HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

POTENTIAL HARMFUL MICROALGAE IN NIGERIAN COASTAL WATERS AND THE LEVEL OF AWARENESS ABOUT THE HAB PHENOMENON IN NIGERIA

Cyril C. Ajuzie and Guy T. Houvenaghel

Laboratoire d'Océanographie Biologique, Université Libre de Bruxelles, CP 160/19, Av. Roosevelt 50, 1050, Bruxelles, Belgium

Since the 1970s when research on HABs started as a full scientific discipline, many regions of the world have witnessed an increase in the number of scientists that are working in this field of science. Therefore, information on the occurrence of HAB species and events, as well as on the negative effects associated with these events (fish kills, human seafood poisonings, water discoloration, etc.) have been reported in nearly every coastal State. However, no information on the HAB species or on the HAB phenomenon seem to be available for the entire Gulf of Guinea in the literature. This warranted us to search on the occurrence of potentially harmful microalgal species in Nigeria's coastal waters - a study that spanned the nearly 950 square km coastline. It also necessitated a search into the level of awareness about the HAB phenomenon in Nigeria - a Gulf of Guinea State. Results indicated that potentially harmful microalgae are present throughout the length of Nigeria's coastal waters. Such species were recorded among the cyanobacteria, diatom and dinoflagellate groups. Also the results indicated that awareness about the HAB phenomenon is very low among the Nigerian medical practitioners and aquatic scientists, and that human seafood poisonings as well as bloom event might have occurred in the country without generating any commensurate attention from the people there.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

BIO-OPTICAL PROPERTIES OF FOUR PHYTOPLANKTONS SPECIES USING IN SITU MEASUREMENTS IN LARGE BATCH CULTURE

Blouin, Frederick - *Université du Québec à Rimouski, ISMER*
Roy, Suzanne - *Université du Québec à Rimouski, ISMER*
Mas, Sébastien - *Université du Québec à Rimouski, ISMER*
Servet Cismeli - *University de Sherbrooke, CARTEL*

With the upcoming of new real-time In situ sensors to estimate the optical variability of the water by remote sensing and predict algal bloom, the knowledge on mono-specific phytoplankton species must be advance to establish the influence of the phytoplankton composition, pigment and physiological state in a field sample. We have made measurements on four mono-specifics phytoplanktons species (one diatoms (Thalassiossira pseudonana), dinoflagellates (Alexandrium tamarense), prymnesiophytes (Imantonia rotunda) and eustigmatophytes (Nannochloropsis sp)) cultured in batch (180L) to estimate their optical properties in different physiological state. The experiment last 19 days and on each day, In situ fluorescence (Turner design), absorption, attenuation (ac-9) and backscattering (ECO VSF) coefficient, absorption coefficient by QFT, pigments composition (HPLC) and specific refractive index, fluorescence, cell size and number (cytometry) were measured. On each species, at least two different physiological states were observed (lag, logarithmic, stationary and/or death phase) and compared. Technical problem occurred with the ECO-VSF using the neon-light source (cause interference on signal). But some extra measurement were done by night and conclusion can be made. Finally, we try to intercalibrate the ECO-VSF and the cytometer refractive index to correlate the backscattering coefficient and the volume scattering function (VSF) between them.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

THE OCCURRENCE OF TOXIN PRODUCING ALGAE IN SCOTTISH WATERS

E. Bresnan, S. Hay, M. R. Heath, S. Fraser, N. Smith, J. Dunn, J. Fraser, S. Robinson

FRS Marine Laboratory, Victoria Road, Aberdeen, AB11 9DB, Scotland.

The toxic phytoplankton monitoring programme has been in operation in Scotland since 1995 and fulfils the requirements of the EU shellfish hygiene directive 91/492/EEC. Analysis of the data collected to date shows a characteristic pattern in the occurrence of toxic phytoplankton species around the Scottish Coast. Alexandrium species occurs along the East Coast of Scotland, extending up to the Orkney Islands during May and June. Dinophysis species occurs in high numbers all around the Scottish coast from July until October. Two distinct populations of Pseudo-nitzschia species are routinely observed. The first P. delicatissima type occurs in March/April, while the second P. seriata type occurs in August/September. Analysis of these populations using transmission electron microscope techniques show up to six potentially toxic species co-occurring at the same time. Results of multivariate analysis of physical and chemical parameters and toxic phytoplankton species using PRIMER-E from a long term monitoring site on the East Coast of Scotland will also be presented.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

TOWARDS ASSESSING ALGAL PHYSIOLOGY FROM REAL TIME IN SITU OPTICAL MEASUREMENTS

Catherine A. Brown, Yannick Huot, Marlon R. Lewis, and John J. Cullen

Dalhousie University, Department of Oceanography, Halifax, N.S., B3H 4J1, Canada

An important objective of coastal monitoring is the early detection of changes in algal communities. The quantum yield of fluorescence is directly linked to algal photosynthetic and non-photosynthetic processes, thus being an indicator of physiological status. We use optical measurements from datasets including a real time coastal mooring network in Lunenburg Bay, Nova Scotia in a new inverse model that retrieves information about the phytoplankton community (i.e. pigment packaging and quantum yield of fluorescence). Apparent optical properties (AOPs), such as the diffuse attenuation coefficient (Kd) and reflectance (Rrs), are a function of both the inherent optical properties (IOPs) and the angular distribution of the light field. Inverse modelling is useful for estimating IOPs in optically complex coastal waters, particularly where regional empirical models have not been established.

Our inverse model has several novel features including: 1) the simultaneous inversion of two AOPs (Kd and Rrs); 2) a spectral representation of the angular distribution of the light field; 3) variable chlorophyll specific absorption; and 4) extension into the ultraviolet range. Thus, we address many limitations of the present models while keeping the formalism simple and operational for real time monitoring of seawater constituents.

Our model should improve estimates of IOPs and, combined with the observational data, measure the quantum yield of fluorescence of the phytoplankton community. This study explores a new method to autonomously maintain sustained observations of algal physiological variability, and we interpret the observed temporal variations in terms of environmental influences.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

DIEL CHANGES IN PHOTOSYNTHETIC AND OPTICAL PROPERTIES OF PICOPLANKTON: POSSIBLE APPLICATIONS IN MONITORING OF HARMFUL SPECIES.

Flavienne Bruyant

Laboratoire d'Océanographie de Villefranche sur Mer, France

Prochlorococcus sp. is one of the smallest but most abundant autotrophic organisms on earth. In the tropical oceans, it is responsible for the majority of the primary production. In the frame of the European project PROMOLEC, we analyzed diel changes in the photosynthetic and optical properties of this organism. Prochlorococcus was grown in an axenic cyclostat under a smooth, time varying, bell shaped illumination. We determined photosynthetic and optical parameters, expression of different photosynthetic genes, together with the current phase of the cell cycle, all at high temporal resolution.

