EMSO implementation and operation: DEVelopment of instrument module

SITE SELECTION REPORT

D5.1

Document identifier:	**EMSODEV-D5.1_V1.3**
Due Date of Delivery to EC	**M4 (December 2015)**
Dissemination level	**PUBLIC**
Actual Date of Delivery to EC	**29/07/2016**
Document date:	**29/07/2016**
Deliverable Title:	**Site Selection Report**
Work package:	**WP5: EGIM Replication and in situ performance evaluation**
Lead Beneficiary:	**NERC**
Other Beneficiaries	**INGV, IFREMER, HCMR, CSIC, MI, UniHB, IPMA, GeoEcoMar**
Authors:	**Andrew Gates, Henry Ruhl**
Document status:	**Final**
Document link:	**https://emdesk.eu/shared/579b250c20c8a-3386762a5650debc7993103c58a5ac6b**

History of changes

Version	Date	Change	Authors
1.1	24.06.2016	Preliminary issue (the first draft created)	Andrew Gates & Henry Ruhl
1.2	21.07.2016	Added the applications to host EGIM as appendices	Andrew Gates & Henry Ruhl
1.3	29.07.2016	Final version	Nadia Lo Bue, Laura Beranzoli, Paola Materia

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1. EXECUTIVE SUMMARY

This document reports the process and outcome of the selection of EMSO nodes to host the three EMSO Generic Instrument Modules (EGIM) that will be created as part of the EMSODEV project. The process was carried out with the aim to deploy three EGIMs over a range of environmental conditions (e.g. pelagic/benthic) and type of observatory (e.g. standalone/cabled). Six nodes applied to host EGIMs following the call for offers.

Each proposal was reviewed and scored using the EC scoring terminology for the observatory infrastructure, site visit logistics and timing and commitments to overall operation and validation in operational conditions. To complete the ranking further consideration was given to the type of observatory and any value added commitments.

The top three ranked applications were from PLOCAN, INGV and IFREMER. These covered the desired range of pelagic and benthic open ocean locations and cabled/standalone observatories. The application from The Marine Institute (shallow water in Galway Bay) was scored equally to IFREMER but was placed 4th because the IFREMER application was open ocean.

There was a delay in this deliverable because the initial call for offers was extended to ensure all node operators had the opportunity to make applications.

2. INTRODUCTION

The EMSODEV project aims to create a standard sensor suite in a single module to monitor essential ocean variables. The sensor suite, known as the EMSO Generic Instrument Module (EGIM), is a key part of the strategy to develop the concept of a European network of ocean observatories. EMSODEV has sufficient funds to construct and test three EGIMs as part of the project. These will comprise one prototype (WP 4) followed by two replicated devices (WP 5).

The aim of deliverable 5.1 is to identify the best existing observatory locations at which to carry out EGIM trials lasting one year in open ocean conditions once laboratory and shallow water testing has demonstrated the capability of the instruments. To prove the value of EGIM it is key that it can be demonstrated across a range of European ocean environments. These must include the open ocean at pelagic and benthic locations. It is also highly desirable to test cabled and standalone versions of the EGIM.

The existing EMSO nodes provide a suitable range of opportunities for rigorous testing of the new EGIMs. Here we report the process and outcome of a call to host EGIM at existing EMSO nodes.

3. THE CALL FOR OFFERS

The call for offers aimed to provide a structure in which EMSO nodes could present their case to carry out test deployments of the EGIM in operational scenarios. The call was divided into five sections in order to determine the most suitable proposals:

1) Observatory Infrastructure
2) Site visit logistics and timing
3) Commitments to overall operation and validation in operational conditions
4) Value added commitments
5) Site environment

The Call for Offers document is included as Appendix 1 of this document.

3.1. Time-line

The call for offers was first published on 15/12/2015. There was a problem with the initial call for offers and some EMSO members did not see call before the deadline (31st January 2016). At the EMSODEV meeting in London 17th March 2016 it was agreed that the call would be extended until 9th May 2016.

Six institutions submitted bids to the call for offers to host an EGIM. Three were received after the initial call and three additional bids were received in response to the extended deadline. In the following weeks the offers were reviewed at NOC and ranked. This ranking was then discussed with the EMSODEV Executive Board (Date 27/05/16) during which the decision was made to send out a questionnaire for completion by the applicants to further scrutinise the offers. The questionnaire was requested to be completed by 20/06/2016 (see Appendix 3).

3.2. Ranking process

Assuming sufficient applications to host EGIM a variety of test locations was considered important. The initial ranking carried out by Henry Ruhl and Andrew Gates at NOC (considered impartial because NOC did not submit a bid to host an EGIM). Three sites were selected as the most promising locations for EGIM deployments.

The score / ranking is based on the first three scoring categories, observatory infrastructure, site visits and logistics, commitments to operation, in points out of 15, with up to 5 points possible for each.

Some proposals offered several options. Only the strongest option from each proposal is discussed here.

Value added commitments were scored, but were not used in determining rank.

4. SUMMARY OF APPLICATIONS FOR HOSTING EGIM

The initial ranking presented here was agreed by the Executive Board. Further discussions are required to with technical / logistical experts to confirm there are not any unforeseen issues with the deployments and then outline maters arising from the selections, such as planning meeting scheduling.

The site environment issues:

- The top two ranks accommodate pelagic and benthic and Atlantic and Mediterranean.
- The 3rd and 4th ranked bids have the same score, but the oceanic bid was given priority due to site environment, where the Azores node is a main node of EMSO.

Some remaining bids are recommended as alternates.

The ranking is outlined below:

4.1. Outcomes

Table 4.1: The outcome of the ranking of proposals

Rank	Bid
1	Plocan
2	INGV (Western Ionian)
3	IFREMER (Azores)
4 (1st alternative)	Marine Institute (Galway Bay)
5 (2nd alternative	IPMA (Gorringe Bank)
6	HCMR (SE Ionian)

4.1.1. First - PLOCAN

PLOCAN presents a case with three phases for deployment of a standalone benthic off the Canaries. This includes the highest ranked option for a pelagic EGIM deployment (but seems to be reliant on the PLOCAN platform being operational?).

Observatory infrastructure:

The sequential phases seem to meet the requirements set out in the call and also provide a series of steps to accommodate trouble shooting. Cabled and non-cabled and benthic and pelagic settings are offered to be addressed.

Site visit logistics and timing:

There are commitments to carrying out the various testing and deployment phases. There is a letter of commitment, albeit not in English.

Commitments to overall operation and validation in operational conditions:

The commitments note almost every requested element from the call. The proponents did not give details of the staff commitments over and above their EMSODEV DoA allocation, which does not include the host effort.

Value added commitments:

Additional sensors are offered (fluorometer or passive acoustics). Another stakeholder, NEXOS, was identified. They expect data to be used in publications, but no science questions were proposed.

Site environment:

The area is Atlantic and this is the only viable proposal which suggested pelagic testing and long-term deployment. It is also the only proposal that offers both cabled and non-cabled evaluation. It was also noted that the application came with substantial detail on the site environment.

PLOCAN	**Option 1**
Observatory Infrastructure	5
Site visits and Logistics	5
Commitments to overall operation and validation in operational conditions	4
Value added commitments	*4*
Total (not including Value added commitments or Site environment)	**14**

4.1.2. Second - INGV (Western Ionian)

INGV present the possibility of placing a cabled benthic EGIM at either 2100 or 3500 m in the western Ionian. There is also an alternative option of a standalone at 3500 m. The added value seems stronger for this observatory. The two cabled options are considered below.

Observatory infrastructure:

The proposal seems to meet the infrastructure specifications of the call for offers. Details are given re: the noted issues including power, infrastructure type and data communication link type (here Gigabit Ethernet) and all appear to successfully meet the criteria.

Site visit logistics and timing:

Cruises can be planned with 6 months' notice, same for recovery, with funding from INGV EMSO national funds. There is no letter of commitment.

Commitments to overall operation and validation in operational conditions:

8 months of time has been committed for technical work including participation in planning meetings. There are commitments to data quality control.

Value added commitments:

The addition of an additional sensor for seismic research could be valuable. INGV can compare with EGIM data with existing observatory infrastructure. They will publish results but to not suggest questions to address with the EGIM.

Site environment:

The site is Mediterranean and the best option was for benthic cabled infrastructure.

Western Ionian	**2100 or 3500 m**
Observatory Infrastructure	5
Site visits and Logistics	4
Commitments to overall operation and validation in operational conditions	5
Value added commitments	*4*
Total (not including Value added commitments or Site environment)	**14**

4.1.3. Third - IFREMER (Azores)

IFREMER present a case for deployment of a standalone benthic EGIM at the Azores node to improve data collection in the vicinity of hydrothermal vent sites.

Observatory infrastructure:

The proposal is detailed and seems to meet all requirements. It outlines a standalone infrastructure setting with details on communication telemetry capability.

Site visit logistics and timing:

Cruises are possible from May-Sep 2017. There is no letter of commitment.

Commitments to overall operation and validation in operational conditions:

The proposal does not actually state allocated time or availability at meetings. They do point out that prototype design and testing is a key part of IFREMER's contribution to EMSODEV. It should be noted that the meetings and related issues go beyond design and testing issues including logistics and evaluation in WP5. Previous track record was also noted.

Value added commitments:

There is a science case for data collection near hydrothermal vent sites, especially considering possible future anthropogenic impacts but specific questions are not suggested. No mention of specific output types was given.

Site environment:

The site is benthic stand alone in the Atlantic and at a hydrothermal vent site, the only such site in the EMSO distributed infrastructure.

Azores	**Option 1**
Observatory Infrastructure	5
Site visits and Logistics	4
Commitments to overall operation and validation in operational conditions	4
Value added commitments	*3*
Total (not including Value added commitments or Site environment)	**13**

4.1.4. Fourth (First alternate) – Marine Institute (Galway Bay):

The Marine Institute present a case for use of the Smart Bay observatory in shallow water at Galway Bay as a test location for the EGIM. Two scenarios are presented: 1) Cabled infrastructure and 2) Un-cabled infrastructure. The cabled option is discussed here.

Observatory infrastructure:

The option provides infrastructure details that meet the requirements specified in the call for offers to host the EGIM. All key points raised in the requirements section are addressed. However, biofouling in the coastal setting will be considerably higher than the open ocean sites and represents added risk.

Site visit logistics and timing:

Commitments to the cruise and funding are given and a supporting letter was provided. Access to the location should be straightforward given the proximity to shore.

Commitments to overall operation and validation in operational conditions:

Experienced technicians are available for the project. A detailed plan of expected effort contribution was given. Data will be monitored for technical faults. No indication was given with respect to attending planning meetings.

Value added commitments:

Comparison of the EGIM instruments with rest of Galway Bay instrumentation. Biofouling research was noted as a potential interesting topic, for this site especially. No mention of specific output types was given.

Site environment:

The main drawback of the proposal is the location, which is coastal and would not be at one of the fully oceanic EMSO node locations. This carries added risks related to biofouling.

Galway Bay	**Option 1**
Observatory Infrastructure	4
Site visits and Logistics	5
Commitments to overall operation and validation in operational conditions	4
Value added commitments	*3*
Total (not including Value added commitments or Site environment)	**13**

4.1.5. Fifth (Second alternate) - Instituto Portugues do Mar e da Atmosfera (Gorringe Bank)

IPMA presents a case to trial EGIM on an untethered mobile lander (Turtle) in intermediate water (400-800 m) at the seamount at Gorringe Bank. It is not clear from the proposal how this deployment is intended to work, there are details lacking about how EGIM would integrate into the Turtle. The proposal does highlight the modular value of a device such as EGIM, which could be used in a variety of settings in future.

Observatory infrastructure:

> The proposal indicates that the EGIM will be powered by batteries on the TURTLE system but does not indicate the Vdc power supply. The details on the observatory infrastructure are limited considering its novelty. It is not clear how the EGIM will be integrated into/onto the Turtle system – "we propose to integrate and connect the EGIM in a dedicated Turtle system and install in an onshore lab or vessel", which adds complexity and risk compared to a conventional fixed system. While very novel and useful for specific science applications, the risk/ science benefit associated with a 'mobile EGIM' is not clear here. While it was mentioned that acoustic modem communications were provided, there was no indication of the potential volume/rate.

Site visit logistics and timing:

> The proposal includes a letter committing 6 days sea time in 2017 to the deployment and recovery, and funds from EMSO-PT.

Commitments to overall operation and validation in operational conditions:

> 12 months staff time is committed to the project including attendance at pre-deployment meetings as well as monitoring the quality of the data.

Value added commitments:

> The proposal highlights the unique characteristics of the Turtle deployment method i.e. the ability to move the system using thrusters, unfortunately it doesn't highlight what the scientific benefits of these abilities are and what questions could be addressed. The linking of EGIM data to seismic, imaging, and tsunami warning themes was noted. No mention of specific output types was given.

Site environment:

> The EGIM deployment would be at a seamount influenced by Mediterranean outflow water where there is some seismic activity.

Gorringe Bank	**Option 1**
Observatory Infrastructure	3
Site visits and Logistics	5
Commitments to overall operation and validation in operational conditions	5
Value added commitments	*3*
Total (not including Value added commitments or Site environment)	**13**

4.1.6. Sixth - HCMR (SE Ionian)

HCMR briefly present four options in the SE Ionian. They are listed in order of feasibility with Option A the most feasible but does not support real-time data. The proposal generally lacks detail and is not considered approvable in its current form.

Observatory infrastructure:

> The proposal doesn't detail the particular specifications of power and cables etc. for the various options. While it was mentioned that the system can accommodate an acoustic modem, it was not clear who was to supply and/or integrate it so the EGIM could communicate with shore, or what the potential data transmission volume/rate would be.

Site visit logistics and timing:

> Cruises occur on a 6-8 month basis (Feb/Mar or Sep/Oct) so should meet the timing for the call. There is no letter of commitment.

Commitments to overall operation and validation in operational conditions:

> There is limited information here. One is left go guess what time the will be able to allocate to key efforts such as meetings, setup, deployment, troubleshooting, or post recovery effort.

Value added commitments:

> A comparison with existing infrastructure could be made but no detail was given.

Site environment:

> The site is Mediterranean and the main option was stand alone, benthic. The cabled option was not viewed well as logistical issues were inferred in the application. Pelagic and benthic options are presented, but the level of detail is limited

SE Ionian	**Option 1**
Observatory Infrastructure	3
Site visits and Logistics	3
Commitments to overall operation and validation in operational conditions	3
Value added commitments	*3*
Total (not including Value added commitments or Site environment)	**9**

5. CONCLUSIONS AND RECOMMENDATIONS

The process carried out here delivered a suitable outcome in that three leading bids were identified that covered a range of observatory types and environmental conditions. Additional alternative options were also identified. Detailed technical discussions are now required to ensure the three identified nodes can successfully deliver long-term open-ocean EGIM trials.

Although the process succeeded, the quality of the replies needs to be improved for future offers of TNA in the EMSO-ERIC. This includes providing clearer instructions on the application forms to ensure that all technical information is available at the time of the first application. The inclusion of project management milestones and more comprehensive presentation of expected outcomes (including scientific questions), value, and stakeholder benefit could improve the clarity on which options might proceed well and have the best impact.

6. APPENDIX 1

6.1. Call for offers to host open ocean EGIM trials

Contribution to EMSODEV D5.1

This task identifies and selects the sites where EGIM deployments will be carried out. The aim is to evaluate the opportunity and feasibility to deploy additional EGIMs including national contributions of effort. Site selection will be done by the EMSODEV Steering committee according to the terms and conditions presented here.

Please note that while WP5 will provide limited technical support and shipping costs, there is no financial support associated with this call.

For each of the criterion please present the case for your node. Each section has guidelines as to the important aspects for consideration and how the criteria will be weighted in the overall decision process.

Note Bene: This is an extension to the call process accounting for communication issues with the call. All applications are due to the EMSO interim office by 9 May2016 to the following email address (interim.office@emso-eu.org).

The review will take place by the EMSODEV SC with a decision to be announced in the following weeks.

We will use the EC scoring terminology for each of the following criterion:

- Observatory infrastructure
- Site visit logistics and timing
- Commitments to overall operation and validation in operational conditions
- Value added commitments

For each criterion, your offer will be given **scores** of 0 to 5 (half marks are possible), as follows:

0 — The proposal fails to address the criterion or cannot be assessed due to missing or incomplete information (unless the result of an 'obvious clerical error')
1 — Poor: the criterion is inadequately addressed or there are serious inherent weaknesses
2 — Fair: the proposal broadly addresses the criterion but there are significant weaknesses
3 — Good: the proposal addresses the criterion well but with a number of shortcomings
4 — Very good: the proposal addresses the criterion very well but with a small number of shortcomings
5 — Excellent: the proposal successfully addresses all relevant aspects of the criterion; any shortcomings are minor.

One other aspect will also be considered.

- Site environment
    - This criterion will be evaluated across the offers examining what combinations of offers can provide.

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

With reference to the WP2 workshop description of EGIM (see D2.1), the following must be considered so that the EGIM can be integrated into the infrastructure:

A) Cabled infrastructure:

- Power: [300 – 400] Vdc, able to provide up to 200 W
- Data: Ethernet 100BASE-T

B) Non cabled infrastructure

- Power: [26 – 36] Vdc, able to provide up to 150 W
- An energy amount of 4000 W.h (Watt x hour) must be accounted for and made available for power-supplying the EGIM throughout its deployment.
- Data: serial link (EIA-232)

C) Instillation/integration

- Are connectors wet mateable / dry mateable?
- What lengths of cable are available?
- Provide information on the type of cable terminations.

According to your standard operational techniques and means:

- Is there space on your node to integrate the EGIM. If not, could you manage a separate standard EGIM structure as a connected lander (or attachment to the main mooring)?
- Would you connect the EGIM to your node on board the deployment vessel (or onshore) or under water?
- What communication software is/will be used for shore to EGIM connections?

Other points:

- Please note that the full connector (plug and bulkhead) to build termination of the EGIM interface cable (data link and power supply) should be provided by the node owner. The port dedicated to the EGIM should be galvanically switched and fully protected against short circuits.
- Are there redundant communication channels between the node and the shore?
- Are the communication channels isolated to ensure improved reliability under external fault conditions?
- What communication software is / will be used for shore to EGIM connections?

