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Authors	C. Despinoy, I. Puillat (Ifremer)
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Abstract 1. From Physics to Fish: The COSYNA cabled underwater observatory in the North Sea

Möller, K.O. (HZG), Fischer, P. (AWI)
klas.moeller@hzg.de

Climate change and increasing human activities are identified as two major stressors increasingly affecting the integrity of coastal marine ecosystems worldwide. Even though there are numerous studies and methods to evaluate the status of single components of coastal ecosystems, there is still a crucial lack in assessing multiple ecosystem components in a holistic way at appropriate scales. While hydrographic variables have been increasingly monitored in selected areas of the world with higher temporal and spatial resolution over the last decades, there is almost no non-destructive monitoring in sufficient temporal resolution of the biological community like the zooplankton, the jellyfish or the fish community – even though these trophic levels are sensitive indicator to environmental changes. We here present a cabled underwater observatory approach which has been deployed in the German Bight in 2012 (Southern North Sea), and which was successively upgraded in a higher trophic monitoring station. The COSYNA cabled underwater observatory combines two remote-controlled underwater imaging systems (a Video Plankton Recorder and an optical macrocrustacean, jellyfish and fish observatory - called RemOs), two Acoustic Doppler Current Profilers and a variety of hydrographic sensors, allowing continuous and automatic small-scale observations in near real-time of high resolution data from hydrography up to zooplankton and fish. This observatory is part of the Coastal Observing System for Northern and Arctic Seas (COSYNA) providing a unique dataset in combination with a suite of other sensor platforms including e.g. FerryBoxes, Research vessels, Gliders, HF-Radar, remote sensing as well as modeling. The observatory is located in close vicinity to the Helgoland Road time series station allowing comparisons, ground truthing and combination of modern optical and traditional plankton sampling methods. Our integrative monitoring approach is bridging the gap between physics, primary production and higher trophic levels, helps to identify and track rapidly occurring environmental changes and thereby provides a potential tool for integrated ecosystem assessment and management within the marine strategy framework directive.

Abstract 2. Spatiotemporal changes in surface sediment characteristics, benthic macrofauna composition and sediment profile images in the West Gironde Mud Patch (Bay of Biscay, SW France)

Lamarque B (UB), Grémare A (UB), Lavesque N (CNRS), Romero-Ramirez A (UB), Bernard G (CNRS), Poirier D (UB), Schmidt S (CNRS), Deflandre B (UB)
bastien.lamarque@u-bordeaux.fr

The West Gironde Mud Patch (WGMP) is a muddy belt surrounded by sands located 25 km off the mouth of the Gironde Estuary in the Bay of Biscay. WGMP is the primary depository of the sediment particles originating from the Gironde Estuary. It is considered as a typical mobile mudbelt where sedimentation and resuspension both contribute to control the structuration and the functioning of benthic ecosystems. Surface sediment characteristics, benthic macrofauna composition and sediment profile images characteristics were assessed in October-November 2016 at 8 stations (30-75 m in depth) located along 2 inshore-offshore transects (JERICObent-1 cruise; EU/JERICO-Next program). The so-obtained results were compared with: (1) the spatial mapping of the WGMP recently proposed by Cirac *et al*. (2016), and (2) comparable data collected in July 2010 at only 3 stations by Massé *et al.* (2016). Our results clearly showed major changes in the external delimitation of the WGMP in comparison to the 2 above mentioned studies, which highlighted the need for the establishment of a synoptic map of the WGMP. For most assessed parameters, they were clear inshore-offshore gradients. Except for the 2 shallowest stations, which were characterized by the presence of superficial sands, surface sediments consisted of muds with organic carbon concentrations between 0.6 and 1.5 %DW. Macrofauna compositions also showed discrepancies between the two shallowest stations and the other ones. Macrofauna abundances were between 92 and 941 ind.m^{-2}. They tended to decline offshore together with species richness. Conversely, the number and depth of oxic-voids within the sediment column tended to increase with depth. Overall, there were major differences in macrofauna composition and sediment profile image characteristics, between 2010 and 2016, which were put in relation with an exceptionally energetic 2013-2014 winter.

Abstract 3. **The identity of the JERICO-RI**

Keeble S (BLIT), Keeble K (BLIT), Durand D (COVARTEC), Puillat I (IFREMER), Painting S (CEFAS), Ortiz V (SOCIB), Delauney L (IFREMER), Schmidt A (IFREMER)
simon@bluelobster.co.uk

Defining a solid identity of the JERICO-RI provides trust in a 'brand' and gives credibility to its aims. The identity consists of a strong logo, strapline and a suite of clear and concise key messages that define the JERICO-RI in general, and its importance to the main end user groups. The JERICO-RI identity has been defined through consultation with the project consortium and the project end-user panel using an iterative approach. The project end-user panel comprises 11 experts representing the JERICO-RIs main policy, science and industry user groups. Using a collaborative approach to define the identity is vital to creating a brand that is effective in communicating JERICO-RI and its importance to each user group. A clear and concise identity that is agreed amongst the consortium and expert representatives of the main user groups is also key to creating advocates. These advocates will have the willingness and the ability to promote the JERICO-RI and its products and services to their wider networks in a consistent manner. A comprehensive plan to communicate the key messages and establish them as a standard voice within the community has been developed. The communication strategy will use the JERICO-RI identity presented in a variety of media and graphical products to promote the JERICO-RI products and services to targeted extended communities and networks.

Abstract 4. **Long term Underwater localization in extreme conditions, EvoLUL**

Dr. Eng. Joaquin del Rio (UPC), Eng. Ivan Masmitja (UPC), Dr. Sc. Konstantin Kebkal (EvoLogics), Pierre-Jean Bouvet, Dr. Sc. (ISEN-Brest)
joaquin.del.rio@upc.edu

The project evaluates different underwater acoustic localization tools deployed in shallow waters. The applications cover both: static and moving targets.
A long term deployment experiment was carried out to offer the possibility to ensure robustness of the equipment and quality of the data along time. Variability of the measurements have been studied and correlated with sea conditions since Obsea underwater observatory platform measures waves, currents and water properties.

Abstract 5. **Assimilating Ibiza Channel HF Radar Currents in a High Resolution Model**

Jaime Hernandez-Lasheras, Baptiste Mourre, Emma Reyes, Alejandro Orfila, Joaquín Tintoré
jhernandez@socib.es
bmourre@socib.es

High Frequency radars (HFR) provide continuous and high-resolution surface current measurements in coastal areas, allowing to better understand surface ocean dynamics and providing valuable data to improve numerical model predictions through data assimilation. Since 2012, SOCIB operates two coastal HFR antennas with the purpose of monitoring the surface currents in the Ibiza Channel (Western Mediterranean Sea).Several experiments have been carried out to evaluate the improvement in model forecasts when assimilating HFR measurements in addition to multiplatform
observations from satellite and ARGO floats, with the objective of being able to be implemented in the operational system. A control simulation assimilating multiplatform observations without including HFR velocities allow to characterize the influence of HFR measurements on the forecast performance. Results have been assessed comparing against independent HFR fields and surface drifter.

