



Annual Report 2013

EDITORIAL

2013,

POOLING RESOURCES AND DEVELOPING PROJECTS IN PARTNERSHIPS

BY PIERRE BAHUREL



Mercator Ocean has always worked in partnership, pooling resources and developing cooperative projects. It is driven by the pursuit of excellence and the public interest. This strategy is in its genes and one of its major strengths, partly explaining its successful development these past 15 years. It enables the project team to rise boldly to challenges well beyond the reach of a single company working on its own.

Mercator Ocean was actually founded for this very purpose, so its employees face major challenges confidently and methodically. Its very purpose was to usher French operational oceanography into a new era by providing a capacity for analysis and forecasting second to none. For several years, Mercator Ocean has been helping steer the GODAE OceanView¹ international network of operational oceanography centres with the aim of embodying this new discipline in a well-structured organisation. Mercator Ocean has now brought together within Europe the immense assets of a community of specialists to build a European service offering operational monitoring of the oceans, a challenge raised by the societal and economic stakes hinging on the marine environment.

In 2013, Mercator Ocean's determination to take action has been the driving force behind many different projects, as this report shows.

One in particular stands out, because it is charting the future of operational oceanography in Europe, being the preparatory pre-operational phase of Europe's Copernicus programme. Having successfully led the demonstration phase of the ocean monitoring community service, with over 3,000 subscribers to date, Mercator Ocean and its partners paved the way in 2013 for the operational phase of this European Union programme. The project entails creating a European organisation to run the service, lead the community and boost the downstream service industry.

As Mercator Ocean channels its ambition through the many partnerships it develops, 2013 was marked by intensive consultation and work with associated organisations, and in particular its European partners in the development of operational

oceanography. This open, transparent approach is laying a solid foundation for the initiatives to come and sending the European Union a clear message of the commitment of the main players and its role as an organisational fulcrum for the whole community.

As a leader in its field, Mercator Ocean was chosen by the community to steer the European service during the formative years of its creation. This choice has since been confirmed as the company was also asked to propose a solution for the lasting integration of the service within the major environmental monitoring agencies.

For the Mercator Ocean team, its responsibility as a leader is enacted in its daily actions. It consists in steering the company in keeping with its main objectives in France, Europe and abroad, while ensuring its vitality by [ongoing and dynamic] **innovation, increasing reliability, improving the service, looking ahead and creating value.** These five functions reveal the company's capacity to rise to the challenges it is asked to meet both reliably and energetically. The main operator and coordinator of the Copernicus Marine Service is expected to be a driving force capable of developing a service that will last.

The 2013 annual report describes our activities in terms of these five key functions: the results show that the achievement of the company's ambitious objectives depend on these essential functions that fuel and consolidate our commitment in the fields of science, service and partnerships.

2013 testifies to the vitality of our approach—a combination of daring, responsibility, method, the pursuit of excellence and the public interest—which is laying the groundwork for meeting the European challenges of 2014.

Pierre Bahurel

¹ *Global Ocean Data Assimilation Experiment*



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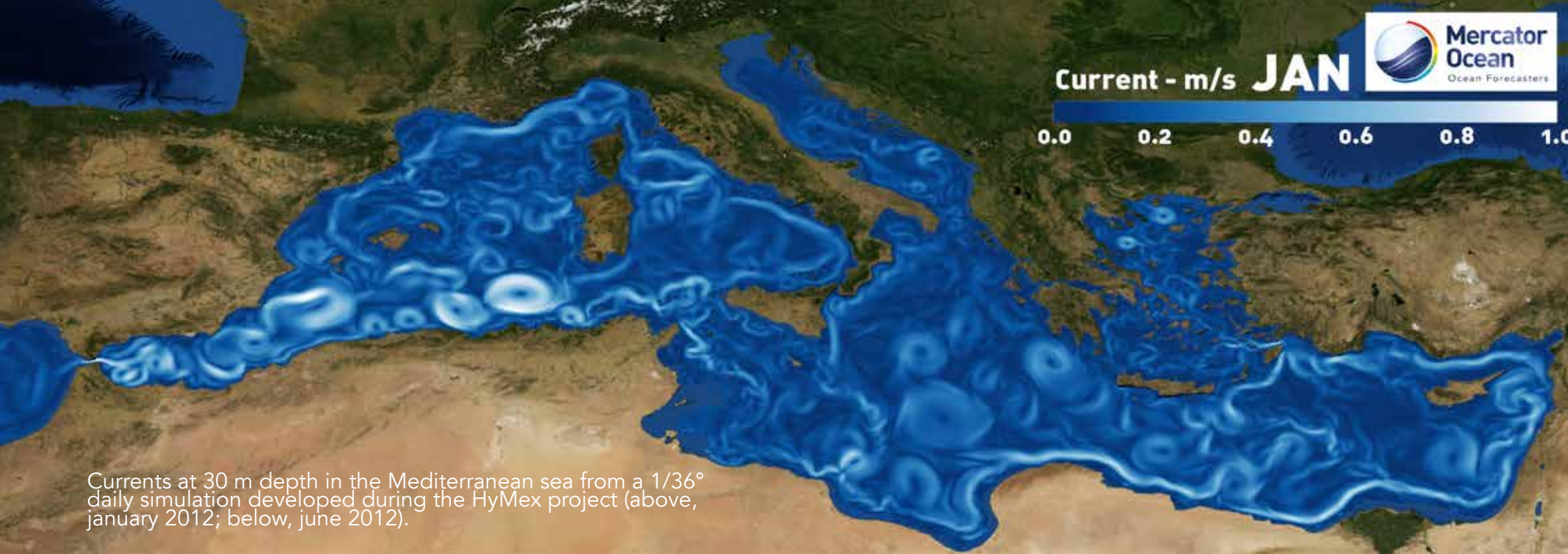
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Currents at 30 m depth in the Mediterranean sea from a 1/36° daily simulation developed during the HyMex project (above, january 2012; below, june 2012).



The biggest eddies can measure several hundred kilometers and their lifetime is from some months to some years.
(© Mercator Océan)

INNOVATE

A PIONEERING SPIRIT

A PIONEERING SPIRIT MEANS BEING A PIONEER IN OUR CORE BUSINESS. IT INVOLVES TESTING NEW METHODS FOR MODELLING, DATA ASSIMILATION OR EVALUATING ANALYSIS AND FORECASTING SYSTEMS. IT ALSO REQUIRES INNOVATIVE RELATIONSHIPS WITH OTHERS. MAKING KNOWN WHO WE ARE, WHAT WE DO, FOR WHOM AND WHY; TALKING ABOUT THE ISSUES AND THE STAKES, SCIENCE, OCEANS; DISCOVERING WHAT BRINGS US TOGETHER; BY CONSOLIDATING ITS UNIQUE IDENTITY, MERCATOR OCEAN IS LAYING THE FOUNDATIONS FOR ITS FUTURE.

CONCEIVING TOMORROW'S SYSTEMS

Analysis and forecasting systems¹ become more realistic as the grid mesh is refined and the parameterisation² improved. In 2013, the R&D teams working on modelling tested grid refinement in regions with a large dynamic range for example with AGRIF³ in the Straits of Gibraltar. New parameterisations for tides and vertical mixing for instance have been developed and tested in a simplified (1D) configuration and in realistic regional and global configurations.

Data assimilation consists in harmoniously integrating relevant real information into the model while constantly seeking global coherence. To improve how actual observations are taken into account, and include new observations, new settings have been integrated. The R&D teams have also been working on setting up a new ensemble-based assimilation method that will better quantify the reliability of forecasts, a crucial indicator of customer satisfaction.

Another innovative method in operational oceanography involves coupling an ocean model with an atmosphere model, thus improving the forecasts of one or both models. Under the terms of a study on the Indian Ocean for the French ministry of ecology, sustainable development and energy in conjunction with Météo-France, coupling a regional ocean model with an atmosphere model gave promising results for forecasting tropical cyclones. In the field of biogeochemistry, teams developed new scenarios for interactions between an ocean circulation model and a marine biogeochemical model. A promising method for the future, coupling becomes truly audacious when using models on the scale of Mercator Ocean's numerical models.

¹ A model (i.e. a mathematical simulation) of the ocean in which observation data are integrated (or "assimilated") to produce the most realistic estimates of ocean state as possible.

² Parameterisation is a representation of processes that cannot be explicitly translated on the model's spatial or temporal scale.

³ Adaptive Grid Refinement In Fortran: software that can be used in any large-scale model.

