2014 Mercator Ocean Annual Report

MERCATOR OCEAN
OCEAN FORECASTERS

Contents

Editorial

Pierre Bahurel

2014 kept its European promise and clearly defined the conditions dictating Mercator Ocean's services during the operational phase of Copernicus.

2014 kept its European promise and clearly defined the conditions dictating Mercator Ocean's services during the operational phase of Copernicus. Yet, despite all the scenarios and roadmaps drafted or considered since 2008 with respect to the **Copernicus Marine Environment Monitoring Service**, the year turned up some surprises, requiring us to adapt quickly and rise to the challenge. Just like a competition, marathon or polar expedition, the « home stretch » is equally as important as the previous years of preparation and development.

2014 may be considered as a series of organisational milestones for Mercator Ocean, engaged in a race against time involving key steps for its core business, decisive phases for its organisation, critical periods for its transition and finally painful periods when friends pass away.

This annual report simply describes what has shaped us in 2014 through three closely-related sides of the same prism: **doing** (our activities), **being** (our structure) and **becoming** (our transition).

Doing → Our activities

In 2014, we sought to consolidate our scientific and technical assets in order to meet the expectations of our partners and develop our production capability for both global ocean and reanalysis products. We fleshed out our dual service capability (national and European mandates) by working on the transparency of our two offers and our knowledge of usage. We also initiated partnerships for scientific outreach activities targeting the general public.

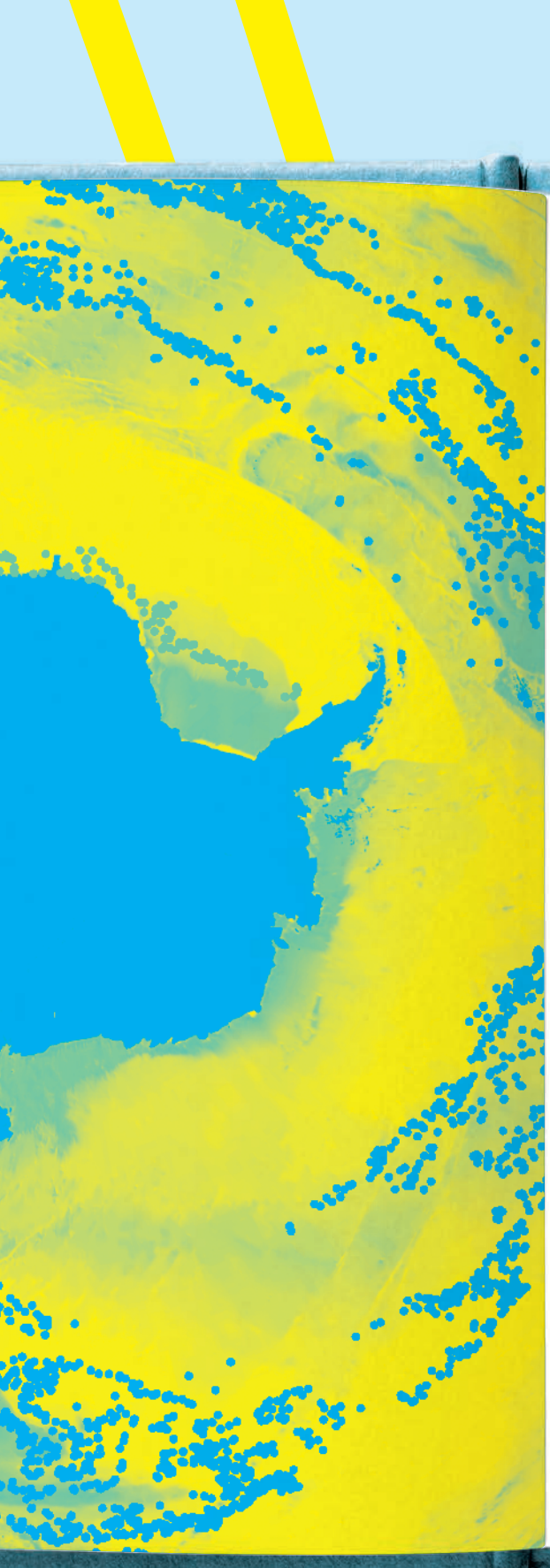
Being → Our structure

To ramp up Mercator Ocean so as to reach in 2015 the performance standards required by the European Union's **Copernicus Marine Service**, we worked on upgrading our team skills, optimising our organisation, consolidating our administrative, legal and financial management and ensuring that all our management processes—especially reporting—were 100% reliable. We maintained our involvement in all the regional, national and international programmes that help raise our profile and reached out to a wide public through Internet communication tools.

Becoming → Our transition

As the coordinator and key scientific and technical partner, Mercator Ocean also had to successfully draw the MyOcean2 contract to a close before defining, in conjunction with the European Commission, a transitional contract under Horizon 2020 to assure continuity of funding and service prior to the Copernicus contract (MyOcean Follow-On). We also had to tender for the operational phase of the **Copernicus Marine Service** then define with the European Commission suitable conditions for this new seven-year phase. This led to the signing of a service delegation agreement on 11 November 2014 for immediate implementation. This contract is of capital importance not only for Mercator Ocean, but for all European operational oceanography players and users. It consolidates the whole marine sector value chain, from satellite and in situ ocean observation infrastructures to public and commercial services adding value to ocean observations, forecasting and analyses.

This annual report is dedicated to our colleague and friend ***Nicolas Ferry.***



Chapter 1

Sentinel of the seas

Achievements in our core business

Since 2013,
R&D has been led by three teams
whose missions are distinct
but whose activities
are closely linked:

➔ Innovation for operational oceanography,

responsible for designing, planning, developing and validating scientific and technical developments in ocean modelling, data assimilation and observation systems.

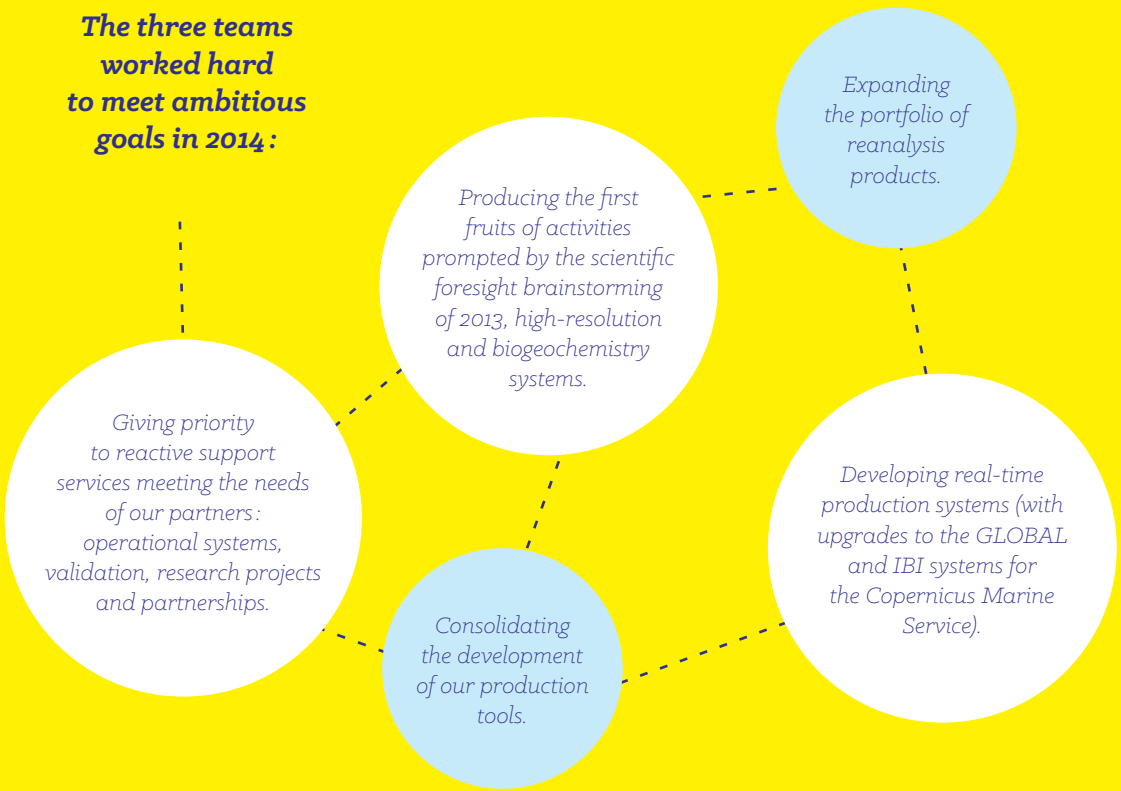
➔ Development of analysis and forecasting systems,

responsible for designing, planning, developing and validating scientific and technical developments in ocean analysis and forecasting systems and making sure they can be transferred to operational systems.

➔ Evaluation of analysis and forecasting systems,

responsible for producing long-term delayed time simulations and guaranteeing the measurement and documentation of the scientific quality of both these delayed time products and real-time Mercator Ocean analysis and forecasting products in terms of reliability and precision.

The three teams worked hard to meet ambitious goals in 2014:



1.1 Helping our shareholders advance

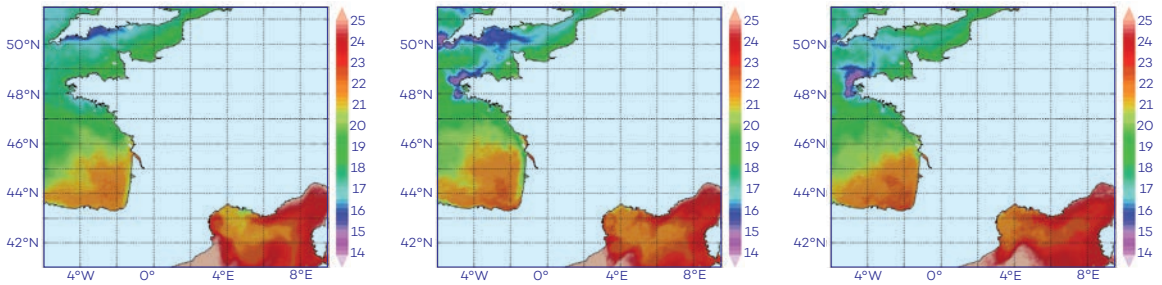
By upgrading our Class 4 scientific qualification tools and developing innovative quality diagnostics in 2014, we were increasing reliability for our shareholders. We also helped them by :

➔ Quality support

Providing quality control support for the Meteo-France « Prévi/mar » team

➔ Investigating anomalies

Conducting a study for Meteo-France in late September to assess the exceptional character of surface temperature anomalies then occurring in the Gulf of Lion. The study was regularly updated through to late 2014 in order to provide input for discussion and communication to several Meteo-France teams, including the CNRM and DCLIM (see illustration).



a. Sea surface Temperature AROME (4-day persistence) - August 2014

b. Sea surface Temperature IBI36 (4-day forcast) - August 2014

c. Sea surface Temperature Observations (L3S MF/CMS) - August 2014

Extract from the preliminary study conducted for Meteo-France to assess the pertinence of using Mercator Ocean Sea Surface Temperature predictions for weather forecasting rather than observed SSTs. The maps are monthly means for August 2014 (a) of the persistence of observed SSTs (OSTIA) seen by AROME on day 4 of the forecast, (b) SSTs predicted by IBI on day 4 of the forecast, and (c) high-resolution SST observations (product L3S of the CMS, Meteo-France). In some areas, it may be seen that IBI36 is more accurate than the persistence, particularly off Brittany, in the Bay of Biscay and in the Mediterranean. IBI36 is too cold in the English Channel and along the Aquitaine coastline. Initial results (not shown) reveal the added value of IBI36, especially for the winter.

➔ Global reanalyses

Pursuing global reanalysis activities (GLORYS) and investigating their impact on the initialisation of seasonal Meteo-France forecasts looking ahead to the future system.

➔ Comparative study 1

Conducting a comparative study of MyOcean and Mercator Ocean products for the Baltic Sea on behalf of SHOM for the monthly Mercator Ocean/SHOM meetings to validate Mercator Ocean systems and the service supplied to SHOM. This report shows the advantages of MyOcean regional products over PSY2 in particular, but also the high quality of PSY2 products for the area through comparison with independent ferrybox data.

