Posters Submissions – EOOS Conference 21 23 November 2018

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Theme: From standalone to integrated ocean and coastal observing platforms

Title: Coriolis: an integrated in-situ ocean observation infrastructure for operational oceanography and ocean/climate research

"The Coriolis (www.coriolis.eu.org) structure gathers efforts of seven French institutes (CNES, CNRS, IFREMER, IPEV, IRD, Météo-France, SHOM, CEREMA) to organize the in-situ component of the French operational oceanography infrastructure. The objective is to organize the data acquisition and real-time/delayed mode data processing of in-situ measurements required for operational oceanography and ocean/climate research. Coriolis is focused on a limited number of physical and biogeochemical parameters that are acquired systematically and in real time or slightly delayed mode. Coriolis follows a fully open data policy.

The framework of collaboration for Coriolis was renewed in 2014 and now covers the time period of 2014 up to 2020. By signing this new agreement, the eight directors of French institutes have clearly stated their willingness to sustain and consolidate further the Coriolis in-situ infrastructure. The new framework agreement strengthens the links between research and operational oceanography. The scope is also extended to integrate the main French contributions to the global and regional in-situ observing systems: Argo, gliders, research vessels, ship of opportunities, drifting buoys, marine mammals, tidal networks and high frequency coastal observatories. The new Coriolis 2014-2020 framework agreement provides a better integration of the French contributions to the Global Ocean Observing System (GOOS/JCOMM). It also confirms and extends the European mission of Coriolis, in particular, in the framework of the Euro-Argo ERIC, EuroGOOS, EMODnet and the Copernicus Marine Environment Monitoring Service.

The different networks contributing to Coriolis 2014-2020 are organized by one or several institutes or laboratories with a pooling of resources for at sea operation, data processing and data dissemination and R&D activities (transverse components) (see figure). The at sea component facilitates the functioning of the entities for the at sea operation activities and ensures that data are transmitted in real time to Coriolis data centers. The data center component consists of distributed data centers operated by the different partner institutes and the Coriolis data portal providing a single access point to all data sets both in real time and in delayed mode. R&D component relies on laboratories in charge of networks and dedicated personnel working on cross-cutting issues (e.g. consistency between networks). The objective is to

improve real time/delayed mode quality control methods and prepare long term delayed mode quality control data sets and associated products (e.g. Cora).

Coriolis 2014-2020 also features a strengthened organization and governance. A Steering Committee (co-chaired by S. Pouliquen and R. Reverdin) with representatives of all networks and of the three transverse components (at sea operation, data center, R&D) is in charge of the scientific and technical management. It reports to a Governing Board (directors of institutes). A Scientific Council (shared with Mercator Ocean) provides the required scientific guidance, in particular, for issues related to the integration with modelling and data assimilation."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Approches for integrating Underwater Noise Measurements into ocean observation systems

"Underwater noise has been significantly raising in the past decades due to an increment of human-related activities in the oceans such as shipping, industrial activities, seismic explorations, etc. These activities may have adverse effects on fish and mammals, such as communications masking and modifying predator–prey interactions.

In order to assess and limit the impact of these, the European Commission approved the Marine Strategy Framework Directive (MSFD) which aims to achieve a good environmental status in European waters. Within this directive different environmental challenges are addressed, including the long-term monitoring of underwater noise throughout European waters.

EMODnet Physics, one of the European Marine Observation and Data network thematic portals, which is is currently providing access physical parameters of the oceans, has recently started working on water noise with the aim of making available more operational data (in terms of parameters and format that are close to MSFD I.11 requirements), offer a single European entry point to impulsive noise registries (MSFD I.11.1) and work on (regional) sound maps.

In this presentation, we give an overview of how EMODnet Physics is organized, with a particular focus on this new data flow and its perspectives and the very first operational results, the connection to HELCOM and OSPAR impulsive sounds registry, and how it is exploiting both the LIDO (Listen to Deep

Ocean) knowledge and the BIAS project (https://biasproject.wordpress.com/) experience to develop and make available monthly sound maps."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: European Marine Observation and Data network and and River Runoff data management

"Rivers runoff exert a strong influence in their neighbouring coastal area in several ways, modifying the water stratification, introducing significant fluctuations in circulation patterns and modulating the impact of upwelling events.

In the current context of a global decline of the hydrometric networks, the uncertainties include the river runoff reaching the coast and most of the water properties as temperature, salinity, etc. For this reason, river climatologies are generally imposed in the land boundaries of coastal or regional ocean models, ignoring river variability in flow and other associated properties. Anyhow, the main weakness of river climatologies is its incapacity to include the interannual variability compared to watershed model applications that are in agreement with the main river flow trends.

On the other hand, watershed models tend to overestimate river flows, especially during dry seasons. EMODnet Physics has started integrating and making availble near real time river runoff and in situ river run off trends (monthly and annual means).

Operational observations and watershed modelling forecast for the main rivers and stations near the river discharge area will be increasingly made available to the public and research community through the EMODnet physics webpage. Watershed models implementation will be based on the MOHID Land model.

MFC community is welcoming this new data to improve the MFCs thermohaline circulation in coastal areas by a better characterisation of the land-marine boundary conditions.

Data management methods and standards are going to be presented."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: The strategy for evolution of Argo in Europe

"The international Argo programme is a major element of the global in-situ ocean observing system. More than 3900 floats are now globally measuring temperature and salinity throughout the whole ocean down to 2000 meters depth, delivering data both in real time for operational users and after careful scientific quality control for climate change research and monitoring. The Euro-Argo research infrastructure organizes and federates the European contribution to Argo. A legal and governance framework (Euro-Argo ERIC) was set up in May 2014 that allows European countries to consolidate and improve their contribution to Argo international.

During the recent years, Euro-Argo fostered R&D activities for enhancements of Argo floats, equipped with biogeochemical sensors or able to dive down to abyssal ocean, acting from the floats design up to the analysis of their measurements. European Argo data centres have been adapted so that they can now handle the new data formats.

In addition to its contribution to the core-Argo programme, one of the main challenges for Euro-Argo is now to implement the next phase of Argo with an extension towards biogeochemistry (e.g. oxygen, biology), the polar oceans, the marginal seas and the deep ocean. Meeting such challenges is essential for the research and the long-term sustainability and evolution of the Copernicus Marine Service. Euro-Argo has recently revised its deployment's strategy for the next decade. We will present this strategy and provide some highlights on the implementation-plan for the years to come."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: On the role of metrology in oceanography: the example of the TRUSTED project

"Sea Surface Temperatures (SSTs) obtained from satellite-borne instruments, are wildly used in climate and meteorological applications, for the global coverage of ocean they provide. Most of these instruments are well-calibrated and they provide consistent and sufficiently accurate observations, but what is often missing is a fiducial reference infrastructure to validate the high resolution and high accuracy SST measured by the Copernicus Sentinel-3 Sea and Land Surface Temperature Radiometer (SLSTR).

The Copernicus funded TRUSTED project was initiated by EUMETSAT to fill that gap. Led by CLS, it aims to deploy an independent network of over 100 DBCP compliant Surface drifter buoys. These will be designed and produced by NKE Instrumentation. Météo France is in charge of the deployment and recovery of the buoys, and JCOMMops of the metadata management.

The buoys are equipped with a high resolution SST (HRSST) sensor. The Shom is in charge of the calibration of these sensors and insuring the traceability to the SI (International System of Unit), that is to say, to the international temperature standards with a determined uncertainty, of the measured temperatures.

The phase 1 of the project consists in the development of two prototypes, of the calibration procedure and of the metrological characterization of buoys and of sensors. This characterization consists in determining the influence of the buoy and of its environment on the accuracy of the measured temperatures, as well as the response time of the HRSST sensor. The end result of this phase is the provision of an uncertainty budget to determine if this reference network is within the maximal tolerance of ± 0.05 °C required by EUMETSAT. The Shom is also in charge of the deployment of the two prototypes and of their comparison at sea with reference instruments.

TRUSTED is therefore a good example of what metrology can bring to oceanographic data acquisition and of its pivotal role within data acquisition projects."

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Theme: Regional ocean monitoring efforts

Title: Expanding observational capabilities in the Macaronesian region with ocean gliders

"The Macaronesia is a vast area playing a key role in the East boundary of the Central North-Atlantic ocean-circulation system. Despite a significant and multidisciplinary scientific and research activity in terms of ocean monitoring for decades by key EU research-groups through the use of a wide range of observing systems and methodologies, the area is still undersampled, mainly due access and coverage constrains, as well as observation sustainability. Nowadays, ocean gliders offer a new approach in terms of capacity and sustainability, allowing undertake ocean-monitoring in spatiotemporal scales hitherto unavailable.

The present work shows preliminary results from the latest and most representative missions with buoyancy-driven and surface ocean-gliders in the area, as joint-initiatives between multidisciplinary institutions and companies from Portugal, Germany, USA and Spain, whose main goal focuses on to improve and expand ocean-observation capabilities in a cooperative and synergistic way, strengthening glider endurance-lines between Macaronesian archipelagos, as part of the global ocean-observation strategy conducted by the Marine & Maritime Network (R3M), as contributing party aligned with European and international efforts in the North Atlantic basin through initiatives like GEOSS, EGO, EuroGOOS, EMODNet, AORA-CSA and AtlantOS, among others."

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Theme: Regional ocean monitoring efforts

Title: The IEO-OS in the Mediterranean Sea: contributions of the RADMED monitoring program to the knowledge of the system

"The Spanish Oceanographic Institute (IEO) maintains a large and coherent ocean observing system around the Iberian Peninsula, the Canary and the Balearic Islands. The Spanish Institute of Oceanography Observing System (IEOOS) (Tel et al. 2016) provides quality controlled data and information about Spanish surrounding waters and comprehends several subsystems, from tide gauges, permanent moorings and traditional oceanographic ships to modern automatic systems as buoys or Argo floats.

Within the IEOOS, the RADMED monitoring program (López-Jurado et al. 2015) is already conducting many of the evaluations required under the MSFD at a set of fixed stations along the Spanish Mediterranean

coast. The different aspects of the ecosystem that are regularly sampled are the physical environment and the chemical composition of the water column that condition the primary production. Primary producers are studied by microscopy, flow cytometry and total chlorophyll-α analysis. The photosynthetic activity, the respiration and the degradation of organic matter determine the gas interchanges with the atmosphere, being the CO2 interchange one of the most important in the actual context of climate change. This is sampled continuously using a SUNDANS system. The relations with the next trophic level can be estimated from the zooplankton studies, sampled by bongo nets.

All RADMED CTD and biogeochemical data are send to SeaDataNet (http://www.seadatanet.org/) through the IEO data centre (CEDO, Centro Español de Datos Oceanográficos). At the same time all data are included in the IBAMar database (Aparicio-Gonzalez et al. 2015).

Using temporal series at different RADMED fixed stations along the Spanish Mediterranean coast, some of them sampled seasonally since 1992, it is possible to calculate interannual and seasonal climatologies for dissolved oxygen, chlorophyll-α and nutrients at those positions. Some preliminary results on these climatologies will be presented.

Aparicio-González, A., López-Jurado, J.L., Balbín, R., Alonso, J.C., Amengual, B., Jansá, J., García, M.C., Moyá, F., Santiago, R., Serra, M., Vargas-Yáñez, M.,. Ibamar database: Four decades of sampling on the western Mediterranean Sea. Data Science Journal 13:172–191, 2015.

López-Jurado, J.L., Balbín, R., Amengual, B., Aparicio, A., Fernández de Puelles, M.L., García, M.C., Gazá, M., Jansá, J., Morillas-Kiefer, A., Moyá, F., Santiago, R., Serra, M., Vargas-Yáñez, M., Vicente, L. The RADMED monitoring programm: towards an ecosistema approach. Ocean Science Discussions, 11 (6):897–908, 2015.

E. Tel, R. Balbín, J.-M. Cabanas, M.-J. Garcia, M. C. Garcia-Martinez, C. Gonzalez-Pola, A. Lavin, J.-L. Lopez-Jurado, C. Rodriguez, M. Ruiz-Villarreal, R. F. S´anchez-Leal, M. Vargas-Yáñez, and P. Vélez-Belchí. IEOOS: the Spanish Institute of Oceanography Observing System. Ocean Science, 12 (2):345–353, 2016."

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Theme: Regional ocean monitoring efforts

Title: Ocean-Monitoring Strategy in the Macaronesia region: the R3M Network

"The East-Central North Atlantic, also known as Macaronesia, is a key area for marine and maritime sectors like research, technology, navigation, energy, border security, tourism, among others. However, logistics and support level to develop and maintain an accurate, useful and sustainable monitoring strategy programme is still clearly below the needs.

