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National observation infrastructure: an example of a fixed-plateforms network along the French Coast: COAST HF

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Abstract :

Since the eighties, several French organizations (Ifremer, CNRS, and marines universities) have joined their forces to operate the first high frequency automated network around France. Now days, 14 Instrumented platforms are in operation along the North Sea, the Atlantic and Mediterranean French coasts. Furthermore, this organization is now largely contributing to the French national Research Infrastructure named “I.R. ILICO”.

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I. INTRODUCTION

While the feasibility of continuous and high frequency *in situ* monitoring is now operational, manual sampling is still the basis for most of the assessment of the coastal environmental zone. The European Water Framework Directive is an excellent illustration of that case, where all the collected data are measurements provided by human operator at sea…But a better understanding of many zones and typically the estuaries and bays also needs more and more measurements. Consequently, new technologies in sensors, and innovations tend to show that the next stage will include more automated measurements. Those automated monitoring of physical, biological and chemical parameters is being done by using large buoys and fixed infrastructures.

II. *"COAST HF"* GENERALITIES

In France, the major research institutes and marines universities joined together in order to optimize and federate themselves around the essential coastal automated stations. The

National Observation Infrastructure network ***"Coast HF"*** was consequently created and organized in 2018. All the data are since that moment available through different web accesses as:

- www.coriolis-cotier.org,
- www.copernicus.eu

Fig. 1. ***"Coast HF" French network***

Furthermore, the operational ***"COAST HF"*** network is now an essential part of the national French Research Infrastructure ***"ILICO"***: So that, ILICO gathers eight elementary networks which are represented below:

www.ir-ilico.fr

Fig. 2. ***"ILICO"*** organigram

The members which have created that Research Infrastructure are:

Fig. 3. ***"ILICO"*** members

The main parameters recorded over the 14 platforms are logged each 10 minutes and transmitted each 12 hours to the central shore station (all the measurements are physically taken just under the surface; typically 2 meters):

- Temperature,
- Salinity,
- Fluorescence
- Turbidity,
- Dissolved Oxygen
- pH

Some additional parameters are also available on several stations such as:

- Currents, and waves height, period ***(Mesurho station)***
- Nutriments (NH3, NO3, SiO4, PO4) ***(Smile buoy)***
- Primary production ***(Smile buoy)***
- CO2 fugacity ***(Marel Iroise buoy)***
- Meteorological parameters: wind, pressure, humidity, Photosynthetically Absorbance Radiation: ***(SCENES buoy, MAREL Carnot Station)***

And several stations are also providing surface and bottom measurements ***(MOLIT buoy, Mesurho platform, and EOL buoy.)***

III. *"COAST HF"* ARCHITECTURE

A. Global organisation

First, the network was organized to share human and technical resources from the logistic, to the data management even throw the metrology aspects and best practices.

After that, proceedings were built under the acceptance of all the partners with the objective to all work under quality qualifications (ISO 90001 and ISO 17025).

The finality of the network is at the end to produce qualified data in order to keep the possibility for the scientists to work together, compare and valorize the data independently from the sensors and the platform of data logging. This way of work should also be available at a Europe scale.

B. Data management

Consequently, the data management is at the end of the process one of the most important piece of the puzzle. It's more evident by looking at the diagram below:

Fig. 4. **European datagate accesses**

IV. EXAMPLES OF PLATORM AND ASSOCIATED RESULTS

The objective of this paragraph is to show a typical significant example for a number of chosen referent platforms, from the North to the South.

A. **MAREL CARNOT** *station (nutriments measurment)*

Fig. 5. **Marel Carnot Station**

This station was launched in 2004, it is one of the oldest of the "**Coast HF"** network. This platform was installed close to the harbor of Boulogne-sur-Mer in the Channel Sea. One of the reason for the location was to study the trend about the development of a species of plankton. The proliferation of this gelatinous plankton is directly related to the nutriments concentration. The "***Marel Carnot***" automated station offers the possibility of *in situ* continuous high frequency measurement as shown in the fig 6 below.

