Project

Cal/Val Software Description

User Manual

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CHANGE RECORD

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1.0	06/10/10	all	First version of document.	Jenny Nilsson, Vladyslav Lyubartsev. Alessandro Grandi.	Marina Tonani.

TABLE OF CONTENTS

GLOSSARY AND ABBREVIATIONS

NRT	Near real time.
DB	Data base.
SST	Sea surface temperature.
SW	Software.
LAMP	Software bundle (Linux Apache MySQL Php).
MySQL	A database management system.
PHP	Scripting language for web development.
NCL	Scripting language for scientific data processing and visualization.
CSV	Comma separated values. Ascii format for data base tables.
ScCP	Scientific Calibration Plan
ScCR	Scientific Calibration Report

I INTRODUCTION

In order to evaluate the quality of the Med_MFC products, a NRT validation system based on Class 4 diagnostics (model and observational data comparisons) has been developed. Independent in-situ observations from 13 centers (cf. Tab. 1 and Fig. 1) are presently being downloaded operationally on a daily basis by the Med_MFC operational center at INGV. The observations and their corresponding model values (forecasts and analyses) are stored in a MySQL data base (DB). On-fly comparisons of temperature, salinity, sea level and currents can be made on a dedicated web site, which communicates dynamically with this DB. Recently, satellite observations of sea surface temperature (SST) has also been added to the DB, hereby offering direct confrontation of in-situ, satellite and model SST estimates.

Table 1: List of partners (in-situ observations) in alphabetical order

	Institute:	**Contact person:**
1	CNR-ISSIA	Sara Pensieri
2	CNR-ISMAR	Mariangela Ravaioli
3	CSIC	Joaquin Tintoré, Guillermo Vizoso
4	HCMR	Dimitris Kassis, Leonidas Kassis
5	IFREMER	Ivane Pairaud
6	IMS-METU	Emin Özsoy
7	IOLR	Dov Rosen, Ron Goldman
8	ISPRA	Gabriele Nardone, Sara Morucci
9	NIB-MBS	Vlado Malacic, Boris Petelin
10	OC-UCY	Daniel Hayes
11	OGS	Giulio Notarstefano, Manuel Bensi
12	Puertos del Estado	Marta de Alfonso, Marcos Garcia
13	UMT-IOI-POU	Aldo Drago

Detailed information on the collected in-situ observations is given in the document “*WP9.5_insitu_observations.pdf*”, available for download on the CalVal web site.

Figure 1: Locations of moored in-situ data in the Mediterranean Sea.

II SOFTWARE PACKAGE

II.1 CalVal server-side requirements

The CalVal software (SW) is based on the open-source software bundle **LAMP** (acronym for: Linux Apache Mysql Php). The LAMP stack is widely used because it offers a great number of advantages for developers:

Easy to code: Novices can build something and get it up and running very quickly with PHP and MySQL.

Easy to deploy: Since PHP is a standard Linux module, it is easy to deploy PHP applications by uploading *.php* files once MySQL is running.

Develop locally: LAMP can be set up so an app can be built locally, then deployed on the Web.

Cheap and ubiquitous hosting: Even the cheapest web hosts options allow PHP and MySQL to be run.

For more info on LAMP cf. http://en.wikipedia.org/wiki/LAMP_(software_bundle)

The general structure of the CalVal software package and the application of the LAMP stack is provided in Fig. 2.

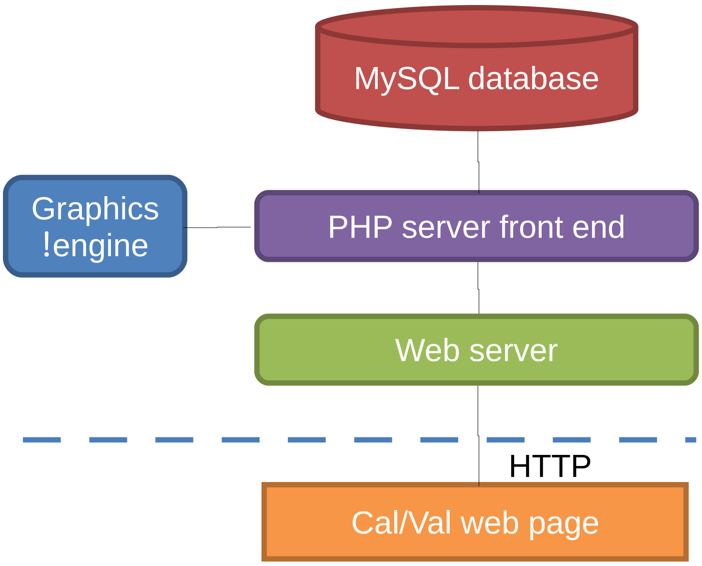

Figure 2: CalVal software architecture..

II.2 Brief description of the software components

Apache is presently the most used web server, and it is a standard Linux component. http://www.apache.org/

MySQL is a relational database management system that runs as a server providing multi-user access to a number of databases. http://www.mysql.com/

Several other third-party proprietary and free graphical administration applications (or "Frontends") are available that integrate with MySQL and enable users to work with database structure and data visually. Here we have used **phpMyAdmin** which is a free and well-known web-based frontend widely installed by Web hosts worldwide, since it is developed in PHP and requires the LAMP stack. http://www.phpmyadmin.net/

PHP is a widely used general-purpose scripting language that is especially suited for producing dynamic web pages, and it is a standard Linux component. http://www.php.net

Furthermore, the CalVal SW requires installation of **NCAR Command Language** (NCL), since PHP does not work with the data format NetCDF. However, NCL is not as well supported by MySQL as PHP, thus NCL is primarily used for converting NetCDF data files to MySQL format CSV.

NCL is a free interpreted language designed specifically for scientific data processing and visualization, http://www.ncl.ucar.edu/overview.shtml. It can be easily installed in Linux, the executables are available both as source code and binaries.

The CalVal package is compliant with the following web browsers: Firefox, Safari, Internet Explorer, Google Chrome, Opera.

II.3 Export of MySQL data base

A zip-package of the import modules and CalVal software routines can be provided to the WP9.5-partners upon request. Weekly copies of the MySQL DB will be placed on a dedicated server and accessible for the WP9.5 partners by FTP. These copies are to be imported into their MySQL databases, whereafter the validation results can be visualized and published independently on the web using the CalVal SW.

