Project of Strategic Interest NEXTDATA

Scientific Report for the reference period **01/01/2012-31/12/2012**

WP1.3 - Marine observation system and climate recontructions

WP 1.3
(Resp. Nadia Pinardi, INGV)

Partners: INGV

1. Scheduled activities, expected results and Milestones

The first year of activity aims at studying the feasibility and the implementation of a space-time one hundred years "Reconstruction-Reanalysis" (RR) of the Mediterranean Sea climate variability, with spatial resolution of few kilometers and a temporal resolution of few hours. To this end, the available data of the SEADATANET, EMODNET and MyOcean programs, including in situ and satellite data, will be collected and processed with a uniform quality control technique. The data assimilation system will be calibrated and prepared for providing the high resolution RR.

The Milestone for the first year of activity is:
M1.3.1 (PM12): Definition of the RR system and the data assimilation procedure.

2. Deliverables expected for the reference period

D1.3.1 (PM12): Historical marine data and Quality Control (QC) procedure for the Mediterranean Sea Reconstruction/Reanalysis (RR)..
D1.3.2 (PM12): Implementation of the numerical model and the data assimilation scheme of the Mediterranean Sea Reconstruction/Reanalysis (RR) System.

3. Activities which have been actually conducted during the reference period

3.1 Research Activities

Due to the sparseness of observations in the first fifty years of the last century, as shown in Figure 2a and better described in Deliverables D1.3.1 and D2.2.1, it is not possible to build a proper reanalysis in the first part of the period under investigation. We will refer more properly for the first fifty years to a reconstruction of the Mediterranean climate variability. A reanalysis is possible in the last fifty years, thanks to increasing data availability with time as shown in Figure 2b-c. Therefore the present activity is renamed "Reconstruction-Reanalysis" (RR) of the Mediterranean Sea climate variability.

A detailed analysis of RR quality will be evaluated during the third year of activity, as reported in the Executive Plan, both from a quantitative point of view, as in *Adani et al. 2011*, and a qualitative point of view, referring to the wide existing literature. The expected RR quality will vary according to the availability of observations. The constant data search/discovery and update of our database will improve progressively the final RR quality. This can be obtained also thanks to the technical advancements introduced in the RR system, like the Ocean General Circulation Model (OGCM) and the data assimilation technique.

The RR feasibility study concerned a quality control of different components of the Mediterranean RR system (schematized in Figure 1) based on the previous INGV reanalysis production for the past 25 years (1985-2010). Table 1 summarizes the INGV Mediterranean Reanalysis system developments:

I. **MedReanV2** (*Adani et al 2011*) produced in the framework of CIRCE Project (http://www.circeproject.eu/)
II. **MedReanV4** in production within the framework of **MyOcean Project** (implementation project of the GMES Marine Core Service)
III. Mediterranean RR system under construction

All the technical details included in Table 1 will be described in Deliverable D1.3.2 *(Implementation of the numerical model and the data assimilation scheme of the Mediterranean Sea Reconstruction/Reanalysis (RR) System).*

One of the main tasks of the first year of WP1.3 activity was the review, update and collection of the existing **historical marine data for the RR period 1912-2011**. Deliverable D1.3.1 describes in details the work done. Observations are a fundamental component of the Mediterranean RR system (Figure 1) since an integrated observing and prediction system relies on the observational component in different phases:

- model initialization;
- model calibration;
- data assimilation;
- validation and quality assessment of model results.

The RR system needs in situ temperature and salinity observations along the water column and remote sensed observations of altimetry (SLA) to be assimilated in the numerical model (see Figure 1 from D.1.3.1). Sea Surface Temperature (SST) satellite observations are not assimilated but they are used to correct interactively the surface heat flux on the base of the difference between modeled SST and observed SST. In situ temperature and salinity profiles are also used to compute statistical gridded products, like monthly climatology, used to initialize the RR system but also for future quality assessment of RR results.

These data sets have been collected in synergy with WP2.2 from European Marine databases (SeaDataNet, GMES) and have been archived, as described in Deliverable D2.2.1, in a specific format to be assimilated in the RR system. A brief description of remote sensed observations (SLA, SST) is given and further details are included in deliverables D1.3.1 and D2.2.1. None Quality Control (QC) procedure has been implemented for these data since their quality assessment has been already carried out from **MyOcean SST-TAC** and **Sea Level TAC**. It will follow a brief description of the in situ data set (see also D.2.2.1) and the QC strategy adopted.

