Hydrodynamic-statistical forecast of storm wind over the Barentsovo, North and Norway Seas.

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Development of successful method of forecast of storm winds with the velocity more than 20m/c and more than 25m/c, that often result material losses, could allow one to take proper measures against destruction of buildings at the coats of seas and to protect people. Well-in-advance successful forecast (from 12 hours to 48 hour) makes possible to reduce the losses. Prediction of the phenomena involved is a very difficult problem for synoptic till recently. The existing graphic and calculation methods still depend on subjective decision of an operator. Nowadays in Russia there is no hydrodynamic model for forecast of the wind with the velocity V=20m/c and more, hence the main tools of objective forecast are statistical methods using the dependence of the phenomena involved on a number of atmospheric parameters (predictors).

Statistical decisive rule of the alternative and probability forecast of these events was obtained in accordance with the concept of "perfect prognosis" using the data of objective analysis. For this purpose the different teaching samples of present and absent of this storm wind were automatically arranged that include the values of forty physically substantiated potential predictors.

Then the empirical statistical method was used that involved diagonalization of the mean correlation matrix **R** of the predictors and extraction of diagonal blocks of strongly correlated predictors. Thus for these phenomena the most informative predictors were selected without loosing information. The statistical decisive rules for diagnosis and prognosis of the phenomena involved U(**X**) were calculated for choosing informative vector-predictor. We used the criterion of distance of Mahalanobis and criterion of minimum of entropy by Vapnik-Chervonenkis for the selection predictors.

Successful development of hydrodynamic models for short-term forecast and improvement of 36-48h forecasts of pressure, temperature and others parameters allowed us to use the prognostic fields of those models for calculations of the discriminant functions in the nodes of the grid 150x150km and the values of probabilities P of dangerous wind and thus to get fully automated forecasts for European part of Russia and Europe. In order to change to the alternative forecast the author proposes the empirical threshold values specified for this phenomenon and advance period 36 hours over the territory of Norway, North and Barentsovo seas.

According to the Pirsey-Obukhov criterion (T), the success of these automated statistical methods of forecast of storm winds 36 –48 hours ahead in the warm season for the territory of Baltic countries is T = 1-a-b=0,54…0,78 after author experiments. .

A lot of examples of forecasts of storm wind and connected with them choppy seas over the territory of Norway, North and Barentsovo seas are submitted at this report. The same decisive rules were applied to the forecast of these phenomena during cold period in this year too. There were very many storm winds at autumn too. The very high waves and high velocity of storm wind were observed at this territory. The forecast of these phenomena with earliness even 36-48h were successful enougth.

South Indian Ocean circulation - an observational perspective

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The south Indian Ocean circulation is subjected to periodic and non-periodic disturbances including low frequency planetary wave activity. Estimation of the mean velocity field enables to delineate the embedded variability and the associated oceanic and atmospheric processes. Today's ocean observing capability has been supplemented by various platforms of observations which are adequate enough to deliver the ocean state in fine spatial and temporal scales, provided that they are combined appropriately and analyzed aptly. Most of the earlier information on south Indian Ocean circulation is based on ship drifts and occasional current meter deployments. The hydrographic sections at selected locations do indicate the relative flow fields often referred to some arbitrary levels. Recently, with the advent of satellite altimeter, which measures the sea surface height, embrace large amplitude undulations of the geoid and the small amplitude undulations of the sea surface dynamic topography. The large number of satellite tracking surface drifters deployed as a part of Global Drifter Program is still operational and continues to deliver valuable data. In addition, under the Global Argo Programme many Argo floats are already deployed in the south Indian Ocean since 2001 and which are providing temperature-salinity profiles as well as some surface drift information also. From the foregoing, by suitably combining the satellite altimeter data and the surface drift observations, it is now feasible to estimate the absolute sea surface topography. In the present study, the circulation is determined from satellite derived products and using hydrographic observations and compared. To determine the instantaneous sea surface dynamic topography, the temporal mean sea surface dynamic topography must be determined by combining the satellite altimetry, satellite tracked surface drifter data, Argo suface drift data and wind observations. Both the drifter data and the Argo float surface drift data provide the surface velocity, which includes the geostrophic and ageostrophic components too. Separating the ageostrophic component from the drift velocity make it is possible to combine data with the sea level anomaly to estimate the mean sea surface velocity. Assuming geostrophy, the sea surface dynamic topography can be converted to sea surface geostrophic velocity and vice versa. Combining the temperature -salinity profiles with the temperature -depth profiles enables to estimate the dynamic topography in desired spatial and temporal scales.

FerryBox – Application of Continuous Water Quality Observations Along Transects in the North Sea

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In order to distinguish between anthropogenic and natural changes in an ecosystem, the environmental parameters and the driving forces need to be monitored in different temporal and spatial scales. The limitation of conventional monitoring methods particularly with regard to temporal and spatial resolution is often a serious hindrance to a better understanding of marine ecosystems and the underlying biogeochemical processes. The use of unattended automatic observing systems onboard of ships of opportunity offers a cost-effective and reliable possibility to obtain regular observations of near-surface parameters with a high spatial coverage and temporal resolution.

In the Southern North Sea the application of the so called FerryBox systems has been successfully applied since 2002. FerryBoxes have been installed on different ferries and cargo ships as well. The system allows high frequent monitoring of oceanographic parameters (temperature, salinity, turbidity) as well as biological relevant parameters such as chlorophyll, nutrients, oxygen and pH along a transect.

In combination with remote sensed data the spatial limitation to a certain transect can be overcome. Combination of these in-situ observations with remote sensing enhances the spatial resolution of the transect related measurements. Examples of the synergy between both operational measuring strategies as well as the limits of comparability of the different methods for chlorophyll-a detection are shown.

The long-term continuous oxygen observations along the track can be used to estimate the seasonal dynamic of oxygen productivity. By combination with wind fields derived from a regional meteorological model the new production can be calculated. Together with other variables measured by the FerryBox (salinity, temperature, chlorophyll-a, turbidity) areas of high productivity, such as fronts, can be easily detected and quantified. The new production values obtained using the oxygen flux method clearly depicts zones of high and low biological productivity along the transect in the Southern North Sea.

After seven years of experience in the North Sea it turns out that FerryBox systems are a cost-effective monitoring tool to get a high yield of reliable high frequent water quality data along a transect improving conventional monitoring strategies. The yield on reliable data is high due to low-maintenance inline sensors and easy access for services at the home port. Over a longer time period problems may occur due to changes of the utilized ships on a certain routes resulting in extra costs for moving the equipment from one ship to another and causing gaps in the time series as well. The experiences reveal that the operation of the system is easier to handle and to coordinate on ferries than on cargo ships due to the normally very regular schedule of the ferries in contrast to often very irregularly schedule of cargo ships.

The high resolution of FerryBox systems in space and time provides deeper insights in marine processes which can be used for better assessing the ecosystem and the underlying biogeochemical processes in the marine environment. Special events like strong short-term algae blooms, which will be detected only occasionally by standard monitoring methods, can be studied in detail and related to variations in influencing factors such as temperature, wind and nutrient load. However, due to its limitations (surface measurements, certain ship tracks only) only a combination of research ship cruises, buoy measurements at strategic locations, remote sensing and numerical modelling will give the deep insights needed for an understanding of the ecosystem as a prerequisite for future management options.