II.4 Flexibility of the CalVal package

A great advantage of the CalVal package is the inherent flexibility of the software components, which allow the users to modify the DB in relation to their specific needs. Data from new sources (in-situ, model, satellite) and/or new variables are easily added to the DB.

Performance limits. In order to guarantee an ok working system it is recommended to not display data from more than 3 “Datasources” (cf. Chapter V and Annex A) at the same time. Here we allow only comparisons of two Datasources simultaneously, however, the total number of sources are many more (in-situ original, in-situ daily, satellite, model forecasts and analyses)

III THE MED_MFC OPERATIONAL CENTER

NRT access to the in-situ observations was established by FTP protocols between INGV and the partners in January 2010, and data has been downloaded daily in operational mode since May 2010. A 3-month rolling archive of Med_MFC-current forecasts and analyses data is kept, as well as a 10-days rolling archive of satellite SST values. The daily operations are summarized below.

III.1 In-situ observations

Daily FTP procedures. Every morning the in-situ partner's ftp accounts are searched for new data. These observations are then stored on a dedicated server at INGV. At present, data is being retrieved from the following platform as given in In Tab.2, moreover, glider and drifter data is provided by some partners however the present-state software does not yet support these observations.

Table 2: Observations presently available for validation of Med_MFC-Currents.

Institute	Platform(s)	Variables	Sampling freq.	Data format
CNR-ISSIA	ODAS (W1M3A)	T, S	Every 3 hours	Ascii
CSIC	Endorrocat Cabrera	T, S, currents, Chl-a, turbidity T, S, currents, Chl-a, turbidity	Every 10 min Every 10 min	NetCDF NetCDF
HCMR	10 POSEIDON buoys	T, S, currents, waves, fluorescence, turbidity, meteorological parameters.	Every 3 hours	NetCDF
IFREMER	MESURHO.	T, S	Every 30 min	Ascii
IOLR	Hadera	Currents	Every hour	Ascii
ISPRA	15 moored buoys 6 Tide gauges	T SL	Every 30 min Every 30 min	Ascii Ascii
NIB-MBS	Vida	Currents	Every hour	Ascii
OC-UCY	Paphos MEDGOOS-3	T, SL T, S	Every hour Every 30 min	Ascii Ascii
OGS	E2M3A	T, S, currents	Delay time	Ascii
Puertos del Estado	8 moored buoys 15 Tide gauges	T, S, currents SL	Every hour Every hour	NetCDF NetCDF
UMT-IOI-POU	Portomaso	T, SL	Every hour	Ascii

III.2 Satellite observations

Delay-time satellite SST fields for the Mediterranean Sea are downloaded operationally from the SST TAC and used for SST validation (WP 13, Mediterranean contact person: Bruno Buongiorno Nardelli, CNR). The satellite SST values were calculated (bilinear interpolation) for relevant in-situ surface temperature locations.

III.3 Med_MFC model values

Med_MFC-currents: Sea level, as well as 3D temperature, salinity, and velocity fields.

The CalVal SW offers validation of both Med_MFC-currents forecasts (FC-3d) and analyses (AN). A sketch of the scheduling of the Med_MFC forecasting production is given in Fig. 3.

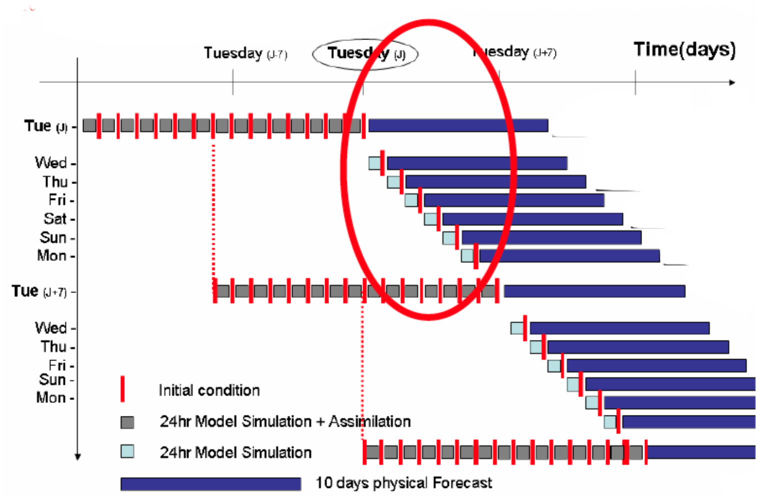

Figure 3: Med_MFC-Currents forecast production.

It was decided that the forecast quality of forecasts produced 3 days ago would be evaluated by the CalVal SW. (Meaning, if it is Thursday, then the Thursday prognosis was produced on Monday.) Analyses for the previous two weeks are produced weekly, hence continuously recalculating the last week using high quality observations and forcing.

<u>A note on the model data interpolation</u>

Model values are retrieved at the corresponding in-situ locations at sensor depth levels, which implies that the model fields must be interpolated in space in order to be representative of the observations. Linear interpolation is applied in the vertical plane, while bilinear interpolation is used the horizontal plane. As the sampling frequency of the in-situ data is higher than the MyOcean product release (daily mean fields), there is no need for time interpolation of the model fields.

In some special cases, the in-situ sensors are located partially or completely outside of the Med_MFC model domain. It was investigated if these observations could be compared to the model data from the nearest nodes. If 2-3 nodes were available, then the model data would be provided as weighted averages between these grid points. If the in-situ observation was outside of the domain, then the nearest node would be used.

The accuracy of interpolating model data between 2-3 nodes, or even using the nearest node, was evaluated in terms of “ensamble node” confrontations with in-situ observations from 17 different sites (ISPRA and HCMR), cf. Fig 4. Furthermore, the RMSD between the model values from neighbouring grid points, and the auto-correlation of the values was examined.

Med_MFC-currents analysis surface fields for the period 18 May 2010- 16 June 2010 (29 days) were studied into detail. Each Med_MFC box is 1/16° (for latitude this equals to

60/16 naut.miles = 7 km), and the maximum shift in boxes was 12 in latitudinal direction and 16 in the longitudinal. (Lat/Lon proportion 4/3 at 41N latitude.)