The second main task of the first year of the project was the design of the feasible technical improvements to include in the **RR system** regarding the **Ocean General Circulation Model (OGCM) and the data assimilation scheme implementations**. Deliverable D1.3.2 describes in details the work done.

The RR system consists of daily three-dimensional variational analysis followed by a 1-day OGCM integration, as implemented by *Adani et al. 2011*. The data assimilation scheme is the **OceanVar** (*Dobricic and Pinardi, 2008*). The differences with previous reanalysis efforts (**MedReanV2** and **MedReanV4**) are schematized in Table1. It will follow a description of the principal characteristics of the OGCM and the OceanVar data assimilation scheme to be used in the Mediterranean Sea RR production scheduled in the next year of the project. **RR system calibration** was carried out for the years 1985-1987 considering MedReanV2 as our reference product skill.

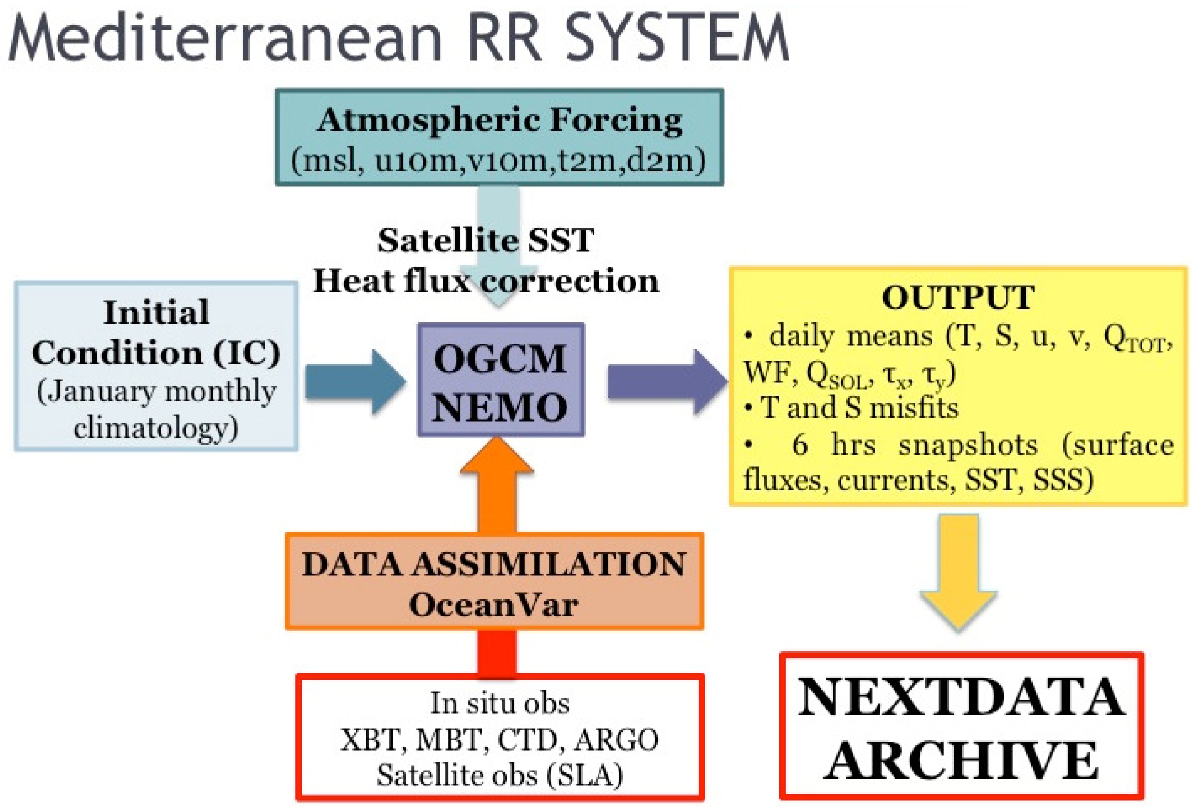

Figure 1. Schematics of the Mediterranean Reconstruction/Reanalysis (RR) system and its components: (center) the Ocean General Circulation Model (OGCM) based on NEMO code *(Madec, 2008)*; (left) the Initial Conditions (IC); (top) the atmospheric forcing (mean sea level perssure-msl, u and v wind components at 10 meters- u10m, v10m, air temeperature at 2 meters-t2m, dew point temperature-d2m); (bottom) the OceanVar assimilation scheme (*Dobricic and Pinardi 2008*) and in situ and satellite (SLA-sea level anomaly) observations collected in the dedicated archive by WP2.2; (right) RR output fields of 3D temperature, salinity, currents, 2D total heat flux at the air-sea interface, water flux-WF, solar radiation-Qsol, momentum flux components-τ, misfits between model and observations, and snapshots every 6 hours of 2d surface temperature, salinity, currents and the total heat flux components. All these model data will populate the NextData archive.

	MedReanV2 (1985-2007)	MedReanV4 (1985-2010)	RR (1912-2011)
Project	CIRCE *Adani et al. 2011*	MyOcean	NEXTDATA
OPERATIONAL SYSTEM	Sys3a2(OPA8.1) *Tonani et al.2008*	Sys4c1 (OPA9.0) *Oddo et al.2009*	(NEMO3.4)
LBC (Atlantic Box)	closed	open	open
Initial Condition IC	MedAtlas Climatology (obs 1995-1999) *Maillard et al. 2005*	SDNV2aa climatology (obs until1987)	SDNV2aa climatology (obs until1987)
ATM Forcing	ERA15 1.125° (1985-1992) ECMWF analysis 0.5° (1993-2007)	ERAInterim 0.75° (1985-2010)	**AMIP** 1.125° (1912-1957) **ERA40** 1.125° (1958-1978) **ERAInterim** 0.75° (1979-2011)