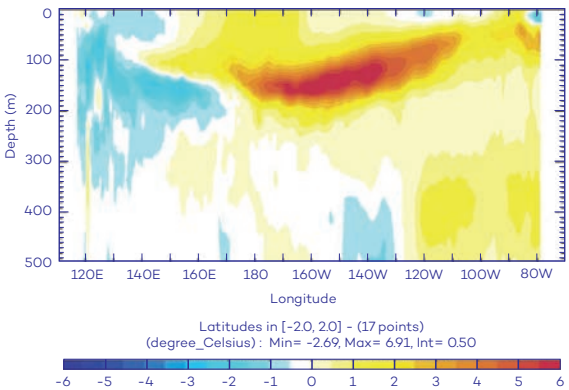
➔ E-AIMS project

Participating in the E-Aims project led by Ifremer
(cf page 15)

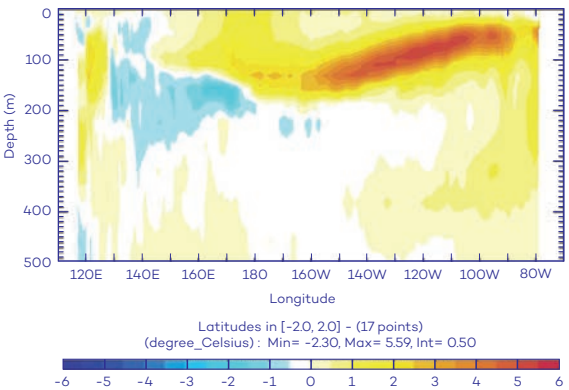
➔ Global Climate Bulletin

Contributing to the Meteo-France Global Climate Bulletin (see illustration).

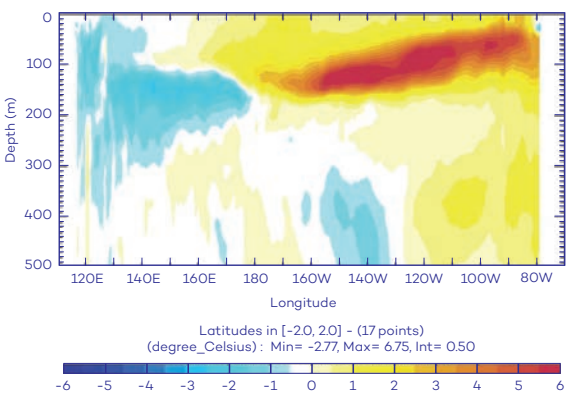
April 1997 - GLORYS2V3 T Anomaly
(ref:GLORYS2V3_75) cross section 2°N–2°S Pacific



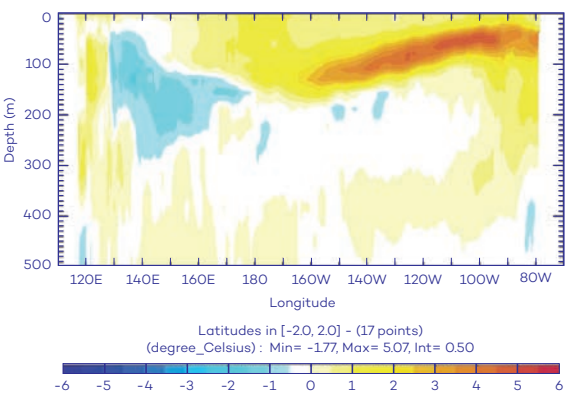
April 2014 - PSY3V3R3 T Anomaly
(ref:GLORYS2V3) cross section 2°N–2°S Pacific



May 1997 - GLORYS2V3 T Anomaly
(ref:GLORYS2V3_75) cross section 2°N–2°S Pacific



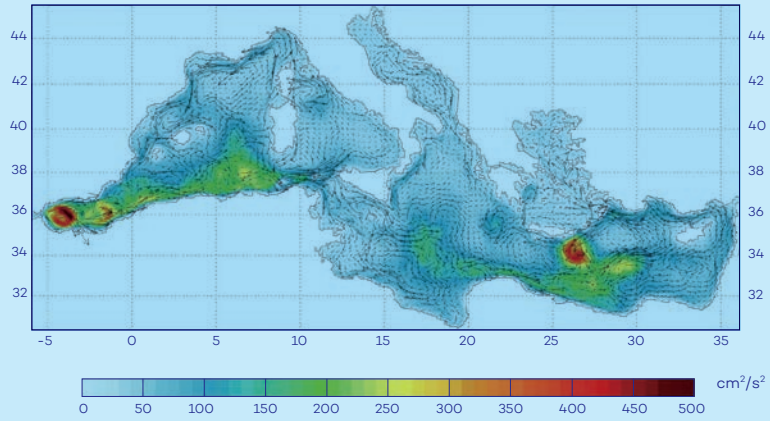
May 2014 - PSY3V3R3 T Anomaly
(ref:GLORYS2V3) cross section 2°N–2°S Pacific



In April 2014, an unusually large downwelling Kelvin wave crossed the equatorial Pacific, giving rise to intense speculation about the likelihood of an El Niño event in the winter of 2014-2015. As part of Mercator Ocean's expert support for Meteo-France's Global Climate Bulletin, and in particular the seasonal forecasts, Mercator Ocean compared this event with the development of the 1997-1998 El Niño episode using a GLORYS2V3 reanalysis (1992-2012), of which this figure is an extract. It shows that the amplitude of the April 2014 wave is similar to that observed in April 1997. However, in 1997, the signal remained strong in the month following its occurrence, whereas in 2014, the anomaly in May was already weaker than the previous month.

➔ HyMeX project

Contributing to HyMeX (Hydrological cycle in the Mediterranean Experiment), a study led by CNRS and Meteo-France. Mercator Ocean provides real-time analyses and forecasts during observation campaigns but also during the analysis of observations made. Mercator Ocean is also contributing to the ocean modelling part by helping develop the NEMOMED12 1/12° model and using this configuration to produce simulations and reanalyses (see illustration.)



This figure, taken from the MEDRYS1V2 reanalysis product generated and validated in 2014 (Hamon et al, in preparation), shows mean circulation at 40m in the Mediterranean for 1992-2013. This reanalysis is the result of cooperation between Mercator Ocean and Meteo-France (ARPERA high-resolution atmospheric forcing) under the MISTRALS umbrella programme (Mediterranean Integrated STudies at Regional and Local Scales) which includes HyMeX, MERMeX and ChArMEx among others.

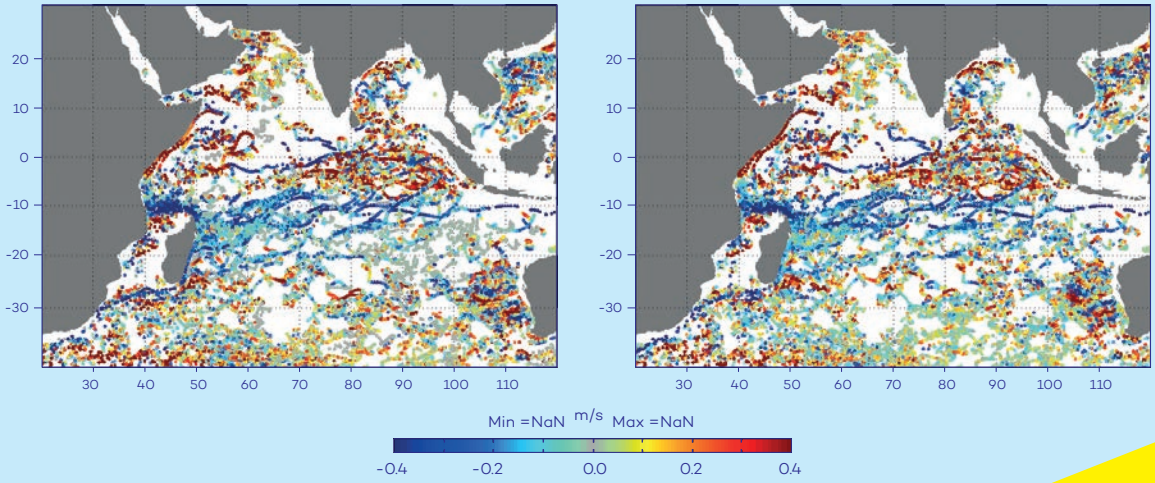
➔ AMICO project

Participating in AMICO, a project on operational integrated modelling for coastlines funded by the French Ministry of Ecology, Sustainable Development and Energy that was initiated in 2013 on the basis of three activities respectively led by LEGOS, MIO and LOS.

➔ Comparative Study 2

Zonal velocity of obs U drifts in 2013

Zonal velocity of model U drifts in 2013



In 2014, SHOM enquired about the quality of Mercator Ocean's data on surface currents in the Indian Ocean. This figure is an extract from the subsequent dedicated study. It shows the current measurements from SVP drifting buoys, the currents deduced from surface movement of ARGO floats (YoMaHa'07) (a) for comparison with modelled Mercator Ocean surface currents (b).
http://apdrc.soest.hawaii.edu/projects/yomaha/yomaha07/YoMaHa070612.pdf

1.2 Evolution of the global forecasting system

The global forecasting system processes the physical and marine biogeochemistry components.

PISCES model

The second component is based on the PISCES ¼° model forced offline by a ¼° physical model integrating the abovementioned observations. There is currently no data assimilation scheme for the biogeochemical model.

NEMO model

The first component is based on the NEMO 1/12° physical ocean model (see illustration 8) which integrates, through the SAM2 data assimilation scheme, satellite-derived sea level and surface temperature observations in addition to *in situ* observations of vertical temperature and salinity profiles.

2014 was dedicated to various R&D activities designed to resolve the imperfections identified in the different systems currently in operation. They included the assimilation of new observations, such as surface velocity and ice concentrations, and essential parametrisation of vertical mixing parameters, the scheme in use leading to a systematic stratification error in the summer.

Dynamic topography

A new mean dynamic topography taking into account the latest distribution of GOCE (Gravity field and steady-state Ocean Circulation Explorer) and GRACE (Gravity Recovery and Climate Experiment) satellites was also developed. This new product should enhance the general circulation and water mass representation. Finally, the prescription of observation errors being too approximate in assimilation schemes, an adaptive error regulation system was set up.

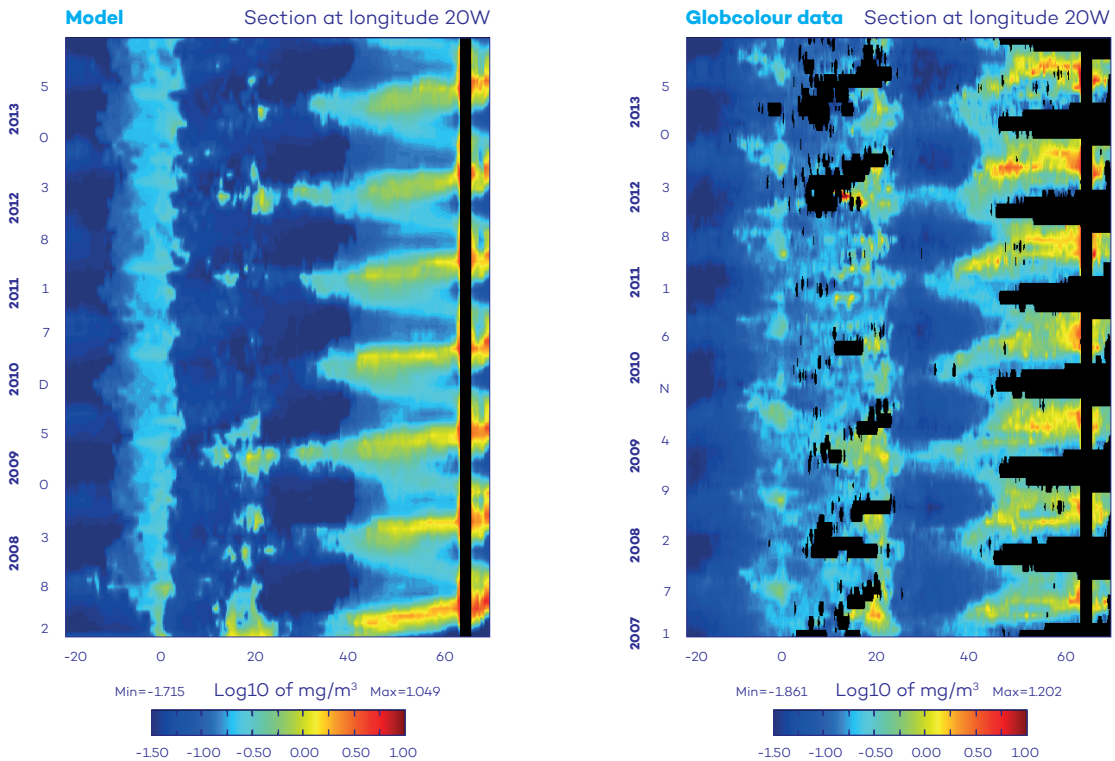
Bio component

For biogeochemistry, the offline operational scenario was improved in terms of both frequency and resolution of the physical/biogeochemical coupling. 2014 was also marked by the release of a ¼° biogeochemistry version. The global configuration at 1/12° continues to evolve, with a release based on a recent NEMO version (NEMO 3.5) stabilised in 2014. This release also includes the 75-level vertical grid and recent parametrisations and numerical schemes such as time splitting or GLS. This configuration will subsequently be used for future updates of forecasting and reanalysis systems.