In particular Fig. 4 presents a temperature time series from the Cagliari buoy (provided by ISPRA). The Cagliari buoy is located off the southern Sardinia coast, and is on the limit of the Med_MFC grid domain with only 3 neighbouring nodes. The in-situ temperature is plotted in blue and the 11 nearest nodes are plotted in red; the nearest node number 10 is high-lighted in dark red. It was found that the temperature values in the nearest model grid points (the ensamble) were generally relatively similar, thus it was concluded that a weighted average would be representative of the model value at the in-situ site.

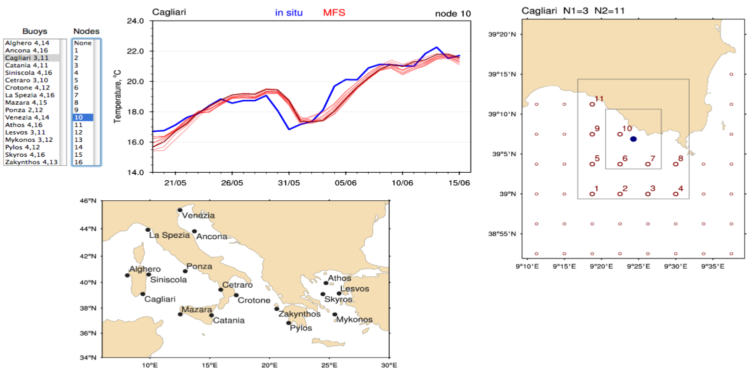

Figure 4: Screenshot of the model interpolation information site. Case example of in-situ location with only 3 neighbouring model nodes (Buoy: Cagliari, Institute: ISPRA, Variable: T, Depth: 0m, 2010). In-situ temperature is marked in blue and model temperatures in red.

All “temperature ensamble node” plots from the 17 ISPRA and HCMR buoys are available at:

http://gnoo.bo.ingv.it/myocean/calval/tests/buoys.html

The studies of RMSD and autocorrelation between the model grid points gave at hand that temperature, salinity, and sea surface height are all characterized by a rather symmetric spatial variability, hereby supporting the decision of using the weighted averages or nearest nodes when all 4 nodes are not available.

All RMSD and auto-correlation plots for temperature, salinity, sea level and velocity please are available at:

http://gnoo.bo.ingv.it/myocean/calval/tests/autocorr.html

Based on these results, it was decided that in the very few cases of in-situ locations outside of the model domain (Enderrocat from CSIC and Hadera from IOLR), model data from the nearest node would be an acceptable compromise.

III.4 Outlook

Addition of “lagrangian” data sets (drifters, floats and gliders) to the data base.

Validation of Med_MFC BioGeoChemistry.

V1 External products: 3D chlorophyll (chl) concentration and nutrients (ammonia, phosphate and nitrate).

At this moment it has not been possible to include validation of Chl and nutrients in the CalVal SW due to the lack of reliable/representative NRT in-situ observations. However, BGC model validation using processed ocean colour Chl-estimates from the OC TAC (WP12, Mediterranean contact person: Rosalia Santolieri, GOS ISAC) is at present done by OGS, hence some of these activities could possibly be added to the CalVal SW next.

Addition of regional model data. The participating forecasting systems are described in the document "WP9.5_regional_models.pdf", and can be downloaded from the CalVal web page. Model inter-comparisons are foreseen within CalVal V2.

IV FILE TRANSFERS IN THE CALVAL SW

After retrieval, all data is converted to common format (CSV) and imported to a MySQL data base. Model and satellite-derived values are calculated for the in-situ locations and stored correspondingly in the DB. These actions are performed operationally on a daily basis, and briefly described in the following subsections.

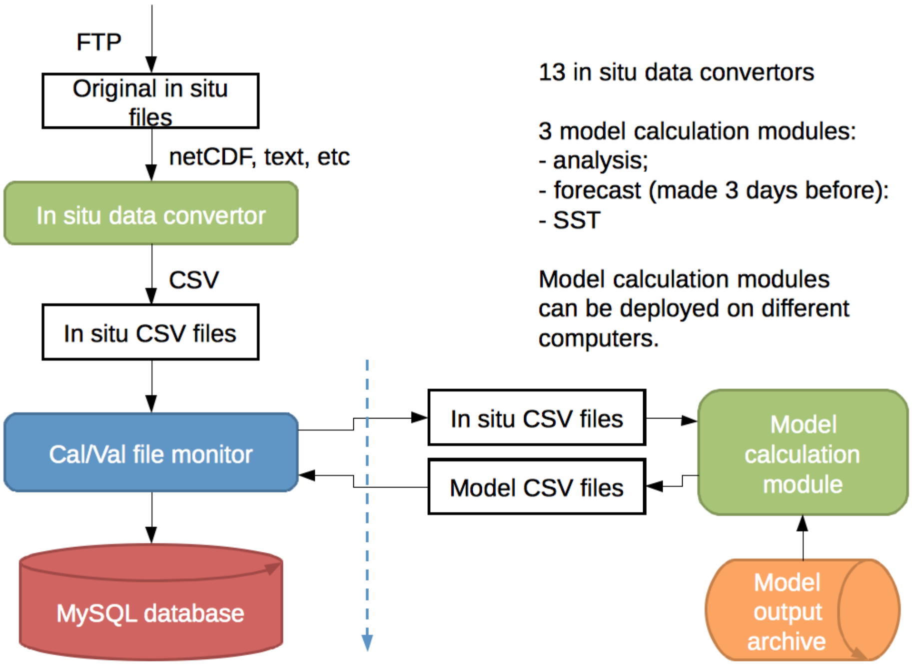

Figure 5: Flow chart of data file transfer, format conversion, model value calculations, and MySQL DB population.

IV.1 Daily routine

The daily upload of data, format conversion, population of the MySQL DB and update of the web interface is controlled by the routine *calval.daily.routine.sh*. This routine contains the following actions:

- Upload and convert in-situ data.
- Update in-situ locations.
- Retrieve model values for in-situ and SST comparisons.
- Upload Satellite SST data.
- Populate MySQL data base.

- Time aggregation of in-situ data

  (Daily: 12 midday-12 midday, and night time: 00-04 for SST comparisons).

- Run Java Script.

- Update in-situ meta data.