Multi-parametric Eulerian Observatories in the Eastern Mediterranean

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In the framework of the national buoy program of Greece, HCMR operates two deep-sea observatories in the Eastern Mediterranean Sea: the POSEIDON-E1M3A station of the south Aegean Sea and the POSEIDON-Pylos station of the south-eastern Ionian. Both of them are developed to provide near real time multi-parametric deep sea observations in support of both operational applications and scientific research. E1M3A was developed and operates since 2000 as part of the Mediterranean Moored Multi-sensor Array (M3A). This network of fixed point observatories is a component of the Mediterranean observing system that has been developed through major EU projects (MFSPP 1998-2001, MFSTEP 2001-2005) and national initiatives (ESEO, Adricosm, POSEIDON, CYCOFOS etc) under the coordination of MOON (www.moon-oceanforecasting.eu) and MedGOOS (www.medgoos.net). Other components of the Mediterranean observing system are the Argo floats (MedARGO), the VOS program and the remote sensing component for delivery or customized products for assimilation into ocean forecasting systems. E1M3A is designed for the delivery of physical observations (temperature, salinity, currents) in the upper 1000m of the ocean, bio-optical observations (chlorophyll-a, dissolved oxygen, light attenuation, PAR, nutrients) in the euphotic zone (0-100m) as well as air-sea interaction parameters (air temperature, atmospheric pressure, wind, relative humidity, precipitation, radiation). It was designed as a modular system with multiple nodes. The problems identified during the early years (2000-2005) were attributed to biofouling and failures of the telemetry systems. They were taken into account during the system re-build in 2005-2007 under the POSEIDON-II project. The upgrade E1M3A observatory operates at a deep site of the Cretan Sea (1400m) since May 2007 being integrated into the POSEIDON buoy network and its data telemetry and management system. It has been recently upgraded with the integration of a pCO2 system that is currently under pre-operational testing and is expected to deliver for the first time routine measurements of CO2 in the Eastern Mediterranean Sea. The POSEIDON-Pylos observatory was developed in 2008 with emphasis on deep water column and near seabed measurements of physical properties. The mooring line is equipped with 9 CTDs in the upper 1000m as well as a Passive Aquatic Listener (PAL) at 500m depth. The later is used for the first time in the Mediterranean sea for rainfall and wind estimates as well as for marine mammal detection. All sensors deliver data to the surface buoy through the inductive cable of the mooring. A standalone seabed platform is deployed at 1680m depth for near-bottom measurements of temperature, salinity and dissolved oxygen. The platform is also equipped with a high-precision pressure sensor for Tsunami detection as a first step towards an early warning system for the area. Data are transferred every 3 hours from the platform to the surface buoy through an acoustic modem. In case of Tsunami detection the system switches to an alarm mode and data are transmitted every 15 seconds. Both ob-

servatories contribute to the EuroSITES project (www.eurosites.info) and the OceanSITES international programme (www.oceansites.org). They are also components of the In-Situ TAC of the MyOcean project (www.myocean.eu.org) that develops the Marine Core Service of GMES.

Tidal and wind-driven surface currents in the German Bight: HFR observations vs. model simulations

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High-frequency coastal radar (HFR) observations of surface currents in the German Bight and hindcasts from a primitive equation numerical model were examined with respect to tidal and wind-driven components. The region of interest lies between the shallow mudflats of the North Frisian islands and the island of Helgoland 50 km offshore, with water depths ranging from less than 5 m to approx. 30 m. HFR observation data cover six months from August 1991 to February 1992. Measurements with a coherent integration time of 18 minutes were repeated every 30 minutes. Based on signals from two radar sites, zonal and meridional velocities are available at a horizontal resolution of 3 km. The model domain covers the region of interest as well as the surrounding German Bight with a horizontal resolution of 1 km and a vertical resolution of 21 layers in sigma coordinates, of which only the surface layer was used for the analyses.

A tidal harmonic analysis was applied to extract the dominant tidal components and to obtain corresponding tidal ellipses. For the HFR observations, the analysis was additionally carried out taking into account observation error estimates provided by the HFR for each individual sample. Complex correlation coefficients between HFR as well as model surface currents and the wind field (ECMWF atmospheric analysis data as well as local wind measurements) were calculated to examine wind-driven components.

The highly non-random occurence of missing values in HFR observations is apparent in some of the analyses. This may pose challenges in their interpretation since the possible causes (including, but not limited to: geometry of antenna setup, sea state, radio frequency interference) are not always easy to separate, e.g., the variations in range due to ionospheric reflections follows a 24 hour cycle which correlates to daily wind variations. Good agreement between analysis results based on HFR and model data can be found especially for mesoscale spatial patterns (e.g., of tidal ellipse orientation or of the magnitude of complex correlation with the wind field).

Surface circulation in the eastern Levantine Basin as deduced from satellite-tracked drifters

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Starting in summer 2009, satellite-tracked drifters were released south of Cyprus and east of Israel to study the surface circulation in the eastern Levantine basin. In total, 13 units were deployed in 2009 and more deployments are planned in winter and spring 2010. The drifters are the Surface Velocity Program (SVP) designs with a drogue at 15-m nominal depth and a Sea Surface Temperature (SST) sensor. Preliminary results based on the data between August and December 2009, reveal the following circulation features: 1. A strong coastal current off the coasts of Israel, Libanon and Syria, flowing to the north and northeast. Ubiquitous loops in the drifter tracks indicate the presence of eddies generated by the coastal current through instability processes. 2. A long-lived (more than a month) anticyclonic eddy which detached from the coastal current northwest of Haifa, Israel. Its period is about 4 days and its diameter about 80 km. This features is often referred to as the Shikmona Eddy. 3. An anticyclonic eddy controlled by the Eratosthenes Seamount south of Cyprus. 4. Complex surface circulation features in the passage between Cyprus and Syria, with only a few drifters moving north and joining the Cilician Basin.

An assessment of pan-Arctic Ocean freshwater content changes from the 1990s to the IPY period

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Unprecedented summer-season sampling of the Arctic Ocean during the International Polar Year period (IPY, $2006-2008$) makes possible a quasi-synoptic pan-Arctic estimate of liquid freshwater (LFW) inventories. In comparison to observations from $1992-1999$, LFW content relative to a salinity of 35 in the layer from the surface to the 34 isohaline increased by more than $3000\,km^3$ in the Arctic Ocean (water depth greater than $500\,m$). This is close to half the annual export of freshwater (liquid and solid) from the Arctic Ocean reported in the literature.

The dataset comprises observations from multiple platforms, including autonomous systems used during IPY. The LFW inventories are mapped for both time periods using objective analysis.

Observations and a model simulation show regional variations in LFW were both due to changes in the depth of the lower halocline, often forced by regional wind-induced Ekman pumping, and a mean freshening of the water column above this depth, associated with an increased net sea ice melt and advection of increased amounts of river water from the Siberian shelves. Over the whole Arctic Ocean, changes in the observed mean salinity above the 34 isohaline dominated estimated changes in LFW content; the contribution to LFW change by bounding isohaline depth changes was an order of magnitude smaller, and non-linear effects due to both factors were negligible.