Please place your relevant case material here. [500 words or less]

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations:

- Prior to deployment cruise, participation to one or more preparation meetings is needed according to specifications and testing milestones of EMSODEV WP 2, 3 and 4 (at least MS2 training session and MS3 shallow water testing)
- Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here. [300 words or less]

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here. [300 words or less]

7. APPENDIX 2 – APPLICATIONS TO HOST EGIM

Rank	Bid
1	Plocan
2	INGV (Western Ionian)
3	IFREMER (Azores)
4 (1st alternative)	Marine Institute (Galway Bay)
5 (2nd alternative	IPMA (Gorringe Bank)
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Call for offers to host open ocean EGIM trials

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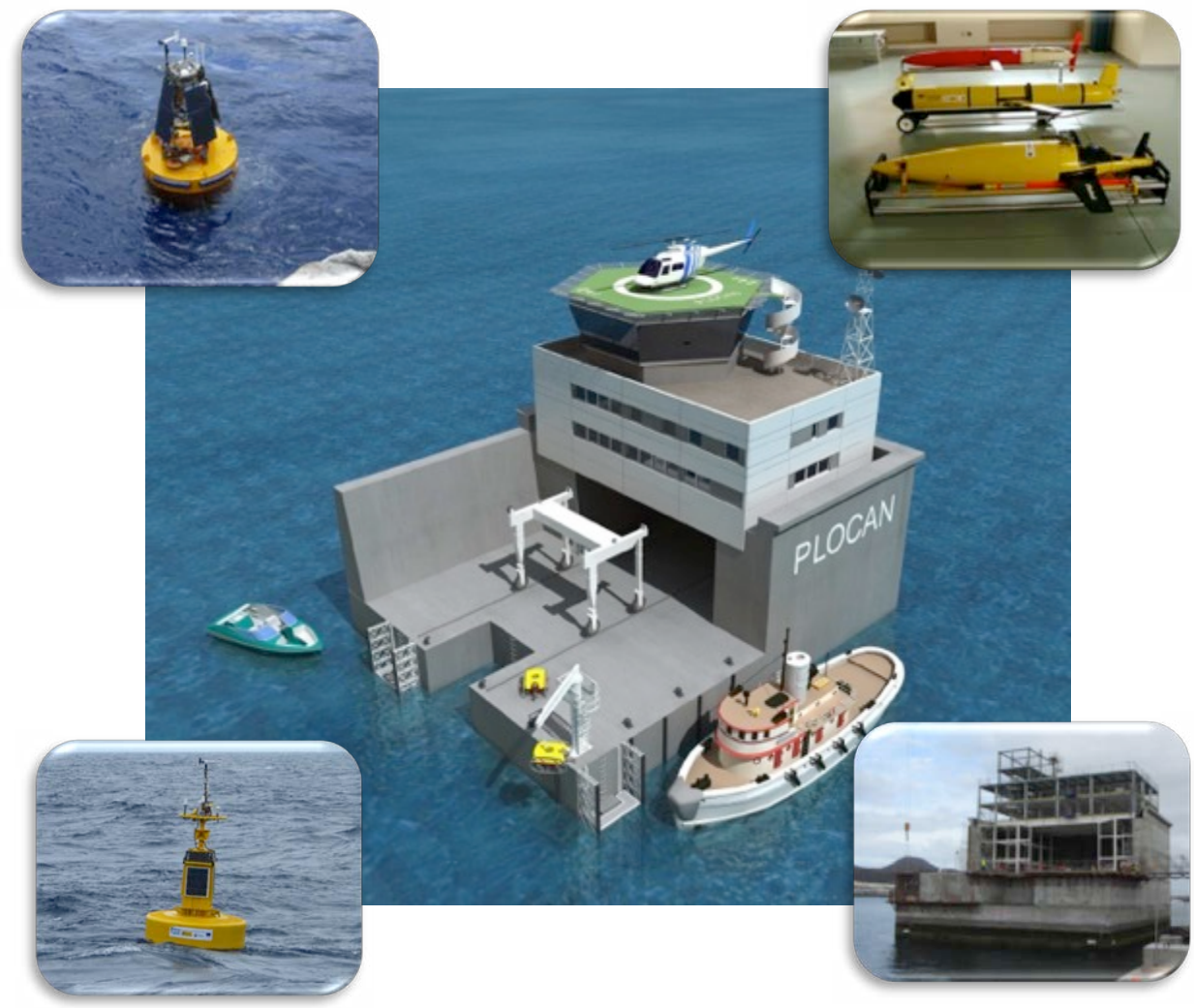

PLOCAN consorcio

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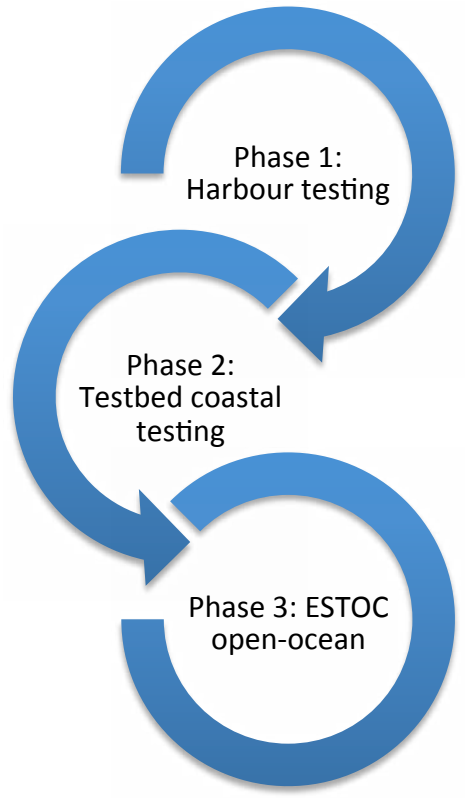

A 3-phase approach for the EGIM testing

Observatory infrastructure

The infrastructure already needs to be in place or funding (and logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

With reference to the WP2 workshop description of EGIM (see D2.1), the following must be considered so that the EGIM can be integrated into the infrastructure:

A) Cabled infrastructure:

- *Power: [300 – 400] Vdc, able to provide up to 200 W*
- *Data: Ethernet 100BASE-T*

B) Non cabled infrastructure

- *Power: [26 – 36] Vdc, able to provide up to 150 W*
- *An energy amount of 4000 W.h (Watt x hour) must be accounted for and made available for power-supplying the EGIM throughout its deployment.*
- *Data: serial link (EIA-232)*

C) Instillation/integration

- *Are connectors wet mateable / dry mateable?*
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- *Provide information on the type of cable terminations.*

According to your standard operational techniques and means:

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- *What communication software is/will be used for shore to EGIM connections?*

Other points:

- *Please note that the full connector (plug and bulkhead) to build termination of the EGIM interface cable (data link and power supply) should be provided by the node owner. The port dedicated to the EGIM should be galvanically switched and fully protected against short circuits.*
- *Are there redundant communication channels between the node and the shore?*
- *Are the communication channels isolated to ensure improved reliability under external fault conditions?*

Please place your relevant case material here. [500 words or less]

PLOCAN can provide several infrastructures for the EGIM test in the Central Eastern Atlantic. The test may be stepwise in order to provide the best guarantees that the system qualifies, from shallow water to deep open-ocean environment. Three phases, all proposing different operational or scientific conditions, are foreseen.

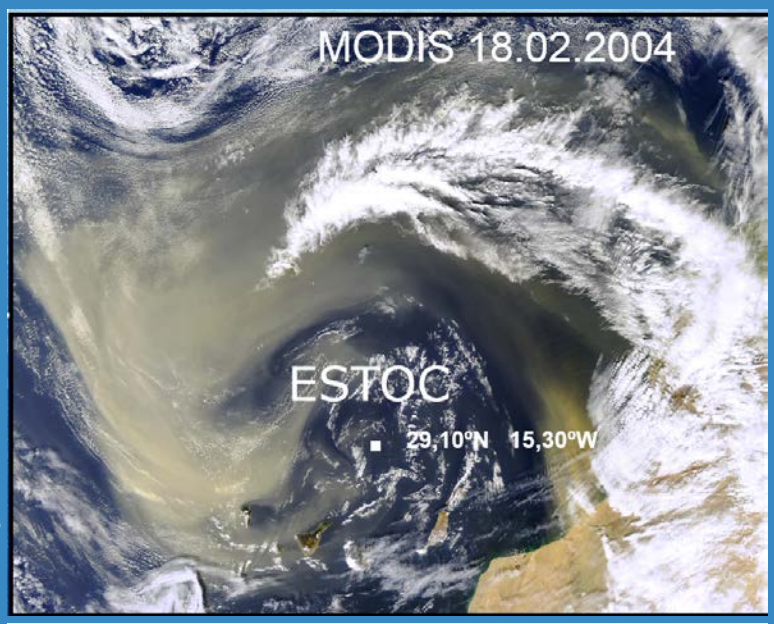
Figure 1 PLOCAN on-shore facilities and harbour pier (Phase 1)

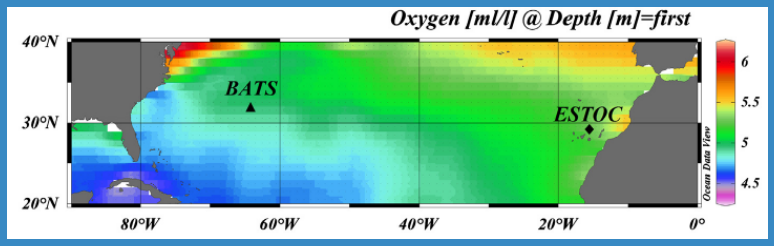
Phase 1 (P1): PLOCAN Harbour pier at Taliarte, with daily support from on-shore facilities, operational. This phase can provide a basic functionality test (technological) before open-sea deployment.

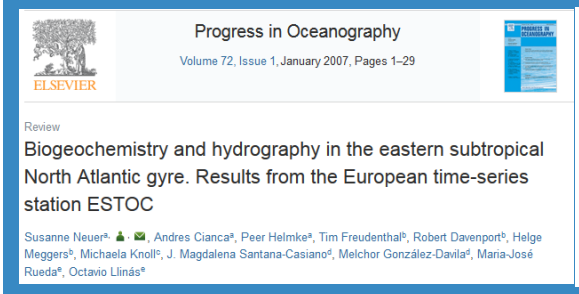
Phase 2 (P2): PLOCAN oceanic test bed (23km2 exclusive use and periodically sampled, (physical+biogeochem+acoustics), with support from the PLOCAN offshore platform (construction phase near completion, to be deployed summer 2016, operational end of 2016). See environmental sampling data in next sections.

Phase 3 (P3): PLOCAN open-ocean station with maintenance every 6 months – operated since since 1994. ESTOC, operated by PLOCAN and part of the EMSO-water column infrastructure, is a multidisciplinary station located in the Central Eastern Atlantic, an open ocean site with over 15 years of continuous surface and mid-water meteorological, physical and biogeochemical monitoring (latitude: 29.04, longitude: -15.15, depth (m): 3670). Other observatory characteristics are that it is logistically situated at 60 nautical miles north of the Canary Islands in subtropical oligotrophic waters by the Atlantic eastern subtropical gyre, it is affected by the Canary current, and gets influences from the NW African upwelling and Saharan and Sahel aerosols.

- located 100 km north of Canary Islands in the Canary Current, the weak eastern boundary current of the subtropical North Atlantic gyre.
- 3600m water depth
- exhibits open ocean, oligotrophic gyre characteristics
- No directly influenced by the coastal upwelling
- Influenced by mineral deposition of atmospheric dust from the nearby Sahara
- Almost same BATS latitude






ELSEVIER

Progress in Oceanography

Volume 72, Issue 1, January 2007, Pages 1–29

Review

Biogeochemistry and hydrography in the eastern subtropical North Atlantic gyre. Results from the European time-series station ESTOC

Susanne Neuer[a], Andres Cianca[a], Peer Helmke[a], Tim Freudenthal[b], Robert Davenport[b], Helge Meggers[b], Michaela Knoll[c], J. Magdalena Santana-Casiano[d], Melchor González-Davila[d], Maria-José Rueda[e], Octavio Llinás[e]

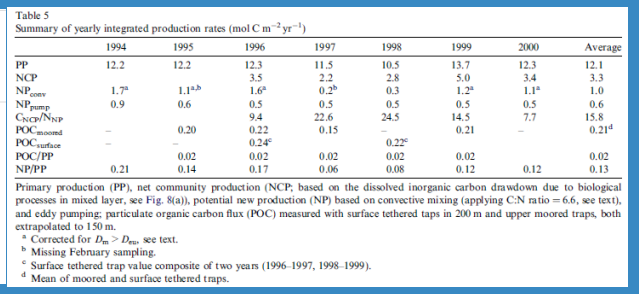
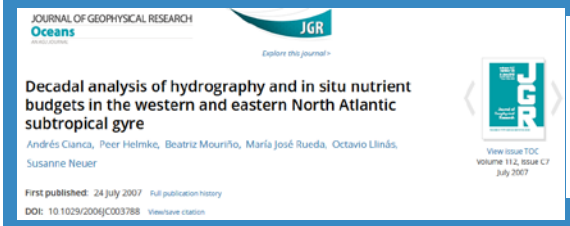


Table 5
Summary of yearly integrated production rates (mol C m^{-2} yr^{-1})

	1994	1995	1996	1997	1998	1999	2000	Average
PP	12.2	12.2	12.3	11.5	10.5	13.7	12.3	12.1
NCP			3.5	2.2	2.8	5.0	3.4	3.3
NP_{conv}	1.7[a]	1.1[a,b]	1.6[a]	0.2[b]	0.3	1.2[a]	1.1[a]	1.0
NP_{pump}	0.9	0.6	0.5	0.5	0.5	0.5	0.5	0.6
C_{NCP}/N_{NP}			9.4	22.6	24.5	14.5	7.7	15.8
POC_{moored}	–	0.20	0.22	0.15	–	0.21	–	0.21[d]
$POC_{surface}$	–	–	0.24[c]		0.22[c]			
POC/PP		0.02	0.02	0.02	0.02	0.02		0.02
NP/PP	0.21	0.14	0.17	0.06	0.08	0.12	0.12	0.13

Primary production (PP), net community production (NCP; based on the dissolved inorganic carbon drawdown due to biological processes in mixed layer, see Fig. 8(a)), potential new production (NP) based on convective mixing (applying C:N ratio = 6.6, see text), and eddy pumping; particulate organic carbon flux (POC) measured with surface tethered taps in 200 m and upper moored traps, both extrapolated to 150 m.

[a] Corrected for $D_{tu} > D_{mix}$, see text.
[b] Missing February sampling.
[c] Surface tethered trap value composite of two years (1996–1997, 1998–1999).
[d] Mean of moored and surface tethered traps.


JOURNAL OF GEOPHYSICAL RESEARCH
Oceans

JGR

Decadal analysis of hydrography and in situ nutrient budgets in the western and eastern North Atlantic subtropical gyre

Andrés Cianca, Peer Helmke, Beatriz Mouriño, María José Rueda, Octavio Llinás, Susanne Neuer

First published: 24 July 2007

DOI: 10.1029/2006JC003788

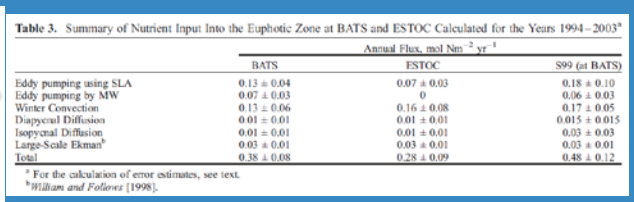
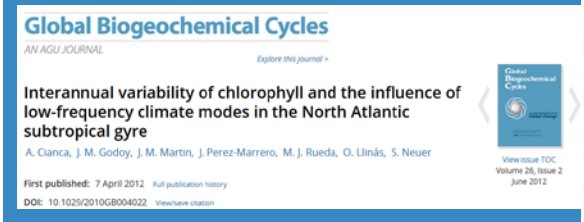


Table 3. Summary of Nutrient Input Into the Euphotic Zone at BATS and ESTOC Calculated for the Years 1994–2003[a]

	Annual Flux, mol Nm^{-2} yr^{-1}		
	BATS	ESTOC	S99 (at BATS)
Eddy pumping using SLA	0.13 ± 0.04	0.07 ± 0.03	0.18 ± 0.10
Eddy pumping by MW	0.07 ± 0.03	0	0.06 ± 0.03
Winter Convection	0.13 ± 0.06	0.16 ± 0.08	0.17 ± 0.05
Diapycnal Diffusion	0.01 ± 0.01	0.01 ± 0.01	0.015 ± 0.015
Isopycnal Diffusion	0.01 ± 0.01	0.01 ± 0.01	0.03 ± 0.03
Large-Scale Ekman[b]	0.03 ± 0.01	0.03 ± 0.01	0.03 ± 0.01
Total	0.38 ± 0.08	0.28 ± 0.09	0.48 ± 0.12

[a] For the calculation of error estimates, see text.
[b] *Williams and Follows* [1998].


Global Biogeochemical Cycles

AN AGU JOURNAL

Interannual variability of chlorophyll and the influence of low-frequency climate modes in the North Atlantic subtropical gyre

A. Cianca, J. M. Godoy, J. M. Martin, J. Perez-Marrero, M. J. Rueda, O. Llinás, S. Neuer

First published: 7 April 2012

DOI: 10.1029/2010GB004022

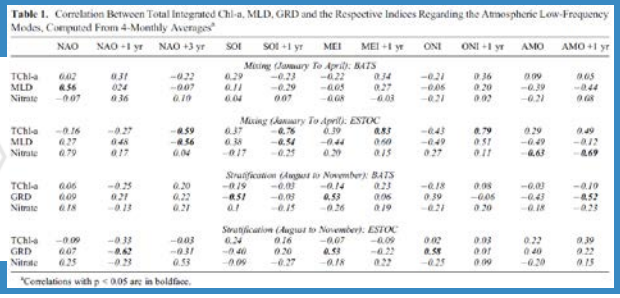
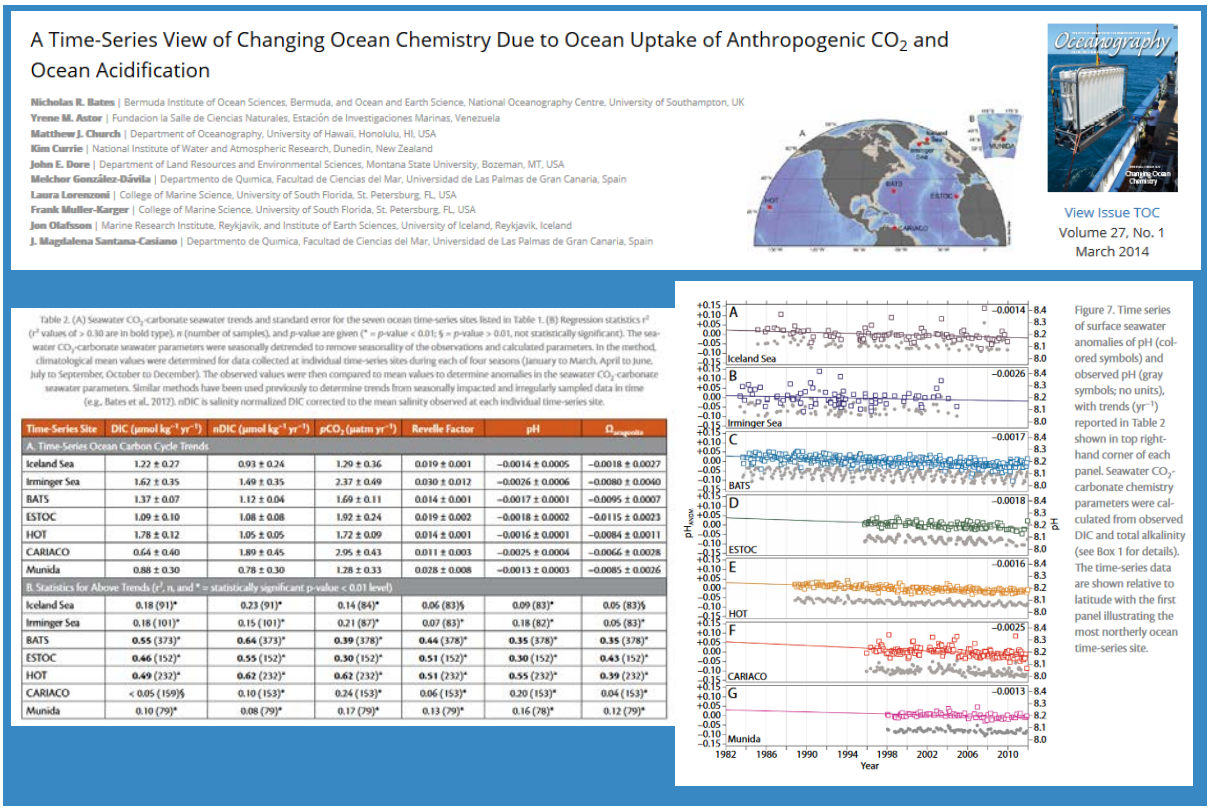


Table 1. Correlation Between Total Integrated Chl-a, MLD, GRD and the Respective Indices Regarding the Atmospheric Low-Frequency Modes, Computed From 4-Monthly Averages[a]

	NAO	NAO +1 yr	NAO +3 yr	SOI	SOI +1 yr	MEI	MEI +1 yr	ONI	ONI +1 yr	AMO	AMO +1 yr
Mixing (January To April): BATS											
TChl-a	0.02	0.31	−0.22	0.29	−0.23	−0.22	0.34	−0.21	0.36	0.09	0.05
MLD	**0.56**	024	−0.07	0.11	−0.29	−0.05	0.27	−0.06	0.20	−0.39	−0.44
Nitrate	−0.07	0.36	0.19	0.04	0.07	−0.08	−0.03	−0.21	0.02	−0.21	0.08
Mixing (January To April): ESTOC											
TChl-a	−0.16	−0.27	**−0.59**	0.37	**−0.76**	0.39	**0.83**	−0.43	**0.79**	0.29	0.49
MLD	0.27	0.48	**−0.56**	0.38	**−0.54**	−0.44	0.60	−0.49	0.51	−0.49	−0.12
Nitrate	0.79	0.17	0.04	−0.17	−0.25	0.20	0.15	0.27	0.11	**−0.63**	**−0.69**
Stratification (August to November): BATS											
TChl-a	0.06	−0.25	0.20	−0.19	−0.03	−0.14	0.23	−0.18	0.08	−0.03	−0.10
GRD	0.09	0.21	0.22	**−0.51**	−0.03	**0.53**	0.06	0.39	−0.06	−0.43	**−0.52**
Nitrate	0.18	−0.13	0.21	0.1	−0.15	−0.26	0.19	−0.21	0.20	−0.18	−0.23
Stratification (August to November): ESTOC											
TChl-a	−0.09	−0.33	−0.03	0.24	0.16	−0.07	−0.09	0.02	0.03	0.22	0.39
GRD	0.07	**−0.62**	−0.31	−0.40	0.20	**0.53**	−0.22	**0.58**	0.01	0.40	0.22
Nitrate	0.25	−0.23	0.53	−0.09	−0.27	−0.18	0.22	−0.25	0.09	−0.20	0.15

[a] Correlations with $p < 0.05$ are in boldface.

