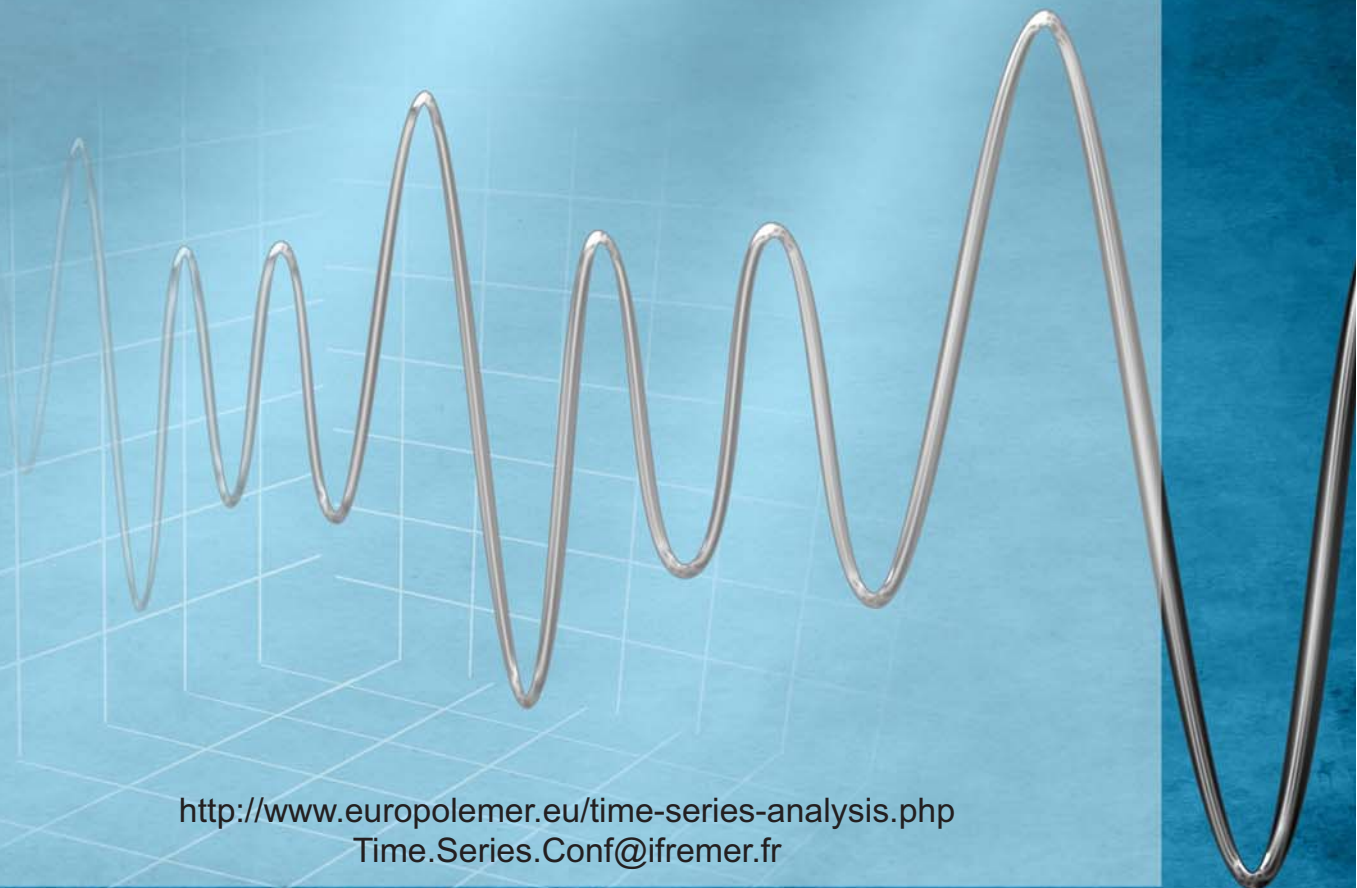# Time-series analysis in marine science and applications for industry

Centre Nautique de Moulin Mer, Brittany, France.

A Europole Mer Gordon-like conference
at the crossroad of marine science.

Share your experience of time-series analysis in the fields of
oceanography, biochemistry, biology, ecology, bio-acoustics,
geosciences, seismology, offshore engineering, ...

Training 17-18 Sep 2012
Conference 19-21 Sep 2012

http://www.europolemer.eu/time-series-analysis.php
Time.Series.Conf@ifremer.fr

Infographie : Alexandre PERETJATKO

Content

Contact references

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Time.Series.Conf@ifremer.fr

On Site contact references

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(and parking place is here:
48.31855 -4.284685
48°19'6.78"N 4°17'4.866"W)

Version: Wednesday, September 12, 2012:

Purpose of the conference

Time-series analysis is the future for marine science to understand ocean processes and their dynamics. It not only helps identify the phenomenon represented by sequences of observations, but also helps forecast events by feeding models. For instance, areas of accelerated climate change like the Arctic or of high potential natural hazards like Istanbul are of high interest.

The purpose of this conference is to integrate the scientific community and research activities across fields in marine science (physical oceanography, marine chemistry, marine biology, ecology and geology) to share the rapidly developing knowledge and to enhance cross discipline interactions and collaborations.

This conference will be the first of a series of conferences dealing with marine science time-series. It will focus on analysis and interpretation of time-series acquired from fixed platforms, repeat sections and modelling, on time scales ranging from months to decades in sub-sea environments.

Starting by a 2-day training course and followed by a 3-day scientific conference, **this event promotes transfer of knowledge between researchers from several fields**. Both training courses and conference presentations are mainly based on application examples and case studies from field experiments.

The conference is based on the "Gordon conference format", with all activities taking place on the conference site, including meals and accommodation, thus allowing ample time for informal discussions and brain-storming opportunities.

Scientific themes of the conference
1) "Low" to "High" frequency signals in oceanography
2) Geosciences and seismic monitoring: HF and BF signal
3) Passive and active acoustical ecology
4) Marine ecology from coastal to deep-sea ecosystems
5) Applications for industry

Organising Committee
I. Puillat (Ifremer)
M. Prevosto (Ifremer)
B. Ferré (University of Tromsø)
P. Morin (CNRS/INSU Roscoff)
S. Thomas (Europôle Mer)
N. Réniers (Europôle Mer)

Scientific committee
H. Mercier (CNRS/LPO) and B. Cornuelle (SCRIPPS)
P. Morin (CNRS/INSU Roscoff) and E. Frajka-Williams (NOCS)
J. Mienert (University of Tromsø) and L. Geli (Ifremer)
C. Gervaise (GIPSA)
J. Sarrazin (Ifremer) and M. Matabos (Neptune Canada, University of Victoria)
M. Prevosto (Ifremer) and I. Rychlik (Chamers University)

Program

1. Training part: 17-18 September 2012

1A. Sunday 16 Sep: welcome of participants:

17:10	Conference shuttle departs from train station
17:40	Conference shuttle departs from Airport
19:00	Conference shuttle departs from train station (mini bus)
19:30	Conference shuttle departs from Airport (mini bus)
18:30-20:00	Welcome of participants
20:00	Dinner

1B. Training sessions at a glance: Monday 17 & Tuesday 18 Sep

Time	Monday 17 Sep		Tuesday 18 Sep	
8:30-10:30	**Plenary Course** 1: Introductory course on Time-series analysis and applications J.M Boucher and R. Fablet (Telecom Bretagne)		**AC3 group 1** Spectrogram analysis applied to marine mammal detection C. Gervaise & L. di Iorio (GIPSA and ENSTA Bretagne)	**AC4 group 2** Extreme Value theory in environmental sciences. Ph. Naveau (CNRS\LSCE)
10:45-12:45	**Plenary Course 2**: time-series in Marine biology P. Legendre (Univ. de Montréal)			
12:45-13:45	Lunch			
14:00-16:00	**AC1 group 1** Sound signal analysis C. Gervaise & L. di Oro (GIPSA and ENSTA Bretagne)	**AC2 group 2** Case study on time series analysis in Marine Biolgy P. Legendre (Univ. de Montréal)	**AC4 group 1** Extreme Value theory in environmental sciences. Ph. Naveau (CNRS\LSCE)	**AC3 group 2** Spectrogram analysis applied to marine mammal detection C. Gervaise & L. di Iorio (GIPSA and ENSTA Bretagne)
16:30-18:30	**AC2 group 1** Case study on time series analysis in Marine Biolgy P. Legendre (Univ. de Montréal)	**AC1 group 2** Sound signal analysis C. Gervaise & L. di Iorio (GIPSA and ENSTA Bretagne)		
19:00-20:30	Pancakes Dinner!		19:00-20:30 Dinner and welcome of new participants	

AC: applied course

1C. Training sessions description

For the training part, attendees are kindly asked to bring a laptop with R software installed.
This software is free and available on Internet : http://www.r-project.org/

Poster sessions: Posters will be made available from the first day until the last day. Poster discussions are expected to take place during coffee breaks and between lunch time and afternoon session (30 minutes), everyday.

Plenary Course 1
J.M Boucher and R. Fablet (Telecom Bretagne)
CNRS UMR 6285 LabSTICC
Brest, France
ronan.fablet@telecom-bretagne.eu
jm.boucher@enst-bretagne.fr

Course Title: " INTRODUCTORY COURSE ON TIME-SERIES ANALYSIS AND APPLICATIONS"

This lecture will provide an overview of the conventional methods used in the analysis of time series analysis. Beginning with a reminder of the key concepts regarding stochastic processes, it will then discuss the processing of stationary and non-stationary data and will outline the main properties, advantages and drawbacks of each method.

The program will focus on:
  - Classic spectral analysis by periodogram, tradeoff between time and frequency resolution
  - Parametric models for time series (AR, MA and ARMA models) and relationship to spectral analysis
  - Empirical orthogonal functions (Principal component analysis)
  - Short Time Fourier transform
  - Time-Scale analysis (wavelet transform)
  -Wigner-Ville transform
  - Hidden Marrkov models

Plenary Course 2 + Applied Course AC2
P. Legendre (Université de Montréal, Canada)
Département de sciences biologiques,
Université de Montréal, Canada
Pierre.Legendre@umontreal.ca

Course Title: "TEMPORAL EIGENFUNCTION METHODS FOR MULTISCALE ANALYSIS OF COMMUNITY COMPOSITION AND OTHER MULTIVARIATE DATA"

The course will focus on temporal eigenfunction analysis, a new family of methods for multiscale analysis (i.e. analysis that addresses several scales of variation) of univariate or multivariate response data. For ecological communities, the analysis can be univariate and focus on synthetic descriptors such as species richness, or multivariate and analyse the entire community composition data table. The course will present distance-based Moran's eigenvector maps (dbMEM, formerly called PCNM), generalized Moran's eigenvector maps (MEM), and asymmetric eigenvector maps (AEM) developed to model directional process. Examples will show how this form of analysis can

be combined with classical regression-type analysis (for univariate data) or canonical analysis (for multivariate data), in the framework of variation partitioning, to bring out the multiscale structure of the response data. R functions implementing the methods described in the course will be used by the participants in a practical session.

Applied Courses AC1 and AC3
C. Gervaise and L. Di Iorio (GIPSA, Grenoble and ENSTA Bretagne, France)
Department 'Signal and Image Processing'
GIPSA LAB
Saint Martin d'Heres, France
cedric.gervaise@gipsa-lab.grenoble-inp.fr, diiorio.lu@gmail.com

Two courses on signal processing applied to passive acoustic monitoring for the study and observation of coastal ecosystems will introduce basic concepts of acoustic signal processing and data analysis applied to real data and specific scientific questions. The two courses will rely upon 6 months of real data collected in 2011 in the Parc Naturel Marin d'Iroise, France.

Course AC1 (4h): spectral analysis, soundscape description, application to the observation of benthic, climatic and anthropogenic contributions in coastal ecosystems.
Content :
1) Introduction to the role of coastal ecosystems and their monitoring.
2) What is ambient noise and how can it contribute to study coastal ecosystems?
3) Which sound features do best describe a coastal habitat: Received level, Background noise Level, Power spectral density?
4) How to evaluate these features with Fourier transform
5) Practical application: Analysis of short-term (20s), mid-term (1 day) and long-term (6 months)sound measurements from data recoded within the Parc Naturel Marin d'Iroise, France.

Course AC3 (2h): detection, spectrogram analysis applied to marine mammal detection.
Content :
1) Introduction to sound production of cetaceans
2) Time-frequency representations
3) Introduction to detection theory
4) Whistle detection in a spectrogram (short-time Fourier transform)
Practical application: Analysis of short (20s) sound snapshots containing whistles and clicks from bottlenose dolphins, analysis of long-term (1 month) measurements to study the spatial and - temporal distribution of a resident bottlenose dolphin population (Iroise sea, Parc Naturel Marin d'Iroise).

Applied Course AC4
Ph. Naveau (LSCE, Saclay, France): AC2 course
Laboratoire des Sciences du Climat et l'Environnement (LSCE) CNRS
naveau@lsce.ipsl.fr

Course Title: "EXTREME VALUE THEORY IN ENVIRONMENTAL SCIENCES"
Extreme value theory is playing an increasingly important role in many areas of meteorology, hydrology, engineering and finance. This class on extreme value theory will develop the basic theoretical framework of extreme value models and the statistical inference techniques for using these models in practice. There will be an emphasis on practical applications (study of extreme winds on buildings, floods in hydrology, extreme weather and climate events). From a more

theoretical point, the treatment of extreme value methodology for time series, spatial processes, and some of standard models which occur in applications could be studied.

Depending on student backgrounds and interests, either a more exhaustive treatment of the probability theory of extremes or a more extensive presentation of applications and/or related fields will be emphasized.

2. Conference part: 19-21 September 2012

2A. Welcome of new participants Tuesday 18 evening

Poster sessions: Posters will be made available from the first day until the last day. Poster discussions are expected to take place during coffee breaks and between lunch time and afternoon session (30 minutes), everyday.

