

# ICES WGOOFE REPORT 2015/2016

SCICOM STEERING GROUP ON ECOSYSTEM PROCESSES AND DYNAMICS

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## Interim Report of the Working Group on Operational oceanographic products for fisheries and environment (WGOOFE)

12–13 January 2016

24–25 January 2017

Brussels, Belgium



**ICES**  
**CIEM**

International Council for  
the Exploration of the Sea

Conseil International pour  
l'Exploration de la Mer

## **International Council for the Exploration of the Sea Conseil International pour l'Exploration de la Mer**

H. C. Andersens Boulevard 44–46  
DK-1553 Copenhagen V  
Denmark  
Telephone (+45) 33 38 67 00  
Telefax (+45) 33 93 42 15  
[www.ices.dk](http://www.ices.dk)  
[info@ices.dk](mailto:info@ices.dk)

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## Executive summary

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The rationale behind the calling of a Workshop on Operational Oceanographic Products (WKOOP), in 2008, and subsequent formation of Working Group on Operational oceanographic products for fisheries and environment (WGOOFE) in 2009, was a recognition that the availability of marine environmental data and diversity of data sources had increased rapidly throughout the preceding decade. Given this diversifying set of data sources, users (e.g. ICES working groups) urgently required guidance to select the most suitable options for their work. Now in its eighth year, under its third set of chairs, WGOOFE reports that the generation and availability of marine data from models, in situ sensors and satellites in orbit has increased further, and the need for navigational aids for the 'data warehouse' remains strong.

The group has held two annual meetings at the headquarters of EuroGOOS, Brussels, Belgium, in order to exchange information on new developments in operational oceanography and to continuously refresh its advice to ocean data users in the fisheries and environmental working groups of ICES. A close working relationship with EuroGOOS has been established, as that organisation has its own working group with a remit of increasing the use of operational products.

The main task for the current cycle of WGOOFE is to overhaul and improve its existing website [<http://groupsites.ices.dk/sites/wgoofe/operationalOceanography/Pages/default.aspx>]. The website in its current form has proved useful to many fisheries and environmental users but needs to be updated to reflect recent changes in the supply of ocean data. Co-location of the WGOOFE website with EuroGOOS is under discussion and may lead to a higher visibility as well as increased possibilities for maintenance and update. WGOOFE notes the success of 'super-portals' such as the Copernicus Marine Environmental Monitoring system, and the various EMODNET thematic gateways. More information will be given to users via the new website, and examples of best practice and practical advice will be given.

WGOOFE continues to work closely with other ICES groups. The Herring Assessment Working Group (HAWG) has requested advice for its latest report, and work is in progress to deliver sea surface temperature, sea bed temperature, mixed layer depth and primary production for selected herring spawning grounds and larval drift pathways.

## 1 Administrative details

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**Working Group name**

Working Group on Operational oceanographic products for fisheries and environment (WGOOFE)

**Year of Appointment**

2015

**Reporting year within current cycle (1, 2 or 3)**

1 and 2

**Chair(s)**

Rodney Forster, UK

Dominique Obaton, France

**Meeting venue**

Brussels, Belgium

**Meeting dates**

2015 meeting (year 1): 12–13 January 2016

2016 meeting (year 2): 24–25 January 2017

## 2 Terms of Reference a) – z)

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- a) Develop, through an iterative process with users, further index based products of environment and oceanographic change and variability for application to and take up by the ICES integrated assessments and advice;
- b) Demonstrate, through specific case studies, applications of oceanographic products in integrated assessments and advice;
- c) Communicate through various mechanisms, to the ICES community the availability of oceanographic datasets, products and time-series. This should include publicizing and maintaining the WGOOFE website, developing fact sheets for ICES expert groups and further targeted meetings with groups and workshops;
- d) Act as an interface for ICES for multinational projects, networks and organizations on operational oceanographic products, such as Copernicus Marine Environmental Monitoring Service, EMODNET, Sea Basin Checkpoint studies, and Euro-GOOS. Work with producers of ocean data to understand the expectations and abilities of users;
- e) Respond to ad hoc requests for advice on oceanographic products for the ICES ecosystem modelling, advisory and ocean observing communities.