All parameters showed strong diel variations. The maximum rate of carbon fixation and photosynthetic efficiency were maximal in the morning and strongly decreased around noon. Recovery was completed only at the end of the dark period after cell division took place. While excess irradiance was found to be responsible for the drop in photosynthetic parameters during the day, our data suggest that recovery was slowed during the night by cell division. For each period of the cell cycle we identified a different cell activity (Carbon fixation, division etc…) characterized by changes in optical properties. Different cell activity (e.g. toxin production of HAB species) could be monitored in the natural environment.

Diel variations in photosynthesis properties such as those observed during this study have to be accounted for when modelling phytoplankton growth in the natural environment. To do so, the effects of photo acclimation and cell cycle on photosynthesis may have to be considered separately. This will be done for toxic phytoplankton species during my post-doctoral research.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

THE UNIVERSITY OF NEW HAMPSHIRE'S CENTER OF EXCELLENCE FOR COASTAL OCEAN OBSERVATION AND ANALYSIS (COOA)

Janet W. Campbel

COOA Director, University of New Hampshire

In October 2002, the University of New Hampshire established the Centre of Excellence for Coastal Ocean Observation and Analysis (COOA) with a $2M award from NOAA. COOA is one of seven partner institutions comprising NOAA's Coastal Observation Technology System (COTS). The UNH centre of excellence will develop and implement new methodologies for coastal ocean observing across the spectrum from data acquisition, analysis, integration and synthesis. Supporting activities include model-data assimilation and design of data and information products. COOA has been launched with five seed projects led by UNH researchers with expertise in a core discipline underlying coastal ocean observation and analysis. The new efforts reflect and will immediately implement the COOA core missions, including the integration, interpretation, and analysis of data and the creation of new information and information products. Our targeted customer is initially the expert user: typically a researcher who is adept in accessing and manipulating web-based data and information. Three of the seed projects entail coordinated field programs in the Gulf of Maine. Another project, Web-COAST, will serve integrated data and information via the Internet. The fifth project involves research and development of specialized materials for coastal moorings. Additionally, COOA offers graduate research fellowships in coastal ocean observing.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

RECURSIVE ESTIMATION TECHNIQUES APPLIED TO CONTINUOUS TIME SERIES OF WATER QUALITY PARAMETERS IN COASTAL SYSTEMS

*Ciavatta *, S., and Pastres, R.*

Dept. of Physical Chemistry, Univ. of Venice,
Dorsoduro 2137, 30123 Venezia
**Corresponding author:*
Tel.: +39-(0)41-2348632; fax: +39-(0)41-2348594. E-mail: ciavatta@unive.it.

This work presents the application of mathematical models to the analysis of continuous water quality time series that were collected in the Lagoon of Venice. By coupling regression and mechanistic models with recursive estimation algorithms that are based on Kalman filtering theory, the non-stationarity of the time series and the non-linearity of their relations were addressed. Accordingly to this procedure, which is particularly suitable for on-line time series analysis, it is assumed that the model parameters evolve stochastically with time and their values are sequentially updated when a new field measurement is collected and "assimilated" by the model. The results of recursive fitting, interpolation, smoothing and forecasting of pH, Salinity, Dissolved Oxygen and Chlorophyll-a time series are here presented. The results demonstrate that recursive estimation techniques can be useful in order to process the huge mess of multivariable data sets collected in coastal zones by real time water quality monitoring systems.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

EDDY ACTIVITY OFF THE BRAZILIAN SOUTHEAST COAST AND ITS RELATIONSHIP TO PHYTOPLANKTON ABUNDANCE

Aurea Maria Ciotti , Ilson C. A. da Silveira, Mayza Pompeu, Sueli Susana de Godoi, Leandro Calado, Salvador Airton Gaeta,

IOUSP, São Paulo, Brazil

The Brazil Current (BC) presents intense meandering as it flows along the Brazilian Southeast coast. The presence of isolated large amplitude meanders has been reported through the analysis of sea surface temperature from AVHRR data. The formation of these eddies seem related to two distinct processes. Around 22S meanders with large amplitude, usually cyclonic, eventually neck off shedding a cold core ring that can either be reattached to the current or advected offshore. From between 23S and 28S, the narrower shelf combined to an abrupt change in coastline orientation contribute to form large cyclonic meanders. Occasionally, the wavy pattern grows in amplitude as the BC flows south forming mushroom-like structures composed of cyclonic and anticyclonic vortices. In this case, the formed eddies do not separate from the current axis. Due to the small temperature gradients, however, a quantitative assessment of these features remains difficult. Here we examine the use of ocean color as a tool to characterize the frequency and intensity of the meanders' core as well as their area. High-resolution radiometric data from SeaWiFs and a good quality set of in situ bio-optical data were combined into local algorithms to estimate chlorophyll concentration and light absorption coefficients for both phytoplankton and dissolved organic matter. These algorithms were applied to construct a two-year time series of biological parameters maps, and the bio-optical features were used to estimate eddies activity. Inner shelf biological activity and the exportation of carbon offshore appeared to be tightly coupled with eddy activity.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

PROPERTIES AND DIVERSITY OF HAB; A CHALLENGE FOR REAL TIME MONITORING

Alejandro Clément, Alejandra Aguilera and Claudio Fuentes

Plancton Andino Ltda. P.O. Box: 1036 Puerto Varas, Chile. http://www.plancton.cl

The shellfish and fish aquaculture industry need a fast, simple, inexpensive and accurate monitoring system to detect HAB in space and time.
At the moment, our response period, i.e., the time since collecting the water, information or data and the result or product is around 24-48 hours, and it depends in methods, technology, human resources and the distance from sites to the laboratory.
The goal is to decrease this time period and to develop or apply a near real time monitoring systems for HAB in the south of Chile. The main objective of this study is to analyse the local harmful algal species, and their properties or specific attributes, taking into account the potential application for in situ sensors.
The problem is that harmful algal are very diverse taxonomically or from a genetic point of view and also considering the eco-physiological aspects. The most common harmful diatoms are Pseudo-nitzschia and Leptocylindrus, in relation with dinoflagellate are Alexandrium, Dinophysis and Gymonidinium and with respect other flagellates, Heterosigma. These algae are in the same space, in the inland sea of the south of Chile, but usually bloom in different period of time.
Finally, we expect to find some regular properties, for at least, the most important harmful algae and then to propose, apply and test the adequate technology and methods for real time monitoring.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

BIOSENSORS FOR THE DETECTION AND MONITORING OF ALEXANDRIUM MINUTUM ALONG THE FRENCH COASTS

E. Antoine1, C. Compère2, S. Cosnier3, H. Moreau4,
M. Barbier2, E. Erard2, E. Guilminot2,
M. Lehaitre2, H. Perrot5, C. Gabrielli5, C.M. Pradier6, M. Salmain7

1-Ifremer, Centre de Nantes, rue de l'Ile d'Yeu, BP 21105, 44311 Nantes Cedex 3, France
2-Ifremer Centre de Brest, B.P. 70, 29280 Plouzané, France
3-Laboratoire d'Electrochimie Organique et de Photochimie Redox, Bâtiment Chimie Recherche, Université Joseph Fourier Grenoble 1, 301 rue de la Chimie, BP 53, 38041 Grenoble Cedex 9, France
4-Laboratoire Arago – UMR 7628 CNRS – Université Paris VI " Modèles en biologie cellulaire et évolutive ", BP 44, 66651 Banyuls sur mer, France.
5-UPR 15 du CNRS, Laboratoire de Physique des Liquides et Electrochimie du CNRS, Université P. et M. Curie, Tour 22, 5ème étage, 4, place Jussieu, 75252 Paris cedex 05, France.
6-Ecole Nationale Supérieure de Chimie de Paris – Laboratoire de Physico-Chimie des Surfaces, 11, rue Pierre et Marie Curie, 75005 Paris, France.
7-Ecole Nationale Supérieure de Chimie de Paris – Laboratoire de chimie organométallique (UMR CNRS 7576), 11, rue Pierre et Marie Curie, 75005 Paris, France.