18:15	Welcome of participants
19:00	Dinner

2B.Wednesday 19 Sep: "Low" to "high" frequency signals in Oceanography"

Morning session chaired by:
> Dr. H. Mercier, CNRS/LPO, Brest, France
> Dr. B. Cornuelle, SCRIPPS, USA

This session will deal with physical and biogeochemical oceanography from observed data and numerical models outputs: modes of variability (EOF, CCA, SSA, MSSA) and statistical methods for detecting climate change

8:15-8:30	Dr. A. Dosdat, Europole mer Director and Ifremer Brest Centre Director "WELCOME WORDS AND INTRODUCTION"
8:30-8:45	Dr. I. Puillat, Ifremer, "PRESENTATION OF THE CONFERENCE: AGENDA AND ORGANISATION"
8:45-9:35	Dr. Bruce Cornuelle, SCRIPPS (USA), "THE CALIFORNIA CURRENT IN THE CLIMATE SYSTEM: ANALYSIS OF OBSERVATIONS".
9:35-10:15	Dr. Bénédicte Ferré, University of Tromsø (Norway) "TEMPERATURE, SALINITY AND CURRENT TIME SERIES FROM THE AOEM EXPERIMENT OFFSHORE SVALBARD"
10:15-10:45	Coffee Break
10:45-11:25	Dr. Gregory Beaugrand, LOG, Wimereux (France), " HOW TO DETECT AND ANTICIPATE CHANGES IN SPECIES AND ECOSYSTEMS IN THE CONTEXT OF GLOBAL CHANGE? "
11:25-12:05	Dr. Torbjørn Lorentzen, University of Bergen (Norway) "HYDROGRAPHICAL TIME SERIES FROM STATION M – NORWEGIAN SEA "

Lunch and after: special edition!

12:15-15:30	Pic nic and outdoor activities (trekking, kayak etc...)

<u>**Afternoon and evening session**</u> chaired by:

Dr. P. Morin, CNRS/UPMC, Station Biologique de Roscoff, France

Dr. Eleanor Frajka-Williams, NOCS, UK

This session will deal with seasonal signal, inertial and sub-inertial processes, tidal processes, analysis of regional time-series, etc, including spectral analysis and cross analysis, wavelets and other statistical approaches.

15:30-16:10	Dr. Nathalie Daniault, Bretagne University/UBO (France) *"ANALYSIS OF CURRENT AND TRANSPORT DATA FROM EULERIAN MOORINGS ON CONTINENTAL MARGIN"*
16:10-16:50	Dr. Eleanor Frajka-Williams, NOCS (UK) *"CHARACTERISTICS OF TRANSPORT ESTIMATES IN THE SUBTROPICAL NORTH ATLANTIC FROM THE RAPID ARRAY: GYRES, EDDIES AND THE MOC"*
16:50-17:10	Coffee break
17:10-17:50	Dr. Craig Jones, Marine Science and Engineering Institute, Santa Cruz, CA (USA) *"A DEEPER LOOK AT ESTUARINE PROCESSES - WAVELETS AND CIRCULATION "*
17:50-18:30	Pr. François Schmitt: CNRS/LOG, Wimereux (France) *"MULTISCALE TIME SERIES ANALYSIS: SCALING AND EXTREMES, STRUCTURE FUNCTIONS AND EMPIRICAL MODE DECOMPOSITION"*
18:30-19:15	**First round table and discussions**
19:00-19:30	Dinner

2C.Thursday 20 Sep: "Geosciences and Seismic Monitoring" and "Applications for industry"

Morning session: " Geosciences and Seismic Monitoring", chaired by:
> Pr. J. Mienert, University of Tromsoe, Norway
> Pr. L. Geli, Ifremer, France

This session will deal with coral reef response to ocean temperature and chemistry changes over human time scales and beyond, cascading water masses and sediment transport in times of climate change, seabed fluid flow release in response to seismic activity.

8:15-9:05	Dr. Thomas Feseker, University of Bremen (Germany) *"MULTI-PARAMETER TIME SERIES FROM AN UN-CABLED DEEP-SEA OBSERVATORY AT AN ACTIVE MUD VOLCANO".*
9:05-9:55	Dr. Stephen Monna, INGV (Italy) *"ANALYSIS AND INTERPRETATION OF GEOPHYSICAL TIME SERIES FROM SEAFLOOR OBSERVATORIES IN EMSO SITES"*
09:55-10:45	Coffee break
10:45-11:25	Dr. Gaye Barakci, Ifremer Brest (France) *"COMBINING COLLOCATED ACOUSTIC GAS BUBBLE RECORDERS AND OCEAN BOTTOM SEISMOMETERS TO DETECT GAS RELATED PROCESSES IN SHALLOW SEDIMENT LAYERS"*
11:25-12:15	Pr. Mathilde Cannat, IPGP, Paris (France) *"EMSO-AZORE . A NEAR-REAL TIME MULTIDISCIPLINARY OBSERVATORY OF HYDROTHERMAL PROCESSES AND ECOSYSTEMS AT THE MID-ATLANTIC RIDGE: GEOPHYSICAL MONITORING OF SUBSEAFLOOR PROCESSES"*

Lunch

12:15-13:15	Lunch

Afternoon session: "Applications for industry", chaired by:
Dr. Marc Prevosto, Ifremer Brest, France
Pr. Igor Rychlik, Chalmers University, Sweden

This session will deal with time-series analyses for ocean engineering: extremes / return values, joint extremes (wind, wave, current), fatigue, prediction / propagation statistical models (neural network, hidden Markov chains, etc).

13:45-14:25	Pr. Igor Rychlik, Chalmers University (Sweden) *"RELIABILITY APPLICATIONS OF SPATIO-TEMPORAL HS MODEL"*
14:25-15:05	Dr. Wengang Mao, Chalmers University (Sweden) *"WHIPPING / SPRINGING ON THE EXTREME PREDICTION OF SHIP RESPONSES "*
15:05-15:45	Michel Olagnon, Ifremer Brest (France) *"STATISTICAL PROCESSING OF WAVE DIRECTIONAL SPECTRAL TIME-SERIES INTO A CLIMATOLOGY OF SWELL EVENTS"*
15:45-16:15	Coffee break
16:15-16:55	Dr. Julie Bessac, Rennes University (France) *" GAUSSIAN STATE-SPACE MODEL FOR WIND FIELDS IN THE NORTH-EAST ATLANTIC"*
16:55-17:35	Dr. Kevin Ewans, Shell (Indonesia) *"EVALUATING ENVIRONMENTAL JOINT EXTREMES FOR THE OFFSHORE INDUSTRY"*
17:35-18:15	Ståle Johnsen, Statoil (Norway) *"EVALUATE THE ENVIRONMENTAL EFFECTS OF OIL PLATFORM DISCHARGES IN THE NORWEGIAN SECTOR OF THE NORTH SEA"*
18:20-19:00	**Second round table and discussions**
20:00-22:00	Dinner and Social event: Party time!

2D. Friday 21 Sep: "Marine Ecology from Coastal to deep-sea ecosystems and acoustic monitoring"

chaired by:

Dr. J. Sarrazin, Ifremer Brest, France,

Dr. M. Matabos, University of Victoria, Canada

Dr L. Di Iorio, ENSTA Bretagne, France

This session will deal with sensing of marine ecosystem thanks to passive and active acoustics, growth, behaviour, community dynamics, succession patterns, natural versus anthropogenic changes, environmental variations, resilience, and links between abiotic and biotic conditions through time.

Morning session:

8:15-9:05	Dr. Lucia. Di Iorio, ENSTA Bretagne *"FROM OCEAN SOUNDS TO COASTAL ECOSYSTEM MONITORING"*
9:05-9:55	Dr. Mike van der Schaar, UPC (Spain) *"USING DEEP-SEA OBSERVATORIES TO IDENTIFY OCEAN NOISE TRENDS"*
09:55-10:45	Coffee break
10:45-11:25	Pr. Philip C. Reid, SAHFOS, Plymouth (UK) (TBC) *"ECOLOGICAL TIMES-SERIES AND CLIMATE CHANGE"*
11:25-12:15	Dr. Eric Thiebault, Station biologique de Roscoff (France) *" LONG-TERM CHANGES IN A FINE SAND MACROBENTHIC COMMUNITY FROM THE BAY OF MORLAIX (WESTERN ENGLISH CHANNEL): THIRTY YEARS OF SAMPLING*

Lunch

12:15-13:15	Lunch

Afternoon session (continuation)

13:45-14:25	Dr. Jacques Grall, Brest University, UBO (France) *"LONG TERM CHANGES IN BENTHIC COMMUNITIES AND COASTAL SYSTEM FUNCTIONING IN RELATION TO ANTHROPOGENIC BUT ALSO TO CLIMATE FORCING."*
14:25-15:05	Dr. Henry Ruhl, National Oceanography Centre, Southampton (UK) *" ECOLOGY AND DYNAMICS IN THE DEEP-SEA (PAP SITE)"*
15:05-15:45	Dr. Marjolaine Matabos, University of Victoria (Canada) *"TEMPORAL VARIABILITY IN BENTHIC COMMUNITY DYNAMICS USING SEAFLOOR IMAGERY"*
15:45-16:15	Coffee break
16:15-16:55	Dr. Jozée Sarrazin, Ifremer (France)*" SHORT- AND LONG-TERM ECOLOGICAL VARIATIONS AT DEEP-SEA HYDROTHERMAL VENTS – A MULTIDISCIPLINARY OBSERVATORY APPROACH "*
17:00-18:20	**Final round table and closing discussions (next actions)**
19:00-21:00	BBQ

End of conference

Posters list

AGUIRRE Arturo	Growth of Peruvian scallops Argopecten purpuratus (Lamarck, 1819): importance of the availability and quality of seston.
AMORIM Fabiola	Estudo dos Processos Físicos subjacentes à dinâmica de blooms de algas tóxicas na região adjacente à costa central de Portugal.
ARUNIMA Sen	Community succession via time-series analysis in hydrothermal vent habitats of the Eastern Lau Spreading Center, Tonga
BENSI Manuel	Thermohaline variability and mesoscale dynamics observed at the E2M3A deep-site in the Southern Adriatic (Mediterranean Sea)
CANNAT Mathilde	EMSO-AZORES. A near-real time multidisciplinary observatory of hydrothermal processes and ecosystems at the mid-atlantic ridge : geophysical monitoring of subseafloor processes
CHRYSANTHI Tsimitri	The characteristics of Lake Baikal's internal wave spectrum.
CIAVATTA Stefano	Climate-driven changes in plankton trophic dynamics
CROS Estelle	Learning from the seismicity in the Marmara Sea
CUVELIER D.	A glimpse of the day to day of a hydrothermal faunal assemblage in the Atlantic
DARGACZ Aneta	Times-series analysis in addition to novel techniques of passive acoustic detection and wave buoy measurements of wave breaking process.
DE VLEESCHOUWER David	The Late-Devonian (~370 Ma) climate response to astronomical forcing
DEROT Jonathan	Analysis of high frequency monitoring biogeochemical time series in the coastal waters of the eastern english channel
DRAGON Anne-Cécile	Mertz polynya sea-ice variability over 1979-2009 and its links to the surface atmosphere
FONTAN Almudena	Air-sea interaction patterns and time scales within the southeastern Bay of Biscay
GAYATRI Dudeja	Detection of global warming using satellite records of ocean productivity
GERTMAN Isaac	Anthropogenic effects on the Dead Sea atmospheric boundary layer and water body
HAMMERSCHMIDT	Analysing long-term fluid pressure data: an example from the SmartPlug

Sebastian   borehole observatory

IRISSON Jean-Olivier   Detecting hydrologic seasons in a long term monitoring time series

JACKSON Chu   Soft-bottom communities along a low oxygen gradient in Saanich Inlet

KALYUZHNAYA Anna   Data assimilation in the flood forecasting model for Saint-Petersburg

KHARITONOVA   Numerical modeling of wind waves in the Western Crimea coastal zone, Black
Lyudmila   Sea.

KLIMCHUK Evgeniya   Sverdrup transport temporal and spatial variability in North Atlantic based on
                         NOC1.1 dataset.

KPOGO-NUWOKLO K.   Construction of a realistic wave climate from swell systems statistics
Agbéko

LEITAO Francisco   Times-series analysis for study ecological trends in Portuguese fisheries over
                        the last 60th years.

LOPEZ-CASTEJON   Time series analysis for tide-surge overlapping. A critical analysis to
Francisco   understand the water exchange of a non-tidal coastal lagoon in the SW
                        Mediterranean Sea.

MARREC Pierre   Time-series analysis of the CO2 system in the English Channel/North Atlantic
                        continental shelf using pCO2 sensors on fixed buoys and Voluntary Observing
                        Ships (VOS)

MARTINI Séverine   How to analyse bioluminescence time series from the ANTARES in situ
                        observatory ?

OGUGUAH Ngozi   Variations in Air and Sea Surface Temperature at the Commodore channel and
                        Victoria Beach, Lagos Nigeria.

PETER Franek   Analysis of Håkon Mosby Mud Volcano seismic data

PRISTA Nuno   Using SARIMA models to assess data-poor fisheries

RAZVAN Mateescu   Multi-annual Analysis of the Waves Time-series for Marine Regime
                        Characterization in the Danube Delta Area

REDA Anna   Analysis of freak wave measurements in the Baltic Sea

RENOSH P.R.   Analysis of a high frequency time series of bio-optical properties in complex
                        coastal waters: couplings with turbulence

RIGOBERTO Rosas-Luis   Environment variation related to jumbo squid Dosidicus gigas and short-finned
                        squid Illex argentinus

SOLABARRIETA   HF radar observations of surface currents in the SE Bay of Biscay
Lohitzune

STAUFFER Beth   Tidally-mediated bloom initiation in a nearshore embayment resolved from a high resolution time-series.

URANGA Jon   Automated analysis in tuna long-range sonar signals for fishing vessels.

Meeting logistics:

The conference organisers will provide transport between Brest train station ("gare SNCF" in Brest center), Brest airport (in front of airport main gate) and the conference and accommodation Centre at Logonna-Daoulas as follows:

Conference transport between Brest and conference venue at Logonna-Daoulas

Conference shuttle from Brest to Logonna-Daoulas
Sunday 16 Sep arrivals

Pick up points (Keolia bus)	Pick up time
Brest train station ("gare SNCF"). See meeting point after	17:10
Brest Airport just outside terminal at arrival level	17:40*
Destination: Logonna-Daoulas conference center	(arrival around 18h00)

* This shuttle will wait for the 16h55 flight

Pick up points (Mini bus)	Pick up time
Brest train station ("gare SNCF"). See meeting point after	19:00
Brest Airport just outside terminal at arrival level	19:30*
Destination: Logonna-Daoulas conference center	(arrival around 20h00)

* This shuttle will wait for the 19h20 flight

Keolia bus is a coach from the Keolia Company

Tuesday 18 Sep arrivals

Pick up points (Keolia bus)	Pick up time
Brest Airport just outside terminal at arrival level	17:30
Destination: Logonna-Daoulas conference center	(arrival around 18h00)

Pick up points (Mini bus)	Pick up time
Brest Airport just outside terminal at arrival level	21:30
Brest train station ("gare SNCF"). See meeting point after	21:50
Destination: Logonna-Daoulas conference center	(arrival around 18h00)

Conference transport between conference venue at Logonna-Daoulas and Brest

Conference shuttle from Logonna-Daoulas to Brest

Wednesday 19 Sep departures

07:30	Shuttle (Mini bus) departs from conference location to train station (arrival near 08:00) and then to the Airport (arrival near 08:30)

Friday 21 Sep departures

11:30	Shuttle (mini bus) departs from conference location to Airport (arrival near midday)
19:30	Shuttle (mini bus) departs from conference location to Airport (arrival near 08:00)

Saturday 22 Sep departures

5:00	Shuttle departs to Airport (arrival at 5:30)
6:50	Shuttle departs to Airport (arrival at 07:20) and train station (arrival at 08:00)
09:00	Shuttle departs to Airport (arrival at 09:30) and train station (arrival at 10:30)

Important notice: no possibility to stay on site after 9:30 am (wedding organisation)

Public transport between Brest airport and Brest train station ("gare SNCF")

The airport shuttle (Navette aéroport) runs after each flight and connects with the Tramway Line A at Porte de Guipavas. It takes about 30 minutes to Brest centre and Brest train station ("gare SNCF") via shuttle + tramway.