Relocatable zoom

Development activities continued on the SIREN relocatable zoom tool. The first release was integrated in the NEMO community ocean model code.

Hovmöller diagram of Log10(chlorophyll) between 2007 and 2013 at 20°W in North Atlantic (20°S:70°N).



This illustration is taken from the Quality Information Document (QUID) summarising the validation of BIOMER4 ¼° global biogeochemical products available from the MyOcean catalogue released in June 2014. The interannual variability of surface chlorophyll is correctly captured, even though the blooming in the high latitudes of the northern hemisphere are always one to two months early in BIOMER4. There is also a clear improvement in surface chlorophyll bias in BIOMER4 at ¼° compared to the previous BIOMER1 version which greatly overestimated surface chlorophyll, especially in the equatorial belt.

1.3 Assimilation and impact studies

Progress in line with particular improvement in observation data

SAM2 data assimilation scheme

Mercator Ocean's SAM2 data assimilation scheme is used in most of our operational systems as it offers an optimal combination of ocean observations and model forecasts for analysis purposes.

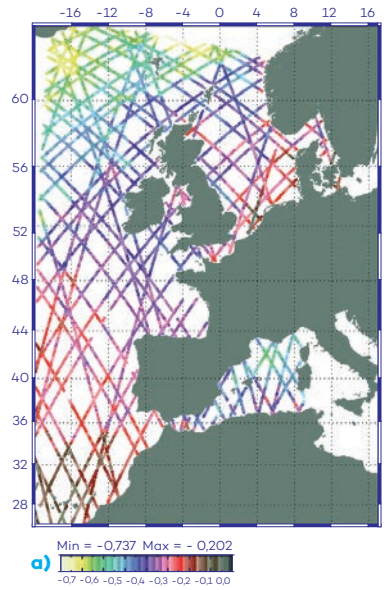
In 2014, SAM2 was widely used for impact studies such as the Observing System Evaluation (OSE) and Observing System Simulation Experiments (OSSE) which entail understanding and analysing the impact of new sources of data for assimilation (whether in situ or satellite data). These studies also provided the opportunity to pass on our specifications to observation agencies.

In 2014, these impact studies concerned:

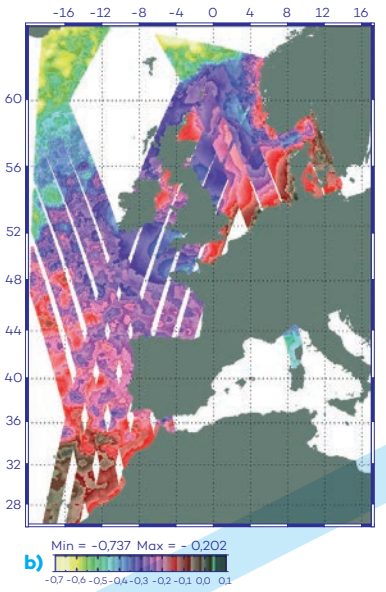
→ future data from the ARGO network as part of the E-Aims project (see page 15)

→ the future French-US Surface Water and Ocean Topography (SWOT) mission in the framework of a CNES contract.

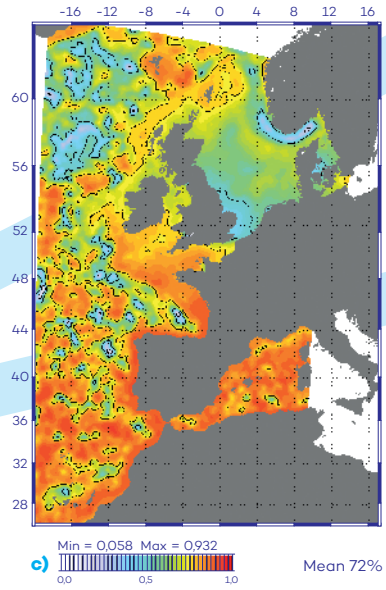
3 satellites

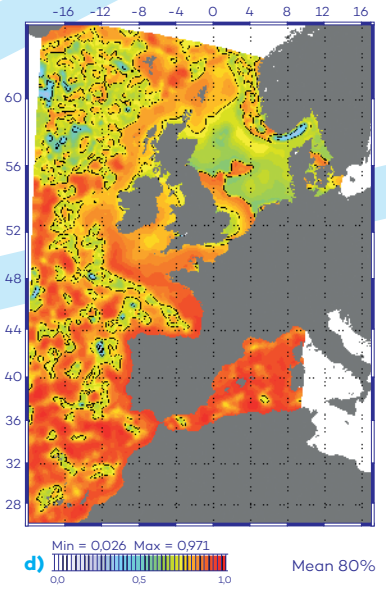


SWOT



Correlation between simulated observations and forecasts





The first experiments laying the groundwork for the assimilation of high-resolution data from SWOT were completed in 2014. Experiments such as OSSE were carried out in the IBI (Iberian, Biscay and Irish) region, simulating observations with a 3-kilometre resolution model (1/36°) then integrating them in a 9-kilometre model (1/12°). This figure shows the satellite coverage of observations over a five-day window with three satellites (a), which may be considered conventional coverage, and with SWOT (b). The initial results (figures c and d) show that assimilating simulated SWOT observations significantly enhances the correlation between observations and forecasts over the whole area. Obtained in an idealised context, these results need to be consolidated by further research using higher resolutions and taking better account of observation errors.

A transitional year for the reanalysis

By simulating the ocean in the past, reanalyses shed light on how the ocean functions

The death of Nicolas Ferry on 5 May 2014 deeply saddened the whole meteorological and oceanographic community. **Nicolas Ferry had been a pillar of ocean reanalysis developments for years**. The team has taken up and pursued his work with courage and determination, completing in 2014:

➔ **Two regional reanalysis products**, MEDRYS (Mediterranean) and IBIRYS (Atlantic coastline), validated under the ENIGME partnership,

➔ **Longer reanalyses** (ERA-Interim period from 1979 to the present) to bridge the gap up to real-time products,

➔ **Reanalysis of the biogeochemistry product** (BIOMER-GLORYS2V3),

➔ **Preparations for a global 1/12° reanalysis.**

➔ **Mercator Ocean's participation in the ERA-CLIM2 project** designed to produce a coupled ocean-atmosphere reanalysis for the 20th century. Mercator Ocean is helping develop both the data assimilation method for oceans and sea ice and the marine biogeochemistry system.

Scientific partnerships with a structural impact

Unceasing commitment as a contribution to international science.

NEMO consortium

Mercator Ocean has been an active player in the NEMO consortium (Nucleus for European Modelling of the Ocean) for several years. In 2014, the NEMO software code (version 3.6) for all the configurations used within Mercator Ocean was standardised. In December 2014, Toulouse hosted the NEMO developers' workshop.

E-AIMS project

Europe's E-AIMS project, coordinated by Ifremer, is currently paving the way for a new generation of Argo floats for the future Copernicus Marine Service, key aspects being dependability, lifetime, data transmission, biogeochemical observations, deep-sea measurements and under-ice operations in polar waters. Mercator Ocean is a project partner, quantifying the impact of the Argo network and its potential upgrades in global analysis and forecasting systems.

CREG

The Canadian Arctic Ocean and Nordic seas configuration (CREG), initiated a few years back and shared with Canadian government scientists, meets the need for a realistic description of the mean state and variability in the Arctic Ocean and adjacent seas. Developed by Canadian teams, this configuration has been coupled with Mercator Ocean's SAM2 data assimilation system. This joint French-Canadian «Arctic platform» has led to enhanced sea ice assimilation methods and reanalysis products covering the area, both of which are laying the foundation for high-resolution global reanalyses. Partnering Environment Canada is fostering the stability of CREG.

French Arctic project

The French Arctic project is a science observatory aiming to brainstorm working methods and find solutions to meet the vital challenges of the Arctic worldwide. Mercator Ocean activities focus on the Arctic Ocean, with a contribution to the ICE ARC (2014-2018) project designed to better understand and quantify the socioeconomic impacts of the rapid melting of Arctic ice. Mercator Ocean is providing uncertainty levels for estimations of sea ice volume and transportation.

The 2012-2013 operational oceanography scientific foresight programme is a key structural element for Mercator Ocean. We focused in 2014 on shaping roadmaps and setting up projects common to various players. The R&D department has geared its medium-term priorities to this forward-looking science programme ***(see page 16).***

Interview with

Bernard Barnier,
GMMC[1] Chairman

The brainstorming in 2013 on future prospects for Mercator Ocean's operational oceanography science activities provided the main thrust for the Mercator Coriolis Mission Group's (GMMC) annual call for tenders. Generally speaking, the call for tenders requires that proposals demonstrate the relevance of projects for operational oceanography and that activities lie within the framework of applied research designed to enhance Mercator Ocean's current analysis and forecasting systems, the CORIOLIS centre, and the development of new-generation systems in line with the future prospects invoked. The call for tenders clearly states its interest in privileged partnership projects (PPR – Projet en Partenariat Renforcé), which are collaborative projects proposed by research teams from different laboratories with the support of Mercator Ocean and/or Coriolis personnel who make a significant contribution. The request process for Argo profiling floats has also been greatly improved.

reviews the « Scientific Foresight » in 2014

Scientific foresight has emphasised a number of priority areas within a broad range of themes as varied as the dynamics of surface layers and coupling with the atmosphere, the global tide, emsemble-based (or probabilistic) data assimilation, the assimilation of future data or current data not yet integrated and observation system simulations (OSSE), global and regional reanalyses, coupled physics/biogeochemistry/biology modelling and the complementarity between the network of Argo floats and satellite observations. In 2015, the GMMC's Scientific Council decided to analyse the scientific foresight recommendations in the context of Mercator Ocean's provision of ***Copernicus services*** *and of the new CORIOLIS agreement, and to strengthen its advisory role for both entities.*

(1) GMMC / GMMC (Groupe Mission Mercator Coriolis): The Mercator Coriolis Mission Group brings together research teams selected each year through a scientific call for tender. The group is designed to undertake any research considered to usefully contribute to the development and/or consolidation of both deep-sea and coastal operational oceanography.
LEFE / Since 2014, the GMMC has formed part of the LEFE programme on fluid envelopes and the environment. LEFE is managed and coordinated by INSU, the French national institute for universe sciences. This programme is implemented by ADEME, the CEA, CNRS, EDF, IRD, MEDDE, CNES, INSU, Ifremer, IPEV, Meteo-France and Mercator Ocean.
(2) CORIOLIS / In situ data centre for measurements taken at sea through continuous, sustainable data collection networks. These observations are made from ships or through autonomous stationary or drifting systems.