Abstract 6. **High resolution glider missions to monitor and understand the variability of the circulation & ecosystem response from basin to mesoscale**

Y. Cotroneo[1], G. Aulicino[1,2], S. Ruiz[3], A. Pascual[3], A. Sánchez Román[3], G. Fusco[1,5], M. Torner[4], E. Heslop[4], G. Budillon[1,5] and J. Tintoré[3,4]
1 Università degli Studi di Napoli "Parthenope", Napoli, Italy
2 Università Politecnica delle Marche, Ancona, Italy
3 Instituto Mediterráneo de Estudios Avanzados, IMEDEA(CSIC-UIB), Esporles, Spain
4 Balearic Islands Coastal Observing and Forecasting System (SOCIB), Palma de Mallorca, Spain
5 Consorzio Interuniversitario Nazionale per la Fisica delle Atmosfere e delle Idrosfere, CINFAI, Tolentino (MC), Italy
cotroneo@uniparthenope.it

Since 2014 four deep glider missions were conducted in the Western Mediterranean Sea between the Balearic Islands and the Algerian coast in the framework of the "Algerian BAsin Circulation Unmanned Survey -ABACUS". These missions were carried out through the SOCIB external access program, supported by JERICO and JERICONEXT TNA EU funded framework. The main objective of ABACUS was to establish and understand the high-resolution variability of the circulation collecting physical and biological data of the surface and intermediate water masses across one of the key Mediterranean Sea chokepoints. More specifically ABACUS allowed the realization of several repeated and also the investigation of the dynamics of mesoscale eddies, given the joint use of real time satellite data and the adaptive sampling capabilities of gliders. Glider physical and biological data have been also compared with both remotely sensed data and numerical model output. Additionally, a comparison with historical data collected in the same area has been performed. Results from ABACUS showed that in situ glider data can provide useful information on the internal structure, properties and dynamics of mesoscale features like eddies and filaments that can be barely observed by classical ship-based measurements (Cotroneo et al., JMS, 2016). The high-resolution glider data reveal good correlation with both the altimetry along track data from satellite missions and outputs of several models (Aulicino et al., JMS, 2018). Surface layer data show large amplitudes and gradients, emphasizing the intense dynamic activity in the study area while the variability observed at intermediate depths contributes in describing an increasing trend in both temperature and salinity of the Mediterranean water masses. These results have been discussed in the cited scientific papers and in more than ten presentations at international conferences (i.e.: EGU general assembly, 2016-2018; IUGG general assembly, 2015; IAPSO-IAMAS-IAGA joint assembly, 2017). ABACUS JERICO & JERICONEXT datasets are publicly available through SOCIB and JERICONEXT web sites and have a DOI assigned, https://doi.org/10.25704/b200-3vf5. A major conclusion is that a larger number of glider sections across this basin, extending over the four seasons, are needed to understand the intense spatial and temporal variability of the circulation in this region and its impact on the circulation and ecosystem response in the western Mediterranean; the continuation of the Mallorca-Algeria endurance line through the ABACUS 5 missions planned in 2018/2019 will certainly contribute to this aim.

Abstract 7. **Data completion, characterization of environmental states and dynamics using multiparameter time series: DTWBI, DTWUMI & uHMM R-packages.**

Emilie Poisson Caillault[1], Kelly Grassi[1,2,3], Thi Thu Hong Phan[1,4], Camille Dezecache[1,3], Jean Prygiel[5], and Alain Lefebvre[3]
1 LISIC, EA4491, Université du Littoral Côte d'Opale, France.
2 WeatherForce, France.
3 IFREMER, Laboratoire Environnement et Ressources, Boulogne-sur-mer, France.
4 Vietnam National University of Agriculture (VNUA) - Hanoï, Vietnam.
5 Agence de l'Eau Artois-Picardie, Douai, France.
emilie.caillault@lisic.univ-littoral.fr - Alain.lefebvre@ifremer.fr

Several challenges are associated with using HF collected data and require optimized numeric tools to deal with this amount of information. We present two R packages uHMM and DTWBI/DTWUMI, which enable fast computation for segmentation/classification and prediction of multivariate time series with missing values. The DTWBI/DTWUMI package provides routines for imputing large gaps within time series (univariate/multivariate) based on dynamic time warping methods. Several signal representations are implemented (local derivative: DDTW, adaptive local/global feature: AFDTW) and performance criteria are added to compare similarity between two signals (query and reference).
The uHMM package provides routines and friendly end-user interface for detecting recurrent or extreme events in a multivariate dataset and to characterize their dynamics, by building an unsupervised Hidden Markov Model. It offers many functionalities from the correction and selection of variables to the classification, modeling and prediction of time series. Besides, optimized methods of clustering (fast kmeans, fast spectral clustering) are proposed to deal with HF dataset.
Developed algorithms provide an efficient computational framework for exploiting all available information without any a priori knowledge and undertaking studies from large spatial-temporal scales events (phytoplankton bloom dynamics for example) until extreme events detection (storms, floods). Several numerical examples in climatology, water quality monitoring demonstrate the relevance of the DTWBI/DTWUMI and uHMM packages.

Thi-Thu-Hong Phan, Emilie Poisson Caillault, Alain Lefebvre, André Bigand, Dynamic time warping based imputation for univariate time series data, Pattern Recognition Letters, 2017, ISSN 0167-8655, https://doi.org/10.1016/j.patrec.2017.08.019.
T. T. H. Phan, E. P. Caillault, A. Bigand and A. Lefebvre, "DTW-Approach for uncorrelated multivariate time series imputation," 2017 IEEE 27th International Workshop on Machine Learning for Signal Processing (MLSP), Tokyo, 2017, pp. 1-6. https://doi/10.1109/MLSP.2017.8168165.
K. Rousseeuw, E. Poisson Caillault, A. Lefebvre and D. Hamad, "Hybrid Hidden Markov Model for Marine Environment Monitoring," in IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, vol. 8, no. 1, pp. 204-213, Jan. 2015. https://doi.org/10.1109/JSTARS.2014.2341219.

https://cran.r-project.org/web/packages/uHMM/index.html
https://cran.r-project.org/web/packages/DTWBI/index.html
Key words: multivariate time series, event detection, unsupervised classification, dynamic time warping, missing values, R.

