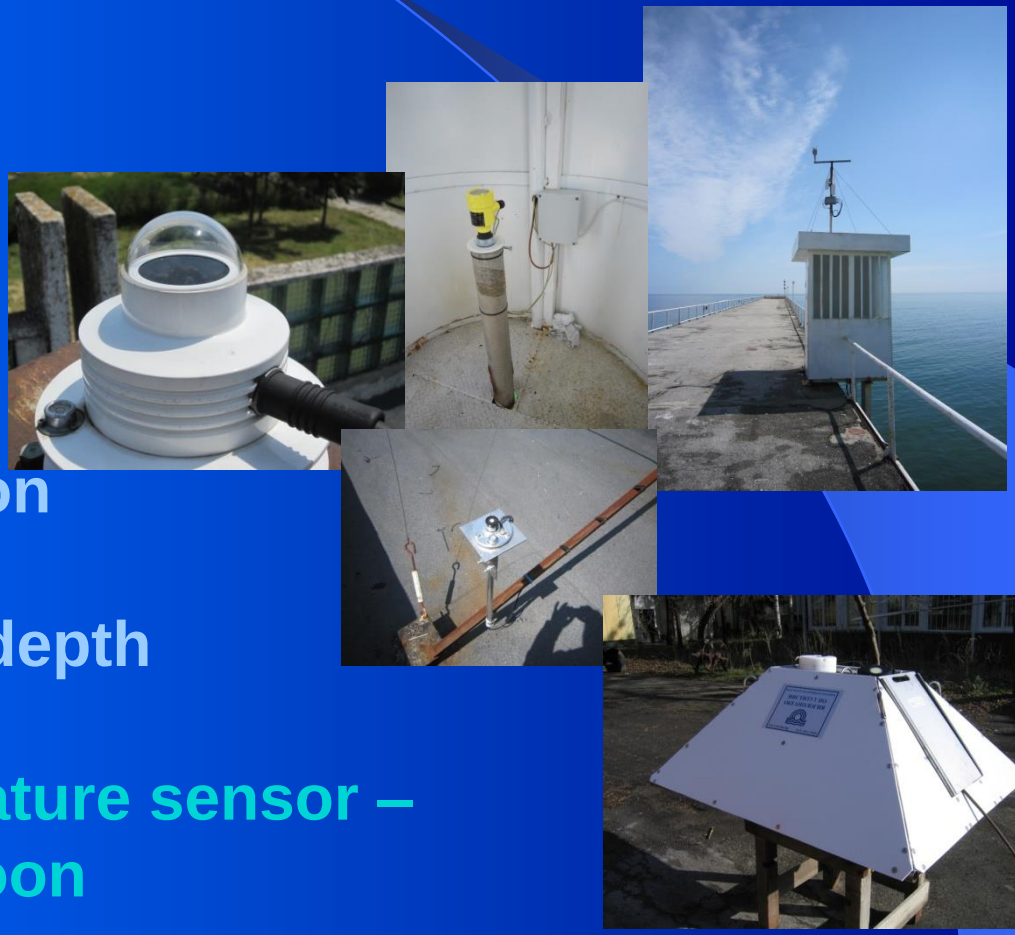
1977 – 1991

14 International coastal experiments were carried out

1977 – digital data transmission and recording
1983 – digital data on magnetic disk
1985 – digital data radio transmission
1990 – fiber optics data transmission
2005 – data in internet

SENSORS INSTALLED

- Weather station
- Sea level gauge
- UV radiation
- Total solar radiation
- RDCP – 18 meter depth
- Sea water temperature sensor – will be installed soon



