PRESS RELEASE

4th July 2019

JERICO-NEXT connects European research to observe coastal waters

More accurate sensors to measure carbon flows, new methods to identify microalgae and pesticides or sweeteners detected in the sea for the first time: the JERICO-NEXT European project has contributed to developing tools to monitor coastal waters. It ended with a general assembly from 1st to 5th of July, at the Ifremer Centre in Brest (France).

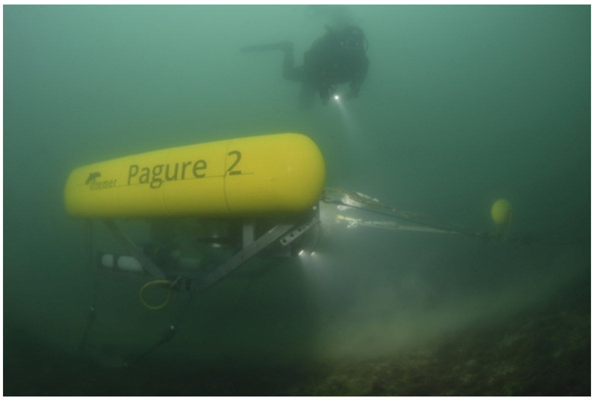
Which chemical elements are found near the coast? How does the coastal ocean absorb atmospheric CO_2? What is the status of marine coastal diversity? Three questions among the many asked, to allow us to gain a better understanding and safeguard coastal environments. A European project coordinated by Ifremer began in 2015 to improve observation systems that collect data on coastal waters. It concludes this year, with a week-long general assembly that will bring all the partners together at the beginning of July. Named JERICO-NEXT, it is a direct extension of the JERICO project, which ran from 2011 to 2015. It was financed by the European Horizon 2020 programme. The goal: to share observation resources and to standardise analysis methods to provide a set of harmonised European data.

Many different types of sensors and samplers are used to observe the ocean. They are placed on different types of supports, depending on the research aims: unmanned vehicles can measure physico-chemical parameters in the water column, while devices placed on ferries will collect data closer to the surface. These devices may be supplemented by radar observations made from coastal shore, used to study the waves and currents, as well as fixed observatories placed on the seabed or on sea-surface platforms. The project combines physical, biochemical and biological measurements to gain a better understanding of the ecosystems.

JERICO-NEXT brought together 34 partners from 15 European countries: research organisations and private companies. It also gave outside research teams access to the observation resources of the network, to conduct their own studies. Other parts of the project were dedicated to developing new instruments and to managing the data produced. Illustration with four following examples of studies conducted.

A technological system to observe the seabed

Sliding on skates or gliding not far from the bottom, the Pagure observes life on the ocean floor. The machine was developed by a team led by Antoine Carlier, Sandrine Vaz and Jean-Valery Facq, from Ifremer. It is fitted with a camera that records in front of the machine, while a camera positioned beneath takes high resolution pictures vertically at regular intervals. Other equipment can be added, which can measure physico-chemical parameters of the water mass of water, depending on study requirements. The equipment is designed to be towed by a boat. Easier to use and far less costly than a remotely operated vehicle (ROV), it doesn't require a specialised team. The system is fitted with floats to make it lighter and to minimise damage to the seabed it is exploring.



Sliding on skates or gliding not far from the bottom, the Pagure observes life on the ocean floor. © Ifremer – O. Dugornay

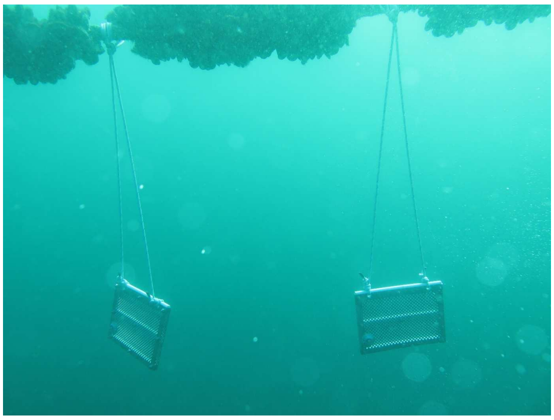
After being tested in a pool and in the sea, the Pagure II optimised and upgraded during JERICO-NEXT undertooks its first scientific campaign in April 2018. It observed benches of American limpets in the Brest harbour. The aim of the study was to determine the influence of this invasive mollusc from the United States on the biodiversity of the seabed. The data collected is still being analysed, but it appears that the benches of American limpets may have a positive effect locally: they enable certain species living on hard substrates, such as sponges, the native oyster or the black scallop, to attach themselves. But across the harbour, the American limpet tends to make invertebrate communities on the coastal seabed uniform. Since then, the equipment has taken part in other campaigns, particularly to measure