The GOOP: Global Ocean Observed Products

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In the 'Global Ocean Observed Products' initiative from CLS, satellite and in-situ observations of the ocean temperature, salinity, sea level heights and surface currents are synthesized to produce global, gridded maps of the 3D ocean state: Weekly 3D maps of temprature and salinity are computed in the framework of the ARMOR3D project through the 1993-2009 period while montly maps of currents are produced in the framework of the SURCOUF3D currents over the same time period. These reanalyses of the ocean state based on observations only are fully complementary to more sophisticated operational ocean forecasting systems as developped in the framework of the European MyOcean project for which they act as very useful validation products. In addition, the GOOP provide a consistent view of 15 years of the ocean 3D state and are therefore fondamental for the better understanding and monitoring of the ocean's evolution.

Morphology and dynamics of the Danube Delta littoral between the Sulina and Sfântu Gheorghe river mouths (Romania)

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The delta littoral is situated between the river mouths of Sulina and Sfantu Gheorghe, with a length of 33 km and it represents the central alignment of the delta sector. The dynamic complexity increases to the south and to the north of the two river mouths, due to several alluviation and erosion factors. Littoral morphology and dynamics is getting complicated also due to the hydro technical works built up by the European Danube Commission, and continued by other companies, at the Sulina mouth. At the end of 2008, the length of the short dams (advancement dams) in Sulina exceeded 9 km and the advancement in the aquatic littoral zone radically changes the direction of the currents and waves. In the area of the central delta littoral, for about 9 months a north-south current occurs, and for about 3 months (during summer) a south-north one. The two flows annihilate each other next to Sfantu Gheorghe mouth. The meeting of the two water fluxes with different directions, generates a special dynamics in the sector situated south to the Sulina mouth: in the immediate neighbourhood, an intense alluviation process occurs (alluvia trap), while in the central sector, a significant erosion process is present (between Sondei channel and Împuţita brook). The littoral erosion next to the Sondei channel could reach, in certain periods, up to 10-12 cm/year. A proof of this complicated dynamics is represented by the rapid shore line change rate, but also by the particle size value of the material involved. On the whole, the sector between the two river mouths is dominated by erosion, while progradation is less represented.

Co-incident in-situ observations of turbulence and zooplankton with a new biophysical profiler

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Turbulence is ubiquitous in the oceanic environment and it has been theorized that, depending on its intensity, turbulence can either enhance or inhibit feeding by zooplankton. This has been supported by laboratory experiments, but whether turbulence is an important factor in the ocean is poorly known because of the difficulty of making simultaneous measurements of zooplankton and turbulence in-situ. We present data from a newly constructed vertical profiler that combines video plankton and microstructure measurements. In the summer of 2009, this profiler was deployed in a relatively stable fjord setting (Saanich Inlet, British Columbia) and a dynamic continental shelf setting (Roseway Basin off Nova Scotia). Small-scale physical complexity of the water column (represented by turbulence and temperature variance) is related to distributions and size-spectra of zooplankton. We also critically explore putative evidence of biologically generated turbulence in the fjord.

Coastal stations, offshore buoys and a HF radar for monitoring high frequency ocean processes in the SE Bay of Biscay: some examples of model validation.

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At the SE Bay of Biscay, along 170 km coastline, a marine observational system gives multiparametric information of shelf and slope marine and oceanographic variables at high temporal resolution. The in-situ measuring system is formed by: (i) 6 coastal stations measuring oceanographic (temperature, currents, tides and waves) and meteorological parameters; (ii) 2 deep sea buoys (located over the slope between 450 and 550 m depth) measuring oceanographic (temperature, salinity and currents from surface to 200 m and waves) and meteorological parameters and (iii) a HF Radar array (200 km range, 6 km horizontal resolution). This system provides since 2008 systematic and long-term routine measurements together with real-time data, invaluable for operational oceanography purposes.

The analysis of time series of atmospheric, hydrographic and current data permits describing the ocean circulation and improving the understanding of the ocean processes taking place at different time scales. Diurnal, semidiurnal and inertial signals dominate the high frequency range of variability in this area. Over the slope, although less energetic than in other oceanic regions of the Bay of Biscay [Van Aken et al. 2007], significant internal tide and inertial variability is observed. These oscillations would be responsible for part of the vertical shear-induced mixing.

In the same area, ROMS model [Song and Haidvogel, 1994] is used to obtain realistic simulations, covering a regional and a sub-regional domain (6 and 2 km horizontal resolution, respectively) and using real-time high resolution atmospheric forcing. Model-data comparisons show a reasonable agreement in terms of surface dynamics and variability at a seasonal scale. However, model-data discrepancies, in terms of vertical stratification and high frequency processes, are observed.

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Investigating changes in the Atlantic Waters characteristics along the Egyptian Mediterranean Coast.

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Abstract:

The paper investigates the changes in characteristics of the Atlantic Waters (AW) as they move eastwards along the Egyptian coast in the South-eastern Mediterranean.

The study analyzed a long series of temperature, salinity and σ_t data, collected by several expeditions that were carried out by research vessels of different nationalities, including Egypt, during the period 1959-2008, averaged for the winter and summer seasons.

The paper also examined the long-term (50 years) changes that occurred in the characteristics of the water masses off the Egyptian coast as a result of damming the Nile River in 1965 and the subsequent cessation of its discharge into the Mediterranean. These changes were considered in terms of their possible contribution to the observed changes in the characteristics of the AW along the Egyptian coast.

The results show that the sea surface temperature of the southeastern Mediterranean waters off the Egyptian coast varied between 16.6-18.5^{o}C in winter, and between 22-28^{o}C in summer. Furthermore, the salinity of the coastal waters off the Egyptian coast has, on average, increased from 26.675 in 1964 before the erection of Aswan Dam, to around 38 in the 1970s and reached more than 39 in 2008.

Vertically, only one water mass could be observed in winter in the upper 200 m layer, whereas in summer, three distinct water masses could be observed. The subsurface water mass, which is of Atlantic origin, occupying the 50-150 m layer and characterized by low salinities ranging from < 38.60 to 38.80, runs throughout the study area from west to east and spreads over the range of density between 27.5-28.5 σ_t.

Temperature and salinity anomalies indicated increasing trends for both temperature and salinity that reached 0.62^{o}C/dec and 0.067/dec, respectively for the Mediterranean surface waters. For the Atlantic water, the trends were 0.56^{o}C/dec for temperature and 0.035/dec for salinity. These results confirm that the increase of temperature and salinity of AW with time are attributed to both anthropogenic modifications, especially the Nile damming, and the local climatic changes, which need further investigation.

Eddy HF radar observations in the Gulf of Lions

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Coastal mesoscale eddies were evidenced during a HF radar campaign in the Gulf of Lions, North-western Mediterranean Sea, from June 2005 to January 2007. These anticyclonic eddies are characterized by repeated and intermittent occurrences as well as variable lifetime, and could have important consequences in terms of dispersion or retention at local scales. The eddy generation and driving mechanisms are investigated by means of an academic numerical study. The influence of the wind forcing is analyzed, using a number of idealized configurations in order to investigate river discharge, buoyancy and bathymetric effects.

Multiscale analysis of high frequency coastal monitoring data

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The marine environment is an example of complex system with many interactions at many time scales. To understand and characterize such system, high frequency databases are needed, together with adequate analysis models and techniques. In the LOG in Wimereux we have developed in the past years several methods to analyze such high frequency data, and characterize their multiparametric fluctuations at many different time scales.