### 3 Summary of Work plan

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For 2017:

- Examine new services arising from Copernicus Marine, Land, and Climate Services.
- Provision of advice on new, large-scale data services (EMODNET).
- Update WGOOFE website according to evidence received at 2015 and 2016 annual meetings.
- Expand provision of advice on data to a wider range of ICES groups. Approach the regional assessment expert groups (e.g. WGINOSE, WGEAWESS, WGNARS) to start the process.
- Case Study Development: produce a fully documented case study with e.g. Herring Assessment Working Group (HAWG). Evaluate data provision to HAWG (has the data been used; if not, why? Are there improvements needed?).

### 4 List of Outcomes and Achievements of the WG in this delivery period

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- HAWG and WGOOFE interaction. Exchange of mails and teleconference between the two groups. HAWG require ocean data to better understand herring recruitment and ecology. Indices for parameters such temperature, stratification and primary production could be used to describe conditions on spawning grounds and during larval drift. Work done by Mark Payne in 2013 with WGOOFE which was received very positive by HAWG, actions taken to propose new indices to the WG [to be updated after HAWG March 2017 meeting].
- Update of the WGOOFE website which proposes an overview of different available products at the global scale and for the European regional basins.
- Discussion started with habitat mapping working group (WGMHM) on choice of most suitable input layers for modelling.

### 5 Progress report on ToRs and workplan

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#### 5.1 Terms of Reference A and D

The group has maintained an overview of developments in the field of operational oceanography through discussions and presentations at its annual meetings in 2016 and 2017. A synthesis of developments is presented below.

##### 5.1.1 ICES “OOPS” call

##### Presentation 2017 by Sylvain Cailleau and Dominique Obaton

A call for tenders known as the “OOPS call” was launched by ICES three years ago, to encourage data providers to come forward with different products according to pre-

determined list of objectives. Mercator-Ocean, on behalf of CMEMS, was one of the successful bidders.

ICES aims to encourage uptake of OO products by displaying on its website data on, for example trends in temperature and salinity (at the surface and at the seabed), of the North Western European shelf seas over a long period of time. These products exist in CMEMS (over a period of time of 23 years) but ICES would like to access to them through WMS which has not good performance in CMEMS. CMEMS has worked on it to improve it, tests are being done on the ICES side and a teleconference is expected beginning of this year.

**Action:** through 2017 – WGOOFE to review (when launched) CMEMS temperature and salinity (at the surface and at the bottom).

**Action:** seek feedback from WGOH on the operational products and link/compare with existing IROC data service

### 5.1.2 Copernicus marine service (CMEMS), status January 2017

#### Presentation 2017 by Sylvain Cailleau, Dominique Obaton

CMEMS is one of the largest portals for marine data and has over 6000 registered users. WGOOFE aims to keep ICES informed of developments in the data service, as well as providing feedback from a user perspective.

Recent updates include:

- Access to oceanographic products by regional basins and for the global ocean
- New web search (marine.copernicus.eu) with 4 independent criteria: geographical domain, variables, time period, products with/without depths
- Better visibility on products : nitrogen, oxygen, mixed layer depth ...
- Next catalogue improvement (foreseen in spring 2017) with:
  - Waves
  - Sentinel 3 products
  - IBI biogeochemistry model
  - An additional year (current year minus 2) for all long time series products

It was noted for the Marine Strategy Framework Directive that CMEMS has no commitments regarding the Directive, but might provide support to the member states (e.g. eutrophication).

The first CMEMS User Uptake calls were released in the summer 2016, with the objective of displaying success stories of CMEMS use, i.e. demonstration of downstream coastal operational services using CMEMS products. Selection was made at the end of January 2017 and contracts are expected to start in March.