Total Cloud Cover TCC	NCEP–NCAR (1985–92) ECMWF analyses 0.5° (1993-2007)	ERAInterim 0.75° (1985-2010)	**AMIP** 1.125° (1912-1947) **NCEP–NCAR**(1948-1978) **ERAInterim** 0.75° (1979-2011)
Precipitations	NCEP–NCAR (monthly climatology)	CMAP (monthly climatology)	**AMIP** (montly climatology) **NCEP–NCAR** (monthly climatology) **CMAP** (monthly climatology)
SST	SST reconstruction (1985-2007) *Marullo et al.2007*	SST reconstruction (1985-2007) *Marullo et al.2007* MyOcean data (2008-2010)	**HadISST1** (1912-1985) **SST reconstruction**(1985-2007) *Marullo et al.2007* **MyOcean data** (2008-2011)
Partial Cells	NO	YES	YES
True Stress	NO	YES	YES

Table 1. INGV Mediterranean Reconstruction/Reanalysis system developments: 1) MedReanV2 already available from *Adani et al. (2011)* within the framework of CIRCE Project (http://www.circeproject.eu/); 2) MedReanV4 in production within the framework of MyOcean Project; 3) RR100 NEXTDATA developing system for the Mediterranean Sea.

Historical Marine Data

Altimetry data come from MyOcean Sea Level TAC (Thematic Assembly Centre) and are delayed time (DT) SLA data "upd" version. The Delayed Time component of SSALTO/DUACS system is responsible for the production of processed Jason-1, Jason-2, T/P, Envisat, GFO, ERS1/2 data in order to provide a homogeneous, inter-calibrated and highly accurate long time series of SLA. The time period of satellite altimetry monitoring starts from 1985 (GeoSat) but RR will assimilate data starting from 1992.

Satellite SST data set is a time concatenation of SST products specific for the Mediterranean Sea characterized by horizontal maps already optimally interpolated onto the RR model grid at 1/16th of a degree:

1. **reprocessed data** (1985-July 2008) of the recent AVHRR Pathfinder SST (*Marullo et al., 2007*);
2. **MyOcean SST** (July2008-2011) L4 High Resolution Mediterranean SST products (*Buongiorno Nardelli et al. 2013*).

For the time period preceding 1985 we will consider the Met Office Hadley Centre's sea SST data set, **HadISST1** (*Ryner et al., 2003*) at 1 degree of horizontal resolution available from 1870 to date. This choice is consistent with the idea to use AMIP (Atmospheric Model Intercomparison Project - *Gates, 1992*) type of atmospheric forcing for the pre-ERA40 period starting from mid-1957. Details will follow later in the report, when Model implementation is described.