We show here several examples, considering data from a high frequency monitoring system: MAREL ("Mesures Automatiques en Réseau pour l'Environnement Littoral") network operated by IFREMER (French Research Institute for the Exploitation of the Sea) and installed in Boulogne-sur-mer (France). This database consists in measurements of temperature, dissolved oxygen (DO), pH, nitrogen (NO3+NO2) chlorophyll a, particulate organic carbon (POC), salinity, particulate organic nitrogen (PON), phosphorus and silicates, recorded at a fixed location, automatically, every 20 minutes, from 2004 to 2009.

We apply to these data several analyses techniques in order to characterize the dynamics of their fluctuations on a wide range of scales. We consider first the covariation between some parameters couples ((pH, DO), (DO, Chla), (Chla, N)) using some regression using a kernal estimator in order to consider conditional averages. We also consider the probability density function of some ratios (N:P, Si:N, Si:P, COP:Chla, COP:NOP) that reveal in all cases a "wild" behaviour with many extremes. We also use spectral analysis and estimate the Fourier spectral density of the MAREL time series, in order to reveal periodicities, scaling regimes, and turbulence influence. Finally we consider bivariate extremes in order to characterize the coupling between several quantities, highlighting physical-biological nonlinear coupling.

New tools for ocean observing network assessments applied to water level measurements in the German Bight

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A set of tools for the statistical assessment of ocean observing networks is presented and applied for the analysis of different instrumentation scenarios in the German Bight. An optimal linear estimator is used to re-construct ocean state parameters from observations taking into account both the prior distribution of the state and measurement errors. The proposed method enables a re-construction of any scalar parameter or vector field with linear relationship to the state. The performance of the observing network is quantified in terms of the re-construction quality. Apart from the capability of the network to provide estimates of state parameters at the time of the observations, the potential of the measurements for forecasts is investigated as well. Furthermore a generic method to compare single measurements with continuous observations is presented. Finally a technique is described to quantify the relative importance of different components of an observational network.

The proposed methods are applied to water level measurements in the German Bight. A numerical model is used to estimate the background statistics. Synthetic measurements provided by tide gauges, satellite altimeters, and HF radar are considered in the analysis. The estimation of the complete water level field in the German Bight is compared for altimeter and tide gauge measurements. It is shown that the orientation of the satellite track with respect to the coastline is of high relevance. The importance of water level measurements taken in deeper water, e.g., at the FINO-1 platform, is demonstrated. It is shown that continuous tide gauge measurements provide more information on the area mean water level in the German Bight than altimeter observations taken by ENVISAT and JASON-1/2. It is furthermore shown how the information provided by a tide gauge propagates with the Kelvin wave. Implications for the design of an assimilation scheme are discussed. The potential of HF radar to provide information on water levels and the respective change rates is analysed. Different radar locations and systems with one and two radar stations are investigated.

The monitoring system of the Kazakhstan sector of Caspian Sea

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The Caspian Sea is the largest closed reservoir in the world, which washes the western part of Kazakhstan. The area of water territory is 371,000 sq km; the sea level is lower than the level of the ocean on 28.5 m (1971). Maximum depth is 1,025m (in the southern part); the Kazakhstan part is not deep, and the depth of the North Caspian sea is about 15-20 m. The Caspian Sea is divided according to physical and geographical conditions to 3 parts - North Caspian, Middle Caspian and South Caspian Sea. Fauna is represented by 1809 species, 415 of which belong to the vertebrates, 101 species of fish, it also has the majority of the world's sturgeon, freshwater fish - roach, carp, pike, saltwater fish - carp, mullet, sprats, Kutum, bream, salmon, perch, pike, mammal - caspian seal. The plant world is represented by 728 species, of which algae are dominated - blue-green, diatoms, red, brown, Stoneworts and others, from flowering - eelgrass and seagrass. Development of sea oil-and-gas deposits of the Kazakhstan sector of Caspian sea entails increase of anthropogenous pressure on the environment. According to preliminary estimates, the volume of recoverable hydrocarbon resources in the Kazakhstan sector of Caspian Sea is about 8.0 billion tons per year. The impact of terrestrial and marine infrastructure, oil and gas facilities on natural systems is reflected in discharges and emissions into the environment of gaseous, solid and liquid pollutants, consumption of natural resources for industrial, farm and household needs, and violation of coastal landscapes. Dangerous influence on the environment is burning natural oil gas on torches. In this regard, there is a need for a system of state monitoring. In a basis of environmental monitoring system of the Kazakhstan sector of Caspian Sea has been put an ecosystem approach, creation of an automated system on the basis of GIS technologies and modeling of forecasts of environmental condition. Objects of monitoring in the Caspian Sea will be: air, sea water, bottom sediments, coastal ecosystems, benthos, plankton, aquatic vegetation, fish, birds, seals. The main component of environmental monitoring system of the Kazakhstan sector of the Caspian Sea will be conducted on the basis of the complex program "Ecologist".

1.Modeling of Ecological processes

•Data support by 3 types of sources: files with List structure, Prototype Files and files with Analogs of Normative

•International and Regional Regulation

•Creating of Pollution Matrix

•Adjusting of adaptive Factors

2.Choosing and elaborating the proper mathematical methods for Resource Control

•Consecutive Calculations Method

•Coordinated Descend Method

•Liner Programming

3.Computerizing

•Analyses of Environment State

•Multi Projecting of resource control

•Algorithmic and Graphical Support of Step by step Project forming

Block Scheme of System

New Object - Creating New Object for Applied Ecological Study (OAES)

Choosing Territory, Environment Media, Harmful Substances

Description of Pollution Sources, Measures and Natural Phenomena

Forming Models

Old Object - Choosing Old OAES

Model Creating and Parameters Adjusting

Report – Analyses of Ecological State

Control – Multi Project Designing of Environment Measures

The system of environmental monitoring of the Kazakhstan sector of Caspian Sea will allow to evaluate the ecosystem of Caspian Sea and the coastal areas in the Kazakhstan sector, air pollution, sediment, impacts on biodiversity, to identify the oil film on water surface, to determine the parameters of the spill, to convert the monitoring results in graphical and tabular form, to predict the development of the current situation with regard to the influence of external factors in the geographic information (GIS) environment, to plan operations localization of zones of pollution and disaster situations.

Bio-Optical Studies of Predictability and Assimilation for the Coastal Environment (BIOSPACE)

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The predictability of underwater light and coupled bio-optical and physical properties of the water column is very important for many Navy missions and operations. It is also critical for understanding, monitoring and managing of the ecosystem health and dynamics. During the last couple years, in collaboration with researchers from university and industry, NRL has been conducting modeling and field studies of variability and predictability of underwater light and coupled water properties on time scales of 1 to 5 days. This research involves development of high-resolution, three-dimensional coupled physical, bio-optical models and their integration with interdisciplinary in situ and remotely sensed observations, as for example, with observations of satellite ocean color and data collected by AUVs and gliders. There are many scientific questions that we plan to address in the project: how bio-optical properties are impacted by change in physical conditions, the degree of complexity in the bio-optical physical model that is needed to represent variability of observed properties on a time scale of 1-5 days, how best to assimilate observations and to deploy autonomous assets in sampling bio-optical properties in coastal ocean. Results of simulations with the coupled, bio-optical, physical model of the Monterey Bay are presented. The error characterization and uncertainty of predictions has been evaluated during different regimes and conditions in the Bay, including upwelling/relaxation events, development of fronts and eddies and presence of remote forcing.