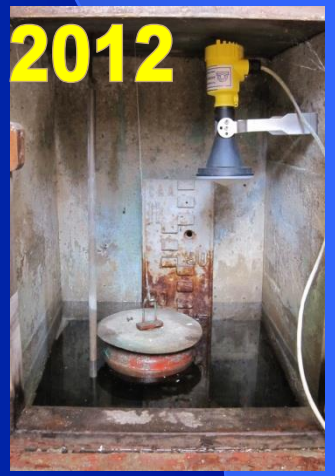
BulSeaL

Bulgarian coastal stations sea level observing programme

Bulgarian sea level coastal stations

No	SLCS	National Index	Latitude N	Longitude E	Operator	Established	Years in operation	INSTRUMENT
1	Shabla	150	43° 32′	28° 37′	NIMH	1973	40	Pole
2	Kavarna	100	43° 27′	28° 22′	NIMH	1973	40	Pole
3	Baltchik	200	43° 24′	28° 10′	NIMH	1950	63	Pole
4	Varna	300	43° 12′	27° 57′	CA	1919	94	A.Ott
5	Nesebar	400	42° 39′	27° 44′	NIMH	1924	89	Pole
6	Burgas port	500	42° 29′	27° 29′	CA	1910	103	A.Ott
7	Burgas Fish port	550	42° 29′	27° 29′	NIMH	1973	40	Pole
8	Burgas Oil port	600	42° 29′	27° 29′	NIMH	1973	40	Pole
9	Irakly	700	42° 45′	27° 53′	CA	1970	43	SUM
10	Ahtopol	800	42° 06′	27° 56′	CA	1970	43	SUM
11	Shkorpilovtci		42° 57′	27° 54′	IO-BAS	2010	3	VEGAPULS 61
12	Balchik port		43° 24′	28° 10′	PI	2009	4	Range Finder SM-094/10W
13	Varna west port		43° 11′	27° 39′	PI	2009	4	Range Finder SM-094/10W
14	Pmorie port		42° 33′	27° 38′	PI	2009	4	Range Finder SM-094/10W
15	Burgas port		42° 29′	27° 28′	PI	2009	4	Range Finder SM-094/10W
16	Oil port Burgas		42° 27′	27° 32′	PI	2009	4	Range Finder SM-094/10W

Technology of Sea Level Observations



UPGRADE

Bul ARGO

2010 - 2013

BulArgo is a project funded by the Bulgarian National Science Fund to the Ministry of Education, Youth and Science, which aims to establish a national research infrastructure in the frame of Euro-Argo activities.

BulArgo is incorporated in the National roadmap of Scientific infrastructure

COORDINATOR

Institute of Oceanology - BAS

PARTNERS

Institute of Oceanology - BAS,

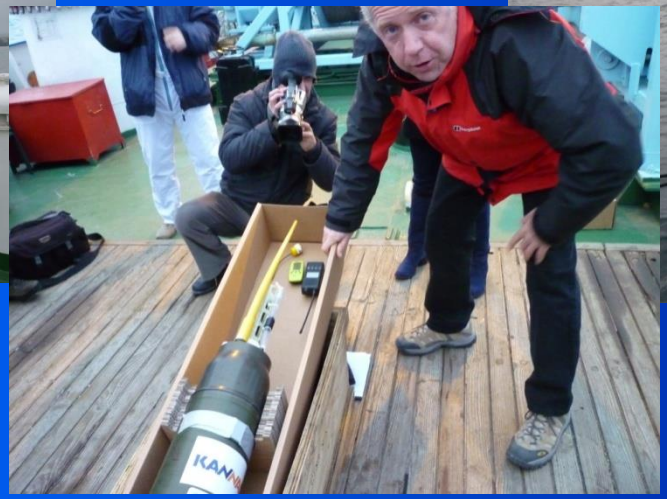
Sofia University "St. Kliment Ohridski"