Abstract 8. **Trend analysis (TTA tools) and unsupervised clustering (uHMM tools) to characterise environmental events and their dynamics from low and high Frequency data series.**

Grassi K[1,2], Devreker D.[1], Bigand A.[3], Poisson Caillault E.[3] , Lefebvre A.[1]
1 IFREMER, Laboratoire Environnement et Ressources, Boulogne-sur-Mer, France.
2 Weather Force, Toulouse.
3 LISIC, EA 4491, Université du Littoral Côte d'Opale, Calais, France.
Grassi.Kelly@ifremer.fr
Alain.lefebvre@ifremer.fr

In addition to Low Frequency (LF) conventional monitoring strategies, many fixed or embedded measurement systems (buoys, Ferrybox, …) are now implemented for high frequency (HF) marine water observations and monitoring in contrasted marine environment. They collect a huge amount of data (biological and physical parameters) but few of them are analyzed deeply and modeled to allow an optimized marine water quality and ecological status assessment. A good knowledge of these data is a hard task because of important variability in ecosystem dynamics and the nature of the data (non linearity, missing data, …). These systems should provide more knowledge on, for examples, (i) phytoplankton dynamics changes facing anthropogenic pressures and global change, (ii) direct and indirect effects of phytoplankton blooms, including Harmful Algal Blooms, leading to alteration of ecosystem structure and function, goods and services.
Whereas LF data continue to give up their secrets when using common statistical approaches, HF data are so complex that data processing methodologies need to be developed, adapted and/or optimized.
We proposed two R genuine user interfaces allowing LF and HF scientific communities to process data using best-fitted statistical methodologies. The TTAinterfacelTrendAnalysis package should help to describe the main statistical characteristics of their time series (data summary, autocorrelation, anomalies,…), and also provide trend assessment possibilities using Mann-Kendall family test.
The unsupervised Hidden Markov Model approach (uHMM R-package) allows defining environmental state characteristics based on a spectral clustering from a combination of physico-chemical and biological parameters. Hidden Markov Model is a well-adapted stochastic signal model to represent time series dynamics. It is possible from the environmental state segmentation to build such a model in order to forecast environmental recurring, rare or extreme events.
To improve state characterization and state prediction, semi-supervised machine learning techniques are investigated.

Abstract 9. **Follow the glider: Discover the ocean´s secrets with underwater gliders**

Ortiz V. (SOCIB), Bonilla A. (SOCIB), Rodríguez R. (CSIC), Miralles A. (SOCIB), Fernández J.G. (SOCIB), Ruiz S. (IMEDEA (UIB-CSIC)), Tintoré J. (SOCIB).
vortiz@socib.es

Follow the Glider is an educational tool developed by CEFAS (Centre for Environment, Fisheries & Aquaculture Science), IMEDEA (Mediterranean Institute for Advanced Studies, UIB-CSIC), and SOCIB (Balearic Islands Coastal Observation and Forecasting System) as part of the FP7–JERICO European project, and is based on the glider monitoring tool.
Follow the Glider enables students and teachers to follow the course of ocean gliders in almost real time, examine past missions, understand the data provided by these autonomous underwater vehicles, and recognize the importance of coastal research for developing predictive models and facing phenomena such as climate change.
This project aims to provide teaching materials for students aged 10 to 16 and offer an introduction to coastal and marine research in the Mediterranean Sea.

Abstract 10. **Improving our present understanding of the physical processes and coastal ocean impacts promoted by a long submarine canyon – the Nazare Canyon case.**

Vitorino, João (Instituto Hidrográfico)
joao.vitorino@hidrografico.pt

Submarine canyons are ubiquitous features of continental margins. Long submarine canyons cut a substantial or the totality of the continental shelf and slope they incise and promote important constrains on the oceanographic conditions of the coastal ocean environment with correspondent impacts on the marine ecosystems. The abrupt topography, energetic processes and large geographical area of influence that characterize these canyons render these areas some of the most challenging marine environments to observe or to simulate with numerical models.
The Nazare Canyon (W Portugal) is the largest submarine canyon indenting the Portuguese continental margin and one of the largest of the European margin. It is a long and narrow submarine canyon cutting the complete shelf and slope environment and extending for more than 200km, from abyssal areas deeper than 5000m to just a few hundreds of meter from the beach of Nazare. Since 2002 Instituto Hidrografico conducts a multidisciplinary program of observations aimed to understand the dominant physical, sedimentary and chemical processes that are associated with the Nazare Canyon. In 2009 a permanent monitoring infrastructure – the Nazare Canyon Observarory MONICAN – was implemented and is presently contributing to the JERICO-NEXT network.
In the framework of JERICO-NEXT project, and under the JRAP 6 activity, a high resolution numerical model with data assimilation is being used with the double goal of improving our understanding of the subinertial processes that affect the Nazare Canyon area of influence and to highlight the add-value of several components of the MONICAN observing system to contribute to this improved understanding. Here we present some of the main aspects and results of the ongoing work.

Abstract 11. **The Nazare Canyon Observatory MONICAN (W Portugal) – providing support to local populations and research communities**

Vitorino, J. (IH), Martins,I.(IH), Zacarias,N. (IH), Almeida, S. (IH), Diniz, F. (IH)
joao.vitorino@hidrografico.pt

Instituto Hidrográfico (IH) operates a real-time monitoring system for the Portuguese continental margin which comprises multi-parametric buoys, HF radars, wave buoys and coastal tide gauge stations. Between 2009 and 2011 those capacities were implemented in the area of influence of Nazare Canyon which extends for more than 200km and cuts the complete continental margin offshore the village of Nazare (W Portuguese coast).
Since its implementation the MONICAN systems are providing hourly measurements of waves, meteorological parameters, water temperature, currents in the water column or coastal sea level height that are being used in several research works, master thesis or PhD thesis. But several of its main impacts are felt outside the research community. The implementation of the Nazare Canyon Observatory MONICAN was conducted in partnership with the Nazare City Hall. This allowed a close contact with the local nautical communities, particularly with the fishing community, an essential aspect in the design of products to end-users and in the identification of dissemination channels. This direct communication is playing a key role during periods of extreme weather events or in the articulation with local initiatives aiming the sustainable use of coastal ocean resources.
In 2011 the MONICAN observatory gained worldwide visibility following the successful attempt of the American Garret McNamara to surf the giant waves promoted by the canyon very near the northern shore of Nazaré. Big wave surfers as well as large crowds of visitants and world media are since then attracted to this area, which triggered an explosive increase of tourism in the region. The real-time measurements and forecasts provided by MONICAN become not only an essential infrastructure to support these activities but also by playing the role of an open window over the coastal ocean that meets the public curiosity about Nazare Canyon and boost dissemination and educational activities.

Abstract 12. **The North-Western Mediterranean Sea multiplatform observing system: present applications, incoming advancements, and future perspectives**

Berta M. (CNR-ISMAR), Griffa A. (CNR-ISMAR), Mantovani C. (CNR-ISMAR), Corgnati L. (CNR-ISMAR), Magaldi M. (CNR-ISMAR), Marini S. (CNR-ISMAR), Molcard A. (CNRS-MIO), Quentin C. (CNRS-MIO), Brandini C. (LaMMA), I. Pairaud (IFREMER)
maristella.berta@sp.ismar.cnr.it
annalisa.griffa@sp.ismar.cnr.it