I**n situ temperature and salinity** data sets considered for the RR production were collected from three main sources:

1. **SeaDataNet** (SDN hereafter) European infrastructure (DG-Research – FP6) provides data from 1900 up to nowadays;

2. **MEDAR-MEDATLAS** dataset covering the period 1985-1999 (*Maillard et al. 2005*);

3. **MFS** (Mediterranean Forecasting System) and **MyOcean** In situ TAC for data starting from 1999.

The merging of these data sets was necessary due to missing data within the SDN infrastructure. SDN historical database gathers in situ data from about forty NODCs (National Ocean Data Center) and its data population started and progressively increased on the first phase project implementation. The second phase of SDN project (started in September 2011) is now devoted to the assessment of the quality of the database content and the duplicate elimination. Potential duplicates were thus identified and excluded from successive usage and analysis.

Looking at the annual data distribution of the number of temperature and salinity observations within SDN database from 1990 to 2012 (Figure 2c), it is evident the decrease of the number of observations for the recent years due to a time lag between the sampling and the insertion of the data inside the SDN infrastructure, which is a common characteristic of historical databases. This required the use of **MFS and MyOcean in situ TAC operational observations to integrate the SDN data set in the recent period**. We intend for MFS operational observations, near real time (NRT) observations collected in the Mediterranean Sea within different precursor projects spanning a time period 1999-2009 when MyOcean Project started. Precursor European projects are:

- **MFSPP** (Mediterranean ocean Forecasting System Pilot Project) **1998-2001** EU-MAST project MA 53-CT98-0171;
- **MFSTEP** (Mediterranean ocean Forecasting System Towards Environmental Prediction) **2003-2005** DG-Research – FP5 EU Contract Number EVK3-CT-2002-00075;
- **MERSEA** (Marine Environment and Security for the European) Strand 1 **2001-2003**;
- **MERSEA** Integrated Project **2004-2008**.

Another check has been implemented to verify the presence of MEDAR-MEDATLAS data set (assimilated in **MedReanV2** from *Adani et al., 2011*). Missing data have been integrated to obtain the most extensive dataset.

The time period 1911-1946 is characterized by very few observations (Figure 2a) and in many years there are no observations at all. Data availability starts and systematically increases from 1946. The sparseness of observations between 1912 and 1946 will allow to assimilate very few observations but a Mediterranean Sea climate reconstruction will be possible thanks to the use of AMIP type of atmospheric data as surface forcing fields and of the HadlSST1 data to correct the surface heat flux as it is better explained in the Deliverable D1.3.2.