See more information on airport shuttle and schedule at
http://www.brest.aeroport.fr/navette-aeroport
or
http://www.brest.aeroport.fr/wpfichiers/1/1/ressources/File/NavettesEte2012120621diffusion.pdf

Participants arriving early on Sunday may choose to take the airport shuttle to Brest centre and catch the conference shuttle at Brest train station at 16h45, instead of waiting for the conference shuttle at the airport.
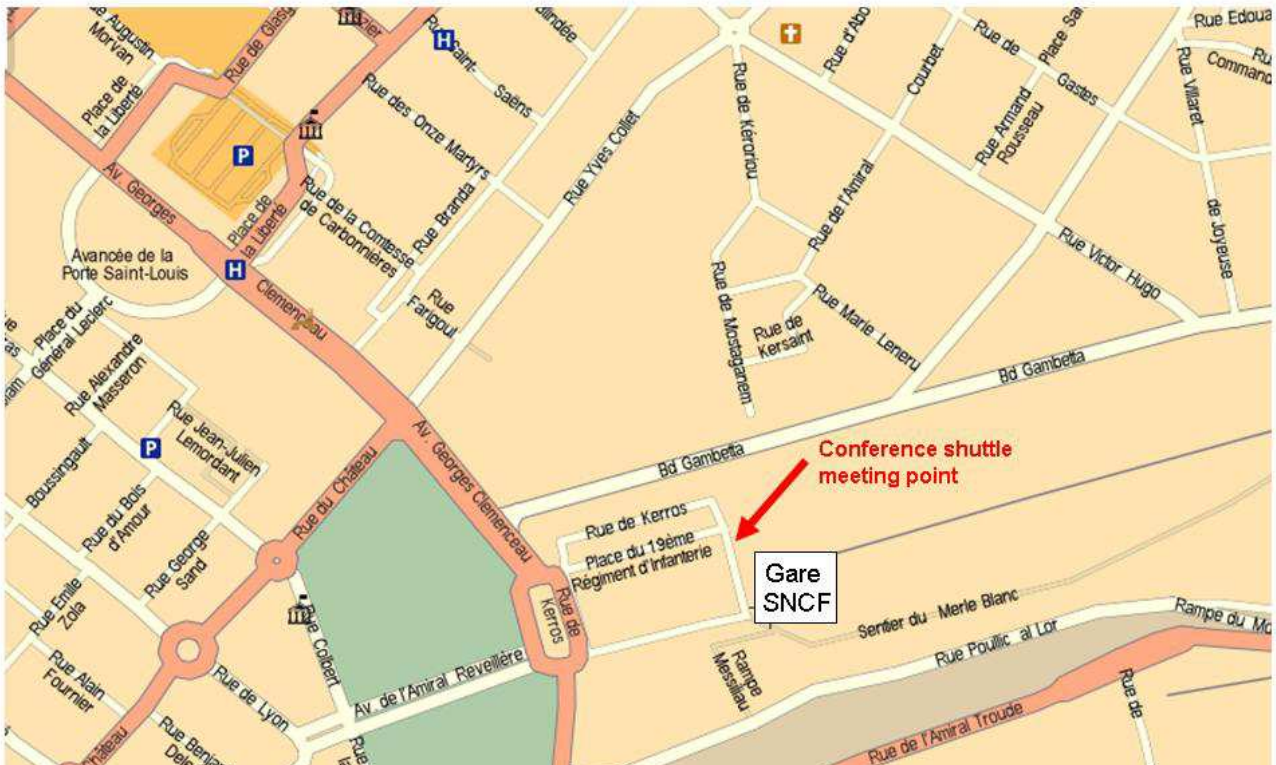
The following participants will take this shuttle either at the train station in Brest centre or at Brest airport depending on their arrival time.

Participants who cannot catch this shuttle to go from Brest to Logonna-Daoulas on Sunday 16 September have been contacted individually. **If you have not been contacted and your name is not in the list above, please contact Time.Series.Conf@ifremer.fr as soon as possible.**

Participants to be picked up :

Arturo	Aguirre	Wengang	Mao
Jan	Albertsson	Severine	Martini
Fabiola	Amorim	Marjolaine	Matabos
Matthias	Baeye	Razvan	Mateescu
Manuel	Bensi	Jurgen	Mienert
Mairi	Best	Stephen	MONNA
Mathilde	Cannat	Philippe	Naveau
Vanessa Rossana	Cardin	Ingunn	Nilssen
Pierre	Cauchy	Ngozi	Oguguah
Jackson	Chu	Krzysztof	Podgorski
Stefano	Ciavatta	Nuno	Prista
Bruce	Cornuelle	Anna	Reda
Aneta	Dargacz	Pannimpullath	Renosh
David	De Vleeschouwer	Rigoberto	Rosas
Jonathan	Derot	Erwan	Roussel
Lucia	Di Iorio	Igor	Rychlik
Anne-Cecile	Dragon	Francois	Schmitt
Gayatri	Dudeja	Arunima	Sen
Vincent	Escaravage	Lohitzune	Solabarrieta
Kevin	Ewans	Beth	Stauffer
Tomas	Feseker	Chrysanthi	Tsimitri
Almudena	Fontan	Jon	Uranga Aizpurua
Eleanor	Frajka-Williams	Mike	Van Der Schaar
Peter	Franek	Heinrich	Villinger
Antonina	Gertman	Phil	Wallhead
Isaac	Gertman	Johan	Wikner
Sebastien	Hammerschmidt		
Saeed	Hariri		
Anders	Hermansen		
Tania	Hernandez Farinas		
Jean-Olivier	Irisson		
Stale	Johnsen		
Craig	Jones		
Anna	Kalyuzhnaya		
Lyudmila	Kharitonova		
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Pierre	Legendre		
Francisco	Leitao		
Francisco	Lopez-Castejon		
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Access map for participants with own transport

Address: Centre Nautique de Moulin Mer 29460 Logonna Daoulas - Brittany (France).
GPS : 48°19.114 N et 004°17.013 O
Access map: see map below or download fil on http://www.europolemer.eu/time-series-analysis.php
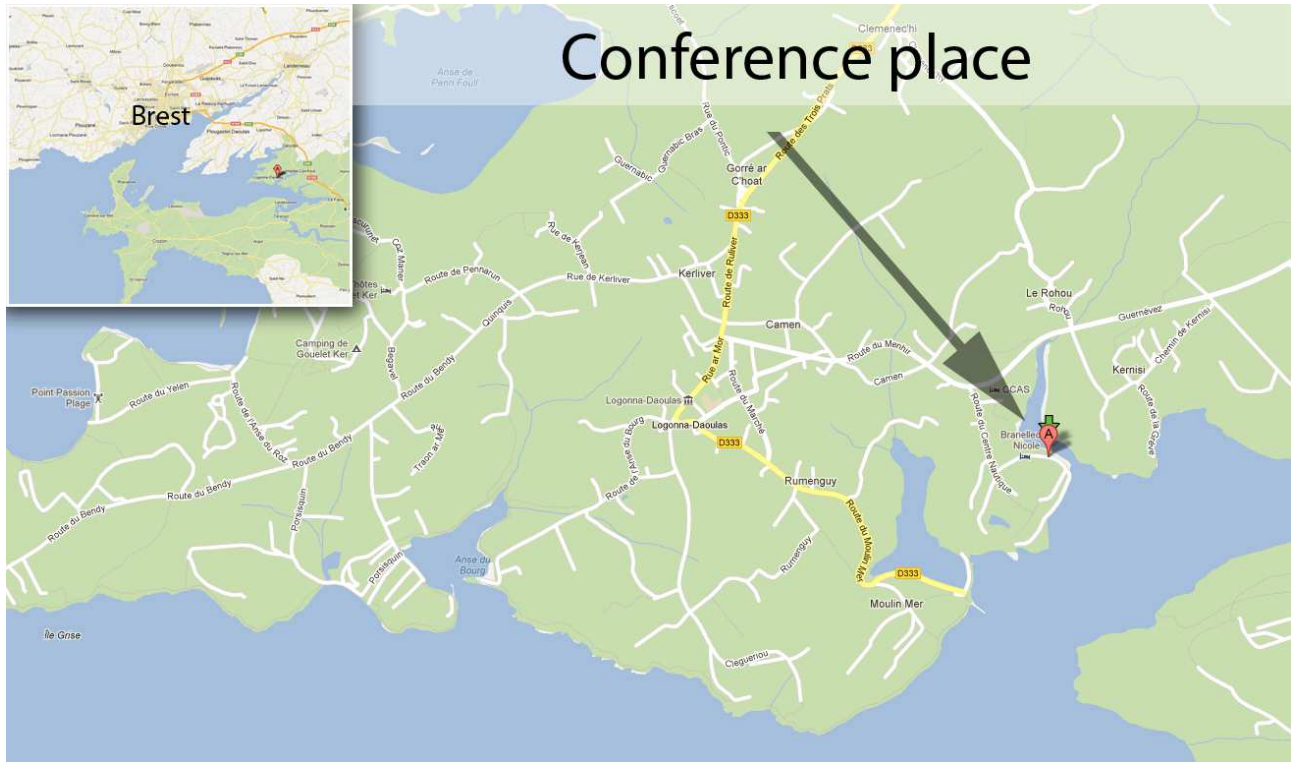
Accommodation

Accommodation is planned and included for all participants except for "Local participants" from Sunday evening until Wednesday morning for the Training Part, and from Tuesday evening until Saturday morning for the Scientific part. Rooms will be allocated upon arrival at the conference venue for the following participants:

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Arturo	Aguirre
Jan	Albertsson
Fabiola	Amorim
Matthias	Baeye
Gregory	Beaugrand
Manuel	Bensi
Julie	Bessac
Mairi	Best
Thomas	Bulteau
Mathilde	Cannat
Vanessa	Cardin
Rossana Pierre	Cauchy
Jackson	Chu
Stefano	Ciavatta
Bruce	Cornuelle
Aneta	Dargacz
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Gayatri	Dudeja
Vincent	Escaravage
Kevin	Ewans
Tomas	Feseker
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Isaac	Gertman
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Jean-Olivier	Irisson
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Francisco	Leitao
Francisco	Lopez-Castejon
Torbjorn	Lorentzen
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Anna	Reda		Beth	Stauffer
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If you are not a "Local participant" (see here after) and your name is not listed above, please contact Time.Series.Conf@ifremer.fr as soon as possible.

Local participants:
Local participants are those living in the Brest area who decided to come back home every evening, meals are taken in charge by the organisation. Nevertheless, due to the late ending session on Wednesday and the dinner on Thursday few beds are kept available in case of fatigue.

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Jacques	Graal		Laurent	Toffin

Note: Accommodation and transport outside planned conference schedule is the responsibility of and at own cost of participant.

Some accommodation options in the centre of Brest:
Hotel Vauban: http://www.espacevauban.com/hotel.html
Hotel Agena: http://www.agena-hotel.com/
Both are within walking distance of the Brest train station.

More options on http://www.brest-metropole-tourisme.fr/en/your-holiday/

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ANNEXES
Presentation abstracts and poster abstracts

Presentation abstracts

Abstracts are listed in order of appearance according to program
Presenting author is underlined, and only affiliation of presenting authors is indicated.

Session "Low and high frequency signals in Oceanography"

Chaired by :
H. Mercier (CNRS/LPO) and B. Cornuelle (SCRIPPS)
P. Morin (INSU/Station biologique de Roscoff and E. Frajka-Williams (NOCS)

THE CALIFORNIA CURRENT IN THE CLIMATE SYSTEM: ANALYSIS OF OBSERVATIONS

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The California Current system (CCS) is an important example of a productive eastern-boundary current system. Locally wind-driven upwelling combines with influences from the circulation of the entire Pacific Basin. The California Cooperative Fisheries Investigations (CalCOFI) has been collecting observations in the CCS for more than 60 years. This rich dataset can be mined statistically for long-term trends and climate linkages, but it also can be used for synoptic (re)analysis. I will present some recent work on the CCS using both statistical analysis and state estimation with a dynamical ocean model. The scientific questions motivating the study include understanding of local and non-local influences on the current system. Technical details of different analysis tools will also be discussed.

Keywords: Eastern Boundary currents, Time Series analysis, State Estimation, climate, upwelling, statistics

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TEMPERATURE, SALINITY AND CURRENT TIME SERIES FROM THE AOEM EXPERIMENT OFFSHORE SVALBARD

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Understanding the effects of climate change on the Arctic region is a major scientific challenge of high societal relevance as it is uniquely sensitive to climate change. The MASOX (Monitoring Arctic Seafloor – Ocean Exchange) observatory has been deployed from October 2010 to August 2011 offshore Svalbard, in a ~400m depth site where methane hydrate is actively dissociating from sub-seafloor methane (Westbrook et al. 2009. Escape of methane gas from the seabed along the West Spitsbergen continental margin, *Geophysical Research Letters*, 36). The main objective of this observatory is to determine the potential causative effect of warming shallow Arctic seas on methane hydrate stability, increasing free and methane gas release in the water column. Current, temperature, salinity and oxygen measurements show a strong seasonal variability, highlighting the water masses transport from southern and eastern Svalbard.

Keywords: Arctic; Monitoring; climate change; gas hydrates; water masses; seasonality

HOW TO DETECT AND ANTICIPATE CHANGES IN SPECIES AND ECOSYSTEMS IN THE CONTEXT OF GLOBAL CHANGE?