The North-Western Mediterranean Sea is characterized by highly populated coasts, where areas of intense industrial development alternate with touristic and environmental relevant marine protected areas (MPAs). Monitoring and investigating marine currents and the transport of biological and pollutant substances provides the basis for relevant applications for marine blue growth, such as ecosystem and fishery management and navigation safety.
In the framework of JERICO-NEXT, coordinated efforts at international level aim at monitoring and investigating the dynamics in the NW Mediterranean Sea through the combination of independent and complementary observational platforms. High Frequency Radars (HFRs), used to monitor surface currents and transport, are combined with targeted in situ bio-chemical and physical observations.
At present, there are two JERICO-NEXT HFR networks, one in the La Spezia area (CNR-ISMAR) and the other in the Toulon area (CNRS-MIO), even though the complete coverage in the NW Mediterranean Sea includes also two antennas managed by the Regione Toscana-Consorzio LaMMA.
Within JERICO-NEXT, and in collaboration with other ongoing projects, common standards are used for the management and interoperability of HFR data, thus fostering and promoting the use of HFR technology in Europe. HFR validation experiments, performed in collaboration with the international LOGMEC effort, have provided velocity information at the surface from drifters and in the water column from moored and vessel-mounted ADCP. Low-cost thermistor lines (MASTODON-2D) developed by Ifremer were deployed off the Provence coast to investigate upwelling dynamics. Surface and water column datasets show the complexity of the dynamics at seasonal and synoptic scales. A preliminary study aiming at blending velocity data set at the surface with data along the water column is presently under investigation. Synergetic activities within the Interreg project IMPACT are also providing chemical information. Bio-physical applications recently developed combining HFR data with drifter data and otolithes analysis to investigate recruitment of small pelagic in the Adriatic Sea provide guidance for analogous studies in the NW Mediterranean Sea.
The HFR network in the NW Mediterranean Sea will be drastically improved in the next few years as part of two Interreg projects (IMPACT and SICOMAR-PLUS) extending from the Corsica Channel to Toulon by 2021. The new HFR coverage will include also the location of the long-term mooring (active since 1985 in the Corsica Channel) providing water column bio-physical properties.
We envision further developments of the multiplatform observing system in the NW Mediterranean Sea by installing on fixed and drifting platforms automated video monitoring systems capable to disclose remarkable information on biodiversity, non-indigenous and commercial fish species in accordance with the monitoring approach supported by the EC Marine Strategy Framework Directive.
The proposed observing network will be used to monitor sea dynamics, transport of bio-chemical properties (including plastics), as well as species behavior and distribution, therefore providing fundamental information for the management of coastal and marine activities. The multiplatform observing system in the NW Mediterranean Sea, combined with growing centralized frameworks of data management and distribution, i.e. Copernicus Marine Environment Monitoring Service and SeaDataNet/SeaDataCloud, will provide the basis for an extended European coastal infrastructure.

Abstract 13. **Combination of "machine learning" methodologies and automated data acquisition systems for phytoplankton detection and classification**

Wacquet G. (CNRS-LOG), Louchart A. (CNRS-LOG), Blondel C. (Ifremer), Hébert P.-A. (LISIC ULCO), Poisson-Caillault E. (LISIC ULCO), Gomez F. (CNRS-LOG), Lefebvre A. (Ifremer), Grosjean Ph. (UMONS), Artigas L.F. (CNRS-LOG)
Guillaume.Wacquet@univ-littoral.fr

In recent years, improvements in automated data acquisition techniques have been carried out in order to sample, characterize and quantify phytoplankton communities during oceanographic campaigns or in the frame of monitoring networks (at low or high frequency). However, these acquisition and digitization techniques, including those concerning «imaging-in-flow» and «flow cytometry» systems, still generate an important quantity of data which cannot be processed manually. Indeed, a full manual quantification of the particles based on a simple visual inspection can be time-consuming, tedious and consequently lead to erroneous or missing identifications. For this purpose, different dedicated R-packages were and are still being developed to allow greater automation in data analysis and classification while permitting a limited user-interaction during the process. The common methodology consists in combining few expert knowledge and some "machine learning" algorithms at different levels: to classify particles into different groups based on the definition of a specific training set, but also to partially validate the "most suspect" predictions which can represent a consequent fraction of the global error. Moreover, in order to orientate the automated classification and consequently to reduce the global error rate, some interactive tools were developed to adapt the training set to the phytoplankton communities generally encountered in the studied area ("active learning"), or to constraint the algorithms to merge or separate some groups ("constrained clustering"). These different semi-automated analytical tools were applied on different *in vivo* image and signal datasets acquired with the FlowCAM and CytoSense devices respectively, during several cruises in the English Channel, in order to evaluate their operational ability to automatically monitor the diversity of samples. Spatial distributions of the target groups, based on their abundance, were computed and could allow to highlight different sub-regions in the English Channel during the studied periods.

Abstract 14. **Carbon Fluxes and Primary Production in a Shelf Sea from a FerryBox**

Yoana G. Voynova (HZG) and Wilhelm Petersen (HZG)
yoana.voynova@hzg.de

The North Sea, a northern European shelf sea, is a site of efficient pumping of carbon dioxide from the atmosphere to the North Atlantic Ocean. The carbonate system variability in this region necessitates high-frequency measurements of carbonate parameters like pH and pCO_2. FerryBoxes have been successfully used over the past 5+ years to continuously measure these parameters along large sections of the North Sea. Now, these datasets are providing a detailed picture of the carbon dynamics in surface waters in the central and south regions of the North Sea. Weekly surface water measurements between England, Norway and Belgium have been combined with dissolved oxygen measurements to quantify carbon dynamics in surface waters, and also to derive 5+ year time series of primary production estimates. Seasonal patterns of delta pCO2 in specific regions such as the shallow Dogger Bank and the seasonally stratified southern-central regions of the North Sea have been shown to differ, thus influencing the efficiency of the carbon pump in these regions.

Abstract 15. **Addressing the timing and extension of phytoplankton bloom through the eastern Channel - southern North Sea continuum in spring: an automated approach.**

Arnaud Louchart (CNRS-LOG), Reinhoud de Blok (U. Ghent), Elisabeth Debusschere (VLIZ), Alain Lefebvre (IFREMER), Fabrice Lizon (CNRS-LOG), Jonas Mortelmans (VLIZ), Machteld Rijkeboer (RWS), Klaas Deneudt (VLIZ), Arnold Veen (RWS), Luis Felipe Artigas (CNRS-LOG)
arnaud.louchart@etu.univ-littoral.fr

The eastern Channel and southern North Sea are continuously influenced by the Atlantic waters and freshwaters inputs, as well as by tidal fronts. At the French coast, brackish waters from estuaries are driven from the Channel to the North Sea by the residual tidal current creating a “coastal flow”. It leads to a Region of Freshwater Influence (ROFI) that flows from the Bay of Seine to the Scheldt and Rhine estuaries, supplementing and maintaining a high nutrient concentration along the French, Belgian and Dutch coast.
During recent years, semi-automated techniques were applied in these areas at a high resolution to highlight spatial and temporal patterns in phytoplankton successions and outbursts. They provide rapid estimates of abundance and chlorophyll *a* content for the whole community, at the single-cell or colony level, from small picoeukaryotes up to large microphytoplankton.
The timing and extension of phytoplankton blooms was addressed during a series of three consecutive cruises in spring 2017 (PHYCO-CNRS cruise, Lifewatch-VLIZ cruise, Zirfaea-RWS cruise) in the frame of regular monitoring networks and the Joint European Research Infrastructure for Coastal Observation - New Expertise (JERICO-Next H2020) project. The cruises started after the onset of spring blooms in the eastern Channel and followed their extension along the eastern Channel towards the southern bight of the North Sea. A multi-spectral fluorometer and a pulse-shape recording flow cytometer were deployed for continuous and/or discrete sampling analysis. Both techniques highlighted patchiness and sharp variations in abundance and fluorescence per group with some inshore-offshore gradients and decreasing distance from estuaries. Multivariate analysis was used to reveal relations between nutrients and phytoplankton communities.