Synergy of Multychannel, Multyspectral, Multyplatform remote sensing data and Marine and Atmospheric Modeling for Sea study

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Recent observing systems allow to investigate processes and phenomena with spatial scales ~ 0.1-100 km playing significant role in marine ecosystem functioning.

Combination of the data from different platforms together with HR modeling gives the new information in a qualitative sense.

AVHRR, MODIS, MERIS, ASTER, ETM+, ASAR, QuikScat data with NCEP, SKIRON, MM5 atmospheric data and Black Sea operational model output were used for description of:

oil spill detection and manifestation in optics

HAB registration and study

Mesoscale wind impact on marine ecosystem

Study were supported by EC FP6 SESAME, ECOOP projects and MOPED INTAS project.

A Strategy to Deal with Ocean Data

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That we are far more proficient at generating data or in acquiring it with experiments and sensors than we are in using that data is not so much a growing problem but a looming scandal. Relying on technology to make access and analysis faster is not enough; we present a two-pronged strategy to cut the Gordian knot of data overload. Our plan exploits of the right advances in computer and information technology: namely feature recognition and data bases. Datasets are large and numerous, but rife with redundancy. We assert that data sets can be decomposed into patterns over space and time, and a residual (noise) that itself can be defined parametrically. Thus, large swaths of data can be reduced to a population of generating functions. In ocean studies, currents, eddies, and fronts comprise the majority of the data, especially in the view of the analyst who would use the data if not confronted with daunting size and complexity. Blind data compression using wavelet-based algorithms are effective and well studied; we see this as a first step because wavelets define patterns, not features. Our strategy goes beyond the wavelet approach that stops well short of presenting the data in a form amenable to quick analysis. Instead, we have developed rapid and robust methods for detecting vortices and for computing streamlines and stream fronts without recourse to unreliable derivatives, preferring more statistically stable integral measures. We are supported by the fact that the solutions to the Navier-Stokes equations can be reduced to a very small number of geometric ideals Roulstone, 009). Reduction to features requires extensive use of data mining tools like R and KNIME; but these tools are not file-centric, which brings up the second thrust of our proposal-the replacement of files and filesystems with a data base framework. This work was pioneered by the late Jim Gray of Microsoft Research [Bell 2006]arch who showed that there was no performance loss in the transition, and an enormous gain in flexibility and set up. We apply this methodology to the analysis of simulation output from models in use at LANL and also to biogenic data sets acquired from remote sensing devices. We show that the data so pre-processed and re-organized leads to faster and more effective analysis, visualization, and comparison.

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Physical-biogeochemical study using a profiling float: Subsurface primary production in the western subtropical North Pacific as evidence of large diapycnal diffusivity associated with the Subtropical Mode Water

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Based on the extensive profiling float observation carried out as part of the Kuroshio Extension System Study (KESS), large vertical eddy diffusivity (2-5 x 10^{-4} m^2 s^{-1}) near the upper boundary of Subtropical Mode Water (STMW) was reported [*Qiu et al.*, 2006]. On the other hand, recent measurement of turbulent kinetic energy dissipation rate indicated much smaller vertical eddy diffusivity (10^{-7}-10^{-5} m^2 s^{-1}) over the whole depth range of STMW [*Mori et al.*, 2008]. However, the direct comparison between these two estimates is possibly inappropriate because the former is based on the potential vorticity change over a couple of months and the latter on the instantaneous turbulent measurements.

Noticing that the large diffusivity would have an impact on subsurface redistribution of nutrients and dissolved gas components, we carried out physical and biogeochemical observation to examine the vertical diffusivity near the top of STMW using a profiling float. The profiling float equipped with a fluorometer and a dissolved oxygen (DO) sensor along with a CTD sensor was deployed in the STMW formation region and acquired quasi-Lagrangian, 5-day-interval time-series records from March to July 2006. The time-series distribution of chlorophyll showed a sustained and sizable subsurface maximum at 50-100 m, just above the upper boundary of the STMW, throughout early summer (May-July). The DO concentration in the lower euphotic zone (50-100 m) was supersaturated in the same period, but did not show net increment. On the other hand, regardless of expected oxygen consumption by organism, DO concentration at 100-150 m near the top of STMW, which was below the euphotic zone, only slightly decreased. These small temporal variations of DO in the lower euphotic zone and near the top of STMW probably reflect downward oxygen transport by large diffusion rather than small biological activities. The estimated diffusivity based on the assumption of the large downward transport of oxygen was 2.5 x 10^{-4} m^2 s^{-1}, which supports the previously estimated large diffusivity. Since our estimation is based on temporal evolution of the DO concentration over several weeks, it is fairly consistent with the previous estimation. The nitrate transport into the euphotic zone by this large diffusion was estimated 1.2 mmol N m^{-2} d^{-1}. All of transported nitrate could be utilized for photosynthesis by phytoplankton; the net community production can be estimated 8.0 mmol C m^{-2} d^{-1}.

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High-resolution measurements of an upwelling filament during the CAIBEX campaign (summer 2009)

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Upwelling filaments consist of shallow, elongated structures of cool water developing near the coast and extending a few hundred kilometers offshore. They are frequently observed in the four main upwelling regions (California Current, Canary Current, Humboldt Current and Peru-Chile Current) either by remote sensing imagery, or by oceanographic cruises.

In the frame of the CAIBEX project, dedicated to the study of the exchanges between the coastal zone and the open ocean, high-resolution measurements of the Cape Ghir filament (NW Africa, 30°38'N) were carried out using the SeaSoar, a towed profiling conductivity temperature depth measurement package, capable of undulating from the surface to 500 m at tow speeds of up to 12 knots.

Nine meridional transects were performed in the course of the campaign, with a decreasing distance with respect to the coast in the successive tracks. The maximal depth reached by the SeaSoar was 400 m. Comparison with SST and chlorophyll images revealed that the filament was sampled in several of the transects. The transect closest to the coast was repeated with CTD measurements.

In this work we present analysis of vertical and horizontal sections for the variables measured by the SeaSoar: temperature, salinity and fluorescence. The originality of the work resides in the fact that it is one of the first time that an upwelling filament is sampled with such a fine resolution.

Heton' dynamics over a submerged obstacle

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In the context of a two-layer quasi-geostrophic model on an f-plane, the problem of a self-moving compensated baroclinic vortex (heton) incident on an isolated axially symmetric submerged obstacle of a small height is considered. The method of counter dynamics is used to study the characteristic features of the vortex field in the vicinity of the obstacle, depending on the vertical structure of the heton, the height and horizontal sizes of the obstacle, and also the velocity of the background flow.