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The biodiversity of marine ecosystems is being altered by many human-induced factors including overexploitation of marine resources, chemical pollution and physical alterations, eutrophication, invasion of exotic species and global warming. With this multitude of direct or indirect anthropogenic influences, in addition to the confounding effects of the natural variability of the marine environment related to hydro-climatic forcing, managing marine ecosystems and achieving sustainable exploitation represents a real challenge. Many statistical analyses from multivariate to time series analyses can be applied to detect, understand and anticipate changes in both biological and ecological systems. However, conventional techniques can rarely be applied directly to ecological data. For example, some time series analyses are so sensitive to missing data that they cannot be applied when they occur. Correlation analysis and more generally inferential testing cannot be performed when time series are temporally autocorrelated. These issues will be discussed and recently developed techniques or analyses rarely applied in oceanography techniques will be presented to rapidly detect biological and ecological changes and anticipates major ecosystem shifts.

Keywords: Biodiversity, marine ecosystems, variance, mean state

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HYDROGRAPHICAL TIME SERIES FROM STATION M – NORWEGIAN SEA

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Having performed daily oceanographic measurements in the deep Norwegian Sea since 1 October 1948 until the end of November 2009, Ocean Weather Ship Station (OWS) M, at 66°N, 2°E, can present the longest existing homogeneous time-series from the deep ocean.

With the expansion of civil aviation and growing understanding of the impact of aerological observations on weather forecasts after World War II, ICAO (The International Civil Aviation Organization) demanded a greater network of aerological stations, primarily in the North Atlantic.

At station M routine programme was implemented within physical oceanography, including serial observations of temperature, salinity, and (since 1953) oxygen weekly at standard depths to 2000 meters, and serial observations of temperature and salinity at standard depths down to 1000 meters 3 or 4 times a week. This programme has been running continuously since 1 October 1948 until the end of November 2009 when the weather ship service on the station was terminated. The method of obtaining temperature and salinity observations (Nansen bottles with reversing thermometers) has not changed significantly either so the time series are indeed homogeneous.

We will give a brief overview over the hydrographical time series data and present an example how the time series can be applied in a statistical analysis.

Keywords: long-term dynamics of temperature series, stationarity and climate change

ANALYSIS OF CURRENT AND TRANSPORT DATA
FROM EULERIAN MOORINGS ON CONTINENTAL MARGIN

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The circulation and related transports at the south-east tip of Greenland were determined from direct current observations of a moored current meter array. The measurements covered a time span from June 2004 to June 2006. I will show all the steps needed to construct a time series of transport from eulerian current measurements and then comment on the statistical tools used to analyze this time series.

The East Greenland - Irminger Current transport west of the 2000 m isobath was then weekly estimated, between 1992 and 2009 by combining surface geostrophic velocities derived from altimetry with an estimate, via EOF decomposition, of the vertical structure of the transport variability statistically determined from the previous moored array measurements. The reconstructed 17‑year time series of the EGIC transport was afterwards validated against independent estimates.

Keywords: current meter measurements, time series, spectral analysis, coherence spectrum , Empirical Orthogonal Function.

CHARACTERISTICS OF TRANSPORT ESTIMATES IN THE SUBTROPICAL NORTH ATLANTIC FROM THE RAPID ARRAY: GYRES, EDDIES AND THE MOC

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The RAPID/MOCHA project has been making estimates of the transbasin Atlantic Meridional Overturning Circulation (MOC) since April 2004. The MOC is a key player in the global climate system, responsible for transport 1.5 PW of heat northwards in the Atlantic. Understanding sources of variability are critical to determining how the MOC may change due to climate change. The MOC is estimated from individual components being the Gulf Stream transport through Florida Straits, Ekman transport from winds, and a mid-ocean transport from moorings at the eastern and western boundaries of the Atlantic. The time-series of transport show variability on a range of timescales from subseasonal to interannual, with spectral analysis identifying peaks at monthly and annual periods. The covariability between transport estimates that contribute to the MOC calculation have nonstationary variability; in early years of measurement, the individual components were unrelated, each contributing variability independently to the MOC. In recent past, correlation and coherence analysis identifies a change in behavior at the western boundary: where the Gulf Stream and western boundary transports covary at periods longer than 50 days. I will discuss the characteristics of these timeseries, as determined from a range of time series analysis methods, and their physical interpretation.
Keywords: Meridional overturning circulation, eddy variability, correlation, coherence, spectra, nonstationarity.

A DEEPER LOOK AT ESTUARINE PROCESSES - WAVELETS AND CIRCULATION

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Understanding sediment transport is key for environmental management of the Lower Passaic River (LPR), New Jersey, USA. The LPR is contaminated with numerous hydrophobic contaminants, which strongly sorb to sediments in the system. Deposition of cleaner sediment can reduce biologically available contaminant concentrations, while erosion of contaminated sediments can result in a redistribution of contaminants to other parts of the system. Therefore, the sediment transport processes are important in determining the magnitude and rate of recovery of LPR sediments.

LPR is a partially mixed estuary, with its main source of sediments from flow over Dundee Dam at river mile 17. Under daily low flow conditions, the LPR experiences tidal delivery and deposition of sediment from Newark Bay due to estuarine circulation. During occasional high flow events, river flow in the LPR dominates and there is a net flux of sediments out of the river to Newark Bay. Large storm events provide energy for erosion of sediments in higher shear regions of the river, with subsequent deposition of resuspended sediment in lower shear regions. The net flux of solids during high flow events is orders of magnitude larger than upstream tidal delivery of sediment from the bay during low flow events. Long term transport has resulted in net deposition in the river coupled with a net efflux of sediment from the river.

Wavelet analysis was used on hydrodynamic and geophysical measurements collected at several locations along the 17-mile stretch of the LPR to decompose time series of measured data into time-frequency space in order to determine dominant modes of variability and how these modes vary in time. The advantage of wavelets over traditional fast Fourier transforsm (FFTs) is that wavelet analysis identifies dominant frequencies in a temporal context. Cross wavelet transforms reveal high common power between two variables in time-frequency space and wavelet coherence exposes strong coherence and relative phase between two variables in time-frequency space. This presentation will explore the analysis of data at locations along the LPR and examine how the wavelet analysis reveals the underlying physical relationships governing sediment transport in the system.

Keywords: Wavelet, sediment transport, estuary, environmental, sediment flux

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MULTISCALE TIME SERIES ANALYSIS: SCALING AND EXTREMES, STRUCTURE FUNCTIONS AND EMPIRICAL MODE DECOMPOSITION

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Marine ecosystems are complex systems and their variability is characterized, in time and space, by possible huge fluctuations on a wide range of scales. New methods are needed to analyse and characterize these fluctuations. We focus here on methods inspired by the fields of turbulence and signal processing. We consider extremes of increments of time series (characterized using probability density functions studies), and scaling properties using in particular Fourier power spectral analysis.

We particularly focus on intermittency, considered using structure functions approach, as well as using the newly introduced Empirical Mode Decomposition. The latter method, complemented by Hilbert Huang Spectral Analysis, has been introduced in 1998 and now there are several thousands studies using the method. We will present the method and show how it can be used to consider multiscale intermittency properties of time series.

We will show the theories and illustrate the results using high frequency marine turbulence time series as well as MAREL biogeochemical monitoring time series.

Keywords: multi-scale; extremes; scaling; empirical mode decomposition; power laws

Session "Geosciences and seismic monitoring"

Chaired by J. Mienert (Tromsoe University) and L. Geli (Ifremer)

MULTI-PARAMETER TIME SERIES FROM AN UN-CABLED DEEP-SEA OBSERVATORY AT AN ACTIVE MUD VOLCANO

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The Håkon Mosby mud volcano (HMMV) is located at around 1250 m water depth on the Barents Sea slope. In the past decades, numerous scientific expeditions provided evidence of persistent high seepage rates and abundant gas hydrates at shallow sediment depths. However, the temporal variability of activity and the corresponding dynamics of the gas hydrate reservoir associated with this mud volcano remained poorly understood. An in situ sediment temperature observation conducted between 2005 and 2006 provided the first indications of rapid changes in activity on time scales of weeks and months and suggested complex and dynamic flow patterns of mud or pore fluids. These observations led to the installation of an un-cabled observatory within the framework of the ESONET Demonstration Mission "LOOME", which recorded physical and chemical parameters in the sediment, at the seabed, and in the water column between 2008 and 2010. The data revealed alternating periods of high activity and quiescence that lasted from a few days to several weeks and point to a complex interplay of pore fluid flow, gas hydrate dynamics, seafloor deformation and sediment movement.

Keywords: deep-sea observatory, mud volcano, gas hydrates, fluid flow, methane seepage, episodic activity

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ANALYSIS AND INTERPRETATION OF GEOPHYSICAL TIME SERIES FROM SEAFLOOR OBSERVATORIES IN EMSO SITES

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EMSO is a large-scale distributed European Research Infrastructure (RI) of the ESFRI roadmap. It is made up by fixed-point, seafloor and water column observatories with the basic scientific objective of long-term and, where possible, real-time monitoring of environmental processes related to the interaction between the geosphere, biosphere, and hydrosphere. It encompasses key sites of European waters, from the Arctic, through the north-western Atlantic and Mediterranean Sea to the Black Sea.

Scientific experiments and sustained observations have been developed regularly in many of the EMSO sites. This presentation will show geophysical time series acquired in some of these sites by GEOSTAR-class observatories with the aim to address the potentiality of the scientific observations for the investigation of remote tectonic and volcanic areas and the importance of a multidisciplinary approach to unravel the complex interactions among different natural phenomena traditionally studied apart such as seismic and volcanic activity, gas seepage, deep water-circulation regime. In particular, analyses of some geophysical time-series from the Western Ionian, Iberian Margin and Sea of Marmara will be presented in the frame of a trans-disciplinary approach.

[1] G. Cianchini, De Caro Maria Grazia, D. Embriaco, G. Etiope, F. Frugoni, G. Giovanetti, V. Iafolla, F. Italiano, N. Lo Bue, S. Monna, G. Marinaro, C. Montuori, T. Sgroi.

Keywords: marine geophysics, multi-parameter analysis, trans-disciplinary approach

COMBINING COLLOCATED ACOUSTIC GAS BUBBLE RECORDERS AND OCEAN BOTTOM SEISMOMETERS TO DETECT GAS RELATED PROCESSES IN SHALLOW SEDIMENT LAYERS

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Submarine degassing processes may be either natural (continuous exploration efforts and progress in multi-beam sonar techniques in the recent years have shown that natural seafloor degassing is a wide spread phenomenon), either artificial resulting from human activities (e. g. sediment destabilization related to oil exploration, pipe leaking, etc). Whether natural or artificial, degassing processes require a number of generic tools for their detection and monitoring.

We here present different multiparameter datasets from the submerged section of the North Anatolian Fault, within the Sea of Marmara, showing that the combination of collocated acoustic gas bubble recorders and Ocean Bottom Seismometers (OBSs) provide the means to detect gas accumulation and release processes in shallow sediment layers. Understanding the physical processes is a prerequisite, before we can propose methods for combining all different datasets and detecting anomalous signals that could eventually be identified as indicators that a potentially dangerous situation is under way.

Keywords: degassing processes, geohazards, seafloor monitoring

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EMSO-AZORES. A NEAR-REAL TIME MULTIDISCIPLINARY OBSERVATORY OF HYDROTHERMAL PROCESSES AND ECOSYSTEMS AT THE MID-ATLANTIC RIDGE : GEOPHYSICAL MONITORING OF SUBSEAFLOOR PROCESSES

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The EMSO-Azores project focuses on the Lucky Strike hydrothermal vent field, on the ridge south of the Azores. It addresses two main questions : What are the feedbacks between volcanism, deformation, seismicity, and hydrothermalism at a slow spreading mid-ocean ridge? and How does the hydrothermal ecosystem couple with these sub-seabed processes?

With partial support from ESONET we successfully deployed (in 2010), and maintained (in 2011) a near-realtime buoyed multidisciplinary observatory system. Sensors are connected to two junction boxes, acoustically linked to a surface buoy with satellite communication to shore. The connected instruments (seismometer, pressure probes, GPS, ecological sensors) are nested in arrays of autonomous sensors (OBSs, pressure probes, temperature probes in selected vents, currentmeters and temperature probes in the water column). The interpretation of time series data also relies on repeated observations and sampling of fluids and faunas.

In this presentation we will outline the latest results of this prototype observatory system, focusing on the geophysically-oriented components of the experiment (seismicity, geodesy, fluid temperature and chemistry). We will outline our approaches to time-series analyses and discuss perspectives for future studies and modelling.

Keywords: multidisciplinary seafloor observatory, hydrothermal circulation, seismicity, ground deformation, mid-ocean ridge

Session "Applications for industry"

Chaired by M. Prevosto (Ifremer) and I. Rychlik (Chalmers university)

RELIABILITY APPLICATIONS OF SPATIO-TEMPORAL HS MODEL

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In the talk we shall first present a spatio-temporal random non-homogenous field used to describe variability of the significant wave height. Some aspects of statistical estimation of the model will be mentioned. Then following applications will be discussed

1) *Long-term variability :* Estimation of safety indexes for fatigue of a container ship sailing in North Atlantic. Estimation of 100 years Hs .
2) *Medium term variability:* Validation of radar measurements (confidence intervals) during a voyage .
3) Extrapolation of hindcast data to denser grid, time span of few hours and distance of 100 km.

Keywords: Spatio-temporal models, non-separable covariances, significant wave highs, fatigue damage

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WHIPPING/SPRINGING ON THE EXTREME PREDICTION OF SHIP RESPONSES

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Wave-induced vibrations, also known as whipping and springing, are defined as the high frequency response of ship structures. Whipping is usually referred to the ship response caused by transient impact loading, such as slamming, green water or underwater explosion. Springing is associated with a stationary resonant response phenomenon of the ship beam. In this study, the full-scale measurements of a 2800 TEU container ship that operates in the North Atlantic Ocean, will used for the investigation of extreme prediction of ship responses. The measurement campaign includes 7 voyages from Europe to North America and 7 voyages back to Europe, lasting for continuous 6 months. The record frequency of time series of stress (strain) is 25 Hz, which is able to capture the response of whipping/springing of this ship.

The whipping/springing-induced contribution to the extreme response is investigated by means of the level crossing approach. It shows that the level crossing model for Gaussian load cannot be used for the prediction of extreme responses, such as the 100-year stress, based on the full-scale measurement. A more complicated non-Gaussian model is required to consider the contribution from whipping/springing. In this study, a simple formulation is derived to compute the necessary parameters in compute the upcrossing intensities. One parameter is called the significant response range hs , 4 standard deviation of stress signals in one stationary sea state. The other is the mean stress up-crossing frequency fz. It is found that the first parameter could be approximated by only considering ship response (stress) without whipping/springing. The other parameter is approximated by taking the expected value of encountered wave frequency. The capability and accuracy of this method is demonstrated by stress signal from both measurements and numerical analysis.