SCIENTIFIC FORESIGHT FOR OPERATIONAL OCEANOGRAPHY

BY B. BARNIER, GMMC SCIENTIFIC COUNCIL CHAIR

In 2013, the findings of close consultation between scientific research and operations communities brainstorming on future science prospects were collated in a report written by the drafting committee.

While paying great attention to the emerging needs of user communities, these forward-planning discussions were guided by the idea that for operational oceanography, just as for many other emerging services based on advanced technological innovations, supply also influences the demand of users further downstream.

It was therefore decided to envision a future general integrated operational system, basing discussions on its defining characteristics in order to develop recommendations on the research to be conducted, tools to be built, methods to be developed and observations to be used etc. that would match the strengths of the national research community so that the system could become a reality. This vision was acquired through a review that recognised that, thanks to researchers' close involvement in a community effort, French operational oceanography has acquired remarkable skills in the development and operation of integrated systems designed to analyse and forecast the physical state of offshore oceans with a high spatial resolution.

As revealed by the scientific brainstorming sessions, the major challenges that operational oceanography and associated scientific communities will have to meet in the next ten years are to consolidate traditional strengths such as offshore physics, to extend skills to coastal zones and all ocean sciences, from biogeochemistry or biology to sedimentology and fisheries etc., and to develop the ability to interface with applications in other areas where the ocean plays a crucial role (such as seasonal forecasting or climate

research). These forward planning discussions identified priority research actions to be carried out in order to foster development of the future system. They also revealed a new paradigm for interaction between research and operational communities in which the researchers will not be there mainly to help players in the operational field construct a system by contributing their skills but will be real partners within a more integrated cooperative project in which the efforts of each party depend on their own knowledge and missions. This new paradigm will greatly determine the LEFE call for tender in 2014.

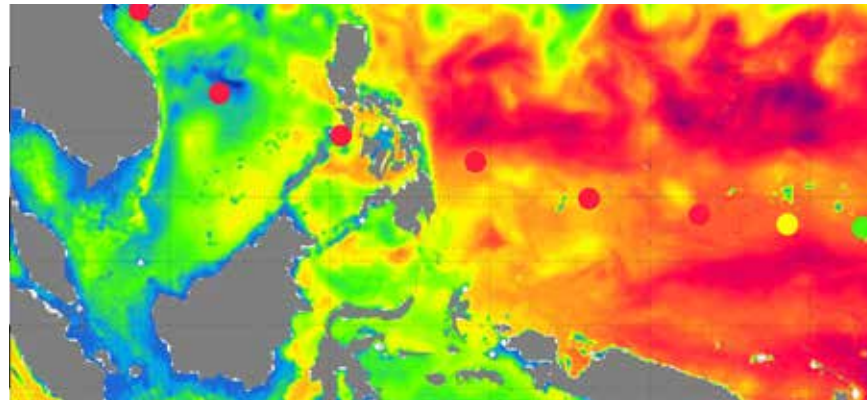
DOES INNOVATION IN SYSTEMS IMPROVE PRODUCTS?

Before the production stage, Mercator Ocean's R&D teams work to enhance system performance and quality. The choice of improvements is usually made following discussions between the teams and the rest of the scientific community but can be prompted by a direct customer request.

An example would be the new scores used to qualify the reliability of a model by comparing the trajectory of an actual surface drifting buoy with that of a virtual float in the model. These indicators will probably be used by the operators of the Météo-France drift model to better quantify uncertainty on drift forecasts.

Another example concerns the new settings designed to improve data assimilation. For a study ordered by CNES, bespoke simulations were carried out to reveal the impact on models of different altimetry data inputs. This work led to new assimilation system settings that fully exploit the altimetry data. Observation data providers can also use these results to plan ahead and enhance their future product offer.

Finally, in the near future ensemble-based methods for assimilating operational systems will lead to new diagnostics and scores, giving users new trustworthiness indicators for products.

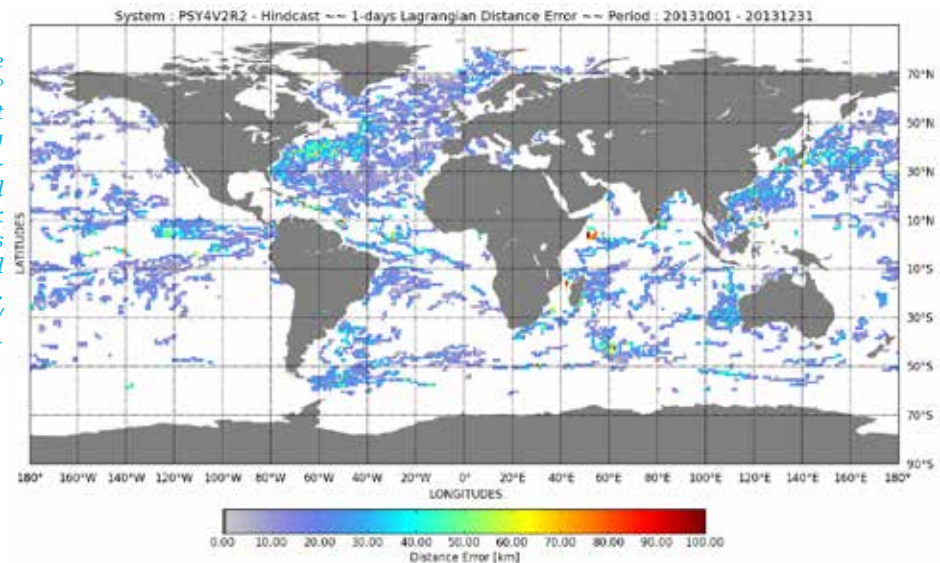


Changes in the intensity of Typhoon Haiyan (11/2013) as it approaches the Philippines. The map shows the depth of the 26°C isotherm in colours ranging from blue (shallow) to red (over 100 metres deep). The typhoon increases from category 3 (green) to category 5 (red). To develop into a category 5 typhoon, it draws its energy from the ocean: the surface water becomes cooler as it loses energy so the 26°C isotherm lies nearer the surface (yellow).

UPGRADING OUR QUALIFICATION METHODS

The team responsible for scientific qualification worked in 2013 on the development of new diagnostics. One, for instance, will be used to regularly validate the ocean dynamics of analyses and forecasts on the basis of independent Lagrangian floats. The scores provided by this type of diagnostic tool are eagerly awaited, particularly for applications concerning drifting objects or particles (see box).

Map of the mean distance errors calculated in 1° x 1° boxes after one day drifting at sea. The trajectories of drifting buoys in the Atlantic Oceanographic and Meteorological Laboratory (AOML) network are compared to trajectories modelled by the 1/12° global forecasting system. (© C.Régner / Mercator Océan) ►



SHARING OUR PASSION

In 2013, the Marketing & Communication team designed new tools such as the online multimedia library of the Mercator Ocean website where visitors can find accurately-labelled maps, videos and photos. They continued to develop novel tools, rolling out an Android version of the online smartphone application for the MyOcean project.



RELIABILITY

DAILY INVESTMENT

THE COMBINED WORK OF ALL THE TEAMS, NEW WORKING AND PROJECT MANAGEMENT METHODS AND UPGRADING OF THE PRODUCTION CENTRES ALL UNDERLINE MERCATOR OCEAN'S COMMITMENT TO CONSTANTLY ENHANCING RELIABILITY.

■ CONSOLIDATING TOOLS AND METHODS

A more reliable processing system: in 2013, the tools such as those used to sequence operations in the operational production lines and post-processing tools used to establish the diagnostics and maps for qualifying models were consolidated and implemented to further increase reliability.

More reliable source codes: operational production software programs are developed by several different teams. It is therefore crucial to be sure that developers are working on the latest version. In 2013, the different releases of the assimilation source code were standardised so that developers and operations managers could reliably transfer programs to the operational production lines. At the same time, still very much involved in the NEMO¹ programme, scientists have stabilised a new version of the source code, including their own developments and those of other groups in the consortium.

More reliable host machines. As soon as the new Météo-France computers were available, they were fully exploited by the R&D and IT support teams to test out their capacities and ensure code portability (see box for operational aspects). The Naviti computer was made available on Mercator Ocean's in-house network for production purposes. This new computer allows teams to try out their new developments locally.