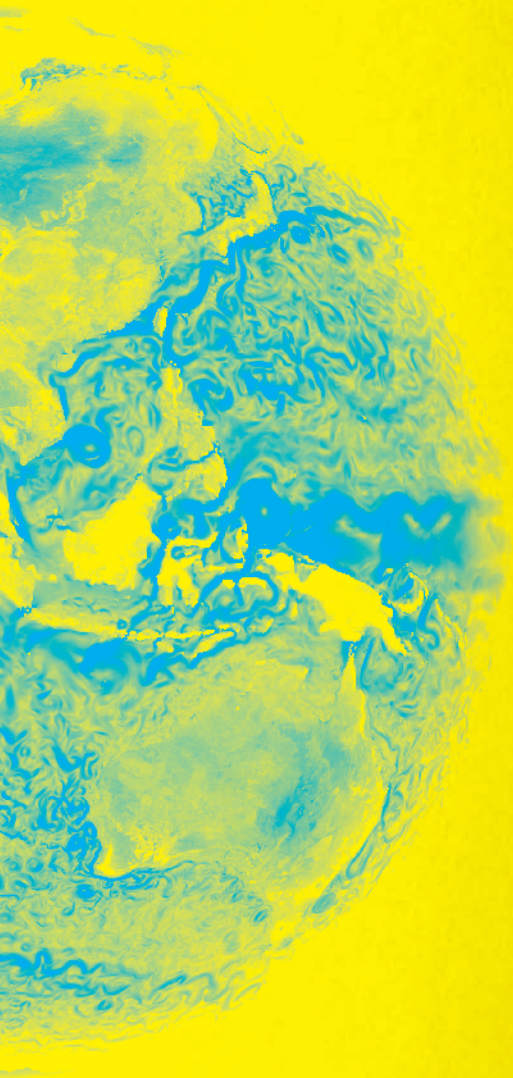
A new dedicated supercomputer

Computer resources are vital for developing our activities.

Ocean20

Thanks to the support of the Information Systems department (DSI) and its cooperation with Meteo-France, Mercator Ocean's R&D and operational production departments benefit from powerful computational equipment geared to its objectives. Looking ahead to global ocean reanalysis at 1/12° using 75 levels, which requires a near-constant occupation of considerable computer power, Mercator Ocean's Information Systems department had issued a call for tenders in autumn 2013 in order to purchase a dedicated supercomputer. Last April, the decision was taken to buy a BULL supercomputer delivering 30 teraflops of power, commissioned in the summer to fulfil its dedicated function.

The high-resolution models developed by Mercator Ocean also require substantial data storage and archiving means. The DSI continues to make use of Meteo-France facilities and has estimated general needs at 2 petabytes for archiving data produced in 2014. A call for tenders was issued in September 2014 to update and dilate our own data storage and archiving space.



Chapter 2

Sharing the oceans

User services : continuity and high performance

2.1 Produce and serve continuously

The Production & Services department is constantly seeking to deliver on time, comply with service commitments, solve problems quickly, remain in touch and provide constant support to our partners and an ever-increasing number of Mercator Ocean and MyOcean service users.

The priority in 2014, more than ever, was service continuity against a background of new products, two changes in the MyOcean service and planned stoppages in the production line.

The challenges of the team in charge of operational production (Operations and Services department) were considerable. In addition to the daily and weekly routine workload to operate and maintain Mercator Ocean's 11 operational systems (see graph 1), the team also:

➔ integrated the global biology model and the high-resolution North-East Atlantic model into the operational sequence at the time of the annual MyOcean service release in April 2014,

➔ prepared all the bespoke products for Mercator Ocean users (see graph 2),

➔ improved the production line integration processes so as to systematically display the quality of production, particularly by developing an automated measurement capability for both technical and scientific performance,

➔ drafted detailed technical information records for potential users,

➔ handled two production line stoppages. Although perfectly planned, these stoppages involved difficult transitions. The first, in the first half of 2014, involved the definitive transition of Mercator Ocean systems from the old Meteo-France computers (shut down) to the first machine of the new Meteo-France supercomputer platform. Later in the year, operational production was switched over to the second Meteo-France machine on the Toulouse-Montaudran site (Espace Clément Ader).

System performance in 2014 (graph 1)

PSY4V2R2

Optimal 98.08
Nominal 0
Degraded 1.92
Ok 98.08

PSY3V3R3

Optimal 100
Nominal 0
Degraded 0
Ok 100

PSY2V4R4

Optimal 100
Nominal 0
Degraded 0
Ok 100

IBI36V4R1

Optimal 100
Nominal 0
Degraded 0
Ok 100

PSY2G3R3

Optimal 98.08
Nominal 0
Degraded 1.92
Ok 98.08

BIOMERV1VR4

Optimal 100
Nominal 0
Degraded 0
Ok 100

PSY4QV2R2

Optimal 96.17
Nominal 2.74
Degraded 1.09
Ok 98.9

PSY3WV3R3

Optimal 99.18
Nominal 0.82
Degraded 0
Ok 100

PSY2QV4R4

Optimal 97.27
Nominal 1.64
Degraded 1.09
Ok 98.9

IBI36QV4R1

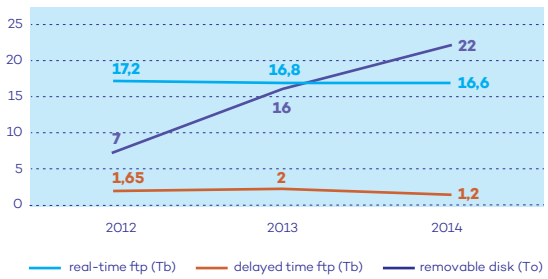
Optimal 80.20
Nominal 12.26
Degraded 7.54
Ok 92.46

Deliveries on the rise

The implementation of first three then four daily real-time systems since 2013 has led to an increase in the volume of data delivered: in 2014, 40 terabytes were distributed (22 for real-time products and 18 for delayed time products, including 13.7 terabytes for GLORYS).

The Service Desk is responsible for relations with Mercator Ocean and MyOcean users. In 2014, the team had to cope with a substantial increase in the services delivered to Mercator Ocean users and in the number of subscribers to MyOcean, requiring both assistance and support:

Data traffic (Tb) (graph 2)



Mercator Ocean bespoke service

101 bespoke services delivered in 2014, including 56 regular services (expert appraisals and «real-time» numerical products) and 45 one-off services (expert appraisals and delivery of «delayed time» numerical products).
Bespoke services accounted for around **10,000 deliveries** in 2014, compared to 7,000 the previous year, an increase of

42%

MyOcean pre-operational service

The MyOcean Service Desk continued to register some 100 to 150 new users per month in 2014, reaching a total of **4,600 subscribers worldwide**, compared to 3,200 in late 2013 i.e. an increase of

43%

Downloads are consequently on the increase.

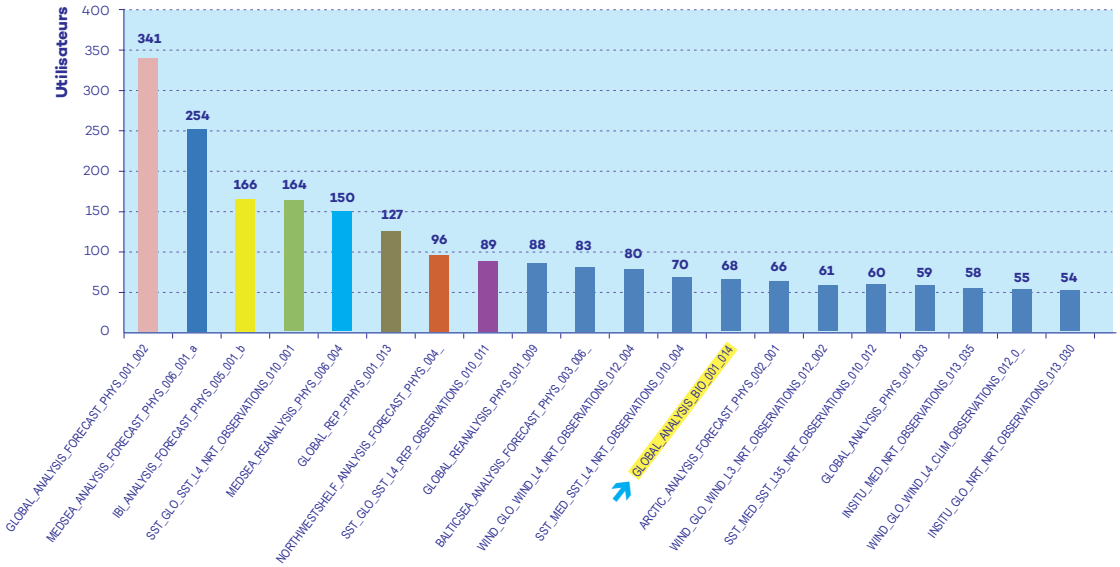
2.2 Identify and target users

The Mercator Ocean products in the April 2014 release of the 124-product MyOcean catalogue are among the most popular, with the daily global product downloaded by 341 users (32 terabytes). The other very popular product is global reanalysis.

A newcomer

The new biology global reanalysis product was added to the catalogue in June 2014 and by December 2014 had already climbed to the 13th most popular download.

MyOcean 2014
Top 20 of the downloaded products



Dedicated extranet

Two of our founding members, Meteo-France and SHOM, have dedicated access to extranet pages offering them a direct, up-to-date view of the services supplied to them.

Meteo-France premium space

420
pages were consulted

281
single visits

Espace premium SHOM

405
pages were consulted

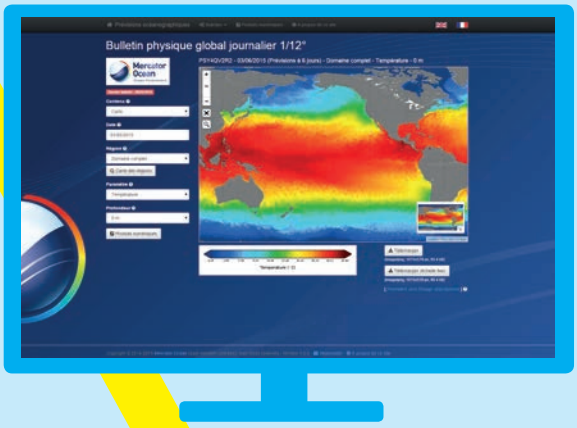
264
single visits

MyOcean User Workshop

Mercator Ocean holds an annual MyOcean User Workshop. It offers users the chance to meet and converse with other MyOcean service users, and gives Mercator Ocean the opportunity of informing them on service developments and listening to their needs. In June 2014, the MyOcean User Workshop was held in partnership with the European Maritime Safety Agency (EMSA), one of the key users of MyOcean in Lisbon. We hosted some 100 users. There was a specific focus on maritime safety, and the Portuguese community were given the opportunity to express their specific needs over the 2-day event. One of the surprises of this workshop was to note how mature MyOcean users are becoming through their participation, with more precise and concrete requests concerning data access, validation and quality in addition to resolution.

A new « Image Bulletin »

In September 2014, the new « Image bulletin » was published for the first time. More user-friendly and more visual, it is open to all users, whether scientists or not. They are « live ocean forecasts ».

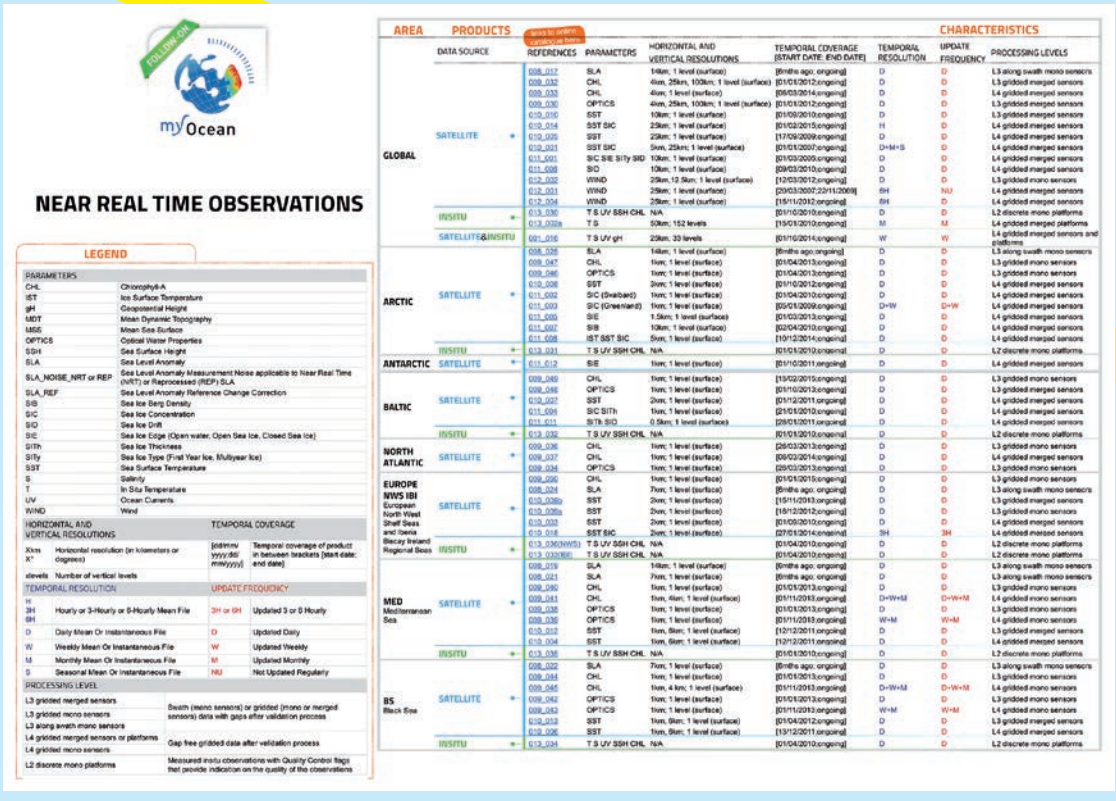


Still on the subject of MyOcean, Mercator Ocean signed a major contract with the International Council for the Exploration of the Sea (ICES) which will exploit our data for fisheries in the North Atlantic.