Despite technology advances addressed to ocean monitoring has been significantly improved during last two decades with new platforms, sensors and telemetry systems, there are still many unsolved gaps in terms of data quality, reliability, efficiency and sustainability. These gaps becomes particularly relevant in ocean regions like the Macaronesia, fitted by archipelagos located notably far away one to each other.

Based on particular and common initiatives for many years ago from several institutions across the region, nowadays there is a multidisciplinary group of universities, companies and institutions aiming, in partnership, to consolidate a regional ocean observing strategy under the name of R3M (Macaronesian Marine Monitoring Network) where harbour infrastructures are playing a key role in regards an specific network of autonomous devices for biogeochemical and meteorological monitoring in Canary Islands, Azores, Madeira and Cape Verde . In addition, the R3M is the reference framework to gathered, manage and display the information provided by all existing in-situ observing platforms (fix and mobile) like moored buoys, ASV, underwater gliders, meteorological stations, etc. in this area, according to needs from specific end-users and general public.

The present work attempts to show the R3M's current status, from different perspectives: technological, partnership and engagement, data management and display, among others, always fully in line with international directives, rules, standards and formats on ocean observation."

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9. Tom Cox

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Theme: Future look at the next generation of observing & monitoring tools and approaches;

Title: Tune in on 11.57 µHz and listen to primary production – estimating photosynthesis rates from high frequency O2 data

"Primary production by phytoplankton in oceans and coasts is a process of key importance: it lies at the base of aquatic foodwebs, provides oxygen to the atmosphere and water, and plays a huge role in the cycling of carbon dioxide. Estimating (global) rates of primary production is thus crucial in our understanding of global cycles and foodwebs. Further, global warming is hypothesized to reduce rates of production due to increased water column stratification and the subsequent reduced inputs of nutrient from deeper, colder waters. Additionally, certain regions recovering from eutrophication show decreasing

trends in primary production because of decreased riverine nutrient inputs. Consequently, monitoring trends and changes in primary production is an essential part in assessing global warming and other anthropogenic impacts.

In 2 recent papers we introduced a novel approach to estimate gross primary production (GPP) based on high frequency O2 time series (Cox et al, 2015; Cox et al, 2017). Based on an analysis in the frequency domain of the governing equations of O2 dynamics, we derived a relation between the diel amplitude in O2 fluctuations and (time averaged) GPP. We called this technique the Fourier method for estimating GPP. The Fourier method requires no quantification of other processes, such as respiration and air-water exchange, as they do not or only to a limited extent act with a diel frequency. Complex demodulation, a mathematical technique to estimate the slowly varying amplitude of an oscillating signal, takes the Fourier method one step further. With complex demodulation it is possible to derive time varying GPP. As a surprising result, diagnostic simulations demonstrate that it is possible to estimate daily averaged GPP rates.

Based on numerical model studies and application on real-world O2 time series, we have demonstrated that the Fourier method can give reliable estimates of GPP in a range of estuarine and coastal systems. The application to deep systems is a challenge, because of vertical gradients and (partial) stratification. In such systems, a quantitative estimate of GPP might not be be possible. However, application to a deep, seasonally stratified Fjord system shows that the method can still give qualitative results, and could potentially be used to identify episodes of nutrient inputs.

Conceptually, the most important aspect of the method is that it allows for a direct estimate of a rate merely from a concentration time series. The Fourier method is one of the very few methods that achieve this. The fundamental reason why this is possible is because of the known, diel periodicity of the photosynthesis process, driven by incident irradiance.

Cox, T.; Soetaert, K.; Maris, T.; Kromkamp, J. & Meire, P.and Meysman, F. (2015), 'Estimating primary production from oxygen time series: a novel approach in the frequency domain', Limnology And Oceanography:Methods 13, 529-552.

Cox, T.; Soetaert, K. & van Beusekom, J. (2017), 'Tune in on 11.57 $$Hz and listen to primary production', Biogeosciences 14, 5271-5280."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: European Metrology Network on Climate and Ocean Observation: the creation of a 'one-stop shop' for reliable measurements of ECVs

"A sustained and reliable ocean observing system is fundamental to understand the oceanic environment and help mitigate the climate change. By "… providing 97% of the Earth's water and 95% of its biosphere, the ocean is a crucial source of food, water, energy and raw materials, and acts as a medium for tourism, transport and commerce. Valued at US$24 trillion (WWF report 2015), the global ocean has been termed the world's seventh largest economy" [www.eoos-ocean.eu/about/what-is-eoos/].

Metrology is essential to ensure the traceability to the International System of Units (SI) of any measured Essential Climate Variable (ECV). It is the foundation of data quality and standardization, enabling mutual recognition of measurements and long-term reliability. The Global Climate Observing System (GCOS) recognise the importance of metrology and, in 2010 a Memorandum of Understanding has been established between the World Meteorological Organization (WMO) and the Bureau International de Poids et Mesures (BIPM), to promote metrology into environmental observation.

In Europe, the European Association of National Metrology Institutes (EURAMET) has recently agreed the creation of a "European Metrology Network (EMN) on Climate and Ocean Observation" intended to establish a 'one-stop shop' of metrology (advice, services) tailored to meet the needs of European (and global) climate and ocean observation related stakeholders.

The overarching aim of this EMN is the promotion of the effective and efficient implementation of high-level metrology for the Essential Climate Variables (ECVs), by the design of widely accepted traceability chains to the International Systems of Units.

The EMN will be organised with three technical sections covering "Atmosphere", "Ocean" and "Land & Earth Observation".

The "Ocean" section will focus on the metrology for Essential Ocean Variables (EOVs) and some additional ocean specific parameters, aiming at:

- Coordinating the provision of NMI and DI measurement capability to the European part of the Global Ocean Observing System EOOS
- Improving accuracy and stability of existing calibration capabilities and developing and disseminating new references for EOV e.g. pH, salinity, temperature, inorganic carbon, dissolved oxygen.

The poster will explain the creation and development of the European Metrology Network, focusing on the metrology for EOVs. The objectives, the structure, the role of the involved NMIs and the collaboration with the relevant stakeholders will be described, as well as, the different planned tools to address the metrological needs of the Oceanographic Community in a coordinated way."

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Theme: Regional ocean monitoring efforts

Title: The A-TWAIN and Fram Strait Arctic Ocean Observatories

"The Norwegian Polar Institute maintains two marine observatories in the European Arctic: A-TWAIN monitors the inflow of warm Atlantic water in the West Spitsbergen Current while the Fram Strait observatory measures the outflow of cold Polar water and sea ice in the East Greenland Current.

Warm water that flows northward from the Atlantic into the Arctic Ocean plays a crucial role for regional environmental conditions. The A-TWAIN observatory collects unique measurements of the Atlantic Water that enters the Arctic Ocean north of Svalbard. A-TWAIN was initiated in September 2012 during a cruise when a large hydrographic survey was undertaken and the first array of moored instruments was deployed to measure temperature salinity and velocity year-round. The array is supported with cruises typically every second year, during which moored instruments are serviced and additional hydrographic measurements are collected.

Measurements from the A-TWAIN observatory have allowed us to investigate the structure of the Atlantic water inflow and informed us about the extent to which the Atlantic inflow affects sea ice loss in the Eurasian Basin of the Arctic Ocean, while also providing information about mechanisms of lateral exchange with the basin interior.

Fram Strait is the largest gateway to the Arctic Ocean and the only gateway allowing deep water exchange. The Fram Strait observatory is centred around an array of moored instruments which provide a continuous, year-round time series of temperature, salinity, velocity and sea ice thickness measurements in the Arctic outflow. Additional measurements, as well as water samples and sea ice cores are collected along an annually repeated section every September when the mooring array is serviced. Helicopter-borne sensors are used to measure sea ice thickness and topography along the section typically every second year. The observatory was initiated the 1990s, but sparse hydrographic measurements have been collected from the region since the 1960s making this one of the longest climate time series in the Arctic Ocean.

Moored hydrographic and current measurements from the Fram Strait observatory reveal changes in the fluxes of freshwater leaving the Arctic Ocean while biogeochemical measurements reveal changes in freshwater sources and the ocean acidification state. Concurrent moored and helicopter-borne measurements of the sea ice reveal a thinning ice cover as well as variability in the categories of sea ice passing out of the Arctic Ocean though Fram Strait.

Monitoring key climate parameters at these ice-covered polar observatories presents some unique challenges and there are some observational gaps, which we are working to narrow. For example, specialised instruments are deployed in the upper 25 m of the water column where there is a high probability of collision with sea ice ridge keels and automatic water samplers have been deployed to

collect samples for laboratory measurement in winter when the observatories are inaccessible due to heavy ice conditions."

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Theme: EOOS: Sustainability, future priorities & next steps.

Title: From data to decision: new challenges in digitalisation of ocean toward data intelligence in support to more effective ocean man

"Integrated maritime policy covers a number of cross-cutting policies, including blue growth, knowledge of the marine environment, good environmental status, maritime spatial planning marine safety and monitoring of maritime areas. In this context, the need to develop integrated sustainable management based on the ecosystem approach implies to take into account complex systems interconnected spatially and temporally: biodiversity & ecosystem status and functions; ocean dynamics; society and economy. The purpose here is to present the key challenges to construct a successful innovative end-to-end ocean data management system, from data acquisition to decision making products based on digital solutions. Acquisition of physical, chemical and biological parameters of ocean in various spatial and temporal scales is vital of an efficient operational monitoring and research to improve the knowledge of a poorly understood environment. Monitoring must address many of the challenges of sustainable management: knowledge and diagnosis; definition of objectives and strategy; assessment performance in relation to stated goals and objectives; reduction of the uncertainty of management decisions related to the effects on both natural and socio-economic systems; governance and communication. Thus, the capitalization of knowledge is most valuable when it becomes part of decision-making processes. However, not all datasets, even those of high quality, are useful in marine management. The use of standardized Essential Variables helps to focus sustainable development goals allowing the monitoring of complex system founded on the continual updating of data based on a strong research basis and stakeholders' involvement linking science to society. Freely-available ocean observation data mainly providing by research data repositories are an essential part of the infrastructure for open science bringing considerable economic, scientific, and social benefits. Acquisition of knowledge and its capitalization (collect, process and ensure the management of information) is essential for the implementation of digital tools and the creation of innovative value-adding services and facilities (user-friendly, open-source, efficient and transparent tools for data visualization, integration and sharing, smart indicators) for a large variety of users, humans and machines. The design of a decision support tool based on geospatial information system is not new. However, new issues of geospatial ocean big data enable the development of efficient analysis of large volumes of oceanographic data in space and time in High-Performance Computing (HPC) environment. The aim is to have simpler workflow, as in the open data cube initiative (https://www.opendatacube.org/), using cloud computing and developing an open-source Discrete Global

Grid Systems (DGGS) geographical analysis system in support environmental assessment and decision-making for stakeholders. Beyond the challenges related to DGGS, the issue of the post processing of multivariate information is a major issue, needing the combination of innovations in observation sensors, spatial sciences, data mining and artificial intelligence (machine learning, inductive approach and predictive algorithms).

This is typically useful to meet the issue of managing both ocean adaptive management as MSFD or MSP and ocean dynamic management in real time, in a multidimensional highly dynamic system."

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Theme: Future look at the next generation of observing & monitoring tools and approaches;

Title: JERICO-RI: The integrated coastal component for the European Ocean Observing System

"JERICO-RI, the European research infrastructure of coastal observatories, is an ocean observing system of systems, designed to provide high-quality data that are supporting knowledge development on the complex and often coupled physical, chemical and biological processes characterizing the coastal waters of Europe. As such, JERICO-RI is foreseen to become an important building-block of the future EOOS. JERICO-RI is built around a multiplatform and multidisciplinary approach in order to tackle the complexity and high variability of coastal processes. It is targeted to answer to the requirement of an ecosystem approach, supporting research on multi-stressor impact on the environmental status. JERICO-RI integrates several types of observing platform, deployed in coastal and shelf seas, i.e. fixed buoys, piles, moorings, drifters, Ferrybox, gliders, HF radars, coastal cable observatories and the associated technologies dedicated to the observation and monitoring of the European coastal seas. The RI is to serve both the implementation of European marine policies and the elucidation of contemporary and future key scientific questions. It therefore includes observations of the physical, chemical and biological compartments and aims at a better integration of marine biology with physical and chemical oceanology.

The implementation of the JERICO-RI encompassed setting up, integrating and harmonization of existing coastal observing systems around Europe into a system of systems, covering all European coastal waters from the Baltic Sea to the Black Sea, This endeavour started in 2011 in the framework of the JERICO-FP7 project, and presently pursued through the H2020 JERICO-NEXT project, which involves 34 scientific and industrial partners. The main objective of the JERICO-RI consortium is to establish and implement a common strategy towards a sustainable coastal observing system of systems for Europe supporting with

sustainable blue growth in the European coastal ocean through technology, expertise, scientifically sound observations, data, and innovation.