■ SECURING INPUT DATA

The quality of the analyses and forecasts produced by Mercator Ocean depend on the observation data either directly assimilated or used to validate systems. In order to secure the observation data procurement processes, Mercator Ocean signs annual supply contracts with observation data providers. However, this is not always enough, and in 2013 teams had to react very quickly to compensate for

¹ *Nucleus for European Modelling of the Ocean: a modelling platform for oceanography research, operational oceanography, seasonal forecasts and climate research. Mercator Ocean is a member of the consortium organising and controlling project developments.*

disruptions in the observation network due, for example, to the decommissioning of Jason-1 in July and NOAA's interruption of services in October due to the US government shutdown.

■ CONTROLLING BUDGETS

Mercator Ocean teams contribute to numerous national, European and international science projects. The company's professionalism and reliability are also shown by its strict management not only of technical aspects but also of project budgets. To help team leaders and project managers to adjust their monthly budget forecast, the Administration & Finance department set up a sliding projected expenditure system.

DID YOU KNOW ?

In addition to in situ data, Mercator Ocean systems assimilate data from three different altimeters on three satellites: Jason-2, Cryosat and SARAL/AltiKa. This is an ideal, but somewhat risky, configuration as problems may arise following satellite failure, an interruption of data or satellite decommissioning, for instance.

ROBUSTNESS OF OPERATIONAL SYSTEMS

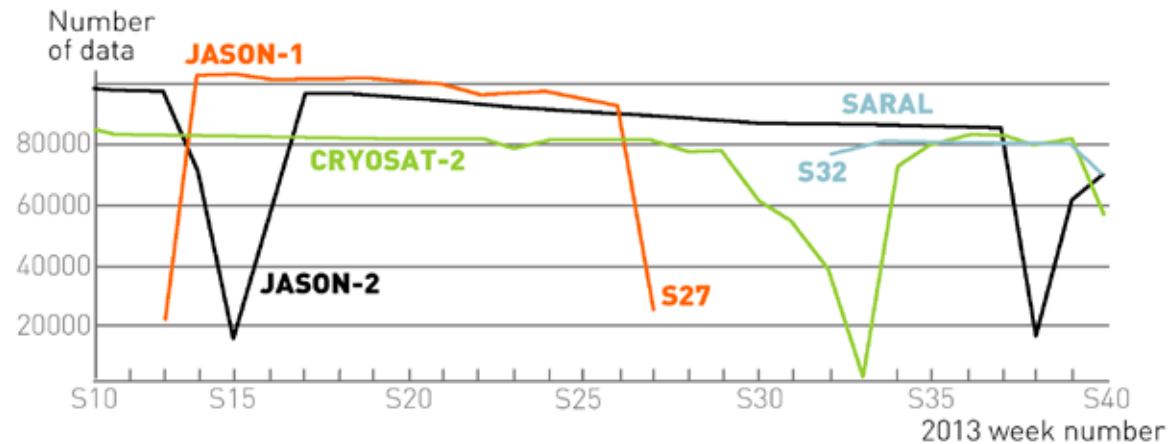
Ensuring a production line remains operational entails constraints such as the constant monitoring of processes, maintenance of the whole processing chain and host machines and, in the event of a problem arising, exemplary responsiveness to reinitiate all the systems. Operations team members therefore know the operational production lines perfectly and have the advanced technical skills needed.

Their technical ability was put to the test when the mainframe computer was changed in 2013. The team migrated all the source codes from one machine to another, ensuring compatibility between the host environments before reinstalling all the software and programs. The final step entailed validating each process before declaring the new computer fully operational.

Yet there are many risks in running an operational production line, including computer, network or data problems. For an example of the latter, we can take the interruption of input data when Jason-1 failed in June 2013. The systems assimilate altimetry data from the instruments of three different satellites. An interruption in the data from one satellite leads to less accurate forecasts. It is therefore essential to remedy the problem as quickly as possible.

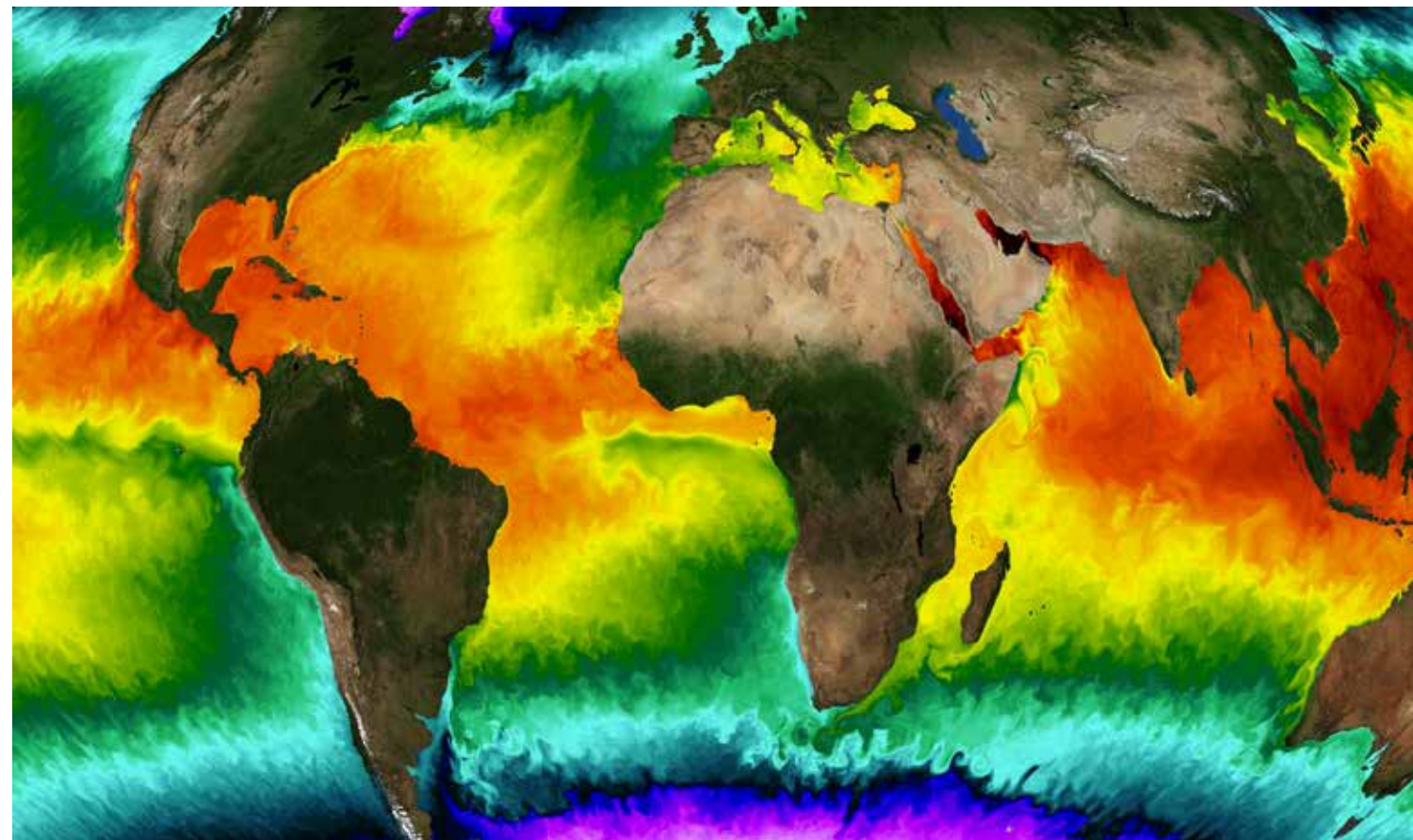
It took less than one month for Mercator Ocean teams to test data from the new AltiKa altimeter on board SARAL then develop corresponding data acquisition, assimilation and validation programs. They finally had to validate the process prior to operational commissioning.

This exercise not only increased the robustness of the operational production lines but directly validated a change process for input data.



▲ The rise in the volume of data assimilated by Mercator Ocean systems during the summer of 2013 show how quickly the data from the SARAL satellite were acquired, assimilated and validated by the new programs (in one month).

▼ Sea surface temperature map from the 1/12° global system, updated daily. This huge 8m x 4m map is part of the physical oceanography exhibition at Oceanopolis in Brest, North-West France. (© Mercator Océan)



IMPROVE

DEVELOPING TO ENHANCE SERVICE

THE GROWTH OF OUR SERVICES REQUIRES US TO OFFER OUR BEST PERFORMANCE AT EACH AND EVERY DELIVERY, WHETHER IN THE AREA OF SCIENTIFIC EXCELLENCE OR CUSTOMER RELATIONS. THESE EFFORTS LEGITIMISE THE DEVELOPMENT OF OUR IMAGE AS A DRIVING FORCE BEHIND OCEANOGRAPHY BEYOND THE CITY OF TOULOUSE.