National Institute of Meteorology and Hydrology - BAS

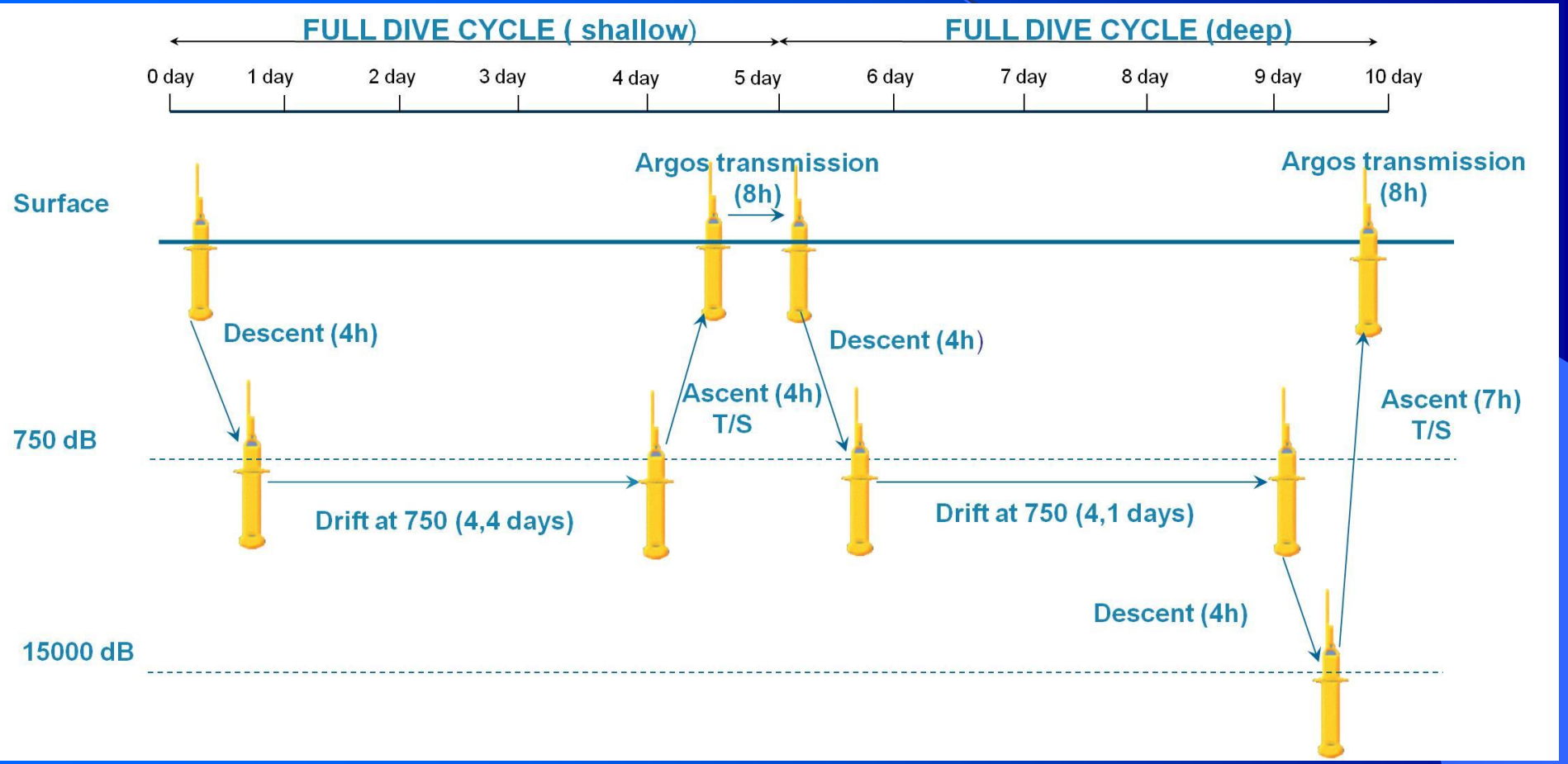
DEPLOYMENT PLAN

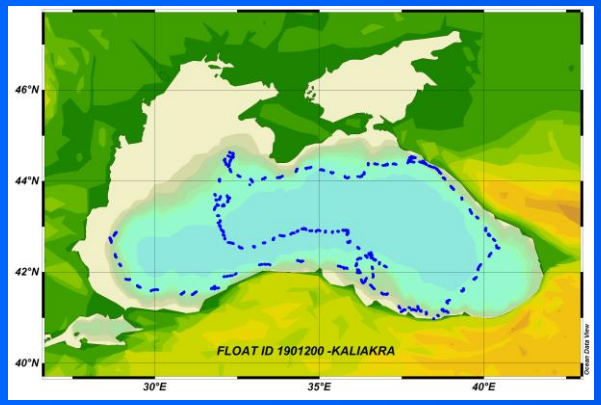
2011 - 3 Argo floats (one with DO sensor)