Figure 2 ESTOC CARBON EXPORT MEASUREMENTS: PRODUCTION RATES - NUTRIENT INPUT FROM THE PRINCIPAL PHYSICAL PROCESSES (10 YEARS) - INTERANNUAL VARIABILITY OF THE CHLOROPHYLL AND ITS CORRELATION WITH THE MAIN LOW-FREQUENCY MODES (10 YEARS)



A Time-Series View of Changing Ocean Chemistry Due to Ocean Uptake of Anthropogenic CO_2 and Ocean Acidification

Nicholas R. Bates | Bermuda Institute of Ocean Sciences, Bermuda, and Ocean and Earth Science, National Oceanography Centre, University of Southampton, UK
Yrene M. Astor | Fundacion la Salle de Ciencias Naturales, Estación de Investigaciones Marinas, Venezuela
Matthew J. Church | Department of Oceanography, University of Hawaii, Honolulu, HI, USA
Kim Currie | National Institute of Water and Atmospheric Research, Dunedin, New Zealand
John E. Dore | Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT, USA
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Oceanography
View Issue TOC
Volume 27, No. 1
March 2014

Table 2. (A) Seawater CO_2-carbonate seawater trends and standard error for the seven ocean time-series sites listed in Table 1. (B) Regression statistics r^2 (r^2 values of > 0.30 are in bold type), *n* (number of samples), and *p*-value are given (* = *p*-value < 0.01; § = *p*-value > 0.01, not statistically significant). The seawater CO_2-carbonate seawater parameters were seasonally detrended to remove seasonality of the observations and calculated parameters. In the method, climatological mean values were determined for data collected at individual time-series sites during each of four seasons (January to March, April to June, July to September, October to December). The observed values were then compared to mean values to determine anomalies in the seawater CO_2-carbonate seawater parameters. Similar methods have been used previously to determine trends from seasonally impacted and irregularly sampled data in time (e.g., Bates et al., 2012). nDIC is salinity normalized DIC corrected to the mean salinity observed at each individual time-series site.

Time-Series Site	DIC (μmol kg^{-1} yr^{-1})	nDIC (μmol kg^{-1} yr^{-1})	pCO_2 (μatm yr^{-1})	Revelle Factor	pH	$\Omega_{aragonite}$
A. Time-Series Ocean Carbon Cycle Trends						
Iceland Sea	1.22 ± 0.27	0.93 ± 0.24	1.29 ± 0.36	0.019 ± 0.001	−0.0014 ± 0.0005	−0.0018 ± 0.0027
Irminger Sea	1.62 ± 0.35	1.49 ± 0.35	2.37 ± 0.49	0.030 ± 0.012	−0.0026 ± 0.0006	−0.0080 ± 0.0040
BATS	1.37 ± 0.07	1.12 ± 0.04	1.69 ± 0.11	0.014 ± 0.001	−0.0017 ± 0.0001	−0.0095 ± 0.0007
ESTOC	1.09 ± 0.10	1.08 ± 0.08	1.92 ± 0.24	0.019 ± 0.002	−0.0018 ± 0.0002	−0.0115 ± 0.0023
HOT	1.78 ± 0.12	1.05 ± 0.05	1.72 ± 0.09	0.014 ± 0.001	−0.0016 ± 0.0001	−0.0084 ± 0.0011
CARIACO	0.64 ± 0.40	1.89 ± 0.45	2.95 ± 0.43	0.011 ± 0.003	−0.0025 ± 0.0004	−0.0066 ± 0.0028
Munida	0.88 ± 0.30	0.78 ± 0.30	1.28 ± 0.33	0.028 ± 0.008	−0.0013 ± 0.0003	−0.0085 ± 0.0026
B. Statistics for Above Trends (r^2, n, and * = statistically significant p-value < 0.01 level)						
Iceland Sea	0.18 (91)*	0.23 (91)*	0.14 (84)*	0.06 (83)§	0.09 (83)*	0.05 (83)§
Irminger Sea	0.18 (101)*	0.15 (101)*	0.21 (87)*	0.07 (83)*	0.18 (82)*	0.05 (83)*
BATS	**0.55** (373)*	**0.64** (373)*	**0.39** (378)*	**0.44** (378)*	**0.35** (378)*	**0.35** (378)*
ESTOC	**0.46** (152)*	**0.55** (152)*	**0.30** (152)*	**0.51** (152)*	**0.30** (152)*	**0.43** (152)*
HOT	**0.49** (232)*	**0.62** (232)*	**0.62** (232)*	**0.51** (232)*	**0.55** (232)*	**0.39** (232)*
CARIACO	< 0.05 (159)§	0.10 (153)*	0.24 (153)*	0.06 (153)*	0.20 (153)*	0.04 (153)*
Munida	0.10 (79)*	0.08 (79)*	0.17 (79)*	0.13 (79)*	0.16 (78)*	0.12 (79)*

Figure 7. Time series of surface seawater anomalies of pH (colored symbols) and observed pH (gray symbols; no units), with trends (yr^{-1}) reported in Table 2 shown in top right-hand corner of each panel. Seawater CO_2-carbonate chemistry parameters were calculated from observed DIC and total alkalinity (see Box 1 for details). The time-series data are shown relative to latitude with the first panel illustrating the most northerly ocean time-series site.

Figure 3 RECENT PUBLICATION (2014) WHERE ESTOC PATICIPATES WITH OTHER OBSERVATORIES TO DESCRIBE THE EVOLUTION OF THE MAIN VARIABLES OF THE CARBON SYSTEM IN THE OCEAN

--

Most PLOCAN infrastructures are in place at the time of submission, including funding *and* logistics (until 2021), and all infrastructures for (P1,P2,P3) are or will be ready by January 2017.

The functionality of the communications infrastructure will include seafloor cable (Phase P2 Benthic) with internet and power capability. Cable to be deployed from the PLOCAN offshore platform.

The following can be provided for P1,P2,P3:

A) Cabled infrastructure (P2):

- Power: 400 Vdc, able to provide up to 51.3kVA
- Data: Ethernet 100BASE-T

B) Non cabled infrastructure (P1&P3)

- Power: 36VDC, able to provide 150 W (P1,P3: underwater battery pack)
- An energy amount of 4000 W.h (Watt x hour) will be made available for power-supplying the EGIM throughout its deployment.
- Battery pack needs an investment of the order of 20-30k€.
- Data: serial link (EIA-232) (P1: Yes; P3: currently studying installation of a

communication link with surface buoy)

C) Installation/integration

- Dry matable connectors (P1,P2,P3)
- What lengths of cable are available: Standard lengths (COTS) fittest for purpose.
- Provide information on the type of cable terminations: Cable and termination will be supplied for the purpose of the test (P1,P2,P3).

Other points:

- A structure will be provided to integrate the EGIM on, and accommodate for, P1,P2,P3.
- EGIM connection procedure: P1: from the pier, P2: from the platform, P3: on-board vessel
- Protected termination of the EGIM interface cable (data link and power supply) will be provided.
- Communication software: PLOCAN application used for communication with ESTOC station (SIBOY software @ siboy.plocan.eu). OGC-SWE services currently in development (NeXOS). All data are available publically from PLOCAN THREDDS server.

Dimension

- ***Location :*** East coast of Gran Canaria ***Area:*** 23 km2
- ***Depth***: From shore to 600 m

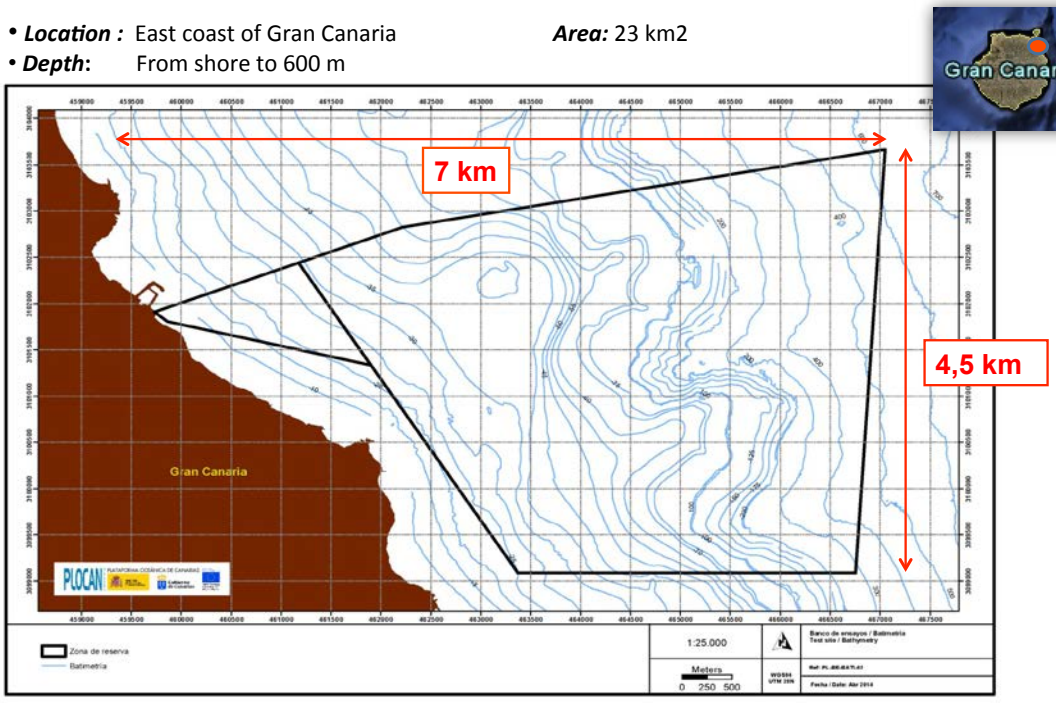


Figure 4 PLOCAN testbed 23km^2 area (P2), from 30m to 600m depth. The site is periodically monitored for physical and biogeochemical variables at increasing depths.

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.
Service cruises (P2: "PLOCAN 1" fast boat and Las Palmas subcontractors as needed, P3: Spanish Institute of Oceanography (SIO) vessels generally accommodate the maintenance of the ESTOC station. A copy of the SIO-PLOCAN framework collaboration agreement that allows for yearly cruises attending ESTOC is provided in Annexe.

For P1 and P2 PLOCAN will provide small to medium size research boat time for all operations during the expected window - February 2017 to December 2017. If construction is completed in time, testbed operations will also be supported by the PLOCAN offshore platform. P1 operations will be supervised daily from the PLOCAN on-shore facilities.

For P3, In case the open-ocean ESTOC operation would be compromised during the period, PLOCAN operates a replica of the station on its oceanic testbed where the EGIM can be installed using a subcontracted ship.

Figure 5 ESTOC Frame (150m depth) on SIO RV Alvariño 2016 - ESTOC Buoy - PLOCAN 1 boat with crew and gliders

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations:

- *Prior to deployment cruise, participation to one or more preparation meetings is needed according to specifications and testing milestones of EMSODEV WP 2, 3 and 4 (at least MS2 training session and MS3 shallow water testing)*
- *Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.*

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]

PLOCAN will provide technical support for the preparation, the deployment and the recovery of operations for P1 (daily), P2 (weekly-monthly) and P3 (twice a year, SIO Support):

- Prior to deployment, PLOCAN will participate to the necessary training sessions for the preparation and installation of the EGIM.
- Before, during and after deployment, PLOCAN technical stall will provide support for activities related to mechanical, electronical, software and data management, for sensor calibration, checking, maintenance, and download of stored data.

As per the EMSODEV DoW (PLOCAN as Third Party of CSIC), PLOCAN has an assigned number of person months for testing and assembly of the EGIM.

PLOCAN will contribute to the evaluation of the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here. [300 words or less]

In agreement with its general dissemination strategy, PLOCAN will work into the dissemination and outreach of the results of the foreseen deployment, whether scientific or technological (IEEE OES, Oceanography magazine and other relevant journals or conferences).

PLOCAN, as coordinator of the NeXOS project, will add at least one of the NeXOS new sensor developments on the module. NeXOS A1 (passive acoustics embedded analyser[1]) and O1 (multifunctional compact fluorometer[2]) will be delivered during 2016 and readily available for 2017 (NeXOS demonstration phase). An interesting outcome will be to test sensor functionality from the EGIM in P2. This activity could also provide useful insights for the upgrade of the module in terms of interoperability and also be an excellent synergetic activity between EMSO and an Ocean of Tomorrow project team, including European SMEs. For more information www.nexosproject.eu.

[1] A1 is a compact low-power multifunctional passive acoustics sensor system, enabling on-platform measurement and characterisation of underwater noise and several soundscape sources, aimed for platforms with limited autonomy and/or communication capability.

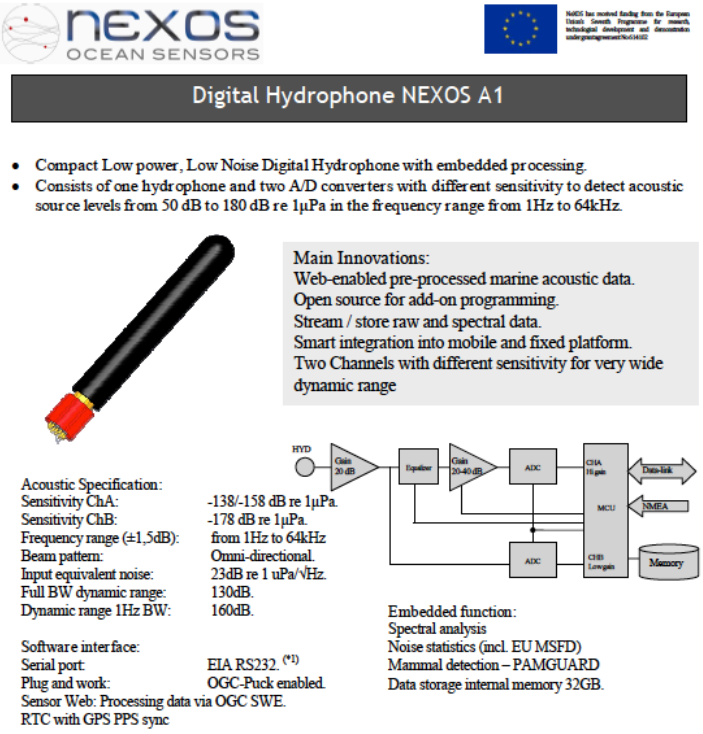


Figure 6 NEXOS A1 CHARACTERISTICS. A1 follows the ESONET-EMSO label requirements for passive acoustics, including connector pin-out. It can work on a cable (Ethernet A1) or stand-

alone system (Serial A1).

[2] O1 is a compact low-power multifunctional optical sensor system based on multi-wavelength fluorescent technology to provide detailed information on both water constituents and other relevant contaminants being optically active in the respective spectral region.

Figure 7 NEXOS O1 CHARACTERISTICS. NeXOS O1 is a plug and work (OGC-PUCK) enabled sensor. NeXOS O1 follows several ESONET-EMSO label requirements.

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

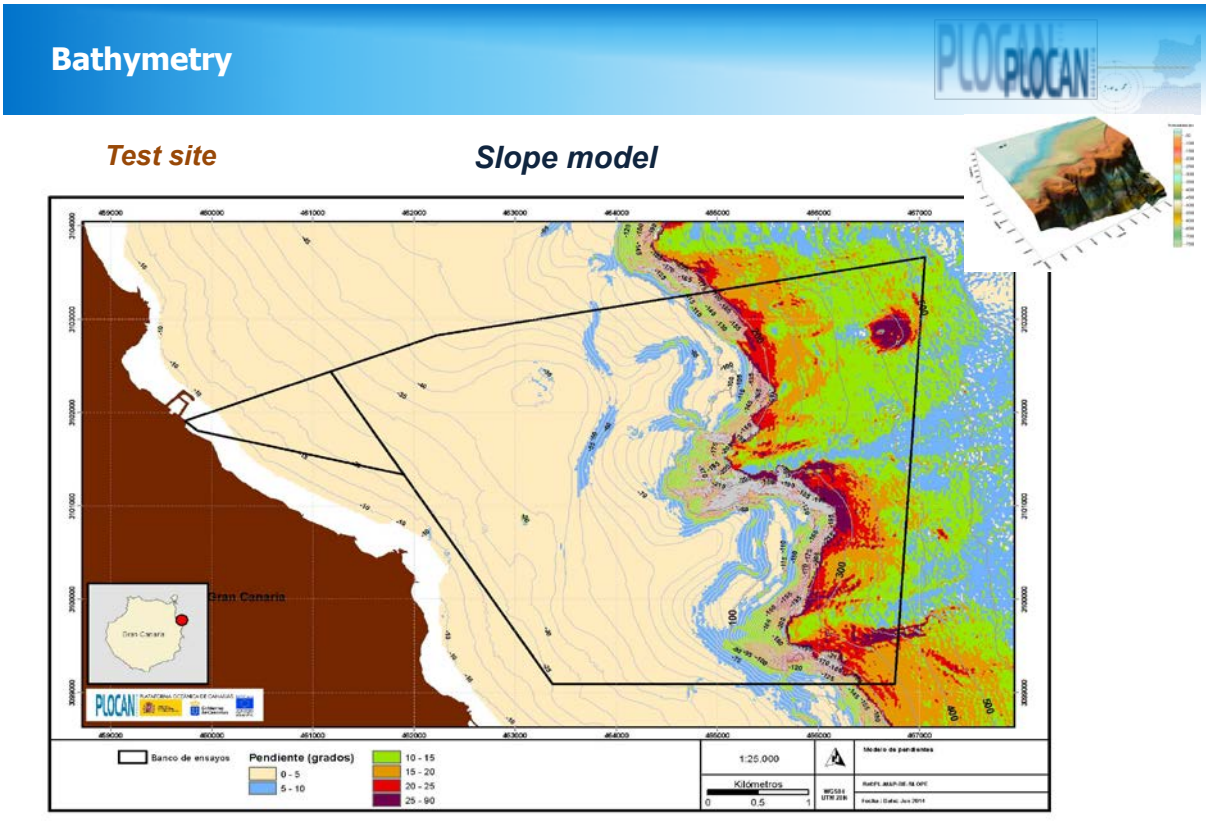
We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here. [300 words or less]

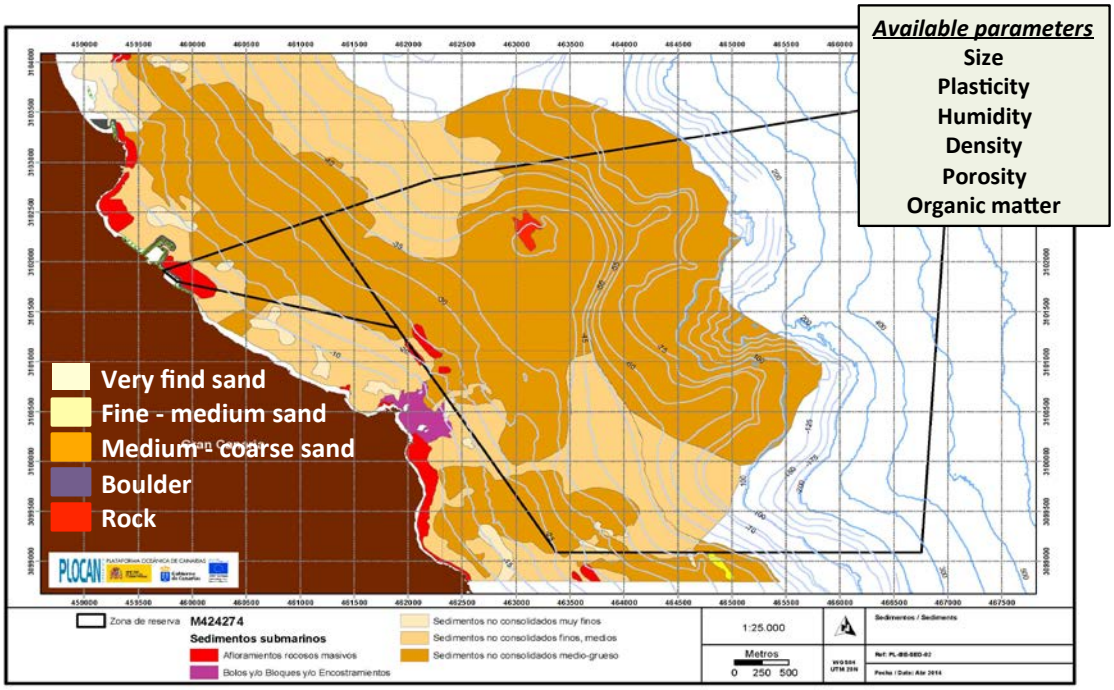
We hereby describe environmental conditions at phase 2 and 3, posterior to Phase 1 (functional tests from Taliarte pier).