Forecasting the oceanographic conditions in the Nazare Canyon area (W Portugal)

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Marked by abrupt topographies and driven by highly energetic processes with a broad range of temporal and spatial scales, submarine canyons offer challenging environments to test and implement ocean monitoring strategies and operational forecasting tools. Located off the western Portuguese coast, the Nazare Canyon is one of such exceptional areas and the largest submarine canyon of the European margin. With a length of more than 270km and extending from abyssal depths over 5000m to a few hundred meters from shore, the Nazare Canyon is being the focus of an intense monitoring effort conducted by the Portuguese hydrographic office, Instituto Hidrografico (IHPT), with the co-funding of major European projects (EUROSTRATAFORM, HERMES, HERMIONE). In 2008 this effort was extended, with the implementation of capacities in real-time monitoring and operational forecasting of the canyon conditions, which are conducted in the framework of project MONICAN (EEA Grants). Here we describe the efforts presently being developed at IHPT to implement an operational forecast system for the Nazare Canyon area. The system is planned to cover the dominant processes that take place at this submarine canyon and nearby area of influence, which were previously identified. It is also designed to made full use of the data collected by different observation platforms and real-time system being operated by IHPT in that area. Operational forecasting of wave conditions affecting the Nazare Canyon area use an integrated system that combines a North Atlantic wave model (WaveWatch III) and a regional wave model (SWAN models). Daily forecasts of wave conditions and associated products are disseminated to the general public through the IHPT web page. Circulation models (HOPS, ROMS) are being implemented and tested to provide forecasts of the shelf-slope circulation in the canyon area of influence, promoted by wind forcing and interactions with the deep-ocean dynamics. These models will use boundary conditions from large scale circulation models (MERCATOR, NRL-Hycom) and assimilation of a broad range of measurements. Inner shelf and littoral processes are being simulated using SHORECIRC, XBEACH and ROMS models. Multidisciplinary surveys, covering the canyon area of influence, were conducted to test observation strategies and new sensor solutions that could be adequate to the data assimilation. Developments to be carried in the very near future include the adaptation of the forecast system to assimilate data collected by a HF radar system to be implemented in the Nazare Canyon area in 2011, in the framework of a national funded project (SIMOC).

"Ice-T": an autonomous buoy for real time measurement of sea-ice thickness and heat exchanges at the ocean-ice-atmosphere interface. Current status and future plans.

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Polar regions are most sensitive to the ongoing climate warming. In the Arctic, sea ice extent and thickness have shrunk substantially during the past decades, and most recent observations indicate that these changes are accelerating. The decline of sea ice extent during the last 3 summers was particularly dramatic, with a deficit of nearly 40% compared with the summer sea-ice cover in the years 1980-2000. These changes outpace the most pessimistic climate models predictions. Models indeed need observations to refine their predictions. These are necessary for a better determination of the current state from which future changes are forecasted. They are also needed to improve the parameterization of energy exchanges at the ocean-ice-atmosphere boundaries.

While sea ice extent is now routinely monitored from space, remote sensing of ice-thickness is still in its early stage and a large part of our current knowledge of this parameter stems from field observations. Dedicated missions have recently or will be shortly launched (e.g. CryoSat-2) but field data remain necessary to calibrate and validate sea ice thickness estimates from satellite. Moreover exchanges of heat between the ocean, the ice, and the atmosphere cannot be measured from space.

Polar surface instruments face new constraints with the decline of perennial ice, and it becomes necessary to develop floating devices adapted to the seasonal ice. The " Ice-T " (Ice-Thickness) buoy, developed at LOCEAN since 2005, is a prototype instrument for automated measurement of sea-ice thickness together with the terms entering the thermodynamical sea-ice mass

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balance. The instrument is intended both for thin and thick ice conditions. It is made of two bodies: a surface buoy trapped in the ice, and a subsurface weighting float (or “fish”), hanging below the ice layer, connected with a cable for data and energy transmission. The instrument currently measures the ice thickness, thermal profiles within the ice and snow layers, and allows as well to estimate the snow load. In addition we can accurately estimate ocean currents at the base of the ice, which ,combined with salinity measurements, makes it possible to estimate the ocean-ice heat flux. Additional sensors include a GPS and provide also basic meteorological parameters. All data are real time transmitted through the iridium communication system.

The prototype was successfully deployed in the Storfjord polynya region, Svalbard, in 2007. We present the concept of the instrument as well as the validation campaign and discuss future plans within a recently funded project. The latter involves in particular new technological developments to complete the estimate of fluxes both at the ice surface (atmospheric fluxes) and at the ocean-ice interface.

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Automated video system for storm impact evaluation at Praia de Faro (South Portugal)

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An automated video system was developed mainly to evaluate morphological storm impacts on the exposed, sandy, reflective Praia de Faro beach (S. Portugal). For that purpose 2 IP cameras were installed and connected to a PC acquiring imagery from the coastal zone during 10 min every hour during daylight, with an acquisition frequency of 1 Hz. The system is used to monitor a coastal section 500 m alongshore with resolution varying from 0.2 m to 3 m and is programmed to execute scheduled image processing operations, so as to generate snapshot, time averaged (timex), variance and timestack images on an hourly basis. Automatic shoreline extraction algorithms were developed combining colour segmentation, on the timex images, and pixel intensities criteria, on the variance images. The extracted shorelines are combined with real time wave and tidal measurements to produce intertidal topographic impressions for each tidal cycle. Comparison of the latter with RTK-GPS topographic surveys showed RMS errors ranging from 10 to 20 cm. The system is designed to run real time, with image geo-referencing based on a DTM in an effort to reduce geo-location errors from object shadowing. The latter is constantly updated from the remote sensed topography, as well as from regular field surveys which also serve for validation and updating of other-than-intertidal sections. Camera movement aspects (e.g. due to wind) are also taken into consideration, through feature matching between consecutive images and correction of camera orientation. The system is fully operational since September 2009 and coupled with ongoing efforts for topographic, bathymetric and hydrodynamic data acquisition aims to assess storm induced morphological changes.

Mapping partial pressure of CO2 of surface ocean water using automated instrumentation on ships of opportunity and remote sensing

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Knowledge of partial pressure of CO2 (pCO2sw) in surface seawater is a key requirement in constraining the amount of anthropogenic CO2 that enters the ocean, and its subsequent impacts on marine ecosystems (the "ocean acidification" effect). Monitoring pCO2sw is challenging because of the highly variable patterns of the CO2 fields controlled by a complex interplay of physical and biological factors that vary by region and season. Automated systems are currently deployed on ships of opportunity (SOOP) thereby increasing the number of in situ surface water observations. Several different means are employed to interpolate the measurements in space and time. Here we describe the developments to create mapped CO2 fields, including commercialization of instrumentation, clear protocols and standards, and novel interpolation techniques.

The automated instrumentation for SOOP that has been transitioned to the commercial sector is widely adopted worldwide. This is accompanied with grassroots efforts to standardize operations and data reduction (Pierrot et al., 2009). Close attention is paid to standardization since biases are an insidious problem in analyses. Several different products have been developed including a global climatology of air-sea CO2 fluxes (Takahashi et al., 2009) and regional air-sea CO2 flux maps based on SOOP and remote sensing of sea surface temperature and wind. The development of two near real-time products to estimate spatiotemporal ocean acidification patterns in the Caribbean Sea (Gledhill et al., 2008) and global interannual variability of sea-air CO2 fluxes (Park et al., 2010) will be described in further detail.