This poster summarizes the work carried out since and the present drivers of the JERICO-RI science strategy for providing data and services.

Keywords: JERICO, JERICO-NEXT, Coastal Observatory, integrated multi-disciplinary system of systems, harmonization, sustainability, Open access, Blue growth."

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Theme: Ocean observation and Human Health: Monitoring needs and benefits

Title: The Olrac suite of electronic logbook (eLog) software solutions: Utilising all ocean going vessels as marine observation collect

"As civilisation's footprint on our oceans increases, there is a need to continuously monitor the human impacts on the entire ocean ecosystem. While there are vast efforts to do so, the reality is, considering the enormous expanse that needs to be covered, one can say that this effort is just a "drop in the ocean".

What if, the countless vessels already roaming the oceans, daily, were used as scientific, fisheries and general observations data collection platform? What if, each of these vessels and the individuals onboard were equipped with reliable and easy to use tool to enable all forms of marine related data collection? This is the vision of OLSPS!

OLSPS develops the Olrac suite of electronic logbook (eLog) software solutions. Innovative, comprehensive, paperless solutions for the collecting, analysing, plotting, mapping, reporting, tracing and transmitting of all marine and vessel-related data. This software is fully customisable and can be used for commercial fisheries, coast guards, cargo shipping companies, scientific surveyors, cruise ship operators and/or citizen science enthusiasts.

The Olrac suite of eLog software consists of two core components. Firstly, The Olrac Dynamic Data Logger (OlracDDL), a dedicated vessel unit, eLog solution, capable of capturing, storing and reporting of all marine-related data and observations. Secondly, The Olrac Dynamic Data Manager (OlracDDM), a complete web based system with the capacity to store and manage data, from any number of vessels, on one integrated platform.

The three relevant deployment options of the OlracDDL are suited for:

- Fishing operators - to record, report and manage commercial fishing data, during fishing operations, in real-time or post-event, using various data entry tools. The recorded data can be summarised into aggregated compliance, commercial and scientific reports.

- Onboard fishing observers - to monitor fishing operations and collect, enter and report a combination of environmental, scientific and fisheries related data.

- Casual marine observers - a generic, simple-to-use, yet very sophisticated marine observation collection platform called The Olrac Marine Observer (OlracMO). This technology allows any seagoing person, even those with little or no scientific/technical training, to accurately identify and report a broad spectrum of marine observations. These observations include hundreds of marine species such as cetaceans (dolphins, whales, and porpoises), sharks and rays, seals, turtles, sea birds, jellyfish and more. The OlracMO also permits the recording and reporting of pollution events, debris, other vessels activities, structures at sea, etc.

OlracDDL also offers Electronic Monitoring (EM) integration module as an enhancement utility to complimentary surveillance method used in conjunction with onboard observers. OLSPS approach is that EM technologies must be tightly integrated with advance Electronic Reporting (ER or eLog) technologies in a complimentary manner where fishers have the legal duty to honestly and accurately report his catch and effort data as required by law. The EM images can be then used for limited verification of key events such as the monitoring of possible discarding event, rough catch estimates, transfer of fish while at sea or during port landing, etc. This permits timely and accurate visual auditing of critical events during fishing operations."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Research Vessels are essential tools for ocean observations

"Ever since the HMS Challenger performed its global circumvention, ships have been essential platforms to study the seas and the oceans. Over the past decades, state of the art research ships have evolved into extremely specialized platforms that allow the most demanding and ambitious research activities in both coastal and remote, deep oceanic environments.

In the past 15-20 years the capacity of dedicated research vessels has been complemented with all sorts of robotic and autonomous vehicles, landers, moorings, drifters, satellite observations, cabled

observatories, etc., allowing data collection efforts that are impossible or too expensive to perform with ships.

Yet, all these infrastructures totally and heavily rely on ships to be deployed, maintained and/or recovered. The number of vehicles and autonomous observatories is still quite limited but increasing. The European research fleet is confronted with a growing demand to cover these services. Even the modern cabled observatories, which are being developed and deployed at European seas (EMSO ERIC) and worldwide, and which provide continuous near real-time data, depend heavily on oceanographic vessels for service and data validation.

A fleet of modern and sophisticated research vessels remains a crucial element for marine research and ocean observations. The integration of this research fleet and its coordination with other observing infrastructures should form the basis of a truly integrated European Ocean Observing System.

The functioning of a European Ocean Observation System will therefor by necessity need to consult the expertise residing in ERVO (European Research Vessel Operators), OFEG (Ocean Facility Exchange Group) and the EuroFleets+ project to ensure an efficient use of the available capacity of the European research fleet. A working group, composed of members of these networks, is under the mandate of the European Marine Board, currently drafting a position paper on the European research fleet, including its relationship of with EOOS."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Ocean Best Practices System: knowledge exchange for practitioners

"There is an ever-present need for the identification and dissemination of best practices in the multidisciplinary field of ocean observation and data management. However, the complexity of these domains and the diversity of its stakeholders make discovering relevant best practices (BP) a challenge. On the other hand, harmonizing the adoption of best practices across organizations, especially during the design and implementation of an Ocean Observing System becomes a crucial factor in establishing the

basis that guarantees its successful development and evolution. Nonetheless, addressing this aspect requires connecting and exchanging consensual best practices in ocean observation operation and technology, data management and applications. Equally important is the creation of a repository providing efficient discovery and access of documented best practices, and also expanding means of community engagement, including peer review and training.

The AtlantOS Project (through its Best Practices Working Group), the ODIP Project, the NSF Research Coordination Network, the UNESCO-IOC/IODE and others are collaborating on the development of an enhanced Ocean Best Practices System, based upon expanding the already existing IODE OceanBestPractices Repository and using new means to foster OBP use by a broader ocean community. This poster presents the progress of the collaborative efforts in developing the System that will become an essential building block as one of the fundamental elements of the European Ocean Observing System.

An Ocean Best Practices System (OBP-S) has been designed expressly to address the challenges of multidisciplinary research needed to answer the global challenges such as climate change and others (Pearlman et al., 2017). This solution covers the entire range of ocean observations including observing, data management and user support and draws on the developing fields of natural language processing and ocean vocabularies. But more than a technology, implementation is needed for effective community engagement. Thus, the OBP-S will provide mechanisms for community dialogues and to facilitate publishing BPs. One aspect of this effort is the recently created Frontiers in Marine Science, Research Topic: Best Practices in Ocean Observing, which will become a place of commentary and dialogue. Peer review of best practice articles is a means of promoting community adoption and providing increased visibility of methodologies. It also has significant benefits for those in universities and elsewhere that use number and quality of publications as a metric for advancement. Working together with Frontiers, the Research Topic offers this medium to describe and disseminate robust and high-quality methodologies and interoperability, linked and referenced to the OBP repository document as appropriate.

As the System depends on the quantity and quality of documents provided by its stakeholders, the project will pay substantial attention to community engagement. This is important, but does not stand in isolation. Training and capacity building are also an essential element for BP adoption. For OBP-S, this will be done working closely with established organizations such as IODE Ocean Teacher Global Academy (OTGA), POGO and the SCOR Committee on Capacity Building as well as other activities such as the summer schools run by major research initiatives such as IMBER, CLIVAR, SOLAS and GEOTRACES.

Reference:

Pearlman, Jay; Buttigieg, Pier Luigi; Simpson, Pauline; Muñoz, Cristian; Heslop, Emma and Hermes, Juliet (2017) Accessing Existing and Emerging Best Practices for Ocean Observation, a new approach for end-to-end management of best practices. In, Oceans 2017, Anchorage, 19-22 June 2017. MTS/IEEE Oceanic Engineering, pp. 1-7."

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Theme: Future look at the next generation of observing & monitoring tools and approaches;

Title: Antares E2 - Making large scale aerial ocean observation affordable

"Different sensor platforms can be deployed for ocean observation, each with its particular advantages and characteristics. Specific issues when considering the use of aerial sensor platforms are range, safety and not least the cost of data gathering versus the value of the data collected. New developments in the fields of propulsion technology and high reliability architectures result in significant changes to overall data gathering costs. This means that the cost/benefit analysis for the utilisation of aerial sensor platforms must be re-assessed.

The Antares E2 is a fixed wing aerial sensor platform currently under development. Featuring a very high endurance of up to 40 hours, a typical mission flight speed of 140 km/h (76 kts) and operations between sea level and an altitude of 6000 m (20.000 ft), the aircraft offers new opportunities for ocean observation.

Power for the multi-redundant electric propulsion system comes from high efficiency methanol fuel cells.High redundancy and high reliability system architectures combined with adverse weather capabilities result in both increased system availability and high mission success rates. At the same time, extremely low operational costs means that observation tasks can now be carried out where in the past these costs have been prohibitive.

A typical payload consists of a 360° multi mode maritime radar system, visible and infrared light cameras, radio receivers and satellite communication equipment. Additional sensors can be integrated according to the particular observation objectives. In order to facilitate this integration, the possible observation objectives, required sensors and future use cases for the aircraft will have to be identified and assessed in cooperation with the potential users in the ocean observation community."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: WAVY: Covering Marine Observation Gaps

"Surface drifters have been used for a long time to gather information about Ocean motion. A significant evolution has occurred since the message-in-a-bottle to present day's high accuracy GPS-positioned, multi-sensor, real-time tracked drifters. Different float designs have been tested over the last decades, mainly for deep-sea, and such approach was not followed by a similar drifter development for the nearshore dynamics. To our knowledge, WAVY is the first drifter to have been designed specifically to carry out measurements in the surf zone. It is a product being developed in the MELOA project, with its foundations in RAIA Regional Oceanographic Observatory (www.marnaraia.com).

The main distinguishing characteristics of the WAVY drifters are their small size, making them very easy-to-handle; their optimized buoyancy, minimizing their vulnerability to direct wind effect; and the mass distribution inside them, that minimizes the pendular motion, making them particularly stable, thereby allowing a very high rate of position acquisition. MELOA seeks to preserve these characteristics, while promoting the upgrade of the present WAVY and developing a family of drifters, which will range from small drifters suitable for beach and surf zone studies, to somewhat larger drifters tailored for coastal and long-term open ocean observations. The family will consist of five members, namely WAVY Basic, WAVY Littoral, WAVY Ocean, WAVY Ocean-plus and WAVY Ocean-Atmo, at different technology readiness levels (TRL).

MELOA is developing the prototypes for the different WAVY configurations and engaging with the marine community to test them in different marine environments. Results of test campaigns will be made widely available and used to develop the first products and services to showcase the usefulness of the WAVY data.

Focused on providing solutions to cover ocean observation gaps, MELOA (www.ec-meloa.eu) will address different use cases of marine in-situ measurements, while increasing the availability of in-situ data for coastal and open ocean zones. WAVY is laying the foundations of marine observation systems based on low-cost devices, while fostering innovation and contributing to the Sustainable Development Goals 9, 13 and 14."

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Theme: Sharing efforts and collaboration across sectors and communities

Title: IBISAR: service for real-time ranking of met-ocean data products for emergency and SAR operators

"Reliable near-real time (NRT) operational data and model forecasts are crucial to provide useful technical support to improve the Maritime Safety Agencies (MSA) response capacity in case of maritime emergencies, Search and Rescue (SAR) operations and marine environment protection. SAR and environmental risk simulations are mostly based on Lagrangian trajectory models. The accuracy of oil spill tracking and trajectory forecast of a drifting target depends on the integration scheme and on the wind and sea surface velocity field used in the Lagrangian model. Therefore different forecast of currents can result in disparate trajectories that together with the growing number of available ocean observation and model products can hinder the consensus on which model should be used.

In this regard, skill assessment (SA) methods are required to quantify model performance, by providing easily interpretable and understandable metrics, to be used as a confidence indicator of the forecast in a systematic and long-term routine manner. The IBISAR SA service, built on an existing operational service, executes first an automated process to simulate trajectories from the available met-ocean datasets and procure next an evaluation of the model performance. In this evaluation, observed and predicted trajectories are compared to provide a dimensionless skill score metric. Surface current data from multi-platform observing systems (e.g. drifting buoys, satellite-derived observations, High-Frequency Radar - HFR- and moorings) are used to estimate errors in the forecast model outputs.

Through the IBISAR service, users will be able to easily access the met-ocean data for downloading, visualizing and comparing different data products, assessing the quality of different model predictions and HFR performance in comparison with real-time or historical measurements. The service focuses on the IBI (Iberian-Biscay-Ireland) region, supporting a myriad of socio-economically important activities including fisheries, oil and gas shipping, commercial ship traffic, coastal and marine environment management and protection, marine safety and energy production. IBISAR service can be used by targeted users (e.g. SAR operators, emergency responders and other maritime safety, coastal and marine environment actors) as a decision-support tool to choose on-the-fly the best available met-ocean product as input for their SAR and environmental risk modelling applications.