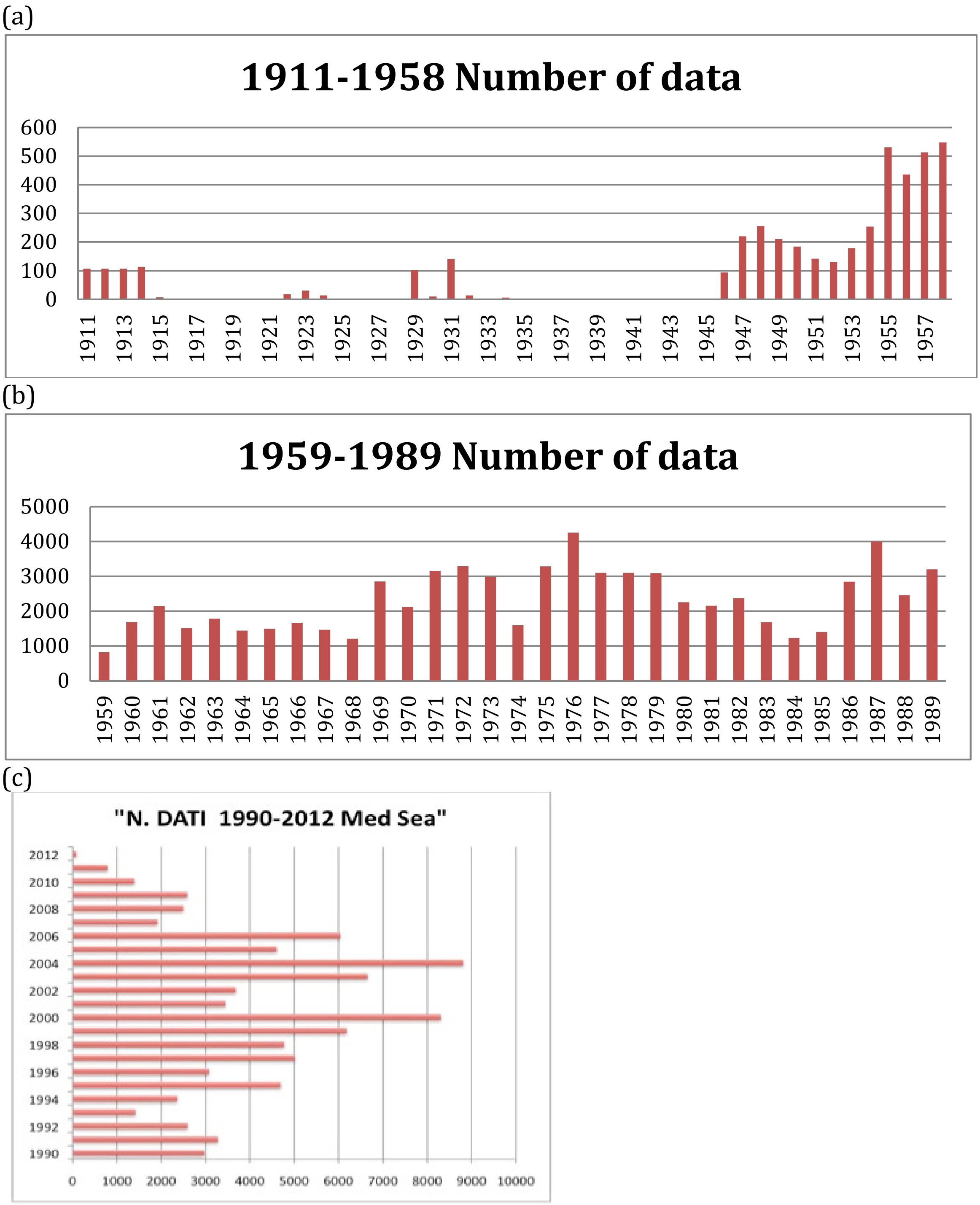

Figure 2. Annual distribution of T&S data within SDN infrastructure for the Mediterranean Sea: (a) for the time period 1911-1958; (b) for the time period 1959-1989; (c) for the time period 1990-2012.

Data Quality Control

Quality Control analysis has been applied to in situ data, since remote observations have already passed through specific and detailed MyOcean SST and Sea Level TACs QC processes.

The downloaded in situ observations have been selected through the **general quality indexes** applied consistently by SDN, MFS, MyOcean and MEDAR-MEDATLAS automated basic quality check. In particular we selected the **profiles with general flags equal to 1 related to their right positioning in space and time (longitude, latitude, time)**.

A **visual inspection** of the downloaded data has been performed using ODV (Ocean Data View) software that can easily manage big amount of data and it has been developed to be compliant with SDN and MEDAR-MEDATLAS data format. **General depth flags**, associated to each profile, equal to 0, 1, 2 have been then chosen to refine our data set in order to do not discard too many observations.

Key	Entry Term	Abbreviated term	Term definition
0	no quality control	none	No quality control procedures have been applied to the data value. This is the initial status for all data values entering the working archive.
1	good value	good	Good quality data value that is not part of any identified malfunction and has been verified as consistent with real phenomena during the quality control process.
2	probably good value	probably_good	Data value that is probably consistent with real phenomena but this is unconfirmed or data value forming part of a malfunction that is considered too small to affect the overall quality of the data object of which it is a part.
3	probably bad value	probably_bad	Data value recognised as unusual during quality control that forms part of a feature that is probably inconsistent with real phenomena.
4	bad value	bad	An obviously erroneous data value.
5	changed value	changed	Data value adjusted during quality control. Best practice strongly recommends that the value before the change be preserved in the data or its accompanying metadata.
6	value below detection	BD	The level of the measured phenomenon was too small to be quantified by the technique employed to measure it. The accompanying value is the detection limit for the technique or zero if that value is unknown.
7	value in excess	excess	The level of the measured phenomenon was too large to be quantified by the technique employed to measure it. The accompanying value is the measurement limit for the technique.
8	interpolated value	interpolated	This value has been derived by interpolation from other values in the data object.
9	missing value	missing	The data value is missing. Any accompanying value will be a magic number representing absent data.
A	value phenomenon uncertain	ID_uncertain	There is uncertainty in the description of the measured phenomenon associated with the value such as chemical species or biological entity.