CMEMS products are available to any users, with registration before download. Feedback very welcome, to be sent to [servicedesk.cmems@mercator-ocean.eu](mailto:servicedesk.cmems@mercator-ocean.eu)

**Action:** review the new CMEMS portal for the WGOOFE products website refresh.

### 5.1.3 EuroGOOS

**Reporting:** Rodney Forster, Sylvain Cailleau, Glenn Nolan

Feedback was given from the annual meeting of EuroGOOS, 25–27 May 2017 to which WGOOFE was invited. Rodney presented on the rationale behind WGOOFE and started discussion on links with EuroGOOS. There is a EuroGOOS product working group with similar aims to WGOOFE.

**Action:** joint working on website update was proposed.

A very interesting presentation was heard from Richard Nash (Oceanographic products for fisheries, IMR, Norway) who detailed the type of data useful for fisheries ecologists.

**Action:** Nash slides placed on the SharePoint site, ideas captured and fed into discussion with HAWG

A contract was signed between EuroGOOS and Mercator Océan last September to work on upstream & downstream interfaces to reinforce links between CMEMS and EuroGOOS (how CMEMS is used and how it can be improved depending on use, connection with national systems, to see how it can be sustainable ...). This demonstrates further the move towards larger, more sustainable data portals.

### 5.1.4 EMODnet

**Reported by:** Patrick Gorringe, Sylvain Cailleau

- EMODnet has 8 different lots including physics (marine in situ observations, past 60 days)
- Products downloadable without password in text format
- A very useful data viewer (for marine physics)

Physical in situ products are now the same in EMODnet and CMEMS: EMODnet physics can be seen as a shopping window of CMEMS in situ. This simplifies matters for users.

A Memorandum of Understanding was signed between CMEMS and EMODnet physics in August 2016. The objectives is to ensure a bridge between the two services for the in situ products by allowing any user reaching either of the services to go easily to the other one and benefit from the particularities of both services

- EMODnet Physics is a bespoke service of in situ products with a nice viewing functionality. It also allows a clear visibility of data producers
- CMEMS is an operational service of a large variety of products including in situ ones. Its servers and access to the products are already used by EMODnet and it is planned to have CMEMS SLA and service desk to be used by the two services as well as to exchange information on the monitoring of users.

**Action:** Feedback from fisheries / marine environment users to be sent to EMODnet, CMEMS. To have a more frequent update of EMODnet physics data (very near to real time) –i.e. higher than once per day (Dominique).



### 5.1.5 EOOS: European Ocean Observing System

**Presented by Glenn Nolan, Patrick Gorringer**

EOOS is a broad-scale effort to provide a coordinating framework from the different programme/directives/projects/Regional Ocean Observing Systems through to DGs MARE and DG-Research and up to the international level (ICES, CIESM, IOC, WMO).

Description can be found at <http://www.eoos-ocean.eu>

EOOS is a coordinating framework designed to align and integrate Europe's ocean observing capacity, promote a systematic and collaborative approach to collecting information on the state and variability of our seas, and underpin sustainable management of the marine environment and its resources.

It is not yet a legal entity yet. Coverage will be: the global ocean. It aims to make the products as widely available as possible (collect them once and make them available to all).

The starting point will be essential ocean variables:

- Physics: mature;
- Biogeochemistry: mature + 1 pilot;
- Biology and ecosystems: still concepts, 2 already pilots. The variable list: phyto biomass & productivity, HAB incidence, zooplankton diversity, fish abundance and distribution, apex predator abundance and distribution, live coral cover, mangrove cover, macroalgal, canopy cover.

EOOS does not focus only on operational oceanography. Aimed as a high-level coordinating body, 'upstream' from Emodnet, SeaDataNet and CMEMS, EOOS will encourage agreement between the different partners and have a strategic lobbying role for ocean observing.

Consultation ran until 20 January 2017 to have community recommendations about the shape and direction of EOOS, this gave around 150 answers including many from outside the marine physics community. Primary analysis will be done by the 9 February 2017.