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Observations of coastal upwelling/downwelling processes on the West Florida Shelf using a mixture of gliders, profilers, moored ADCPs and HF radars

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Concurrent in situ observations of coastal ocean temperature, salinity, dissolved oxygen, chlorophyll, and other optical properties from autonomous underwater gliders and bottom-stationed oceanographic profilers (BSOP), plus in situ observations of velocity from moored acoustic Doppler current profilers, supplemented by surface velocity remotely sensed by land-based HF radars are used to describe the evolution of coastal upwelling and downwelling events on the West Florida Shelf. Some of these observing systems have been in place for many years; others (gliders and profilers) are new additions. Recognizing that no single measurement system is adequate to sample coastal ocean processes, these data are used in combination to examine a few individual events, revealing transport pathways for coastal ocean water properties and demonstrating how a mix of instrumentation may be useful in interpreting variability that may be aliased by only using one type of data.

Oceanic Variability in NCEP Climate Forecast System Reanalysis

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At National Centers for Environmental Prediction (NCEP), a reanalysis of the atmosphere, ocean, sea ice and land over 1979-2009 has been recently completed as the Climate Forecast System Reanalysis (CFSR). The reanalysis is unique in that the first guess is derived from a 6-hourly coupled atmosphere-ocean-land-sea ice forecast, and which involves a state-of-the-art atmosphere, ocean, land and sea ice model, advanced data assimilation systems, and updated observational data sets. The primary use of the CFSR will be to provide initial conditions for a reforecast of the new operational CFS over 1981-2009 for calibration and skill estimation. The oceanic component of CFSR, representing a new ocean reanalysis, will replace the current operational ocean reanalysis produced by the Global Ocean Data Assimilation System (GODAS).

Given the importance of global ocean climate variability on different facets of society, for example, the role of oceanic memory in the predictability on seasonal to decadal time scales, it is critically important to assess the quality of oceanic variability in the CFSR against various independent observations and analyses. The operational ocean analysis system are also used in monitoring and understanding major climate modes of variability such as El Niño and Southern Oscillation (ENSO), Indian Ocean Dipole (IOD), Pacific Decal Oscillation (PDO), Tropical Atlantic Variability (TAV) and Atlantic Meridional Overturning Circulation (AMOC). For example, the GODAS outputs have been extensively used at Climate Prediction Center (CPC) of NCEP to monitor the current conditions and recent trends of major climate modes (see http://www.cpc.ncep.noaa.gov/products/GODAS).

Our assessment of oceanic variability in the CFSR will include comparisons with various in situ and satellite observations such as TAO/TRITON/PIRATA/RAMA moorings, drifter currents, Altimetry sea surface height, tide gauge observations, OceanSites and other analysis products such as OSCAR ocean currents, NCDC objective temperature and analysis. Ocean surface fluxes in CFSR will be validated against in situ and satellite observations such as OceanSites, QuickScat winds, ISCCP radiation, and other analysis products such as OAFlux, and FSU winds. Variability in oceanic Kelvin waves, Tropical Instability Waves, mixed layer depth, and upper ocean heat content variability associated with major climate modes will be analyzed.

Water, Heat and salt Transport across the Strait of Otranto

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The water, heat and salt transports through the Strait of Otranto are estimated applying direct method to historical current and hydrographical data (from December 94 through November 95). A variational inverse method based on a variational principle and a finite element solver is used to reconstruct the current, temperature and salinity fields across the Strait section from sparse measurements. The mean annual inflow and outflow water transport rates are estimated as 0.901±0.039 Sv and -0.939±0.315 Sv, respectively, and the net transport for the period of study is equal to -0.032±0.208 Sv. Thus, on a yearly time interval, the inflow and the outflow are practically compensated. The heat and salt transports due to advection process are estimated for five monthly periods, namely December 1994, February, May, August and November 1995. Considering these five periods representative of the seasonal cycle during the year, their average values show that there is a net heat advection into the Adriatic Sea on a yearly basis. The estimated value of advected heat and the corresponding error are 2.408±0.490 TW, which is equivalent to a heat gain of 17.37±3.53 W m^{-2} for the whole basin. This value is compared to the heat loss of -36±152 (std) W m^{-2} through the air-sea interface calculated by means of bulk formulas over the Adriatic Sea. The two values are expected to be balance each other in order to close the heat budget of the basin. The possible reasons for this difference to occur are discussed. On a yearly basis, the salt transport is estimated as an input of salt equal to 0.05×10^{6} Kg s^{-1}. The average annual fresh water budget is estimated as -0.002 Sv, equivalent to the mass of fresh water of 2.00×10^{6} Kg s^{-1} or to the level of 0.45 m yr^{-1} for the entire Adriatic Sea. The import of salt that is less than the gain of fresh water is in agreement with the fact that the Adriatic Sea is a dilution basin.

I need a video projection for presentation.

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The PRIMI 2009 summer cruise: multiplatform observation of oil spills in the Central Mediterranean Sea.

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We report the results of an oceanographic cruise organized in the framework of the ASI-PRIMI project on oil-spill dispersion monitoring and forecasting. During the cruise, carried out in the summer of 2009, oil spills were detected in the Central Mediterranean using microwave and optical satellite observations. The cruise plan was organized so as to have the ship within the selected image frame at acquisition time, so as to maximize the possibility to reach and sample spills identified in satellite data. Several oil spills were sampled in situ with onboard radar, lidar and optical measurements, and surface water samples were collected to assess oil type. Lagrangian experiments were also organized to verify the performance of the PRIMI forecasting system in tracking the spill and to assess the role of wind and currents in spill drift. Preliminary results indicate the robustness of the spill detecting and forecasting system, and that future work combining satellite and in situ data is necessary to assess the spill severity from the oil spill signature in satellite imagery.

APPLICATIONS OF THE AUTONOMOUS OCEAN MOORED PROFILER AQUALOG FOR THE BLACK SEA STUDIES

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This presentation introduces a new ocean moored profiler named Aqualog. The profiler moves down and up along a mooring line, which is taut vertically between a subsurface flotation and an anchor. The profiler is a multisensor observational platform that carries a load of modern oceanographic instruments. The sensors include, but are not limited to the FSI Excell 2" Micro CTD probe, the Nortek Aquadopp 3D current meter, and the AANDERAA fast Oxygen Optode 4330F. The acoustic Doppler current meter is a horizontal beam single frequency 2 MHz instrument remotely sensing the water volume in the range of about 0.5-2 m from the profiler with a sampling frequency of 23 Hz. When the carrier is moving with the speed of 0.1 m/s the vertical profiles are measured with a vertical resolution of 0.05 m for pressure, conductivity and temperature, 0.3 m for acoustic backscatter signal and horizontal current speed and 0.8 m for dissolved oxygen.

The ocean moored profiler multiparametric observation technology has a number of advantages which are briefly summarized below. Unlike conventional mooring where the equipment is placed on fixed depths, Aqualog conducts continuous measurements of vertical profiles applicable for assessing both integral and differential characteristics of the ocean fine structure. By combining pressure, conductivity, temperature, and horizontal current velocity data it is possible to evaluate vertical mixing. The joint analysis of dissolved oxygen data and the strength of the acoustic backscatter signal give a better understanding of the variability of the marine ecosystem vertical structure at multiple time scales.