Abstract 16. **On the implementation of an integrated platform for phytoplankton automated observation in European coastal waters: a JERICO-NEXT (H2020) Joint Research Action.**

Artigas L. F. (CNRS LOG), Karlson B. (SHMI), Aardema H. (RWS), Brosnahan M.L. (WHOI), Claquin P. (CNRS BOREA), Créach V (CEFAS), de Blok R. (UGent), Debusschere E. (VLIZ), Deneudt K. (VLIZ), Gómez F. (CNRS LOG), Grégori G. (CNRS MIO), Kromkamp J. (NIOZ), Lefebvre A. (IFREMER LER/BL), Lehtinen S. (SYKE), Lizon F. (CNRS LOG), Louchart A. (CNRS LOG), Möller, K. (HZG), Rijkeboer M. (RWS), Thyssen M. (CNRS MIO), Seppälä J.(SYKE), Stemmann L. (CNRS OOV), Veen A. (RWS), Wacquet G. (CNRS LOG), Puillat I. (IFREMER)
Arnaud.Louchart@etu.univ-littoral.fr
felipe.artigas@univ-littoral.fr

In order to better understand phytoplankton temporal and spatial distribution in coastal systems, automated *in vivo* approaches are being deployed since the last decade. These innovative techniques provide new insights into the detection of phytoplankton community changes affecting growth rates, size structure, taxonomic and/or pigmentary composition, which can occur at different time and spatial scales, evidencing rapid as well as long-term changes in environmental conditions. When implemented in automated environmental monitoring platforms, as fixed stations, moorings, research vessels and/or ships of opportunity, these techniques can represent valuable "near-real time" and "early-warning" systems of community changes which can evidence changes in ecosystem state, as the occurrence of blooms and, in particular, of harmful algal blooms (HAB), which can lead to disruption of marine food webs and mass mortalities of marine organisms and which are of special interest in areas of fishing, aquaculture and tourism. Therefore, there is need to improve the discrimination and operability of automated techniques addressing phytoplankton diversity (at nearly taxonomical and/or functional levels) and productivity. In the frame of the Joint European Research Infrastructure network for Coastal Observatories – Novel Expertise (JERICO-Next – H2020, 2015-2019), scientists inter compare, work on technical and analytical improvements and apply a combination of phytoplankton automated observation approaches, based on single cell/particle or bulk optical characteristics, in several European coastal systems ranging from oligotrophic (West Mediterranean) to mesotrophic (southern Bay of Biscay, Celtic seas) and eutrophic systems (eastern Channel, southern North Sea, Skagerrak/Kattegat, Baltic Sea), characterised by different phytoplankton communities, timing and extension of blooms (and potential HABs developments of dinoflagellates, diatoms, haptophytes, cyanobacteria). Three main groups of techniques, image in-flow or *in situ* acquisition and analysis, pulse shape-recording automated flow cytometry, as well as multispectral and variable fluorometry and spectrophotometry, are being critically explored and implemented in different sites and platforms. A summary of the main results gathered by a combination of these techniques is presented and discussed.

Abstract 17. **MICROPLASTOX - Microplastics in the marine environment: estimation and ecotoxicological assessment.**

da Costa, J.P. (UA), Rocha-Santos, T. (UA) Duarte, A.C. (UA).
jpintocosta@ua.pt

Microplastics (plastics < 5mm) are present in many household items and are also formed due to the cracking and embrittlement of larger plastic particles. Owing to their inherent physical and chemical characteristics, MPs are persistent and ubiquitous aquatic contaminants that can be potentially ingested by benthic and planktonic organisms, thus entering food webs. Additionally, studies have shown that the microbial communities that colonize these materials differ enormously from the indigenous free-living marine communities. All these threats are further exacerbated by these materials' ability to adsorb other contaminants, namely, persistent organic pollutants. However, the exact prevalence of these materials in the environmental remains a topic of debate. Therefore, a detailed quantitative and qualitative monitoring of microplastics and their effects in the marine environment is highly recommended by the Marine Strategy Framework Directive.
Hence, neustonic nets have been deployed at the Galway Cable Observatory (SmartBay, Ireland) and at the POSEIDON-HCB (HCMR, Greece) buoy, and sampling onboard the MS Fantasy (NIVA, Norway) resorting to resorting to the on-board water pumping system is currently underway. This approach will allow to ascertain the efficacies of the different methodologies and the geographical "triangle" of these sampling sites will contribute to establish a wider understanding of the real prevalence of these materials in European waters.
Subsequently, the isolated microplastics will be used to accurately evaluate their ecotoxicological effect, as most studies focusing on this subject resort to unrealistic concentrations of these materials, thus putting into question the environmental validity of such findings.

Abstract 18. **Monitoring of organic contaminants by passive samplers in Southern Europe coastal areas: MONICOAST Project**

Montero N. (UNICA), Belzunce M.J. (AZTI), Marrucci A. (UNICA), Schintu M. (UNICA), Frangoulis C. (HCMR), Ntoumas M. (HCMR), Kalampokis A. (HCMR), Petihakis G. (HCMR), Perivoliotis L. (HCMR)
natalia.montero@unica.it

Contamination of surface waters is one of the most important current environmental problems. Regulatory monitoring, to comply with European Directives, consists in spot water sampling and the measurement of the contaminants in the laboratory. This approach presents several drawbacks, such as low temporal representativeness (especially in dynamic systems) and the high uncertainty associated to compounds present at low concentrations (i.e. below the detection limit of analytical techniques). Passive samplers have been suggested as an alternative to spot sampling, as accumulate contaminants continuously during the deployment time, integrating their temporal variability and enabling their measurement at very low concentrations. Thus, the overall aim of the MONICOAST Project is to evaluate the presence and distribution of organic pollutants (PAHs, PCBs, OCPs) in Southern European coastal areas by means of passive samplers. MONICOAST is a collaborative project between the University of Cagliari (UNICA, Italy), AZTI (Spain) and the Hellenic Centre for Marine Research (HCMR, Greece). In the framework of the JERICO-Next Transnational Access (TNA) Call, passive samplers (i.e. silicon rubber) will be deployed at two buoys (i.e. Heraklion Coastal Buoy (HCB) and Saronikos Buoy (SB)) located in the Mediterranean Sea and affected by various sources of contamination. Passive samplers will be deployed for 3-4 months at two consecutive periods (June-October, October-January). The long-term deployment of passive samplers in these buoys will ensure that organic contaminant concentrations are measurable (over the detection limit) and representative of the contamination in the study area. Besides, the environmental data (e.g. temperature profiles, salinity, currents data) provided by the oceanographic buoys will be used for the interpretation of the results. This project will contribute to a comprehensive understanding of the distribution of organic compounds in Southern European coastal areas.