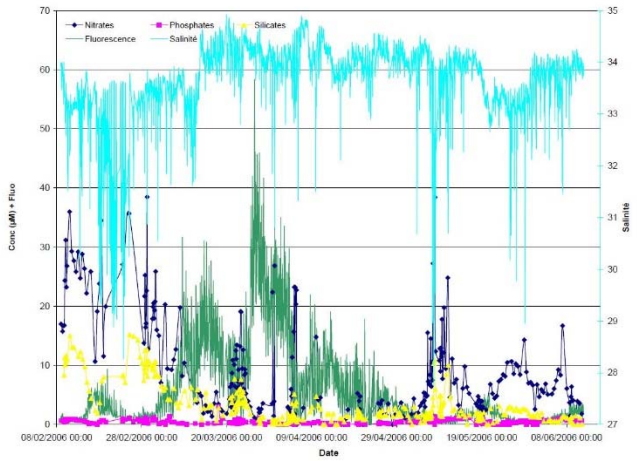

Fig. 6. **High frequency Nutriments data sheet on Marel Carnot Station**

B. ***SCENE*** *buoy (turbidity acquisition)*

Fig. 7. **SCENES buoy in Bay of Seine River**

This buoy is the latest station which runs now in an operational way in the bay of Seine close to the harbor of Le Havre where one of the most important question is the sediment transport.

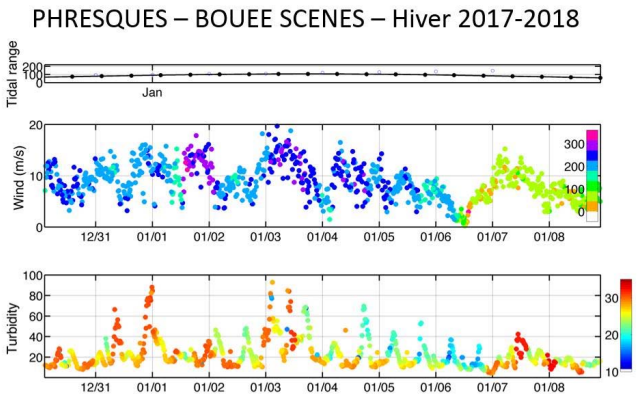

Fig. 8. **High frequency turbudity measurement on SCENES Buoy**

C. ***SMILE*** *buoy (primary production measurements)*

Fig. 9. **SMILE station in Bay of Seine River, close to Luc Sur Mer**

This platform was very recently moored in the Channel, close to the harbor of Ouistreham in Normandy. The problematic was here the study by the University of Caen of the primary production by the mean of integration of a brand new *in situ* instrumentation: the Fast Rate Repetition Fluorimeter (FRRF by Chelsea Instrument).

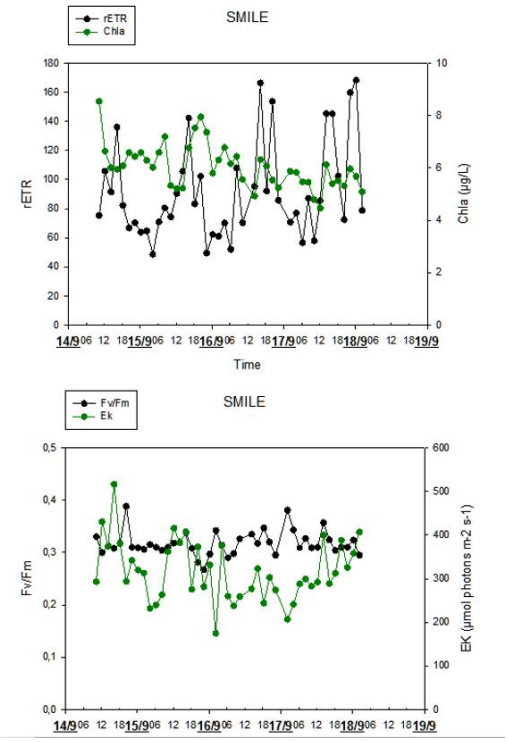

Fig. 10. **First results on the Smile buoy (Primary production)**

D. ***MAREL IROISE*** *station (PCO2 measurements)*

Fig. 11. **Marel Iroise buoy in Iroise Sea close to Brest**

Marel Iroise is now the oldest *in situ* high frequency long term station, which was moored in 2000 in the Iroise Sea close to the harbor of Brest. It is at the moment the only one station which records continuously the Carbon Dioxide fugacity.