MEETING AN EVER-INCREASING DEMAND

The service provided by Mercator Ocean has been increasing constantly since 2009, testified by the growing number of deliveries of numerical data files, maps and expert appraisals. The 6,938 deliveries in 2013 reflect a 30% growth compared to the previous year.

The service for Copernicus also increased significantly between late 2012, when there were some 1,700 registered users, and late 2013, when there were some 3,200 users. This growth is mainly due to improvements in the service, such as online registration, rationalisation of the catalogue, new Mercator Ocean products (e.g. the Daily Global Bulletin), a more user-friendly site and better delivery options, including the “authenticated ftp” system.

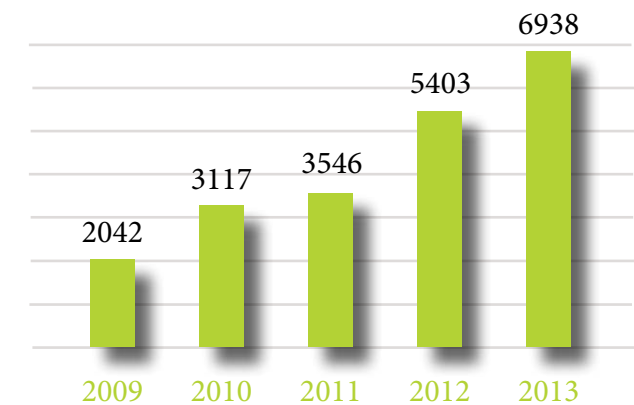
CONSOLIDATING OUR REGIONAL ROOTS

Mercator Ocean is rooted in its region just as oceanography sets it apart. At the request of the Midi-Pyrénées Regional Council, oceanography was included in a strategic report to which Mercator Ocean contributed.

In 2013 partnerships were also created with the Toulouse Métropole urban community (e.g. the La Novela festival’s science popularisation events and the Trades Forum), the Cité de l’Espace space theme park (permanent exhibit and lectures) and higher education establishments such as Sciences Po Toulouse (educational workshops). The company has also been given more coverage in local media (“Objectif News”, local newspaper “la Dépêche” and “20mn”).

DEVELOPING GOOD PRACTICES IN CUSTOMER RELATIONS

In 2013, the team in charge of the Mercator Ocean and MyOcean service desk set up joint management tools to provide a more professional service, especially in terms of follow-up. A questionnaire sent to MyOcean2 users in December 2013 and returned by nearly 400 respondents, offered very high satisfaction indicators, especially as concerns regular service developments: 84% of answers declared the information on product and service upgrades to be “useful to very useful” and 89% considered the scientific quality and availability of products to be “good to very good”. Customer relations are also built up through tutorials provided and events such as the MyOcean User Workshop. The 2013 edition, organised jointly with the European Environment Agency (EEA), attracted nearly 110 attendees from 21 countries to Copenhagen (Denmark). Users were able to make their voice heard, requesting a lasting European core service and active support for national agencies, especially with respect to the Marine Strategy Framework Directive which requires EU member states to achieve a good environmental status (GES) for their marine waters by 2020.



Evolution of the annual deliveries by Mercator Ocean.►

SCIENTIFIC RESOURCES SUPPORTING OUR OFFER

Mercator Ocean's scientific innovations serve the operational oceanography community and stimulate development of our product and service offer. In 2013, our reanalysis systems were improved, offering a "replay" of past ocean conditions:

- new version of the $1/4^\circ$ global reanalysis;
- new high-resolution regional reanalysis for the North East Atlantic (IBI) which couples physical and biogeochemical data;
- improvement of the global forcing set by correcting biases of the ERAinterim reanalysis (ECM-WF) for the 1979-2013 period.

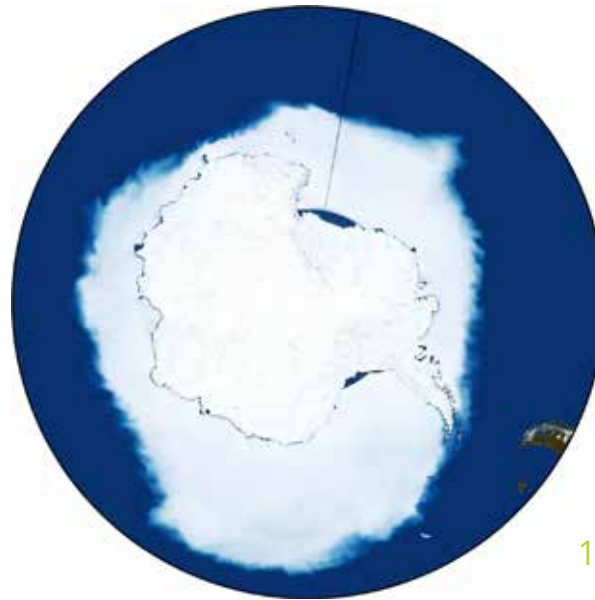
In 2013 there was a real leap forward in quality for all the Mercator Ocean systems (PSY4, PSY3 and PSY2) due in particular to better settings (bias and assimilation data), consequently enhancing systems such as IBI and BioMER.

The commissioning of the $1/12^\circ$ Daily Global Bulletin in April 2013 is also a highlight of 2013. It brings a significant added-value to users compared to the $1/4^\circ$ Global Bulletin and the $1/12^\circ$ Weekly Global Bulletin. It is disseminated through the MyOcean web portal.

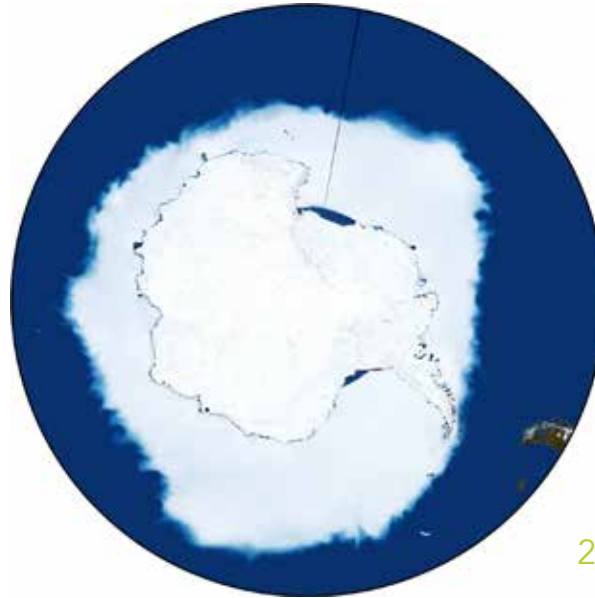
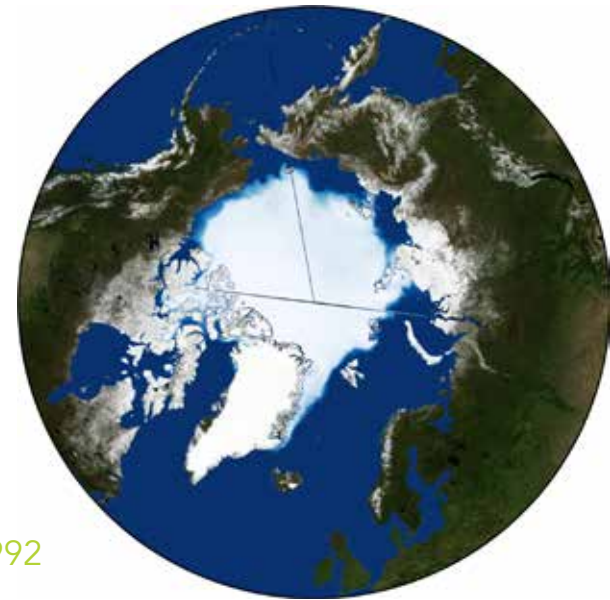
Mercator Ocean takes great satisfaction in observing that this new product, offering a daily $1/12^\circ$ analysis and forecast for the global ocean, was the most popular download from the MyOcean catalogue in 2013.

DID YOU KNOW ?