2012 - 2 Argo floats (one with DO sensor)

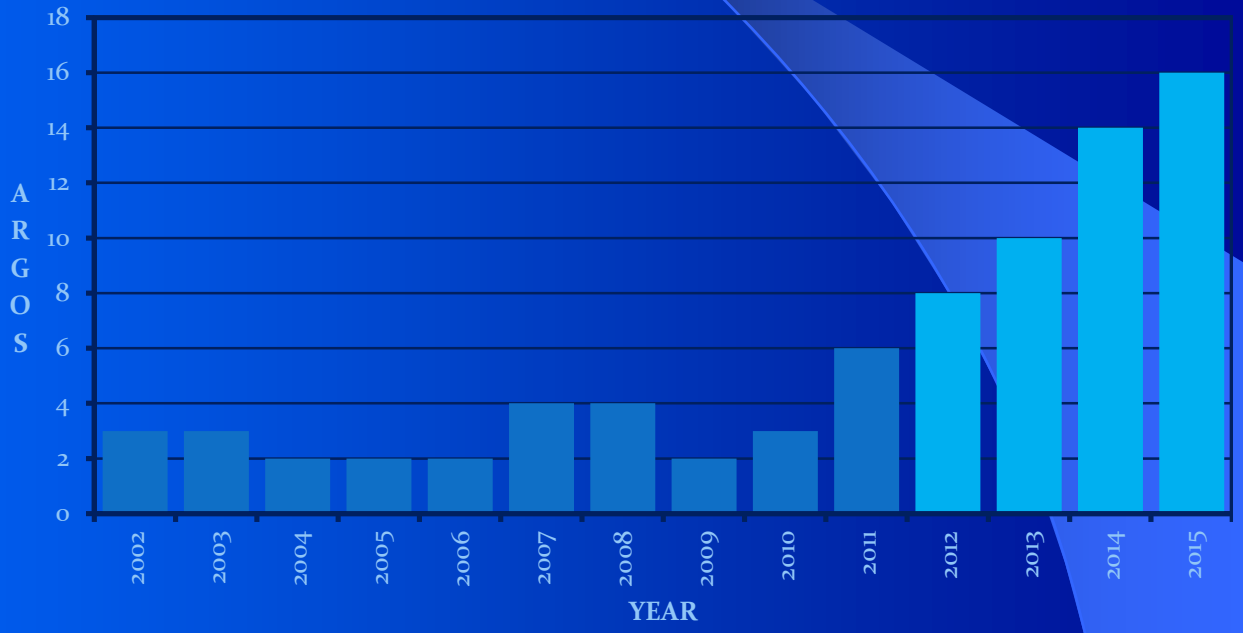


DIVE CYCLE


FULL DIVE CYCLE (shallow)
FULL DIVE CYCLE (deep)
0 day
1 day
2 day
3 day
4 day
5 day
6 day
7 day
8 day
9 day
10 day
Surface
Argos transmission (8h)
Argos transmission (8h)
Descent (4h)
Descent (4h)
Ascent (4h) T/S
Ascent (7h) T/S
750 dB
Drift at 750 (4,4 days)
Drift at 750 (4,1 days)
Descent (4h)
15000 dB