Toxic strains of Alexandrium minutum produce neurotoxins responsible for paralytic shellfish poisoning, which upon accumulation in shellfish represent a human health risk. This species recurrently forms toxic blooms in the Northern part of the French Brittany coast. At present algae identification relies on tedious microscope observations mostly performed by skilled taxonomists in laboratories. Newly emerging fields of molecular taxonomy, nanoscale technology and biotechnology offer opportunities for the development of in-situ biosensors for the detection and monitoring of toxic algae. Due to the complexity and to the interdisciplinary nature of such a development, this research requires collaboration between the fields of material science, surface analysis, chemistry, marine microbiology and biochemistry. This paper presents the different actions carried out and the adopted strategies:

- immunological probes (monoclonal antibodies of the cell surface) and nucleic acid probes of the target species used as biological component;
- immobilisation steps and characterisation of the immobilised biological material;
- optical, electrochemistry and quartz microbalance transducers.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

APPLICATION OF THE OCEAN RESPONSE COASTAL ANALYSIS SYSTEM (ORCAS) TO THE STUDY OF HABS

Percy L. Donaghay1, James M. Sullivan1, Casey Moore2, Bruce Rhoades2, and Margaret A. McManus3

1 Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882
2 WET Labs, PO Box 518, 620 Applegate Street, Philomath, OR 97370
3 Ocean Sciences Department University of California Santa Cruz, Santa Cruz, CA 95064

ORCAS is a system that uses arrays of autonomous bottom-up profilers to provide coherent, fine-scale profiling of multiple oceanographic parameters in three dimensional space and time. The system is designed to be rapidly deployed to quantify biological, physical, chemical, and optical responses of coastal systems to episodic events such as harmful algal blooms, recruitment events, and the onset of hypoxia or anoxia. Major progress has been made in the development of the core technologies need for autonomous bottom-up profiling. Totally self-contained versions of ORCAS were used in August 2002 in Monterey Bay, CA, to autonomously collect high-resolution profiles of temperature, salinity, density, inherent optical properties (spectral absorption, spectral attenuation and volume scattering function), chlorophyll fluorescence, bioluminescence, and oxygen concentration. At the end of each cast, the profiler stayed at the surface only long enough to telemeter the data, collect a GPS fix, and receive any instructions regarding future casts. The autonomous profiler then returned to the bottom until the next profiling cycle. During the week-long field test, centimetre-resolution data from 178 sequential hourly profiles was processed and plotted in near-real-time and used to detect, track and optically characterize the development of an intense Pseudo-nitzschia bloom that was restricted to a sub-meter thick thin layer. These field results indicate that the ORCAS profilers have developed to the point where they can be used in open coastal waters to assess the occurrence, persistence, and optical characteristics of thin layers that have been hypothesized to play critical roles in the development of HABS.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

COASTAL OBSERVATIONS OF BROWN TIDE INITIATION BASED ON IN SITU OPTICAL PROPERTIES

Stacey M. Etheridge, U.S. Food and Drug Administration, Laurel, MD, USA
Collin S. Roesler, Bigelow Laboratory for Ocean Sciences, W. Boothbay Harbor, ME, USA

Brown tides of the pelagophyte Aureococcus anophagefferens are common in Long Island, New York embayments. Several hypotheses abound regarding the ecological controls on these blooms, including the advantage of this species to utilize organic nutrients. Coastal observations using optical techniques were made in two Long Island embayments to investigate conditions under which brown tides initiate. A time series (17 May–8 June 2000) of particle size distributions, size-fractioned pigments, and optical properties was collected at each location. A. anophagefferens presence was insignificant in West Neck Bay (WNB), whereas a brown tide developed in Quantuck Bay (QB). Temperature and salinity were similar at both locations, although initial particle concentrations, chlorophyll, and bulk optical properties were a factor of 2 greater at QB. Bulk optical properties remained constant at WNB, yet increased exponentially at QB. The temporal variations at QB were dominated by phytoplankton biomass and colloidal protein changes. At WNB rapid fluctuations in algal composition occurred despite the invariant bulk optical properties. Variations in CDOM at WNB were minimal. These observations suggested that A. anophagefferens had less algal competition and more available CDOM at QB, creating conditions favourable for a bloom. Results demonstrate that coastal observations using in situ optical measurements provide information for identifying areas of brown tide development.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

MONITORING PHYTOPLANKTON BIOMASS, PRIMARY PRODUCTION AND BIOPHYSICAL PARAMETERS IN THE HAURAKI GULF, NEW ZEALAND.

MARK GALL (1), John Zeldis (1), Ken Richardson (2), Matt Pinkerton (2) and Philip Boyd (3)

(1) National Institute of Water and Atmos. Research (NIWA), Christchurch, New Zealand.
(2) NIWA, Wellington, New Zealand.
(3) NIWA, Centre for Chemical and Physical Oceanography, Dunedin, New Zealand.

The northeastern continental shelf of New Zealand is influenced by upwelling and downwelling events. The shelf and adjacent Hauraki Gulf support wild fisheries, aquaculture and marine reserves. The Gulf is surrounded by extensive urbanisation and pastoral development. Understanding the functioning of the marine ecosystem in this region relies on the ability to monitor phytoplankton biomass, and the factors that control it, on appropriate temporal and spatial scales. As such, we have adopted a multi-scaled and multi-faceted approach to monitoring in this region, utilizing data from ship surveys, biophysical moorings and remotely using satellite data on ocean colour and temperature.

From 1998, phytoplankton biomass, primary production, species composition and their size structure have been monitored using in-situ biophysical moorings and station sampling. Two main stations were selected to determine cross-shelf effects of upwelling/downwelling circulation - one near the continental shelf edge (150 m depth) and one in the more coastal Hauraki Gulf (40m). Integrating Natural Fluorometers (INF's) were moored at 15m to estimate phytoplankton biomass and photosynthetic rates for extended periods in high temporal detail. Recent surveys (2002-2003) have focused on the spatial and temporal dynamics in the Firth of Thames at the head of the Gulf.