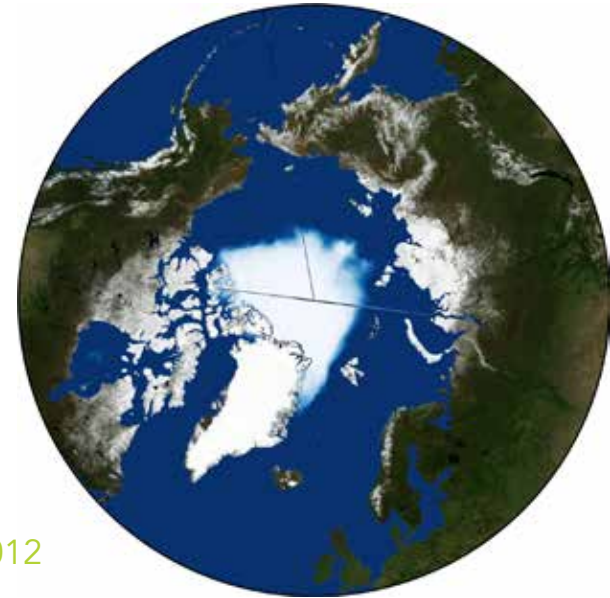
In 2013, Mercator Ocean delivered to one of its customers a complete reanalysis product covering a period of nearly 20 years and representing some 10 Terabytes of data.



1992



2012



▲ Changes in the Antarctic (left) and Arctic (right) sea ice between 1992 and 2012 revealed by the $1/4^\circ$ delayed-time system. The global reanalyses regularly produced by Mercator Ocean offer research opportunities such as this one, monitoring changes in sea ice over several decades. (© Mercator Océan)



LOOK AHEAD

PAVING THE WAY FOR EUROPE'S FUTURE MARINE ENVIRONMENT MONITORING SERVICE

EXPERIENCE HAS SHOWN US THE NEED TO BE FLEXIBLE AND TO CONSTANTLY DEVELOP. WE HAVE THUS GROWN FROM A SMALL RESEARCH BODY INTO AN ORGANISATION THAT DELIVERS RELIABLE OPERATIONAL SERVICES TO ASSOCIATES AND USERS WORLDWIDE. 2013 WAS A YEAR OF PREPARATIONS, LAYING THE FOUNDATIONS FOR ALL KINDS OF CHANGE.

■ GEARING UP OUR ORGANISATION

The consortia driving MyOcean and then MyOcean2 in the project phase since 2009, have worked unceasingly to pave the way for the future marine monitoring service offered by Copernicus. The commissioning of this service in 2015 has required structural changes to Mercator Ocean so as to meet administrative, operational and scientific requirements. Following in-house consultation, a new organisation was therefore set up in early 2013. The company's new, simplified organisation chart is centred on a consolidated Directorate General, three operational departments (R&D, Production & Services, Development & Partnerships) and two functional departments (Administration & Finance and IT Systems).

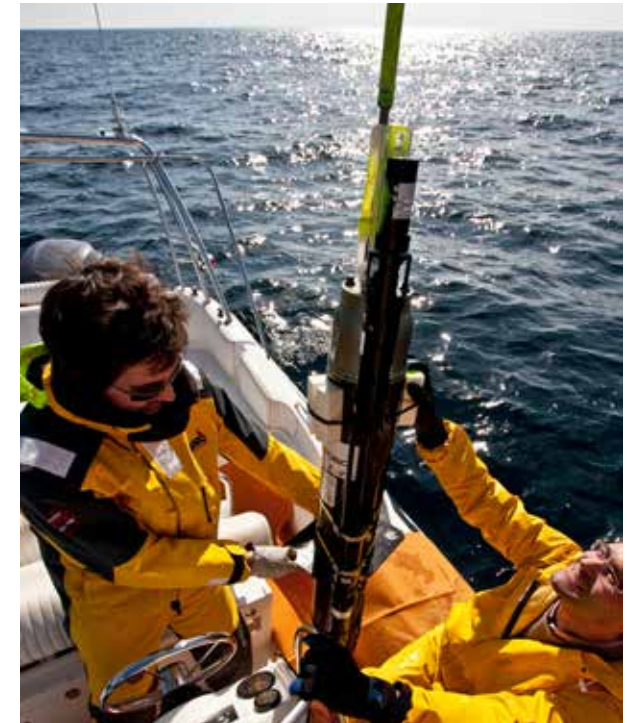
Following the migration of all source codes to the new Météo-France supercomputer in readiness for the decommissioning of the NEC machines in February 2014, Mercator Ocean quantified its computing resource needs for its R&D activities. On another note, the "Customer solutions" team worked with a world leader in computing services to prepare for a Big Data/Cloud environment.

To enable all Mercator Ocean scientific and operational staff to take decisions and have up-to-date, real-time information on our systems and products, the marketing team has been running a pilot information system since September 2013. This project integrates all the information available on products and systems—creation processes, updates, validation, data processing and dissemination—in addition to a database and interface, to be rolled out in 2015.

2013 also saw the deployment of good project management practices initiated by the "Support & Methods" team. A steering committee was created to monitor major projects. Meeting regularly, this committee ensures that objectives are met and supports project managers as needed.

In 2013, the Administration & Finance department prepared the company for the constraints related to a European Union mandate, working on the processes involved in four particular areas of re-

quirements: in-house quality control, public procurement, the accounting system and audit standards. Similarly, Mercator Ocean prepared its processes for the new European payment standards, a further step in Europe's financial integration. We were therefore ready for application of the Single Euro Payments Area (SEPA) concerning bank transfers and direct debits on 1 February 2014.



Launching an ARGO profiling float. The assimilation of in situ data from the global ARGO network is crucial to the quality of Mercator Ocean's forecasting systems (see box on the righthand page). (© Imedea)

PREPARING FOR FUTURE OBSERVATION DATA

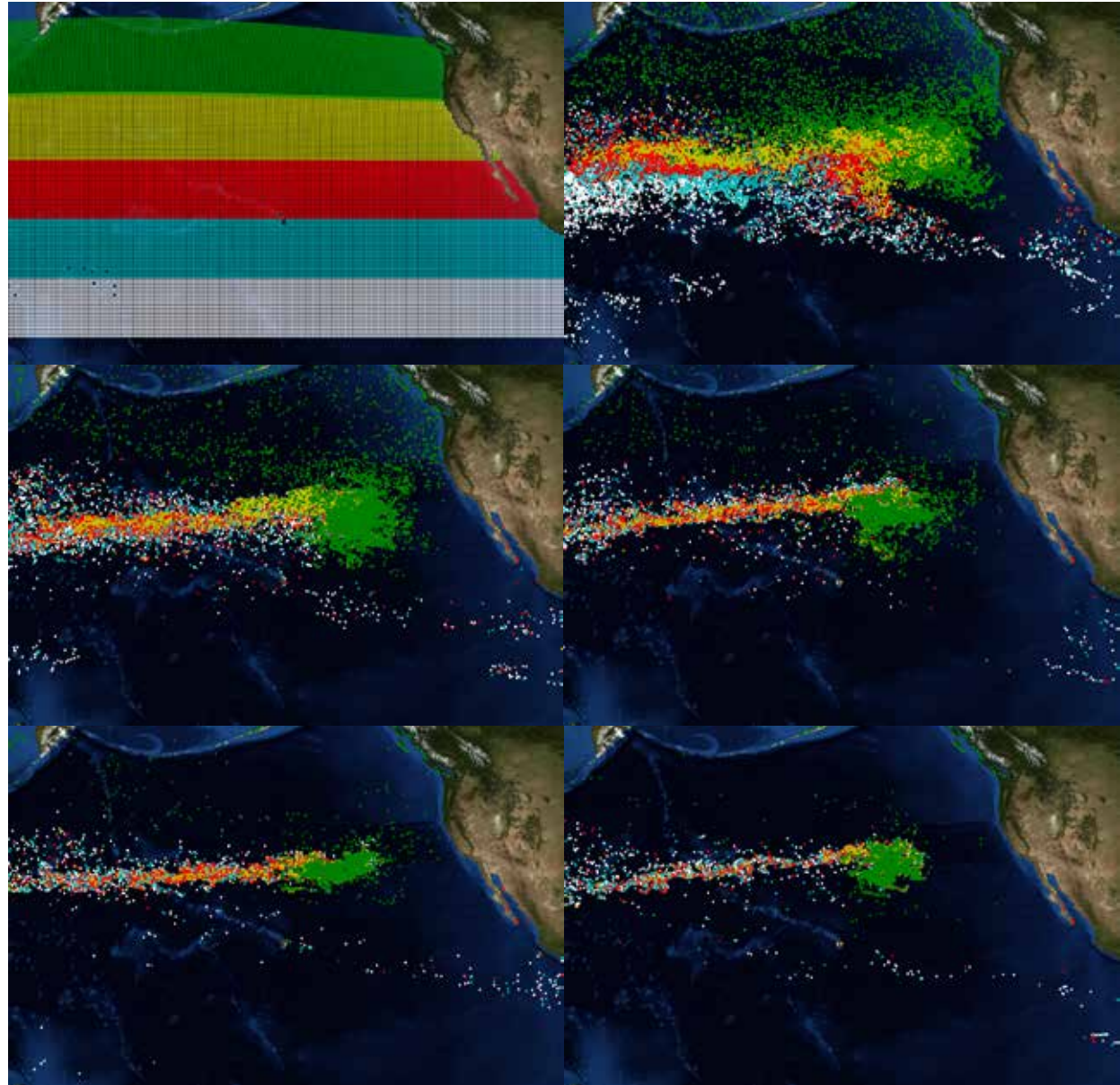
In keeping with major European and international programmes, satellite or in situ observation infrastructures evolve according to their respective schedules, which may be short- or long-term. We have to adapt to changing circumstances, developing new data assimilation methods for our models. In 2013, work began on the following projects, together with an evaluation of their contribution: deeper, better sampled in situ data from the global Argo programme, the SWOT satellite's better spatial resolution and high-resolution altimetry data from the MyOcean TAPAS project (Tailored Altimeter Product for Assimilation System).