Active Argo Floats in Black Sea



New Argos 2012-2015

BulArgo	- 2
EuroArgo	- 4
E-AIMS	- 3
PERSEUS	- 4

Bulgarian Black Sea Monitoring Programme

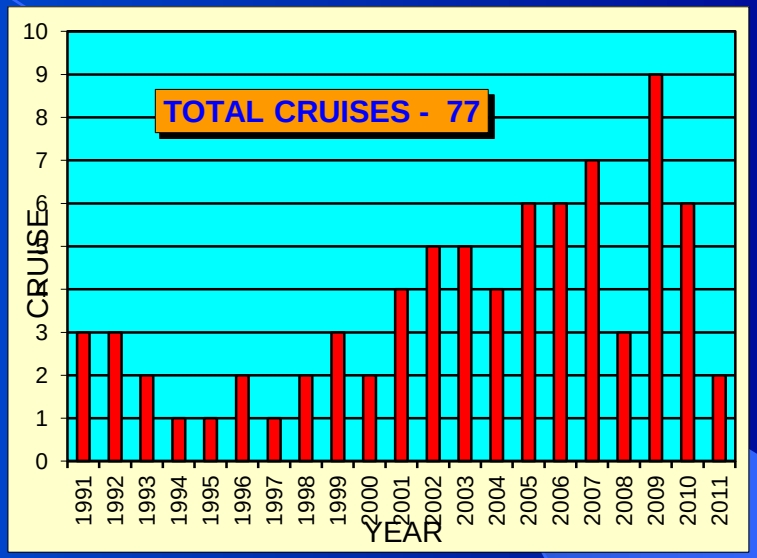
1991 - 2011

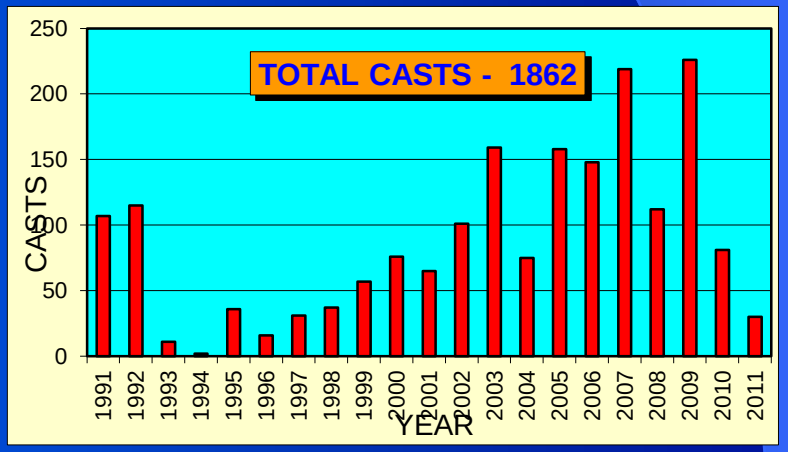
Bulgarian Black Sea Monitoring Programme

GOALS AND OBJECTIVES

- To provide relevant information to the governmental institutions for making decisions referring protection and recovery activities for the sustainable development of the coastal zone and Bulgarian part of the Black Sea
- To set up a coordinated, scientifically based system for complex monitoring and prediction of the Black Sea variables in regional and national scale
- To ensure long-term and regular observations on the physical, chemical and biological parameters and states of the marine environment and biota