Tab. 2. Quality indexes defined by SeaDataNet.

Then a **gross range check** has been applied to avoid unrealistic temperature (4 <T<30C°) and salinity (15<S<40psu) values. Duplicate check has been done applying specific tolerances on time (0.1 days), longitude (0.02deg) and latitude (0.02deg). Then an ODV built-in spike detector has been applied before saving the full data set with the relative quality flags in a spreadsheet file compatible with DIVA software used to compute temperature and salinity monthly climatology (D1.3.2).

Observed profiles were then written on ASCII files to be read from the OceanVar data assimilation scheme. **A further QC was performed during this phase considering the quality indexes associated to temperature, salinity and depth at each vertical level.** Only the profiles having more than the 75% of "good" data will be assimilated in the reanalysis. We defined good data the vertical records whose three (T ,S, depth) flags were all equal to one.

For example, if a temperature and salinity profile contains 10 vertical records only the vertical records with all three quality flags equal to 1 were selected. Only if the number of the selected records is more than the 75% of its original number the profile passes to the next phase and thus it will be assimilated in the RR. In this case the profile should possess 8 good vertical records.

The circulation model for the Mediterranean RR

The second component of the RR system (Figure1) is the **ocean general numerical model (OGCM)** first implemented by *Tonani et al. 2008* based on OPA8.1 code (*Madec, 2008*), then developed and upgraded to OPA9.2 code (NEMO) by *Oddo et al. 2009*. A first model implementation was used to produce **MedReanV2** (*Adani et al 2011*) while a second model implementation is now running for **MedReanV4** reanalysis production (see Table 1).

The OGCM domain covers the entire Mediterranean Sea extending also into the Atlantic with a 1/16 of a degree horizontal resolution, 72 unevenly spaced vertical z-levels. The OGCM uses vertical z coordinates with **vertical partial cells** to better fit the bottom depth shape (*Oddo et al. 2009*). Figure 3, extracted from *Madec* (*2008*), shows how varies the bottom shape representation with standard vertical coordinates (a) and with vertical partial cels (b).

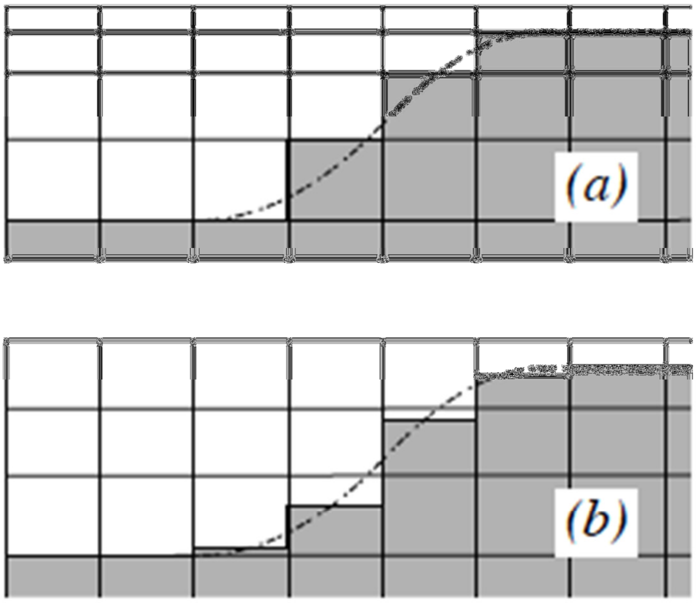

Figure 3. The sea bottom as represented by (a) standard z coordinates, (b) coordinates with partial cells on the bottom. Extracted from *Madec 2008* – fig 3.5 –page 44.

The Atlantic part of the domain (Atlantic box) presents three lateral boundaries where the model is nested within monthly mean climatological fields computed from 10 years of daily output (1993-2003) of the 1/4 degrees global model MERCATOR-1/4 (*Drevillon et al., 2008*).

Air-sea fluxes are computed through bulk formulae which need the following input atmospheric data: 1) air temperature at 2m; 2) dew point temperature; 3) zonal and meridional wind components at 10m; 4) mean sea level pressure; 5) total cloud cover. A specific study on the air-sea fluxes parameterization has been done. We evaluated for RR production the usage of:

- extrapolation technique for air temperature and specific humidity from 2 to 10m, as required by the bulk formulae;

- **true stress** which considers the wind speed relative to marine currents to compute the momentum flux.