IV.2 The in-situ data converters and import modules

Specific format conversion and import modules were created for each data provider and “probe” (13 data providers, cf. Tab. 1), depending on the original data format these were coded in PHP (**Ascii** and **MedAtlas** files) or NCL (**NetCDF** files). The structure of the conversion module file name follow the convention:

data2csv.ORGANISATION.DEVICE.php/ncl

Ex. of ascii import module: *data2csv.ifremer.buoy.php*

Ex. of NetCDF import module: *data2csv.csic.buoys.ncl*

The identification strings PROBE, ORGANISATIONS and DEVICE (e.g. moored buoy, tide gauge etc.) derive from the MySQL nomenclature that was created for the CalVal SW (cf. Section V and Annex A). Each in-situ location is given a unique probe_id number. After import the list of all in-situ locations is updated (by two PHP scripts*: calval.locations.php* and *calval.sst.locations.php)* and saved in a KML file for Google Earth visualization purposes. The in-situ values are temporally stored in a CSV table (cf. ex in Tab. 3), before being imported in the MySQL DB.

The sampling frequency of the in-situ data range from 10 min to 3 hour snapshots or averages. For web publication purposes, three different time aggregations were chosen for the in-situ data, depending on the type of comparisons that is to be made, this action is detailed in Tab.3. The time aggregation is done by the PHP scripts: *calval.insitu.daily.php* and *calval.insitu.sst.php.*

Table 3: Time aggregations of in-situ data, and the validation purposes.

	Original data	**Daily aggregation**	**Night time aggregation**
Time interval	No action	12am-12am	12pm-04am
Purpose	Display original data	Med_MFC comparisons	SST comparisons

IV.3 Satellite data import modules

The satellite data is retrieved from NetCDF files hence this action done by a NCL script (*sat.sst.locations.ncl*).

The satellite data import module search the list of in-situ locations, where probes that measure temperature in the upper 3 m are selected for satellite SST comparisons.

Satellite SST values are calculated at the corresponding probe coordinates, whereafter the SST data is stored in the CSV table (cf. Table 4).

IV.4 Model data import modules

The Med_MFC model data is retrieved from NetCDF files hence this action done by a NCL script (*mfs.locations.ncl*).

The model data import module search the list of in-situ locations, and calculate model values (both for forecasts and analyses) for these positions, moreover, model SST values are calculated for the same probes as described in IV.3. The model mean SST values are calculated for model surface level (bilinear interpolation onto the in-situ SST locations). The model data is stored in the CSV table (cf. Table 4).

IV.5 Update of MySQL data base

When the daily uploading/conversion procedure of in-situ, satellite and model data is completed the data is stored in a CSV table (cf. Example in Tab. 4). The datasource_id indicate if the data is in-situ, satellite, forecast or analysis values, and the variable_id sort the measured parameters (temperature, SST, salinity, sea level, or currents) from each in-situ location (probe).

Table 4: Example of CSV table ready for import into the MySQL DB.

datasource_id	probe_id	year	month	day	hour	minute	depth	lat	lon	variable_id	value
4	11	2010	1	8	4	0	3	36.48	-6.96	1	17.3825
4	11	2010	1	8	4	0	3	36.48	-6.96	2	36.3422
4	11	2010	1	8	4	0	3	36.48	-6.96	4	-0.03876
4	11	2010	1	8	4	0	3	36.48	-6.96	5	0.055158
4	7	2010	1	8	5	0	3	40.6839	1.46833	1	14.0108
4	7	2010	1	8	5	0	3	40.6839	1.46833	2	38.1254
4	7	2010	1	8	5	0	3	40.6839	1.46833	4	-0.00953
4	7	2010	1	8	5	0	3	40.6839	1.46833	5	0.042408
4	8	2010	1	8	5	0	3	39.516	0.204667	1	14.7394
4	8	2010	1	8	5	0	3	39.516	0.204667	2	37.4858
4	8	2010	1	8	5	0	3	39.516	0.204667	4	-0.07445
4	8	2010	1	8	5	0	3	39.516	0.204667	5	-0.03957
4	3	2010	1	8	5	0	3	39.555	2.10167	1	14.5773
4	3	2010	1	8	5	0	3	39.555	2.10167	4	0.012065
4	3	2010	1	8	5	0	3	39.555	2.10167	5	-0.06803

These identification strings are crucial in order to import correctly the data in to the MySQL DB. The import is performed by the PHP script *calval.csv2sql.php* and requires the sub-routines: *calval.paths.inc.php*, *calval.mysql.inc.php*, and *calval.lib.inc.php*, which sets paths, defines the identification strings, and connects to the MySQL DB.

IV.6 Update of CalVal web page

When the daily update of the MySQL DB is complete, a Java script is run in order to update the CalVal web page *(calval.javascript.php).* The last action in the daily routine is to update the in-situ meta data, which is published on webpage together with the model-observation comparisons. Specific information on the probe such as data provider (ORGANISATIONS), DEVICE, Lat/Lon coordinates, VARIABLES and sensor depths, length of time series, sampling frequency, quality control and a link to the data providers web site (see Fig. 13 for example of meta data display). This action is performance by *calval.probes.html.php.*

V WORKING WITH MYSQL AND PHPMYADMIN

The general structure of the MySQL DB is described by Fig. 6, where *Data* is the main table. There are five reference tables: *Variables*, *Datasources*, *Probes*, *Devices and Organisations*.

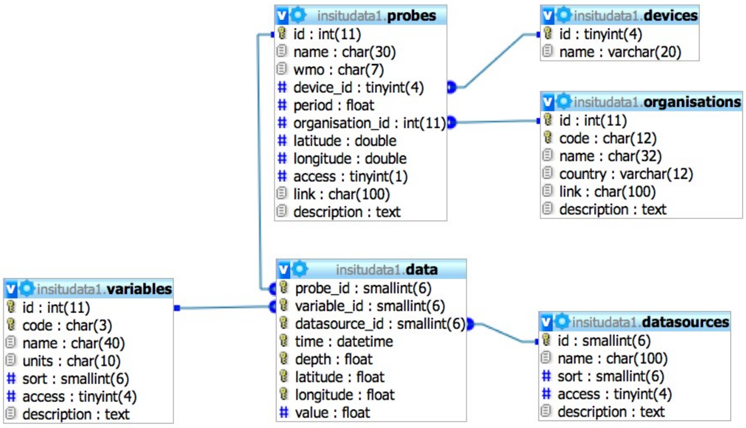

FIgure 6: MySQL data base structure, visualised by phpMyAdmin.