The Surface Water and Ocean Topography (SWOT) satellite is a joint French-US mission to study ocean and inland waters. (© D.Ducros /CNES)

DID YOU KNOW?

Mercator Ocean was accredited for the CIR research tax credit, a status that is meant to largely benefit our customers.



▲ Simulations of particle drift on the surface of the Pacific Ocean over ten years enabled Mercator Ocean experts to chart a route for the "7th Continent Expedition" led by Patrick Deixonne in June 2013. Maps show the position of particles (from top to bottom and left to right) at T_0 ; T_0+24 months; T_0+48 months; T_0+72 months; T_0+96 months and T_0+120 months. (© Mercator Océan)

CREATE VALUE CONTRIBUTING TO THE PERFORMANCE AND INFLUENCE OF OUR ASSOCIATES AND PARTNERS

OUR ASSOCIATES NEED RELIABLE DATA FOR THEIR PUBLIC SERVICE MISSIONS OR RESEARCH PROGRAMMES. IN 2013, MERCATOR OCEAN'S COMMITMENT EXCEEDED THIS REMIT AS WE SOUGHT TO CREATE VALUE THROUGH R&D PARTNERSHIPS AND THE DEVELOPMENT OF NEW APPLICATIONS.

MERCATOR OCEAN CONTRIBUTES TO THE ACTIVITIES OF ITS FIVE SHAREHOLDERS—CNRS, IFREMER, IRD, MÉTÉO FRANCE AND SHOM—BY DELIVERING OPERATIONAL SERVICES THROUGHOUT THE YEAR, WHETHER DAILY OR WEEKLY INFORMATION IN REAL TIME OR DELAYED TIME AND BY WORKING CLOSELY TOGETHER ON JOINT PROJECTS (AND ESPECIALLY RESEARCH PROJECTS.

■ OPERATIONAL SUPPORT

In 2013, Mercator Ocean delivered a daily and weekly real-time service to Ifremer—the French institute of marine research and exploration—in the framework of a prototype coastal oceanography service known as PREVIMER.

Mercator Ocean delivered a real-time service each week to Météo France, related to its seasonal and marine forecasts, complemented by monthly R&D expert support for the drafting of the Global Climate Bulletin.

Every day, Mercator Ocean provided SHOM—the French Navy's hydrography and oceanography department—with a real-time service of 13 to 26 Gigabytes of data for assimilation into its operational systems, together with a new real-time service based on the daily global high-resolution system currently being tested by SHOM, and occasionally a delayed-time service. Throughout the year, this service was delivered using an operational production line that has been optimised to secure SHOM's access and is being monitored separately.

■ MAJOR COOPERATIVE DEVELOPMENT PROJECTS

Mercator Ocean contributes to numerous important development projects for the scientific and technical community. Its main projects in 2013

concerned:

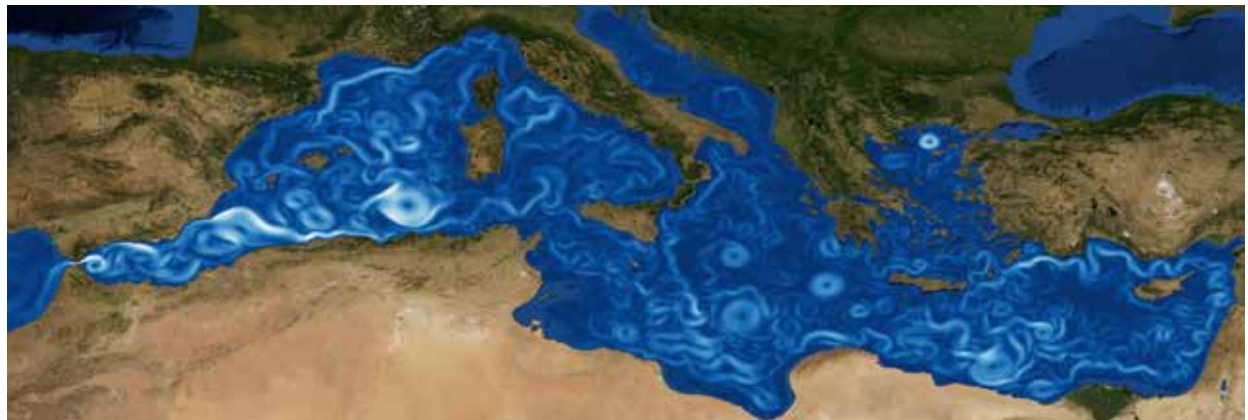
CORIOLIS: the in situ data used by Mercator Ocean systems are supplied by the Coriolis service. Throughout 2013, the operational and scientific link was maintained.

NEMO (Nucleus for European Modelling of the Ocean): Mercator Ocean's R&D team designed, tested and integrated numerous developments of use to the European consortium (which includes CNRS, the French national scientific research centre) and indeed the whole user community, including Météo-France. Developments concerned boundary conditions, tides and vertical mixing.

Throughout 2013, Mercator Ocean's R&D team consolidated its cooperation with research teams in major cooperative projects involved in high-resolution hindcasting using DRAKKAR, co-steering joint work on reanalyses with GLORYS, and consolidating efforts on biogeochemistry through the MERCATOR VERT project to establish coupled simulations with BioMer, the biogeochemical $\frac{1}{4}^\circ$ model

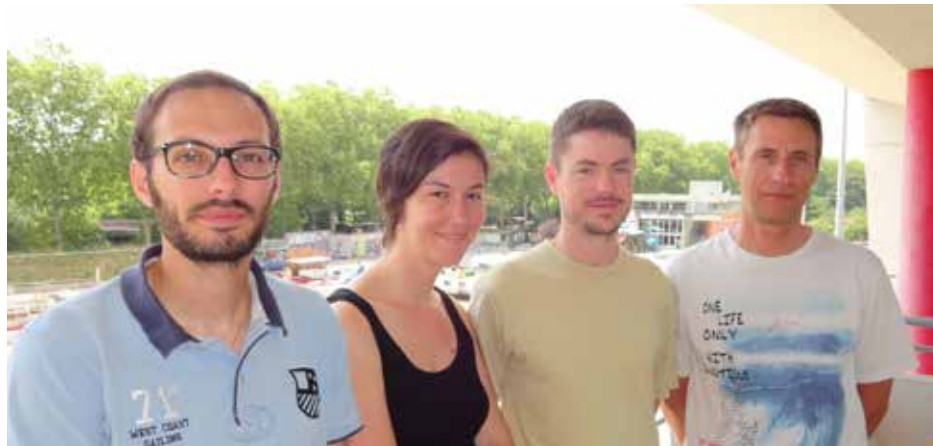
By drawing up special bulletins, Mercator Ocean is helping to lay the groundwork for the PIRATA campaigns. This international programme involving Brazil, France and the United States, is designed to collect ocean and weather data in the tropical Atlantic.