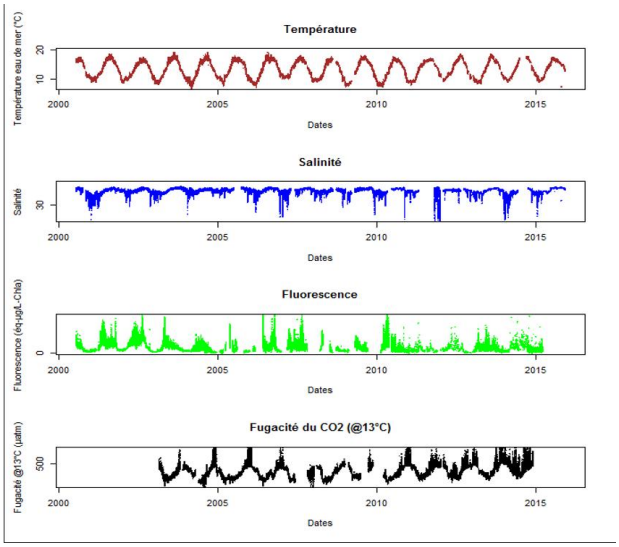

Fig. 12. **CO2 fugacity meaurement on long term series Marel Iroise**

E. MOLIT buoy (two levels measurment station)

This very particular buoy was moored in the Bay of Vilaine with the scientific motivation to analyze and compare the physicochemical parameters from the surface and bottom sea water. The place is known to have some anoxia in particular conditions. The consequence is a very special mooring as shown below, with two level of pumping for analyze.

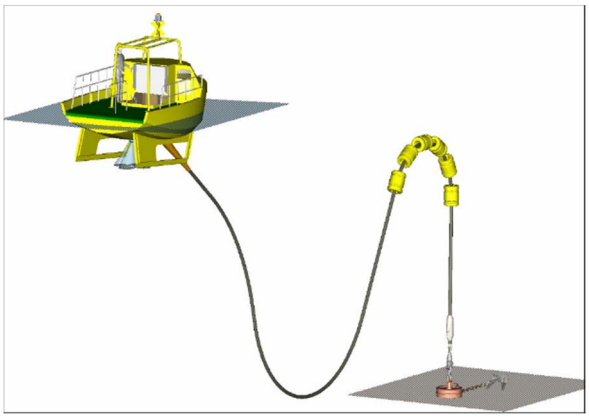

Fig. 13. **Special mooring for two levels MOLIT buoy**

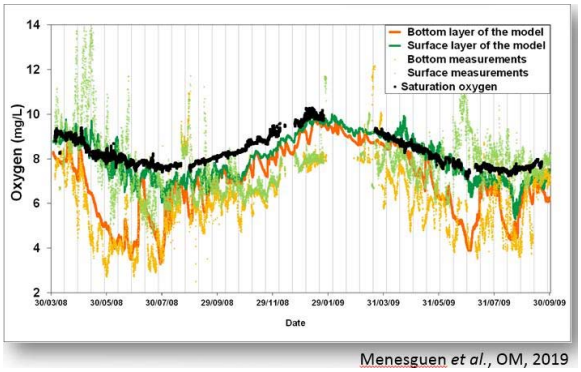

Fig. 14. **Example of stratification measurement on MOLIT buoy**

F. MESURHO Station (example oj two levels station)

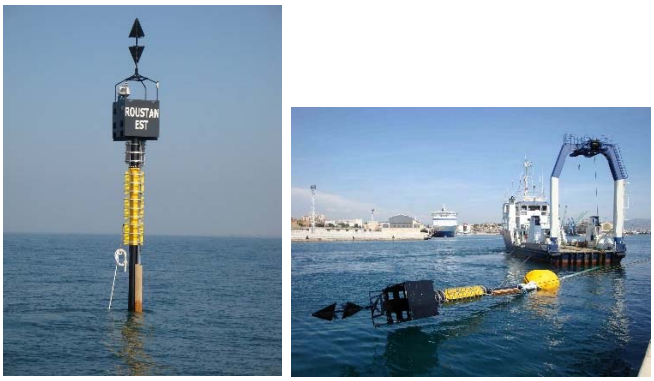

Fig. 15. **Mesuho two levels automated station in the Mediterranean Sea**

This station is part of the very rare two levels measurement buoy, moored in the Mediterranean Sea close to Fos sur Mer in the estuary of Rhone River. The main reason of this two levels station is the study of sediment transport threw the river Rhone, with a highly stratified sea water.