The accompanying data sets exemplify the spatial and temporal dynamics associated with the Hauraki Gulf region and provide insight into the factors controlling phytoplankton abundance in this region.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

A ROLE FOR OCEAN BIOTA IN THE GENESIS OF TROPICAL INTRASEASONAL ATMOSPHERIC VARIABILITY

Hezi Gildor, Adam H. Sobel, Mark A. Cane, and Raymond N. Sambrotto

Lamont-Doherty Earth Observatory of Columbia University

The tropical intraseasonal oscillation (ISO) is a prominent mode of atmospheric variability in the tropics. It is quasi-periodic with a typical period of 40-50. The ISO interacts with the El Nino-Southern, the monsoons, and extratropical weather, and so is of global importance. Despite many attempts to explain the origin and characteristic of the ISO there is no widely accepted explanation for these waves and atmospheric models fail to simulate them realistically. In recent years, it has been realized that the sea surface temperature (SST) also varies on intraseasonal time scales, suggesting a significant role for air-sea interaction in the ISO dynamics. We propose that temporal variations within the marine ecological system can induce intraseasonal variations in sea surface temperature through the effect on solar penetration of chlorophyll and other optically active organic components. Sensitivity studies with a simple model suggest that these small oscillations in SST, though small if uncoupled to the atmosphere, may stimulate radiative-convective oscillations in the atmosphere that amplify them and thus induce or modulate significant variability in the coupled system. Long-term bio-optical measurements in the Western Pacific, where satellite time series are degraded by clouds, would provide a test of our theory and would improve our understanding of the heat balance in this climatically important region.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

NEURAL NETWORKS FOR PREDICTING ALGAL LEVELS IN ESTUARIES DURING NON-BLOOM PERIODS

Hwee Hwee, Nick Heng

Royal Melbourne Institute of Technology (RMIT University), Australia

Estuarine algae blooms can cause serious health risks to human, disrupt ecological health and cause negative economical impacts in Fishing and Tourism. By using water quality data collected from a YSI multi-parameter probe and the Stuttgart Neural Network Simulator (SNNS), this project aims to develop a robust model able to predict algal levels in an estuarine environment. The model will be a useful management tool for estuary managers allowing them to have advance knowledge of abnormally high algae levels in the water.

A neural network was set up employing data collected throughout the spring/summer season from the Gippsland Lakes, East Victoria, Australia. The Gippsland Lakes is a large shallow estuarine lake system that has been severely impacted by eutrophication on the catchment and the opening of a permanent entrance in the late 19th Century.

The network was built to predict chlorophyll-a by the use of a time-delay structure where inputs are one time step (i.e. 1-hour) before that of the relative output variable. Selected by their significance in algal growth; the input variables in the network are chlorophyll-a, temperature, dissolved oxygen level, salinity and turbidity, hence, producing an output of chlorophyll-a value predicted for the following hour. The network was trained and validated on the same data set collected from the site.

The initial network had shown good convergence with a negligible mean square error. Effects of varying the number of hidden layers and learning rules in reducing prediction error and over fitting are also examined.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

DIFFUSE ATTENUATION (490 NM) FROM MULTIPLE OPTICAL MOORINGS TO QUANTIFY CHLOROPHYLL DEPLETION BY MUSSELS IN A COASTAL AQUACULTURE OPERATION

Diego A. Ibarra1,2,, Allan D. Cembella2, Jon Grant1 and John J. Cullen1

1 Department of Oceanography, Dalhousie Univ., Halifax, Nova Scotia B3H 4J1, Canada
2 Institute of Marine Biosciences, National Research Council, 1411 Oxford Street, Halifax, Nova Scotia B3L 3V2, Canada

The decrease in chlorophyll concentration due to bivalve suspension feeding (i.e. chlorophyll depletion) can have a negative impact to the coastal ecosystem. Chlorophyll depletion was measured at five locations within a mussel farm in Ship Harbour (Nova Scotia, Canada), an aquaculture site with periodical occurrence of harmful algal blooms. Two Tethered Attenuation Coefficient Chain Sensors (TACCS; Satlantic, Inc.) were used to determine the diffuse attenuation coefficient at 490 nm (Kd; m^{-1}) within the stratum where mussels were cultured (4 to 8 m). The values of Kd were converted to concentration of chlorophyll-a plus phaeopigments using an empirical algorithm: [Pigments] = 7.629 Kd - 2.1481 ($r^2 = 0.75$; n = 7; p = 0.012). Coloured dissolved organic matter (CDOM) had little influence on Kd and was correlated with riverine freshwater input. The phytoplanktonic pigments acted as tracers since they were preferentially removed from the water column by the cultured mussels. Therefore, simultaneous measurements of Kd inside the mussel lease and at a reference (upstream) location were used to calculate the average chlorophyll depletion (D). One location at the time, D was measured at the five locations and the results were used to validate two depletion models of contrasting complexity. The numerical model, forced with in situ current velocity, predicted depletions within 3.8% from observations. The analytical model predicted depletion within 1.3% from observations. These passive optical moorings are powerful tools to assess and monitor phytoplankton supply to bivalve aquaculture operations and to detect phytoplankton blooms (harmful and not harmful) in coastal ecosystems.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

THE POSSIBILITY TO USE FUZZY LOGIC MODELLING TO PREDICT DINOPHYSIS SPP. BLOOMS ALONG THE SWEDISH WEST COAST.

Marie Johansen

Göteborgs universitet, Kristinebergs MArina Forskningsstation, 450 91 Fiskebäckskil, Sweden

There is an urgent need to find realistic models which can predict when blooms of toxic algae will appear, so mussels can be harvested before the concentration of “algal toxin” in the mussels gets too high. Traditional models used to calculate growth rates of phytoplankton usually depend on distinct factors, derived from experiments, which have a well known effect. However, the factors initiating harmful algal blooms are sometimes unknown or not clearly understood. The lack of knowledge about important factors is partly due to difficulties to cultivate harmful algal species. One possible way to overcome this fact is to use a model, which use transition stages with uncertainty between classes, for example Fuzzy Logic modelling. A model of this kind, Ecofuzz®, will be used in this study trying to predict Dinophysis spp. abundance. Data collected along the Swedish West Coast during 1988-2001, together with knowledge derived from literature, have been used to obtain factors important for occurrence of italicized wordsDinophysis spp.. These factors together with new results from a field study autumn 2001 will be the base in creating the model. The objective is to create a model that will predict when italicized words Dinophysis spp. will occur in critical abundances in the water column.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

RED TIDE INDEX: AN ALGORITHM FOR DETECTING DINOFLAGELLATE BLOOMS WITH ADEOS-2/GLI

Mati Kahru, B. Greg Mitchell

Scripps Institution of Oceanography, UCSD, La Jolla, CA 92093-0218, USA

A novel algorithm for the detection of red tides has been developed using the unique 380 nm spectral band available on GLI that is not available on other ocean color sensors. The algorithm is based on the approach described in Kahru and Mitchell (1998) and should allow detection of blooms of common red tide organisms with high intracellular concentrations of mycosporine-like amino acids (MAAs). The availability of the 380 nm band on GLI allows the potential for detection of dinoflagellate red tides while concentrations are still moderate (Chl a of 1 mg m-3). It is critical for this algorithm that the water-leaving radiances at 380 and 412 nm are accurately derived.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

MONITORING OF CYANOBACTERIAL BLOOMS: NEW TECHNIQUES FOR REAL TIME OBSERVATIONS AND SCIENTIFIC ANALYSIS ON CAUSAL RELATIONSHIPS.

