ISSN 1314-3379

MYOCEAN BLACK SEA IN SITU THEMATIC ASSEMBLY CENTER

Veselka Marinova, Atanas Palazov, Asen Stefanov and Violeta Slabakova

Abstract: *MyOcean aims at providing a sustainable service for Ocean Monitoring and Forecasting validated and commissioned by users. The MyOcean information includes observations, analysis, reanalysis and forecasts describing the physical state of the ocean, its variability and the ecosystem response through primary biogeochemical parameters. It also contributes to research on climate by providing long time-series of reanalysed parameters. Within these projects, the in-situ Thematic Assembly Centre of MyOcean is a distributed service integrating in situ data from different sources for operational oceanography needs. The In-situ TAC is composed of three entities: coordination group, global In-Situ centre, regional In-Situ centres. The Bulgarian Oceanographic Data Centre (BGODC) has become the regional assembly centre (RDAC) for the Black sea in situ data. The Black Sea In Situ TAC component operated by IO-BAS (Varna, Bulgaria) delivers in situ data to the global assembly centre, to the Black sea MFC (regional monitoring and forecasting center) and to the external users.*
Keywords*: in situ, data exchange, data management, operational oceanography.*

1. Introduction

MyOcean aims at providing a sustainable service for Ocean Monitoring and Forecasting validated and commissioned by users. The MyOcean information includes observations, analysis, reanalysis and forecasts describing the physical state of the ocean, its variability and the ecosystem response through primary biogeochemical parameters. It also contributes to research on climate by providing long time-series of re-analysed parameters. It started in 2009 for 3 years and continued for 2.5 additional years through the MyOcean II project in April 2012 followed by MyOcean-FO until end of April 2015.

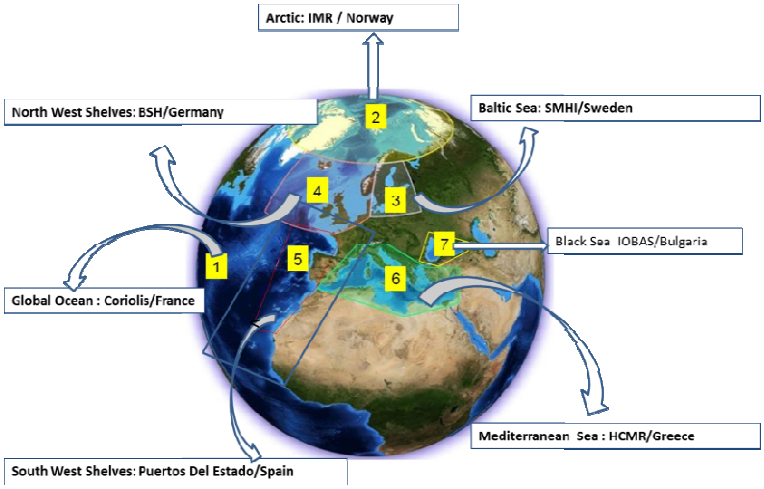

Figure 1: In Situ TAC regional organisation providing the institute coordinating the activity per region

Within these projects, the in-situ Thematic Assembly Centre of MyOcean is a distributed service integrating data from different sources for operational oceanography needs. The MyOcean in-situ TAC is collecting and carrying out quality control in a homogeneous manner on data from outside MyOcean data providers (national and international networks), to fit the needs of internal and external users. It provides access to integrated datasets of core parameters to characterise ocean state and ocean variability, by this, contributing to initialization, forcing, assimilation and validation of ocean numerical models which are used for forecasting, analyses and re-analysis of ocean conditions. Since the primary objective of MyOcean and MyOcean2 was to forecast ocean state, the initial focus was on observations from automatic observatories at sea (e.g. floats, buoys, gliders, ferrybox, drifters, SOOP) which are transmitted in real-time to the shore at global and regional scales both for physical and

biogeochemical parameters. The second objective is to set up a system for re-analysis purposes that requires products integrated over the past 30 years for temperature and salinity parameters.