**Action:** feedback to WGOOFE from this consultation, end of February (Glenn Nolan)

### 5.1.6 iFADO project

**Presented by: Francisco Campuzano**

The need for an over-arching Atlantic project arose following the Portugal MSFD meeting that was held in March 2016 between different Portuguese organisations and Mercator Océan. The focus of the iFADO project is on activities on MSFD around the Atlantic area (20 partners from 5 countries) and the aims are:

- to fill the gaps and link the existing initiatives and have a better organisation between countries;
- to use new techniques, to provide proof of new technology;
- to use national initiative at the EU level.

iFADO was submitted to INTERREG end at the end of December 2017 and a result will be known mid-year. Budget: 3 600 000 € for a project of 4 years.

Micronesia is in the partner consortium. Mercator involved (no budget) to ensure the links with CMEMS. The project is expected to have relationship with the stakeholders, such as local authorities that can take a long time to react to technological advances.

**Action:** See if it possible to extend the concept to the whole north Atlantic, using WGOOFE advice.

## 5.2 Terms of Reference B

### 5.2.1 Interaction with Herring Assessment Working Group (HAWG)

HAWG have requested input of environmental data to better understand the herring behaviour, particularly recruitment. An ideal indicator would be simple and represent variability in the marine ecosystem. It could also be generated quasi-automatically from a script connected to a data portal. Examples of what to look for, and how to construct an index were discussed prior to and during the WGOOFE annual meeting. Unusual winters (e.g. anomalously low North Sea temperature in early 2013), direction of water transport (pushing larval drift away from suitable pelagic habitat), mixed layer depth (index of storminess). The team are looking at existing NOOS and BSH products as well as the CMEMS portal.

Actions:

- Extract temperature (surface and sea bed). 1985-2017, OSTIA for SST and NWS Physics for SBT. Monthly mean for the North Sea and then from the spawning ground polygons (Downs, Buchan, Banks, Shetland) –Rodney.
- Transports: surface water transport (total water net transports) calculation in the North Sea. Direction: south west, narrowest part in the channel + Northern part North of Shetlands. Monthly mean transport: November to February. Time series back to 1980. Bee (NOOS) + Holger (BSH) + Dominique (Mercator Océan).
- Stratification index: calculation for HAWG have been done using the new CMEMS Mixed Layer Depth layers. CMEMS MLD (MLT) could be very useful for the Herring working group. But, need to have evidence the model vertical structure is real. Look for restratification after mixing or heavy rain event (Rodney).

**Also,** upwelling index. Ekman transport calculated from the wind (wind driven transport). Evolution during time (Hovmuller plot) off the Portuguese coast -2D plot + 1 curve depending on time –Francisco.

**Action:** to look at the agreement between different models (ensemble approach) – Francisco.

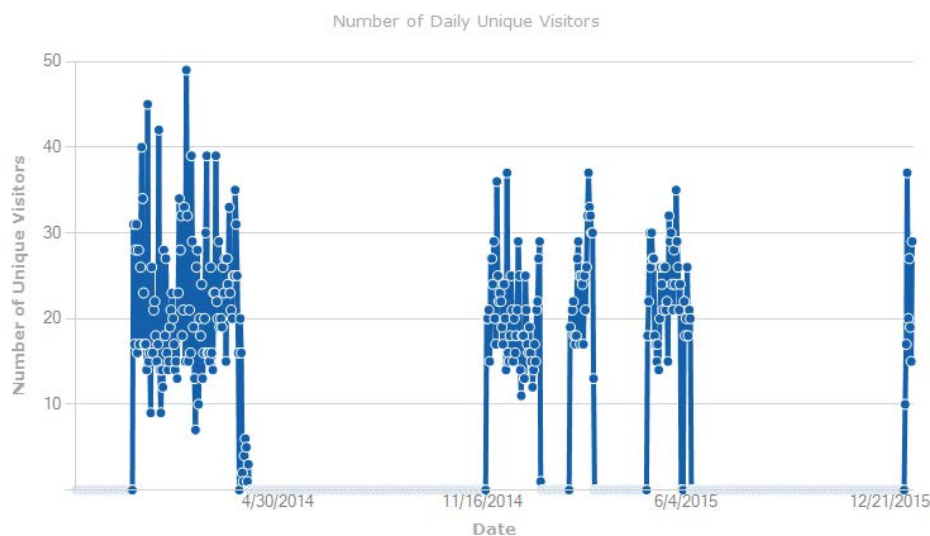
## 5.3 Terms of Reference C

### 5.3.1 WGOOFE website

The portal comparison website developed by WGOOFE in 2011 has now been operational for six years.