The improvement and validation of IBISAR service are being carried out by a Public-Private Partnership between an advanced Marine Research Infrastructure and data provider (SOCIB, public sector), a Technological Centre with expertise on marine and food research (AZTI, private non-profit organization) and a Downstream Service Provider (RPS Ocean Science, private sector), under the umbrella of CMEMS (Copernicus Marine Environment Monitoring Service) User Uptake programme. This service relies on tight collaboration across ocean-related institutions and sectors working on marine safety and environmental protection, in particular with the Spanish Maritime Safety and Rescue Agency. Furthermore Puertos del Estado (Spanish Port System), key actor in the Copernicus Marine Service structure, actively collaborate providing best practices exchanges regarding coastal observations and model datasets integration into the service and synergies with existing assessment tools."

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Theme: From standalone to integrated ocean and coastal observing platforms

Title: How to develop European hydrographic platform serving all EU policies; a prospective pilot project?

"The coastal area is a major challenge for all the maritime policies due to the cross interaction among the climate change action (erosion, marine flood ...), the necessity to preserve marine ecosystems and habitats, the needs to develop sustainable economic activities.

A study, financed by the DG MARE along the coastal areas of 160 maritime regions of 13 EU countries, “Coastal mapping”, did a balance sheet of the gaps and needs of high resolution bathymetry to deliver to all the scientific studies and to stakeholders in charge of implementation of coastal and maritime policies. Only in the area of the project, 175 000 km2 of coastal gaps were identified.

The project put on light the necessity to increase the EU capacities to produce precise, standardized, validated bathymetry, useful for all the community and the necessity to put in place mutualized platforms of acquisition in the area of EU maritime basins.

Bathymetric Lidar was identified as a major challenge.

A EU strategy were suggested to the EU Parliament with 3 Axis totally on-line with EOOS;

-Set up coordinated programs for data acquisition at maritime basin scale, that needs to put in place mutualized observing platforms;

-Promote good practices for the production of bathymetric data from multiple sources, standardized for re-use by all coastal stakeholders for maritime policies;

-Increase opportunities for bathymetric data acquisition in the framework of the EU operational programs and funds; and ensure that those data are standardized and capitalized;

Within FP7 and with the support of the European Commission, the EuroFleets project is a successful first step towards the integration of the European research fleets. It has been possible to network ships, submarines and on-board equipments, to host mixed multidisciplinary teams and to have common developments.

But only the networking of the means of the scientific community with those of the European hydrographic offices community will make possible to achieve all the ambitious objectives set by the EU for the whole maritime area, formed by the national waters of its Member States. The poster proposes on the basis of the recommendations of the Coastal Mapping project and the achievements of the Eurofleets project to extend to all European bodies in charge of collecting information at sea, beyond the sole research organisations: a pilot project to;

- design a EU acquisition platform for physics, in particular bathymetry, sharing infrastructures of acquisition, strategic prospective for acquisition in EU financed projects, assessment for standards.

- develop the strategy for transnational access to means of acquisition of data at sea, and study the way of participation of EU funding to this mutualization,

- study the possibility to put in place joint campaigns partly led by the EU

- develop a shared vision of knowledge needs and gaps, facilitated by increased standardization of information exchanges and by the pooling of methodologies

In the specific and cross-cutting area of bathymetry, this pilot project would participate to the success of the EU's overall maritime strategy."

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Theme: Regional ocean monitoring efforts

Title: RAIA Observatory: Oceanographic and meteorological data and forecasting services in the western of Iberia since 2009

"Enhancing observations and understanding of ocean conditions and processes will facilitate the development of a blue economy. For example, it is well know that the western of the Iberian coast have an enormous potential for the development of the ocean renewable-energies.

Since 2009, the RAIA Observatory has been working as a cross-frontier infrastructure of monitoring and prediction of the ocean environment. RAIA Observatory has a clear goal of give support to the main maritime activities developed in these zones (maritime transport, ocean renewable energy, fishing, etc.),

which will benefit and be strengthened through the information, services and products provided by the observatory.

Besides, the effects of natural variability and human-caused climate change on the blue potential need to be assessed. RAIA Observatory, through MARRISK Interreg V project, is qualified to perform the research needed and to develop products that address these areas to help decision makers.

Inside RAIA Observatory, an infrastructure of oceanic monitoring has been developed. This network provides reliable in-situ meteorological and oceanographic information of high quality and density. Ocean (sea temperature, salinity, density, wave and currents at several depths as well as oxygen and chlorophyll concentrations.) and meteorological (wind, air temperature and humidity)data are measured at 10 min frequency and are available in real time after an automatic quality control.

Besides, meteorological and oceanographic operational models has been implemented, adapted and validated to reproduce the regional oceanic and atmospheric dynamic. Everyday, these models provide high resolution forecasting up to 72 hours of the state of the sea (wind, wave, currents, temperature and salinity fields).

These information, available models and observational data, are accessible from Web. A distributed architecture is in place enabling multiple standards based services for data access. Both THREDDS and OGC Catalogue services empower users when searching for available data. Available services are in compliance with EU INSPIRE directive. Taking advantage of THREDDS servers' capabilities a RAIA visualiser has been implemented to show real-time data on a GIS based framework from all the models and observations available for RAIA area of interest.

Finally, specific applications for end users have been developed using the capacity of the Observatory to provide predictions and observations in real time."

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Theme: Regional ocean monitoring efforts

Title: "Climate change; The tidal station of Genoa: 135 years of sea level measurements"

"The tidal station of Genoa is collecting sea-level data since October 1883 when a Thomson-model tide-gauge started to operate. Along with the tidal measurements performed in Trieste (1890) and Cadiz (1880) , the collected data-set is the longest sea-level time series available for the Mediterranean Sea, representing crucial observations for the assessment of long term sea-level variation. The station is

located inside the port of Genoa (44°24’43.3” N – 08°55’32.2” E) and has always been managed by the Italian Hydrographic Institute.

Now the tidal station includes a stilling well with an OTT Thalimedes float operated shaft encoder level sensor and an external OTT RLS 24 GHz radar level sensor, a non-contact radar pulse. Atmospheric pressure sensor sampling at 5 min interval completes the station.

Since 1954 sea level measurements have been used to obtain the mean sea level, which is the standard to calculate heights and elevations throughout Italy (benchmarks can be seen inside and outside the box), while the analysis of the long term time series contribute to better understand the effects of climate change.

Tidal components used for tidal prediction (tidal tables are issued each year by IIM) are those computed since 1955.

Starting from 2008, the sampling interval of both the instruments was increased to 1 minute, thus allowing the analysis of short period sea level oscillations such as seiches and meteo-tsunamis. For this reason the tidal station of Genoa is fundamental for the monitoring of the sea level surface and the phenomena associated. Its time series are continuously validated and used to investigate the development of the mean sea level along with the interactions of non-tidal components due to atmospheric interactions, responsible, in many occasions, for sudden raising of the sea-level. These events are important for the planning of harbour structures and in general for the interactions of human activities along the coast.

In this work time series of the mean sea-level variation, meteo-tsunamis events and spectral analysis of nontidal components, such as seiches and oscillations induced by atmospheric pressure, are shown as an example of the monitoring of the sea level along the coast of Genoa.

Sea level measurement, gathered over the years by IIM, represents one of the historical series and documents that can be broadly used for climate change modelling and evaluation. For this reason, the IIM is collaborating, in side of IHO-EU Network, with others Hydrographic Institute in the Mediterranean basin (France, Spain, Greece etc.) in order to build propositions of future projects inside the EU framework and EOOS objectives."

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Theme: Regional ocean monitoring efforts

Title: Ocean Radar Data used to improve Current Forecasting for the Port of Rotterdam

Since October 2015 a pair of WERA ocean radar systems is operational at the Dutch coast to monitor the currents at the entrance of the Port of Rotterdam situated at the mouth of the river Rhine. The radars are to be an integrated part of an improved hydrodynamic operational forecasting system which is under development for navigation to this port. This operational forecasting requires the highest availability and accuracy from the radar data. The system was configured with these aspects in mind. Furthermore, there is a strong focus on the on-line quality control procedures. The configuration and concept of on-line quality procedures will be presented and data and statistics are shown. The acquired current data from the radars is presently compared to other data sources and model results. These analyses show the level of complexity of the currents in the estuary and how much of that can be seen on the surface. Some of the results will be shown.

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Theme: Regional ocean monitoring efforts

Title: SOCIB, a regional ocean observing and forecasting infrastructure contributing to a long term sustained EOOS

"SOCIB is a marine research infrastructure, a multi-platform ocean observing and forecasting system that is leading a new era of ocean observation, a key grand challenge our society is facing today. SOCIB's observing capacity is composed of a variety of cutting edge multi-disciplinary monitoring platforms (e.g. surface drifters, profiling drifters, moorings, coastal stations, satellites, research vessel, high-frequency radar, autonomous underwater gliders, sea turtles) all continuously recording and transmitting data in near-real-time to SOCIB Data Center, in charge of making to make them publicly available for scientists and society.

Systematic and sustained ocean observations monitoring essential variables are vital to establish the ocean state and variability and to understand the ocean's role in climate variability facilitating climate prediction and scenario development and contributing to testing and improving climate models. Ocean observations are also essential to preserve ocean's health and to respond to real time society needs at regional and local scale, to guarantee the sustainability of natural resources and the preservation and science-based management of the marine and coastal environment. Clear examples of topics of particular relevance to the Balearic Islands are the sustainability of Bluefin tuna fisheries, the preservation of the shorelines and/or the development of downstream services and products to enhance safety in beaches and at sea.

SOCIB and similar infrastructures worldwide, because of their scientific excellence, critical mass, multidisciplinary, integrated and targeted approach, open data policy and sustained funding, are establishing new research ecosystems that facilitate mission-oriented innovation. More specifically, SOCIB contributes to state of the art science, implements new technologies, responds to society needs and challenges and develops new products. Through all this, and with well-focused outreach and science-society engagement, SOCIB team contributes to bridge the science-policy gap. SOCIB is establishing new ways of international partnership to reach high level goals & grand challenges that are leading to major science breakthroughs, innovations in ocean observation and forecasting, and new ways of more efficient and science based coastal and ocean management to guarantee healthy oceans for a sustainable planet of our future generations.

SOCIB is therefore fully aligned with SDG's and the recent UN initiative declaring the oceans as the new frontier and 2021-2030 the Decade of Ocean Science for Sustainable Development to mobilize the scientific community, policy-makers, business and civil society around a programme of joint research and technological innovation. More specifically, SOCIB efforts are in synergy with different international initiatives and programmes (EMODnet, EuroGOOS, CMEMS, Euro-Argo ERIC, Global HFR Network, JCOOM) and aligned with european joint projects (JERICO-NEXT, Medseacheckpoint, ODIP2, CMEMS-SE INCREASE, CMEMS-INSTAC-phase2, CMEMS-User Uptake IBISAR), favoring the networking and the coordination to improve efficiency. The vision of scientific excellence with impact on society together with the implementation of integrated regional observing systems can provide useful guidelines for connecting the pieces of the n-dimensional ocean puzzle and for potentially guiding the evolving European Ocean Observing System (EOOS)."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Stress testing the EU monitoring capacity for the Blue economy

"In 2013 EMODnet started to develop a marine observations assessment framework, so-called "EMODnet Checkpoint" to establish how well the European marine monitoring data meets the requirements of the sustainable blue economy. In this poster only the Mediterranean and Black Sea results are shown but all the regional seas have been activated.

Checkpoints have developed an innovative monitoring assessment framework that considers "Use Cases" or "Challenges" to evaluate the fitness for use of monitoring data sets (observational and modelling). In other words, the quality of the Challenge products will inform on how monitoring data set are "fit for use".

The Mediterranean and Black Sea Checkpoint assessment developed a “Service” composed of: 1) a GIS metadatabase with information about upstream data sources for Challenge products and availability indicators; 2) a Web GIS product display with links to the upstream data sources; 3) a browser and dashboard tool to evaluate statistics of indicators. User requirements are recorded in the product catalogue (Data product Specifications), which can be viewed for later corrective actions. The gaps emerging from this framework

The final results of the monitoring assessment have shown very consistent gaps, some across the two basins others specific of each area."