Finally, the difference of extreme prediction using the full-scale measurements (with and without whipping/springing) and classical principles is also presented, and deserves more investigation in the future research.

Keywords: Extreme prediction, Whipping/springing, upcrossing intensity

STATISTICAL PROCESSING OF WAVE DIRECTIONAL SPECTRAL TIME-SERIES INTO A CLIMATOLOGY OF SWELL EVENTS

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Accurate estimation of the nature and occurrence probabilities of long-term sea conditions is a major issue for the design of coastal and offshore structures, for the preparation of marine operations, and for other applications such as marine energy, coastal erosion, etc. When those conditions are complex, it is necessary on one hand to extract a condensed meaningful structure from the available time-history of measured directional spectra, yet on the other hand the commonplace simple joint probabilities of, say, global wave height, period and direction are far from sufficient to fully describe the climate complexity, for instance in West African regions.

We present here some preliminary results of a method that identifies time-consistent events in the history, models them, and investigates their occurrence process, thus allowing to reconstruct synthetic histories of a larger number of sea-state parameters with acceptable statistical properties. The method consists in the following steps:
- Extraction of wave systems from each directional spectrum
- Gathering over time of systems corresponding to the same storms into events
- Identification of parametric models for the time-evolution of wave characteristics within each event.
- Model of the occurrence process of the discrete events.

Keywords: Joint probabilities, array time-series, spectral parameters, wave climate

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GAUSSIAN STATE-SPACE MODEL FOR WIND FIELDS IN THE NORTH-EAST ATLANTIC

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We propose a stochastic space-time model for wind fields at regional scale in the North-East Atlantic. This work aims at developing stochastic models which can generate realistic wind conditions and be used to estimate various related risks (renewable energy, coastal erosion,...).

We use a gaussian linear state-space model in which the hidden state represent the mean circulation at the regional scale and the observationn equation relates the regional conditions to the local ones. One of the goal of the model is to reproduce space-time motions of the meteorological systems as, for example, the propagation of a storm in the channel. The observation equation of the state-space model describes the spatial structure of the variables and time structure is contained in model equation: the hidden variable is an auto-regressive process.

The estimation strategy is based on maximum likelihood (Kalman filter and EM algorithm). Estimation is done on 6-hourly reanalysis data from ECMWF. The model is validated by comparing statistics of the data with those computed from artificial realizations of the model.

This model does not allow to correctly reproduce the weather regimes existing in this area. The next step could be to add an extra layer of hidden variables. These variables with values in a finite state space will describe the various regional weather types and will provide a more flexible model.

Keywords: stochastic weather generators, wind time series, markov-switching autoregressive model, multiscale model, overdispersion

EVALUATING ENVIRONMENTAL JOINT EXTREMES FOR THE OFFSHORE INDUSTRY

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Understanding extreme ocean environments and their interaction with fixed and floating structures is critical for offshore and coastal design. The joint effect of various ocean parameters on extreme responses of offshore structures is important. For example, it is known that mean values of wave periods tend to increase with increasing storm intensity, and a floating system responds in a complex way to both parameters. Joint extreme estimation for the offshore industry fall mainly into two camps - response-based and response-independent. Both are discussed, but the emphasis is on new methods associated with response-independent methods.

Many methods of multivariate extreme value analysis are based on models which assume implicitly that in some joint tail region each parameter is either independent of or asymptotically dependent on other parameters; yet in reality the dependence structure in general is neither of these. The underpinning assumption of multivariate regular variation restricts these methods to estimation of joint regions in which all parameters are extreme; but regions where only a subset of parameters are extreme can be equally important for design.

Design contours are useful to describe the joint behaviour of environmental, structural loading and response variables. Different forms of design contours are discussed and a new method for joint estimation of contours of constant exceedence probability for a general set of variables is described, including those based on the First Order Reliability Method. The methods are discussed in terms of contours of constant exceedence probability using measured and hindcast data from the Northern North Sea, the Gulf of Mexico and the North West Shelf of Australia.

Keywords: environmental time series, Joint extremes, offshore structure design

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EVALUATE THE ENVIRONMENTAL EFFECTS OF OIL PLATFORM DISCHARGES IN THE NORWEGIAN SECTOR OF THE NORTH SEA

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In 2011 Statoil initiated a program to develop real time based integrated environmental monitoring of discharges from oil and gas exploration and production to the marine environment. The goal is to develop technology and methodology for real time recording of vital environmental parameters in the influence area of oil and gas E&P activities offshore to improve environmental management and performance. The development is building on Statoil.s experience in collecting time series of marine environmental data from sensor systems and sensor platforms, and the company's risk based approach to environmental management.

Statoil is presently operating several systems for time series data collection related to different offshore E&P operations in the offshore sector, varying from monitoring discharges from drilling operations to data collection in virgin areas with no petroleum infrastructure. It is the company's ambition to share relevant data with the scientific community, by giving relevant institutions access to these data.

Our latest initiative is the establishment of a cabled ocean observatory outside Vesterålen in Northern Norway, focusing on oceanographic parameters and biomass fluxes in the water column. The presentation will address this and other ongoing projects, technology development, ambitions and plans for the development of integrated environmental monitoring.

Keywords: environmental monitoring, real time data, sensor technology, sensor platforms, marine environment, oil and gas industry

Session "Marine Ecology: from coastal to deep-sea ecosystems and Acoustical ecology"

Chaired by
J. Sarrazin (Ifremer) and M. Matabos (University of Victoria), L. Di Iorio (ENSTA Bretagne)

FROM OCEAN SOUNDS TO COASTAL ECOSYSTEM MONITORING

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Coastal ecosystems are crucial in terms of their ecological and socio-economical importance. Benthic organisms have a paramount impact on these ecosystems since they influence the regulation of primary production and play a major role in transforming and exporting organic matter and in influencing biogeochemical processes. Monitoring their activity and responses to environmental fluctuations therefore is a key element for understanding ecosystem dynamics. However, acquiring high-resolution time series to characterize biological rhythms, spatio-temporal variability, and environmental quality at different ecological levels is arduous. Here we demonstrate how listening to the sounds emitted involuntarily by a variety of benthic organisms (e.g. crustaceans, molluscs, echinoderms) contributes to fill this gap. We introduce the term "micro acoustics" describing the behaviour at the individual/species level; the term "meso acoustics" referring to the population or community and enabling the characterisation of a habitat; and the term "macro acoustics" used to describe and compare ecosystems or habitats also at different spatial scales. We show how the analysis of species-specific sounds or ambient noise of data acquired over several months helps monitoring the activity of an ecosystem sentinels used as quality indicator, to describe the natural variability, the biomass and species richness of a habitat and to assess responses to environmental changes.

Keywords: passive acoustic monitoring, ambient noise, benthic ecology, environmental description, ecosystem sentinels of biological origin.

USING DEEP-SEA OBSERVATORIES TO IDENTIFY OCEAN NOISE TRENDS

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The growing scientific and societal concern about the effects of underwater sound on marine ecosystems has been recently recognized through the introduction of several international initiatives, like the International Quiet Ocean Experiment, aiming at measuring the environmental impact of ocean noise on large spatial and temporal scales. From a regulatory perspective, the European Marine Strategy Framework Directive includes noise (and other forms of energy) as one of eleven descriptors to determine Good Environmental Status of the oceans. The Directive specifically requires Member States to provide a measure of annually averaged noise. The Laboratory of Applied Bioacoustics has developed a software package that measures sound levels and monitors acoustic sources in real-time; this software was used for the LIDO project (www.listentothedeep.com), which originated from the European Sea-floor Observatory Network of Excellence (ESONET). The system is currently operating worldwide from several wired and radio-

linked observatories. Recently, through a zero-cost contract with the CTBTO (Preparatory Commission for the Comprehensive nuclear-test ban treaty organization), years of data from hydroacoustic stations were analysed to look for background noise trends and to detect cetacean presence. Here, we present the analysis of four CTBTO platforms, each covering 42 months of data, focussing especially on the estimation of background noise levels and the measurement of noise contributions from anthropogenic sources. Continuous monitoring of background noise will help to understand whether long-term exposures, in areas with intense shipping or seismic campaigns, for instance, might alter animal natural behaviour and may be used in the future to assess the effects of ocean noise on marine life.

Keywords: ocean observatories, noise, acoustic events, acoustic long-term time series

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ECOLOGICAL TIME-SERIES AND CLIMATE CHANGE

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On a global scale there are only a small number of marine ecological time series that have been maintained using a consistent methodology over a long period of time. This is in contrast to time series of physical and to some extent chemical data, which are easier to measure in a consistent manner and often have strategic value e.g for weather forecasting. Spatially gridded and satellite based time series will also be mentioned. Few ecological time series studies survive beyond three years (thesis projects) and very few beyond a decade, and this situation is ongoing as funding for marine science stalls due to the global economic crisis. Monitoring is often the first programme to be cut in the research portfolio of laboratories and funding agencies and is rarely ring-fenced. Maintaining such programmes is expensive and time consuming, and the proponents often lose sight of the importance or become tired of the repetitiveness of their work fighting against funding, publication and other priorities. In the past monitoring to produce time series was considered as poor science, on a par with stamp collecting. The survival of many surveys has been fortuitous due to the foresight of a few scientists and funders who saw the intrinsic value of the work against criticism from process orientated and laboratory based experimental researchers. The true value of historical datasets is now well recognised due to an increasing awareness of the need to assess the impacts and rates of environmental change from for example, climate, eutrophication and overfishing. Increasingly policy makers are becoming aware of the value of time series data for policy development and marine management and as a means of assessing rates and impacts of climate change. An attempt will be made to summarise other time series datasets used in climate change research. It is now clear from long programmes such as the Continuous Plankton Recorder and the Helgoland dataset that the value of a time series increases progressively as new previously un-thought of applications are applied to the data and samples. In a global context there are large gaps in coverage of time series by region, ecosystem and water depth, especially in the open ocean. For plankton especially this is a huge gap in knowledge, given their importance in the carbon cycle. I will examine the past record of ecological time series and comment on the statistical analyses used prior to 2000 to interpret Continuous Plankton Recorder (CPR) data. The presentation will also highlight and analyse the reasons why a few long-term programmes have been successful and others not. Their importance in climate change research will be emphasised. An urgent need to develop and implement an appropriately funded ecological observation programme, integrated with research and modelling, that complements the present physical and chemical monitoring of the Global Ocean Observing System (GOOS) will be stressed.

Keywords: , Ecological time series, climate change, Global Ocean Observing System, Continuous Plankton Recorder, long-term, monitoring,

LONG-TERM CHANGES IN A FINE SAND MACROBENTHIC COMMUNITY FROM THE BAY OF MORLAIX (WESTERN ENGLISH CHANNEL): THIRTY YEARS OF SAMPLING

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In the Bay of Morlaix, benthic samples were collected at 2-3 month intervals (i.e. 5 observations per year) from one station in a fine sand community over a thirty-year period (1977-2006). In parallel, different environmental variables measured at different frequencies are available to describe climate variability (i.e. sea surface temperature, wind speed and direction, and freshwater inputs) as well as large-scale hydroclimatic indices (NAO, AMO, NHT). The site was also strongly affected by the Amoco Cadiz oil spill during which 220,000 tons of hydrocarbons were discharged in April 1978.
Data were analysed to identify inter-annual variability and long-term trends in the densities of the dominant species and the community structure in response to both anthropogenic disturbances and climate change. A typology was proposed to classify the species according to their temporal variations corresponding to different types of ecological responses to environmental changes (e.g. erratic proliferations of opportunistic species, multi-year cycles, and positive trends).
Our results highlight the importance of long-term observations for the understanding of temporal dynamics of coastal benthic communities and disentangle the relative role of natural and human-induced changes. For managers, they raise the question of a reference status of a habitat and the shifting of baselines.

Keywords: macrofauna, coastal environment, climate change, oil spill, reference status, English Channel

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"LONG TERM CHANGES IN BENTHIC COMMUNITIES AND COASTAL SYSTEM FUNCTIONING IN RELATION TO ANTHROPOGENIC BUT ALSO TO CLIMATE FORCING."

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Western Brittany coastal ecosystems have been subjected to disturbance due to anthropogenic activities for centuries. However, recent improvement in fishing techniques or in agricultural activities has meant that impacts to coastal benthic communities have drastically increased.
In parallel, seawater temperature has been regularly increasing along the last century in response to global warming, which may also influence benthic communities.
In order to measure the consequences of these impacts to the benthic communities and the coastal ecosystem functioning, we use multiple long-term series (hydrological parameters, chlorophyll concentration, phytoplankton, benthic communities, and benthic indicator species) from the bay of Brest and the adjacent Iroise.
We will give several detailed examples of such impact including:
- how clams and scallop dredging has profound, long term impacts on the biodiversity and nursery role of a fished maerl bed, while in comparison, adjacent unfished areas do not show similar damages.
- regarding eutrophication, how the use a novel approach coupling quantitative long term data to trophic web structure (obtained through stable isotopes analysis) allowed to delineate strong eutrophication events and benthic communities recovery through time.
- how the survey of species at their northern limits of distribution may help to better understand and predicts changes to coastal systems under global warming
Keywords: benthic community, fishing impact, eutrophication, climate change, biodiversity, ecosystem functionning

Biogeochemical and Ecological Research at the Porcupine Abyssal Plain

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Research at the Porcupine Abyssal Plain (PAP) has included time-series studies of biogeochemical and ecological variation since 1989. The site is located in the sub-polar northeast Atlantic and is subject to seasonality, as well as longer term variations. Since 2002, the infrastructure has also included long-term mooring deployed sensors for temperature, salinity, chlorophyll-a fluorescence, nitrate and pCO_2 all from the upper mixed layer. Currently, in collaboration with the UK MetOffice, atmospheric data are also collected at PAP. Data from the atmospheric and upper ocean sensors are made available in near real time via MyOcean and the Global Telecommunications System (GTS). Data and samples from PAP have been used to understand the efficiency of carbon uptake in the surface ocean, its transfer to deeper depths, and ultimately the impact on benthic ecology of the abyssal plain. Order of magnitude variations have been found at interannual scales in several key variables including the flux of particulate organic carbon and the abundance of specific megafauna species on the seafloor. Current time-series research at the site is focused on understanding the degree to which climate, mixed layer depth, primary productivity, and pCO_2 variations are related and influence carbon transfer in the ocean. We will discuss approaches used to disentangle potential links between variables including multivariate community analysis, spectral analysis and phenology.