Bulgarian Black Sea Monitoring Programme



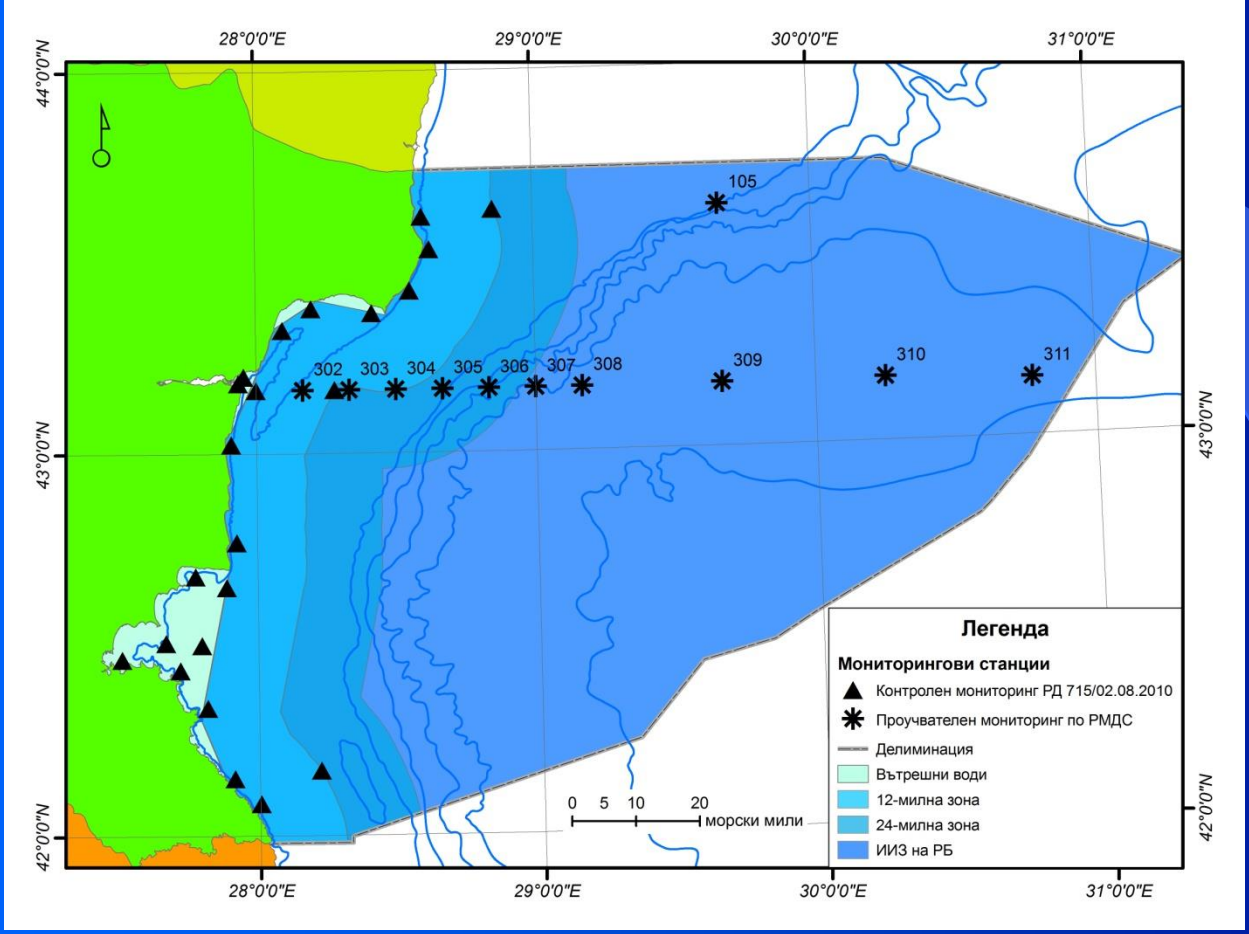


Bulgarian Black Sea Monitoring Programme

Bulgarian Black Sea Monitoring Programme 1991-2011 was realized with the support of BULGARIAN ACADEMY OF SCIENCES and international projects:

- HYDROBLACK
- COMSBLACK
- NATO SfP-971818 ODBMS Black Sea Project
- CESUM-BS
- ARENA
- Sea-Search
- BSERP
- ASCABOS
- SEADATANET
- SESAME
- EUROFLEETS etc.