The *Organisations* and *Devices* tables structure the *Probes* table. *Datasources* distinguish between in-situ, satellite and model data (forecasts and analyses). The meta content of these tables is provided in Annex A, and examples of the internal structure are shown in Figs. 7-12.

probe_id	variable_id	datasource_id	time	depth	latitude	longitude	value
3	1	3	2010-08-02 00:00:00	3	39.555	2.10167	26.3601
3	9	3	2010-08-02 00:00:00	0	39.555	2.10167	26.4002
3	4	3	2010-08-02 00:00:00	3	39.555	2.10167	-3.59453
3	5	3	2010-08-02 00:00:00	3	39.555	2.10167	8.59705
4	1	3	2010-08-02 00:00:00	3	43.63	-3.04	22.0572
4	9	3	2010-08-02 00:00:00	0	43.63	-3.04	22.1395
4	2	3	2010-08-02 00:00:00	3	43.63	-3.04	35.4248
4	4	3	2010-08-02 00:00:00	3	43.63	-3.04	-20.3058
4	5	3	2010-08-02 00:00:00	3	43.63	-3.04	9.4154
5	1	3	2010-08-02 00:00:00	3	43.73	-6.17	19.8361
5	9	3	2010-08-02 00:00:00	0	43.73	-6.17	19.9903
5	2	3	2010-08-02 00:00:00	3	43.73	-6.17	35.5084
5	4	3	2010-08-02 00:00:00	3	43.73	-6.17	-16.9137
5	5	3	2010-08-02 00:00:00	3	43.73	-6.17	-4.17346
6	1	3	2010-08-02 00:00:00	3	43.49	-9.21	14.8479
6	9	3	2010-08-02 00:00:00	0	43.49	-9.21	14.8984
6	2	3	2010-08-02 00:00:00	3	43.49	-9.21	35.5194
6	4	3	2010-08-02 00:00:00	3	43.49	-9.21	-11.7636
6	5	3	2010-08-02 00:00:00	3	43.49	-9.21	-9.64336

Figure 7: Internal structure of the *Data* table.

id	name	sort	access	description
1	In situ original	1	0	Reference data for all other datasources with orig...
2	MED_MFC-Currents AN	4	0	MFS SYS4a analysis daily, made on Tuesday
4	MED_MFC-Currents FC	6	0	MFS SYS4a forecast daily, made three days before i...
10	Satellite	3	0	Satellite measurements. Only SST at his moment.
11	In situ daily	2	0	In situ data are averaged from midday to midday, a...

Figure 8: Internal structure of the *Datasources* table.

The option *access* can hide specific datasources/probes/variables, the 0-option indicates that the component is 'active'. The *sort* option indicates in which order the list will be displayed on the CalVal web site.

id	code	name	units	sort	access	description
1	T	Temperature	°C	1	0	Sea water temperature
2	S	Salinity	PSU	2	0	Sea water salinity
3	SL	Sea Level	cm	3	0	Sea Level
4	U	Zonal Current	cm/s	4	0	Zonal Current Velocity
5	V	Meridional Current	cm/s	5	0	Meridional Current Velocity
6	DOX	Dissolved Oxygen	ml/l	8	3	Dissolved Oxygen
7	CHL	Chlorophyll-a	mg/m3	9	3	Concentration of chlorophyll-a in sea water
8	TRB	Turbidity		10	3	
9	SST	Sea surface temperature	°C	7	0	These values are compared with satellite SST. In s...
10		Currents	m/s	6	0	Vectorized velocity

Figure 9: Internal structure of the *Variables* table.

In this case, the *Variables* table is prepared for importing biogeochemical variables (chlorophyll, dissolved oxygen and turbidity), however the access-key is set to non-zero, since this function is not active yet. The table includes also a short description on each variable.

id	name	wmo	device_id	period	organisation_id	latitude	longitude	access	link	description
31	Cabrera		2	1	13	39.22452	2.96655	0	http://imedea.uib-csic.es/tmoos/boyas/index.php?se...	
32	Cabo de Palos	61417	1	1	2	37.65133333	-0.32466667	0	http://www.puertos.es/es/oceanografia_y_meteorolog...	Seawatch buoy. Quality control by range check (mi...
33	Cabo de Gata	61198	1	1	2	36.57	-2.34	0	http://www.puertos.es/es/oceanografia_y_meteorolog...	Seawatch buoy. Quality control by range check (mi...
34	Mahon	61197	1	1	2	39.73	4.42	0	http://www.puertos.es/es/oceanografia_y_meteorolog...	Wavescan buoy. Quality control by range check (mi...
35	Cabo Begur	61196	1	1	2	41.915	3.645	0	http://www.puertos.es/es/oceanografia_y_meteorolog...	Wavescan buoy. Quality control by range check (mi...
36	Alghero	61213	1	0.5	14	40.54861	8.10694	0	http://www.mareografico.it/	No quality control.
37	Ancona	61218	1	0.5	14	43.825	13.71944	0	http://www.mareografico.it/?session=0S786207469W73...	No quality control.

Figure 10: Internal structure of the *Probes* table.

The *Probes* table contains information on each in-situ location, such as platform name and coordinates, sampling frequency, quality control and links to corresponding web pages.

id	name
1	Moored buoy
2	Moored profile buoy
3	Tide gauge

Figure 11: Internal structure of the *Devices* table.

The *Devices* identification number is only used internally in the software to facilitate the retrieval of data when the validation results are to be visualized on-line.

id	code	name	country	link
2	PUERTOS	Puertos del Estado	Spain	http://www.puertos.es
3	IFREMER	IFREMER	France	http://www.ifremer.fr/
4	HCMR	HCMR	Greece	http://www.hcmr.gr/
5	OGS	OGS	Italy	http://www.ogs.trieste.it/
6	OC-UCY	OC-UCY	Cyprus	http://www.oceanography.ucy.ac.cy/cycofos/index.ht...
7	IOLR	IOLR	Israel	http://www.ocean.org.il/MainPageEng.asp
8	ISSIA	CNR-ISSIA	Italy	http://www.cnr.it/
9	ISMAR	CNR-ISMAR	Italy	http://www.ismar.cnr.it/
10	IMS-METU	IMS-METU	Turkey	http://www.ims.metu.edu.tr/
11	NIB-MBS	NIB-MBS	Slovenia	http://www.mbss.org/portal/index.php?lang=en
12	UMT-IOI-POU	UMT-IOI-POU	Malta	http://www.capemalta.net/
13	CSIC	CSIC	Spain	http://imedea.uib-csic.es/
14	ISPRA	ISPRA	Italy	http://www.isprambiente.it/site/it-IT/

Figure 12: Internal structure of the *Organisations* table.