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Theme: Regional ocean monitoring efforts

Title: MONIZEE: THE PORTUGUESE REAL TIME OBSERVATION NETWORK OF THE OCEAN

"A real-time monitoring system for the Portuguese Exclusive Economic Zone (MONIZEE system) was installed by Instituto Hidrográfico, the Portuguese Hydrographic Office. Starting from a number of monitoring capacities already existent since the 1970s, such as coastal tidal gauges and wave buoys networks, the system was expanded during the last decade by the inclusion of networks of multiparametric buoys and HF radar stations. At its present stage of development the MONIZEE system covers the coastal ocean area off the Portuguese mainland. It extends for more than 1000km along a particularly interesting area of the North Atlantic eastern boundary layer that comprises the northern margin of the Gulf of Cadiz and the western Portuguese margin. The measurements collected at the fix-point stations that integrate the system are complemented with ship observations conducted as part of dedicated research surveys or in an opportunistic way. The MONIZEE system is presently contributing to global and European programs such as GTS and IBIROOS and integrates the European network of coastal observatories gathered under JERICO-NEXT. The installed capacities are also contributing to regional observatories such as the RAIA observatory (northwestern margins of Portugal and Spain) and the recently started OCASO observatory (southern margins of Portugal and Spain).

The integration of real-time monitoring capacities with operational forecast tools gives to the MONIZEE system unique capacities in the prevention of harmful situations and in the support to crisis management operations.

In this communication we present an overview of how the MONIZEE system is being used to monitor key oceanographic processes that characterize the Portuguese coastal ocean area and have a clear trans-boundary expression, promoting the connectivity between different regional areas along the European

margin or linking the eastern boundary layer dynamics to the North Atlantic basin circulation. The contribution of the MONIZEE system to improve our understanding of these processes as well as the role presently played by this system in supporting coastal populations and marine policies are exemplified in the poster. An overview of the near future development of the system, in particular the articulation with new monitoring technologies, will also be presented."

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Theme: Citizen Science for observation and monitoring

Title: Marine Litter deposition modelling

"Select citizen science data for the island of Ireland annual Coastwatch survey has just been transformed into one open access database with over 20000 survey occasions. The last 7 years are also available as GIS maps down to 500m shore detail. Coastwatcher citizen volunteers participate in both survey and result follow up action decisions.

Three result use examples are then outlined (i) locating and protecting previously unknown Zostera beds, (ii) early detection of IAS and (iii) predicting type and volume of marine litter deposition.

The verbal pitch will highlight the potential for converting data held in other countries of the Coastwatch Europe network into open source and for doing a large scale 2019 Coastwatch survey across Europe with comparison across the seas. "

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28. Cláudia Viegas

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Theme: Linking ocean observations to modelling.

Title: Ocean observations- a key factor for model implementation and validation for the Azores 3D-hydrodynamic and biogeochemical model

"The Azores Economic Exclusive Zone (AEEZ), located in the mid North Atlantic Ocean, covers an area bigger than 950 000 sq. km. around Azores archipelago. AEEZ sea floor is mostly deep, up to 5500m depth, with shallowest areas around the islands, in the Mid Atlantic Ridge, and in several seamounts.

An 3D-hydrodynamic model has been developed for the Azores region, using a nesting models approach, allowing to produce results for the entire AEEZ, with higher resolution results for regional models, and specific areas, like Condor Seamount.

The implemented model uses a 3-D configuration, with a constant horizontal spatial grid, and 50 vertical layers, with sigma layers the surface, and cartesian layers from the surface up to 5500 meters depth (maximum depth). Using a downscaling technic, from the global circulation model, MyOcean, available at Copernicus Marine Service (http://marine.copernicus.eu/), high resolution 3D hydrodynamic are produced. Model atmospheric component is forced by Global Forecast System model (GFS), also available online (https://www.ncdc.noaa.gov/data-access/model-data). The bathymetry was obtained gathering data from Azores University and EMODNET (http://www.emodnet.eu/data).

To implement this ocean hydrodynamic model, the use of global ocean and atmospheric model results available online, is crucial. The calibration and validation of physical parameters like water level, temperature and salinity, requires in-situ and remote data sources. In this work are presented model validation results using Argo buoys, tide gauges, and satellite data.

Long term time-series obtained from tide gauges, located in fixed points, were used to validate water level results. Satellite images allows to validate sea surface temperature and salinity for the entire study area. To validate these parameters along the entire water column, Argo buoys data is used. These buoys provide discrete sea salinity and temperature data for the inter water column. These 3 were essential to develop the first steps of this model implementation.

Ocean observatories. Ocean observatories collect long-time series, either in the surface, in the water column, or in the deep-sea bottom, allowing to detect temporal and seasonal oceanographic events, offering a unique opportunity to better understanding ocean processes, and to validate physical and biogeochemical parameters. Data from MOMAR observatory, managed by IFREMER, since 2010, located in LuckyStrike seamount, will be used in the next step of this model validation. Also the data previously, collected during Condor observatory implementation (2008-2012), from the subsurface down to the sea floor, where multidisciplinary cruises, opportunistic samples collection, deployed and moored instruments, collected data on key parameters will be used.

The link between modelling and ocean data is crucial for model improvement. The availability of ocean data online from several sources like Copernicus Marine Service, EMODNET, and NOOA, was essential for this first modelling approach in Azores, and more data will be essential for model development, calibration and validation. Collaborative projects like FixO3 and EMSO, and international frameworks like Pangea or GOOS, are other good examples of ocean data sharing initiatives that will be useful for model improvements."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Reference Chemical Profiles for the N-NW Spanish Standard Sections

"Since 1991, Spanish Institute of Oceanography (IEO), within the RADIALES time-series monitoring program, has monthly sampled key oceanographic variables (nitrates, nitrites, phosphates, ammonium, silicates and dissolved oxygen) in 5 standard sections around the Galician and Cantabrian coast. The European Marine Observation and Data Network (EMODnet) projects promote the validation and control of these biogeochemical data collections.

The validated dataset, from 1991 to 2014, has been flagged according to internationally accepted quality criteria. This dataset has been used to define chemical reference-average profiles for each station and its inter- and intra-annual variability in the purpose of establishing reference and range seasonal profiles. In the aim of describing the chemical behaviour of the area and its variability along the time, including as short changes as long-term ones, this study covers coastal, shelf-break and oceanic waters.

The created reference profiles are a useful tool to validate future data on the area and to compare environmental conditions in order to determinate changes not only explained by seasonal variability. Furthermore, the early detection of variations in nutrient concentrations is essential to predict the ecosystem responses, and these references are also valuable in the initial stages of these mentioned responses.

Key words: climate variability, chemical profiles, nutrients, standard sections"

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Theme: Linking ocean observations to modelling

Title: GOFS16, the CMCC Global Ocean Forecasting System at eddying resolution for ocean forecasting and coastal applications

"GOFS16 is the short-term predictions operational ocean forecasting system, developed and maintained operational by the euro-Mediterranean Center on Climate Change(CMCC). Its horizontal resolution of 1/16° (6.9 km at the equator, up to ∼2 km at high latitudes) with 98 unevenly-spaced vertical levels, makes it one of the few mesoscale resolving operational systems in the world. GOFS16 is based on an eddying global NEMO-LIM configuration (Iovino et al. 2016), and is coupled to a 3DVAR data assimilation methodology (Storto et al. 2015) to provide daily initialization fields. The system assimilates salinity and temperature profiles (XBT, CTD, ARGO, moorings), sea surface temperature from Metop-A/AVHRR and GCOM-W/AMSR-2, along track satellite altimetry observations from CMEMS (Jason-2, Altika, CryoSat2), and sea-ice concentration by the National Centers for Environmental Prediction (NCEP), on a daily basis. The forecast system is forced by 3-hourly momentum, radiation, and precipitation fluxes from the NCEP operational Global Forecast System (GFS) fields , and it runs once a day to produce a 6-day forecast. Results include global sea surface height, three-dimensional temperature, salinity, velocity fields, and sea-ice properties. An overview of the system is presented. Assessment of predictive skills is carried out with all the available observations.

GOFS16 is also used for several downstream applications, namely regional and coastal downscaling in several regions of the world ocean. Downscaling in several regional and coastal areas is realized with a new tool, the Structured and Unstructured Relocatable ocean model for Forecasting (SURF, Trotta et al. 2016) based on NEMO, reaching resolutions of 1/64° and nested within the global operational model.

Iovino, D., Masina, S., Storto, A., Cipollone, A., and Stepanov, V. N.: A 1/16◦ eddying simulation of the global NEMO sea-ice–ocean system, Geosci. Model Dev., 9, 2665-2684, 2016.

Storto, A., Masina, S., Navarra, A.: Evaluation of the CMCC eddy-permitting global ocean physical re-analysis system (C-GLORS, 1982-2012) and its assimilation components, Q. J. R. Meteorolog. Soc., 142 (695), 738-758, 2015.

Trotta, F., Fenu, E., Pinardi, N., Bruciaferri, D., Giacomelli, L., Federico, I., Coppini, G. A Structured and Unstructured grid Relocatable ocean platform for Forecasting (SURF), Deep-Sea Res. II, 133, 54-75, 2016."

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Theme: Linking ocean observations to modelling

Title: The Copernicus Marine Service ocean forecasting system for the Mediterranenean Sea

"The Mediterranean Monitoring and Forecasting Center (MED-MFC) is part of the Copernicus Marine Environment and Monitoring Service (CMEMS) and provides regular and systematic information on the time-evolving Mediterranean sea physical (including waves) and biogeochemical state. The systems consist of 3 components: 1) Med-Physics, a numerical ocean prediction systems, based on NEMO model, that operationally produces analyses, reanalysis and short term forecasts of the main physical parameters for the entire Mediterranean Sea 2) Med-Bio, a biogeochemical analsyis and forecasting system based on the Biogeochmical model BFM which provides information on chlorophyll, phosphate, nitrate, primary productivity, oxygen, phytoplankton biomass, pH and pCO2; 3) Med-Waves based on WAM model and providing analysis, forecast and reanalysis products for waves in the Mediterranean Sea.

The Med-Physics analysis and forecast system is composed by the hydrodynamic model NEMO (Nucleus for European Mod- elling of the Ocean) 2-way coupled with the third generation wave model WW3 (WaveWatchIII) and forced by ECMWF (European Centre for Medium-range Weather Forecasts) atmospheric fields. The model solutions are corrected by the 3DVAR data assimilation system (3D variational scheme adapted to the oceanic assimilation problem) with a daily assimilation cycle of Sea Level Anomaly and vertical profiles of Temperature and Salinity.The system has a resolution of 1/24 degree in the horizontal and 141 vertical levels. The model has a non-linear explicit free surface and it is forced by surface pressure, interactive heat, momentum and water fluxes at the air-sea interface.

The Med-Bio system provides both NRT and Reanalysis products. The biogeochemical analysis and forecasts for the Mediterranean Sea at 1/24 degree are produced by means of the MedBFM v2.0 modeling system (i.e. the physical-biogeochemical OGSTM-BFM model coupled with the 3DVARBIO assimilation scheme). MedBFM uses as physical forcing the outputs of the Med-Physics products. Seven days of analysis/hindcast and ten days of forecast are bi-weekly produced on Wednesday and on Saturday, with the assimilation of surface chlorophyll concentration from satellite observations (provided by the CMEMS-OCTAC). In-situ data are mainly used to estimate and reduce model uncertainty.

The Med-Waves modelling system is based on the WAM Cycle 4.5.4 wave model. It consists of a wave model grid covering the Mediterranean Sea at a 1/24° horizontal resolution, nested to a North Atlantic grid at a 1/6° resolution. The system is forced by ECMWF winds at 1/8°. Refraction due to surface currents is accounted for with the input currents originating from CMEMS Global (1/12°) and Med (1/24°) MFCs. The system assimilates altimeter along-track significant wave height obtained from the CMEMS Wave TAC. It provides 1-day analysis and 5-day forecast hourly wave parameters. Currently, wave buoy observations of significant wave height and mean wave period obtained from the CMEMS INS-TAC are used to calibrate and validate the Med-waves modelling system. Model-buoy comparisons at individual wave buoy locations and/or for selected wave buoy groups (e.g. offshore/coastal) are performed.