Bulgarian Black Sea Monitoring Programme - MOEW2012

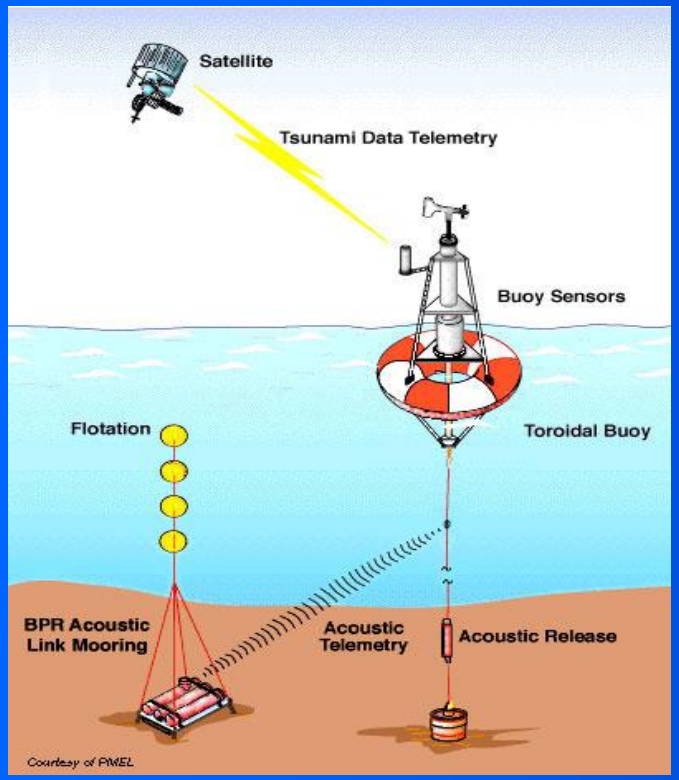


MARINEGEOHAZARD

2010 - 2013

Set-up and implementation of key core components of a regional early-warning system for marine geoehazards of risk to the Romanian-Bulgarian Black Sea costal area

Romania-Bulgaria Cross-Border Cooperation Programme



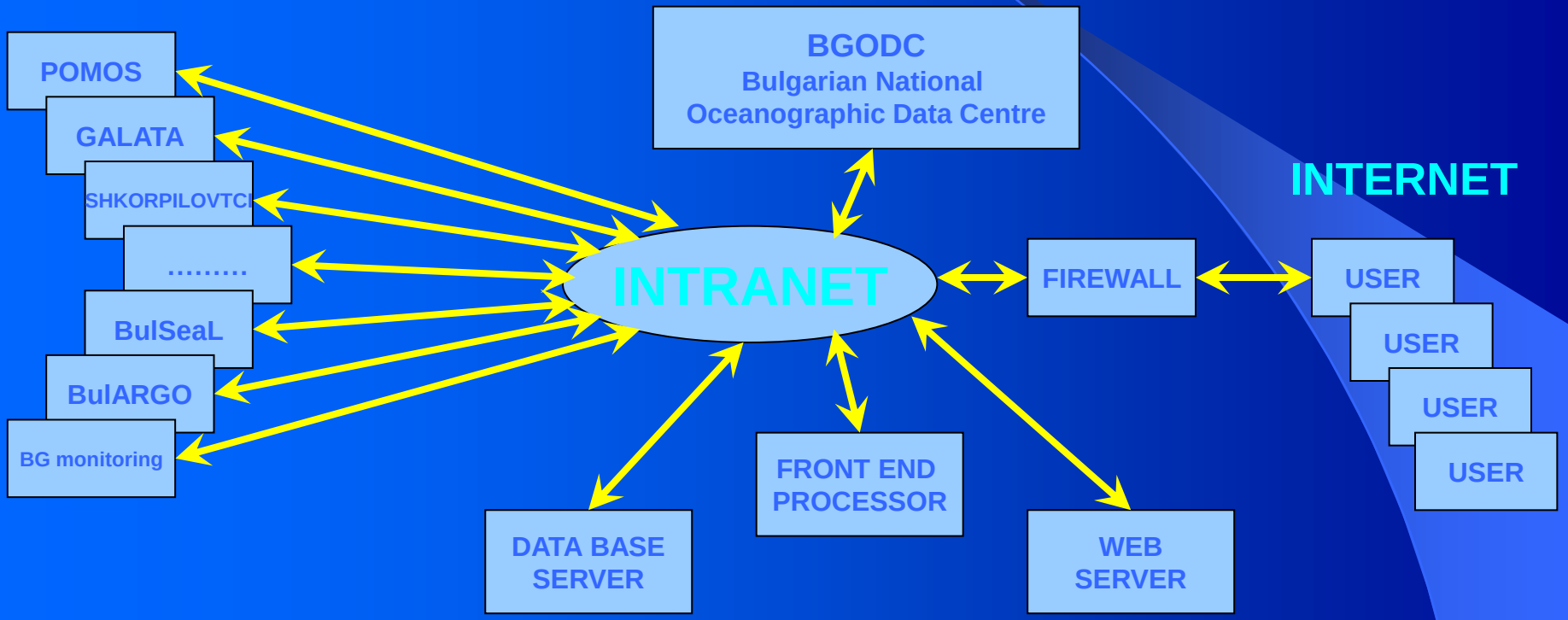
The on-shore coordination centers are located in:

- **Romania (Constanta branch of GeoEcoMar)**
- **Bulgaria (IO-BAS headquarters in Varna)**

NOMOS - INTEGRATION CHALLENGES

- ✓ Technical and technological
- ✓ Legal and administrative
- ✓ Organizational
- ✓ Financial

NOMOS – ARCHITECTURE



Integration of the systems is on data and dissemination level

NATIONAL POLICY AND REGULATION

The WATER ACT is the legal basis for marine monitoring in Bulgaria.

There are also DECREES of the Council of ministers which regulate meteorological services, marine researches and hydrographic services.

Marine science and services are the duty of several organizations:

- INSTITUTE OF OCEANOLOGY - BAS – all kind of oceanographic researches
- NATIONAL INSTITUTE OF METEOROLOGY AND HYDROLOGY - BAS – marine meteorology and forecasts
- NAVY HYDROGRAPHIC SERVICE – hydrographic services
- INSTITUTE OF FISHERY RESOURCES – marine biology
- UNIVERSITY OF SOFIA – education and research on oceanography, biology and meteorology
- NAVAL AKADEMY - education and research on ocean engineering

Different systems are operated by different organizations

FUTURE ACTIVITIES

- New systems and sensors: GALATA platform will be updated with new set of sensors. ADCPs will be installed on several regions. Shkorpilovtci coastal base sensors set will be expanded
- Integration – System of Systems: All system will be integrated in common portal
- Data management and dissemination: New data management system is planned to serve integrated systems. New dissemination tool will be developed
- Synchronization of DMS with requirements of different projects
- Products and forecasts: Collected data will be used to generate new products and for forecasts verification.
- Basin scale integration: Integration of NOMOS in the Black Sea observing systems will benefit riparian countries and will generate added value

CONCLUSIONS

- NOMOS is a national research initiative undertaken in cooperation with EU partners
- A WEB centric oceanographic data management system is developed
- To provide an encompassing solution, the project focuses on the following contributions:
  - **WEB centric communication system** ensuring flexible and operative infrastructure for data and information exchange between partners and end users;
  - **A managed reporting environment** that defines security, caching, distribution, access, and usage reporting, while a single, integrated tool set allows to manage centrally the development and delivery of reports;
  - **GIS data** are available on the Web without change the existing data workflow i.e. how the data is created, maintained, and used by desktop applications. GIS data are kept in its native format without translation or having to maintain yet another copy of that data;
  - **Prepare necessary organizational, technological and technical prerequisites** for integrated and operative Black Sea observing system;
  - **Website has been matured as a prime vehicle** for delivery of NOMOS data, information and advisory services

LESSONS LEARNED

- To build NOMOS we need clear strategy and argumentation for funding and development
- NOMOS should be user driven and should provide useful operational data and information in understandable form
- NOMOS should be flexible, open for further development, connectable to neighboring systems and designed and built according international standards

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THANK YOU FOR YOUR ATTENTION !