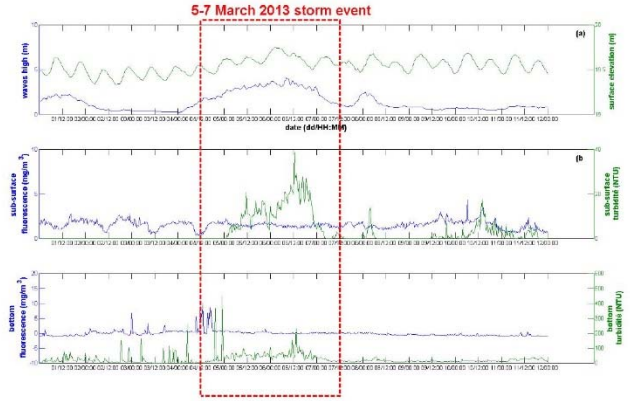

Fig. 16. **Mesurho examples of exteme events**

V. INNOVATION

One of the most important constraint for the coastal monitoring at sea is the energy (production and consumption). So that teams are working in the both sides:

- Limitation of energy consumption by designing very low consumption devices,
- Use of new energy production systems as solar panel, wind mills or even wave energy converter.

The Ifremer Institute worked over the two ways, firstly on a very low consumption embedded automate named COSTOF2 and which would in a near future be installed on all our coastal stations. This new device is now industrialized by the RTSYS local Company: https://rtsys.eu/fr/costof2.

Ifremer worked also on new systems for energy conversion, and has for instance a partnership with the GEPS-Techno Company a specialist in wave converter generator: www.geps-techno.com/octopusea/. The results of this

cooperation is the SMILE Buoy which uses Sonar Panels and wave converter to be self-sufficient for the energy.

ACKNOWLEDGMENT

All the authors thanks to all of the members of the national network "**Coast HF"** and especially all the shadow workers…people without whom the network wouldn't be operational. Coastal monitoring is a 24 h over 24 h and 7 days a week job and must be operational on very long term, even if the basis of stations is automated systems…

REFERENCES

I [1] Knauth, H.-D.; Schroeder, F.; Kohnke, D.; Holzkamm, F. - EUROMAR-MERMAID: experimental operation of the prototype network - OCEANS apos; 97. MTS/IEEE Conference Proceedings Volume 1, Issue, Page(s):686 vol.1 - 6-9 Oct 1997

[2] Woerther, P.; Grouhel, A. - MAREL: automated measurement network for the coastal environment - OCEANS apos; 98 Conference Proceedings Volume 2, Issue, 28 Sep-1 Oct 1998 Page(s):1149 - 1154 vol.2 – 1998

[3] Blain S., Guillou J., Tréguer P., Woerther P., Delauney L., Follenfant E., Gontier O., Hamon M., Leildé B., Masson A., Tartu C., Vuillemin R. (2004). "High Frequency Monitoring of Coastal Marine Environment using MAREL buoy". *Journal of Environmental Monitoring*, 6 (6) 569-575. 2004

[4] Prien, R.D. (2007), *Technologies for new in situ chemical sensors*, Oceans '07 IEEE Aberdeen, 18.-22.6.2007, Aberdeen, UK

[5] Vuillemin R., Le Roux D., Dorval P., Hamon M., Sudreau J.P., Le Gall C., Sarradin P.M. (2007). "CHEMINI, a new generation of in situ chemical analysers for marine applications". *European Geosciences Union*, Geophysical Research Abstract, Vol. 9, 06213, 15 – 20 April 2007, Vienna, Austria

[6] Schmitt F, SB Zongo Méthodes d'exploitation des mesures à haute fréquence[7] Bouget J.F. Allenou J.P. Information note to authorities : « Teneurs en oxygène dissous en Baie de Vilaine » July 2009

[8]: F. Lecornu, Yann-Hervé DeRoeck "Coastal observations and forecast" La houille Blanche N°1 2009

[9] F. Lecornu (IFREMER), Jerome Paillet (SHOM), Hugues Ravel (Meteo-France) "A Coastal operational forecasting system" SeaTechWeek 2008 Brest (France)

[10] F. Lecornu, Yann-Hervé DeRoeck, Didier Sauzade, Jacques Legrand:"French Coastal Operationnal forecasting system" SFJO 2008 (Japan)

[11] :M Répécaud [1] , Y. Aoustin, S. Barbot, M. Hamon, D. Le Piver, L. Quemener, C. Podeur, R. Vuillemin, K. Bucas, T Rudelle, P. Jegou. "Trophimatique project and chemical analysers (SeaTech Week 2008, Brest)