P2 Phase (Pelagic and Benthic)

Water column environmental data profiles are available from surface to bottom (down to 1000m). Autonomous systems and short to medium length cables (<1km) can be rapidly deployed at several depths. Both pelagic and benthic tests can be performed.



Sediments



Available parameters

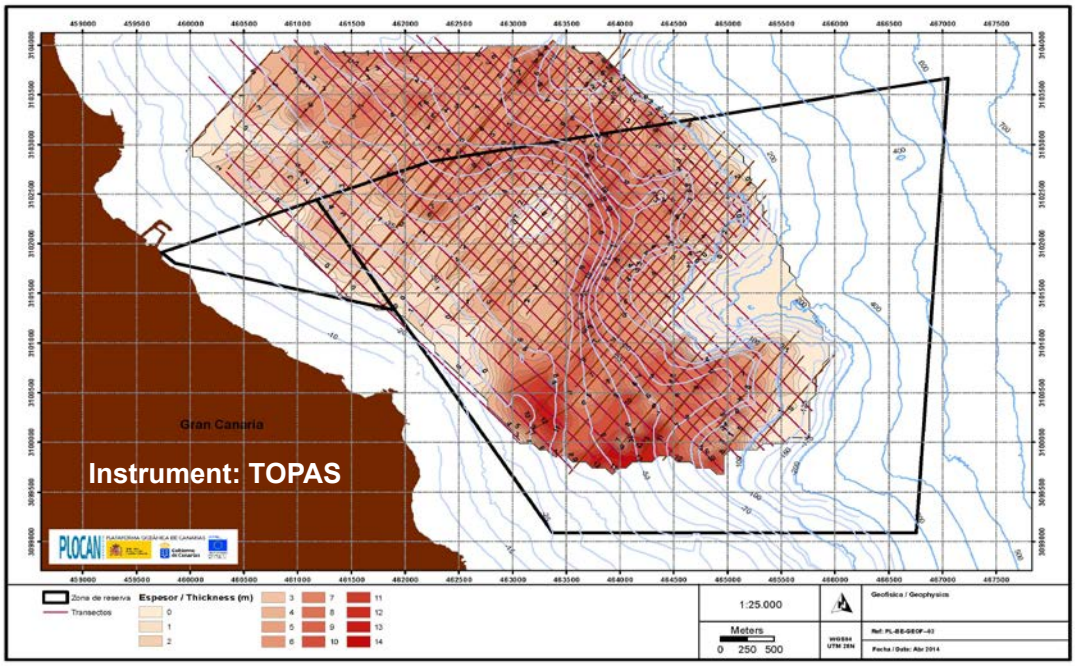
Size
Plasticity
Humidity
Density
Porosity
Organic matter

Sediments. Quality

	Station. Concentration (mg/kg)					Recommendations for the Management of *Dredged Material* in the Ports of Spain (RGMD), CEDEX (1994)	
Contaminant	**A**	**C**	**G**	**H**	**T**	***Action level 1***	***Action level 2***
Hg	0.064	0.094	0.047	0.029	0.265	0.6	3
Cd	<0.1	<0.1	<0.1	<0.1	<0.1	1	5
Pb	16.9	1.2	3.7	<0.1	30.5	120	600
Cu	<0.1	12.4	7.0	6.4	<0.1	100	400
Zn	7.8	23.5	9.1	18.0	16.7	500	3000
Cr	12.1	8.8	13.5	7.8	9.9	200	1000
As	3.2	3.4	10.0	3.1	6.0	80	200
Ni	5.3	2.7	4.0	5.5	1.3	100	400
∑ 16 PAHs	<0.0001	0.03738	<0.0001	0.00155	0.03169	2	6
∑ 7 PCBs	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.03	0.1

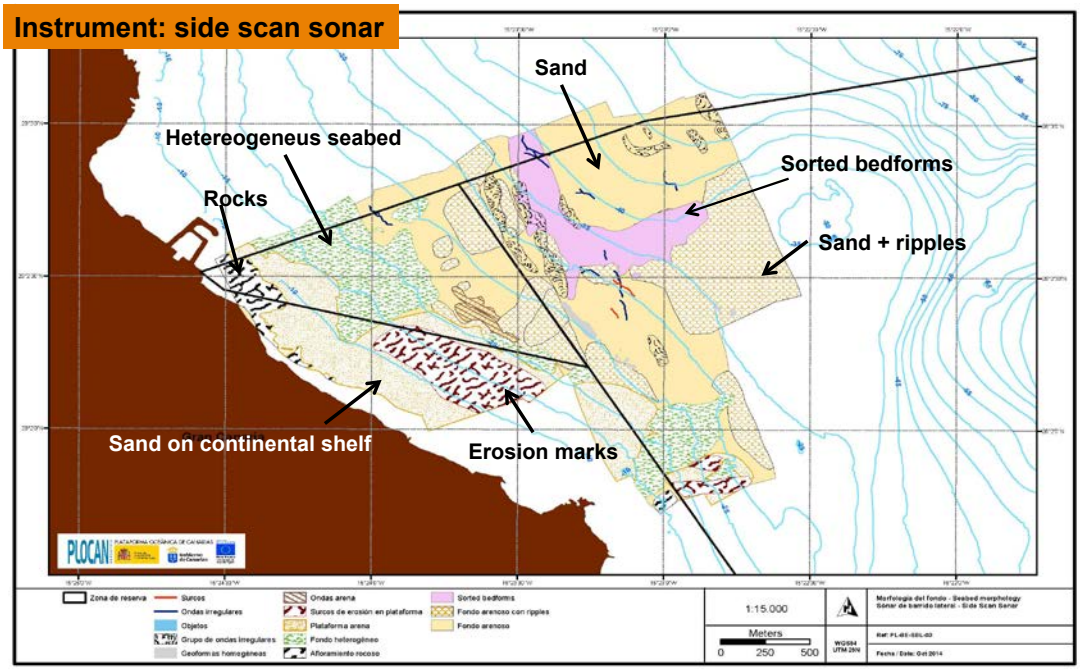
Clean sediments. **Category I** according to the RGMD

Geophysics

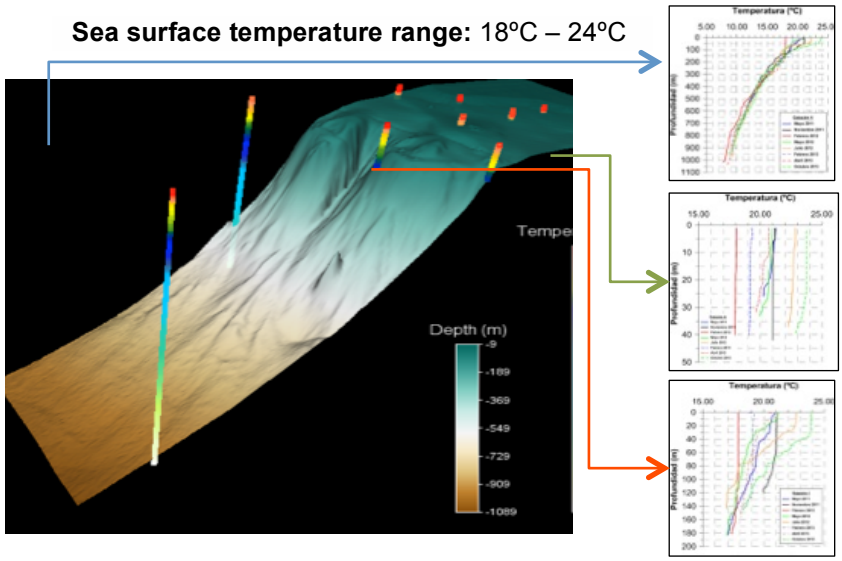


Seabed morphology

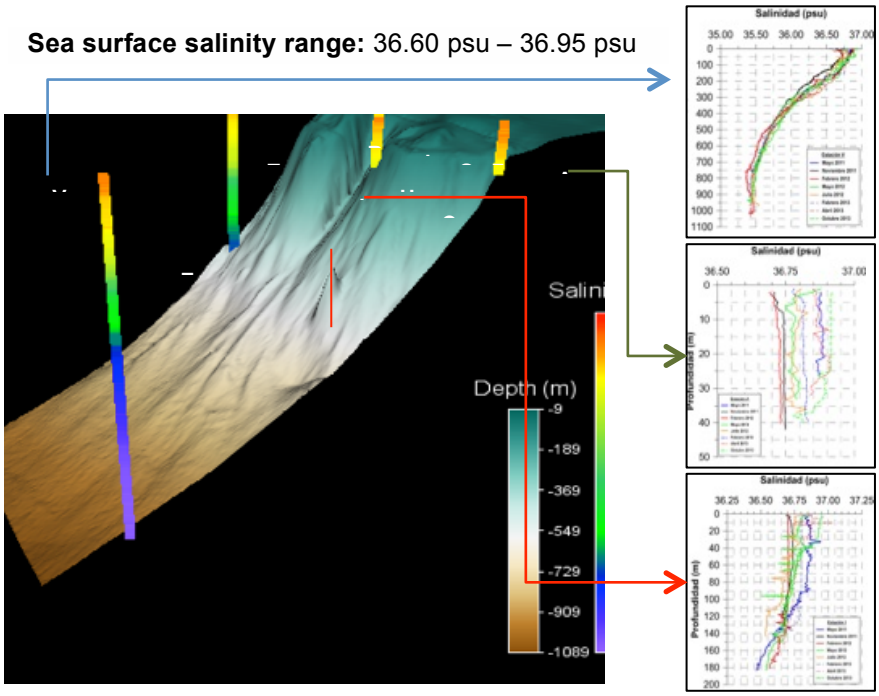
Instrument: side scan sonar



Sea surface temperature range: 18ºC – 24ºC

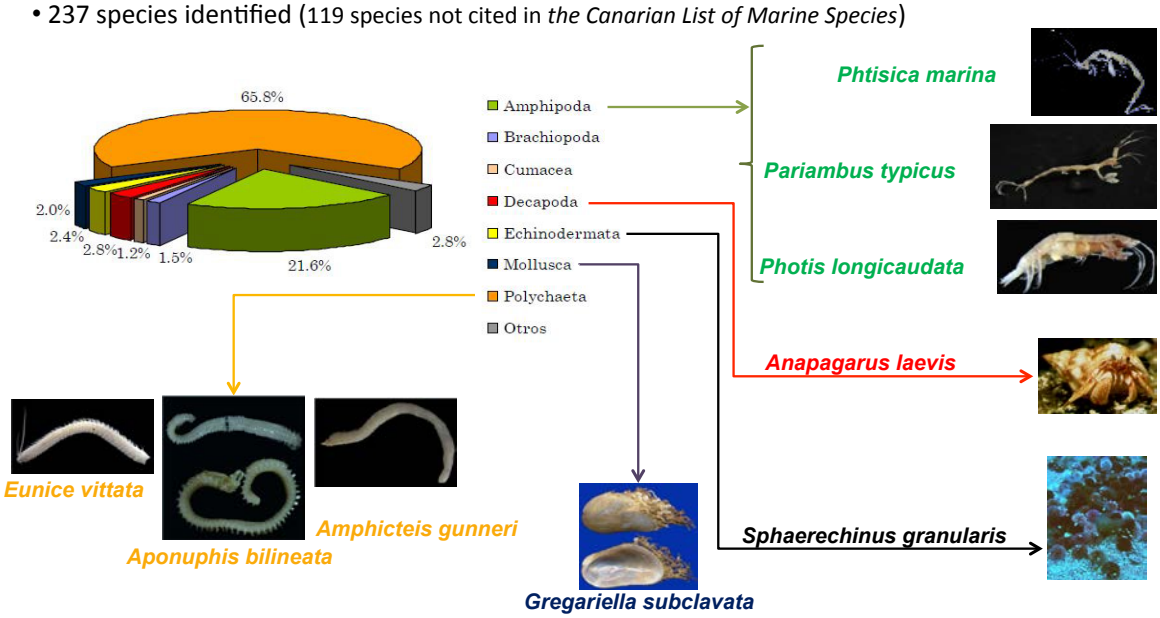


Sea surface salinity range: 36.60 psu – 36.95 psu



Benthic infauna

- Macrofauna: Length > 0,5 mm
- 13 taxonomical groups identified
- 237 species identified (119 species not cited in *the Canarian List of Marine Species*)



Benthic infauna: community health

Azti **M**arine **B**iotic **I**ndex (AMBI)

Ecological groups

Borja, A., J. Franco, V. Pérez, 2000. *Marine Pollution Bulletin*, 40(12): 1100-1114.

Group I: Species very sensitive to disturbance: present under unpolluted conditions (initial state): specialist carnivores, some deposit-feeding tubicolous polychaetes.
Group II: Species indifferent to disturbance: present in low densities, non-significant variations with time (from initial state, to slight unbalance), suspension feeders, less selective carnivores, scavengers.
Group III: Species tolerant to excess organic matter enrichment: They occur under normal conditions, but are stimulated by organic enrichment (slight unbalance situations), surface deposit-feeding species, as tubicolous spionids.
Group IV: Second-order opportunistic species: (slight to pronounced unbalanced situations). Mainly small sized polychaetes: subsurface deposit-feeders, such as cirratulids.
Group V: First-order opportunistic species: (pronounced unbalanced situations). These are deposit-feeders, which proliferate in reduced sediments.

Summary of the AMBI values and their equivalences (modified from Borja et al., 2000)

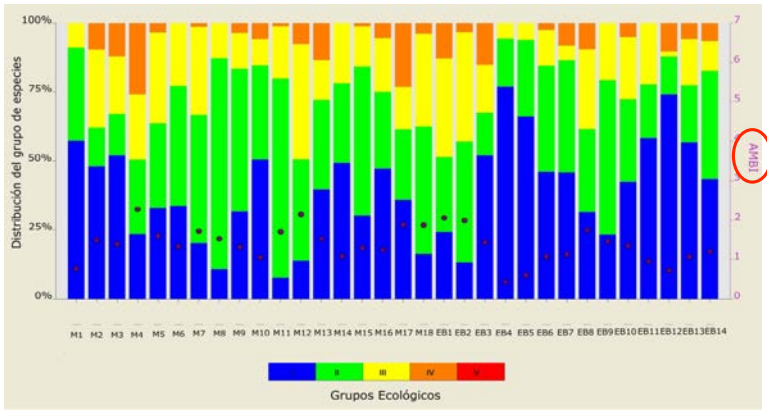
Biotic coefficient	Dominating ecological group	Benthic community health	Site disturbance classification	Ecological status
$0.0 < AMBI \leq 0.2$	I	Normal	Undisturbed	High status
$0.2 < AMBI \leq 1.2$		Impoverished		
$1.2 < AMBI \leq 3.3$	III	Unbalanced	Slightly disturbed	Good status
$3.3 < AMBI \leq 4.3$		Transitional to pollution	Moderately disturbed	Moderate status
$4.3 < AMBI \leq 5.0$	IV–V	Polluted		Poor status
$5.0 < AMBI \leq 5.5$		Transitional to heavy pollution	Heavily disturbed	
$5.5 < AMBI \leq 6.0$	V	Heavy polluted		Bad status
$6.0 < AMBI \leq 7.0$	Azoic	Azoic	Extremely disturbed	

The last column shows the proposed equivalent ecological status for the application of the WFD (Borja et al., 2003b).

I. Muxika, A. Borja W. Bonnea (2005) Ecological Indicators, 5, 19–31

Benthic infauna: community health

	AMBI	Benthic community health	Site disturbance	Ecological status
Average	**1,391**	**Unbalanced**	**Slightly disturbed**	**Good**
Minimum	*0,431*	*Impoverished*	*Undisturbed*	*High status*
Maximum	*2,275*	*Unbalanced*	*Slightly disturbed*	*Good*

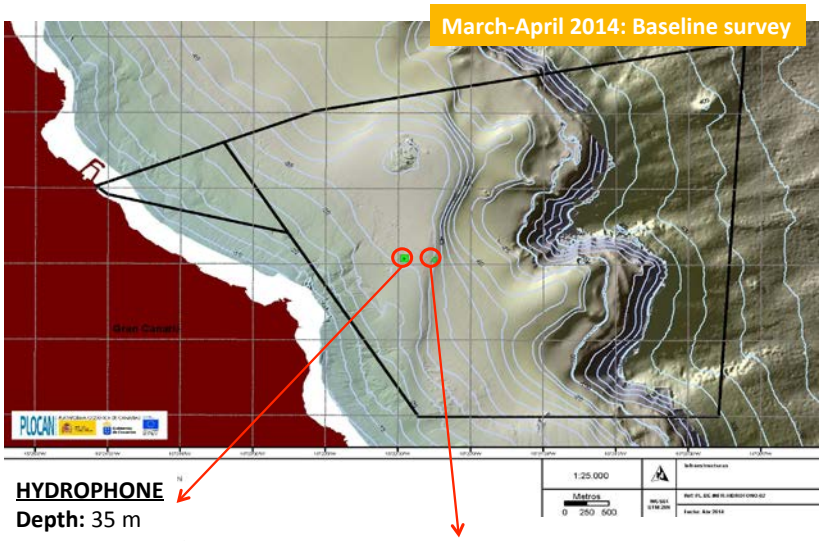


AMBI

Submarine noise

Objective: **Long-term monitoring of submarine noise generated by the devices deployed in the test site**

Pending data processing

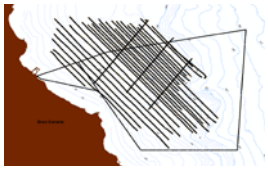


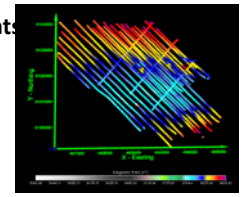
HYDROPHONE
Depth: 35 m
Deployment: 15th March 2014
Recovery: 25th April 2014