The *Organisations* table keep information on the data providers, name of institution, country and a link to their web pages.

VI WEB PUBLICATION AND VISUALISATION

VI.1 Web site layout and functions

The WP9 CalVal web page offers NRT validation of both forecasted and analysed temperature, salinity, sea level and currents in terms of MERSEA Class4 diagnostics. In Fig. 13, a screenshot of the site shows the software main functions. First of all there are two major plot options, Buoy time series or Buoy profiles. By clicking on either of these specific plot options will appear to the left.

Upper left side: Request options for variable, such as: time, depth, in-situ data provider. Lower left side: A list of observations that fit with request is produced dynamically for the time series (static list for profiles). The middle screen shows, in this case, the distribution of independent in-situ temperature observations in the Mediterranean Sea, and with the selected buoy time series (or profile) below along with the corresponding model value time series (or profile). Right side: Meta data regarding the in-situ observation and the providing institute is provided on the right, e.g. data provider logo, name of platform, exact coordinates, available variables and sensor depths, length of time series, quality control and a link to the data provider's web page.

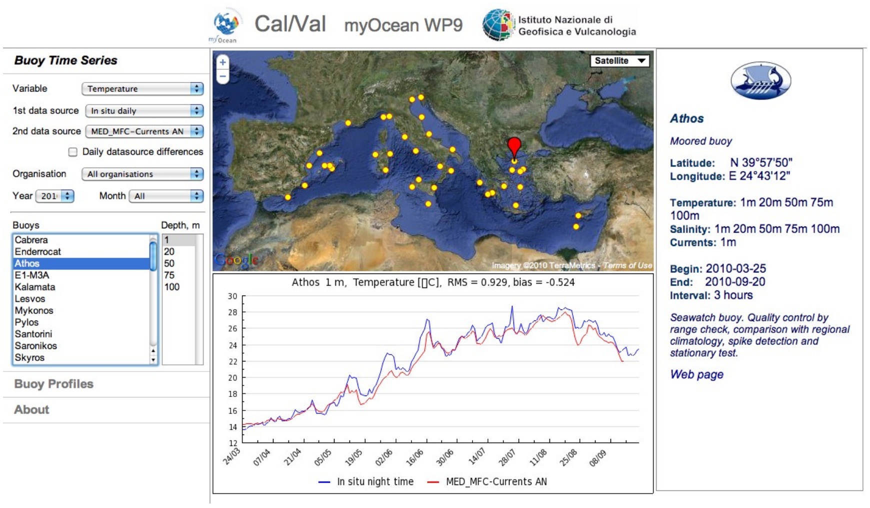

Figure 13: Screenshot of the WP9 CalVal web page for time series. Example of NRT model and independent in-situ confrontation (Buoy: Athos, Institute: HCMR, Variable: T, Depth: 1m, 2010).

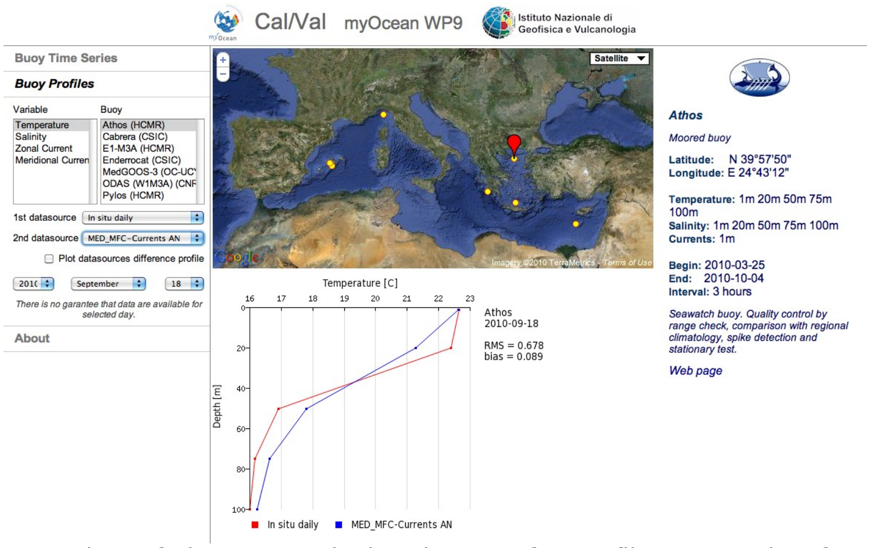

Figure 14: Screenshot of the WP9 CalVal web page for profiles. Example of NRT model and independent in-situ confrontation (Buoy: Athos, Institute: HCMR, Variable: T, 18 Sept. 2010).

A special case is the plot option currents under Buoy time series, which provides a lagrangian confrontation of modelled and observed currents in the Mediterranean.

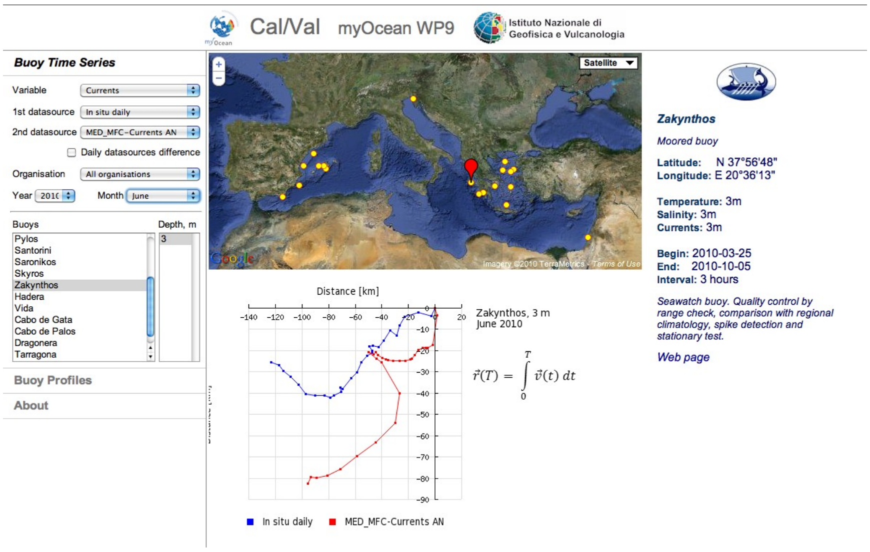

Figure 15: Screenshot of the WP9 CalVal web page for currents (time series). Example of NRT model and independent in-situ confrontation (Buoy: Zakynthos, Institute: HCMR, Variable: U&V, June 2010).