Inga Kanoshina
Estonian Marine Institute, Marja 4D, 10617 Tallinn, Estonia
Urmas Lips
Estonian Maritime Academy, Luise 1/3, 10142 Tallinn, Estonia
Juha-Markku Leppänen
Finnish Institute of Marine Research, P.O. Box 33, FIN-00931 Helsinki, Finland

Cyanobacterial blooms are common in the Baltic Sea. They are dominated by Aphanizomenon spp. and Nodularia spumigena and take place in July-August. Investigations of bloom development using different approaches have been carried out in the Gulf of Finland during recent years. A combination of different monitoring methods can give a better picture about the current situation and could enable to predict the cyanobacterial blooms in advance. The ship-of-opportunity technique allows observing the upper layer dynamics from meso- to basin wide scale with high temporal and spatial frequency at low cost. Unattended measurements on board a commercial ferry along a transect between Tallinn and Helsinki have been conducted for six years: 1997-2002. The influence of weather conditions - temperature and wind - on the cyanobacterial bloom development was investigated. The formation of cyanobacterial blooms was favoured by warm and calm weather, while in cold and windy conditions other species formed mass occurrences. Water temperature has been found to be the main factor controlling the initiation of the bloom, in general, while vertical stratification appeared to be the critical factor determining the intensity of the bloom at species level. The spatial distribution of the cyanobacterial bloom was determined rather by the wind-forced advection than by the possible vertical transport of nutrients in the areas of the observed upwelling events.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

WIND, WHALES, AND HARMFUL ALGAL BLOOMS: THE DEVELOPMENT OF A COASTAL MONITORING SYSTEM IN MONTEREY BAY

Raphael M. Kudela, Kenneth W. Bruland, and Mary Silver

Ocean Sciences Department, University of California Santa Cruz, 1156 High Street, Santa Cruz, CA 95064 USA

Coastal California is typically viewed as upwelling-dominated, with strong equatorward and Ekman-dominated offshore flows, bounded to the west by the broad, meandering California Current. This implies that biological and physical processes propagate predominantly southward, that coastal runoff has negligible impacts on the near-shore oceanographic conditions and that much of biological interest is driven by seasonally intense spring upwelling. Recent observations suggest that this view is misleading, and that the occurrence of infrequent but high-impact events such as precipitation-driven coastal runoff and poleward surface flow may dominate the biological signal over large spatial and temporal scales. These events can "fertilize" the coastal ocean with anthropogenically derived nutrients, and may catalyse or exacerbate HAB conditions in the coastal ocean. With funding from the National Oceanographic and Atmospheric Association (NOAA), several partner institutions in the Monterey Bay, California area have established a Centre for Integrated Marine Technology (CIMT; http//www.es.ucsc.edu/~cimt) with the scientific goal of describing how physical forcing (wind) eventually translates into the phenomenal biological productivity (such as whales) seen in central California, and how the presence of frequent HAB events (including both Pseudo-nitzschia and Alexandrium spp.) can occasionally result in dead whales. An overview of the CIMT program, its application to HAB monitoring, and some exciting new technologies and observations such as bio-optical proxies for toxin production and bio available iron, use of molecular probes and flow cytometry for tracking HAB populations, and the causes and consequences of HAB events in Monterey Bay will be explored.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

OPTICAL BUOY NETWORK IN THE ST. LAWRENCE ESTUARY AND GULF

Pierre Larouche, Bernard Pettigrew

Institut Maurice-Lamontagne, Pêches et Océans Canada,
BP 1000, Mont-Joli, Québec, Canada G5H 3Z4

The St. Lawrence system, located in eastern Canada, is well known for the strong spatial and temporal variability of its physical properties resulting in a corresponding variability of its biological properties. To adequately monitor such a system that is a complex mixture of Type 1 and 2 waters on a adequate time/space scale, it is thus necessary to use remote sensing technologies. An important aspect of this monitoring system is however the use of in situ measurements to validate the remote sensing data and provide information when the satellite coverage is not available.
We will present our plans for the implementation of an in situ real-time observation system of physical/biological/optical variables for the St. Lawrence. The presentation will also include the results from the first 4 months mooring of our locally developed oceanographic buoy showing the small temporal scales of variability and the advantages of using automated systems compared with traditional ship sampling monitoring strategies. Results will also include a comparison between remote sensing and in situ measurements of phytoplankton biomass and show the complementarities of both approaches.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

OPTICAL PROPERTIES OF KARENIA BREVIS

Kevin Mahoney and Steve Lohrenz,
The University of Southern Mississippi Dept. of Marine Science, 1020 Balch Blvd., Stennis Space Center, MS 39529

Gary Kirkpatrick,
Mote Marine Laboratory, Sarasota FL 34236

Oscar Schofield,
Rutgers University Dept. of Marine and Coastal Studies, New Brunswick, NJ 08901

Optical techniques can provide a more efficient means of detecting and monitoring harmful algae blooms (HABs) compared to standard techniques employing microscopic analyses of water samples. However, understanding how a particular algal species contributes to the absorption and scatter of light is necessary. The optical properties of Karenia brevis, the red tide organism in the eastern Gulf of Mexico and other coastal areas, were studied in a laboratory. Results from the laboratory experiment include an estimate of the index of refraction for K. brevis, a validation of Mie Theory in modelling backscatter by K. brevis, and hyperspectral (5-nm bandwidth) models of backscattering and backscattering/absorption ratios of K. brevis. Backscattering data were measured during an October 2001 HAB event offshore of Tampa, Florida, as part of the Florida ECOHAB Program. Using parameters measured from the bloom and index of refraction from the laboratory experiment as inputs to the Mie Model, backscattering by K. brevis in the bloom was modelled. A comparison between measured and modelled backscatter was conducted to determine the extent to which K. brevis contributes to in situ backscatter. It was found that during its migratory cycle, K. brevis dominated backscattering when the population was concentrated in the surface waters.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

HARMFUL ALGAE BLOOMS AT MEXICAN PACIFIC COAST DURING WINTER SPRING 2000

Morales-Blake, A.(1)(2), Estrada, M.(1), and Blasco, D.(1)

(1) Institut de Ciències del Mar, CMIMA, CSIC Barcelona, Catalunya, Spain.
(2) Universidad de Colima Facultad de Ciencias Marinas Manzanillo, Colima, México.