The validation of the modeling systems and the estimate of the accuracy of the numerical products are key issues to ensure reliable information to users and downstream services."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: The role of observations in understanding the Black Sea dynamics and recommendations for future observing systems

Since 2016, the Black Sea Monitoring and Forecasting Centre (BS-MFC) in the frame of Copernicus Marine Environment and Monitoring Service (CMEMS) is providing regular and systematic information about the physical state, marine ecosystem and wave conditions in the Black Sea area, keeping efficient operations, advanced technology and high quality modeling products. To improve Near Real Time (NRT) and Multi-Year Products (MYP) system skill scores of Physics, Biogeochemistry and Wave, a robust observing network is fundamental for model verification, calibration and improvement through data assimilation. CMEMS provides an extensive catalogue for the Black Sea area, including insitu and satellite high quality data. However, the lack of data still represents a limit for hydrodynamic core model validation, especially in shallow areas where quality checked and consistent near real time data is insufficient. Furthermore, the quality of chlorophyll data is not optimal due to very few in-situ data to use for calibrating satellite algorithms. Additionally, the retrieval of chlorophyll values from fluorescence data as in ARGO floats is not straightforward in oxygen deficient environments like the Black Sea and required high quality in-situ data for the calibration of the fluorescence-chlorophyll equation. The lack of data applies as well for in-situ wave measurements: mooring buoy stations distributed along the coastal area are extremely insufficient and not continuous in time. The Black Sea is considered as an ideal laboratory where processes common to the world ocean (e.g. cold water formation, deoxygenation, denitrification-nitrogen fixation) are worth to be monitored in a climate change context through the setting of an adequate integrated observation-modelling system. To drive the new scientific challenges for the development of the Black Sea operational systems, it is necessary to define also new technological opportunities for improving both satellite and insitu infrastructures, able to support the R&D activities such as the modeling and assimilation capabilities, validation and verification of modeling products, real time monitoring,

estimation of quality of physical variables (e.g. mixed layer depth, stratification, cold intermediate layer content). The evolution plan of the BS-MFC provides some good examples on how new observations are used for improving NRT and MYP as well as recommendations on how to improve the existing observing network for the description of ocean state and marine environment, useful for enforcing the newly developed Black Sea GOOS at European scale.

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Theme: Linking ocean observations to modelling.

Title: The Copernicus Marine Service for the Black Sea: products for user needs, modelling challenges and future perspectives

The Black Sea Monitoring and Forecasting Centre (BS-MFC) provides regular and systematic information about the physical state, marine ecosystem and wave conditions in the Black Sea area, keeping efficient operations, advanced technology and high quality modelling products, to serve the specific user needs. It is operational since 2016 in the framework of Copernicus Marine Environment and Monitoring Service (CMEMS). The BS-MFC products for the Physics, Biogeochemistry and Waves components are classified as: a) Near Real Time (NRT) analysis and forecast products, updated at daily frequency; b) Multi-Year Products (MYP), updated at yearly frequency. The BS-MFC high level architecture is defined by: a) Physics, Biogeochemistry and Waves Production Units (PU) and related backup and archiving units (AU/BU) for service reliability; b) the Local Service Desk, connected to CMEMS Service Desk and BS PUs for service management; c) the Technical Group for implementing interfaces between the BS PU and the CMEMS Dissemination Unit (DU). The BS-MFC implementation over period 2018-2021 will evolve according to the main scientific and technical challenges to address, such as: 1) upgrades of the core models used for the

BS-MFC hydrodynamics, biogeochemistry and waves modeling frame (NEMO, WAM) , 2) revised implementations of the data assimilation core as a prerequisite for the improvement of the NRT and MY products quality, 3)use of interannual datasets and forecast data for the Danube River freshwater input, 4) evolution of the validation tools for assessing the monitoring and forecasting capabilities of the BS-MFC products, 5) implementation of the optimal interface between the BS-MFC and the Mediterranean Sea Monitoring and Forecasting Centre (Med-MFC) thought the Marmara Sea. The main characteristics of the BS-MFC production units will be extensively described, with a focus on the observations (in-situ and satellite) available through the CMEMS catalogue, and their use in the data assimilation system and for the validation of the BS-MFC products.

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: SeaDataCloud historical temperature and salinity data collection of the Mediterranean Sea and its data gaps analysis

"A new version of temperature and salinity historical data collections for each European marginal sea (Arctic Sea, Baltic Sea, Black Sea, North Sea, North Atlantic Ocean, and Mediterranean Sea) spanning the time period 1900-2017, have been released within the SeaDataCloud Project in June 2018. They are available as ODV collections through the web catalog at https://www.seadatanet.org/Products together with their associated Digital Object Identifier (DOI) and Product Information Document (PIDoc) containing the specifications about product's generation, quality assessment and the technical details to facilitate the users' uptake.

The objective of the presentation is to introduce the first release of SeaDataCloud temperature and salinity historical data collection for the Mediterranean Sea (http://doi.org/10.12770/2698a37e-c78b-4f78-be0b-ec536c4cb4b3), its space-time data distribution and usability. Statistics about the data population of SeaDataNet infrastructure show a progressive increase of available data. Data quality also has improved thanks to the introduction of additional checks exploiting the complete metadata description. In fact, the analysis could be performed by instrument type to verify the data set completeness and consistency, per data originator or distributor to identify systematic data anomalies. The derived metadata statistics allow a monitoring of the data sharing landscape and the advent of new sensors' data, which require particular efforts in data management and quality assessment.

In view of the new derived SeaDataCloud regional climatologies for the Mediterranean Sea, an integration with external data sources is necessary in order to maximize the data space time coverage/resolution and thus the product's quality. Temperature and salinity data integration in the Mediterranean Sea from the

Copernicus Marine Service (CMEMS, http://marine.copernicus.eu/), the World Ocean Database (WOD, https://www.nodc.noaa.gov/OC5/WOD13/) and MEDATLAS (https://odv.awi.de/data/ocean/medatlasii/) highlighted that there are still gaps in the data assembly landscape.

The results of data integration will be presented for the Mediterranean Sea, highlighting the complementarity of the different data sets and the critical aspects to be considered for long term studies and applications. Comparative analysis of data distribution in space and time will highlight the principal characteristics of the original and the merged data sets, while statistics (mean and standard deviation) of temperature and salinity computed over 17 regions of the Mediterranean Sea will describe their principal climatological properties."

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35. Claudia Caro

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Use and usefulness of open source spatial databases for the assessment and management of European coastal and marine ecosystem s

"Assessing the stocks and flows of ecosystem services valued by society is crucial to ensure the sustainable management of marine ecosystems, as required by the European Marine Strategy Framework Directive (MSFD; EC, 2008). The mapping of these ecosystem services enhances the flow of information from researchers to practitioners, contributing to a better management of ecosystem services. The objective of this paper is twofold.

First, a screening and evaluation of available open source spatial databases was conducted to assess their usefulness to map European coastal and marine ecosystem services. Second, these spatial databases were classified according to the DPSIR (Drivers, Pressures, Status, Impacts, Responses) framework and the MSFD descriptors to assess how this information can inform decision-makers. The supply of explicit spatial information was used as main screening criteria and allowed to identify 581 existing databases. These databases were then categorized according to a set of criteria (including data collection methods and updating frequency) related with their usefulness to be applied to map ecosystem services. The databases that did not meet the selected criteria (e.g. no explicit spatial information) were discarded. This process allowed to identify 329 spatial databases useful for coastal and marine ecosystem services mapping in Europe. The databases were then distinguished based on the ability to work the data on a GIS software, identifying 193 databases that allowed further analysis (hereafter applicable), and 136 databases that do

not allow the extraction of data (hereafter non-applicable). The applicable spatial databases were further linked to the i) CICES framework for ecosystem services classification, ii) DPSIR framework and iii) descriptors considered in the MSFD. The obtained results showed that 42% of the spatial databases can be useful to map regulation services, followed by provision (33%) and cultural (21%) services. Considering the DPSIR framework, more than half can be used as proxies to evaluate coastal and marine ecosystems status (66%), followed by proxies of pressures (18%), drivers (8%), responses (4%), and finally impacts (4%). The available databases represent in a better way MSFD descriptors related to Hydrogeological conditions (D7), Eutrophication (D5), and Biodiversity (D1), being the non-indigenous species (D2) and contaminants in seafood (D9) descriptors somehow underrepresented. The obtained findings highlight the spatial open data limitations and challenges when mapping coastal and marine ecosystem services and contribute to the identification of spatial data gaps and opportunities when aiming for the sustainable management of marine ecosystems."

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36. Ellen Vos

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Ellen Vos works for both the Netherlands Hydrographic Service of the Royal Netherlands Navy and for the Dutch Marine Information and Data Centre (IHM). She has a background in geospatial standardisation, biology and public information management. She is passionate on (international) cooperation on sustainable use of oceans from policy level to grass roots level.

Theme: Sharing efforts and collaboration across sectors and communities

Title: Looking for shared language on (healthy) oceans using standards to share efforts across communities and data domains

"Responsibilities are connected to which areas? (An example are the coastal zone of UNCLOS, part of the Administrative Units theme of INSPIRE.) These questions fit within existing work on Marine Cadastre in Europe, as published by Wouters and Balla. In this work the Marine Cadastre is considered to be the cornerstone of a Marine SDI (Spatial Data Infrastructure).

Next step is environmental information (especially depth, or Elevation in the language of INSPIRE) as foundation layer. Several initiatives (like INSPIRE, EMODnet, GEBCO) and standards (like INSPIRE Elevation, IHO S-102, SeaDataNet) are involved. Also meteorological and oceanographic information are needed. Some parts are covered by INSPIRE Annex III themes, but most data is held in domain specific infrastructures. How to connect to these and how to connect these domains in the standardization work?

Finally, willingness to cooperate is key. Shared language is needed even to start cooperation in any context, let alone to reach consensus while crossing different disciplines, management levels and international boundaries. This poster seeks a fruitful combination of purpose driven (sustainable development by means of renewable energy by windfarms) and technology driven elements (improving technical standardization).

The European focus on Marine Knowledge and the global focus on (sustainable use of) healthy oceans are drivers of a better integration of the underlying (geospatial) data infrastructures."

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37. Jane Delany

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Theme: Citizen Science for observation and monitoring

Title: Advancing Citizen Science for Coastal and Ocean Research

"The extensiveness of the world's oceans and coastlines, and the significant challenges and complexity that interacting stressors present to marine diversity, means that 'non-traditional' approaches to data gathering will become increasingly important tools for marine research and observation activities. Citizen Science is a potentially powerful tool for the generation of scientific evidence, particularly in cases where the consideration of large spatial scales is a factor.

While technologies are certainly not mandatory, there is a large potential for them to address a number of new parameters, assist in quality control and acceptance of data, help with visualization and interpretation, and enable free access to data for a more extensive societal reach. Technology has vastly increased accessibility: (i) of the citizen to the scientist, and the ease with which the citizen can return collected data; and (ii) of the natural environment to the citizen and the ease with which the citizen can collect and engage with ocean data. It is this factor that is purported to have been the greatest driver in the dramatic expansion of Citizen Science over the last two decades.

According to the Aarhus Convention, citizens have a right to participate in environmental decision-making, and to be involved in the development and implementation of marine policy. Citizen Science participation can be a channel through which citizens exercise this right. Bottom-up initiatives and policy development, supported by scientific evidence, and addressed by local communities to tackle local issues in a way which is appropriate for their needs, can enable the development of more successful and sustainable outcomes. By facilitating members of the public to address issues that directly affect them - at local, national and global scales - it provides opportunities to influence decision-making about these issues.

Realising the full potential of Marine Citizen Science in Europe will require concerted action by research organizations and research leaders, not only from the marine sciences, but also from diverse fields including psychology, information technology, law and economics. Research funding organizations can promote and support a greater deployment of Citizen Science through national research programmes and strategies. Strong European-level coordination and support is required in order to promote exchange of good practices and to ensure that Citizen Science is contributing to the European Research Area. This EMB working group reflects on the value of marine citizen science in an era of technological development and environmental change. It outlines 8 strategic action areas, grouped under shorter- and longer-term actions, for progressing Marine Citizen Science in Europe."

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Theme: Linking ocean observations to modelling.

Title: Mapping the oil hazard across Atlantic ocean coasts

It is currently estimated that over 600,000 tons of oil end up in the ocean, every year, due to maritime casualties and operations. The volume may sound impressive but the fact that we still ignore the impacts such volume of oil may have in the marine and coastal environments is striking. Mapping the potential oil spill hazard represented by maritime transportation challenges our capability to go through the ocean observation added value chain: firstly, it demands international and coordinated efforts to observe and forecast the ocean dynamics in the appropriate scale. Secondly, a state-of-the-art product must be developed giving answers to the end-users. Finally, it must be checked whether the answers given by the new product tackle the proposed challenge. Under the AtlantOS H2020 project, we have used ensemble oil spill modelling to map the oil spill hazard posed by maritime transportation (and its uncertainties) for the whole ice-free Atlantic basin, relying on meteo-oceanographic products delivered by the Marine Copernicus service. An open, free and interactive web-portal (https://glamor.sincem.unibo.it) was created to make the results available to the end-users. The fitness-for-use of the product (i.e. oil spill hazard map) was evaluated using the EMODNET Checkpoint methodology and gaps in the current observational/modelling system were identified.

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39. Sheila JJ Heymans

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Theme: Linking ocean observations to modelling.