Abstract 19. **Leverage tracking efficiency on oceanographic buoys using an energy autonomous solution transmitting satellite messages (LETS-SAT)**

Koutras G. (Openichnos), Kutsuras T. (Openichnos), Perivoliotis L. (HCMR), Petihakis G. (HCMR)
koutras@openichnos.com

Tracking efficiency on open sea assets is of significant interest in the maritime field. Openichnos delivers an energy autonomous tracking solution which works in truly 100% global scale, using the Iridium satellite constellation for transmitting its data. HCMR's marine monitoring, forecasting and information system for the Hellenic Seas, POSEIDON, has infrastructure such as moored oceanographic buoys which are suitable for long-term testing of Openichnos technology in a harsh sea environment, providing the increase of their coverage percentage and their real time tracking independently from the buoys' main system, acting as backup and emergency system. This collaboration will provide results that can be applicable in the field of marine applications and is a first step for the establishment of a future one in which Openichnos acting as an IoT gateway will also benefit from the buoy main tracking device data transmission as well as meteorological data transmission (wind direction, wind speed, wave height) provided by the POSEIDON buoys.

Abstract 20. **Phytoplankton fluorescence studies in Mediterranean. Feasibility and comparability of different methods in oligotrophic seas. FluorMed-1**

Jukka Seppälä (SYKE), Melilotus Thyssen (CNRS-MIO), Pasi Ylöstalo (SYKE), Gérald Grégori (CNRS-MIO), Olivier Grosso (CNRS-MIO)
jukka.seppala@ymparisto.fi

The FluorMed-1 project aims in providing information on the applicability and comparability of various fluorescence detection methods for phytoplankton community structure at a high frequency in the oligotrophic conditions of the Mediterranean waters. Those methods are used in contemporary online phytoplankton diversity and physiology research on various platforms (buoys, bench with pumped water, ships of opportunity, scientific vessels) and are mostly tested in eutrophied sea areas, where diversity and biomass are important. Since bulk or specific fluorescence sensors are not well defined in terms of detection limits but that they are depicted as required when selecting technology for monitoring the biological state of marine areas, it is important to define the possible applications in the oligotrophic conditions, and when developing the methodology further. The validation and combination between bulk and physiology analysis in oligotrophic areas will be coupled with single cell analysis using high frequency pulse shape recording flow cytometry. This project will enable to go insight the picoplankton community functioning, dominating oligotrophic areas.
In its first part, during April 2018, we tested the limits of detection and quantification (LOD & LOQ), the sensitivity of LED fluorometers and the effects of background signal, under the oligotrophic conditions of Aegean Sea as reproduced in the Poseidon calibration lab (PCL) of HCMR. This will guide the technology selection in the area and will also be openly communicated to all manufacturers and provide suggestion which technique is most matured and ready to be used in oligotrophic seas. In addition, we compared group specific growth rates (determined with flowcytometry) with photophysiological characteristics of natural populations (measured with Frrf). Such comparisons do not exist so far for natural communities, to our knowledge, and this combination of automated methods may provide more detailed insight on proxies of trait-based phytoplankton productivity and open possibilities to study their importance on carbon fluxes.
In its second part, currently running on the HCB buoy (HCMR, Crete)a new fluorescence sensor (Chlorophyll a sensor) has being deployed to analyse the nonphotosynthetic fluorescence quenching patterns, which may improve the end-use of data.

Abstract 21. **Relation between the mesoscale dynamics and the distribution of phytoplankton and floating marine litter in the South-East Bay of Biscay.**

Xabier Dávila (AZTI), Arnaud Louchart (LOG), Jessica Delarbre(LOG), Victor Gauthier(IFREMER), Irene Ruiz(AZTI), Iván Manso(AZTI), Luis Felipe Artigas(LOG) , Ingrid Puillat (IFREMER) , Pascal Lazure (IREMER), Ainhoa Caballero (AZTI), O.C. Basurko (AZTI), Anna Rubio (AZTI)
arubio@azti.es

Mesoscale dynamics have a determinant role in several ocean processes, not only in the transport of momentum, heat and mass, but also in the provisioning of nutrients into the euphotic zone marine floating litter accumulation. However, this relation is not that straight forward in coastal areas. In the south-eastern sector of the Bay of Biscay, the slope current interacts with the abrupt bathymetry and frequently triggers the formation of mesoscale eddies. In this context, the ETOILE campaign surveyed the CapBreton canyon area (SE Bay of Biscay) in early August 2017. The main objective of this campaign was to gather hydrographic and hydrodynamic data and determine the influence of mesoscale processes in the distribution of organic (phytoplankton) and inorganic (floating marine litter) particles. Besides the various remote sensing data available for this area, such as HF radar or satellite data, *in situ* hydrographic measurements were collected by a CTD and a Moving Vessel Profiler. Likewise, other parameters such as temperature, conductivity and *in vivo* multi-spectral fluorescence were continuously recorded. Then, multi-spectral fluorescence casts, chlorophyll *a* (Chl-*a)*, as well as marine floating litter abundance were sampled in selected stations. Here we present the results from a joint analysis, where two cyclonic and two anticyclonic structures were observed. From the observation, we discuss on the differential effect that the two distinct type of (sub)mesoscale eddies exerted in the particle distribution. While cyclones seem to actively accumulate floating marine litter in surface, anticyclones promote primary production below the pycnocline, following a two-step process, first of all, by nutrient upwelling through at anticyclone's periphery and then by phytoplankton advection to the core of the structure. Understanding of the interactions between physics and the observed distributions would contribute to a better management of fisheries and coastal cleaning services in the area.

Abstract 22. **Land-based HF radar, in-situ and satellite data for studying coastal mesoscale processes in the SE Bay of Biscay**

Anna Rubio (AZTI), Ainhoa Caballero (AZTI), Ivan Manso (AZTI), Alejandro Orfila (IMEDEA), Ismael Hernández-Carrasco (SOCIB), Julien Mader (AZTI), Claire Dufau (CLS), Florence Birol (LEGOS), Lucas Merckelbach (HZG), Jeff Carpenter (HZG)
arubio@azti.es

The main aim of this contribution is to showcase recent research efforts using multi-observational data to study the coastal ocean circulation and its variability in the south-eastern Bay of Biscay. Although, near the coast and over the shelf, there is a low agreement between altimetry and HF radar data, several studies have shown a coherence among the different observing systems in the monitoring of the seasonal slope current and mesoscale eddies O(50 km) and upwelling processes recurrent within the study area. For instance, we were able to closely monitor one warm core anticyclonic eddy in the study area, with the use of complementary visible and IR remote sensing data. This eddy, generated after the relaxation of a cyclonic wind-driven current regime over the shelf-slope, persisted during several weeks and other similar structures were identified in the study area. Lagrangian diagnostics performed using HF radar current fields showed how the eddy transported coastal productive waters into the open ocean in a period where open ocean waters are relatively poor. A glider mission, recently performed in the framework of JERICO-NEXT Project, has provided additional data for the study of these coastal processes and for the assessment of coastal altimetry along-track data in the study area covered by the HF radar. The combined use of HF radar and glider measurements will offer useful data to improve the processing of altimetry for coastal studies.