After the 1997-1998 El Niño, the occurrence of harmful algal blooms along the Mexican Pacific coast increased notably. Reports from Mazatlan, Puerto Vallarta and Manzanillo Bays indicated the occurrence of massive algal outbreaks during two months of 2000 but did not give details of their extension. The aim of this study was to identify the responsible species and to use remote sensing ocean color imagery (SeaWiFS) to map the spatial distribution of algal blooms occurring in the Pacific coast of México during winter-spring 2000. Surface water samples and CTD in situ data were collected from the Manzanillo Bays every week from January to June 2000. To determine the outbreak's extension, the chlorophyll concentration was estimated from L1A LAC data, processed to L2 with SeaDAS software. During the study period, several dominant organisms, some of them harmful, were identified, including five phytoplanktonic species, namely Ceratium furca, Cochlodinium polikrikoides, Dictyocha fibula, Thalassiothrix sp. and Scrippsiella trochoidea, and one ciliate, Mesodinium rubrum. The most recurrent and abundant species were C. polikrikoides, an ichtyotoxic dinoflagellate forming dense, reddish brown blooms, which appeared mainly in the surface layers of the water column and occupied large extensions. Maps of chlorophyll distribution obtained from SeaWIFS imagery showed high concentrations during March-April, along the coastal areas from Sinaloa to Colima States, confirming the exceptional HAB outbreaks detected in the area.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

PRESENT STATUS AND FUTURE PLAN FOR HABS STUDIES IN VIETNAM

Doan Nhu Hai and Nguyen Ngoc Lam

Institute of Oceanography, Nha Trang, Viet Nam

Studies of HABs in Vietnam during last decade were gained significant results with both national and international activities. The most success project is the HABViet project phase I with the continuation on phase II (2002-1004). The successful of this project would be listed as: building up a HAB network in Vietnam; a guide book for HAB species; data on HAB species/plankton in coast of Vietnam; and most of all give strong supports on research capacities. Other projects were small scaled and regional. The two current monitoring programs that included HABs are not by mean of a successful HABs management, one is only for the exported culture area, and other is aimed mainly for pollution with low sampling frequency. With the results of last decade, mistakes accounts and demand of the country, a stronger and more effective monitoring program should be established at national scale. A better co-operation between some ministries/institutions in Vietnam as well as countries/institutions in Southeast Asia is also given as it was not by mean of great success during the past.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

TOWARDS THE DEVELOPMENT OF SPECIFIC BIO-OPTICAL ALGORITHMS FOR INTERPRETATION OF OCEAN COLOUR IMAGES OF THE ESTUARY AND GULF OF ST. LAWRENCE (EASTERN CANADA)

Nieke, Barbara;
Institut Maurice-Lamontagne, CP 1000, Mont-Joli, Quebec, G5H 3Z4 Canada

Larouche, Pierre;
Institut Maurice-Lamontagne, CP 1000, Mont-Joli, Quebec, G5H 3Z4 Canada

Roy, Suzanne;
ISMER, 310 Allee des Ursulines, Rimouski, Quebec, G5L 1L3, Canada

Therriault, Jean-Claude;
Institut Maurice-Lamontagne, CP 1000, Mont-Joli, Quebec, G5H 3Z4 Canada

The St. Lawrence ecosystem is a large and complex environment with high variability in primary productivity. This area is also subject to episodic (usually annual) blooms of toxic phytoplankton, Alexandrium and Pseudo-nitzschia , although the optical properties of these blooms have not been described. Major factors causing fluctuations in primary productivity and bloom dynamics are variations in physical variables like currents, vertical stratification and light penetration, due to freshwater runoff, winds, tides and bathymetry. The Estuary and Gulf of St. Lawrence may be divided into sub-regions by bio-optical parameters, and these sub-regions have been classified as Case 1 and/or Case 2 waters. Major problems in the interpretation of ocean colour images in coastal waters are the contributions of CDOM and POM to the bio-optical signature. From the fluorescing components of CDOM, we determined the spatial and temporal variability of the mixing processes of freshwater run-off and marine waters. For example, the results showed that the Magdalen Shallows, usually geographically considered as a “Gulf-region”, should be optically classified as Case 2 waters throughout the year because CDOM in this region is strongly influenced by freshwater run off. The general approach in the five-year ground-truthing program for the St. Lawrence ecosystem has been to build a spatio-temporal data bank for the development of bio-optical algorithms for estimating primary production. We intend to supplement this study with data derived from real-time observational systems, specifically related to the determination of HAB dynamics.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

PROGRESS IN LINKING PHYSICAL OCEANOGRAPHY, PHYTOPLANKTON DISTRIBUTIONS AND TOXIN CHEMISTRY IN M. EDULIS IN COASTAL EMBAYMENTS WEST OF IRELAND.

Glenn Nolan1 Robin Raine2, Joe Silke1, Caroline Cusack1 and Philipp Hess1

1. Irish Marine Institute, Galway, Ireland
2. Martin Ryan Institute, NUI, Galway, Ireland

Fieldwork on the RV Celtic Voyager from 2000 to 2002 has linked the spatial and temporal distribution of harmful algal species to variability in physical oceanographic features on the western Irish shelf and in key coastal embayments in the region. Towed-undulating and standard CTD measurements and bottle samples have been combined with in-situ current profiler, thermistor and satellite-tracked drifter measurements at several sites to reveal the role of bottom density gradients in driving flows that transport harmful algal species, particularly Dinophysis spp. along the shelf and into aquaculturally sensitive bays causing closures of aquaculture sites due to DSP toxin contamination. The physical data is complemented by weekly phytoplankton sampling at key sentinel sites around the Irish coast and use is made of LC-MS chemistry data showing the changes in toxin profile as the season progresses in 2001. In the case of Killary Harbour, a fjord on Ireland's west coast, the 2002 cruise data reveals the presence of thin phytoplankton layers < 1 metre in thickness that may heretofore have been undetected by conventional sampling methods. The progress made in linking these processes will be further developed in a targeted research programme known as Biological Oceanography of Harmful Algal Blooms (BOHAB) that begins in January 2003.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

PARTITION OF TOTAL ABSORPTION COEFFICIENT INTO ITS PHYTOPLANKTONIC AND COLORED DETRITAL MATERIAL COMPONENTS

K. Oubelkheir,
CSIRO Land and Water, GPO Box 1666, Canberra, ACT 2601, Australia

A. Bricaud,
LOV, Quai de la Darse, 06238, Villefranche-sur-Mer, France

Phytoplankton absorption properties have been thoroughly studied last decades mainly based on laboratory spectrophotometer measurements on discrete samples. The recent development of in situ spectral absorption-attenuation meters has opened new areas for phytoplankton absorption properties investigations in in situ conditions and with a high spatial and temporal resolution. However, in both cases (laboratory or in situ determinations), phytoplankton absorption spectra cannot be measured directly, so that experimental or numerical decomposition methods are required. In the present study, a numerical decomposition method is used to deconvoluate in situ measurements of total absorption spectra into its phytoplanktonic and colored detrital material components. This method is first validated on a large dataset of simultaneous phytoplankton, dissolved and non-algal particles spectral absorption measurements performed using a laboratory spectrophotometer (more than 400 samples including coastal and open ocean conditions; Coastlooc database). Finally, the validity of this method is illustrated in the case of in situ profiler (WETLabs ac9) measurements performed in contrasted open ocean conditions, including eutrophic Moroccan upwelling and oligotrophic Mediterranean waters (Prosope survey).