VI.2 Automatic request filter

The request options in the upper right corner work as automatic *Datasources* and *Organisations* filters, hence only in-situ locations that match the request are listed under *buoys*. When a specific *buoy* is selected (clicked upon), a list of available depths appear to the right.

A few particulars should be emphasized:

- The 1st Datasource determine the length of the plotted time series. For example, if *in-situ* is chosen as 1st Datasource and *Med_MFC-Currents AN* as the second, then the time series will begin on the in-situ start date (as in Fig. 13). If instead *Med_MFC-Currents AN* is chosen as first Datasource and *in-situ* as second, the time series will start on 1 January 2010 (cf. Fig. 16).

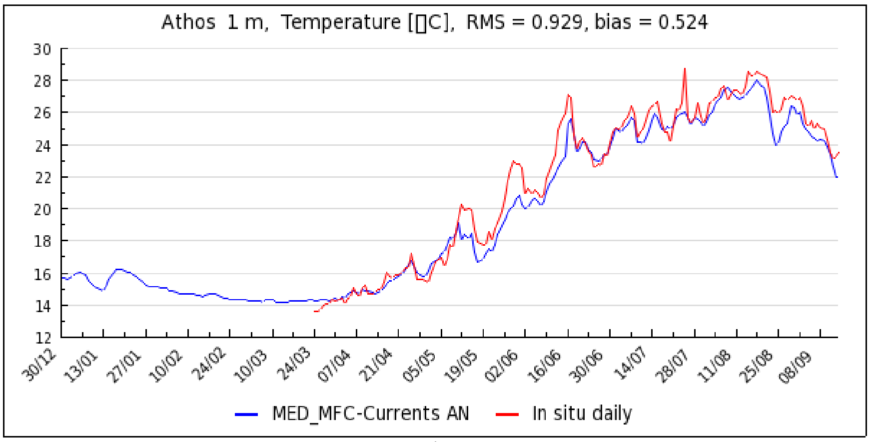

Figure 16: Example of Med_MFC-Currents as 1st Datasource and in-situ as second. Buoy: Athos, Institute: HCMR, Variable: T, Depth: 1m, 2010.

- Under the Datasources options, there is a checkbox called "Daily Datasource differences". This option is only active if you have chosen a datasource that has daily data frequency (all except *In-situ data original*). When checking the box, the bias between the two data sources will be displayed as time series.

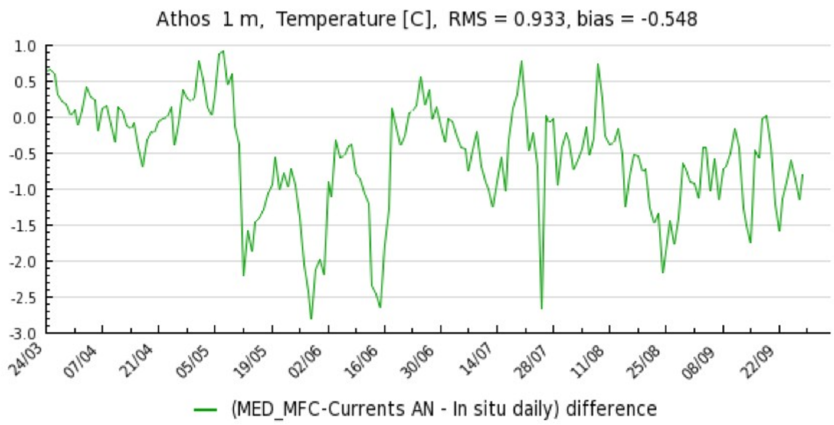

Figure 17: Example of daily bias in temperature between in-situ values and Med_MFC-Currents analyses. Buoy: Athos, Institute: HCMR, Variable: T, Depth: 1m, 2010.

- When the variable *Sea surface temperature* is selected, then automatically, the will only be available the night-time aggregated (00-04am) in-situ data in the *Datasources*.

VI.3 Diagnostics

In order to evaluate and assure the quality of the Med_MFC products in a standardized manner, the validation system was based on MERSEA Class 4 diagnostics (model-observation comparisons). This has been developed for all physical Med_MFC external products, i.e. temperature, salinity, sea level and currents in compliance with the Scientific Calibration Plan (ScCP) and the initial calibration activities were summarized in the Scientific Calibration Report (ScCR). The applied metrics and diagnostics are detailed in Tab. 5.

Table 5: List of metrics for NRT Med_MFC-Currents evaluation (analyses and forecasts), and diagnostics using satellite and independent in-situ observations in 2010.

Name of Metrics	**Description**	**Supporting observation**	**Diagnostics**
Temperature	Temperature time series and profiles.	In-situ moored buoys.	Direct comparisons, RMS and bias at specific in-situ depths.
Salinity	Salinity time series and profiles.	In-situ moored buoys.	Direct comparisons, RMS and bias at specific in-situ depths.
SST	SST time series.	In-situ moored buoys and Satellite SST.	Direct comparisons, RMS and bias at specific sea surface in-situ locations.
Sea Level	SL time series.	In-situ tide gauges	Direct comparisons, RMS and bias at specific sea surface in-situ locations.
Currents (u,v)	Zonal and meridional velocity time series, and profiles.	In-situ moored buoys.	Direct comparisons, RMS and bias at specific in-situ depths.

VI.4 Special features

By clicking on the INGV logo, the Med_MFC-Currents C-grid is superimposed on the Google map in the coastal areas, hereby confronting the in-situ locations with the model domain. By clicking a second time on the INGV logo, the model domain is removed from the map.