In order to meet one of the needs expressed during the User Workshop, the Marketing & Communication team worked on a simple, easy-to-use schematic e-tool printable from the MyOcean website, offering users a full overview of all the product specifications through two documents:

➔ diagram of products dedicated to models,
➔ diagram of products dedicated to observations.

This tool will be updated on each service release. Feedback has been very positive.



NEAR REAL TIME OBSERVATIONS

LEGEND

PARAMETERS			
CHL	Chlorophyll-A		
IST	Ice Surface Temperature		
gH	Geopotential Height		
MDT	Mean Dynamic Topography		
MSS	Mean Sea Surface		
OPTICS	Optical Water Properties		
SSH	Sea Surface Height		
SLA	Sea Level Anomaly		
SLA_NOISE_NRT or REP	Sea Level Anomaly Measurement Noise applicable to Near Real Time (NRT) or Reprocessed (REP) SLA		
SLA_REF	Sea Level Anomaly Reference Change Correction		
SIB	Sea Ice Berg Density		
SIC	Sea Ice Concentration		
SID	Sea Ice Drift		
SIE	Sea Ice Edge (Open water, Open Sea Ice, Closed Sea Ice)		
SITh	Sea Ice Thickness		
SITy	Sea Ice Type (First Year Ice, Multiyear Ice)		
SST	Sea Surface Temperature		
S	Salinity		
T	In Situ Temperature		
UV	Ocean Currents		
WIND	Wind		
HORIZONTAL AND VERTICAL RESOLUTIONS		TEMPORAL COVERAGE	
Xkm X°	Horizontal resolution (in kilometers or degrees)	jjdd/mm/yyyy,dd/mm/yyyyyy	Temporal coverage of product in between brackets [start date: end date]
xlevels	Number of vertical levels		
TEMPORAL RESOLUTION		UPDATE FREQUENCY	
H 3H 6H	Hourly or 3-Hourly or 6-Hourly Mean File	3H or 6H	Updated 3 or 6 Hourly
D	Daily Mean Or Instantaneous File	D	Updated Daily
W	Weekly Mean Or Instantaneous File	W	Updated Weekly
M	Monthly Mean Or Instantaneous File	M	Updated Monthly
S	Seasonal Mean Or Instantaneous File	NU	Not Updated Regularly
PROCESSING LEVEL			
L3 gridded merged sensors L3 gridded mono sensors L3 along swath mono sensors		Swath (mono sensors) or gridded (mono or merged sensors) data with gaps after validation process	
L4 gridded merged sensors or platforms L4 gridded mono sensors		Gap free gridded data after validation process	
L2 discrete mono platforms		Measured in-situ observations with Quality Control flags that provide indication on the quality of the observations	

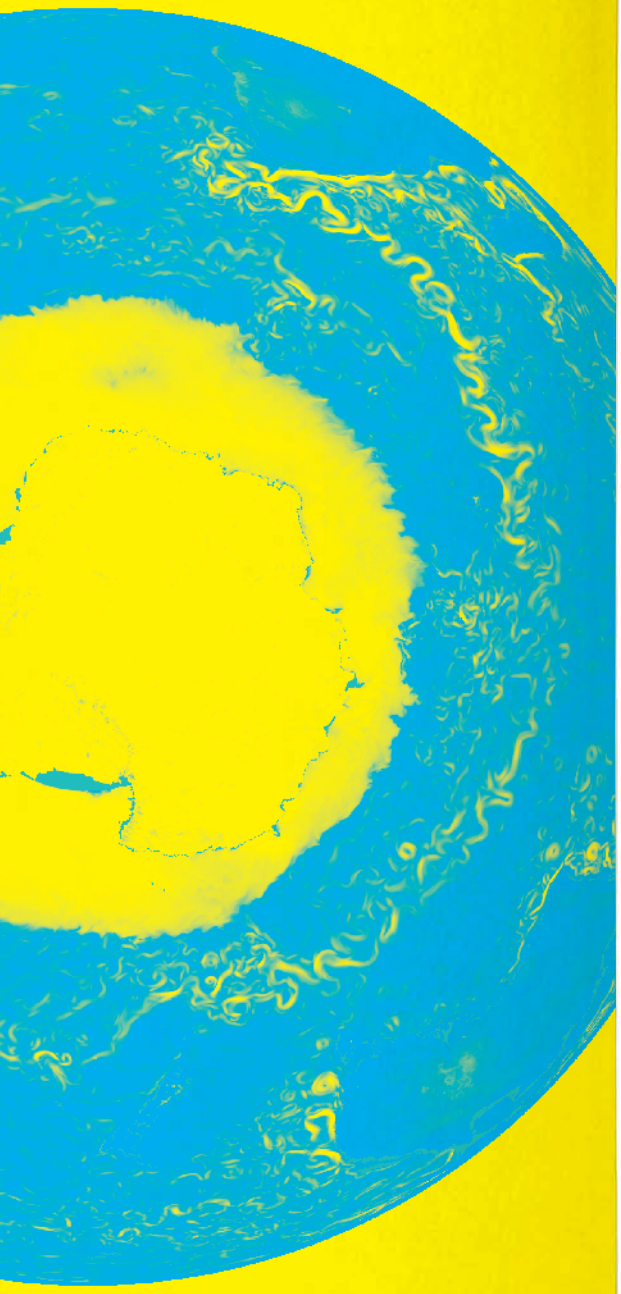
AREA	PRODUCTS			CHARACTERISTICS				
	DATA SOURCE		REFERENCES	PARAMETERS	HORIZONTAL AND VERTICAL RESOLUTIONS	TEMPORAL COVERAGE (START DATE: END DATE)	TEMPORAL RESOLUTION	UPDATE FREQUENCY	PROCESSING LEVELS
GLOBAL	SATELLITE	+	008_017	SLA	14km; 1 level (surface)	[6mths ago; ongoing]	D	D	L3 along swath mono sensors
			009_032	CHL	4km, 25km, 100km; 1 level (surface)	[01/01/2012;ongoing]	D	D	L3 gridded merged sensors
			009_033	CHL	4km; 1 level (surface)	[06/03/2014;ongoing]	D	D	L4 gridded merged sensors
			009_030	OPTICS	4km, 25km, 100km; 1 level (surface)	[01/01/2012;ongoing]	D	D	L3 gridded merged sensors
			010_010	SST	10km; 1 level (surface)	[01/09/2010;ongoing]	D	D	L3 gridded merged sensors
			010_014	SST SIC	25km; 1 level (surface)	[01/03/2015;ongoing]	H	D	L4 gridded merged sensors
			010_005	SST	25km; 1 level (surface)	[17/09/2009;ongoing]	D	D	L4 gridded merged sensors
			010_021	SST SIC	5km, 25km; 1 level (surface)	[01/01/2007;ongoing]	D+M+S	D	L4 gridded merged sensors
			011_001	SIC SIE SITy SID	10km; 1 level (surface)	[01/03/2005;ongoing]	D	D	L4 gridded merged sensors
			011_008	SID	10km; 1 level (surface)	[09/03/2010;ongoing]	D	D	L4 gridded merged sensors
			012_002	WIND	25km,12.5km; 1 level (surface)	[12/03/2012;ongoing]	D	D	L3 gridded mono sensors
			012_001	WIND	25km; 1 level (surface)	[29/03/2007;22/11/2009]	6H	NU	L4 gridded merged sensors
			012_004	WIND	25km; 1 level (surface)	[15/11/2012;ongoing]	6H	D	L4 gridded merged sensors
	INSITU	+	013_030	T S UV SSH CHL	N/A	[01/10/2010;ongoing]	D	D	L2 discrete mono platforms
			013_030a	T S	50km; 152 levels	[15/01/2010;ongoing]	M	M	L4 gridded merged platforms
	SATELLITE&INSITU		001_016	T S UV gH	25km; 33 levels	[01/10/2014;ongoing]	W	W	L4 gridded merged sensors and platforms
ARCTIC	SATELLITE	+	008_026	SLA	14km; 1 level (surface)	[6mths ago;ongoing]	D	D	L3 along swath mono sensors
			009_047	CHL	1km; 1 level (surface)	[01/04/2013;ongoing]	D	D	L3 gridded mono sensors
			009_046	OPTICS	1km; 1 level (surface)	[01/04/2013;ongoing]	D	D	L3 gridded mono sensors
			010_006	SST	2km; 1 level (surface)	[01/10/2012;ongoing]	D	D	L4 gridded merged sensors
			011_002	SIC (Bwbanc)	1km; 1 level (surface)	[01/04/2010;ongoing]	D	D	L4 gridded merged sensors
			011_003	SIC (Greenland)	1km; 1 level (surface)	[05/01/2009;ongoing]	D+W	D+W	L4 gridded merged sensors
			011_005	SIE	1.5km; 1 level (surface)	[01/03/2013;ongoing]	D	D	L4 gridded merged sensors
			011_007	SIB	10km; 1 level (surface)	[02/04/2010;ongoing]	D	D	L4 gridded merged sensors
			011_008	IST SST SIC	5km; 1 level (surface)	[10/12/2014;ongoing]	D	D	L4 gridded merged sensors
	INSITU	+	013_031	T S UV SSH CHL	N/A	[01/01/2012;ongoing]	D	D	L2 discrete mono platforms
ANTARCTIC	SATELLITE	+	011_012	SIE	1km; 1 level (surface)	[01/10/2011;ongoing]	D	D	L4 gridded merged sensors
BALTIC	SATELLITE	+	009_049	CHL	1km; 1 level (surface)	[15/02/2015;ongoing]	D	D	L3 gridded mono sensors
			009_048	OPTICS	1km; 1 level (surface)	[01/10/2012;ongoing]	D	D	L3 gridded mono sensors
			010_027	SST	2km; 1 level (surface)	[01/12/2011;ongoing]	D	D	L4 gridded merged sensors
			011_004	SIC SITh	1km; 1 level (surface)	[21/01/2012;ongoing]	D	D	L4 gridded merged sensors
			011_011	SITh SID	0.5km; 1 level (surface)	[28/01/2011;ongoing]	D	D	L4 gridded merged sensors
	INSITU	+	013_032	T S UV SSH CHL	N/A	[01/01/2010;ongoing]	D	D	L2 discrete mono platforms
NORTH ATLANTIC	SATELLITE	+	009_036	CHL	1km; 1 level (surface)	[26/03/2013;ongoing]	D	D	L3 gridded mono sensors
			009_037	CHL	1km; 1 level (surface)	[09/02/2014;ongoing]	D	D	L4 gridded merged sensors
			009_034	OPTICS	1km; 1 level (surface)	[29/03/2013;ongoing]	D	D	L3 gridded mono sensors
EUROPE NWS IBI European North West Shelf Seas and Iberia Biscay Ireland Regional Seas	SATELLITE	+	009_050	CHL	1km; 1 level (surface)	[01/01/2015;ongoing]	D	D	L3 gridded mono sensors
			009_024	SLA	7km; 1 level (surface)	[6mths ago; ongoing]	D	D	L3 along swath mono sensors
			010_008b	SST	2km; 1 level (surface)	[15/11/2013;ongoing]	D	D	L3 gridded merged sensors
			010_006a	SST	2km; 1 level (surface)	[18/12/2012;ongoing]	D	D	L4 gridded merged sensors
			010_003	SST	2km; 1 level (surface)	[01/09/2010;ongoing]	D	D	L4 gridded merged sensors
			010_018	SST SIC	2km; 1 level (surface)	[27/01/2014;ongoing]	3H	3H	L4 gridded merged sensors
	INSITU	+	013_030(NWS)	T S UV SSH CHL	N/A	[01/04/2010;ongoing]	D	D	L2 discrete mono platforms
			013_030(IBI)	T S UV SSH CHL	N/A	[01/04/2010;ongoing]	D	D	L2 discrete mono platforms
MED Mediterranean Sea	SATELLITE	+	008_019	SLA	14km; 1 level (surface)	[6mths ago; ongoing]	D	D	L3 along swath mono sensors
			008_021	SLA	7km; 1 level (surface)	[6mths ago; ongoing]	D	D	L3 along swath mono sensors
			009_060	CHL	1km; 1 level (surface)	[01/01/2013;ongoing]	D	D	L3 gridded mono sensors
			009_041	CHL	1km, 4km; 1 level (surface)	[01/11/2013;ongoing]	D+W+M	D+W+M	L4 gridded mono sensors
			009_038	OPTICS	1km; 1 level (surface)	[01/01/2013;ongoing]	D	D	L3 gridded mono sensors
			009_036	OPTICS	1km; 1 level (surface)	[01/11/2013;ongoing]	W+M	W+M	L4 gridded mono sensors
			010_012	SST	1km, 6km; 1 level (surface)	[12/12/2011;ongoing]	D	D	L3 gridded merged sensors
			010_004	SST	1km, 6km; 1 level (surface)	[12/12/2011;ongoing]	D	D	L4 gridded merged sensors
	INSITU	+	013_035	T S UV SSH CHL	N/A	[01/01/2010;ongoing]	D	D	L2 discrete mono platforms
BS Black Sea	SATELLITE	+	008_022	SLA	7km; 1 level (surface)	[6mths ago; ongoing]	D	D	L3 along swath mono sensors
			009_044	CHL	1km; 1 level (surface)	[01/01/2013;ongoing]	D	D	L3 gridded mono sensors
			009_045	CHL	1km, 4 km; 1 level (surface)	[01/11/2013;ongoing]	D+W+M	D+W+M	L4 gridded mono sensors
			009_042	OPTICS	1km; 1 level (surface)	[01/01/2013;ongoing]	D	D	L3 gridded mono sensors
			009_043	OPTICS	1km; 1 level (surface)	[01/11/2013;ongoing]	W+M	W+M	L4 gridded mono sensors
			010_013	SST	1km, 6km; 1 level (surface)	[01/04/2012;ongoing]	D	D	L3 gridded merged sensors
			010_026	SST	1km, 6km; 1 level (surface)	[13/12/2011;ongoing]	D	D	L4 gridded merged sensors
	INSITU	+	013_034	T S UV SSH CHL	N/A	[01/04/2010;ongoing]	D	D	L2 discrete mono platforms