Wave energy converter UNDIGEN
Deployment: 21th March 2014

Magnetic field

Objective: identify significant metallic elements on the seabed

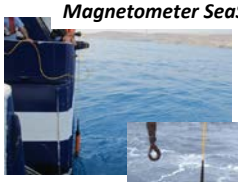


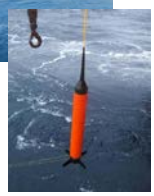


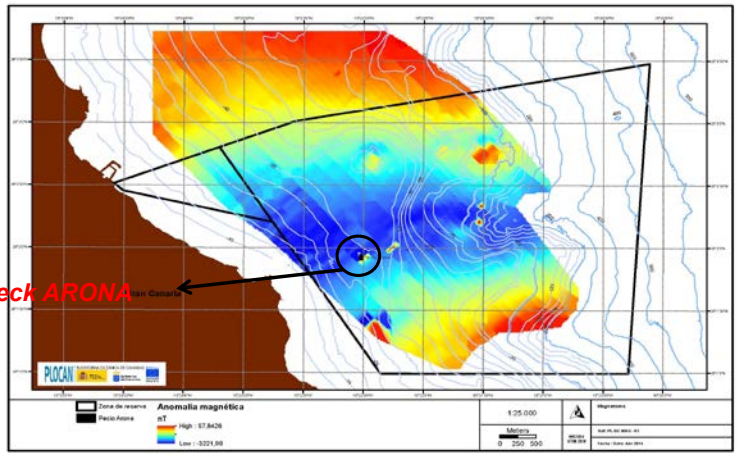
Row data representation

April 2013: Baseline survey

Magnetometer SeaSpy





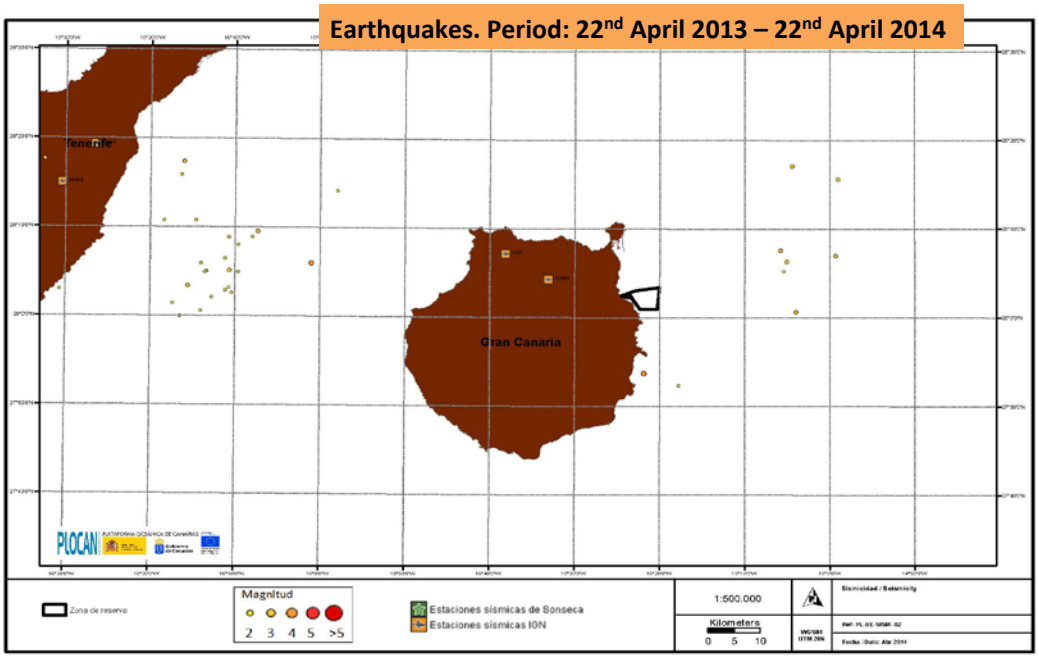


Shipwreck ARONA

Processed data
Magnetic field anomaly

Seismicity

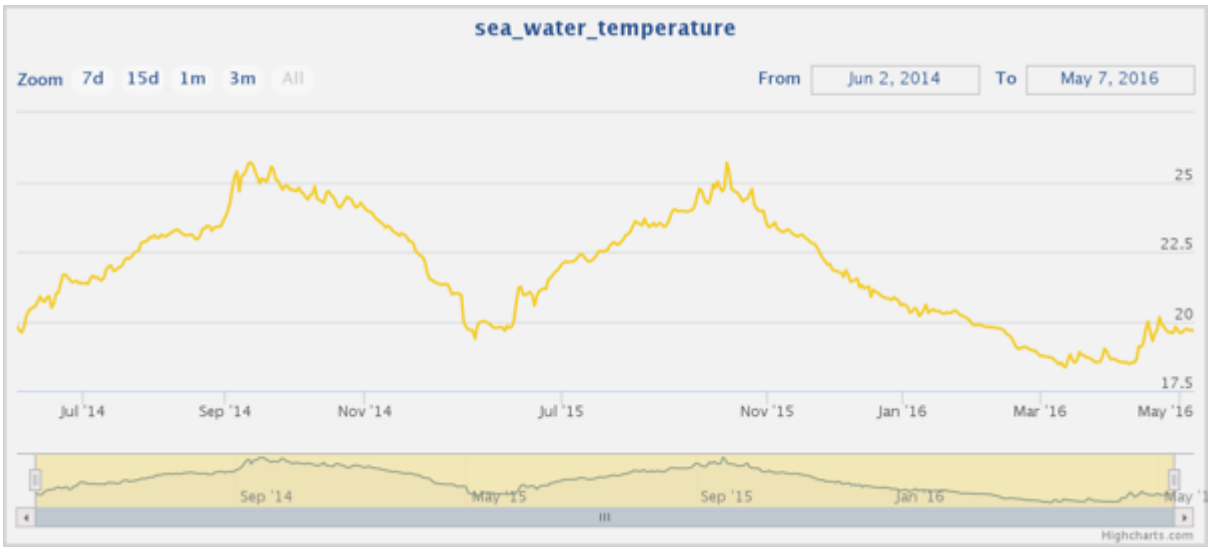
Earthquakes. Period: 22nd April 2013 – 22nd April 2014

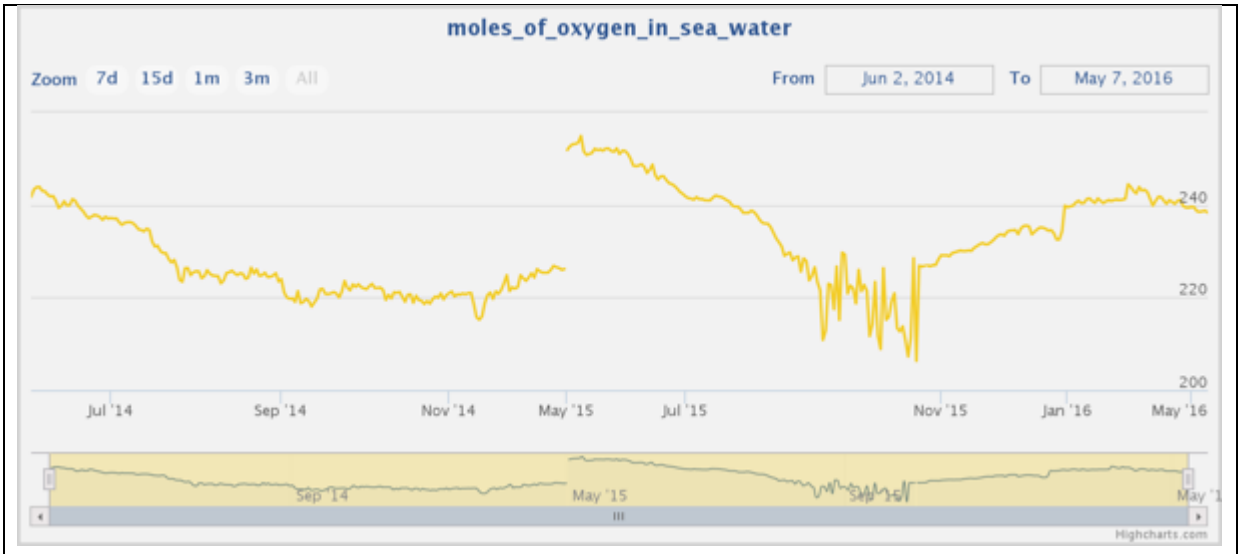


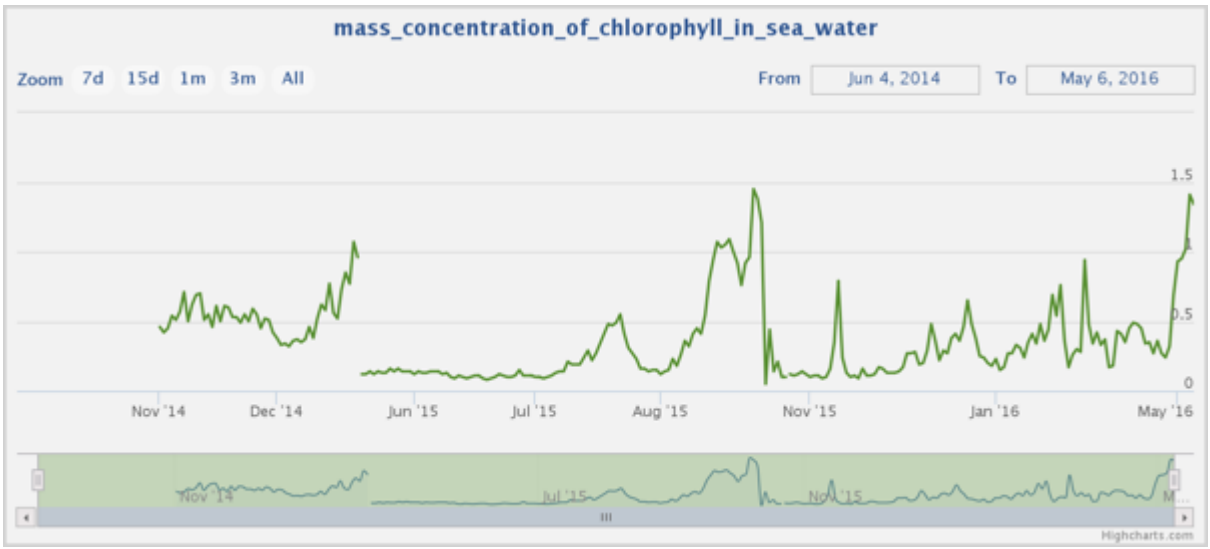
P3 Phase (Pelagic):

ESTOC station environmental data:

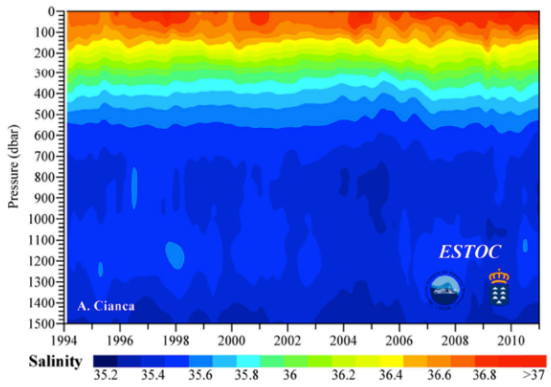
1. Surface oceanographic sensors (real-time acquisition)

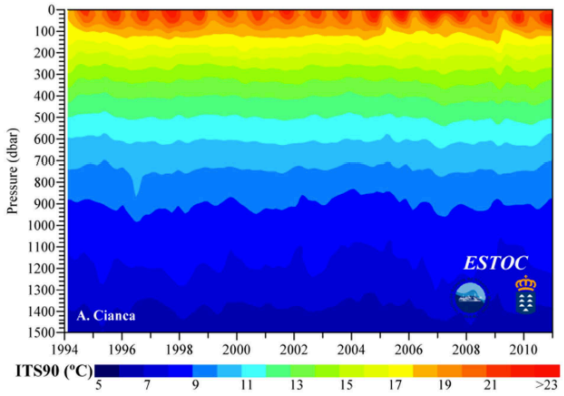






2. Water column profiles (delayed mode, serial communication planned). Gliders periodical sample (4 times per year).
EGIM can be installed near surface or the ESTOC frame at 150m depth.





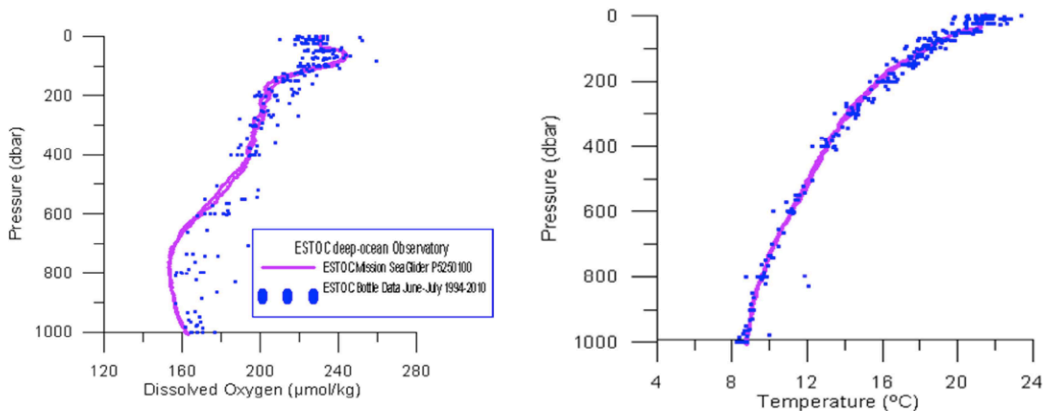


Figure 8 Salinity, Temperature and dissolved O_2 profiles at ESTOC station (Discrete sampling and gliders). EMSO evaluation can consider the best locations for EGIM deployment, these will then be evaluated for technological feasibility.

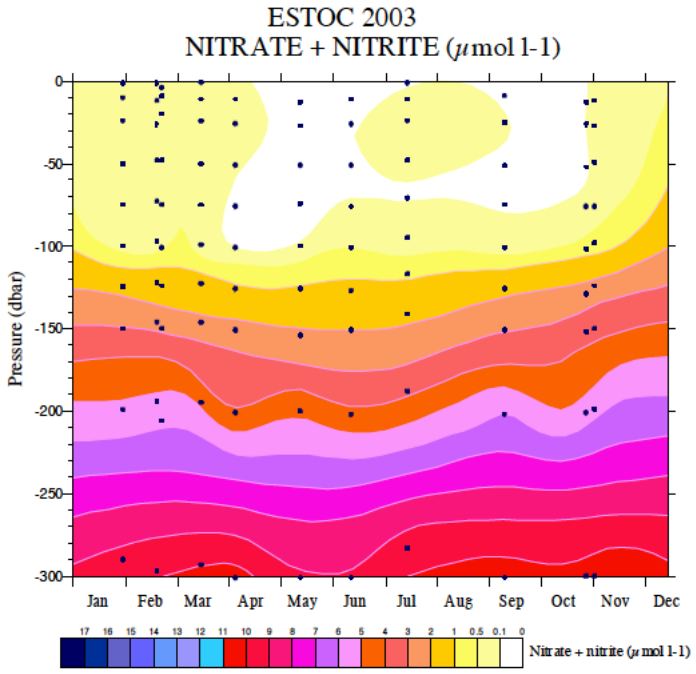


Fig. 5. ESTOC nitrate + nitrite 2003 seasonal cycle from moored NAS (near 100 m moored and 12- hourly resolution) and monthly sampling (10 sampling levels)

Annexe – SIO-PLOCAN General agreement

CONVENIO MARCO DE COLABORACIÓN ENTRE EL INSTITUTO ESPAÑOL DE OCEANOGRAFÍA (IEO) Y EL CONSORCIO PARA EL DISEÑO, CONSTRUCCIÓN, EQUIPAMIENTO Y EXPLOTACIÓN DE LA PLATAFORMA OCEÁNICA DE CANARIAS (PLOCAN) PARA EL DESARROLLO DE PROGRAMAS DE ACTUACIÓN CONJUNTA DE CARÁCTER ACADÉMICO Y DE INVESTIGACIÓN.

En Madrid y Las Palmas de Gran Canaria, a 6 de septiembre de 2011

REUNIDOS

De una parte, D. Eduardo Balguerías Guerra, como Director del Instituto Español de Oceanografía (en adelante IEO), nombrado para dicho cargo por Orden CIN/1630/2010, de 15 de junio (BOE núm. 150, de 21 de junio de 2010), actuando en el ejercicio de la competencia atribuida por el artículo 11.2.d) del Estatuto del IEO, aprobado por el Real Decreto 1950/2000 de 1 de diciembre de 2000.

De otra D. Octavio Llinás González, como Director del Consorcio para el diseño, construcción, equipamiento y explotación de la Plataforma Oceánica de Canarias (en adelante PLOCAN), con CIF nº Q-3500385-D y domicilio en el municipio de Telde, en la carretera de Taliarte, s/n, nombrado por acuerdo del Consejo Rector de dicho Consorcio de 28 de Julio de 2008 y de acuerdo con las facultades atribuidas en sus Estatutos (B.O.E. nº 83 de 05.04.07).

Los intervinientes (en adelante las Partes), que actúan en razón de sus respectivos cargos, se reconocen mutua y recíprocamente la capacidad legal necesaria para la formalización del presente convenio y, en su mérito

EXPONEN

I. Que la Ley 13/1986, de 14 de abril, de Fomento y Coordinación General de la Investigación Científica y Técnica, define al Instituto Español de Oceanografía como un Organismo Público de Investigación. Corresponden por ello al IEO, el cumplimiento de las funciones previstas en el artículo 14 de la citada Ley y las establecidas en el artículo 3 del Estatuto del IEO, aprobado por Real Decreto 1950/2000, de 1 de diciembre, siendo su finalidad el estudio de la mar y sus recursos, encontrándose entre sus funciones la elaboración, coordinación y gestión de programas de investigación de carácter oceanográfico multidisciplinar, con especial atención a su influencia en los recursos vivos. En desarrollo de estas funciones, el IEO desarrolla líneas de investigación para el estudio

Para llevar a efecto estos fines, puede realizar las acciones, establecer los contactos y formalizar los convenios que estime oportunos con entidades, organismos e instituciones, tanto públicas como privadas, nacionales y extranjeras.

II. Que PLOCAN es una infraestructura, dedicada a la experimentación y a la investigación científica y tecnológica en todos los aspectos relativos a las ciencias y tecnologías marinas y de aquellas cuyo desarrollo exige disponer de laboratorios situados en el medio marino. La Plataforma, dado su ámbito nacional, estará al servicio de toda la comunidad científica y tecnológica y abierta a la colaboración internacional de pleno en las iniciativas, actuales y futuras, de coordinación y colaboración europeas en este campo. Como Instalación Científica y Técnica Singular (ICTS) es herramienta esencial para el progreso de la ciencia experimental y el desarrollo tecnológico. Que posibilitará la investigación y el desarrollo científico y tecnológico de las ciencias marinas en el entorno del océano profundo y de aquellas disciplinas que precisan para su desarrollo disponer de laboratorios marinos situados de forma fija en la plataforma continental.

III. Que es deseo de las Partes establecer una estrecha colaboración al objeto de impulsar el cumplimiento de los fines comunes que tienen encomendados, en la certeza de que tal colaboración, al permitir un mejor aprovechamiento de los recursos disponibles y una mayor eficacia en su gestión, permitirá obtener mejores resultados en los programas y acciones a emprender, que redundará en beneficio de las instituciones y, en definitiva, del desarrollo científico y cultural y del progreso de Canarias.

IV. Que, sobre la base de estos antecedentes, las Partes manifiestan su voluntad de formalizar el presente Convenio Marco de Colaboración (en adelante el Convenio) de acuerdo con las siguientes

CLÁUSULAS

PRIMERA: Del objeto del Convenio.-

El presente Convenio tiene por objeto regular el marco de la colaboración científica, científico-tecnológica y cultural entre el IEO y el Consorcio PLOCAN, para el cumplimiento de los objetivos siguientes:

1.- Estudio integral del océano en todos sus componentes.

2.- Desarrollo de tecnologías para estudio de los ecosistemas marinos y de la explotación sostenible de sus recursos.

3.- Diseño, implementación y evaluación de tecnologías de aprovechamiento de energías renovables marinas, incluyendo la eólica, y su posible impacto sobre los ecosistemas.

4.- Estudio del efecto del cambio climático sobre la dinámica oceánica y sobre las comunidades biológicas.

5.- Desarrollo de proyectos de desarrollo e innovación con empresas en materias directa o indirectamente relacionadas con los objetivos de este Convenio.

6.- Aportar soluciones a los problemas científicos y tecnológicos específicos del medio marino de las Islas Canarias y del resto de la "Macaronesia."

La amplitud de la colaboración estará condicionada, en cada caso, a las respectivas competencias y a la disponibilidad de los medios de cada Organismo, así como a la prioridad que requieran sus propios programas en curso.

SEGUNDA: De las áreas prioritarias de actuación.-

Para el cumplimiento de los objetivos a que se refiere la Cláusula anterior, ambas instituciones planificarán programas de actuación conjunta, especialmente los relacionados con las áreas prioritarias siguientes:

1. La investigación y el desarrollo científico y tecnológico conjunto de las ciencias marinas en el entorno del océano profundo y de aquellas disciplinas que precisan para su desarrollo disponer de laboratorios situados en el medio marino.

2. Intercambio de investigadores y personal de administración y servicios, de acuerdo a lo previsto en el Artículo Vigésimo Primero, Apartado 2, de los Estatutos del Consorcio PLOCAN.

3. Formación y perfeccionamiento del personal investigador y el de las áreas de administración y servicios de ambas instituciones.

4. Cualquier otra actividad que las partes consideren de interés para el logro de los objetivos de este Convenio.

TERCERA: Del desarrollo de los programas y acciones.-

El presente Convenio no conlleva ningún gasto.

Los programas y acciones a emprender se desarrollarán posteriormente, en sus aspectos concretos, mediante convenios específicos referidos a cada una de las áreas prioritarias de actuación.

Las aportaciones económicas por los costes que genere la colaboración, serán evaluadas y acordadas, por los órganos competentes de las dos Instituciones, para cada uno de los convenios específicos en que ésta se concrete.

Para posibilitar la ejecución de los convenios específicos en las distintas áreas, las partes firmantes podrán recabar ayudas, subvenciones y colaboraciones de otras entidades, públicas y privadas.

CUARTA: Del seguimiento del Convenio.-

Para la puesta en marcha, control, seguimiento y comunicación de lo previsto en el presente Convenio, así como en los futuros convenios específicos que al amparo del mismo se elaboren, se constituirá una Comisión de Seguimiento (en adelante la Comisión). La Comisión tendrá asimismo las funciones previstas en la Cláusula Séptima y cuantas le asignen en posteriores convenios y normas de desarrollo. Los acuerdos de la Comisión deberán adoptarse por unanimidad.