To evaluate the air temperature and specific humidity extrapolation we used COSMO-Med data that provide values at 10m of the variables. We used NEMO routine turb_core_2z.f90 that computes turbulent transfer coefficients of surface fluxes according to *Large and Yeager (2004)* to extrapolate COSMO air temperature and specific humidity values from 2m to 10m and we compared the results with COSMO data at 10m.
To evaluate the introduction of true stress in the momentum flux parameterization we performed two simulation for the time period 1985-1987 with and without true stress computation and we validated model results with in situ temperature and salinity profiles and with satellite SST.

The **Initial Condition (IC)** definition needed the production and analysis of many temperature and salinity climatologies that consider different temporal periods to be able to better represent the mean hydrodynamic conditions of the initialization period. A new temperature and salinity monthly climatology (named SDN_v2aa) has been calculated utilizing the extensive historical data set from 1900 to 1987, which only partially comprehends MEDAR-MEDATLAS data (1985-1999) used instead in MedReanV2 IC (*Adani et al., 2011*). We considered all the observations available in January from 1900 to 1987 to compute the initial condition (January monthly climatology) because we did not want the climatology to be affected by the Eastern Mediterranean Transient (EMT), since it is not clear yet that an equivalent of the EMT has occurred before 1993. Mediterranean observations have been blended to the World Ocean Atlas climatology (WOA) in the Atlantic Box. The climatology has been computed with DIVA software tool (Data-Interpolating Variational Analysis), which allows to spatially interpolate observations on a regular grid in an optimal way.

The **atmospheric forcing** is the third component of the RR system (Figure1 and Table 1). After previous experiences (*Adani et al. 2011*) we will consider in RR a concatenation of the latest ECMWF (European Centre for Medium-Range Weather Forecasts) atmospheric reanalysis data products that have been archived by WP2.2:

- **ERAInterm** (*Dee et al. 2011*) data cover the time period **1979-nowadays** with horizontal resolution of **0.75°**
- **ERA40** *(Uppala et al. 2005)* data cover the time period **September 1957-August 2002** with horizontal resolution of **1.125°;**

Both data sets present 6 hours of temporal resolution.
For the hundred years RR production is taken into consideration the quality of **AMIP** type (*Gates, 1992*) of forcing in order to cover the entire period of study. AMIP type of data (*Cherchi and Navarra, 2007)* are available starting from **1900 up to 2003** and were created through a set of experiments performed with the ECHAM4 atmospheric GCM on a T126 grid (**1.125°** of horizontal resolution) forced by HadISST1 (*Rayner et al. 2003*) interpolated onto model grid. AMIP data have 12 hours of temporal resolution. In particular 7 experiments are available in our archive with similar characteristics but they must be analyzed and compared to the ECMWF reanalysis products to choose the best one to use.

During this year we started also the **implementation of the higher resolution OGCM** based on the upgraded NEMO3.4 parallel code. The increment of model horizontal resolution goes from 1/16 to 1/24 of a degree. DBDB1 bathymetry has been interpolated on model grid and particular investigation was dedicated to model topography (coastline, minimum depth) and vertical discretization definition. We tried various configurations with different number of vertical levels (72, 81, 91, 101) to be able to represent in an optimal way the ambient stratification and its seasonal variability. The OGCM configuration with 91 vertical levels was selected. A preliminary simulation has been performed to assess that the input data (bathymetry, initial condition, atmospheric data, river outflow data) are read correctly and that the surface fluxes are computed correctly.

The Data Assimilation Scheme

The fourth component analyzed is **data assimilation scheme** that uses both in situ (temperature and salinity profiles) and remote sensed data (Sea Level Anomaly) to correct the OGCM results. **OceanVar** is a three-dimensional variational scheme, set up by *Dobricic and Pinardi,* (*2008*) for the operational forecasting system (*Dobricic et al 2007*), that allows to correct model fields for all dynamic variables (T, S, sea level, u and v current components).
The assimilation cycle to be used in the RR system differs from the operational one described in *Dobricic et al* (*2007*). The assimilation cycle is daily, as implemented by *Adani et al. (2011)* in the **MedReanV2**, and takes into consideration the observations within the 24 hours time interval that spans from 12:00 of day J and 12:00 of day J+1. The correction estimated is applied at model restart at 12:00 of day J+1.