Numerous ongoing scientific projects (e.g. SiMed, HyMex and Remember) are broadening our



knowledge of the Mediterranean, assisted by Mercator Ocean's benchmark simulations. Cooperation with Ifremer linking offshore/coastal zones led in 2013 to the development of a reconfigurable spectral nudging module of great use in regional and coastal models.

GMMC is currently one of the actions of the national LEFE programme on fluid envelopes and the environment. A specific call for tender on operational oceanography activities was published in 2013. There were more bids in response than in previous years, and of the 29 project proposals (15 of which involved Mercator Ocean directly), 23 were selected (11 involving Mercator Ocean). Some of these projects are considered by the community to be of major importance in that they involve numerous partners and laboratories working closely with Mercator Ocean. In 2013, projects relating to physical and biogeochemical modelling, data assimilation, the production of benchmark simulations and reanalyses (GLORYS, DRAKKAR, SiMED and Mercator Vert) were continued or finalised. In 2014, some of these projects will be pursued while others will be initiated. New project themes include ocean-atmosphere or physical-biogeochemical coupling (AMICO-BIO, ENGLOBE or downscaling an atmospheric model) or regional projects covering the Arctic Ocean or the Bay of Biscay (ENIGME and Mercator Blanc). The GMMC Scientific Council and many project managers participated in the LEFE symposium held from 13 to 15 January 2014 in Toulouse.



◀ The QuoVaDis team (quarterly quality report) : Charly Régnier, Marie Dréviron, Bruno Levier, Eric Greiner (not in the picture : Coralie Perruche et Charles Desportes). (© Mercator Océan)

DID YOU KNOW?

Mercator Ocean has a scientific advisory board for consultation by its R&D teams. Board members are from partner organisations, key oceanography laboratories or research centres. The scientific advisory board meetings provide a forum for exchange between board experts and specialists at Mercator Ocean and Coriolis, especially for the GMMC LEFE tender.

BESPOKE EXPERT APPRAISALS

Quality is the determining factor in all operational systems. In addition to circulating QuoVaDis, our quarterly quality bulletins, Mercator Ocean has carried out targeted validation studies on the products delivered to Météo France and SHOM.

Météo-France and Mercator Ocean work closely together to forecast cyclones or develop coupled atmosphere-ocean solutions (feasibility studies).

Our research teams have also been asked to intervene from time to time as part of their work. For instance their expertise has been applied for LEGOS to determine the impact of an ocean thermal energy power station on the marine ecosystem, to study ocean circulation in the Bay of Biscay and to analyse the deep ocean's contribution to the rise in sea level; for the Villefranche sur Mer oceanography laboratory to develop metrics; and for LGGE to investigate renewable energy sources.

The experience and skills developed by Mercator Ocean through the Service desk set up for the MyOcean project are being analysed to identify how they can best be exploited for the joint PREVIMER project.

◀◀ (Left page) Mediterranean currents charted following a 1/36° simulation for the HyMex project. (© Mercator Océan)

◀ April 2013 : GMMC LEFE days hosted by Météo France. (© Mercator Océan)

■ GOING FURTHER TOGETHER

Mercator Ocean has developed an extranet service firstly for Météo-France and SHOM. These “Premium” sites ensure that they are given selected and qualified information about our services and production, along with their indicators.

Mercator Ocean has contributed to the call for tender issued by Météo-France for the replacement of their supercomputer (benchmarking, analyses, meetings of the Technical Evaluation Group and interviews).

Issue 48 of the joint Mercator-Coriolis newsletter, available on the Mercator Ocean web site, was dedicated to in situ observations, a topic dear to Ifremer, member of the Euro-Argo network steering team. In 2013, the Mercator Ocean Scientific Newsletter was downloaded nearly 5,000 times.

Mercator Ocean also began helping develop a future educational site with the Midi-Pyrénées Observatory intended to cover all its areas of competence, including oceanography. The aim is to provide teachers in the Midi-Pyrénées region with online educational resources.

■ OPENING UP OUR EXPERTISE TO MEET PRIVATE SECTOR NEEDS

In 2013, Mercator Ocean signed a major research partnership contract in physics and biogeochemistry with a user in the private sector authorising the latter to export a leading-edge oceanography service.

After initial R&D support from the CNRS, Mercator Ocean took over for another user in the private sector wishing to develop a commercial offshore service offering customers operational outputs every three hours. Other offshore proposals are still under investigation.

This openness to private business needs was extended in 2013 to the European MyOcean Service, 20% of whose users are companies. In its role as coordinator, Mercator Ocean is also participating

in training sessions (three of which took place in 2013) and online tutorials.

SHOWING THE GENERAL PUBLIC THE TRUE VALUE OF MERCATOR OCEAN AND ITS PARTNERS

All our communication media—whether offline or online—became more popular throughout 2013 (www.mercator-ocean.fr had 27,000 visitors; www.myocean.eu had 180,000 compared to 71,000 in 2012; some 20,000 views for our Dailymotion and YouTube programmes in 2013 and a weekly Facebook audience of between 500 and 1,000).

Already involved in numerous local scientific events aimed at the general public (including La Novela and Researchers’ Night), Mercator Ocean wishes to confirm its role as a “knowledge provider” and “oceanography expert” both nationally and internationally. In 2013, the company thus initiated partnerships with science centres and sea museums to set up permanent exhibits (in Toulouse at the Cité de l’Espace theme park and the natural history museum, and in Brest at Oceanopolis) or temporary exhibits (an exhibition is planned at the Villa Méditerranée in Marseille in early 2014). As an ocean data provider, Mercator Ocean has also joined ECSITE, the European network of science centres and museums, which has over 400 members. This will help keep us in the public eye while enabling us to discover new ways of sharing knowledge and to find new partners.

Alongside the CNRS and CNES, Mercator Ocean also put a great deal of effort into partnering Patrick Deixonne’s “7th Continent Expedition” to the island of plastic waste that has accumulated in the Pacific Ocean.

Mercator Ocean’s “Customer Solutions” team helped determine the expedition’s route on the basis of a particle drift demonstrator taking into account ocean currents determined during a GLORYS reanalysis and the probability of

convergence of plastic waste.

This was a high-profile media event involving national newspapers, news programmes, radio broadcasts etc. and revealed Mercator Ocean’s unique contribution and potential.

In 2013, Mercator Ocean considerably extended its image library, thus becoming independent with no need to call on outside assistance for its own media productions.



▲ The «7th Continent» expedition team. (© S.Lardeux / OSL)

EUROPEAN SERVICE

THE MYOCEAN2 PROJECT IN 2013

THE SECOND YEAR OF MYOCEAN2 HAS CONFIRMED THE CONSTANT IMPROVEMENT IN THE SERVICE PROVIDED, CONSOLIDATING THE BASELINE OF THE PRE-OPERATIONAL SYSTEM PRIOR TO THE OPERATIONAL PHASE OF COPERNICUS.

*Dominique Obaton,
MyOcean Service Desk Responsible speaking
on microphone at the MyOcean User Workshop
(Copenhagen, april 2013). ▶*

By late 2013, there were over 3,000 registered users of the MyOcean service, with a growth rate of 100 to 150 new users every month. Over 276 regular public or private sector users worldwide depend each week on MyOcean to produce their own services. The organisation set up to interface with users is proving successful not only in determining needs leading to long-term changes but also in terms of constant service enhancement.

In 2013, MyOcean users benefitted from two new releases:

- In April, the roll-out of a version with major upgrades (V3)—and in particular a reorganised catalogue—made it easier to identify products and use more efficient features to access and display data or search for specific products.

- In November, a new release increased the number of catalogued products to 111.



The project methodology applied since 2009 (MyOcean) to conduct operations and the development of a widely-distributed operational service required two external reviews involving the participation of the expert committee appointed by the European Commission in addition to three in-house reviews. All five validated the compliance of project achievements with needs and specifications, confirming the commitment and reliability of the European consortium coordinated by Mercator Ocean. The first annual project review was held in April at the National Maritime College in Cork (Ireland), attended by representatives of partners and the European Commission.

The project's administrative and financial management was improved by the application of a new management tool making it easier for partners to enter information and keep an eye on finances. The first periodic report for MyOcean2 was delivered to the Commission and the last MyOcean payments transferred to partners, thus bringing the project to a close.

■ UNITING STAKEHOLDERS

The project is pursuing the development of close links with European Service stakeholders, whether in situ data providers, space agencies or national operational services. Specific actions were taken in coordination with EuroGOOS and mutual participation in technical reviews with EUMETSAT and ESA strengthened the crucial link between the Marine Service and its suppliers. The European Commission is now relying heavily on MyOcean2 to clarify the future developments required or new observation data needs.