La Comisión estará compuesta por un total de cuatro miembros, designados paritariamente por cada institución. Tales miembros serán el máximo representante de cada Institución o persona en quien delegue, junto con otra persona más designada por cada Institución a su elección. La presidencia de la Comisión recaerá en el representante de una de las Instituciones, alternándose la misma cada año a partir de la fecha de firma del Convenio. La alternancia se iniciará con la presidencia por parte del IEO.

La Comisión se reunirá con carácter ordinario una vez al año, así como cuantas veces se estime oportuno, a petición de una de las partes. En estas reuniones puede participar personal técnico de cualquiera de las partes previa comunicación a la otra.

Una vez constituida, la Comisión elaborará y aprobará su reglamento de actuación.

QUINTA: De la duración y resolución del Convenio.-

La duración de este Convenio se extenderá durante 5 años a partir de la fecha de su firma.

Podrá ser prorrogado por mutuo acuerdo entre las partes y de forma expresa antes de su finalización. Las prorrogas se efectuaran por periodos de igual duración mientras cualquiera de las partes no proceda a su denuncia formal, que habrá de ser notificada fehacientemente a la otra parte con una antelación de seis meses a la fecha prevista de rescisión del mismo.

En caso de denuncia del Convenio, si existiera algún convenio específico vigente al amparo del mismo éste continuará en vigor hasta la finalización de la actividad concreta que contemple.

SEXTA: De la titularidad y explotación de los resultados.-

Los aspectos relacionados con la titularidad y explotación de los resultados a que den lugar los trabajos a desarrollar al amparo del Convenio, con carácter general, se distribuirán en proporción a la participación de cada una de las Partes en su generación, sin perjuicio de que éstas pactasen para alguna de las acciones a emprender otros acuerdos que deberán estar recogidos, para cada caso, en los convenios específicos que se formalicen.

SÉPTIMA: Régimen jurídico y controversias.

El presente convenio tiene naturaleza administrativa y se rige por lo dispuesto en el articulo 8 de la Ley 30/1992, de Régimen Jurídico de las Administraciones Publicas y del procedimiento Administrativo Común. Queda excluido, por lo tanto, de la regulación de la LEY 30/2007 , de 30 de octubre de contratos del Sector Público, de acuerdo con lo que se establece en el articulo 4.1.c) de la propia Ley.

El régimen jurídico vendrá determinado por las estipulaciones previstas en el presente convenio, sin perjuicio de la aplicación de los principios de la citada Ley de Contratos del Sector Público para resolver las dudas y lagunas que pudieran presentarse.

Las cuestiones litigiosas surgidas sobre la interpretación, desarrollo, modificación, resolución y efectos que pudieran derivarse de la aplicación del presente Convenio, así como de los convenios específicos a que diera lugar, deberán solventarse por la Comisión de Seguimiento prevista en la cláusula cuarta.

Si no se llegara a un acuerdo, la resolución de controversias, serán competencia del orden jurisdiccional contencioso–administrativo, de conformidad con la Ley 29/ 1998, de 13 de julio, reguladora de dicha jurisdicción en su actual redacción.

OCTAVA: De la colaboración entre los firmantes.-

Las Partes colaborarán en todo momento, de acuerdo con los principios de buena fe y eficacia, para asegurar la correcta ejecución de lo pactado y para fomentar e impulsar el desarrollo cultural, científico y tecnológico de competencia de ambas instituciones.

Y para que así conste a los efectos oportunos, en prueba de conformidad, las Partes firman el presente documento, por duplicado ejemplar y a un solo efecto y tenor, en el lugar y fecha indicados en el encabezamiento.

POR EL IEO

Fdo.: Eduardo Balguerías Guerra

Director.

POR EL CONSORCIO PLOCAN

Fdo.: Octavio Llinás González

Director.

Some relevant references

[1] S. Neuer, A. Cianca, P. Helmke, T. Freudenthal, R. Davenport, H. Meggers*, et al.*, "Biogeochemistry and hydrography in the eastern subtropical North Atlantic gyre. Results from the European time-series station ESTOC," *Progress in Oceanography,* vol. 72, pp. 1-29, 1// 2007.

[2] A. Cianca, R. Santana, S. E. Hartman, J. M. Martín-González, M. González-Dávila, M. J. Rueda*, et al.*, "Oxygen dynamics in the North Atlantic subtropical gyre," *Deep Sea Research Part II: Topical Studies in Oceanography,* vol. 93, pp. 135-147, 9// 2013.

[3] E. Delory, J. Hernández-Brito, and O. Llínas, "Defining the Canary Islands Oceanic Platform (PLOCAN) Observing System Mission," in *European Geophysical Union General Assembly*, 2010.

[4] A. Cianca, R. Santana, E. Delory, X. Remirez, C. Barrera, C. LLerandi*, et al.*, "ESTOC: new approach warrants long-term support to the oceanic observational program," presented at the Martech 2011, Cadiz, Spain, 2011.

[5] E. Delory, J. Hernández Brito, and O. LLínas, "The PLOCAN Observatory: a multidisciplinary multi-platform observing system for the Central-Eastern Atlantic Ocean," presented at the IEEE Oceans 2011, Santander, Spain, 2011.

[6] E. Delory, A. Castro, C. Waldman, J.-F. Rolin, P. Woerther, J. Gille*, et al.*, "Objectives of the NeXOS project in developing next generation ocean sensor systems for a more cost-efficient assessment of ocean waters and ecosystems, and fisheries management," in *IEEE Oceans*, Taipei, 2014.

[7] J. Gonzalez, V. Monagas, E. Delory, J. Hernandez, and O. Llinas, "A marine test site for ocean energy converters: Oceanic Platform of the Canary Islands," in *OCEANS, 2011 IEEE - Spain*, 2011, pp. 1-6.

Call for offers to host open ocean EGIM trials

Application to host open ocean EGIM trials on the Western Ionian EMSO node

Contribution to EMSODEV D5.1

Submitted by Gabriele Giovanetti (INGV)

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

With reference to the WP2 workshop description of EGIM (see D2.1), the following must be considered so that the EGIM can be integrated into the infrastructure:

A) Cabled infrastructure:

- Power: [300 – 400] Vdc, able to provide up to 200 W
- Data: Ethernet 100BASE-T

B) Non cabled infrastructure

- Power: [26 – 36] Vdc, able to provide up to 150 W
- An energy amount of 4000 W.h (Watt x hour) must be accounted for and made available for power-supplying the EGIM throughout its deployment.
- Data: serial link (EIA-232)

C) Instillation/integration

- Are connectors wet mateable / dry mateable?
- What lengths of cable are available?

- Provide information on the type of cable terminations.

According to your standard operational techniques and means:

- Is there space on your node to integrate the EGIM. If not, could you manage a separate standard EGIM structure as a connected lander (or attachment to the main mooring)?
- Would you connect the EGIM to your node on board the deployment vessel (or onshore) or under water?
- What communication software is/will be used for shore to EGIM connections?

Other points:

- Please note that the full connector (plug and bulkhead) to build termination of the EGIM interface cable (data link and power supply) should be provided by the node owner. The port dedicated to the EGIM should be galvanically switched and fully protected against short circuits.
- Are there redundant communication channels between the node and the shore?
- Are the communication channels isolated to ensure improved reliability under external fault conditions?
- What communication software is / will be used for shore to EGIM connections?

Please place your relevant case material here. [500 words or less]

Western Ionian EMSO node is operating from more than a decade thanks to a collaboration with INFN and INGV. Some relevant improvements will take place in Spring 2016. The list of the specifications related to the improved node is detailed below.

The node hosts two different electro-optical cables in two different sites: offshore Catania (~2100 wmd) and offshore Portopalo (~3500 wmd). Both sites are powered from onshore laboratories where data are collected in real-time through optical ethernet.

A junction box (JB) is present in both sites. EGIM can be connected to either ROV-operable E/O connector of the JB. Each connector provides gigabit optical ethernet and 300 VDC, 500 W power supply. JB electrical connections are protected against short circuit and overcurrents. Optical fibers and transceivers are doubled for redundancy.

For both JBs, a 50 m long jumper, terminated with the wet-mateable ROV operable E/O connector, is provided by INGV to connect EGIM to the JB. At the other end the jumper is terminated with a Teledyne-ODI E/O penetrator that shall be integrated with EGIM cabled interface.

EGIM structure can be hosted on the node as a separate platform and connected to the JB by an ROV.

Cabled architecture provides a seamless bidirectional connection from shore labs to the EGIM via ethernet.

An additional option can be the deployment of EGIM at the site offshore Portopalo in autonomous configuration. Real-time communication is possible by using an acoustic modem. The modem can be connected to the JB by a ROV operable electrical connector. The connector is provided by INGV and the modem will be provided according EGIM specifications.

At the onshore facility any kind of acquisition software can be installed on a dedicated PC.

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.

INGV needs 6 months forewarning to set the cruise time window. For example if the site selection is made by October 2016, the cruise can start in April-May 2017.
Both deployment and recovery cruises are funded by INGV EMSO National Funds.

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations:

- Prior to deployment cruise, participation to one or more preparation meetings is needed according to specifications and testing milestones of EMSODEV WP 2, 3 and 4 (at least MS2 training session and MS3 shallow water testing)
- Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]

INGV personnel will participate to all needed preparation meetings and training sessions.
INGV will provide skilled staff for assistance in setting-up the observatory and before, during and after the deployment. Qualified personnel will guarantee high level of data quality control. The following professional skills will be provided

- 5 person/month of senior engineers skilled in electronics, software, and experienced in logistics and management of underwater observatories and marine operations
- 3 person/month of senior researchers skilled in marine data analysis and quality control.

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here. [300 words or less]
We are interested in performing cross check of various installed devices.

INGV is able to provide a GURALP CMG-40T seismometer to be connected to one of the EGIM's spare ports.
Data acquired by EGIM will be accessible in real-time by the partnership.
Data acquired by EGIM can be compared with the data acquired by the other sensors at the seafloor in the same site (listed in the table below), operating at EMSO Western Ionian node during EGIM trial. Water column (mooring) sensors will also be operating at Catania site.
These comparison can be the subject of technical and scientific collaborative papers and reports.

Instruments at Catania seafloor site

Instrument	**Vendor - Model**
Triaxial broad band seismometer	Guralp - CMG1T
Gravity meter	INAF-IAPS - prototype #2
Vectorial Magnetometer	Sulas Company - prototype
Scalar Magnetometer	Marine Magnetics - Sentinel 3000
ADCP	Teledyne RD - Workhorse sentinel 600 kHz
Pressure sensor	Paroscientific - 8CB4000-1
Digital hydrophone	SMID - DT-405D(V)1
CTD	SBE 16plus SEACAT
3-C fixed point current meter	Nobska - MAVS3
Differential Pressure Gauge	SCRIPPS-UCSD DPG Prototype V6.0

Hydrophone	OAS - E-2PD
4+4 High frequency hydrophones	SMID - TR-401(V)1

Instruments at Portopalo seafloor site

Instrument	**Vendor - Model**
Triaxial broad band seismometer	GURALP - 3T
ADCP	Teledyne Workhorse Long-ranger
CTD + Oxygen sensor	SBE 16plus V2 + SBE 63
Gravity meter	AGI
High frequency digital hydrophone (x4)	Ic Listen HF
Low frequency digital hydrophone	Ic Listen LF
Pressure sensor	Paroscientific 410K-101
Current-meter	Aanderaa 4520
Scalar Magnetometer	Quantum
Vector Magnetometer	LEMI

Call for offers to host open ocean EGIM trials

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here. [300 words or less]

The Ionian Sea is considered a crucial site since it is a collector of different water masses that play an important role, at intermediate and deep layers, in the thermohaline circulation of the Eastern Mediterranean conveyor belt.

The Catania site is located at about 2100m depth near the submarine slope of the Etna volcano. Thanks to the site's depth, problems related to biofouling are avoided. Furthermore, this site, due to low acoustic noise levels, is suitable for marine mammal detection. Their presence in the area was documented by hydrophones installed on NEMO-SN1 during 2012-2013 (Sciacca et al., 2015).
The Catania site may experience large variations in turbidity as it is located near Mount Etna volcano. During the pyroclastic activity, depending on the weather conditions, the ash fallout may affect the whole water column down to the seafloor. This was confirmed by the large variations detected by the ADCP echo intensity during the eruption events of 2013 [Lo Bue et al., 2015; Giovanetti et al., 2015). Data from EGIM turbidimeter may be correlated to ADCP data for validation.

Parameter ranges recorded at the seafloor in previous missions between 2002-2013:

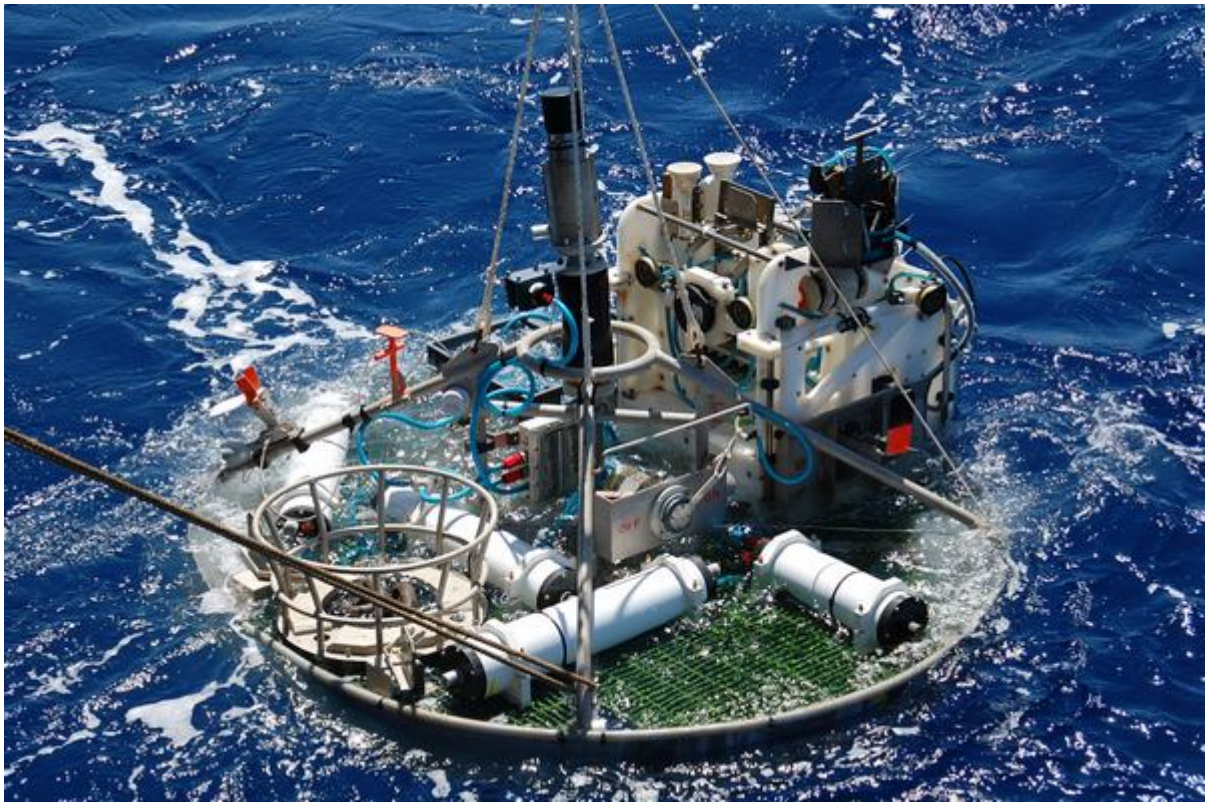
Temperature: 13.71°C -13.82 °C
Salinity: 38.71- 38.79 psu
Pressure: 2060 +- 0.6 dbar
Sea current: mean value about 8 cm/s, max values about 17 cm/s
Median background noise level (in the 17.9–22.5 Hz band): varies between 98 and 116 dB re 1µPa.

The Portopalo site is located at 3600 m depth on a flat surface at about 50 km from the oriental Sicilian sharp shelf break. Data from mooring systems collected since 1999 show thermohaline conditions that are essentially similar to the Catania site and a current system that is mainly barotropic (mean speed value about 5 cm/s) (Ursella, 2002; Bouchè, 2009).

Call for offers to host open ocean EGIM trials

Contribution to EMSODEV D5.1

Document identifier:	**EMSODEV-D5.1_CallForOffers**
Dissemination level	**INTERNAL DOCUMENT**
Document date:	**14/12/2015**
Work package:	**WP5:** EGIM Replication and in situ performance evaluation
Lead Beneficiary:	**NOCS**
Other Beneficiaries	
Authors:	**Henry Ruhl with the contribution of WP5 participants**
Document status:	**Working Document**
Date released to partners	14th December 2015



EMSO AZORES

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

With reference to the WP2 workshop description of EGIM (see D2.1), the following must be considered so that the EGIM can be integrated into the infrastructure:

A) Cabled infrastructure:

- Power: [300 – 400] Vdc, able to provide up to 200 W
- Data: Ethernet 100BASE-T

B) Non cabled infrastructure

- Power: [26 – 36] Vdc, able to provide up to 150 W
- An energy amount of 4000 W.h (Watt x hour) must be accounted for and made available for power-supplying the EGIM throughout its deployment.
- Data: serial link (EIA-232)

C) Instillation/integration

- Are connectors wet mateable / dry mateable?
- What lengths of cable are available?
- Provide information on the type of cable terminations.

According to your standard operational techniques and means:

- Is there space on your node to integrate the EGIM. If not, could you manage a separate standard EGIM structure as a connected lander (or attachment to the main mooring)?
- Would you connect the EGIM to your node on board the deployment vessel (or onshore) or under water?
- What communication software is/will be used for shore to EGIM connections?

Other points:

- Please note that the full connector (plug and bulkhead) to build termination of the EGIM interface cable (data link and power supply) should be provided by the node owner. The port dedicated to the EGIM should be galvanically switched and fully protected against short circuits.
- Are there redundant communication channels between the node and the shore?
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Please place your relevant case material here. [500 words or less]

EMSO AZORES is fully compatible with the EGIM specifications.

(http://www.emso-fr.org/fr/EMSO-Azores, http://www.fixo3.eu/observatory/momar/)

B) It is a stand alone observatory. It can provide :

- Energy through batteries (12V). 150W and 4000W.h are within characteristics.
- Acoustic modem telemetry to a buoy at sea surface and satellite telemetry through Iridium (5 years experience of operation). The data rate is managed by the remote maintenance operator according to battery power available.
- RS232 or RS485 serial links
-

C) Connectors are wet mateable if necessary and may be plugged by the VICTOR 6000 ROV.
In case of wet mateable operation, the system power is switched off.
To minimize many subsea connections, dry mateable connections are used to interface instruments and group them as an equipment pack able to be transported by the ROV or its shuttle.

A few meters of cables are available.
The connector type are similar to the EGIM prototype connectors with the same pin out configuration. Subconn 12 pins.

- There could be space on one node to integrate the EGIM. But if we want to optimize the currentmeter direction and the optical sensors positioning with respect to the active sites, it is proposed to use the standard EGIM structure as a connected lander
- We can either connect the EGIM to one of the nodes on board the deployment vessel or under water, depending on buoyancy budget. The technical team and head of cruise will decide also according to the plan of ROV dives.

Data will be transmitted through the EGIM encapsulation standard (see WP3 documents – protocol according to former EC projects ASSEM and ORION) in order to cope with the acoustic and satellite transmissions. The EMSO data management will be able to display the data stored according to the methods used for http://www.emso-fr.org/fr/EMSO-Azores. Namely, data stored by the EGIM can be downloaded and stores in the same way as the near real time data sent dayly.

The shore to EGIM connection is ensured by IFREMER remote maintenance team through satellite and acoustic links too.

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.

The cruises are already planned several years ahead.

The French Oceanology Fleet Research Infrastructure has:

- allocated a cruise with *N/O Atalante* and Victor 6000 in August 2016 when the new front end electronics COSTOF2, base of the EGIM development also) will be implemented on the two nodes SEAMON EAST and SEAMON WEST
- allocated a cruise with *N/O Pourquoi Pas?* and ROV Victor 6000 in 2017 (between May and September). It is planned to implement a new relay and measuring buoy with COSTOF2 electronics base.
- received the request for a 4 year plan of similar summer cruises on Lucky Strickes is underway

Commitments to overall operation and validation in operational conditions

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- Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]
IFREMER team as designer, prototype manufacturer and EMSODEV partner of WP4 for the testing phase, will have an easy position to fulfil the obligations of an EGIM deployment. The Deliverable D3.1 explains the calibration processes envisaged. Such support will be made available to other candidate sites and Ifremer does not wish this skill to be understood as exclusive. The objective of EMSODEV is to promote the know-how and share it in the perspective of a large use of same technologies an methods in the long lasting context of EMSO ERIC.