Keywords: Porcupine Abyssal Plain, ecology, carbon, biogeochemistry, particulate organic carbon, ocean observatory

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Temporal Variability in Benthic Community Dynamics Using Seafloor Imagery

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Deep-sea ecosystems are subjected to a variety of environmental forces that act at temporal scales that range from diurnal to millennial. Our understanding of how these environmental factors shape benthic communities is very incomplete, and most of what we know is the result of brief ship-based expeditions. Cabled ocean observatories offer a new approach for studying the dynamics in deep-sea benthic communities and their relationship with habitat variables. The power and bandwidth available through cabled connections permits high-resolution, time-series observations for months and even years.
VENUS and NEPTUNE Canada are the coastal and regional components of the Ocean Network Canada observatory. We used the VENUS digital still camera, located at 104 m depth in Saanich Inlet, to acquire a high-resolution photographic time-series to determine animal abundances and bacterial mat coverage in relation to changes in environmental variables. A 890 m depth NEPTUNE Canada camera in Barkley Canyon was used to examine qualitative changes in benthic macrofauna in relation to seasonal environmental changes, over a one-year period. We applied multivariate ordination methods and a principal coordinate analysis of neighbour matrices to decompose the variance in the data and determine temporal structures in our dataset. We will use results from both studies to discuss the power and limitations of the cabled observatory approach to documenting and explaining benthic community dynamics in the deep ocean.

Keywords: cabled observatories, activity rhythms, imagery, Saanich Inlet, submarine canyon, benthic community

SHORT- AND LONG-TERM ECOLOGICAL VARIATIONS AT DEEP-SEA HYDROTHERMAL VENTS – A MULTIDISCIPLINARY OBSERVATORY APPROACH

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Located on oceanic ridges, hydrothermal ecosystems are characterized by strong physicochemical gradients and a unique fauna, sustained by chemosynthesis. Because of their remoteness in the deep-sea, it remains difficult to evaluate sub-annual variations and to understand the variability of the local environment. Long-term monitoring is thus indispensable to gain fundamental knowledge about the response of faunal assemblages to changes in their habitats, growth, succession and biotic interactions.

An autonomous deep-sea observatory is currently deployed in the Atlantic Ocean of which the ecological module focuses on a hydrothermal mussel assemblage. Its first deployment (2006) gathered video imagery, iron-concentrations and temperature. Video imagery is an effective and important tool to monitor long-term natural changes in remote ecosystems, though the data-analysis is very time-consuming. For this purpose, an automated video processing platform was developed. A selection of different image analyses techniques were implemented in this platform. During this presentation, the interface will be presented.

In addition, results on temporal variations from 2006 for both fauna and environment will be discussed. Periodicities and rhythms in environmental variables were unravelled using PCNM/MEM analyses, which decompose the time-series in sinusoidal waves. Significant scales and periods are thus revealed for all variables and tested within ecological models.

Keywords: Hydrothermal vents, time-series, faunal assemblages, image analyses, numerical ecology, automation

Posters abstracts

Poster abstracts are alphabetically ordered according to the first author name.

Growth of Peruvian scallops Argopecten purpuratus (Lamarck, 1819):
importance of the availability and quality of seston.

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Argopecten purpuratus growth (height and ash-free dry weight) and environmental parameters (availability and quality of seston and some physico-chemical) monitoring was conducted for 98 days between April and July 2007 in Paracas bay, Peru. Two treatments were used: bottom and suspended (2 m above bottom) culture. In a first moment the periodicity of striae formation on the valves has been validated: a deposition rhythm of one day striae was found independently of treatment. In a second part, growth rates deviations to theoretical curves, resulting of the Von Bertalanffy growth function fitting, were calculated. The canonical analysis of correlation, made between the growth rate deviations and the environmental parameters, shows that the concentration in phaeopigments is correlated inversely with the deviations and that this one is related to the bottom treatment. The time series cross-correlation analysis of bottom treatment shows that the deviations in height growth rates are correlated with parameters of seston availability, especially the concentration of particulate organic carbon and nitrogen, whereas the growth differences in weight somatic tissues are correlated with the availability and the quality parameters of seston and temperature. The multivariate predictive model suggested shows that the temperature, chlorophyll-a and residual particulate organic nitrogen explain rather well the somatic dry weight variation into the both treatments.

Keywords: seston quality, aquaculture, Peru.

Study of Physical Processes underlying the dynamics of blooms of toxic algae
in the region adjacent to the central coast of Portugal.

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The physical processes of transport and retention of harmful algal bloom dynamics offshore Aveiro (40oN-41oN) are investigated based on in situ observational data. The data consist of hydrographic (temperature, salinity, chlorophyll) and currents (depth time-series and bottom-tracking) measurements during the 2010 and 2011 summer seasons. The results points to a intense upwelling system along the coast mainly due to the wind forcing. Also, a cyclonic eddy formed by the interaction of the alongshore flow with the Aveiro Canyon topography can enhance the upwelling system leading to a strong surface chlorophyll concentration.

Keywords: algal bloom, coastal upwelling system, observational data.

Thermohaline variability and mesoscale dynamics observed at the E2M3A deep-site in the Southern Adriatic (Mediterranean Sea)

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Continuous sampling measurements are strictly essential to better understand the deep convection. The Southern Adriatic Sea, recognized as a dense water formation site able to oxygenate the deep layers of the Eastern Mediterranean, has been constantly monitored at the E2M3A deep-site (Latitude 41° 50' N, Longitude 17° 45' E, maximum depth 1250m) since 2006. Temperature, salinity and currents time-series were merged with air-sea heat fluxes data and analyzed for the period 2006-2010. Here we report on the abrupt temperature and salinity decrease down to 700m depth from March 2008 on (maximum temperature and salinity decrease of ~0.3°C and ~0.06 respectively) and on the continuous temperature and salinity increase (linear trend: ~0.05 °C y-1 and ~0.004 psu y-1) observed at the bottom. A strong relationship with the recently discovered variability of the Ionian surface circulation, responsible for the heat and salt content changes in the Adriatic, emerges. The data also reveal that the passage of mesoscale eddies produces a twofold effect: the contribution to the restratification of the water during the post convection phase by exchanging the buoyancy between the mixed path and the surroundings water and the transfer of heat and salt between the deep and the intermediate layers.

Keywords: Deep Convection, Eastern Mediterranean, Mesoscale Dynamic

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EMSO-AZORES. A near-real time multidisciplinary observatory of hydrothermal processes and ecosystems at the mid-atlantic ridge : geophysical monitoring of subseafloor processes

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The EMSO-Azores project focuses on the Lucky Strike hydrothermal vent field, on the ridge south of the Azores. It addresses two main questions : What are the feedbacks between volcanism, deformation, seismicity, and hydrothermalism at a slow spreading mid-ocean ridge? and How does the hydrothermal ecosystem couple with these sub-seabed processes? With partial support from ESONET we successfully deployed (in 2010), and maintained (in 2011) a near-realtime buoyed multidisciplinary observatory system. Sensors are connected to two junction boxes, acoustically linked to a surface buoy with satellite communication to shore. The connected instruments (seismometer, pressure probes, GPS, ecological sensors) are nested in arrays of autonomous sensors (OBSs, pressure probes, temperature probes in selected vents, currentmeters and temperature probes in the water column). The interpretation of time series data also relies on repeated observations and sampling of fluids and faunas. In this presentation we will outline the latest results of this prototype observatory system, focusing on the geophysically-oriented components of the experiment (seismicity, geodesy, fluid temperature and chemistry). We will outline our approaches to time-series analyses and discuss perspectives for future studies and modelling.

Keywords: multidisciplinary seafloor observatory, hydrothermal circulation, seismicity, ground deformation, mid-ocean ridge

The characteristics of Lake Baikal's internal wave spectrum.

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Lake Baikal is the deepest (over 1.6 Km) lake on earth holding 80% of world's fresh water supplies. The lake supports a remarkable biodiversity with a major deep-water fauna composed almost entirely of endemic species. A unique dataset of temperature and current was collected between 2000 and 2012 with moorings installed in the South basin of the lake. Due to its great depth only the top 200 m are experiencing the direct effects of the wind. However, a strong signal in the temperature data is observed around the inertial frequency most of the time and throughout the depth. Here we investigate the particularities of the internal wave spectrum and we focus on the inertial frequency band. Our goal is to evaluate the importance of the internal oscillations to the mixing and to correlate them to external forcing.

Keywords: time-series, internal-waves, wavelet

Soft-bottom communities along a low oxygen gradient in Saanich Inlet

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In situ observations of seafloor communities living at their minimum dissolved oxygen (dO2) limits are urgently needed to determine how ecosystems can respond to hypoxia.

Biological patterns often occur at small spatial and temporal scales, thus fine scale field observations are important in determining organism level responses to hypoxic events.

To determine how animals distribute themselves along changing gradients of low dO2, we repeated a benthic transect line over 4 years using a remotely operated vehicle fitted with high-definition camera systems and a CTD with oxygen probe.

Our preliminary results reveal the lower limitis of dO2 tolerance for several species in Saanich Inlet and show how animal populations will migrate into shallower depths when a shifting floor of severe hypoxia compresses the area of available habitat.

Keywords: hypoxia, benthos, epifauna

Climate-driven changes in plankton trophic dynamics

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Climate impact on the ocean can induce changes in the plankton community, with effects on the ecosystem functioning and services, e.g. fishery. Data from long-term plankton surveys can provide important insights in the above changes, if adequate analytical tools are applied.

In this work, we investigated the changes of the plankton trophic dynamics induced by fluctuations of essential climate variables (ECVs, e.g. wind velocity and sea surface temperature) in the western English Channel. Decadal time series of phytoplankton and upper trophic taxa, sampled weekly by the Western Channel Observatory, were decomposed in their long-term and seasonal components, by using Dynamic Harmonic Regression (DHR) models and a Kalman filtering algorithm.

The results show that the interannual fluctuations of the ECVs impacted the whole planktonic structure in the last decade, inducing significative changes in the biomass of phytoplankton taxa, microzooplankton and macrozooplankton abundance and production, with effects up to the level of fish larvae.

Crucially, the correlation analysis among the long-term components of the time series indicated that the changes in the ECVs impacted also the trophic relationships between the primary and secondary producers.

This work points out the relevance of plankton survey and sound modelling to investigate the functioning and trends of planktonic ecosystems in the context of global changes.

Keywords: essential climate variables, plankton trophic dynamics, Western Channel Observatory.

Improving the accuracy of earthquake locations using Ocean Bottom Seismometers in the immediate vicinity of the North Anatolian Fault in the western and central parts of the Sea of Marmara

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The Marmara Sea is located between the Agean Sea and the Black Sea, along the North Anatolian strike-slip fault, which experienced a sixty year sequence of earthquakes since 1940, propagating to the west towards Istanbul. Prior to this sequence, which ended with the Izmit and Duzce earthquakes in 1999, at the eastern end of the SoM, the fault ruptured to the west in 1912 in Ganos, with an estimated moment magnitude of 7.4. Therefore, a major earthquake is expected within the Sea of Marmara seismic gap.

In order to better understand the seismicity and to reduce the threshold of detection, a network of ten OBS with four components was deployed by Ifremer with R/V Yunuz of Istanbul Technical University, in the western and central parts of the Marmara Sea to record the micro-seismicity from the immediate vicinity of the Main Marmara Fault, between april and august, 2011. The network was specifically designed to survey the segments crossing the Western High, where gas hydrates

where recently found, the Central Basin and the Kumburgaz Basin. During this period more than one hundred earthquakes were detected by the CSEM (European-Mediterranean Seismological Centre) in the Sea of Marmara.

Because the basins of the Sea of Marmara are filled with more than 5 km of Plio- Quaternary soft ("slow") sediments, it is of critical importance to take into account the velocity structure of the offshore domain, which is drastically different from the one onshore. To improve the localization of seismic events, a 3D velocity model was thus considered and implemented in the Sytmis® software developed by INERIS. This model is based on the tomographic data collected in 2001 using a controlled source experiment and on the numerous multichannel seismic profiles that provide information on, respectively, the deeper structures and the upper, sedimentary layers.

Preliminary results are presented. Special focus will be given on : i) the depth of the events below the Western High, where the NAF is known to intersect a gas reservoir ; ii) on the clustering of the micro-seismicity at both extremities of the Central Basin. As a perspective to future work, an attempt will be made to improve earthquake locations using the dataset from the permanent, cabled, Ocean Bottom Broad-Band Seismometers network operated by KOERI.

Keywords: Seismicity, OBS, Marmara Sea

A glimpse of the day to day of a hydrothermal faunal assemblage in the Atlantic

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Since the discovery of hydrothermal vents in 1976, our understanding of the hydrothermal faunal assemblages is growing, however, their functional ecology and temporal dynamics remain less clear. Many critical features of these rapidly evolving systems can only be discovered and understood through time-series observations. Several ecological time-series studies in the Pacific and Atlantic Oceans have already been carried out but they are - at best - based on yearly visits.

While the use of time-lapse cameras at hydrothermal vents has already demonstrated that sub-annual processes, such as diurnal or semi-diurnal periodicities, also play a role in shaping hydrothermal vent communities and influencing their dynamics. Since a couple of years, the scientific community has been rooting for the development of novel techniques and approaches for studying the temporal aspects of biotic and abiotic variables in deep-sea ecosystems both in real-time and over longer time-scales.

An autonomous deep-sea observatory is currently up and running in the Atlantic Ocean (MoMAR at the Lucky Strike on the Mid-Atlantic Ridge (MAR) at 1700m depth) of which the ecological module (TEMPO) focuses on a Bathymodiolus azoricus hydrothermal vent faunal assemblage. Its first deployment took place in 2006 for which the data available comprises 45 days of video imagery (recording ca. 4 minutes/day), along with 4.5 months of total dissolved iron (Fe) data and 18 months of temperature. First results and ecological interpretations are revealed, while periodicities and rhythms in environmental variables are unravelled.

Keywords: autonomous deep-sea observatory, faunal dynamics, hydrothermal vents, numerical ecology

Times-series analysis in addition to novel techniques of passive acoustic detection and wave buoy measurements of wave breaking process.

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Wave breaking is one of the main processes taken into account in the modelling of wind waves. In the present study an insight into the process of wave breaking was achieved by applying acoustic techniques. The studies are based on the analysis of the noise generated by acoustically - active bubbles produced by breaking waves. The noise was recorded by a system of hydrophones located under the sea surface. Simultaneously, the free surface elevation was measured by wave buoys. The combination of the recorded signals was applied to analyze the wave breaking processes in the time domain for different storm wave parameters. The analysis enabled us to identify wave breaking events for individual waves as well as the intensity of wave breaking processes. Moreover, the applied analysis enabled us to determine the direction and speed of breaking waves as well as the duration of wave breaking events.