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

A JOINT DUTCH-UK COASTAL MONITORING PROGRAMME. 3-YEARS EXPERIENCE AND FUTURE STRATEGIES.

Rutgers van der Loeff, M.M., Suylen, J.M., Heins, C., Roberti, J.R., Laane, R.W.P.M.
National Institute for Coastal and Marine Management RIKZ PO Box 20907, 2500 EX The Hague, the Netherlands

Mills, D.K., Rees, J.M.
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Pakefield Rd, Lowestoft, Suffolk NR33 0HT, UK

In parallel to the development of a network of SmartBuoys in UK coastal waters (companion poster, D.K. Mills) a series of buoys and bottom frames has been deployed in Dutch coastal waters in the years 1999-2002 to monitor parameters related to material transport (suspended load, currents and waves) and to plankton development (nutrients, light conditions, chlorophyll-a). After a pilot study in the Marsdiep tidal inlet, a buoy system was deployed for 18 months at a distance of 10 km off the Dutch coast near Noordwijk, followed by deployments totalling 6 months in more turbid waters at 2 and 5 km offshore. The actual data on light penetration and nutrients provide a field validation for a good representation of nutrient and light limitation in plankton growth models and lend more credibility to the predictions based on such models. The high-frequency data allow a much more detailed description of processes controlling sediment resuspension, turbidity and light conditions than had been possible with traditional ship based monitoring. It is our aim to develop new monitoring strategies for coastal and shelf seas based on the technology set out here in an internationally coordinated programme. Real-time data collected by buoy sensors and remote sensing should be integrated into ecosystem models. A combined observation-modelling operational system could thus be developed with predictive capability.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

AUTOMATIC MEASUREMENTS OF BIOLOGICAL AND CHEMICAL PARAMETERS FROM FERRY BOATS

Friedhelm Schroeder, Wilhelm Petersen, Michail Petschatnikov, Franciscus Colijn

GKSS Research Centre, Coastal Research Institute

The contribution deals with the development and operation of a new operational tool which uses ferry boats as a carrier system for automated monitoring equipment. Such systems can be operated with much less costs than automatic buoys and have better performance with regard to bio-fouling.
Whereas most existing ferry systems mainly measure oceanographic parameters and have to take samples for nutrient analysis, our "FerryBox " consists of a fully automated flow-through system with different sensors and automatic analysers for nutrients and algae. It provides the possibility of automatic cleaning cycles and positions-controlled sampling (GPS). Data can be transferred to shore and the system can be remotely operated by GSM (mobile phone) if the ferry is near the shore.
The FerryBox automatically measures the following parameters: temperature, salinity, turbidity, oxygen, pH, chlorophyll fluorescence, ammonium, nitrate/nitrite, phosphate, silicate and main algal classes (by specific fluorescence). Data acquisition, -storage and telemetry is coordinated by an industrial PC. Bio-fouling is prevented by automated pressure cleaning procedures.
The system has been installed on the ferry Hamburg-Harwich (U.K.) and is under test since November 2001. Results from recent measurements will be presented and discussed in the context of North Sea eutrophication problems.
Future developments will combine ferry data with remote sensing measurements (ENVISAT) and apply these data to numerical models. Within the new EU project "FerryBox" institutions from eight countries will compare their different systems and demonstrate the application of FerryBoxes for water quality assessment.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

MODELLING ALLELOPATHY EFFECT IN PHYTOPLANKTON

J. Solé, M. Estrada, E. García-Ladona.

CENTRE MEDITERRANI D'INVESTIGACIONS MARINES I AMBIENTALS
Passeig Marítim de la Barceloneta, 37-49. 08003 Barcelona, Spain
Tel: +34 932 309 500, Fax: +34 932 309 555
e-mails: jsole@cmima.csic.es,emilio@cmima.csic.es,marta@cmima.csic.es

This work examines the implications of allelopathy and other biological interactions for the development of harmful algal blooms, in the context of a simple spatially homogeneus model. We consider in a general form the contribution of three mechanisms: a) Allelopathy between two algal species, affecting the noxious alga, b) Effect of algal deterrents or toxins on the predators (in this case the zooplankton). and c) Infection (by e. g. virus or parasites) of the noxious alga. The model implementation is based on a NPZ formulation including two species of phytoplankton, toxic and non-toxic, a zooplankton (micro-or mesozooplankton) predator. The virus or parasite infection of phytoplankton is introduced through a so-called 'frequency dependent' infection model. A study of the system response to different scenarios was carried out using selected combinations of the model parameters. Some elements of discussion are: Within a plausible parameter range, allelopathy has a relatively small effect on the behaviour of the system. The introduction of a predator with a feeding 'preference' for one of the algal species has a strong effect on the population dynamics of the phytoplankton. The effects of infection become important only when the density of the affected alga is already high.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

A COMPACT SYSTEM FOR REAL-TIME, UNDERWAY WATER QUALITY MONITORING AND ALGAL BLOOM DETECTION FROM SMALL HIGH SPEED VESSELS.

Andrew Stephens

Environment Protection Authority, Centre for Environmental Sciences, Ernest Jones Drive, Macleod, Victoria, 3085. Australia.

A system is presented for the real-time, underway detection of algal blooms and for mapping the patterns of surface water quality parameters over large open water areas. This system provides spatially intensive data that has lead to better detection and understanding of the dynamics of significant environmental events such as harmful algal blooms in a large southern Australian coastal estuarine system.

The system comprises a laptop computer, GPS receiver, "bbe FluoroProbe" multi-wavelength submersible fluorometer and a "Yeo-Kal" water quality meter (measuring salinity, pH, temperature, turbidity and dissolved oxygen). Flow-through cells housing the fluorometer and water quality probe are fed by the motion of the boat through a transom mounted water pick up. The computer screen displays an "Excel" spreadsheet showing all relevant parameters in real-time, a track plot with a satellite image as a backdrop and "BBE FluoroProbe" software displaying a progressive plot of blue/green, green and dinoflagellate/diatom algal groups. The data is updated every four seconds and the system is operated at speed in excess of thirty knots. The flexibility of the system also allows for vertical profiles when stationary.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

EVALUATION OF THE ENSEMBLE KALMAN FILTER IN ECOSYSTEM STATE FORCASTING

R. Torres1 and J. I. Allen1

1Plymouth Marine Laboratory, The Hoe, Plymouth, PL13DH, UK

A complex Hydrodynamic-Ecosystem coupled 1-D model has been used to evaluate the usability of a sequential data assimilation method, the Ensemble Kalman Filter, in the modelling and prediction of Algal Blooms. The ERSEM-GOTM 1-D model is capable of reproducing the seasonal phytoplankton succession as well as Harmful Algal Bloom events. The complexity of the model allows us to investigate the triggering factors of the blooms and the community structure leading to HAB events. Data assimilation of model generated data show that the Ensemble Kalman Filter is able to constrain the model evolution, particularly during bloom events when the nonlinearity is strongest. We show that different variables are better at constraining the model evolution at different times of the year and explore the minimum sampling frequency and temporal distribution of measurements required for reliable prediction of algal blooms.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

PHYTOPLANKTON FUNCTIONAL GROUPS IN ANTHROPOGENIC IMPACTED WATERS. THE CATALAN COAST (NW MEDITERRANEAN SEA) A CASE STUDY.