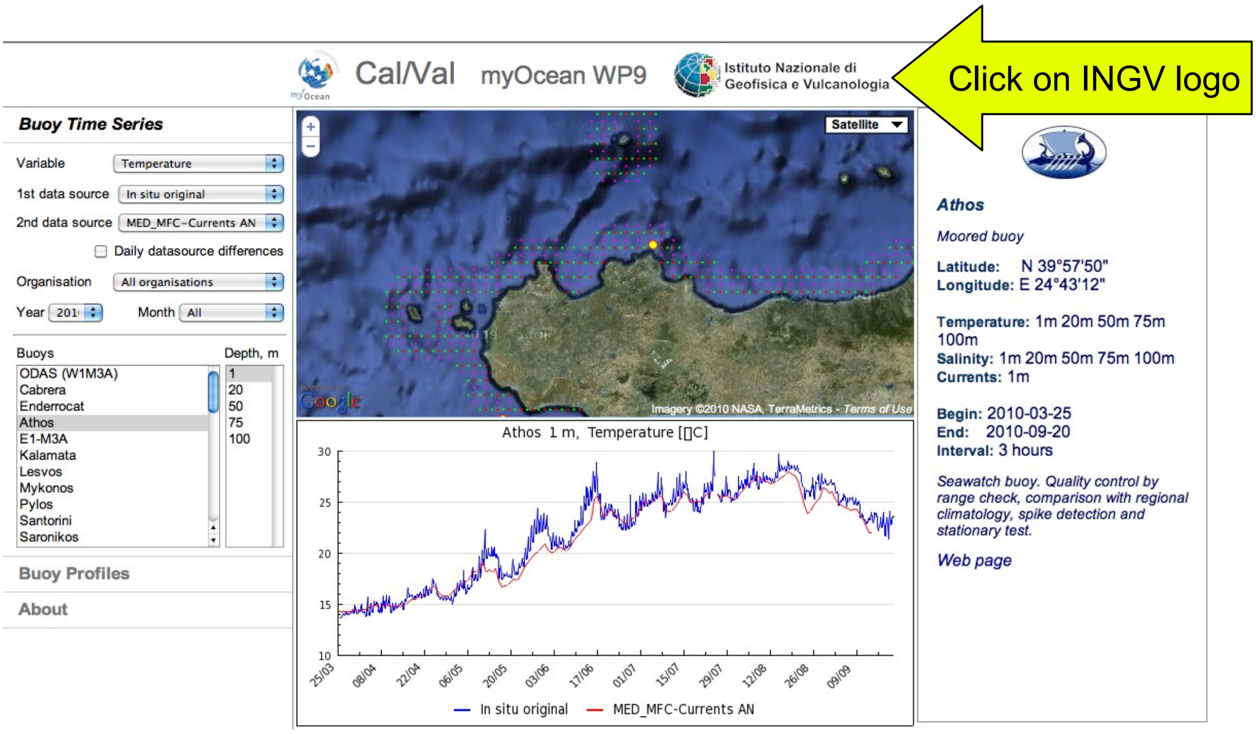

Figure 18: Example of Med-MFC-Currents domain and insitu location (Buoy: Athos, Institute: HCMR).

By zooming-in on coastal-near observations (i.e. tide gauges), it is possibile, thanks to the Google earth satellite images, to get information on the the surroundings where the in-situ sensor is located.

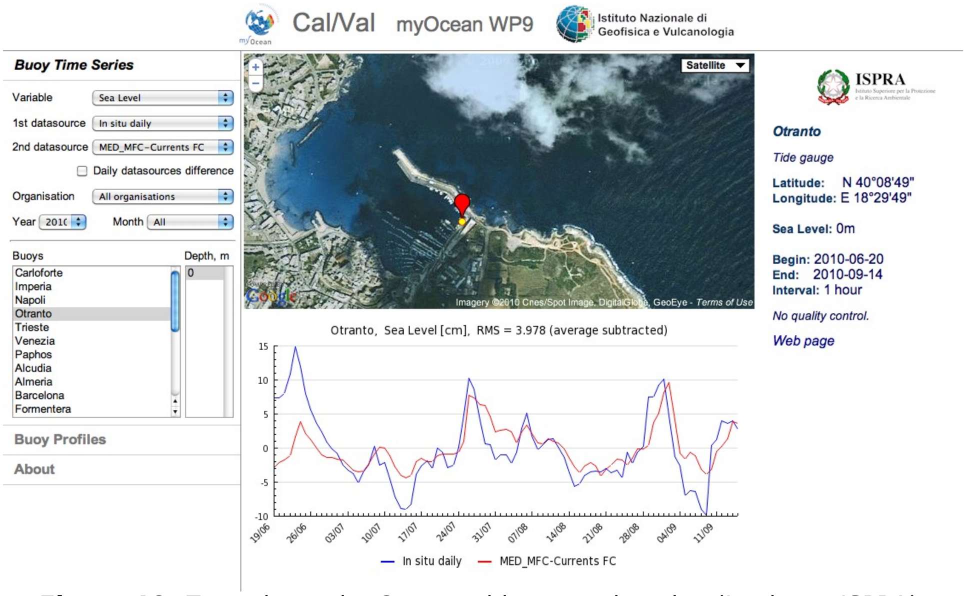

Figure 19: Zoom-in on the Otranto tide gauge location (Institute: ISPRA).

VI.5 Help section (About)

Here is found a description of the general-purpose of the web site and of the MyOcean CalVal activities. Two reference documents (in-situ and regional models) and this software manual are available for downloading.

VII ANNEX A: FULL LIST OF CALVAL (MYSQL) DB NOMENCLATURE

DATA	DATASOURCES	VARIABLES	PROBES	DEVICES	ORGANISATIONS
probe_id	In situ original	Temperature	Ca 70	Moored buoy	PUERTOS
variable_id	In situ daily	Salinity		Moored profile buoy	IFREMER
datasource_id	Satellite	Sea Level		Tide gauge	HCMR
time	Med_MFC-Currents AN	Zonal Current			OGS
depth	Med_MFC-Currents FC	Meridional Current			OC-UCY
latitude		SST			IOLR
longitude		Currents (vectorized)			ISSIA
value					ISMAR
					IMS-METU
					NIB-MBS
					UMT-IOI-POU
					CSIC
					ISPRA

The MySQL DB contains observations from approximately 70 moored in-situ locations in the Mediterranean Sea.

For details on these sites cf. the document "*WP9.5_insitu_observations.pdf*", available for download on the CalVal web page.