The MyOcean In Situ TAC is a production center organised in 7 main elements: a global ocean and 6 European seas. It covers the following geographical domain: the Global Ocean and the European regional seas: Mediterranean (Med), Black Sea (BS), Iberian, Biscay and Irish Sea (IBI), Atlantic North West Shelf (NWS), Baltic and Arctic (Figure 1).

The organisation chosen within the INS TAC is based on regional portals that allow from a single point access to the real time and historical data collected and validated for a specific region (Figure 2). These portals are FTP sites that are organized similarly. On the portal all data are provided in an OceanSites NetCDF format. All regions apply the same Real-Time Quality control procedures.

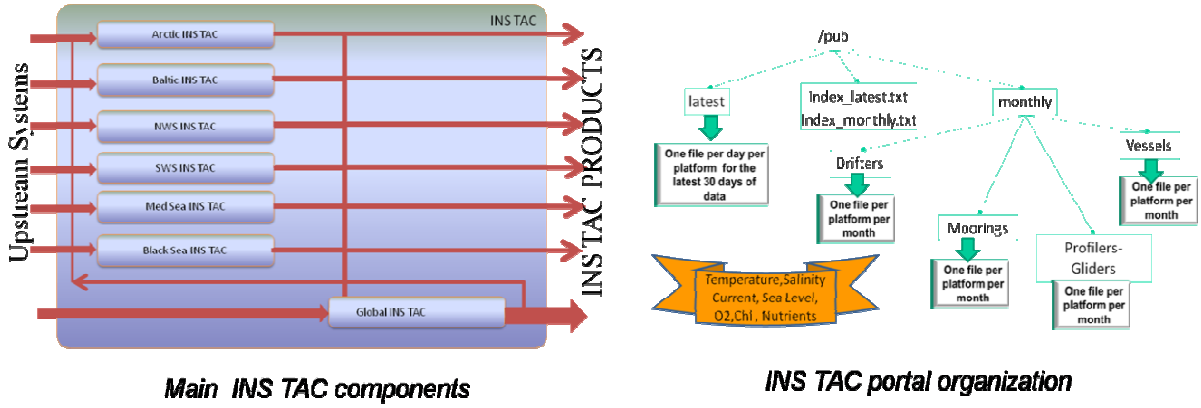

Figure 2. Structure of the MyOcean In Situ TAC.

MyOcean in situ data management is based on national or institutional data centers, Regional data centers (RDAC) and GDAC centre. Six regional data assembly centres (RDAC) for the European area and one for the global ocean are identified. RDAC is responsible for assembling data provided by national or institutional data centres into an integrated dataset. The RDAC collects controls and distributes data according to MyOcean – WP15 agreed rules and validates the dataset consistency in its area of responsibility. The GDAC collects new data files from all RDACs. The GDAC does not apply any quality control (quality control is under RDACs responsibility).

2. Black Sea In Situ Thematic Assembly Center (RDAC)

The Bulgarian Oceanographic Data Centre (BGODC) has become the regional assembly centre (RDAC) for the Black sea in situ data – Black Sea INS TAC. As a regional assembly centre the BGODC delivers in situ data to the global assembly centre, to the Black Sea MFC (regional monitoring and forecasting centre) and to the external users. It acts as both Production Unit (PU) and Distribution Unit (DU) for the Black Sea component of the in-situ TAC. The PU part of the Black Sea component acquires data from different sources, performs RTQC on non quality controlled data and generates the products served by the DU .