The acoustic Doppler current observations by Aquadopp 3D mounted on the profiler are superior to those done by a conventional ADCP. Unlike the traditional ADCP approach where i) a longer working range is achieved by the price of poorer vertical resolution (e.g., 644-meter vertical profile is binned at 32-meter cells by the longest range ever 75 kHz ADCP) and ii) the horizontal span of the beams widens proportionally to the distance from ADCP (e.g., up to 468 m in horizontal at the distance of 644 m by 75 kHz ADCP), the Aqualog obtains horizontal current profiles at the above mentioned fixed distance of 0.5-2 m from the profiler with a uniform ocean-fine-structure resolution throughout the full water column from the near-surface layer down into the abyss. The Aquadopp 3D 2 MHz acoustic remote sensing signal is most sensitive to the underwater sediment, phytoplankton, and zooplankton of the size of about 0.05 mm – 5 mm. If compared to conventional lower frequency ADCPs (75 kHz - 470 kHz), which are more sensitive to certain larger scatters and may occasionally misestimate the swimming nekton species for current fluctuations, the Aqualog current profile data delivers higher signal-to-noise ratio.

The profiler oceanographic sensors are rigid, high-precision and stable giving the

opportunity to make an extended survey of the ocean. So far the typical depth range of Aqualog's profiling was 5–600 m. A titanium instrument housing allows the maximum depth of profiling to reach 3000 m. Vertical speed can be set within 0.1 and 0.3 m/s. The pay load consists of at least 3 probes. Weight in the air is 62 kg without sensors or up to 75 kg with sensors. Start and stop by magnetic switch or as preprogrammed. There is LED indication of the system status. The programmable hardware of the profiler allows the user to set an automatic operation algorithm (variable movement speed, time and period of profiling, stops, etc.). The profiler mooring line is made of stainless steel wire or Kevlar^{TM} fiber. The Aqualog has enough resources to profile a water column in the programming regime during several months. The total profiling distance is about 800 km in still waters for a profiler with a lithium battery pack.

The Aqualog was successfully tested during the expeditions into the north-eastern Black Sea in 2007-2009. By using the Aqualog new data on inertial oscillations, submesoscale variability, and vertical exchange (the mean gradient Richardson number, the eddy viscosity and the eddy diffusivity) in the waters over the continental slope was obtained. The depth of the seasonal thermocline, the vertical gradient of density driven by temperature distribution and the current velocity gradient in the thermocline as well as the vertical exchange coefficient, all are substantially modulated by inertial oscillations and submesoscale vortices. The acoustic backscatter data were useful for studying daily variability of the ecosystem and its vertical structure. In particular the euphotic zone, the oxycline, and the suboxic zone were identified along with the diel migrations of the zooplankton in the top 130 m layer of the Black Sea. The vertical speed of the suspended matter in the anoxic layer deeper than 150 m was also estimated.

Overall, the moored profiler Aqualog is a useful tool for multidisciplinary research of the variability of both biotic and abiotic parameters of the sea environment on time scales from a few hours to several months. A real-time data transmission system is envisaged for the Aqualog profiler. Autonomous profiling multiparametric observatories of the moored type have great potential for being the key technical means for marine environmental monitoring.

Diva Hydrographic Data Sets Stabilisation: An optimal method

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Direct applications of variational inverse methods such as that implemented in Diva software or optimal interpolation for gridding in-situ data do not guarantee that the interpolated temperature and salinity fields are in hydrostatic equilibrium. We present a new algorithm for the removal of hydrostatic instabilities from hydrographic data sets. The principle of the method is to determine values and locations of new pseudo-data that will be added to the original data set in order to assure stability in the analysed field. Optimal pseudo-data location and values are determined using the Data Interpolating Variational Analysis tool Diva in an iterative way. The stabilization algorithm implemented in Diva software takes the errors of the analysis fields into account. The principle of the method, a hydrostatic constraint, is to determine values and locations of new pseudo-data that will be added to the original data set in order to assure stability in the analysed field. Pseudo-data locations are determined on the basis of the density field of a given layer and the correlation length parameter. The value of the pseudo data is computed iteratively by determining the optimal increments to analysed values of temperature and salinity that lead to a non negative Brunt-Vaisala frequency, and is added to the data set corresponding to the depth for which the error of analysis is the highest. We present and discuss two examples of stabilised gridded monthly climatologies of the Mediterranean and Black Sea basins computed in two ways: 1) direct stabilization of extracted monthly climatology data sets. 2) computation of gridded analyses using stabilized seasonal semi-normed reference fields

On the efficiency of some metrics for the near real time assessment of model products in Eastern Channel and Southern North Sea: some results and comments.

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In the context of the EU research project ECOOP (European, COstal sea Operational observing and forecasting system, http://www.ecoop.eu), an updated version of the 3D coupled biological-hydrodynamical model referred to as MIRO&CO model has been operated in a pre-operational mode for the first time. The ecosystem component is the micro-biological loop model MIRO developed by Lancelot and co-workers (Lancelot et al., 1987; Lacroix et al., 2004). The physical component uses the COHERENS-V2 model recently developed by Luyten (Luyten et al., 2005). The model cover the Eastern Channel (from 4° West) and the Southern North Sea (52.5° North).

The search for near real time data and efficient metrics for the validation of such sophisticated tools is still in its infancy and it is the subject of lot of activities in the context of the development of regional forecasting systems carried out in the EU MyOcean research project (http://www.myocean.eu.org/).

In this paper, we present the recent developments dealing with the assessment of the MIRO&CO model forcing and model products. The period of interest starts in March 2009 and stops in December 2009. This was the Targeted Operational Period (TOP) of ECOOP. Assessment deals with, e.g., KPAR, transports through sections, sea surface temperature, salinity, nutrients and Chlorophyll.

Data are coming from fixed stations, remote sensing and similar operational models. A series of metrics are being tested in an attempt to identify, for each model product, the most informative ones.

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A multi-platform experiment for understanding coastal mesoscale and sub-mesoscale processes

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Dynamics along the continental slopes are difficult to observe given the wide spectrum of temporal and spatial variability of physical processes which occur. Studying such complex dynamics requires the development of synergic approaches through the combined use of modeling and observing systems at several spatial/temporal sampling level requirements.

In this work we present the first results of SINOCOP, a multiparametric experiment carried out along the north-western coast of Mallorca Island (Western Mediterranean) from 11 to 21 May 2009. The general goal of this experiment was to develop new methodologies to estimate the 3-dimensional state of the ocean using a multi-sensor observational approach combined with numerical modelling. Observations included coastal and deep gliders, drifters, standard CTDs and remote sensing (altimetry, sea surface temperature and ocean colour). During SINOCOP experiment, two gliders covered a regular grid of 50x40 km2 with a resolution of 4 km between transects in combination with drifters and stardard CTD. The specific scientific and technological objectives are: i) to investigate the limitations and potential improvements of different radar altimetric datasets in the coastal area, ii) to develop new methods for the combination of different sensors and iii) to use high resolution observations (from gliders) together with the numerical results to study the formation, evolution and decay of mesoscale and sub-mesoscale features. Preliminary results show that the multi-sensor sampling strategy allowed investigating the mesoscale and sub-mesoscale processes associated with the Balearic Current, the main oceanographic feature of the area.

All these initiatives are in line with the new OceanBIT Coastal Observing and Forecasting System, a new facility that will address scientific and technological coastal ocean international priorities. The System will be based in the Balearic Islands but will have a more general Mediterranean / Global Ocean interest (the Mediterranean as an ideal, small scale ocean). On a long term, multi-sensor experiments, such as the one presented here, will contribute to advance on the understanding of physical and multidisciplinary processes and their non linear interactions, to detect and quantify changes in coastal systems, to understand the mechanism that regulate them and to forecast their evolution.

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