Overview of the MyOcean in situ products.

For a service ever closer to users and in order to build up a real MyOcean community, the Marketing & Communication team initiated a collaborative forum in March 2014. The service desk helps moderate the forum when addressing scientific or technical issues.

By late 2014, **2,400 users** were participating with nearly **22,000 pages consulted**.

Screenshot of the MyOcean collaborative forum web page
(forum.marine.copernicus.eu)



Chapter 3

Across the seas

Towards delegation of the european marine service

Since 2009,

the MyOcean projects funded by the European Union's R&D framework programmes (FP7, Horizon 2020) have aimed to show the relevance and feasibility of a European Copernicus Marine Service around 2014-2015.

Finalising the project stage

In 2014, as the deadline approached, it became particularly important for the MyOcean2 project to fulfil expectations and meet all its objectives, including the annual service release in April 2014. The coordination of these activities, the collection of contributions from all 59 partners and exchanges with the European Commission led to a particularly intense workload, especially with concomitant preparations for the ultimate project, MyOcean Follow-on, kicked off in September 2014 shortly after the MyOcean Science Days, attended by the MyOcean consortium scientists.

Our roadmaps and organisational projects were suddenly subject to a paradigm shift in the first quarter of 2014, requiring rapid adjustments.

The proposal

The **Marine Service** is one of six services proposed by the EU's Copernicus programme. After approving Copernicus regulations and attributing a large budget within the EU 2014-2020 Financial Framework, the European Commission had to select **Copernicus service** operators. Three of the services—including the Marine Service—were chosen on the basis of a call for expressions of interest issued in January 2014.

An unexpected selection process

For the **Marine Service,** there was only one response to this call for expressions of interest—that of the ECOMF consortium (European Centre for Ocean Monitoring and Forecasting), coordinated by Mercator Ocean. The consortium comprises 14 national organisations, most of which are key institutional players in the MyOcean projects, having expressed through a Memorandum of Understanding signed in 2012 their desire to form a European structure to provide the **Copernicus Marine Service**.

However, in March 2014, the European Commission decided to propose negotiations for a delegation agreement not to the ECOMF consortium but to Mercator Ocean alone.

This decision, accompanied by the requirement that Mercator Ocean become more European—a move approved by its partners—mainly sought to foster open competition for the **Marine Service** components not supplied by Mercator Ocean (the vast majority).

Following this decision, over half of 2014 was therefore spent, against all expectations, in negotiating a delegation agreement with the EU. These negotiations covered in particular the administrative and legal aspects of the contract, the technical appendix which defines the scope and content of the tasks and activities expected of Mercator Ocean, and the associated budgets. Once approved by the European Commission, the delegation agreement on setting up the **Marine Service** was signed on 11 November 2014 by Daniel Calleja Crespo, Director General of DG GROW (Internal Market, Industry, Entrepreneurship and SMEs) and Pierre Bahurel, Director of Mercator Ocean.

Through this agreement, the European Union delegates to Mercator Ocean the commissioning and operation of the **Copernicus Marine Service** up to March 2021. Mercator Ocean will have to manage a budget of €144 million, three-quarters of which will be outsourced following competitive selection.

11 Novembre 2014,
Signing of the delegation agreement.
Right to left: Daniel Calleja Crespo, Director General of the European Commission's DG « GROW », and Pierre Bahurel, Director of Mercator Ocean and Coordinator of the MyOcean project.

This agreement, of capital importance not only for Mercator Ocean but also for all the players and users of European operational oceanography, consolidates the whole value chain, from the space segment and in situ observation resources to public services and sellers adding value to these observations.

Interview with

Virginia Puzzolo,
(EC REA Officer)
Viewpoint of a reviewer appointed by the European Commission to examine MyOcean projects

As the reviewer in charge of investigating the MyOcean Follow-On project, my job was to monitor and ensure on behalf of the European Commission that the project was proceeding as planned so as to guarantee that all the activities underway were in keeping with the contractual obligations and functional expectations of the ***Copernicus Marine Service****. The exceptional results already obtained during the previous MyOcean and MyOcean2 projects were confirmed by MyOcean Follow-On: reliable operational services and high-quality oceanographic products of the physical ocean and its biogeochemical aspects.*

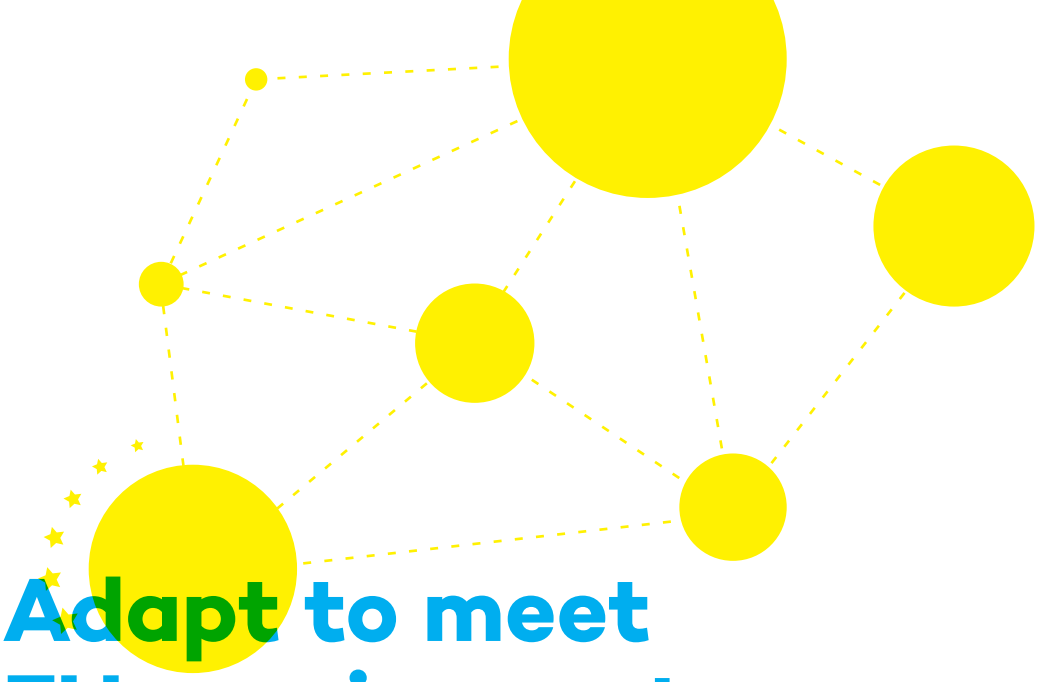
Representatives of the MyOcean2 project
(kick-off at Brussels)

The robust project engineering and high-tech scientific approach of the MyOcean Follow-On teams allowed them to meet the very high level of requirements in both quality and operational terms. The excellent results and performance of this major consortium are due to the close coordination of Mercator Ocean and the tangible involvement of all its teams over the years.

Chapter 4

4 Ocean promises

Key structural changes



Adapt to meet EU requirements

Mercator Ocean had to make the transition in early 2014 from coordinator of a collegial structure to an entity acting on its own behalf.

A huge project

Mercator Ocean aims for universal excellence, whether in scientific, operational or management domains. The administrative and financial management teams rose to the challenge, making one of the most crucial contributions of the year by laying the foundations for managing both the financial and human resources aspects of an EU service.

Administrative management

Early in the year, tools for measuring and communicating management information to in-house executives were developed, tested and made reliable. At the same time, the Information Systems department lent its support to tailor the ERP management system, which became fully automated in the first quarter of 2015.

Human resources

To assist with future changes, the Administration and Finance department began working on the management of jobs and skills ("GPEC" project), so as to match Mercator Ocean's human resources to needs arising from the European service. Job descriptions were reviewed and audited. The tasks of each person were mapped, including projections concerning the end of MyOcean (reduction or stoppage of certain activities) and the beginning of tasks related to the **Copernicus Marine Service** (new responsibilities, new skills). In September 2014, an action plan was drawn up to support and smooth the transfer of competencies and define new profiles. A new structure will emerge for 2015.

From proposal to deployment

The finance management team also brought its legal, fiscal and financial expertise to bear throughout the process of structuring and deploying the **Copernicus Marine Service** delegation. It thus helped with Mercator Ocean's response to the call for expressions of interest in January, the European Commission selection process in March, a management audit (see box) and prepared calls for tenders.