The EMSO Azores community has shown its ability to store, display and promote data through the establishment of DOIs (http://www.emso-fr.org/fr/EMSO-Azores/Data-download). A quality checking process at CNRS and IFREMER is well advanced and proved efficient for FixO3 Service Activities.
Methods used at Endeavour site of Ocean Network Canada cabled observatory are shared and inter-compared with the methods implemented for EMSO Azores.

Value added commitments

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Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

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Due to the rising interest in the cold areas nearby the hydrothermal vent as they are targeted for mineral ressources exploitation and associated natural protection studies, this might correspond to a unique time series collection which will be valuable for the Marine Mineral Resources community and regulation bodies (ISA, Protected Areas,…).

The comparison between two different type of hydrothermal activity between Lucky Strike and Endeavour (ONC) will benefit from additional reference data by the EGIM.

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

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1700 m - South of Azores latitude: 37.5, longitude: -33.00

Lucky Strike site is an hydrothermal vent site. The use of the EGIM will be more to monitor surrounding ocean conditions than specific hydrothermal activities. The time series of the hydrothermal site (oxygen, iron, temperature,…) are showing the need to better understand the surrounding conditions. It will be a reference measurement, extremely useful for the modellers. The ADCP for instance will be used to provide boundary conditions to Submesoscale Atlantic circulation models by physical oceanographers (Christophe Roullet). The role of the deep turbulence phenomenon now accessible by these models is still to be unveiled.

Call for offers to host open ocean EGIM trials

Contribution to EMSODEV D5.1

Document identifier:	**EMSODEV-D5.1_CallForOffers**
Dissemination level	**INTERNAL DOCUMENT**
Document date:	**4th May 2016**
Work package:	**WP5: EGIM Replication and in-situ performance evaluation**
Lead Beneficiary:	**NOCS**
Other Beneficiaries	
Authors:	**Diarmuid Ó Conchubhair, Paul Gaughan, Rogério Chumbinho**
Document status:	**Working Document**
Date released to partners	9th May 2016

emsoGalway
Location: Galway Bay Marine and Renewable Energy Test Site (MARETS), Ireland

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

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Other points:

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- Are there redundant communication channels between the node and the shore?
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- What communication software is / will be used for shore to EGIM connections?

Please place your relevant case material here. [500 words or less]

emsoGalway has been in place at the Galway Bay Marine and Renewable Energy Test Site (MARETS) since August 2015.

The sub-sea cabled observatory includes: fibre optic data and 400V DC power cable; high speed communications via 4 pairs of optical fibres; and a sub-sea cabled sensor platform which hosts a variety of sensors and equipment. emsoGalway contains a total of 18 electrical interfaces (ports) capable of receiving scientific instrumentation. These ports provide electrical power (DC current at various current formats and voltages) and two-way data links to the instruments. The data links can be either Serial (any of three Serial protocols) or Ethernet.

emsoGalway also hosts a total of 4 electro-optical interfaces, and one coaxial interface (reserved for video). 2016 will also see the deployment of an acoustic array on-site, which can also be used for test and validation purposes on-site.

The permanent equipment deployed on emsoGalway and which can be used to test and validate any new equipment deployed on-site includes:

- CTD and a Dissolved Oxygen sensor
- Combined Turbidity and Fluorescence sensors
- ADCP
- Hydrophone
- Two assemblies with underwater lights for the HDTV camera
- HDTV camera

EGIM Deployment Option 1: Cabled infrastructure:

The EGIM can be connected to one of the dedicated science ports (electrical or hybrid) available at emsoGalway depending on the final voltage/power required by the EGIM. This option would be the most suitable and the EGIM's sensors/equipment can then be tested and validated against the core suite of sensors (listed above) already deployed on the observatory. The EGIM would require a robust frame with sufficient ballast to keep it in position.

EGIM Deployment:

In principle, the EGIM would be deployed concurrently with a routine, planned observatory recovery and re-deployment. However, it is expected that wetmateable connectors will be in place in late 2016, so it would also be possible to deploy EGIM in a routine service visit to emsoGalway not requiring a recovery of the observatory either by availing of a port equipped with wetmateable connectors, or by using a long enough dry-mate cable allowing for mating with the EGIM at the surface and then deployment within 50m of the observatory.

Cables and Connectors:

The EGIM would be placed within ~50m of the in-situ observatory in a standalone frame and would be connected to the in-situ observatory via an electrical or a hybrid cable providing Ethernet data connectivity, depending on the final voltage and power required. The selection of connectors would also depend on this requirement, but there would be no impact on the connector on the EGIM side.

Communications:

Communications from shore to the EGIM would be achieved using EGIM's control software; the in-situ observatory's network is Ethernet-based so, by default, instruments deployed in the cable are made available at an IP/port address thus allowing any IP-enabled control software to communicate with the instrument. The communications channels between the shore and the underwater node are redundant, as well as all the electronics and control systems in the node; although sharing the same cable, communications and power channels are totally independent and isolated. Each port is also electrically isolated, so a failure in any instrument would not impact EGIM and vice-versa.

EGIM Deployment Option 2: Non cabled infrastructure:

The EGIM can be deployed as a stand-alone, self-contained unit in close proximity to emsoGalway. This option would still allow the EGIM's sensors/equipment to be tested and validated against the core suite of sensors (listed above) deployed on the observatory.

EGIM Deployment:

The self-contained EGIM unit could be deployed using any suitable vessel of opportunity (MI Research Vessels) or during a planned operations and maintenance cruise to the test site. The EGIM would require a robust frame with sufficient ballast to keep it in position.

Cables and Connectors:

The stand-alone EGIM deployment option would be self-logging **OR** provide data communications via an acoustic modem. Either option would require batteries for power and would not require cables or connectors.

Communications:

Communications in this scenario (provided an acoustic modem is available) would be provided by installation of the acoustic modem pair in the EGIM and in a surface buoy (GB MARETS SmartBuoy), through which redundant channels to shore exist (3G/GPRS and 5.2 GHz band wireless). Wireless communications existing in the test site allow for IP-based applications to communicate with instruments deployed in the buoy or connected to it; the actual protocol would depend on the capabilities of the acoustic modem, but usually serial communications are supported.

An alternative is to install EGIM on the buoy, if possible and depending on final dimensions and configuration, or to connect EGIM on the bottom to the buoy at the surface using a cable (Ethernet or serial communications would be available to choose from).

Site visit logistics and timing
A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.
Please place your relevant case material here, or include as separate document submitted to the Interim Office. A dedicated annual observatory cruise is scheduled going-forward and any EGIM deployment and/or recovery can be co-scheduled with this cruise. If the standalone non-cabled EGIM is selected then either this cruise of a cruise/vessel of opportunity using MI Research Vessels may also be an option along with the dedicated observatory cruise.

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations:

- Prior to deployment cruise, participation to one or more preparation meetings is needed according to specifications and testing milestones of EMSODEV WP 2, 3 and 4 (at least MS2 training session and MS3 shallow water testing)
- Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]

The Marine Institute will dedicate its marine technicians to the EGIM project, these technicians have worked on emsoGalway from project outset and are experienced in working with similar instruments as will be deployed on the EGIM. An overview of estimated technician time which can be dedicated to the project can be found below:

Estimated EGIM Technician Time:

- Pre-Assembly and equipment integration onto frame (Est. Technician Time: 4 weeks)
- Wiring (Est. Technician Time: 1 week)
- Dip-Test (Est. Technician Time: 4 days)
- EGIM Deployment (Est. Technician Time: ~ length of trip)
- EGIM Recovery (Est. Technician Time: ~ length of trip)
- EGIM Decommissioning (Est. Technician Time: 1 week)

The Marine Institute will also evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration. Where appropriate the MI will also compare data with those generated by similar instruments deployed as part of the core suite of sensors on the subsea observatory.

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here. [300 words or less]

Comparison of the EGIM sensors and instruments alongside those deployed as part of emsoGalway core suite of sensors would be an area of interest to both the Marine Institute and EMSO. The MI can also provide acoustic data from the deployment if required as the proposed EGIM deployment will coincide with the operational start date of the test site acoustic monitoring project.

The MI can also compare the EGIM with the in-situ emsoGalway across a variety of other parameters such as:

- Scale of marine fouling (biofouling) and comparison with observatory to estimate areas with more or less marine growth
- Frame/unit degradation due to deployment in saline and (at times) hostile environment
- Storm impact on seabed and knock-on impact on EGIM/Observatory (frame movement, sediment movement etc.)
- Telemetry and power comparison with observatory

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here. [300 words or less]

The Galway Bay Marine and Renewable Energy Test Site is located within the confines of Galway Bay on the west coast of Ireland. The test site area is clearly delimited by 4 cardinal marks at each corner of the site to indicate restrictions on vessel traffic within the area. Water depths on site are between 20-23m with the test site located approximately 1.5km off the coast.

The test site is located in an area which at times has a large freshwater discharge. The average current amplitude is in the vicinity of 0.4 m/s near the bottom but significantly higher amplitudes may be observed in strong tidal flows and during storms; the water temperature at the observatory's depth is between 6 to 8 °C in winter and up to 12 °C in the summer. The yearly-averaged significant wave height above the observatory is about 1m (70% of the time the significant wave height will be less than 1.5m with periods ranging between 5 and 8 seconds). Salinity in the water column, and also at the bottom, can vary significantly from the surface to the bottom depending on fresh water discharge from a nearby source. Typical values observed at the observatory's depth have ranged from 35 to 25 or less. The same applies to turbidity; a great variability from relatively clear sea water to very turbid water has been observed.

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For the attention of:
EGIM Host Application Department
EMSO Interim Office
Via di Vigna Murata 605
00143 Roma
Italy

9th May 2016

Foras na Mara
Marine Institute

Letter of Commitment regarding funding, deployment and operations of EMSO EGIM at emsoGalway site.

To Whom It May Concern,

The Marine Institute (MI), as operators of the Galway Bay Marine and Renewable Energy Test Site (MARETS), in which emsoGalway is located has submitted an application to host an EMSO EGIM.

As part of the application to host the EGIM at emsoGalway, the MI; as principal observatory operators, commit to deploying the EGIM as part of a routine observatory operations and maintenance cruise between February and December 2017. The deployment will be undertaken using either MI Research Vessels or appropriate vessels which the MI use under existing service level agreements.

The MI can confirm that a funding mechanism is in place with regard to the existing observatory's operations and maintenance and any additional EGIM related costs will be applied under the same funding mechanism. The existing observatory will require routine maintenance in 2017 and the MI can confirm that the EGIM deployment will be undertaken during this project cruise.

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Yours sincerely,

Michael Gillooly

Signed by

For and on behalf of **MARINE INSTITUTE (Member of EMSO ERIC)**
Michael Gillooly
Director (Ocean Science and Information Services)
Marine Institute

Date: 9th May 2016

Call for offers to host open ocean EGIM trials

Contribution to EMSODEV D5.1

Document identifier:	**EMSODEV-D5.1_CallForOffers**
Dissemination level	**INTERNAL DOCUMENT**
Document date:	**14/12/2015**
Work package:	**WP5:** EGIM Replication and in situ performance evaluation
Lead Beneficiary:	**NOCS**
Other Beneficiaries	
Authors:	**Henry Ruhl with the contribution of WP5 participants**
Document status:	**Working Document**
Date released to partners	14th December 2015

Call for offers to host open ocean EGIM trials

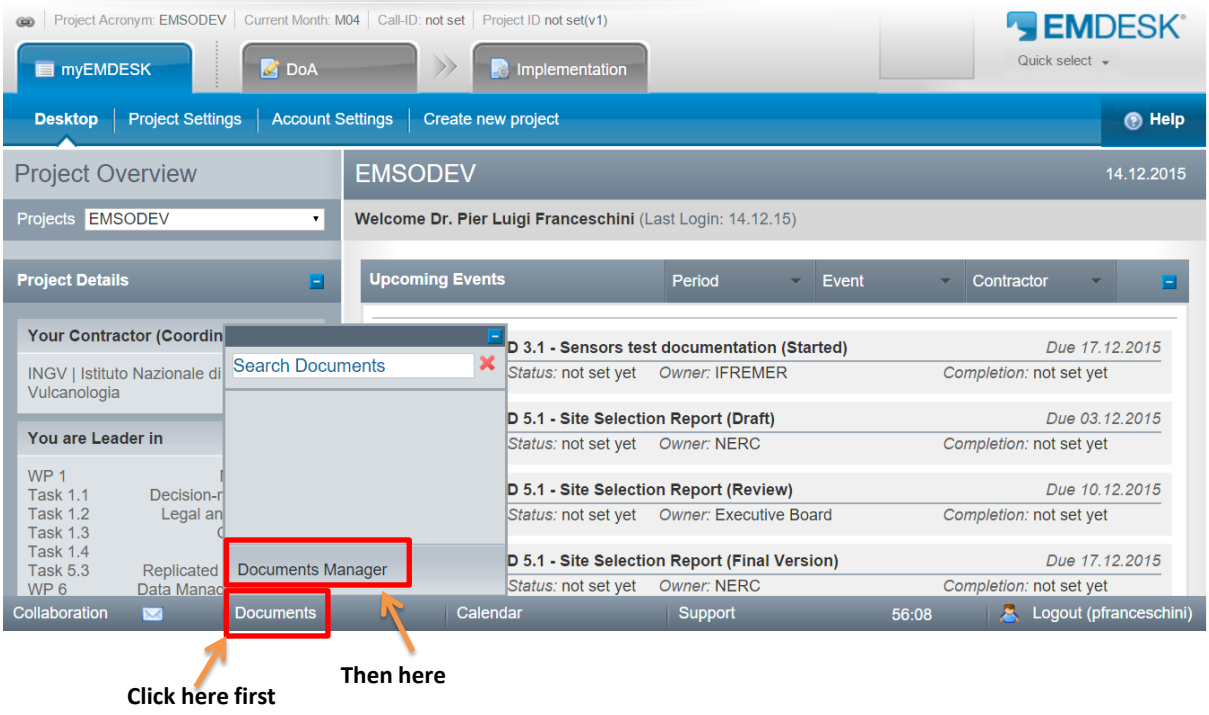
Contribution to EMSODEV D5.1

This task identifies and selects the sites where EGIM deployments will be carried out. The aim is to evaluate the opportunity and feasibility to deploy additional EGIMs including national contributions of effort. Site selection will be done by the EMSODEV Steering committee according to the terms and conditions presented here.

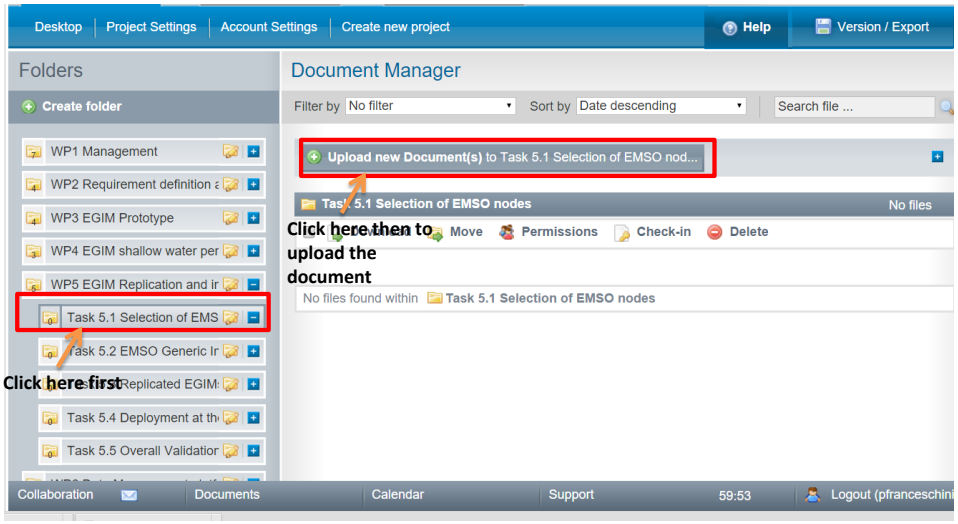
Please note that while WP5 will provide limited technical support and shipping costs, there is no financial support associated with this call.

For each of the criterion please present the case for your node. Each section has guidelines as to the important aspects for consideration and how the criteria will be weighted in the overall decision process. **All applications are due to the EMSO interim office by 31 January 2015 through the following procesure:**

1. Login into EMDESK
2. Click on the "Documents" button on the bottom menu on the left, then to "Documents manager":



3. Click on WP5, and then on Task 5.1 Selection of EMSO nodes



4. Click on “Upload new Document(s) to Task 5.1 Selection of EMSO nodes” as in the picture above to upload your file.

The review will take place by the EMSODEV SC with a decision to be announced in the following weeks.

We will use the EC scoring terminology for each of the following criterion:

- Observatory infrastructure
- Site visit logistics and timing
- Commitments to overall operation and validation in operational conditions
- Value added commitments

For each criterion, your offer will be given **scores** of 0 to 5 (half marks are possible), as follows:

0 — The proposal fails to address the criterion or cannot be assessed due to missing or incomplete information (unless the result of an ‘obvious clerical error’)
1 — Poor: the criterion is inadequately addressed or there are serious inherent weaknesses
2 — Fair: the proposal broadly addresses the criterion but there are significant weaknesses
3 — Good: the proposal addresses the criterion well but with a number of shortcomings
4 — Very good: the proposal addresses the criterion very well but with a small number of shortcomings
5 — Excellent: the proposal successfully addresses all relevant aspects of the criterion; any shortcomings are minor.

One other aspect will also be considered.

- Site environment
    - This criterion will be evaluated across the offers examining what combinations of offers can provide.

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

With reference to the WP2 workshop description of EGIM (see D2.1), the following must be considered so that the EGIM can be integrated into the infrastructure:

A) Cabled infrastructure:

- Power: [300 – 400] Vdc, able to provide up to 200 W
- Data: Ethernet 100BASE-T

B) Non cabled infrastructure

- Power: [26 – 36] Vdc, able to provide up to 150 W
- An energy amount of 4000 W.h (Watt x hour) must be accounted for and made available for power-supplying the EGIM throughout its deployment.
- Data: serial link (EIA-232)

C) Instillation/integration

- Are connectors wet mateable / dry mateable?
- What lengths of cable are available?
- Provide information on the type of cable terminations.

According to your standard operational techniques and means:

- Is there space on your node to integrate the EGIM. If not, could you manage a separate standard EGIM structure as a connected lander (or attachment to the main mooring)?
- Would you connect the EGIM to your node on board the deployment vessel (or onshore) or under water?
- What communication software is/will be used for shore to EGIM connections?

Other points:

- Please note that the full connector (plug and bulkhead) to build termination of the EGIM interface cable (data link and power supply) should be provided by the node owner. The port dedicated to the EGIM should be galvanically switched and fully protected against short circuits.
- Are there redundant communication channels between the node and the shore?
- Are the communication channels isolated to ensure improved reliability under external fault conditions?
- What communication software is / will be used for shore to EGIM connections?

Please place your relevant case material here. [500 words or less]

We propose to install a un-tethered system solution based in a relocating hybrid robotic lander (Turtle System) to host the EGIM equipment, and a moored surface buoy, to bridge the gathered EGIM deep sea data with shore via satellite communications (regular hourly connection, or emergence sporadic communication) or Wi-Fi for maintenance operations. An acoustic

communication system links the seafloor Turtle System to the surface buoy. These systems allow us to, simultaneously, have long term observations combined with a high accuracy location and avoid the high operational costs.

We propose to integrate and connect the EGIM in a dedicated TURTLE system and install in an onshore Lab or on the Deployment vessel. We have conditions to test the functional integration in a test tank or in harbor facilities. The connectors are wet mateable, and lengths of cables have no major constraints and can be defined later.

We will provide transparent software to control the EGIM subsystem and retrieve data from it.

*TURTLE – Deep sea autonomous robotic lander(*www.lsa.isep.ipp.pt/~turtle*):*

Is a system capable of both long-term permanence at the sea bottom and of autonomously relocating itself and surfacing for maintenance. This system is also able to dive and ascent with high-energy efficiency and its autonomous capabilities allow for reduced operational costs and flexibility. One of the applications is seabed observatories (seismic activity, marine biology, oceanography) and material/tools transport and deployment to the seabed. Some advantages are: energy efficient technologies for ascent descent when comparing with current solutions and hybrid lander combining mobility with long-term presence in deep sea; and robotic technologies enabling reduced maintenance and operational requirement.