Keywords: time-series, wave breaking, acoustics

The Late-Devonian (~370 Ma) climate response to astronomical forcing

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Only few general circulation models have been used to simulate the extreme greenhouse climate of the Late-Devonian, and knowledge on its dynamics comes almost exclusively from geological proxy-data. Given that these data sources are fragmentary, the understanding of Devonian climates is limited. Nonetheless, the Late-Devonian is a key-period in the evolution of life: land plants invaded the continents, fish evolved to amphibians, extinction events, etc. To better understand the functioning of the climate system during this key-period, we applied the HadSM3 climate-model.

We simulated Late-Devonian climates by prescribing palaeogeography, vegetation distribution and pCO2-concentration. Different experiments were carried out under 27 combinations of eccentricity, obliquity and precession. First results suggest that the climate at the palaeogeographical position of western and central Europe (~10°S) is highly susceptible for changes in precession. Precession maxima climates are wetter and colder (up to 300 mm/month and 9°C) compared to precession minima climates. Obliquity does not influence strongly this (sub)tropical climate. The imprint of obliquity on polar climates is extensive (up to 6°C).

This work can be considered the first quantitative understanding of palaeoclimatic response to astronomical forcing during the Devonian. Therefore, it offers a crucial framework to correctly interpret time-series analyses on geological palaeoclimatic proxy-records.

Keywords: Late-Devonian, astronomical forcing, climate simulation

Analysis of high frequency monitoring biogeochemical time series in the coastal waters of the eastern english channel

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We considerate here automatic high frequency measurements of biogeochemical properties of sea water in the Eastern English Channel (Boulogne-sur-mer). This system, operated by Ifremer and belonging to the MAREL network of automatic measurements in littoral waters, records every 20 minutes about 15 parameters (including temperature, salinity, pH, dissolved oxygen, nutrients, and in vivo fluorescence) since 2004.

Such time series possess tens of thousands of data; for the analysis we use several methods coming from the fields of statistical physics and turbulence: probability density function analysis, structure functions analysis, fourier power spectra. We also consider the dynamics of stochiometric ratio such as N/P. We particularly focus on extreme dynamics.

The objectives here is to better understand the high frequency and also multi-scale dynamics of biogeochemical parameters and especially phytoplankton communities.

Keywords: high frequency; coastal waters; multi-scale; multi-scale; extremes

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Mertz polynya sea-ice variability over 1979-2009 and its links to the surface atmosphere

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Antarctic sea ice concentration based on passive microwave observations for the period 1979-2009 were analysed to examine the effects of atmospheric forcing. We were especially interested in thestudy of the Antarctic sea-ice dynamic in coastal polynyas, areas of open water within pack ice. Local sea-ice thickness has been estimated in the Mertz polynya, one of the main sea-ice formation areas in east Antarctica and, as such, an important ?biological hotspot? of the Antarctic and Southern Ocean ecosystem. This study of the polynya sensitivity to atmospheric forcing (air temperature, air pressure, wind speed, wind direction etc.) has helped us to determine, with a very fine spatial resolution, the rate of ice growth in winter and the processes occurring as the ice forms. This information will help us track how rapidly climate is changing and help us improve our understanding of the importance of sea-ice for the Southern ecosystem.

Keywords: long-term time series, sea-ice formation, atmospheric forcing

Air-sea interaction patterns and time scales within the southeastern Bay of Biscay

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The understanding of air-sea interaction patterns and time-scales is of prime importance for forecasting changes in the climate, oceanic circulation and ecosystems in general. The air-sea interaction patterns are complex: they have a variety of time-scales and amplitudes and occur simultaneously. Further, the degree to which the Atmosphere and Ocean are coupled varies spatially, from coastal to oceanic environments. In the present investigation, the wind forced currents on the sea surface are investigated with special attention. The contribution of the wind to the current fluctuations occurs over a wide range of frequencies (inertial, diurnal, synoptic, seasonal, etc.). Additionally, the wind-current interaction patterns together with the time-scales involved vary from coastal areas to deep sea. In this context, the purpose of the present study is to describe and determine quantitatively the wind-current interaction patterns and time scales within the southeastern Bay of Biscay.

Keywords: wind-induced currents, land-sea breezes, Bay of Biscay

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Detection of global warming using satellite records of ocean productivity

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Detecting the climate change signal in satellite records of productivity would imply that ocean primary production has been affected by anthropogenic influences. An approach using optimal fingerprints to detect anthropogenic climate change in ocean colour measurements is demonstrated. The methodology has been applied to detect and attribute greenhouse gas induced climate change in sea-surface temperature records, ocean heat content, atmospheric air temperature etc., but this is the first attempt to apply it to ocean productivity records. Monthly chlorophyll concentration (Chl) from Control (1959-2059) and Historical (1959-2005) forced runs of the Geophysical Fluid Dynamics Laboratory (GFDL) CM 2.1 model were used to derive the pattern of the warming signal. Chl data (1997-2006) from NASA's Ocean Biogeochemical Model were projected onto the warming signal. Here, we test the hypothesis that the observed trends are due to anthropogenic climate change. Our results indicate that the global warming signal is not yet detectable. However, introducing adaptations to the methodology, may allow the fingerprint of global warming to be detected in the satellite ocean colour record.

Keywords: ocean productivity, detection-attribution, climate change

Anthropogenic effects on the Dead Sea atmospheric boundary layer and water body

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Intensive utilization of fresh water from the Dead Sea's water shed has led to decline in the sea level since the middle of XX century with rate about 100 cm/year. Long term Dead Sea monitoring, during this period, has been resulting in unique time series of water body parameters as well as meteorological parameters of atmospheric boundary layer. The time series consist from non-equidistant oceanographic casts in the deepest part of the sea and from regular meteorological observations from an open sea station. All data accumulated in MS ACCESS database allowing effective quality control and statistical analysis. The analysis reviled wealth of knowledge regarding non-stationary variability of the Dead Sea meteorological forcing and hydrological regime.

Significant problems in estimation of interranual variability arise due to changing of sensors. For example accuracy of the relative humidity sensor during 1992-2000 was not satisfied for measurements in arid regions. The problem was discovered only in 2002 when a next generation of humidity sensor was introduced. Some statistical processing and correction were implemented to diminish the non-stationarity in time series generated by technically different sensors.

Keywords: Long term monitoring, interannual variability, thermohaline overturn, Dead Sea.

Analysing long-term fluid pressure data: an example from the SmartPlug borehole observatory

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During the last two decades, borehole observatories or CORKs (Circulating Obviation Retrofit Kits) proved to be reliable systems for monitoring in situ properties like fluid pressure, temperature and/or geochemistry. The scientific outcome is vital, not only for understanding the hydrogeology of the oceanic crust, including the global transport of solutes and heat flow budgets, but also in shedding light on seismogenic processes at convergent margins.

The SmartPlug, which is very simple CORK system, was installed in the Nankai Trough accretionary prism, SE Japan, where it crosscuts a shallow branch of a giant splay fault system that showed co-seismic activity during past earthquakes. The 15-months lasting record was heavily influenced by tidal noise, which was dealt with by two ways: (1) By conducting a fast fourier transformation and by calculating the power spectral density, the so-called ?tidal loading efficiency? was obtained, i.e. the total fraction of a pressure change caused by tidal signals which is elastically taken up by the fluid. The tidal loading efficiency was used to infer hydrogeologic and poroelastic properties of the splay fault system, which shed light on its mechanical properties and the possibility of fluid migration. (2) The tidal noise was removed, and after the pressure data was filtered using a butterworth filter, a proper analysis of the time series was possible. By using fluid pressure transients as proxy for strain and combining that with data from local Japanese earthquake catalogues, it was possible to relate pressure anomalies to the occurrence of regional and distant earthquakes, tsunamis and low-pressure weather systems.

The results indicate that no seismo-tectonic event occurred during the monitoring period, and that fluid migration is, based on the present hydrogeologic properties, unlikely. Consequently, previous assumptions that the splay fault might be episodically active only can be supported.

Keywords: in-situ, fluid pressure, tidal loading

Detecting hydrologic seasons in a long term monitoring time series

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Long term monitoring time-series are the key to understanding climate and other anthropogenic changes. The hydrology of Point B in Villefranche's Bay (Southern France) has been monitored weekly since 1952. In 1992, more intense sampling started, a with CTD and fluorometer associated with water samples for oxygen, chlorophyll and nutrients measurement. Here we try to decompose these long series to extract large-scale trends, detect seasonal patterns and study the dynamics of these seasons through time. We focus in particular on the blooming and mixing events. Finally, we start to relate those patterns to the zooplankton series, which are collected with the same frequency at this location.

Keywords: monitoring, season, decomposition

Data assimilation in the flood forecasting model for Saint-Petersburg

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For several centuries, floods were a threat for many European centers such as London, Amsterdam, Saint-Petersburg. Nowadays, special complexes are developed and continuously improved to protect high population cities from economic and cultural damage, which could cause by flood. To protect Saint-Petersburg from destruction a dike, which separates Neva Bay from the Gulf of Finland, was built.

High water level are almost always meteorologically induced water level disturbances that originate in the western and central Baltic Sea, which then propagate and intensify going eastward, leading to increased level in Saint-Petersburg.

To predict extremely level rising a mathematical model based on shallow water equations is taken. This model performs only synoptic component of oscillation (long-term oscillations are not produced at all). To account for so-called background level additional procedure is need to be applied in a couple with hydrodynamic model. For this aim and for enhance the forecasting accuracy applied the assimilation of measured water level in the model. The difference between the modeled and observed water level at a station in the model is used to adjust model results in the neighborhood of that station. Optimal interpolation and Kalman filtering are the relevant approaches to data assimilation and used before operating the barrier's gates.

Keywords: flood forecasting, data assimilation, dike

Numerical modeling of wind waves in the Western Crimea coastal zone, Black Sea.

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A paper presents results of numerical modeling for waves near the Western Crimea coast, Black
Sea. By using a well-developed wave transformation routine (SWAN) the wave heights, periods
and directions were estimated over a low resolution (4,5 km), coarse grid that includes the Sea of
Azov and Black Sea regions and high resolution (600 m), nested grid that covers the Western
Crimea shelf. Moreover this numerical calculations were fulfilled with the results of re-analysis data
from JRA project, Japan Meteorological Agency. As a result the Regional Wave Climate were
obtained for 32-year peripd (1978-2010). For four test locations near the shore statistical
characteristics of waves were examined and compared with the in situ data from on shore
hydrometeorological stations. Notably, our results show good correlation. Furthermore method of
annual maxima, based on the Gumbel integral distribution function was used to analyze an extreme
wave heights. It was revealed that extremely height waves occuring once in a 100 years near the
Western Crimea coast can reach up to eight meters.

Keywords: Regional Wave Climate, numerical modeling, coastal zone.

Sverdrup transport temporal and spatial variability in North Atlantic based on NOC1.1 dataset.

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The North Atlantic Ocean is the most completely observed and extensively studied among other
oceans, but as a dynamic system interacting with atmosphere and affecting surrounding territories it
remains significant for scientists to analyze. In order to understand multi-decadal variability of the
Sverdrup transport (meridional transport estimated from the wind stress curl) a continuous time-
series need to be examined. NOC1.1 flux climatology (Southampton, UK) is the most realistic and
freely available meteorological dataset existing nowadays. It contains monthly components of zonal
and meridional wind stress for World Ocean with $1\times1°$ spatial resolution from 1980 to 2005 year.
Curl of wind stress and then integrated Sverdrup transport were estimated for every month in the
area of Atlantic Ocean within 35S-70N based on the dataset. Revealed that maximum average
yearly Sverdrup transport in North Atlantic is 24.3 Sv (1Sv=106m3/s) at 33N, this value is
consistent with other authors estimates for different time-series. Moreover a comparison analysis
between integrated Sverdrup transport and Florida Current transport (AOML NOAA project) in
vicinity of 27N indicated that average annual barotropic mass transport can determine average
annual Florida Current transport by almost 70%. Presumably rest is determined by thermohaline
component.

Keywords: NOC1.1dataset, Sverdrup transport, North Atlantic.

Construction of a realistic wave climate from swell systems statistics

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Design of a marine structure requires to characterize all sea states that will occur during its service life, whatever complex they may be when they are represented by their decomposition into wave systems. The objective of this study is to propose a methodology that can be used to construct accurately realistic wave climate histories for any desired duration, in typical West Africa conditions. We based our method on the modeling of wave systems in correspondance with the storms that are at their source and that can be identified from the history of environmental parameters of the sea states. A parametric definition of a storm event was first built by modeling the temporal variation of the parameters of swell systems, then statistical study of the model parameters was carried out. Sea states are simulated by combining swell systems, the parameters of which are generated randomly according to their empirical distributions. Swell events could be assembled into realistic simulated sea states, yet it will require additional assumptions on how the events occur in order to build reliable combined sea states for practical use in fatigue design.

Keywords: wave climate, sea states, fatigue design.

Times-series analysis for study ecological trends in Portuguese fisheries over the last 60th years.

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To date, few studies have addressed the aggregate effects of oceanographic and hydrological factors on trends in Portuguese fishery resources. Climate changes affect marine ecosystems and the survival, growth, reproduction and distribution of species, and consequently also fisheries of commercial species. The combined analysis of long-term trends in fisheries and environmental variables may shed light on factors influencing particular species or functional groups and provide a basis for improved assessment and management. In pursuit of this, we compile and review information regarding Portuguese time-series landings over last 60 years. Dynamic factorial analysis were used both as exploratory techniques and analysis techniques to understand the role of climate changes impact (NAO, SSt etc) on landings time series. The results are herein discussed.

Keywords: time-series, multivariate exploratory techniques; dynamic factorial analysis; fishing trends

Time series analysis for tide-surge overlapping. A critical analysis to understand the water exchange of a non-tidal coastal lagoon in the SW Mediterranean Sea.