<http://groupsites.ices.dk/sites/wgoofe/Pages/default.aspx>

There is evidence from tracking statistics that the site is visited frequently (Figure 1), although the origin of the visits is not known. Anecdotal evidence suggest that scientist in the fisheries and environmental community know about the site and find it useful.



**Figure 1. Number of daily visits to the WGOOFE website.**

Information on the site is dated due to the progress made in operational oceanography. Some useful data portals have closed as funding has stopped, and new ones have appeared. There has been a strong convergence between the major operational websites (EMODNET, CMEMS) as discussed above. Hence, there is a need to refresh the content of the site and to provide improved data for the user to help in the selection of data sources.

The improvements to documentation could include adding: the official name of the product (and logo), observations type, models type (name of model, type, whether with data assimilation), details of the WGOOFE five-six scoring system points (make clear to user how the rating was obtained), provider contact details (address of owner, website, viewer link, and download link), citation: to literature, data (DoI, link to publication), time (length of series, time step), spatial (coverage, grid resolution), depth (number of intervals), update frequency and product history, quality control details, abstract of 200 words, details of user case studies.

North Sea - North western European Shelf	Type	Logo - official name of the product	Box: The five six scoring system points - make clear why yellow, red etc.	Contact details: address of owner, website, viewer link, and download link	Citation: to literature, data Unique Identifier, doi, link to publication	Time: length of series, time step	Spatial: coverage, grid resolution	Depth: number of intervals	Update frequency and product history	Quality control details	Observations: Platform	Models: name of model, type, whether with data assimilation etc.
Temperature	Observation	EMODNET	"1+3,4,5"									
	Observation	ICES	"1+3,4,5"									
	Observation	KLWAS	"1+3,4,5"									
	Observation	NORWECOM	"1+3,4,5"									
	Observation	ECOSMO	orange									
	Observation	NAUSICAA	red	fremer								

**Actions:** to update the products by regions with new criteria. To have a first version complete for the North Sea in October 2017. Support in the action has been request from members of WGOOFE, and externally:

- the ROOSES involved by regions to comment on the new table of metadata (access database form). Francisco for IBIROOS (March); Patrick to send around to the ROOSes chair to complete it.
- members from WGOH: to request comments at next meeting (from all regions, hydrodynamics).

## 6 Revisions to the work plan and justification

No revision of ToRs asked.

## 7 Membership and Next meetings

Holger Klein from BSH has been replaced by Ina Lorkowski. Holger was a founder-member of WGOOFE and his input over the years is greatly appreciated.

It was noted that membership from the Baltic states is low, despite a good level of interest in operational oceanography in that region.

Next meeting (year 3): 23–25 January 2018, ICES HQ, Copenhagen, Denmark. To be confirmed, depending on progress with website refresh.

**Idea:** to be able to meet with some of the other ICES groups (try to have ½ day of common meeting).

**Action:** confirm dates to WGOOFE participants in September 2017 then reminder in October 2017 to prepare their travel (Rodney, Dominique)

**Action:** Send updated list of membership to Maria (Rodney).

## **Annex 1: List of participants**

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### **12–13 January 2016, Brussels**

Dominique Obaton (Mercator-Ocean),  
Rodney Forster (IECS, U HULL),  
Boris Cisewski (vTI),  
Francisco Campuzano (MARETEC –IST), -via skype  
Patrick Gorringe (EuroGOOS),  
Vidar Lien (IMR),  
Barbara Berx (Marlab) –via skype  
Dimitry van der Zande (RBINS/REMSEM)