OceanVar **calibration analysis** was performed in order to handle an increasing number of observations. Another issue encountered was the different observation distribution pattern that characterizes the operational prediction system, for which the OceanVar has been originally designed, and the RR system. The different data distribution pattern are related to the different characteristics of the NRT observations used for the forecast production and the DM observations considered for the RR production, that include high resolution surveys regularly spaced on monitoring arrays or transects.

Many experiments have been conducted to tune **horizontal correlation length scales**, the **instrumental error**, to evaluate the possible usage of **vertical super observations** (average computation within vertical layers to avoid redundant information) and to improve the **horizontal filter** that spreads vertical corrections in the horizontal introducing a multi-scale approach. This RR system calibration focused mainly on August/September 1987 when a lot of observations are available thanks to an extensive POEM surveys (*Malanotte-Rizzoli and Robinson, 1988*) which sampled intensively the Eastern Mediterranean. The evaluation of the results has been done using in situ and satellite SST observations but also comparing the obtained circulation with the reference extensive literature about the Eastern Mediterranean circulation in that period, in particular *Robinson at al. 1991*.

3.2 Applications; technological and computational aspects

None in the reference period.

3.3 Formation

None in the reference period.

3.4 Dissemination

None in the reference period.

3.5 Participation in conferences, workshops and meetings

None in the reference period.

4. Results obtained during the reference period

4.1 Specific Results

The OGCM analysis of **air-sea fluxes** parameterization brought about two important results.

First the air temperature and specific humidity extrapolation from 2 to 10m before the bulk formula computation is:

- an advantage for air temperature during winter time when extrapolated values at 10m are close to COSMO 10m, while it produces too high temperatures during the summer season when our model results present already a positive bias versus observed SST;
- an advantage for specific humidity computation during fall/winter seasons but it creates very low values during spring/summer seasons.

We thus concluded to avoid the extrapolation of air temperature and specific humidity from 2m to 10m.

Second the true stress analysis did not produce significant differences in terms of temperature and salinity misfits computed from in situ and satellite observations, we thus decided to keep the true stress implementation.

Data Assimilation calibration results allowed to:

- identify a code bug on the vertical misfit interpolation;
- to discard vertical super observation computation;
- to reduce the correlation length scale in order to minimize the occurrence of overshooting phenomena in the 3D correction field estimation;
- to improve the horizontal filter;
- to test a multi-scale horizontal filter which selects the horizontal correlation length scale on the base of the observed variability.

4.2 Pubblications

None in the reference period.

4.3 Availability of data and models output (format, media, etc.)

None in the reference period.

4.4 Completed deliverables

D1.3.1: "Historical marine data and Quality Control (QC) procedure for the Mediterranean Sea Reconstruction/Reanalysis (RR)".

D1.3.2: "Implementation of the numerical model and the data assimilation scheme of the Mediterranean Sea Reconstruction/Reanalysis (RR) System".

5. Comment on differences between expected activities, results, deliverables and those actually performed

The first year of WP1.3.1 activity focused on the design of a new Reconstruction/Reanalysis (RR) system aimed at studying the Mediterranean Sea climate variability in past century. The results of the higher resolution OGCM at 1/24 of a degree are still preliminary to be implemented within the RR system. The AMIP data analysis and the full validation with the ECMWF reanalysis products (ERA40, ERAInterim) has not been possible during this first year of activity but will be performed soon and included in the next year report. These data should force the RR before 1958, when ERA40 data become available.

6. Expected activities for the following reference period

The activities conducted during the first year and the results obtained so far bring about a partial re-formulation of our activities **for the following reference period** with respect to what has been indicated in the project Executive Plan **(Production of Med RR at 1/24 starting from 1912)**. While further time will be dedicated to the higher resolution RR system implementation/calibration and the validation of the AMIP atmospheric forcing, we will begin **an interim** RR production covering the time period 1958-2011 using the 1/16 of a degree configuration.

In the meantime further efforts will be invested on:

- higher resolution RR system implementation;
- AMIP data quality assessment;
- the improvement of OceanVar data assimilation scheme for the higher resolution RR system;
- the estimation of a new monthly climatology on the 1/24 of a degree to initialize the higher resolution RR system.

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