■ NEXT STEPS

The “MyOcean Follow-On” proposal was coordinated and prepared in readiness for its submission in early 2014 as a new 6-month project under the Horizon 2020 programme. It was designed to follow on from MyOcean2, with the same boundaries and partners. This new phase will ensure service continuity and the developments needed prior to initiation of the operational phase of the Copernicus Marine Environment Monitoring Service .

At the same time Mercator Ocean coordinated the proposals and frequent work meetings with the other 13 partners involved in setting up the future Copernicus Marine Service, which involved joint preparation of the marine community's response to the ‘Call for Proposals’ for running the Copernicus Marine Service which had been issued at the beginning of 2014.



THE COMPANY

**SITUATION AT 31
DECEMBER 2013**

■ SHAREHOLDERS

With a seat at the company's General Assembly:

- The Centre National de la Recherche Scientifique (CNRS – French national scientific research centre), represented by Mr. Alain Fuchs, President
- The Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer – French institute of marine research and exploration), represented by Mr. François Jacq, CEO (successor to Mr. J.Y. Perrot from 12 September 2013)
- The Institut de Recherche pour le Développement (IRD –development research institute) represented by Mr. Michel Laurent, Chairman
- Météo France, represented by Mr. Olivier Gupta, acting Director General (successor to Mr. François Jacq from 18 September 2013)
- The Service Hydrographique et Océanographique de la Marine (SHOM – the French Navy's hydrography and oceanography department) represented by Mr. Bruno Frachon, Director General



■ EXECUTIVE BOARD

Les gérants sont nommés par l'Assemblée Générale pour gérer la société civile :

- M. Philippe BERTRAND, CNRS (ayant succédé à M. Jean-Marie FLAUD, CNRS, démissionnaire au 28 février 2013)
- M. Patrick VINCENT, IFREMER
- M. Pierre SOLER, IRD
- M. Joël POITEVIN, METEO-FRANCE
- M. Laurent KERLEGUER, SHOM

■ SCIENTIFIC ADVISORY BOARD

Consultative body designed to provide guidelines for Mercator Ocean's scientific strategy taking into account the national and international context.

- Bernard Barnier, Chairman, CNRS, (successor to Pierre Brasseur, CNRS, from April 2013)
- Fabrice Ardhuin, Ifremer
- Laurent Debreu, INRIA
- Thierry Delcroix, IRD
- Gérard Desroziers, Météo-France
- Fabrizio D'Ortenzio, CNRS
- Hervé Giordani, Météo-France
- Cyril Lathuilière, SHOM
- Patrick Marsaleix, CNRS
- Christel Pinazo, LOPB
- Pierre Testor, CNRS
- Bruno Zakardjian, University of Toulon-Var

THE ORGANISATION

SITUATION IN 2013



Arrivals :

David Bazin (18/11/2013) - Elodie Fernandez (1/06/2013) -
Mathieu Hamon (1/09/2013) - Elodie Gutknecht (7/01/2013)
Angélique Hameau (1/10/2013)

Departures :

Nicole Orville (31/05/2013) - Guillaume Samson (30/08/2013)
Simon Verrier (30/09/2013) - Gaëtan Vinay (26/09/2013)
Lionel Zawadski (30/06/2013)

Personnel hosted under partnership agreements

- Matthieu CHEVALLIER « Étude de la variabilité de la circulation océanique Arctique dans des modèles OGCM haute résolution » IPEF Météo France (janv. à Déc. 2013)
- Anne DAUDIN « Étude dans le cadre du PPR Green-Mercator » LSCE (fév. à Déc. 2013)
- Floriane NINOVE « Thèse sur l'Impact des observations Argo pour l'analyse et la prévision océaniques » Ifremer (nov 2011 à nov 2014)
- Vasileios VERVATIS « Assimilation de données dans une configuration Régionale du modèle NEMO sur la zone IBI » Legos (avril 2013 à août 2014)

Supervision of 5th year Sciences Po students

Adrien Bonville « Conception des indicateurs pour les élus et décideurs et préparation collaboration entre MO et Sciences Po Toulouse » (juin à sept. 2013)

Supervision of Masters students

- Amandine Declerck « Assimilation de données biogéochimiques dans le système global « Université de Toulon Var (mars à août 2013)
- Angélique Hameau « Analyse de sensibilité aux forçages en temps quasi réel et étude de capacité de prévision du modèle biogéochimique PISCES » Université Paul Sabatier (mars à sept. 2013)
- Simon Verrier « Étude de l'impact de l'état de la constellation altimétrique sur l'analyse et la prévision océanique » Université Paul Sabatier (Fev à juin 2013)

Supervision of High School students

Ilies Felioune, Thibault Maury et Amine Messal (déc. 2013)



THE PROJECTS

2013

2013 PROJECTS	FRAMEWORK OR FUNDING	LEADER	LEADER OR MERCATOR OCEAN CONTRIBUTOR
SARAL (Altika)	CNES announcement of opportunity	CLS, France	Eric Dombrowsky
INDESO	Indonesian Ministry	CLS, France	Pierre Bahurel
CANADA	Canadian Ministry	DFO, Canada	Gilles Garric
OSE/OSSE		CNES	Elisabeth Remy
COTIER			Sylvain Cailleau
OST/ST		CNES/Eumetsat	Eric Dombrowsky
REMEMBER	ANR	IPSL	Jonathan Beuvier
EPIGRAM	ANR	CNRS, France	Bruno Levier
Working Group on “Good Ecological Status” - application of the European Marine Strategy Framework Directive at MEDDE		MEEDE	Fabrice Hernandez
HYMEX – MISTRALS	ANR	Météo France CNRS	Jean Michel Lellouche, Jonathan Beuvier
MyOcean2	FP7 – European Commission	Mercator Océan	Pierre Bahurel
o3MAR	MEDDE (French Ministry of ecology, sustainable development and energy)	Mercator Océan	Jérôme Chanut
E-AIMS	FP7 – European Commission	Ifremer	E. Dombrowsky, E. Rémy
LOBOS	FP7 - European Commission	SISA, Spot Image	Dominique Obaton
PPR Mercator Vert	PPR Mercator Ocean	LSCE, France	Abdellali Elmoussaoui
PPR SiMED	PPR Mercator Ocean	ENSTA, France	Yann Drilllet
PULSATION	ANR	LOCEAN	Romain Bourdalle-Badie
SANGOMA	FP7	ULG Belgique	Eric Dombrowsky
Thesis on the “Impact of Argo observations for global ocean analysis and forecasting” (Ifremer)	Ifremer / Mercator Ocean	Ifremer	Floriane Ninove
VORTEX	Mercator Ocean / Météo France	Météo France	Lucas Nouel
Previmer	Regional development contract for Brittany (CPER Bretagne)	Ifremer	Pierre Bahurel

THE PROGRAMS

2013

PROGRAMS	SUBJECT	MERCATOR OCEAN CONTRIBUTORS	CONTRIBUTION
EuroGOOS (European Global Ocean Observing Systems)	European association uniting 34 national operational oceanography agencies, dedicated centres or research centres. EuroGOOS members provide operational services or conduct operational oceanography research programmes.	Pierre Bahurel (Board)	European coordination
MOON (Mediterranean Operational Oceanography Network)	EuroGOOS network in the Mediterranean area	Pierre Bahurel	Regional coordination
IBI Roos (Ireland-Biscay-Iberia Regional Operational Oceanographic System)	EuroGOOS network along the Atlantic coast	Jérôme Chanut	Research
NEMO (Nucleus for European Modeling of the Ocean)	Baseline for modelling oceanographic research, operational oceanography, climate research and seasonal forecasts. The NEMO group seeks to improve and develop systems. NEMO has six members, including the CNRS and Mercator Ocean.	Pierre Bahurel (Board) Yann Drillet Clément Bricaud	Coordination and research
Godae OceanView	International coordination to improve ocean analysis and forecasting systems worldwide	Eric Dombrowsky (Co-chair) Nicolas Ferry Fabrice Hernandez	Participation
ICES/WGOOFE (International Council for the Exploration of the Sea / Working Group on Operational Oceanographic Products for Fisheries and Environment)	Working group matching marine resource research needs to operational oceanography capabilities.	Dominique Obaton	Working groups



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Co-auteurs Mercator

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