### **24–25 January 2017, Brussels**

Dominique Obaton (Mercator-Ocean),  
Rodney Forster (IECS, U HULL),  
Lars Golmen (NIVA),  
Boris Cisewski (vTI),  
Tomasz Dabrowski (MI),  
Francisco Campuzano (MARETEC –IST),  
Sylvain Cailleau (Mercator-Ocean),  
Vicente Fernandez (EuroGOOS),  
Patrick Gorringe (EuroGOOS),  
Glenn Nolan (EuroGOOS)  
Richard Hofmeister (HZG)

## Annex 2: Recommendations

RECOMMENDATION		ADRESSED TO
1.	To move the existing WGOOFE website to a location where maintenance and updating can be done more easily	ICES secretariat (discussion in progress)
2.	Subpolar gyre index (based on sea surface height)	WGOH
3.	Organise meeting between groups interested in ocean data	ICES secretariat

## Annex 3: Science highlights from the members

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Presentations from the members can be found on the WGOOFE SharePoint.

### **Dimitry van ver Zande (RBINS/REMSEM)**

#### 2015 status

R&D for physics and optics and operational work, in Belgium waters

Eutrophication products (based on remote sensing). CHL P90, CHL mean. Need of very good time series to do statistics and reporting. Because not enough data, building of a model to have a simulation and be able to have errors

Algal bloom indicators (based on remote sensing +in situ). Look at time series. Algal bloom dynamics by detecting CHL + turbidity (in terms of TSM)

High resolution satellite (L8, S2, pleiade, ProbaV) are very useful

Development of tools available to users. Work on new web applications (use of data without downloading them)

### **Vidar Lien (IMR)**

#### 2015 status

Involved in WGIBAR, integrated assessments of the Barents Sea: air pressure, ice conditions, ice coverage, T, volume, water masses. Changes in fish distribution, how can it be explained by plankton, hydrographic components ....

Model intercomparison NEMO, HYCOM and ROMS comparison in the North Atlantic + Arctic. Main conclusion: improvement when there is assimilation (NEMO, HYCOM assimilate and non assimilate versions), HR compensates (ROMS).

Contribution to the ocean state report of the Copernicus Marine service (1st report in 2016 than will be updated annually).

Operational assessment of infectious salmon lice copepodids that affects fish farm. If many lice, need of decrease biomass in the area and on the opposite if few lice, possibility to increase biomass.

### **Boris Cisewski (VTI)**

#### 2015 status

Underwater fish observatory (deployment done in German bight, and planned in Kiel fjord) –radar + 1 or 2 cameras. Observation of cods, mullets, porpoise, seal. Objective: to study invasive species.

Zooplankton observatory. Measure the vertical movement of zooplankton between day and night- down 600m morning and up again the night.

Adjusted hydrography optimal interpolation (AHOI). Monthly maps of T and S. Bottom T, from 1948 to 2013. 0.1°x0.1°, 60 vertical levels with accurate bottom. Links from this project to WGOOFE website.

2016 status

Presentation about the German COSYNA Underwater Node Systems and recent developments.

Zooplankton observatory: coastal system for northern and arctic seas, include a video recorder. One underwater node in Helgoland able to measure phytoplankton + acoustic Doppler (ADCP and ferrybox for the basic physics and water quality) + CTD. Study of the light effect on zooplankton. Migration of zooplankton from the predators (vertical migration patterns). Also shown was a lunar influence on migration discovered by other scientists in the team. Shallow water measurement: 10m water depth (25cm vertical resolution) size of zooplankton 1mm. Be aware of suspended sediments that complicate the measurements. Underwater node off Svalbard. More difficult to use due to ice. Data and trans-national access to the system is available through JERICO-NEXT at <http://www.jerico-ri.eu/infrastructure/underwaternodehelgoland/>.

**Richard Hofmeister (HZG).**

2016 status

Status on ECOSMO End-2-End tool: coupled phy-bio 3D hydro model, Baltic and North Sea + NPZD biomass model.