Abstract 23. **Is the West Gironde Mud Patch (SW France) still an active depocenter today?**

Sabine Schmidt (CNRS), Bruno Deflandre[2], (UB) Pascal Lebleu (UB), Hervé Gillet (UB) Antoine Grémare (UB)
sabine.schmidt@u-bordeaux.fr

The West Gironde Mud Patch (WGMP) is a 420-km^2 mud belt in the Bay of Biscay, located 25 km off the mouth of the Gironde estuary. This clay-silt feature of 4 m in thickness extends between 30 and 75m water depth, surrounded by the sands and gravels that cover the North Aquitaine continental shelf. About 2-3 decades ago, high-resolution sedimentological investigations have demonstrated the WGMP to be the marine collector of half of the Gironde solid discharge. As a contribution to the EU JERICO-Next program, this work aims to present an update of the present-day WGMP sedimentation framework. In the context of ongoing regional changes (long-term decrease of river discharge and increase in winter storm intensity), the question is whether the WGMP is still an active depocenter. Interface cores were collected during JERICOBent-1 cruise (October 2016) along two cross-shelf transects for a total of 9 sites (5 and 4 along the northern and southern transects, respectively). Sedimentation intensity was characterized from seasonal to decadal timescales using a multi-tracer approach (^{234}Th, ^{7}Be, ^{210}Pb$_{xs}$, ^{137}Cs, ^{232}Th, grain size, X-ray). Short-lived radionuclides were detected only at the interface, indicating moderate to low sediment fluxes over the last weeks before sampling. Excess ^{210}Pb activities were detected downcore at depths deeper than 20 cm, but profiles presented contrasted pattern among sites. The shallowest inner stations show very disturbed ^{210}Pb$_{xs}$ profiles, in particular due to the presence of interbedded sandy layers. By contrast, in the WGMP center, ^{210}Pb$_{xs}$ profiles present a surface mixed layer followed by a decrease with depth that corresponds to sedimentation rates ranging between 0.3 and 0.5 cm per year. We will compare the results of the JERICOBent-1 cruise to those of the first investigation done in 90s and discuss the potential change in fine sediment accumulation of the West Gironde Mud Patch.

Abstract 24. **The data life cycle management at SOCIB: responding to science and societal needs**

Xisco Notario, SOCIB (Spain), Cristian Muñoz, SOCIB (Spain), Inmaculada Ruíz, SOCIB (Spain), Miguel Charcos, SOCIB (Spain), Miquel Àngel Rújula, SOCIB (Spain), Paz Rotllán, SOCIB (Spain), Sonia Gómara, SOCIB (Spain), Miquel Gomila, SOCIB (Spain), Charles Troupin, Juan Gabriel Fernández, SOCIB (Spain), Joaquín Tintoré, SOCIB (Spain).
xnotario@socib.es
cmunoz@socib.es

The Balearic Islands Coastal Ocean Observing and Forecasting System (SOCIB, http://www.socib.eu), is a Marine Research Infrastructure (ICTS) that provides world-class, quality controlled metocean datasets, in both real time and delayed mode. This is achieved from across its multi-platform, observation and forecasting system, covering coastal to open ocean areas. This multi-platform approach is needed to properly capture oceanographic processes, that take place at different spatial and temporal scales, and that characterise both ocean state and ocean variability. The SOCIB observation system provides physical and biogeochemical variables from different platforms such as the coastal research vessel, a high-frequency (HF) radar system, weather stations, tide gauges, moorings, drifting buoys, ARGO profilers, gliders (autonomous underwater vehicles) and sea turtle tracking, providing trajectories given by the animals. The forecasting system uses high-resolution numerical models for hydrodynamics (ROMS) and waves (SAPO).
The Data Center is responsible for the different stages of data management and covers the whole data life cycle, ranging from data acquisition using SOCIB observational platforms, numerical models or information generated by other divisions, to distribution and visualization through the development of specific tools for visualising the data sets, including both dedicated web and mobile applications. The implemented system relies on open source solutions.
In order to cope with a wide range of platforms, automatic management and processing are necessary. Here we present some of the applications developed to perform the oceanographic data management of the different platforms and a specific example developed for gliders.
Based on the available data and using a set of web services, several applications were build, 1) SEABOARD, a dashboard combining different sources of information in real time for different types of users, 2) Smartphone apps to access data, platform trajectories and forecasts in real-time, 3) “Medclic: the Mediterranean in one click” (http://www.medclic.es/en/), a web dedicated to the Mediterranean Sea monitoring, with scientific and an outreach components.
Other applications are currently being developed as an adaptation to different sectors within the new SOCIB Products and Services 2017 strategy (beach lifeguard and Bluefin tuna apps).
SOCIB organizational and conceptual structure as a facility of facilities including the Data Centre and its developed components is a good example of Marine Information System within the framework of new Ocean Observatories and/or Marine Research Infrastructures, a system of systems that through FAIR principles, generates added value to both cover the scientific community demands and respond to the general societal needs.

Abstract 25. **4DVAR assimilation of surface current and water level measurements in a 3D barotropic circulation model of the German Bight**

J. Schulz-Stellenfleth, Joanna Staneva, Jochen Horstmann, Helmholtz-Zentrum Geesthacht (HZG), Institute of Coastal Research, Geesthacht, Germany
Johannes.schulz-stellenfleth@hzg.de

Because of the shallow water, the tidal dominated circulation in the German Bight is a challenge for numerical models. There are a lot of uncertainties about the bathymetry as well as the bottom roughness, and the dynamics is complicated by strong nonlinear mechanism, like the generation of overtides. At the same time, the German Bight is a very busy region with a lot shipping and offshore activities resulting in strong demands for accurate information on currents and water levels, i.e., in the context of Search and Rescue (SAR) operations.
In this study a combination of tide gauge observations and measurements from three HF radar stations in the German Bight are assimilated into a 3D circulation model with 1 km resolution and 7 vertical layers in order to improve estimates for water levels and currents. The horizontal grid and bathymetry as well as the open boundary and meteo forcing is indentical to the setup used at the Hydrographic Federal Maritime and *Hydrographic* Agency (BSH). A 4DVAR technique is used, which is based on an adjoint model to compute the gradient of a cost function, which penalizes deviations between the observations and the model results.
The analysis is performed in two steps, where systematic model errors like bottom roughness, internal friction related to turbulence and meteo drag coefficients are treated first. For this purpose, the system is run in a hindcast mode over a certain tuning period. After that, stochastic error components relevant in an operational forecast setup, like errors in the open boundary forcing and the meteo forcing are reduced. This is done in a forecast configuration where a 12 hour forecast is launched based on a 12 hour hindcast.
The results are compared to the operational output of the BSH system as well as to drifter data acquired in 2015. The achieved improvements, as well as remaining residuals between model and observations are discussed. Particular focus is put on the remaining systematic errors and strategies to further reduce these. The results are put into the general context of coastal data assimilation, which is of growing interest in particular with the accelerating activities on the modelling of the European Seas within the Copernicus program.