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Tide analysis is a widely used technique to identify amplitude and phase of tide components in order to understand sea level elevation processes in the coastal ocean. However, in areas in which surge episodes or meteorological phenomena show same or similar frequencies to the tide, it can be quite difficult to perform a tide analysis properly. The aim of this poster is to show different techniques applied to tide analysis of a yearly sea level record of the Mar Menor coastal lagoon (South-Western Mediterranean Sea, Spain). In this area surge episodes and meteorological phenomenon with frequencies close to the S2 and K1 tide component have been found. Some of the techniques applied to discriminate tide and surge signals comprise : 1) different atmospheric data correction, 2) low-pass data filter, 3) spectral analysis and 4) modeling simulations forced by astronomical tide components only, atmospheric forcing only and both together. The Mar Menor is one of the largest European coastal lagoons and is connected to the Mediterranean Sea by three shallow channels. The water exchange between the lagoon and Mediterranean Sea is affected by centimeters changes in the Mediterranean Sea level due to overlapping of surge and tide phase, therefore it is critical to identify those signals by proper use of time series analysis.

Keywords: time-series, tide phase, surge, Mar Menor

Time-series analysis of the CO2 system in the English Channel/North Atlantic continental shelf using pCO2 sensors on fixed buoys and Voluntary Observing Ships (VOS)

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The raise of atmospheric CO_2 due to anthropogenic activities is a major driver of the climate change and the ocean plays a key role in the uptake of this CO_2. The contribution of open ocean to this uptake is presently rather well quantified. The role of coastal ocean to this process remains ambiguous due to the diversity and the high spatio-temporal variability of air-sea CO_2 fluxes in these ecosystems. Time-series analysis of the carbonate system at fixed stations or using Voluntary Observing Ship (VOS) is a novel way to investigate the variability of these fluxes. In particular, the high frequency allows quantifying the partial pressure of CO_2 (pCO_2) from diurnal to inter-annual time scales.

In the CHANNEL project, we investigate the air-sea CO_2 fluxes variability based on high-frequency signals from 2 fixed stations (MAREL in the bay of Brest and ASTAN off Roscoff) and 1 VOS line, which crosses daily the English Channel. These datasets allow us to get a large spatio-temporal coverage of the pCO_2 variability in these systems. We will present the first results obtained with these sensors and discuss the benefits of high-frequency measurements to better understand the CO_2 system dynamic in coastal ecosystems under climate change.

Keywords: Time-series, High-frequency, CO2

How to analyse bioluminescence time series from the ANTARES in situ observatory ?

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Sampling, quantifying and observing marine bioluminescence in the natural environment is currently done using manned submersibles or autonomous underwater vehicles. The recent use of in situ sensor technology such as undersea observatories provides new insights. We use data from the ANTARES neutrino telescope, located 40 km off the French Mediterranean coast at 2475 m depth. This structure is mainly dedicated to the search of

the Cherenkov light emission indirectly produced by neutrinos interactions. However, this deep observatory also provides a huge amount of real-time data at high frequency, of in situ bioluminescence, coupled with oceanographic data. Only two mathematical methods are existing to explore these particular data defined as non-stationary and non-linear. The wavelet and the Hilbert-Huang methods are dedicated to analyse fluctuations at various scales of time and frequencies. Both methods decompose time series into bases of functions dedicated to specific frequencies. In this study, several long time series between the end of 2007 and the middle of 2010 have been analysed providing informations on links between the biological variable bioluminescence and oceanographic ones. These relations are characterized using common frequencies excited in the signals and time where they are excited. These analyses are the first innovative step to propose the use of bioluminescence activity records by Eulerian observatories as a proxy of biological activity in the deep sea. In a final aim bioluminescence sensors would be a new way to provide informations of ecological global changes taking place in the deep ecosystems.

Keywords: observatories, non-stationarity, time-frequency

Variations in Air and Sea Surface Temperature at the Commodore channel and Victoria Beach, Lagos Nigeria.

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Variations in Air and Sea Surface Temperature at the Commodore Channel and Victoria Beach, Lagos Nigeria was carried out between January 2004 and December 2010. Sampling was carried out twice daily at 9am and 2pm. Air temperature was measured with the aid of mercury in glass thermometer; sea surface temperature was measured with the aid of mercury in glass thermometer placed in a temperature bottle. Results show that the highest and lowest air temperature recorded at the Victoria Beach over the sampling period was 31.42°C ± 0.86 and 24.83°C in January2004 and August 2009 respectively. Sea surface temperature recorded at the Victoria Beach showed that the highest reading was 32.51°C± 1.09 in January 2006 and the lowest temperature was 25.39°C in August 2009. Temperature readings at the Commodore channel varied over the sampling period. The highest air temperature readings recorded was 32.06°C± 1.68in August 2006 and the lowest temperature was recorded in August 2005 with a value of 25.93°C± 1.94. Sea surface temperature at the Commodore channel showed that August 2006 had the highest temperature with a value of 33.14°C± 1.66, while the lowest temperature was 26.01°C, recorded in August 2009.

Keywords: Air Temperature, Sea surface Temperature, Victoria Beach

Analysis of Håkon Mosby Mud Volcano seismic data

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Håkon Mosby Mud Volcano, located at around 1250 m deep on the SW Barents Sea slope between Norway and Svalbard, has been the object of intensive study since its discovery in 1990's. It has a diameter of about one kilometer and rises a few meters above the seafloor. Methane seeps, mud flows and high temperature creates suitable conditions for extensive microbial communities. Within the LOOME project a variety of sensors monitoring hydrological, geochemical and biological parameters were deployed in the area. Institute of Geology, University of Tromsø, using long term ocean-bottom seismic station has acquired continuous two years seismic records of vertical and both horizontal components of motion which enabled to record P and S seismic waves. Considerable activity of mud volcano is the source of seismic waves propagating to surroundings. Analysis of seismic records showed that there are two types of events. Irregular occurrences of local tremors are probably caused by sudden stress release in the area. Regularly occurring events with distinct frequency peaks at 4 and 8 Hz presumable correspond to the mud flows. Based on the analysis of time record envelopes we determined the increase of activity of these events with period of about 12-14 hours.

Using SARIMA models to assess data-poor fisheries

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Research on assessment and monitoring methods has primarily focused on fisheries with long multivariate data sets. Less research exists on methods applicable to data-poor fisheries with univariate data sets with a small sample size. We examine the capabilities of (seasonal) autoregressive integrated moving average ((S)ARIMA) models to fit, forecast, and monitor the landings of such data-poor fisheries. We use several Portuguese fisheries where analytical assessments are not carried out and where only short time series of landings are available to model as our case-studies. We show that despite the limited sample size, (S)ARIMA models can be found that adequately fit and forecast the time series of landings. We show how (S)ARIMA models can be integrated in a statistical process control framework and generate model-based prediction intervals that can be used as alarm thresholds in detecting problematic situations in data-poor fisheries. We discuss the information that (S)ARIMA model structure conveys on the species life-cycles, the methodological requirements of (S)ARIMA forecasting of data-poor fisheries landings, and the capabilities (S)ARIMA models present within current efforts to monitor the world's data-poorest resources.

Multi-annual Analysis of the Waves Time-series for Marine Regime Characterization in the Danube Delta Area

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Experimental researches, multi and inter-disciplinary, related to the marine and coastal hydrodynamics, as well as to the shore response and development in the fronts of big river mouths, were become more and more important in the last decades.

The present work emphasize the results of the coastal hydrodynamics processes induced in front of Danube River Delta, mainly affecting the safe navigation, but also human activities, in relation with sediment unbalanced situations and management at regional scale. The work is extended based on the analysis of multiannual wave data recorded within the hydrological monitoring of several coastal hydro-metric stations, in parallel with several hydro-graphic and geomorphological survey.

It is described, on short and medium term, the evolutions of the main hydrodynamic parameters in the adjacent areas of the Danube River mouths and its influence of the navigation accidents. The measured hydrodynamics parameters, where studied on its seasonal/annual and multi-annual variability, but also for certain violent hydrological events in the Romanian coastal zone.

Keywords: marine hydrological times-series, waves/currents analysis, coastal hydrodynamics processes

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Analysis of freak wave measurements in the Baltic Sea

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Within past years numerous cases of large vessels accidents and offshore structures failures have been reported. In many of them the cause of the accident is believed to be individual waves of exceptional wave height or of abnormal shape. These unique and rare phenomena are called freak waves. They pose serious threats to large vessels as well as smaller ships. Such waves deviate strongly in shape or in height from the average sea state, described by the usual integral parameters of significant wave height and peak period. The analysis of a unique set of wave data comprising 20000 wave records from the Baltic Sea disclosed a large number of freak-type waves. In this work a statistical analysis of time series of free-surface elevation recorded by Waverider buoys in the southern Baltic Sea is performed. The analysis focuses on individual extreme waves and wave events. It includes a wide range of aspects related with individual extreme waves to collect as much information as possible on their occurrence and features of extreme waves, and eventually to provide a contribution to a future warning system. The conducted analysis revealed novel and often surprising results of significant importance for scientists and engineers.

Keywords: freak waves, time-series, buoy measurements

Analysis of a high frequency time series of bio-optical properties in complex coastal waters: couplings with turbulence

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This poster describes physical processes (mainly the turbulence and re-suspension of particles due to turbulence) which control the micro scale variability of the bio-optical properties in highly turbid coastal waters. We analyse the variability of the bio-optical properties and their dynamics according to the re-suspension of particles. For this, time series analyses of different bio-optical and physical properties (like current velocity) have been performed from moored stations in coastal waters in the Eastern English Channel. The data bases considered are high frequency (1 Hz) simultaneous measurements during several days in a fixed point in the highly turbid coastal waters of the English Channel. We consider optical, dynamical and biogeochemical properties recorded using different instruments. We mainly focus on the absorption, back scattering, attenuation, turbidity, particle concentration in different size classes, velocity series. For each parameter we consider the statistics (mean values, probability density functions) and the dynamics (Fourier power spectra, structure function analysis) and we also consider cross-correlations between attenuation and turbidity signals, and between particle concentration and turbulence.

Keywords: Bio-Optical Properties, Turbulence, Intermittency

Environment variation related to jumbo squid Dosidicus gigas and short-finned squid Illex argentinus

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Environment variation has been the main factor related to natural populations in the ocean and its influence has modified the availability of fishery resources like sardine and mackerel fish in the Pacific Ocean. The effects of this variation can be measured using time series analysis and the corresponding correlation factor with biomass estimates of the natural resources. This is the principal method applied to understand the dynamic of jumbo squid and the short-finned squid populations in the Pacific Ocean and the Southern Atlantic Ocean. An apparently correlation was observed between the biomass estimates and the chlorophyll and zooplankton anomalies that can explain the changes in abundance and distribution of these squids.

Keywords: Dosidicus gigas and Illex argentinus abundance, climate variation

Community succession via time-series analysis in hydrothermal vent habitats of the Eastern Lau Spreading Center, Tonga

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Deep-sea hydrothermal vent communities of the Western Pacific are dominated by mobile mollusks that harbor chemoautotrophic symbionts. These communities are targeted for mining of polymetallic sulfide deposits, and understanding how these communities change naturally over time will be critical to formulating environmental impact assessment policies and interpretation of post impact studies. We analyzed high-resolution photo-mosaics and spatially explicit in-situ physico-chemical measurements within a Geographic Information System (GIS) to characterize changes in community composition and localized environmental conditions for 7 lava sites and 8 chimney sites in the Eastern Lau Spreading Center (ELSC) over 3 years or 4 years. This has enabled us to test our hypotheses addressing the roles of various groups as pioneering, intermediate or climax species, and their interactions with each other and changing vent conditions. We have discovered that the ELSC fauna responds to changes in subsurface fluid patterns and move to maintain fidelity to a defined range of environmental conditions. The responses of ELSC megafauna to changing local conditions may help explain the rarity of sessile symbiont containing groups on the ELSC, such as those that can dominate at Eastern Pacific hydrothermal vents.

Keywords: time-series, succession, hydrothermal vents

HF radar observations of surface currents in the SE Bay of Biscay

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A CODAR Seasonde High Frequency (HF) radar system is operational since the beginning of 2009 for the oceanic region of the Basque Country (southeastern Bay of Biscay). It forms part of the Basque operational data acquisition system, established by the Directorate of Emergency Attention and Meteorology of the Basque Government. It is made up of two antennas, at the capes Higer and Matxitxako. This system provides hourly surface currents within a 6 km spatial resolution regular grid, covering 10,000 km2. The HF radar technology offers many benefits in several fields as: scientific research on surface currents and oceanic physical processes, security at navigation and maritime rescue, validation and calibration of hydrodynamic and pollutant drift models, etc.

This data, together with those obtained with similar systems developed by other institutions, will permit in the near future to improve the current knowledge about the surface circulation patterns both in the study area.

In this context, the aim of this work is to show the HF radar system of the Basque Country main characteristics and its ability to describe accurately surface circulation at different time scales in the southeastern Bay of Biscay. Monthly and seasonal surface circulation patterns are analysed and described for the period 2009-2011.

Keywords: High Frecuency Radar, surface currents, Bay of Biscay.

Tidally-mediated bloom initiation in a nearshore embayment resolved from a high resolution time-series.

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Blooms of microalgae are a common occurrence in many coastal ecosystems, with a range of effects on marine food webs. Documentation of blooms and their causative environmental factors has typically relied on low temporally-resolved datasets and linear statistical techniques, focusing mainly on climatological trends over long time-series. In the present study, microalgal bloom dynamics within a nearshore, semi-enclosed embayment in southern California, USA, were found to be significantly correlated with the tidal cycle. Wavelet coherence revealed significant decoupling of the semi-diurnal tidal harmonic from chlorophyll fluorescence during periods of bloom initiation, and regression analyses confirmed that up to 24% of variation in algal biomass was explained by tidal amplitude. The tide-biomass relationship was largely explained by initiation of bloom events during or immediately following neap tide and was stronger in the more hydrodynamically-constrained area of the harbor. Neap tides provided « windows of opportunity » for increased phytoplankton growth and retention, and 2- and 7-day histories of dissolved nitrate and salinity were significant predictors of biomass. The current study underscores the role for the tidal cycle in initiation of microalgal blooms and emphasizes the need for high temporal resolution and analyses of local processes to understand episodic bloom dynamics in coastal environments.

Keywords: Algal blooms, wavelet coherence, tidal forcing.

Automated analysis in tuna long-range sonar signals for fishing vessels.

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This study presents a new methodology for automated analysis in tuna long-range sonar signals. This approach attempts to solve the problem of sonar image processing. The study is focused at Albacore (Thunnus alalunga) and Buelfin (Tunnus thynnus) Tuna of the Bay of Biscay. With this process, for each sonar image we obtain measurable regions to analyze, each region is described by a set of characteristics. By the help of expert judgment each region is identified into a class attribute and a database is created for supervised learning. Thus, a classification model is performed. The final aim of this process is to maximize the estimation of tuna in regard to the real values, and to propose a new index of abundance, based on the automatic estimation of sonar images.

Keywords: Sonar image analysis, Supervised classification, Tuna stock estimation.