The INS TAC Black Sea component operated by IO-BAS (Institute of Oceanology - Bulgarian Academy of Sciences, Bulgaria) implements following functions (Figure 3):

- *Data Acquisition*: gather data available on international networks or though collaboration with regional partners;
- *Data Quality control*: apply automatic quality controls that have been agreed at the in- situ TAC level. These procedures are defined by parameter, elaborated in coherence with

international agreement, in particular SeaDataNet, and documented in MyOcean catalogue (http://www.myocean.eu);

- *Product validation*: assess the consistency of the data over a period of time and an area to detect data that are not coherent with their neighbours but could not be detected by automatic QC;
- *Product distribution*: make the data available within MyOcean and to the external users.
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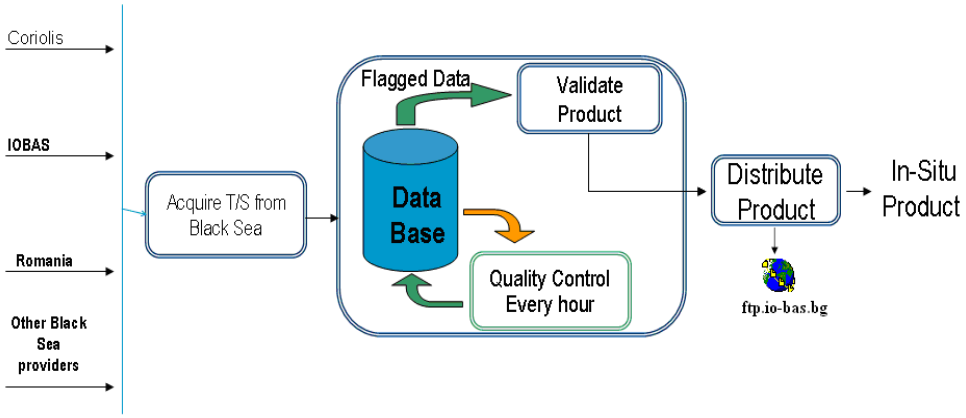

Figure 3. Black Sea INS TAC core functions.

As a consequence, for all European seas, a unique way of distributing the data has been set up (Figure 4):

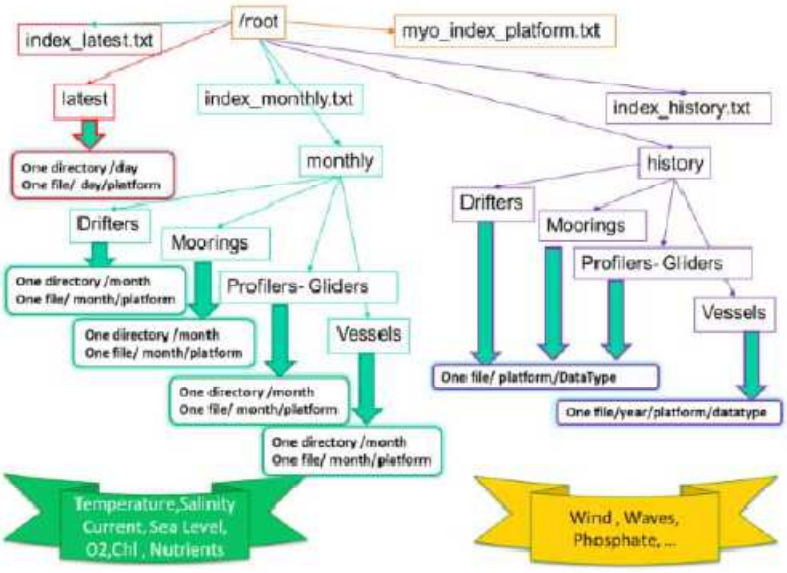

Figure 4. FTP portal organization.

- *Same format*: The OceanSites NetCDF format has been chosen because it is CF compliant, it relies on SeaDataNet vocabularies and it is able to handle profiles and time series data coming from floats, drifters, moorings, gliders and vessels.
- *Same ftp portal organization*: the data are organized in three main directories:

- Latest: Providing access to a sliding window on the latest 30 days of observations for real-time applications.
- Monthly: Accumulating the best copy of a dataset, organized by platform and by month.
- History (REP product): Providing historical aggregated datasets (30 years) for reanalysis activities.

The Black Sea INS TAC is focused on a limited number of parameters:

- *Temperature and salinity*: produced in real time and delayed mode;
- *Currents*: produced in real time ;
- *Sea level*: produced in real time ;
- *Biogeochemical (chlorophyll and oxygen)*: produced in real time.