Title: Enhancing Europe's capability in marine ecosystem modelling for societal benefit

"Marine ecosystem models are an important analytical approach to integrate knowledge, data, and information; to improve understanding on ecosystem functioning; and complement monitoring and observation efforts. They are also a key component of a functioning ocean observing value chain, offering the potential to predict the response of marine ecosystems to future scenarios and to support the implementation of ecosystem-based management of our seas and ocean. Observations and experiments remain vital to provide a mechanistic understanding of marine ecosystem dynamics, inform model design and parametrization, and assess model reliability. In turn, models provide a coherent and comprehensive framework, useful to interpolate and extrapolate experimental findings, test hypotheses, provide scenario analysis and support management of the present and future oceans.

Highlights and recommendations are presented from a recent EMB publication on "Enhancing Europe's capability in marine ecosystem modelling for societal benefit". This includes examples of marine ecosystem models used in management of the marine environment and the existing challenges and research and development needs required to enhance the use of marine ecosystem models as effective decision support tools in evidence-based policy making. Recommendations include enhancing links between marine ecosystem models, ocean observations and data assimilation centres, promoting multi-stakeholder dialogue and co-design of marine ecosystem models to ensure fitness-for-use and increasing the use of computational models in ocean observing system requirement setting, gap analysis and system design."

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Theme: Regional ocean monitoring efforts

Title: Marine coastal condition assessment in a scenario of global changes: from monitoring to decision-making

"The increase of the European population as well as their fixation near the coast results in significant anthropogenic impacts on marine and coastal ecosystems. The increase of pollution, coastal erosion and

climate change are affecting the biodiversity of these ecosystems, both at global and regional scales. The reduction of these impacts and the guarantee of the conservation of the coastal ecosystem is, nowadays, the key element to ensure the long lasting well-being for a growing population (UNEP, 2011).

In Portugal, about 75% of the population lives near the coast. Regional authorities are compromised to minimize the effect of these anthropogenic impacts in the ecosystems and to promote the increase of biomass. Long term monitoring strategies need to be implemented, comprising the full scale characterization of the coastal areas and the continuous monitoring of the maritime variables. Besides the increase in coastal monitoring and sensorization, there is still a lack on methodologies and systems to support the management and aid with the outline of mitigation actions for coastal ecosystems stressors.

An example that shows the regional entities' commitment to this goal is the Next-sea project, which aims at the deployment of the next generation monitoring strategies for coastal ecosystems in scenarios of global change. By combining new low-cost sensors with advanced decision support models, variables such as water temperature, pH, salinity and chlorophyll concentration can be recorded for larger areas and more frequently, in an actionable framework. The sensors will be displayed using an array configuration that should be anchor on the seafloor and be at least 4 to 6 m from the surface. To complement coastal monitoring, a decision support system is also under development. The goal of this system is to allow the assessment in real time of the impact and effect of climate change factors in coastal areas throughout the spatial prediction of climate parameters, the computation of habitat suitability maps and by providing new scientific knowledge databases for coastal erosion problems, water quality and biological ecosystem regeneration. In addition, the system also supports the decision concerning the choice of the best locations to position maritime infrastructures like wind turbines, offshore infrastructures, artificial reefs and other multifunctional equipment, by combining the available maritime information (physical and biological parameters, as well as marine usage constraints due to human activity). This is achieved through the combination of the following techniques: i) geostatistics, to spatially and temporally map and predict the maritime variables in coastal areas; ii) a weight definition technique like the Analytic Hierarchical Process (Saaty, 1970) to combine all the information according to its relevance; and finally, iii) a linear weight combination technique to group all the information accordingly with predefined goal. The Next-sea case study area is the North Coastal National Park located in the North of Portugal.

In this study the initial results obtained after the implementation of the information models are shown and discussed. Among others, the approach adopted showed to be very efficient on delivering maps of information with added semantics, as well as a simple framework to cross simulate variables in search for novel interaction processes between different physical variables or phenomena. Due to the strong visual character of the model outputs such as the spatial variable maps, decision processes were shown to be made significantly simpler and more effective."

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41. Paula Kellett

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Theme: Ocean observation and Human Health: Monitoring needs and benefits

Title: SOPHIE – Putting communities back into ocean observing

"The ocean is inextricably linked with the way we live. The EU-funded Horizon 2020 Project SOPHIE (Seas, Oceans and Public Health in Europe; https://sophie2020.eu/) is establishing the foundations for the future of Oceans and Human Health research in Europe through review, diverse community input, and discussion of strategy, to produce a strategic research agenda for Europe. SOPHIE is funded by the European Union's Horizon 2020 research and innovation programme, grant agreement No. 774567. The meta-discipline of Oceans and Human Health (OHH) spans expertise in the marine, public health and medical fields, and social science, and explores the complex interactions between Ocean Health and Human Health.

Key aspects for this field of research is ocean observation, and building the evidence base of data to start drawing concrete links between the impacts of the ocean on human health, and our impacts on ocean health. Only through better understanding of these complex linkages can both the ocean and humans benefit. Identification and strategic monitoring of human-relevant ocean observation variables and indicators are vital first steps.

The benefits of doing so could be felt in a wide array of fields, including: food and nutrition, sustainable ocean use, blue tourism and coastal living, climate change and adaptation, marine pollution, disaster risk management, mental health and wellbeing, and blue biotechnology. This will only become more important as we strive to move towards a more sustainable future. The SOPHIE Project is exploring the needs, gaps, benefits and priorities, especially in relation to ocean observing, and will make concrete proposals in a Strategic Research Agenda for Europe; a key project output. These recommendations can contribute to the implementation and future evolution of the European Ocean Observing System (EOOS).

Highlighting the direct links to health, daily lives and leisure time might be the draw that society needs to reconnect with the ocean, and strive to protect it better in the future and for future generations. Making ocean observations relevant through clear societal links and accessible through approaches such as citizen science could go a long way to bridging the gap between science and society, and towards bringing ocean observations and their importance to a much wider public. SOPHIE will also further explore these opportunities, by engaging with a wide array of stakeholders in dedicated deliberation exercises, through a large-scale European survey, and through the development of illustrative citizen science projects.

This poster will present an overview of the SOPHIE project, its direct relevance to ocean observing and EOOS, and the ways in which the project will seek to identify clear monitoring needs and benefits from engaging with diverse communities."

42. Roberta Guerra

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Theme: Regional ocean monitoring efforts

Title: A 3-year time series of sinking particles and metal fluxes in Southern Adriatic (Mediterranean Sea)

"Detecting time-varying trends in ocean properties and processes requires consistent, high-quality measurements. A major challenge facing ocean scientists is how to sustain ocean-time series programs that provide high quality data, at sufficient spatio-temporal resolution, to advance our understanding on the ocean-climate-human interactions, and improve our predictive capability about global changes.

The Italian Fixed-Point Observatory Network (IFON) serves as a focal point for integrated, long-term, real-time observations of a series of ocean physical and biochemical properties of water masses, including the Essential Ocean Variables (EOVs) under the Italian Flagship Project RITMARE. The E2M3A fixed observatory is located in the deepest part of the southern Adriatic basin at 41.5 ° N; 18.0° E over a bottom depth of 1200 m, and is equipped with physical sensors and two sediment traps at permanent depths of 150 and 1150 m.

In this work, total mass fluxes (TMF), particulate fluxes of major (Al, Fe) and trace elements (Mn, Cu, Ni, and Pb) were measured using 2013-2016 time series trap samples.

The TMF at □ 1200 m depth was on average 232 mg m-2 d-1 and showed a strong temporal variability over our 3 year study (33 – 885 mg m-2 d-1). The highest mass fluxes occurred in Spring 2014 and 2015 (885 mg m-2 d-1 and 788 mg m-2 d-1, respectively). The lithogenic fraction displayed a similar temporal pattern (21 – 592 mg m-2 d-1), with the highest fluxes recorded in March 2014 and March 2015 (592 mg m-2 d-1 and 563 mg m-2 d-1, respectively).

The temporal trends observed for the fluxes of total mass and the lithogenic fraction is also valid for the elements of lithogenic and anthropogenic origin. The fluxes of Cu, Ni and Pb display a high inter-annual variability (4 – 56 µg m-2 d-1, 10 - 150 µg m-2 d-1, and 3 - 29 µg m-2 d-1, respectively), and peaked in Spring 2014 and 2015.

Time series of current speed, potential temperature (Θ) and salinity (S) at 900 m and 1000 m depth indicate the arrival of the North Adriatic Dense Water (NAdW) in early Spring in 2014 and 2015. Enhanced mass and element fluxes were recorded in the near bottom sediment trap in coincidence with the increase in current speed.

The lithogenic fraction shows a highly significant positive correlation ($p < 0.001$) with Al, Mn, Cu, Ni, and Pb, and this fact could be indicative of a common transport mechanisms of all elements, whether of crustal or anthropogenic origin.

Our time series data show that the flux of elements either of lithogenic and anthropogenic origin to the deep Adriatic is driven by hydrographic and climatic conditions. This is very important in terms of ongoing global change, because any alteration of the hydrographic/climatic conditions can alter the long-term

variability of anthropogenic elements' accumulation in the South Adriatic basin, which could have potential impacts on this deep sea ecosystem."

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43. Sheila Heymans

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Theme: Linking ocean observations to modelling.

Title: How can ocean observation data enhance ecosystem models: An example using long-term stomach records and Fisher's Knowledge

For complex ecosystem models to be used as tools to inform management, their development should incorporate all available data and stakeholder knowledge to address inherent uncertainty. We included long-term stomach records and stakeholder knowledge (food webs and fishing effort trends) into an ecosystem model of the Irish Sea (developed as part of the first ICES Integrated Benchmark Assessment, WKIrish). We show that this data altered our perception of the ecosystem and improve the statistical fit (AICc) of model dynamics to observed data. Diet based uncertainty analyses derived from Linear Inverse Modelling techniques enabled stronger inferences to be drawn from Ecosystem Network Analysis indicators for the Irish Sea food web. The addition of stakeholder knowledge provided altered ecosystem perceptions. Stakeholders distinguished multiple flows between discards and consumers, which were not directly identified in the fish stomach records, leading to higher estimations of system recycling. The addition of stakeholder fishing effort drivers increased the models capacity to replicate historic trends when used in conjunction with ICES fishing effort data and environmental drivers (temperature and North Atlantic Oscillation). Steps such as these and the availability of open-source long-term datasets are essential to address the uncertainty in complex models and achieve greater uptake beyond academic purposes.

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Theme: From standalone to integrated ocean and coastal observing platforms

Title: Strengthening Europe's Capability in Biological Ocean Observations

"In Europe, there is recognition that the biological ocean observation component should be strengthened in tandem with renewed efforts to build a comprehensive, end-to-end, European Ocean Observing System (EOOS). However, despite a growing appreciation of the value of marine ecosystem products and services, Europe's biological ocean observation capability lacks maturity and coordination and currently lags behind the physical and biogeochemical observation components.

Europe needs a strategic vision to increase the relevant biological ocean observation capacity. It is vital to bring together and connect the different marine and maritime stakeholders (from research to environmental monitoring and industry) collecting and collating biological ocean observations to drive efficiency and cost-effectiveness. In addition, support is needed for current biological ocean observation capacity, especially in taxonomic expertise and in enabling new emerging technologies, data management and re-use.

In biological ocean observation, there is still a clear challenge in reaching a threshold between overall scientific relevance, the needs for (EU) legislation without compromising the interoperability at global level, and the feasibility when defining the variables to be monitored.

The European Ocean Observing System (EOOS) is seen as a key coordinating framework to further develop the strategy and implementation of Europe's biological ocean observing system, in the context of the full integrated system, and as a contribution to global initiatives. In particular, EOOS proves to be a very good opportunity to promote an integrated ocean observation system in Europe based on the Essential Ocean Variables (EOVs) from GOOS and the Essential Biodiversity Variables (EBVs) from GEO BON. Even though these variables are designed to be global, engaging regional systems such as EOOS will be key to ensuring progress and maturation.

The European Marine Board (EMB) Future Science Brief No. 3 entitled "Strengthening Europe's Capability in Biological Ocean Observations" presents an overview of the European requirements, observation elements and information products for biological ocean observation, and suggest recommendations on how to bring these observations forward. This poster will introduce the document and its recommendations to the conference participants.

http://www.marineboard.eu/publication/strengthening-europes-capability-biological-ocean-observations-future-science-brief"

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45. Vera Van Lancker

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Theme: Future look at the next generation of observing & monitoring tools and approaches;

Title: Code of Sand. From seabed mapping to geological knowledge base

"Mineral and geological resources are non-renewable on time scales relevant for decision makers. Once exhausted by humans, they are not replenished rapidly enough by nature, meaning that truly sustainable resource exploitation is not possible. Comprehensive knowledge on the distribution, composition and dynamics of geological resources and on the environmental impact of extraction is therefore critical. Anticipating on this, a geological knowledge base has been developed as a platform for resource management (Belspo Brain-be TILES, 2014-2018).