Magda Vila and Mercedes Masó

Institut de Ciències del Mar (CSIC), Passeig Marítim de la Barceloneta, 37-49 08003 Barcelona, Catalonia, SPAIN

Research and control of harmful algae blooms (HABs) often focuses on just a few species of interest. This narrow focus reduces our understanding of the factors responsible for blooms of particular species occur. Here we present results of the multivariate analysis of phytoplankton assemblages in relation to HABs during the annual cycle in confined waters in the northwestern Mediterranean Basin. The aim of the present study was the identification of phytoplankton functional groups that are HAB-occurrence risk indicators. The functional groups of phytoplankton distinguished from the multivariate analysis are bloom-forming dinoflagellates (within which there are toxic dinoflagellates), oceanic dinoflagellates, bloom forming nanoflagellates, summer-autumn diatoms and winter-spring diatoms. Results show phytoplankton assemblages in confined waters follow the characteristic seasonal cycle of the phytoplankton community for the area. We show that most functional groups occur at all sampling stations and along the entire coastline. A clear relationship, however, is apparent between the degree of water confinement, augmented by human alteration of the coastline and both the bloom magnitude and the probability of bloom occurrences.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

AUTOMATED REMOTE HAB PROFILING IN THE GIPPSLAND LAKES USING AN ONLINE WATER QUALITY PROBE

Waters MT,
Natural Resources Engineering, RMIT University, Melbourne Australia

Fratric I,
Environmental Engineering, RMIT University, Melbourne Australia

Online sensors for Harmful Algal Bloom (HAB) detection have advanced significantly recently, making a genuine advance in water quality assessment for estuaries, lakes and reservoirs. One difficulty in interpreting data from these sensors is that readings can only be made at a finite number of depths (usually one), if fixed depth or floating deployments of probes are made. Given that stratification of temperature and salinity can severely affect the distribution of algal organisms within the water column, there is a desire to profile over the depth from surface to sediment, thereby allowing the depth distribution of organisms to be measured during long-term deployments. This is especially an issue in the Gippsland Lakes, a large shallow estuarine lake system in Australia that suffers frequent HAB events. HAB events in Gippsland Lakes are known to be triggered by a complex series of processes that arise when fresh inflows transport nutrients from the upstream catchments into the lakes.

In this study, we developed a profiling system comprising a YSI6600, measuring Chlorophyll A, turbidity, DO, temperature, salinity and depth, a winch and a timer to take profiles over the depth of the water column on an hourly basis.

Issues encountered included the need to isolate the system from its surrounds electrically and physically to prevent debris or wildlife entanglements, timing instrument movements with instrument readings and power requirements; however, good profiles were obtained and the system represents a significant advance on fixed depth instruments.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

DEVELOPMENT OF A MONITORING SYSTEM FOR THE NORWEGIAN COASTAL ZONE ENVIRONMENT

Nina Winther

Nansen Environmental and Remote Sensing Center, Bergen, Norway

As a first step in building up a monitoring system for the Norwegian Coastal Zone Environment, a hind cast modelling system for this area is described. The model system is a regional high-resolution system of the Hybrid Coordinate Ocean Model (HYCOM) for the North Sea, Skagerak and Kategat, coupled with a biochemical model. The regional model receives realistic boundary conditions from larger scale models and is currently being operated in a 1.5year hind cast simulation. HYCOM has never been tested on a coastal area before, and the problems with doing this and results from the validation of the model system will her be presented.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

CONTINUOUS FIELD MONITORING OF ALGAL DYNAMICS AT KAT O AND LUK CHAU WAN, HONG KONG

Ken T.M. Wong1, Joseph H.W. Lee1, Ironside H.Y. Lam2, John I. Hodgkiss2

1Department of Civil Engineering, The University of Hong Kong, Hong Kong, China
2Department of Ecology and Biodiversity, The University of Hong Kong, Hong Kong, China

To study the dynamics of algal blooms and red tides, a continuous monitoring red tide warning system has been developed at two red tide black spots in Hong Kong (Kat O Island in Mirs Bay and Luk Chau Wan in Lamma Island of the southern waters). The system monitors continuously the wind, solar-radiation, tidal current condition as well as the vertical structure of dissolved oxygen, chlorophyll, photosynthetic available radiation and CTD (conductivity, temperature, depth). In addition, regular water samples are collected and the nutrient concentration and species composition are analysed. Since the establishment of the system in January 2000, 15 red tides had been monitored in these two field-monitoring stations. Based on the field data, it is found that the calmer and clearer water body in Kat O is favoring blooms of dinoflagellates, while the more turbulent and eutrophic water body in Luk Chau Wan is favouring blooms of diatoms. The characteristics of these two types of phytoplankton blooms in these two waters will be discussed in relation to historical data and local hydrography. The knowledge gained from these blooms forms a basis for a data-driven predictive modelling system.

HABWATCH

Workshop on
Real Time coastal observing systems for ecosystems dynamics and harmfull algal blooms

June 11-21, 2003 – Villefranche-sur-Mer, France

Poster Session

ASSESSMENT OF NOVEL TECHNIQUES FOR THE MEASUREMENT OF PHOTOSYNTHESIS AND PRODUCTIVITY OVER A SEASONAL CYCLE IN THE WESTERN ENGLISH CHANNEL.

Katharine Woods1,2, Ian Joint1, Steve Groom1 and Patrick Holligan2

1) Plymouth Marine Laboratory, Prospect Place, Plymouth, PL1 3DH, UK
2) University of Southamption SOES,Southampton Oceanography Centre, European Way Southampton,SO14 3ZH, UK.

Studies of temporal variability in phytoplankton photosynthesis are valuable for their ability to show how physical and chemical forcing affect phytoplankton dynamics. The potential to make rapid estimates of phytoplankton productivity has been enhanced by the development of novel techniques based on optical measurements. This research involved the monitoring of phytoplankton photosynthetic capacity and primary production over a one-year time series by different techniques: Fast Repetition Rate Fluorometry (FRRF); Remote sensing and the traditional 14C tracer technique. The aim was to understand and quantify the range of production estimates within and between the techniques and particularly to see how estimates from the novel approaches compared with the traditional chemical tracer measurements. Data were collected over 12 months at a coastal site in the Western English Channel. Weekly measurements of photosynthetic parameters were derived from 14C incubations and from the FRRF and simple models used to calculate daily primary productivity from these values. Remotely sensed chlorophyll data were extracted from SeaWiFS satellite images and algorithms used to estimate primary production. The results are presented in terms of the constraints that can be expected from the different techniques under a variety of physical and chemical conditions.