Press contact :
Julie Danet / Arthur de Pas – 00 33 2 98 22 46 46 / 41 07 - 06 49 32 13 83 - presse@ifremer.fr

the effect of trawling on undersea floors and to characterise the reference status of certain coastal zones, before setting up floating wind farms in the Channel and Mediterranean.

Sweeteners in the sea

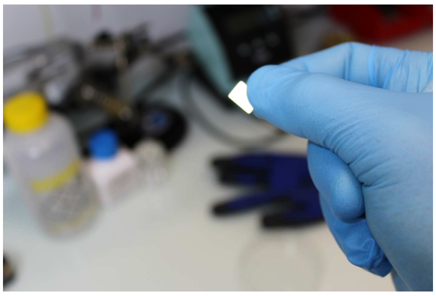
Another study conducted as part of JERICO-NEXT focused on detecting new human-derived contaminants that end up in the ocean at low concentration. This could be pesticides, artificial food additives, such as sweeteners, or medicinal products extreted by humans. The research was coordinated by Luca Nizzetto, from the Norwegian Institute for Water Research (NIVA). The contaminants can arrive in the sea from sewage discharges or rivers. Conventional analytical instruments are not designed for concentrations as low as those encountered in the cases studied. It was, therefore, necessary to review the sampling method and bring in cutting-edge instruments, such as high-resolution mass spectrometers to identify the chemical molecules. Newly designed sampling devices, adapted specifically for deployment on existing coastal observatories were developed and tested. These included systems for the collection of water on FerryBox systemand newly designed passive samplers that collect contaminants and facilitate the deployment and collection operations by a non-specialized operator (*in the photo*).



Passive sampler for contaminants in seawater deployed in the bay of Biscay. © AZTI, Ekaitz Erauskin

The work has made it possible to detect certain antibiotics, food additives or herbicides in the sea for the first time. It has shown that some can be carried over long distances. The study has demonstrated that current marine observation infrastructures can be used to detect new chemical contaminants. The data collected will make it possible to improve the design of future monitoring programmes for chemical pollutants, particularly for the European Marine Strategy Framework Directive.

Better understanding the rise in CO_2 and ocean acidification



New sensors were developed to improve the detection of all the components of the carbon cycle. © Fluidion

Another subject tackled: the carbon cycle in coastal waters. This subject was coordinated by Andrew King, from the Norwegian Institute for Water Research (NIVA) and Lauri Laakso, from the Finnish Meteorological Institute. One part of the CO_2 absorbed by the ocean is dissolved and is called the inorganic fraction. Another part is taken up by living organisms, particularly by plant photosynthesis, called the organic fraction. To better observe and therefore better understand carbon exchanges between the various fractions atmosphere, ocean and biological compartments), the JERICO-NEXT project conducted several investigations. Three new sensors were developed to improve the detection of different components of the marine carbon cycle: these combined pH measurement with an additional measurement, such as carbonate ion concentration or total alkalinity of the seawater. Furthermore, observations of coastal ocean carbon cycling were conducted across Europe between April 2017 and March 2018. They revealed strong variability in the CO_2 concentrations depending on place and time of year. The greatest variation was measured in the Baltic Sea, going from 200 ppm (parts per million) in summer to 700 ppm in winter. This highlights the important role of photosynthetic organisms: they are more active in summer and draw down CO_2. Finally, different sensors were compared in a specialised laboratory, under different salinity, temperature and CO_2 concentration conditions. This last work is important, as sensors are typically not calibrated across a wide range of environmental conditions. These can vary significantly across European seas: for example, the Baltic Sea has salinity close to 0 while the Mediterranean reaches 38. Similarly, water temperatures can go from a few degrees to 30°C.