Abstract 26. **Overview of JRAP5 (carbonate system) intensive campaign observations**

L. Laakso[1], M. Honkanen[1], S. Kielosto[1,2], J. Seppälä[2] ,T. Tamminen[2], P. Ylöstalo[1], C. Frangoulis[3], G. Petihakis[3], M. Ntoumas[3], A. Kalampokis[3], B. Karlson[4], A. Willstrand-Wranne[4], W. Petersen[5], K. Möller[5], Y.G. Voynova[5], C. Cantoni[6], S. Sparnocchia[6], Y. Bozec[7], K. Sörensen[8], A. King[8], R. Bellerby[8]

[1]Finnish Meteorological Institute, Finland, [2]Finnish Environment Institute, Finland, [3]Hellenic Centre for Marine Research, Greece, [4]Swedish Meteorological and Hydrological Institute, Sweden, [5]Helmholtz-Zentrum Geesthacht, Germany, [6]Istituto di Scienze Marine, Italy, [7]Observatoire Océanologique de Roscoff, France, [8]Norwegian institute for water research, Norway

lauri.laakso@fmi.fi

The aim of JRAP5 activity on marine carbonate systems is to address the role and responses of the European Coastal Ocean and Marginal Seas in the global C-cycle, and to provide recommendations for an integrated European C-cycle monitoring.

The main activity of this Joint Research Activity Project (JRAP) was an intensive measurement campaign, focusing on carbonate systems, throughout the European sea areas during the period March 2017 – April 2018, and the accompanying data-analysis leading finally to submission of data to open access databases. In the poster which will be presented in JERICO-NEXT General Assembly in Galway, we will show the current situation and the success rate of the measurements, with some preliminary scientific results.

Abstract 27. **Monitoring Essential Biodiversity Variables (EBV) of European planktonic ecosystems using image acquisitions, machine learning and web applications for a consistent network approach.**

Lars Stemmann, Fabien Lombard, Lionel Guidi, Jean Olivier Irisson, Corinne Desnos, Laetitia Jalabert, Amanda Elineau, Marc Picheral
Sorbonne Université/CNRS Laboratoire de Villefranche sur Mer, UMR7093
stemmann@obs-vlfr.fr

Initiatives to monitor marine coastal areas have increased in the last decades, as anthropogenic perturbations on coastal systems have become increasingly more evident. Plankton communities are scarcely studied in the context of a European wide monitoring of marine waters as considered by the MSFD. Bulk Optical properties (such as fluorescence, turbidity) also simple to obtain in situ are not adequate to study plankton diversity. Imaging techniques followed by semi-automatic classification (automatic classification of imaged objects followed by expert validation) have been applied to in situ studies of plankton or to the analyses of net samples in time series or spatial surveys. Essential Biodiversity Variables (taxonomic and size) have been developed successfully. Huge number of images have been obtained independently. They can be compared across sites (providing the availability of consistent metadata) in order to depict basin scale patterns. Such endeavour is possible due to sensors and machine learning developments but also to the development of web based application for archiving and distribution. For example, the web application, ecotaxa.obs-vlfr.fr/, hosts 60 millions images obtained by 400 users using multiple instruments (Flowcam, IFCB, Zooscan, UVP, Zoocam, …). The analysis of images-derived EBV could then be considered in the future as a relevant method in the frame of the monitoring of plankton for the MSFD. Joining the calibrated image datasets from individual local monitoring program into a network application will enable to build the European monitoring of biodiversity needed to assess the Good Environmental Status of coastal systems.

Abstract 28. **Implications of vertical FRRF profils in spatial studies of phytoplankton dynamic**

Lizon F. (CNRS-LOG), Didry M.(CNRS-LOG), Louchart A.(CNRS-LOG), Michel-Rogriguez M.(CNRS-LOG), Artigas L.F. (CNRS-LOG)

fabrice.lizon@univ-lille.fr

The new multiwavelenght FRRF profiler (Chelsea instrument) provide continuous physiological measurements of phytoplankton photosynthesis and a Gross Primary Production index (GPP named JVPII) in the water column. With this novel instrument it is possible to stimulate photosynthesis successively with several protocols implicating a combination or not of blue, green and red light, directly in the water column and under the natural sun light. This is a considerable advantage compared to the generally used alternative system measuring photosynthesis according to an artificial adjustable actinic light source (LED). The JVPII index can also be computed according to two different algorithms: the absorption cross section of PhotoSystem II (σPSII) algorithm or the absorption (aLHII) algorithm; light absorption being a key factor operated on by selective pressure during the evolution of phytoplankton taxa.
In 2017 we have realized 4 JERICO joint sampling campaigns in contrasted ecosystems from the English Channel to the Baltic Sea, 2 in 2018. Now, more than 160 vertical profils of FRRF (equipped of an hyper-spectral radiometer TRIOS) have been realized for different seasons, hydrodynamical conditions... Typically, biophysical characteristics obtained by FRRF measurements contain taxonomic signatures, upon which is superimposed physiological variability potentially influenced by physiological stress due to high light and low nutrients concentrations.
Data of this novel profiler instrument have never been compared and presented (to our knowledge) for different sampling area dominated by different phytoplankton groups like diatoms, dinoflagellates and cyanobacteria. In situ measurements display the real relationship between the effective PSII quantum yield (YPSII), the σPSII, the concentration of functional reaction centre (RCII), photoinhibition (NSV) and euphotic depth at different period of the day. The resulting FRRF profiler data base will enable to go insight the in situ phytoplankton physiology functioning under natural light in the water column, considering different excitation wavelenght.

Abstract 29. **Follow the glider: Discover the ocean´s secrets with underwater gliders**

Ortiz V. (SOCIB), Bonilla A. (SOCIB), Rodríguez R. (CSIC), Miralles A. (SOCIB), Fernández J.G. (SOCIB), Ruiz S. (IMEDEA (UIB-CSIC)), Tintoré J. (SOCIB).
vortiz@socib.es

Follow the Glider is an educational tool developed by CEFAS (Centre for Environment, Fisheries & Aquaculture Science), IMEDEA (Mediterranean Institute for Advanced Studies, UIB-CSIC), and SOCIB (Balearic Islands Coastal Observation and Forecasting System) as part of the FP7–JERICO European project, and is based on the glider monitoring tool.
Follow the Glider enables students and teachers to follow the course of ocean gliders in almost real time, examine past missions, understand the data provided by these autonomous underwater vehicles, and recognize the importance of coastal research for developing predictive models and facing phenomena such as climate change.
This project aims to provide teaching materials for students aged 10 to 16 and offer an introduction to coastal and marine research in the Mediterranean Sea.