Hybrid Robotic lander specifications:

Depth rated to 1000m; 200 Kg payload; 1400Kg total weight; Autonomous positioning; Variable buoyancy system; Thruster actuation; 8KWh (extensible) on-board batteries; On board processing and sensor data logging; Acoustic communication to the surface; GPS when at surface; Wireless/Satellite communications when at surface; Multiple application sensor payload; Un-tether system – no cable to the surface or TMS. Extra sensors, such as one Ocean Bottom Seismometer and video cameras will be added (see elsewhere in the proposal). The OBS together with a DART system will contribute to the seismic and tsunami hazard mitigation in the region.

Offshore lightweight marker buoy specification:

A small oceanographic buoy will be deployed to support the communications between the EGIM/Turtle System and the onshore control station.

This buoy will be equipped with GNSS and AIS, for position monitoring, and with acoustic and satellite data communication systems.

The buoy will be autonomous in terms of power supply. Power generation will be guaranteed through a hybrid solution based on renewable sources (solar, wind and possibly waves).

Possible adds-on to the buoy (depending on power supply and data logging capacity):

- Alternative communications to shore (e.g. wide band, depending on distance to shore)
- Meteo sensors
- Motion sensors (GNSS/MEMS), which can give an estimate of the buoy dynamics and wave height

Due to the mooring conditions (low depth), significant fouling problems are expected. Therefore bi-monthly visits to the installation should be foreseen.

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.

For commission and decommission the system we propose to use the means of the EMSO-PT consortium, namely the IPMA research vessel “Mar Portugal”, which is capable to operate the ROV LUSO from EMEPC. A letter presenting IPMA commitment to provide at least 6 days of ship time of the RV “Mar Portugal” is submitted to the EMSO Interim office and attached to this proposal.

R/V Mar Portugal (Length: 75; Beam: 15 m; Draft: 4.5 m; EMRI DP system, Container capacity: 4x20´´or 5 x10´´Iso containers, Moon Pool -1.2x1.2m), is fully equipped with a shallow water multibeam echosounder and high resolution multichannel reflection seismic up to 500m water depth, with 30 berths for scientific and technical personal, 10 Ton A Frame and a 30 Ton crane aft, being now fitted with a 25 Ton stern A frame. R/V Mar Portugal operates the ROV LUSO, a 6,000 m rated ROV, a work class Bathysaurus XL,developed by ARGUS Remote

The ROV Luso is a 6,000 m rated ROV operated by the Task Group for the Extension of the Continental Shelf (EMEPC), which is able to survey ~98% of the world's seafloor. Its main application is currently focused on both fundamental and applied deep ocean research and engineering. Luso is a work class Bathysaurus XL,developed by ARGUS Remote Systems AS. The vehicle is supplied with a 3300 VAC 60kVA 400Hz which is converted internally to 185 VAC to thrusters and 110, 220 and 35 VAC to electronic bottles. It is equipped with a HDTV camera system and a variety of multidisciplinary marine research equipment’s: two manipulators, one rosette system (4 Niskin-type bottles), a biologic suction sampler, a saw to cut hard rock samples, CH4 and CO2 sensors, push corers, CTD, DVL and two parallel green laser scaling devices.

For maintenance and evaluation operations regular visits to the site will be performed either by dedicated cruises with smaller vessels or by benefitting from nearby transits of research cruises.

The funding mechanism proposed for this initiative is based on the fact that the European Multidisciplinary Seafloor and Water Column Observatory - Portugal (EMSO-PT), research infrastructure, led by IPMA, has been selected by “Fundação para a Ciência e a Tecnologia” (FCT), the Portuguese national funding agency for all scientific areas of science and technology, to be included in the National Roadmap of Research Infrastructures (RI) of strategic relevance for 2014-2020 (RNIE). This RI is aligned with the ESFRI definition, and selected to be used by the scientific community to conduct top-level research and innovation in their respective fields. The financial framework is in final phase definition. Additionally, some partners from EMSO-PT are engaged to participate in synergistic structural funds launched calls. However this consortium has conditions to support a backup plan, based on own funds.

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations:

- Prior to deployment cruise, participation to one or more preparation meetings is needed according to specifications and testing milestones of EMSODEV WP 2, 3 and 4 (at least MS2 training session and MS3 shallow water testing)
- Before, during and after deployment, what technical support will be available (mechanical, electronical, software and data management) for sensor calibration, checking, maintenance, and download of stored data.

Please note, in terms of hours and skills, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expected to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here. [300 words or less]

The EMSO PT has a team fully dedicated to accomplish the experience, and manage the operations, from the preparation through deployment until the recovery. A commitment of at least 12 Men/Month (~1700 hours) is provided by EMSO-PT technicians with profiles in engineering areas (skills in: mechanics, electronics and informatics) and research area (skills in: Geology, Oceanography and Biology). This team will support the assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV. The EMSO-PT is also ready to join the EGIM support team for the calibration, maintenance and management of information.

The various institutions of EMSO-PT consortium, namely IPMA at Lisbon and ENESC TEC at Oporto, can provide logistic support to the necessary pre-deployment meetings and training sessions, as well for mechanical, electronical, software and data management activities necessary for sensor calibration, checking, maintenance, and download of stored data

Additional sporadic in situ observations of environmental variables will be made during the EGIM deployment and maintenance visits of the node, using sensors available at EMSO-PT institutions.

IPMA will ensure the onshore reception, management and distribution of the received data to the EMSODEV community, as well as the data validity, quality control and data basic analysis in agreement with the description in task 5.5 of the EMSODEV project.

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here. [300 words or less]

The solution adopted for the Turtle was to combine characteristics of a lander system with mobility ones of an autonomous underwater vehicle and to use a variable buoyancy mechanism to provide the main ascent/descent drive. Once near the sea bottom the vehicle can adjust its positioning using a set of thrusters. Once deployed, the onboard computer has the possibility to select the systems to be powered and the vehicle can remain stationed on the bottom gathering data. For ascent the vehicle changes its buoyancy allowing energy efficient dives and emergence, as well as the possibility of performing maintenance and data download at high rates.

Largest earthquakes and tsunamis recurrently affected the Southwestern Europe region. The 1755 M~8.5 Lisbon earthquake is the most important example. One of the seismicity clusters is the Gorringe Bank where in the last 50 years, several large earthquakes occurred, such as, 1964 (Ms=6.5) and 1969 (Ms=8.1). In consequence, this region presents a special interest for the implementation of an Earthquake Early Warning System (EEWS) using an ocean-bottom seismometer (OBS) network installed around the main seismogenic zone (Gorringe bank), coupled with the Observatory Infrastructure. This innovative proposal is based on the evaluation of the reliability and robustness of possible solutions of detection, in situ, and transmission of seismic alert adjusted to the SV-GC conditions

The observatory will be equipped with an image sensor to be triggered by acoustic events interpreted as produced by large mammals.

The EMSO-PT aims at launching, in collaboration with the interested EMSO-ERIC partners, the SW Iberia observatory based on this experience.

IPMA will be the regional operator for NEAMTWS. Within the cooperation with NOAA we will support the installation and maintenance of the DART network in SW Iberia.

Technical and scientific outcome of this experiment will be used for publishing, teaching and general outreach.

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here. [300 words or less]

The Gorringe Bank (GB) is a 5km high, 80km wide and 180km long seamount locate at 150NM from the Iberian margin. It has two main peaks, Gettysbourg and Ormonde, whose summits are only 25 and 33m below sea-level. We will deploy the EGIM in the GB area between the two main peaks, at a depth ranging from 400 to 800m.

GB is a massive ridge of highly serpentinized exhumed mantle peridotite. It has moderate seismic activity, clustering about 4% of the earthquakes registered in the Portuguese earthquake catalog.

The GB originates disturbances in the hydrography and current system, such as the increase in the flow speed, upwelling, turbulence, eddies, and even jets. The upwelling of nutrients from the deep sea leads to high concentrations of nitrates and chlorophyll in the upper layers. GB is in the pathway of the Mediterranean Outflow Water (MOW), which is concentrated between 800 and 1200 metres water depth. It carries warmer and saltier water that reaches speeds that can exceed 0.3 m/s. In the upper layers GB region is influenced by the eastward flowing Azores Current with speeds of some 0.4–0.5cm/s. In the region we can expect temperatures along the water column from less than 4 C up to 22 C at the surface, and salinities from 35.0 to 36.5. Despite ocean water tends to have oxygen levels close to saturation point, some waters at depths of between 100 and 1200 metres can have minimum levels of oxygen.

GB possesses a very rich ecosystem in terms of the biomass and diversity of pelagic and benthic fauna, functioning as a stepping stone for transoceanic dispersal of plankton and planktonic larvae. Benthic species are common, providing the conditions for fish and other nekton with important densities of large pelagic fish like swordfish, tuna, sharks and rays.

instituto português do mar e da atmosfera

Letter of Commitment

The Instituto Português do Mar e da Atmosfera, I.P. (IPMA) hereby declares its commitment to arrange for the availability of the Research Vessel NI "Mar Portugal" for the deployment and recovery of the EGIM open ocean sea trials in the West Iberian Margin EMSO node, carried out in the framework of the European project EMSODEV.

IPMA will ensure a total of 6 ship time days for this operation in 2017, departing from Lisbon to the Gorringe seamount off SW Portugal. The funding is ensured through IPMA's own revenues and/or through funding of EMSO-PT.

NI Mar Portugal (Length: 75; Beam: 15 m; Draft: 4.5 m; EMRI DP system, Container capacity: 4x20´´or 5 x10´´Iso containers, Moon Pool -1.2x1.2m), is fully equipped with a shallow water multibeam echosounder and high resolution multichannel reflection seismic up to 500m water depth, with 30 berths for scientific and technical personal, 10 Ton A Frame and a 30 Ton crane aft, being now fitted with a 25 Ton stern A frame.

NI Mar Portugal operates the ROV LUSO, a 6,000 m rated ROV, a work class Bathysaurus XL,developed by ARGUS Remote Systems AS.

Lisbon, 29th January, 2016

Jorge Miguel Miranda
(The President of IPMA)

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Call for offers to host open ocean EGIM trials

Contribution to EMSODEV D5.1

This task identifies and selects the sites where EGIM deployments will be carried out. The aim is to evaluate the opportunity and feasibility to deploy additional EGIMs including national contributions of effort. Site selection will be done by the EMSODEV Steering committee according to the terms and conditions presented here.

Please note that while WP5 will provide limited technical support and shipping costs, there is no financial support associated with this call.

For each of the criterion please present the case for your node limited to 300 words or less. Each section has guidelines as to the important aspects for consideration and how the criteria will be weighted in the overall decision process. All applications are due to the EMSO interim office by 8 January 2015 to the following email address (interim.office@emso-eu.org). The review will take place by the EMSODEV SC with a decision to be announced in the following weeks.

We will use the EC scoring terminology for each of the following criterion:

- Observatory infrastructure
- Site visit logistics and timing
- Commitments to overall operation and validation in operational conditions
- Value added commitments

For each criterion, your offer will be given **scores** of 0 to 5 (half marks are possible), as follows:
0 — The proposal fails to address the criterion or cannot be assessed due to missing or incomplete information (unless the result of an 'obvious clerical error')
1 — Poor: the criterion is inadequately addressed or there are serious inherent weaknesses
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3 — Good: the proposal addresses the criterion well but with a number of shortcomings
4 — Very good: the proposal addresses the criterion very well but with a small number of shortcomings
5 — Excellent: the proposal successfully addresses all relevant aspects of the criterion; any shortcomings are minor.

One other aspect will also be considered.

- Site environment
    - This criterion will be evaluated across the offers examining what combinations of selections can offer.

Observatory infrastructure

The infrastructure already needs to be in place or funding (*and* logistics) need to be in place such that the infrastructure will be ready by January 2017.

The functionality of the communications infrastructure should include either seafloor cable with internet and power capability, or regular (e.g. hourly, daily) telemetry to shore via satellite connection.

Please place your relevant case material here.

The proposed observatory infrastructure for hosting the EGIM is the Hellenic EMSO site in Pylos.

The infrastructure can host EGIM in four (4) different options from the most feasible to the least feasible at the time of writing:

OPTION A:

The EGIM can be connected to the stand alone POSEIDON III benthic platform. The platform consists of a syntactic foam floating frame with instruments measuring pH, partial CO2 pressure, CH4, conductivity, temperature, dissolved and power currents with an upward looking ADCP. It accommodates a battery pack and a data logger with the ability to transmit measurements with a hydro acoustic modem. The platform is floating 4 meters above an anchoring weight. The most reliable way to connect EGIM is by using the same frame constructed for mooring line installations. EGIM will be placed under the Poseidon III benthic platform, approximately two (2) meters from the seabed at 1680 meters depth.

In this configuration EGIM will work as a stand-alone platform recording and storing the measurements internally only.

In the case that EGIM will not include a battery pack, then power can be provided from the Poseidon III platform via a typical seaconn type 2 pin connector.

The installation / mounting of EGIM on to the Poseidon III platform will be done on board the R/V during the routine maintenance trip and no special tools are needed such as ROV.

Finally, recovery of EGIM will be done during the regular maintenance trips which currently have a 6-8 months frequency.

OPTION B:

The EGIM can be physically connected to the POSEIDON Pylos buoy inductive mooring line with the use of the specially constructed frame for moored EGIM applications. Due to the size of EGIM the installation will be done at the end of the inductive mooring line at 1000 meters depth.

The use of an SBE inductive modem would permit the relay of the measurements performed by EGIM to the surface buoy at regular intervals via the inductive mooring cable line.

Under this option power to EGIM has to come from batteries inside the main frame of EGIM.

As with OPTION A installation will be done on board the R/V during routine maintenance and no special tools are needed, while, recovery of EGIM will be done during the regular

maintenance trips which currently have a 6-8 months frequency.
.

OPTION C:

EGIM can be deployed on the seabed with the specially constructed frame close to the POSEIDON Pylos buoy. The data can be relayed to the surface buoy via the use a hydro acoustic modem while batteries inside the main frame of EGIM will provide power.

The limitation in this option is that a pair of hydroacoustic modems must be provided with EGIM.

In addition the installation of EGIM as a benthic lander might require the use of an ROV, in case the conventional method of deployment by the use of a rope and releaser unit is not recommended.

Recovery of EGIM can be done independently of the regular maintenance trips providing that an R/V is available.

OPTION D:

The EGIM unit can be connected to a spare port of the cabled observatory at the Hellenic EMSO site prior to its deployment as an extra instrument.

It could also be connected to the second spare hybrid ROV wet mate able connector of the cable termination system. It must be noted that this might prove difficult since it requires a fiber optic interface and an additional ROV wet mate able connector. EGIM will currently supports copper Ethernet connection only.

Moreover, the deployment must be accurately tuned with the deployment of the Hellenic EMSO cabled observatory, while the recovery will be limited by the availability of ROV.

Site visit logistics and timing

A commitment that an observatory service cruise to accommodate the installation of the EGIM needs to be demonstrated. The expected window of opportunity for deployment of the EGIM will be from February 2017 to December 2017. Recognising that the ways in which service cruises are planned, funded and organised differs for various EMSO stakeholders, we will accept a letter of commitment from the observatory operator indicating the potential timing of a site visit, the funding mechanism and the expected timing, as well as a statement about the certainty of the occurrence and timing of the service cruise. Expected recovery information should also be noted to the extent possible.

Please place your relevant case material here, or include as separate document submitted to the Interim Office.

The standard maintenance cruises for the Poseidon buoy network is every 6 to 8 months. Typical dates of maintenance cruises are during February or March and September or October.

As mentioned in the previous section access to the cabled observatory might be more difficult in terms of logistics.

Commitments to overall operation and validation in operational conditions

A commitment is also needed for dedicated technical support from the observatory operator in the preparation for, and during the deployment and recovery operations. Please note, in terms of hours, what technical support will be available to dedicate to the EGIM. This will necessarily include, assembly of the EGIM after shipping, setup and pre/post-deployment calibrations following practices outlined in EMSODEV.

A key step in the EMSODEV project will be to evaluate the ability of the EGIM to deliver useful data across a range of themes. The observatory operator is expect to contribute to task 5.5, which will evaluate the EGIM for specific science questions, the quality and regularity of data, trends and any tell-tale issues of technical faults such as occasional observations outside the expected range, or sensor reading drift from the instrument going out of calibration, experiencing biofouling (or errors in anti-fouling remote management), or other sources of error.

Please place your relevant case material here.

The commitment comes from the dedicated technical support team and a calibration laboratory, maintaining the POSEIDON infrastructure. The team has more that 15 years of expertise for setup, deployment, recovery and calibration operations.

Value added commitments

These are not required, but can improve a case. Please indicate if there are any value added commitments you intend to make. For example, does the operator intend to publish any outcome of the EGIM deployment from either technical / methodological (e.g. cross comparisons with other observatory data) or scientific perspectives (e.g. hypothesis testing).

Another example can come from adding capability by adding a sensor via one of the spare EGIM ports. If the operator expects to add something, please provide any technical information they may be helpful in understanding how it's expect to achieve the addition, and the scientific or monitoring driver(s).

Please place your relevant case material here.

Given the current and scheduled setup of the various observing components at Pylos (deep benthic platform, moored buoy and cabled observatory), it will possible to compare and evaluate the EGIM data and its performance.

Site environment

While we do not expect to be able to deploy the EGIM at the full range of environmental conditions found in the EMSO observatories, we do want have some knowledge of performance across a gradient of conditions.

Please indicate the typical conditions experienced at the observatory at the proposed depth / setting. This can include information on the mean/median/ranges of temperatures, oxygen, depths (water column/benthic).

We also expect to have at least one each of a pelagic and benthic variant of the EGIM trialled.

Please place your relevant case material here.

The Pylos site in the SE Ionian is a crossroad where all the above intermediate and deep water masses meet. It is especially on the pathway of the Aegean Sea dense water that travels to the north along the western coast of Greece. Furthermore, it is a very geologically active area with lots of earthquakes and landslides as well as a potential source of Tsunamis that might affect the Eastern Mediterranean Sea.

8. APPENDIX 3 - DETAILED QUESTIONNAIRE

After the initial ranking the following questionnaire was sent out to all the institutions that submitted offers. This was designed to gather further technical information to support the application to host EGIM.

Table 5.1: The detailed questionnaire provided to all EMSO nodes following the initial ranking

General	Institution
	Observatory
	Location
	Benthic/pelagic
	"Habitat"
	Depth (m)
	Operating temperature range
	Basic type (e.g. cabled or standalone)
	Real- or near-real-time data relay?
	Local data storage, apart from the EGIM?
Observatory Infrastructure	
Cabled	Power (300-400) Vdc
	Able to provide up to 200W?
	Data : Ethernet 100BASE-T available?
Standalone	Power (26-36) Vdc,
	Able to provide up to 150W?
	Energy output of 4000W.h
	Data: Serial Link (EIA-232), count of available ports
Installation	Wet mateable/dry mateable?
	Cable length from EGIM to next junction?
	Cable terminations?
Standard operational techniques	Space to accommodate EGIM or Separate EGIM structure as connected attachment/lander?
	Connect offshore/onshore/underwater?
	Communications software for shore to EGIM?
Please indicate current status of supplied observatory infrastructure (e.g. not applicabe, available now, to be purchased, not yet funded)	Power supply batteries, housing, cables

	Mooring lines
	Ballast
	Surface bouy with telecommunications
	Acoustic Modem
	Underwater connectors
	Junction box
	Seafloor cables
	Lander or platform on which to mount EGIM frame
Other	Data link and power supply provided by Node owner?
	Communication frequency basis? Type (acoustic, satellite, inductive)? Available bandwith?
	Port decicated to EGIM galvanically switched and protected against short circuits?
	Redundant communications channels between node and shore?
	Are the communications channels isolated to ensure improved reliability under fault conditions?
Site visit logistics and timings	
	Planned cruise (Feb 2017-Dec 2017)?
	Funds?
	Letter of commitment?
	Recovery?
Commitment to overall operation and validation in operational conditions	Participation in 1 or more preparation meetings?
Available staff time?	Post deployment technical support?
Avaialble consumables funding (e.g. batteries)?	
Value added	Value added
Notes	
Comments	
Observatory Infrastructure	
Site visits and Logistics	
Commitments to overall operation and validation in operational conditions	
Value added commitments	
Logistics	
Expected delivery to host lab for final testing/familiarisation	

Expected date of mobilisation for going to sea	
Expected service cruise start date	
Expected service cruise end date	
Others?	
Risk factors	
What if the EGIM is not delivered to the observatory on time? (includes customs issues etc.)	
What if the cruise schedule changes?	
What if the installation encounters problems such as a faulty underwater connector or similar fundamental technical issue?	
Others?	