Interview with

Lydie Marty,
Director of Mercator Ocean's Administration and Finance department

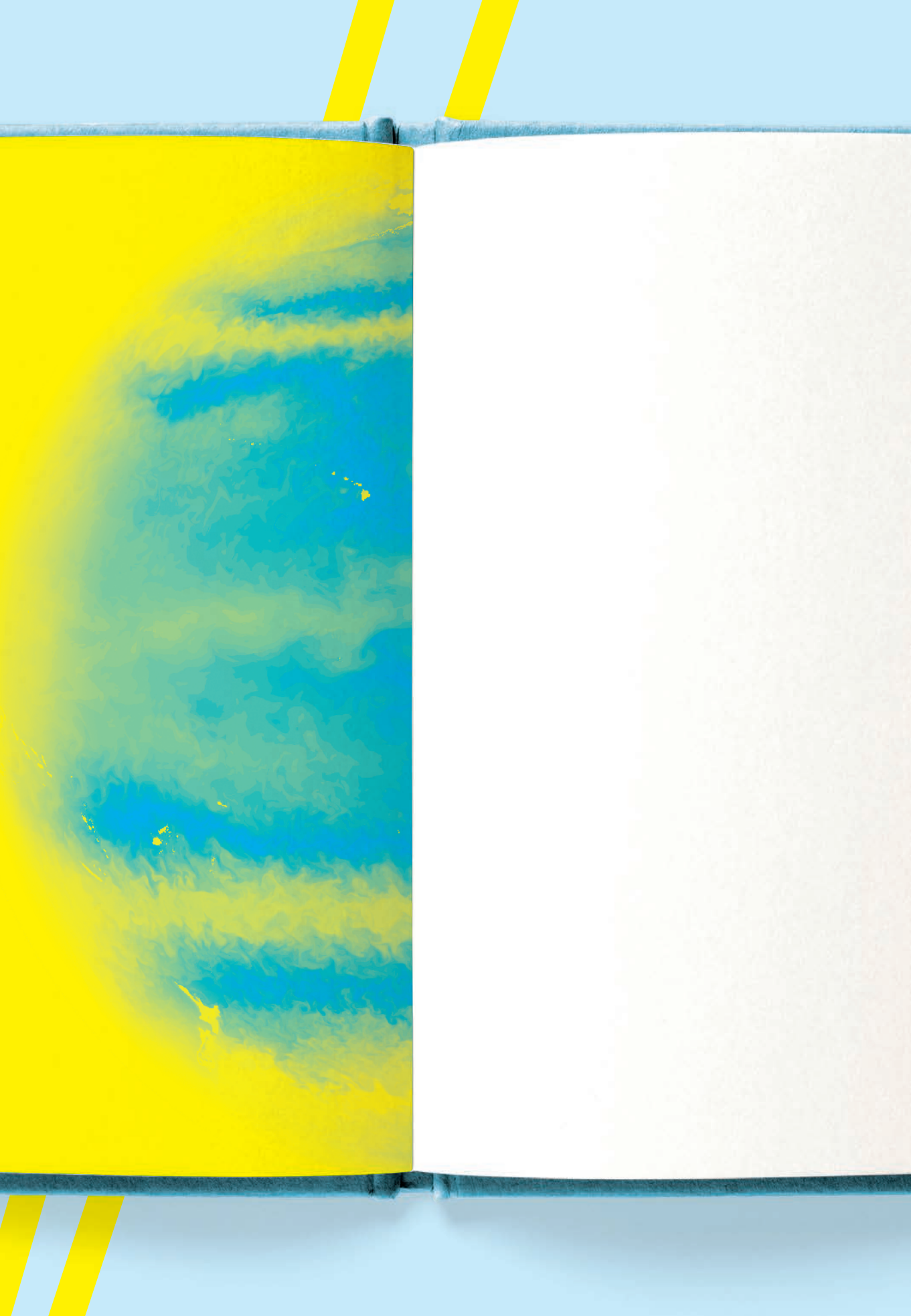
A high-risk audit

« Mercator Ocean's application inevitably led to an audit. In May 2014, the European Commission and auditors PwC gave us ten days' notice.

We were subject to a new audit scheme enforced by the European Commission whereby the auditor has to issue an opinion on Mercator Ocean's ability to fulfil the delegation correctly. The risks were very real. The audit covered management in its broadest sense and its four pillars—accounting system, purchases, in-house quality control and external control.

The auditors spent close to one month on the premises to thoroughly examine everything.

Their opinion, formulated early in the summer, was positive, with 'only' 13 recommendations on in-house control (a figure much lower than the standards). All 13 were implemented within three months. »



Chapter 5

Stella maris*

**starfish in latin language*

Raising mercator ocean's profile worldwide

All Mercator Ocean partners are its ambassadors, raising its profile in France and abroad in scientific, institutional and economic arenas.

Operational oceanography, a national and regional presence

The delegation agreement signed by Mercator Ocean and the European Commission is the result of over 20 years of constant investments by French institutions in the human resources and infrastructures needed to construct and consolidate operational oceanography. In addition to its European and global scope, and because Mercator Ocean is headquartered in Toulouse, the **Copernicus Marine Service** is a showcase for all the regional and national players involved in these activities.

A showcase for the region

Local authorities, and particularly the Midi-Pyrenees Regional Council and Toulouse Métropole, have been and remain today contributors to this success by their long-term support in shaping this regional industry. The European and indeed global dimension of the **Copernicus Marine Service** is also helping to spread the renown of these regions abroad.

National coordination

Mercator Ocean has contributed to the national coordination of Copernicus, supervised by the French Ministry of Higher Education and Research, and the drafting of national viewpoints on this programme in preparation for debates and decisions to be taken within European governance bodies.

European coordination

As a member of the EuroGOOS non-profit organisation, Mercator Ocean supports the community in its efforts to defend the interests of operational oceanography and foster activities, especially in the Mediterranean (MONGOOS), the Ireland-Biscay-Iberia region (IBI-ROOS) and the Arctic (Arctic ROOS). In September 2014, Mercator Ocean attended the seventh EuroGOOS conference in Lisbon on the sustainable development of the «blue economy». The conference also marked the organisation's 20th anniversary.

Two major international partnerships marked 2014 : 5.1

➔ France-Canada

Under the terms of an agreement between Meteo-France and Environment Canada, Mercator Ocean is involved in a cooperative science programme with Environment Canada.

The programme's first progress meeting was held in September 2014. The main focus of this meeting was to exchange mutual tools—the NEMO platform and the SAM data assimilation system—and global and regional Arctic configurations.

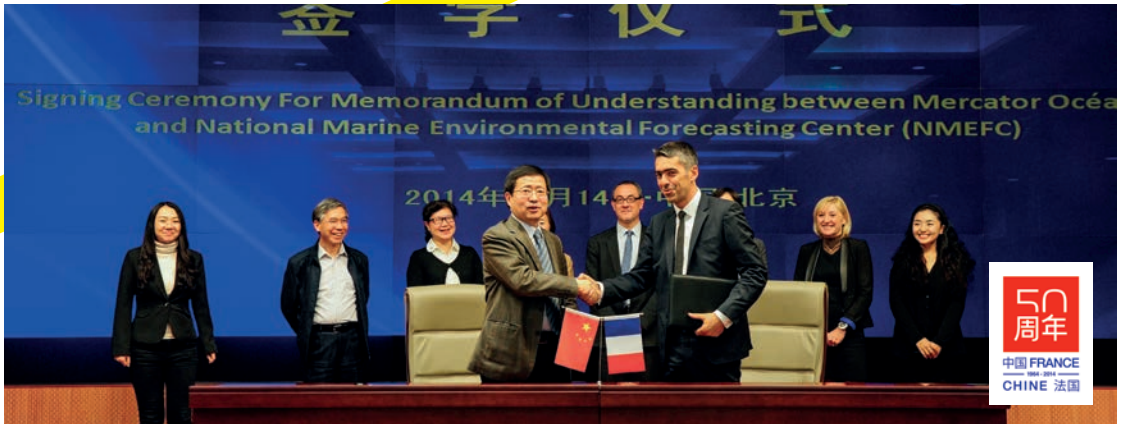
Interview with

Pierre Pellerin,
Research Director, Environmental Numerical Weather Prediction Research, Meteorological Research Division, Environment Canada:
2014 was a critical year for French-Canadian cooperation

2014, a key year for French-Canadian partnership

In 2004, a Canadian committee of interministerial experts recommended the instigation of an international partnership with Mercator Ocean, so as to equip Canada with an operational capability in the realm of global oceanographic forecasting. After 10 years of effort, France and Canada have set up a complementary, robust scientific partnership in the shape of a Memorandum of Understanding on data assimilation and modelling led by Meteo-France and Environment Canada. The Canadian coalition comprises three Ministries: the Environment, Fisheries and Oceans, and Defence.

« We developed a global prediction system geared to the needs of our country on the basis of Mercator Ocean innovations. The Canadian version of the SAM oceanography data assimilation system incorporates a sea surface temperature assimilation component and a sea ice assimilation component developed in Canada. The modelling component also differs slightly from the French version, as the ice model for the Canadian component comes from the Community Ice CodE (CICE). Particular care was taken when developing the system to ensure consistency between the ocean-ice forecasting component and the atmospheric forecasting component. The attention paid to the atmosphere-ocean-ice interface enabled optimal development of an operational coupled system within the Meteorological Service of Canada."



France-China

The signing of a partnership agreement with China's National Marine Environmental Forecasting Centre (NMEFC). Signed on 14 October 2014 during the GODAE OceanView international forum for ocean forecasters, the agreement provides for a bipartite R&D cooperation with expert input from Mercator Ocean on high-resolution global ocean products and expert input from the NMEFC on regional models in the North Pacific and the China Sea. The shared objective is to improve the numerical representation of the ocean and fine-tune the ocean forecasts in this part of the world. The agreement was signed in Beijing by Pierre Bahurel, Director of Mercator Ocean, and Dr Hui Wang, Director of the NMEFC, against a background of 50 years of French-Chinese scientific innovation, led by the MAE. The event was honoured by the presence of the scientific and technological counsel of the French Embassy in Beijing, Mr Norbert Paluch, in addition to official representatives from China's State Oceanic Administration, the NMEFC's supervisory authority.

5.2 Mercator Ocean also participated in various international projects :

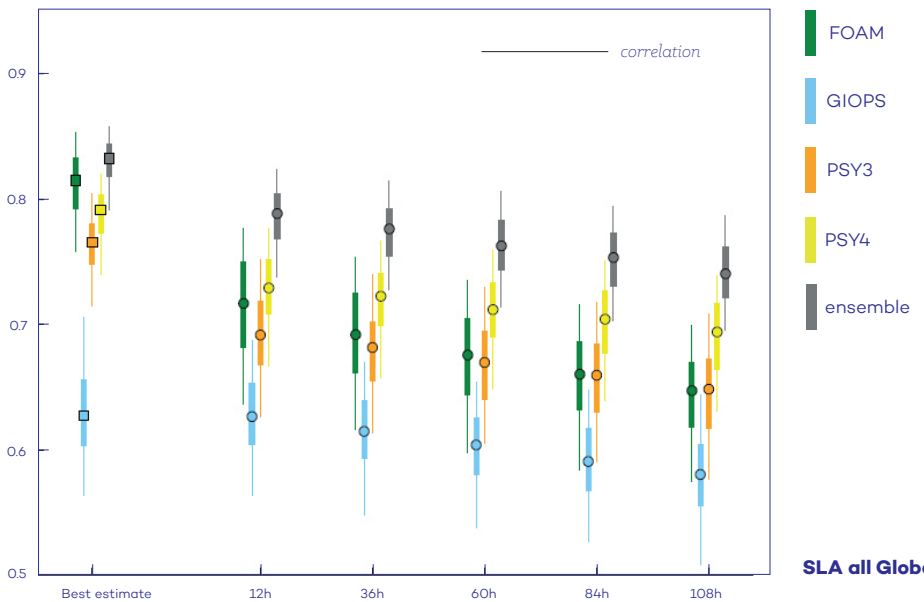
➔ Indonesian seas

Contribution to the development and qualification of INDESO, the regional analysis and ocean forecasting system in Indonesia developed by CLS. Mercator Ocean added the biogeochemical component by coupling the physical and biogeochemical models over a region including Indonesian waters.

Opposite: Elodie Gutknecht and Guillaume Refray, the two Mercator Ocean scientists involved in INDESO

➔ GODAE Ocean View

Involvement in GODAE OceanView, an international network of operational oceanography centres. Mercator Ocean took part in the annual meeting of the GODAE OceanView science team in October 2014, helped coordinate a working group on intercomparison (see illustration) and contributed to the validation of products from systems, participated in the JCOMM Expert Team on Operational Oceanography Forecasting Systems (ET-OOFS), the joint intergovernmental technical committee of the World Meteorological Organisation (WMO) and the International Oceanographic Commission (IOC).