Monitoring microalgae

Microalgae or phytoplankton can proliferate and accumulate rapidly, in response to changes in environmental conditions. They are a good indicator of the quality of the coastal environment. Some of them are potentially toxic for marine resources or man. It is therefore important to monitor them and identify those that are proliferating. Two methods are currently most used: observation by satellite, wide-ranging but does not identify species, and sampling, which is more precise but restricted in space and time. Alternatives are being sought to go further in understanding the dynamics of microalgae. Work on phytoplankton

PRESS RELEASE

conducted as part of JERICO-NEXT has been coordinated by Felipe Artigas, research lecturer at the Côte d'Opale Coastal University, working with the CNRS LOG combined research unit, Bengt Karlson, from the Swedish Meteorological and Hydrological Institute and Jukka Seppälä, from the Finnish Environment Institute. They aimed to broaden the use of semi-automated or automated sensors. These can be placed on observation buoys or on research and transport ships. Thus, it is possible to consider placing sensors on ferries, which would provide measurements over the same route, several times per week or per day.

Several techniques are possible: the first is to collect water and take photos continuously through the microscope's objective lens. Microalgae are identified using automated image recognition software. Another method is to pass the microalgae in front of a laser beam. They are categorised based on their optical properties. This technique is called flow cytometry. A third method is more global and relies on light excitation of pigments and the fluorescence of chlorophyll. It does not allow individual identifications to be made but the size of phytoplankton groups can be assessed. If it is used by varying the light intensity, it is also possible to know the state of health of the microalgae. A first part of the work consisted of testing a large number of available sensors in several European seas. Differences in salinity or concentration of particles and dissolved substances can actually distort the results. It was also necessary to harmonise the categories of microalgae obtained by different techniques, so that the results were comparable, and to be able to monitor the dynamics of the microalgae with high temporal and spatial resolution.

This flow cytometry allows to pass the microalgae in front of a laser beam.

Partners involved in the JERICO-NEXT project

Ifremer (Fr), European Global Ocean Observing System (BE), The Flanders Marine Institute (BE), Institute of oceanology - Bulgarian Academy of Sciences (BR), Finnish Meteorological Institute (FI), Finnish Environment Institute (FI), Euro-Argo Eric (FR), National Center for Scientific Research (FR), Fluidion SAS (FR), Helmholtz-Zentrum Geesthacht (DE), Hellenic Centre for Marine Research (GR), Marine Institute (IE), SLR Environmental Consulting (IR), SmartBay Ireland (IR), National Institute of Oceanography and Experimental Geophysics (IT), ETT (IT), National Research Council (IT), Euro-Mediterranean Center for Climate Change (IT), University of Malta, Deltares institute (NL), Mariene Informatie Service Maris BV (NL), Ministry of Transport, Public Works and Water Management (NL), Durand Research & Consulting (NO), Institute of Marine Research (NO), International Research Institute of Stavanger AS (NO), Norwegian Institute for Water Research (NO), Hydrographic Institute (PT), AZTI Foundation (ES), Spanish Council of Research (ES), Balearic Islands Coastal Observing and Forecasting System (ES), Polytechnic University of Catalonia (ES), Swedish Meteorological and Hydrological Institute (SE), Blue Lobster IT Ltd (UK), Centre for Environment, Fisheries and Aquaculture Science (UK).

A third stage?

After JERICO and JERICO-NEXT, a European funding application has been submitted to continue the project. JERICO S3 would be a direct continuation of the preceding projects. Its objectives are to develop a single European internet portal where coastal data produced by all the partners in the JERICO observation network would be made available. This virtual infrastructure would also make it possible to standardise data processing methods. The project will also seek to develop standardised measurement mini-stations, specific to coastal requirements, to promote the comparison of data collected at different sites by separate teams. The European Commission's response should be known by the end of August.

Press contact :
Julie Danet / Arthur de Pas – 00 33 2 98 22 46 46 / 41 07 - 06 49 32 13 83 - presse@ifremer.fr