Backbone of the knowledge base is a 3D voxel model (volume pixels) of the surface and subsurface of the Belgian and southern part of the North Sea. Standardized and harmonized databases have been created and a methodological workflow for the 3D modelling of offshore aggregates published. Data were added to the highest detail as to maximize their classification to any application (e.g., aggregate industry). Metadata were carefully added to estimate data-related uncertainty.

The 3D geological models were further coupled to 4D numerical environmental impact models as to quantify environmental impact under various scenarios of exploitation. Furthermore, the voxels were filled with decadal sediment transport calculations allowing assessing seabed recovery estimations after extraction, an important asset in many environment-related European Directives.

Data, models, and their uncertainties, are embedded in an end-user driven decision support system (DSS) that uniquely allows querying the full 3D resource volume, and integrating it with any third-party data. From a management perspective, the DSS allows long-term resource predictions, balancing aggregate quality and quantity against various applications, whilst minimizing environmental impact.

As a synthesis of results, the poster will be presenting our ""Code of Sand"", conveying key messages that should be known and understood by all involved in the exploitation of the seabed. Key messages about where the sand comes from, how it behaves, where it is, what impacts its quality, how its extraction impacts the marine environment and how to monitor and manage this precious resource. Perspectives are provided of how dealing with our sand reserves on the longer term."

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Adding coastal pollution monitoring to the latest advances in the Spanish Institute of Oceanography Observing System (IEOOS)

"The Spanish Institute of Oceanography (IEO) has been observing and measuring the ocean characteristics as part of its institutional activity. The tide gauges network has been working for more than 80 years, and standard sections began at different moments depending on the local projects, taking physical, chemical and biological (plankton) measurements. Nowadays, the Observing System (IEOOS) also includes permanent currentmeters moorings, an open-sea ocean-meteorological buoy offshore Santander and an SST satellite image reception station and regional prediction models. The contribution to the ARGO international program and the continuous monitoring thermosalinometers, meteorological stations and ADCP installed on the IEO research vessels complete the system. All these networks are linked to international initiatives like SeaDataNet, Emodnet, IbiROOS or MONGOOS; and allow IEO to give responses to research activities, official requirements and main society demands.

Lately, the IEOOS also incorporates continuous temperature timeseries from IEO's coastal infrastructures. In addition, in order to monitor the pollution on the Spanish coast, concentrations of metals and organic contaminants (PAHs, BDEs, CBs, and pesticides) in biota and sediments, as well as their biological effects, are measured. Their analysis allows integrative assessments of the environmental quality in the studied areas, and gives responses to different requirements as the European Marine Strategy Framework Directive or the European Marine Observation and Data Network (EMODNET, chemistry lot, DGMARE/2012/10) or the Marine Spatial Planning Directive (2014/89/EU).

The IEO has made an important effort in order to recover, homogenize and validate all the data obtained from the different systematic monitoring programs that the institution has been supporting over time. All data were obtained from laboratory analysis of discrete water samples from oceanographic casts, and sediment or biota samples in case of pollutants and their effects. Corrected and standardized data has been completely metadataded and incorporated to the IEO DataCenter permanent archive. This supports the accessibility and reutilization of data and information and gives them an added value. Also, the IEO as part of SeaDataNet European consortium disseminates all the metadata information throughout the web portal www.seadatanet.org. In addition this infrastructure allows traceable data access when the requirements are fulfilled."

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48. Lars Boehme

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Theme: Ocean observation gaps and requirements, and solutions to tackle the challenges

Title: Marine Animals within EOOS

Today marine mammals help to collect marine observations in some of the harshest polar environments on the planet, as well as in the relative shallow continental shelf seas. Through the use of animal-borne instruments, several hundred thousand hydrographic profiles were delivered to the wider community over the last decade especially through the Marine Mammals Exploring the Oceans Pole to Pole (MEOP) consortium. Animal-borne instruments are continuously improving with oxygen, surface wave or surface wind speed sensors being developed and tested. This unique collaboration between biologists and physical oceanographers united in a truly multidisciplinary approach that has yielded great results for both communities and has consolidated animal borne instruments as a robust tool to collect oceanographic data. In this talk, we present new emerging technological opportunities, as well as discuss the growing range of seals, whales, sea turtles, marine birds, sharks or bony fishes that can carry such instruments and therefore expanding further the temporal and spatial coverage of ocean observations.

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49. Lars Boehme

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Theme: Linking ocean observations to modelling.

Title: Animal-borne instruments for real-time shelf sea assessments and forecasting

Europe lacks in-situ ocean profile measurements for the surrounding shelf seas. National and international ocean forecasting models need such data in real time to help constrain the models' 3D structure. Marine biologists have been studying the behaviour of grey and harbour seals (*Halichoerus grypus, Phoca vitulina*) for many years using tags and tracking devices. Since 2017, environmental data collected by such devices have been made available in real-time, so that the data can be assimilated into models and be used to validate operational predictions. A better ocean and weather forecast will have a huge impact on the public and economic sectors and is important for the protection of lives and property. Here, we present the data collected in the first two years filling in some of the observation gaps on the North Western European Shelf and discuss the infrastructure to provide the data to end users, including the Copernicus Marine Environment Monitoring Service.

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50. Francisco Campuzano

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Theme: Challenges for sustainable monitoring and evaluation of the EU Marine Strategy Framework Directive in the Atlantic offshore waters: the iFADO project.

"The European Atlantic Area in situ characterization/monitoring is challenging due to the high costs involved (24% of total EU waters for 12% of total population). The implementation of the EU Marine Strategy Framework Directive (MSFD) is complex if the objective is to extend periodic monitoring programs to offshore waters. Remote sensing and modelling have been recognised by the Copernicus Marine Service as suitable methodologies to characterise the global ocean both for nowcast and forecast.

iFADO (Innovation in the Framework of the Atlantic Deep Ocean, 2017-2021) is an Interreg Atlantic Area project which main objective is to integrate technologies, including remote sensing, numerical modelling and in situ monitoring, to ease management decisions from MSFD competent authorities. iFADO builds on the most recent technologies for data gathering and processing, suited for providing sustainable services to blue economy agents by fostering the regional quadruple helix cooperation (public sector, university/research centres, enterprise and citizens).

Keywords: remote sensing, numerical modelling, traditional monitoring, novel monitoring methodologies, MSFD, deep ocean, governance

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51. Pierre-Yves Le Traon

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Title: ILICO – A French research infrastructure for Coastal Ocean and Seashore Observations

"Established in 2016, ILICO, a French Research Infrastructure for Coastal Ocean and Seashore Observations, is a notable example of national structuration and pan-institution efforts to investigate the forefront of knowledge on the processes at work within the critical coastal zone (near-shore ocean and coastline). ILICO was conceived in an ESFRI (European Strategy Forum on Research Infrastructures) roadmap perspective. ILICO gathers in a pluridisciplinary approach eight distributed network-systems for observation, experimentation, data collection and analysis (COAST-HF, CORAIL, DYNALIT, MOOSE, PHYTOBS, SOMLIT, SONEL, REEFTEMPS) that are accredited and financially supported by French research institutions and the French Ministry for Higher Education, Research and Innovation. ILICO observation points are implemented along the metropolitan and overseas French coasts, where coastline dynamics, sea level evolution, physical and biogeochemical water properties, coastal water dynamics, phytoplankton composition, health of coral reefs are monitored in order to address a wide range of scientific questions.ILICO provides coherence for the whole observation infrastructure in light of the scientists' needs, expressed during recurring prospective exercises. Ultimately, ILICO observation series aim at understanding long-term changes in coastal ecosystems, as well as shorter period (and sometimes extreme) events, allowing the creation of models and scenarios for climate, biodiversity and resources changes, developing research on adaptation or mitigation, assisting in decision-making in light of the risk, and evaluate the effects of public policy.

Research teams involved in ILICO being also parts of several international initiatives or projects (GLOSS, GCRMN, EuroGOOS, Copernicus, JericoNext, etc.), ILICO upcoming challenge is thus to set the plan for a

new FP9 infrastructure, the third component of an Ocean in situ observation triad already composed with EuroArgo and EMSO."

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52. Hilda de Pablo Leonardo

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Title: Examination of the estuarine plume (Tagus estuary) influence on the coastal area under different hydrodynamic regimes

The great variability of hydrodynamic and coastal processes requires the use of sophisticated modeling tools to accurately simulate complex coastal phenomena. Coastal numerical models use thin horizontal and vertical grids for greater accuracy. This translates into output files with large volumes of information. The effort in analyzing these results is simplified if integration tools are used. This is particularly important for long periods of simulation or for different simulated scenarios.

This work describes the strategy used in the Tagus estuary, one of the largest estuaries in Western Europe, and adjacent coastal area. The three-dimensional (3D) MOHID model was implemented to simulate tide-generated flow, density currents, atmospheric forcing, and biogeochemical processes controlled, mainly, by vertical transport and the Tagus Estuary discharge.

The hydrodynamic model was validated using tide gauge data collected at both mouth and inside the estuary. The results of the biogeochemical model were validated using data and monitoring programs carried out in the study area. The fluxes were integrated in time and space (vertically and horizontally) using the boxes methodology implemented in the domain. The results are presented for five different river flow classes, determined from the ten-year analysis of the Tagus river flow.

Results show that the extension of the estuarine plume is determined by the river flow and that the tidal flow associated with the estuary flood/ebb dynamics dominates the transport processes in the Tagus inlet vicinity and the effect of the role of wind and global circulation becomes determining near the mouth of the estuary.

With this methodology, integration boxes may show the influence of systems with different hydrodynamic and biogeochemical properties (river, estuary, mouth, coastal area) on circulation/parameter patterns of a particular area. The spatial and temporal versatility of boxes in MOHID implementation allows differentiating periods in which each of the forcing actors is more significant. The use of integration boxes with vertical discretization of the water column also reproduced the effect of upwelling/downwelling, typical of this coastal area.

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53. Dick Schaap

Abstract authors: Thierry Schmitt (Shom) and Dick M.A. Schaap (MARIS) on behalf of the EMODnet Bathymetry consortium

title: EMODnet Bathymetry - developing a high resolution digital bathymetry for European seas

Theme of the abstract: Linking ocean observations to modelling.

Abstract text: The EMODnet Bathymetry project develops Digital Terrain Models (DTM) for European seas with an increasing resolution. These are produced from survey and aggregated data, collated by an expanding network of contributors from marine research institutes, hydrographic services, government agencies, and companies. Data are indexed with INSPIRE compliant metadata adopting SeaDataNet catalogue services: already > 27.000 survey data sets from 42 providers are included in the CDI Data Discovery and Access service, while > 140 composite DTMs from 28 providers are in the Sextant catalogue.

The EMODnet DTM is produced following an established methodology and using common software 'GLOBE'. Data providers use GLOBE for processing and pre-gridding their data to the EMODnet grid. As a next step regional coordinators generate DTMs for selected sea basins using GLOBE, making a selection of the available data sets, and following the agreed methodology. Each grid cell of the regional DTMs refers to a CDI or Sextant reference, while GEBCO is used for areas without data coverage. As a final step regional DTMs are integrated into the EMODnet DTM applying several QA-QC actions.

The methodology and software have been refined over time since the start in 2008 and resulted in a series of EMODnet DTM releases with increasing coverage, resolution, and quality. The first release was in May 2010 with a resolution of 1/4 arc minute * 1/4 arc minute (circa 450 * 450 meters) and for a selection of European seas. The fifth release, early February 2015, included all European seas and a higher grid resolution of 1/8 arc minute * 1/8 arc minute. The latest and eighth release in September 2018 has a resolution of 1/16 arc minute * 1/16 arc minute (circa 115 * 115 meters) and is based upon more than 9200 data sets.

The DTM can be viewed, downloaded in tiles, and shared with OGC web services by the versatile Bathymetry Viewing and Downloading service which is integrated in the EMODnet Bathymetry portal. The portal and its services are frequently used by a wide range of users from government, research and industry sectors. For example, bathymetry is an important parameter for planning and construction of offshore infrastructure such as pipelines, wind farms, artificial islands, and shipping channels. Industrial users can be engineering firms, dredging companies, energy companies, and others. The EMODnet DTM is also increasingly picked up by numerical modellers. In order to correctly forecast storm surge it is vital that the tidal solution of a model is accurate, which in turn requires an accurate bathymetry. Modellers like UK MetOffice and Deltares have adopted and evaluated the EMODnet bathymetry in their models resulting in overall improvements of their tidal solution, whereby systematic biases have been reduced.

The poster will highlight the EMODnet Bathymetry methodology, its DTM product, and its portal services. It will give some modelling use cases, challenging more modellers to try out the EMODnet DTM for their numerical applications. Moreover it will give a source map illustrating the current gaps in data coverage as relevant input for EOOS.