SLA all Global Ocean

«Class 4» diagnostics (terminology coined by Crosnier and Le Provost in 2007) are used as standard validation and intercomparison tools for ocean forecasting both Europe-wide (MERSEA then MyOcean) and worldwide (GODAE). They are used to add to the observation file the equivalent of the observation over time and space, analysed or planned at different deadlines by different forecasting systems. They can also keep persistence for the last analysis in addition to the climatology value so as to construct forecasting scores for comparison between different systems. This is the subject of the publication by Ryan et al (2015, publication accepted in 2014), scientists in GODAE's Intercomparison and Validation Task Team.

This figure, from Ryan et al (2015), shows the anomaly correlation scores for predicted sea level anomalies (SLA) for Mercator Ocean's PSY3 and PSY4 forecasting systems, the UK Met Office's Forecast Ocean Assimilation Model (FOAM) and Canada's Global Ice-Ocean Prediction System (GIOPS). An ensemble product based on the mean of the different systems is also assessed. This shows the advantage of PSY4 for predicting SLA, it being the only one produced on a scale of 1/12° (all the others being at ¼°). The ensemble is used to improve the score, confirming previous results from ocean current analyses (Scott et al, 2012).

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(3) Scott, R. B., N. Ferry, M. Drevillon, C. N. Barron, N. C. Jourdain, J.-M. Lellouche, E. J. Metzger, M.-H. Rio, and O. M. Smedstad, *Estimates of surface drifter trajectories in the equatorial Atlantic: A multi-model ensemble approach,* Ocean Dynamics, 62, 1091-1109, 2012, doi:10.1007/s10236-012-0548-2.

➔ WGOOFE

Participation alongside IFREMER in a working group on operational oceanographic products for fisheries (WGOOPF) under the International Council for the Exploration of the Sea (ICES). The goal is to bring producers of operational oceanography closer to users by trying to interest both French and European users in oceanography products and services,

➔ OSTST

Input to the Ocean Surface Topography Science Team (OSTST), where CNES and NASA organise scientific discussions on altimetry in order to enhance current products and define future missions (like for SARAL and OCAPI missions). In June 2014, Mercator Ocean also took part in the SWOT Science Definition Team.

➔ Visit of the Japan Aerospace Exploration Agency

Mercator Ocean is always pleased to host foreign delegations. In December 2014, the Japan Aerospace Exploration Agency (JAXA) came to visit, resulting in a fruitful exchange of information on satellite data upstream of our production line.

In 2014, Mercator Ocean reached out to two new communities :

➔ CMF

The French maritime community within the French maritime cluster (CMF), of which Mercator Ocean has been a member since November 2014. The goal is to raise our profile among this community of end users and better discern their needs and developments.

Cluster Maritime Français

➔ ECSITE

ECSITE, the community of 350 international organisations in charge of scientific outreach among the general public (with a focus on science parks, museums and the like), always eager to obtain new educational resources. This door gives us broader access to the general public through our visual productions and knowledge-sharing in science centres and parks. In 2014, Mercator Ocean reached out to the general public through various temporary or permanent exhibits in the Cité de l'Espace theme park in Toulouse (300,000 visitors/year), the Toulouse Natural History Museum (240,000 visitors/year) and the Oceanopolis aquarium and theme park in Brest (450,000 visitors/year).

and is capitalising on its expertise through scientific sponsorship and expedition support :

➔ 7th continent expedition

Our contribution to the 7th continent expedition in the North Atlantic off the Sargasso Sea. Not only did we supply current forecasts but our particle drift simulations enabled the expedition to locate areas where it was likely that plastic waste would amass. There was extensive media coverage of these activities in the press, on television and on Internet.

➔ Support for the Tara and Polar Pod expeditions

In 2014, Mercator Ocean began preparing activities to support the Tara and Polar Pod expeditions. The latter includes a joint science project (see box by Jean-Louis Etienne, page 44).

Interview with

Jean-Louis Etienne, expedition leader, explains:

Mercator Ocean to participate in the polar pod expedition's science projects.

The Antarctic Circumpolar Current amasses superlatives, being the longest (25,000 km) and most powerful current on the planet. Driven by the legendary westerly winds, it encircles the Antarctic at a latitude that sailors call the «furious fifties». Just like a drive belt, it connects the waters of the Atlantic, Indian and Pacific Oceans, driving global ocean circulation. Its cold waters are a huge carbon sink for the planet. Although it has a major impact on the climate and is a vast reservoir of marine biodiversity, the Southern Ocean remains largely unknown.

This is the challenge taken up by the Polar Pod, a «vertical» vessel designed to drift with the circumpolar current and fuel scientific research from 2016 on. Like a floating laboratory, the Polar Pod will investigate various scientific research topics, including atmosphere-ocean exchanges. It will also be used to draw up an inventory of fauna by acoustic methods and to validate satellite measurements.

These research topics interest a huge international scientific community. In France, keen interest is shown by the community gathered around Mercator Ocean and its five founding members, key players in operational oceanography and committed to this scientific adventure in the Southern Ocean. According to the simulations carried out by Mercator Ocean and the drift calculations produced by Meteo-France, it should take three years to drift around the Antarctic, so long as the Polar Pod remains in the right current veins, the Antarctic Circumpolar Current being irregular.

Polar Pod investigations will enhance the community's knowledge, and indeed that of all researchers in this polar region of such critical importance to the study of global warming.

5.3 Digital media

Mercator Ocean and MyOcean also raise people's awareness through their digital resources :

Mercator Ocean
Website 2014

+ 7%
vs 2013

Mercator Ocean
FaceBook 2014

+ 39%
vs 2013

+ 60%
vs 2013

MyOcean
Web 2.0 Forum 2014

New
in 2014

MyOcean
Website 2014

+ 79%
vs 2013

2014 Publications

Marina Tonani, Magdalena Balmaseda, Laurent Bertino, Ed Blockley, Gary Brassington, Fraser Davidson, Yann Drillet, Pat Hogan, Tsurane Kurano, Tony Lee, Arichal Mehra, Francis Paranathara, Clemente A. S. Tanajura, Hui Wang, 2014.

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Projects 2014

Projects selected following the LEFE-GMMC 2014 call for tender and kicked off in 2014

GLISEN	Alban LAZAR
PPR Blanc	Christine PROVOST
ENIGME	Guillaume CHARRIA
GERONIMO	Pascal LASURE
SIMBAD	Florian LEMARIE
SIMED-2	Thomas ARSOUZE
Coastal circulation in New Caledonia	Pascal DOUILLET
AMICO-BIO	Christel PINAZO
ENGLOBE	Julien LE SOMMER
DRAKKAR	Bernard BARNIER
	Anne Marie TREGUIER

Projects selected following the LEFE-GMMC 2015 call for tender and to be kicked off in 2015

SAM-NG	Pierre BRASSEUR
MAREMED	Yann OURMIERES
SIMBAD	Florian LEMARIE

Projects involving Mercator Ocean

European FP7 and H2020 funding

- **MyOcean2**
- **MyOcean Follow On**
- **ERA-CLIM2**
- **E-aims**
- **ICE ARC**

ANR funding

- **REMEMBER**
- **PULSATION**

Other funding

- **AMICO**

Acronyms glossary

ArcticROOS
Arctic Regional Ocean Observing System

ARGO
Argo is a system for observing temperature, salinity, and currents in the Earth's oceans.

AROME
Small scale atmospheric prediction model operated by Meteo-France

CMF
French Maritime Cluster CMS, Météo-France Space Meteorology Centre of Meteo-France

CNRM
National Centre for Meteorological Research at Meteo-France

COPERNICUS
EU Space programme managed by the European Commission for monitoring the Earth.

CORIOLIS
The Coriolis Data Centre handles operational oceanography measurements made in situ, complementing the measurement of the ocean surface made using instruments aboard satellites.

CREG
The Canadian Arctic Ocean and Nordic seas configuration

DCLIM
Direction of the Climatology at Meteo-France

E-Aims
Euro-Argo Improvement project for the Copernicus Marine Service

ECSITE
The European network of science centres and museums

ERA-CLIM2
ERA-CLIM2 project is to apply and extend the current global reanalysis capability in Europe, in order to meet the challenging requirements for climate monitoring, climate research, and the development of climate services.

ERP
Enterprise Resource Planning (business management software

ET-OOFS
The Expert Team for Operational Ocean Forecast Systems has an intergovernmental mandate through JCOMM to provide coordination of activities at operational agencies.

EU
European Union
EuroGOOS
International Non-Profit Association of national governmental agencies and research organisations, committed to European-scale operational oceanography within the context of the intergovernmental Global Ocean Observing System (GOOS).

FP7
EU's 7th Framework Programme for Research and Technological Development (2007-2013).

GLOBAL (system)
Mercator Ocean operational forecasting system covering all the oceans of the globe.

GLORYS
Global Ocean reanalysis

GMMC
Groupe Mission Mercator Coriolis (GMMC) rassemble des équipes de recherche sélectionnées chaque année par appel d'offre scientifique. Le groupe a vocation à entreprendre toute activité de recherche jugée utile au développement et/ou au renforcement de l'océanographie opérationnelle hauturière et côtière.

GODAE Ocean View
GODAE OceanView is the continuation of the Global Ocean Data Assimilation Experiment (GODAE) from 2009 onwards.

Horizon 2020
Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020).

Hymex
Hydrological cycle in the Mediterranean eXperiment

IBI36
Mercator Ocean operational forecasting system in the Iberian Biscay Irish area with a resolution of 1/36° (~2 km)

IBI ROOS
Ireland-Biscay-Iberia Regional Operational Oceanographic System.

ICE ARC
EU FP7 project : «Ice, Climate, Economics - Arctic Research on Change»

ICES
The International Council for the Exploration of the Sea

INDESO
Infrastructure Development of Space Oceanography, INDESO is a scientific program led by CLS aiming at providing the Indonesian Ministry of Fisheries and Maritime Affairs with the technologies, know-how and actions to ensure the long term preservation of the country's fishing capacities and ecosystems.

JCOMM
Joint Technical Commission for Oceanography and Marine Meteorology (WMO/IOC) : Worldwide marine meteorological and oceanographic communities working in partnership in order to respond to interdisciplinary requirements for met/ocean observations, data management and service products.

LEFE
Fluid Envelop and Environment, program coordinated by the INSU (National Institute for Sciences of Universe).

MONGOOS (now MedGOOS)
The Mediterranean Global Ocean Observing System

NEMO
Nucleus for European Modelling of the Ocean, NEMO is a state-of-the-art modeling framework for oceanographic research, operational oceanography seasonal forecast and climate studies.

NMEFC
National Marine Environmental Forecasting Centre of China

OCAPI
Geostationary Ocean colour sensor (Ocean Color Advanced Permanent Imager)

OSTIA
The Operational Sea Surface Temperature and Sea Ice Analysis system (NCOF-UK) produces a high resolution analysis of the current sea surface temperature (SST) for the global ocean.

OSTST
Ocean Surface Topography Science Team

Prévi/mar
Service in charge of Marine Forecast at the Operational Forecast Direction of Meteo-France

PSY
Prototype System. Name Root of a few Mercator Ocean operational systems

REA
Research European Agency

SAM
Assimilation system developped by Mercator Ocean

SARAL
Satellite with ARgos and ALtiKa is a cooperative altimetry technology mission of Indian Space Research Organisation (ISRO) and CNES (French Space Agency).

SHOM
French Navy's Hydrographic and Oceanographic Department.

SOA
State Oceanic Administration

WGOOFE
ICES Working Group on Operational Oceanographic Products for Fisheries and Environment

WMO
The World Meteorological Organization is a specialized agency of the United Nations.

Mercator Océan

8-10 rue Hermès
Parc Technologique du Canal
31520 Ramonville Saint-Agne
France

T +33 (0)5 61 39 38 02
F +33 (0)5 61 39 38 99

www.mercator-ocean.eu
www.marine.copernicus.eu

products@mercator-ocean.fr
communication@mercator-ocean.fr
servicedesk.cmems@mercator-ocean.fr

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Graphic design :
www.atelierjamjam.com

Printer:
www.espace-repro.com