3. Validation framework

The quality control procedures used to validate the reprocessed in situ data are the same as for the near real time data dedicated to assure the accuracy of in situ observations through mainly two validation channels. The first channel of quality control procedures consist of procedures automatically performed testing the quality of the data set. These automatically performed tests are described in the Wehde *et al.* [2] quality control document for real time data. For the first channel a set of metrics were developed (**Error! Reference source not found.**). By performing the QC tests QC flags are allocated to the obtained observational data. The QC flags are presented in **Error! Reference source not found.**.

Code	Meaning	Comment
0	No QC was performed	-
1	Good data	All real-time QC tests passed.
2	Probably good data	-
3	Bad data that are potentially correctable	These data are not to be used without scientific correction.
4	Bad data	Data have failed one or more of the tests.
5	Value changed	Data may be recovered after transmission error.
6	Not used	-
7	Not used	-
8	Interpolated value	Missing data may be interpolated from neighbouring data in space or time.
9	Missing value	-

Table 1. Quality control flags.

The validation process that leads to the assessment of the REP product (second channel) consists of a set of metrics that are area-dependent and that are described in detail in von Schuckmann and Cabanes [1]. The REP product has been controlled using statistical test methods to check the consistency of the observations in the Black Sea and a visual quality control.

Short description	Applicability of metrics for		
	Vertical Profiles: Argo, CTD, XBT	Time Series	Research vessel
Plattform Identification	X (GTS only)		
Impossible date	X	X	X
Impossible location	X	X	X
Position on land	X		
Impossible speed	X		X
Global range	X	X	X
Regional range	X	X	X
Pressure increase	X	X	
Spike	X	X	X
Bottom spike	X (XBT only)		
Gradient			X
Stuck value			X
Grey list	X (Argo only)		
Sensor Drift	X (Argo only)		
Frozen profile	X	X	
Deepest pressure	X (Argo only)		
Rate of change		X	
Duplicate check	X	X	X

Table 2: Metrics used for the quality control of temperature and salinity data.

A Matlab code program to provide jointly automatic and visual data check was developed in IO-BAS. Delayed mode quality control processing includes metadata control, physical data control and visual data control. An overview of the main processing is given in following:

- Metadata control:
  - duplicate cruises and profiles check;
  - data and chronology check;
  - ship velocity check;
  - location check;
  - sea depth check;
  - observation depth check.
- Physical data control:
  - density inversion check (data are checked for detection of density inversion; such errors are to be checked visually);
  - spikes check (taking into account the difference not only in values but in gradients too);
  - climatic check (comparison with SeaDataNet climatology). Climatic checking includes:
    - three standard deviations checking (±5σ deviation for 0-50 m, ±4σ deviation for 50-100 m, ±3σ deviation from 100m and below);
    - checking of density at standard depths (19 standard depths - 0,10,20,30,50,75,100,150,200,250,300,400,500,600,800,1000,1200,1500,2000 m);
  - cross-validation check - comparison between current data source and nearest quality controlled dataset derived from nearest platforms.

All data are checked to be within ±3 Mean Standard Deviation from the mean. Data that have not passed this check were checked and corrected manually using visualization tools.

- Visual quality control: a visual QC is performed on all the presumed erroneous data which are pointed out by the application of the assessment procedure, before taking any decision about changing the flags.

Acknowledgements:

This work is part of the MyOcean, MyOcean2 and MyOcean-FO projects. Historical products were built in partnership with SeaDataNet2 EU.

REFERENCE

[1] von Schuckmann, K. and C. Cabanes. 2010. Validation methods of temperature and salinity measurements: Application on global measurements performed at the Coriolis data center, MyOcean project guideline, WP15.
[2] Wehde, H., K. von Schuckmann, S. Pouliquen, A. Grouazel, T. Bartolome, J. Tintore..2013. Quality Information document for Near Real Time INSITU products. MyOcean document.

За контакти:
гл. ас. д-р инж. В. Маринова,
ИО-БАН, Варна
E-mail: marinova @io-bas.bg