Latest developments, 2 new functional groups added to the model: fish & macrobenthos which allow more precise/additional measurement of fish biomass. Tracing matter fluxes: N (nitrogen). Loss increases with shallowness. Shallowness creates residual circulation (refresh by rain).

Moving to an unstructured grid to be able to have higher grid structure at the coast (from few km at sea to 100m res at the coast). First result on salinity structure are good, also for temperature. To be further studied.

**Tomasz Dabrowski (MI)**

2016 status

- ERDDAP server (develop by NOAA) used by MI and also IMR, Ifremer and others. Very useful tool and free software to install from which the user can download data as required want, i.e. oceanographic data on regular grid. Marine Institute ERDDAP opened to anybody under [erddap.marine.ie](http://erddap.marine.ie). (IMR first in Europe to use it, other countries (research institutes mainly) use it around the world). Gives the possibility to download data sets in different formats: NetCDF, WMS, graphs (online tool to produce a graph).
- **Action: report on user trials using ERDDAP**
- Weekly HAB bulletin (through FP7 –AZIMUTH project) operational service now running for more than 3 years. Use CMEMS NWS products: CHL (L4) + SST maps, weekly average. Run an operational model: forecast for next 3 days (bottom water, at 2 m, surface water) and 2D map + transect in the Bantry bay + Killary harbour where there is estimation of water pathway (transport of phytoplankton). Toxins outbreak links to downwelling or upwelling event even if down- up-do not go systematically to toxin events. Particular species



considered: *Karenia mikimotoi*. Users are aquaculture farmers. Free to subscribe regular bulletin is an excellent example of communicating ocean data to users...

<http://www.marine.ie/Home/site-area/data-services/interactive-maps/weekly-hab-bulletin>

- Monthly oceanographic bulletin showing max chl, phytoplankton anomalies, SST anomalies, mean surface-bottom T diff, mean MLD, mean surface currents, mean bottom T. IMR model nested in GLO CMEMS. Bulletin for internal IMR users that started 2 years ago. Ongoing open discussion to distribute the service that could be done through ERDDAP.

#### **Lars Golmen (NIVA)**

##### 2016 status

Lars reported on the NIVA Ferrybox system: there are 5 to 6 lines operational under the maintenance of NIVA. A new surface autonomous vehicle called Sailbuoy has been developed for pH and pCO<sub>2</sub> data. Macroplastic litter is a rising pollution issue with consequences for fish consumption and some coastal litter. Around 10 million tons of plastic ends in the ocean each year.

#### **Rodney Forster (IECS, U HULL)**

##### 2016 status

Project AURA was described: this is a development in offshore wind research at Hull – several universities involved (from UK: Durham and Sheffield), as well as industry (Dong Energy and Siemens, and UK Offshore Renewable Energy Catapult). Aim is to have a multi-disciplinary organisation facing North Sea and aimed at reducing cost of offshore wind as well researching sustainable multiple uses of OWF sites. Institute will build regional capacity in operational oceanography - available in the Humber offshore area are HZG ferry box route, a Cefas Smartbuoy in the Dowsing bank plus various wave buoys.

#### **Francisco Campuzano (MARETEC -IST)**

##### 2015 status

Portugal involved in AtlantOS with 3 institutes (Univ. Algarve, CIIMAR, Univ. Azores)

Started to work on stratification index developed by Martin, as well as salinity/fresh water and eddy index

##### 2016 status

A high resolution Tagus estuary model using MOHID water and MOHID land was described. These 2 MOHID models can be used all over the world (relocatable). There is a new MOHID model for watershed that estimates run offs and primary production.

Downscaling is possible at several levels in the MOHID environment: from open ocean to estuary using all MOHID models (coupled) on Portugal coastal area and Tagus estuary. At the largest spatial scale: the IBI CMEMS physical model is downscaled to the Tagus

mouth. Having riverine input makes a big difference to model performance. Example also shown of application to Madeira Island

Further description given of: MARPOCS project (multinational response and preparedness to oil and chemical spills). Partners from Morocco, Spain, France. Started last year.