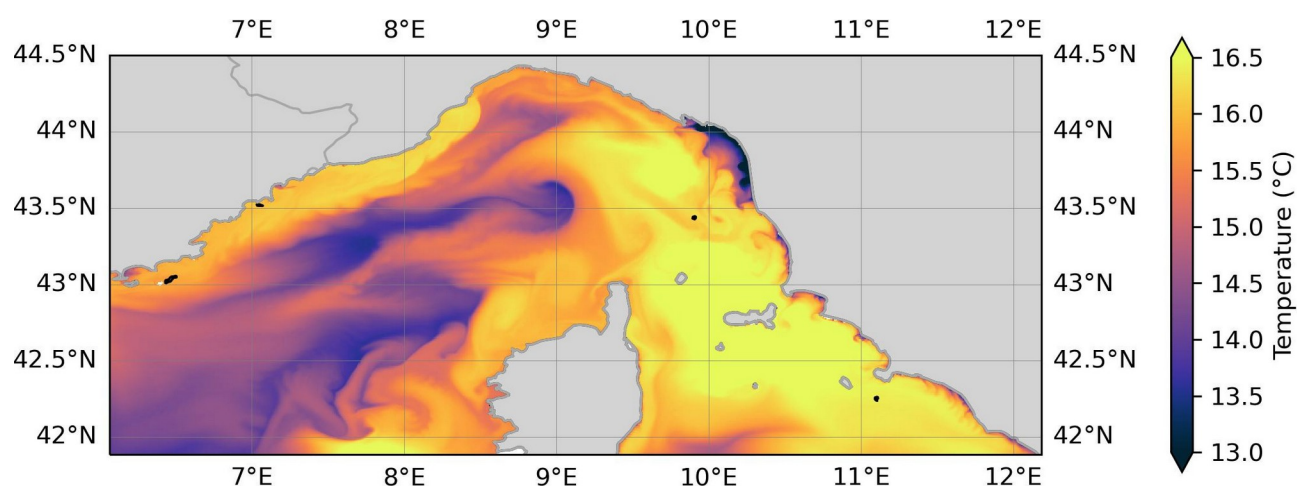




# MANUAL FOR DATA\_MED TOOLS

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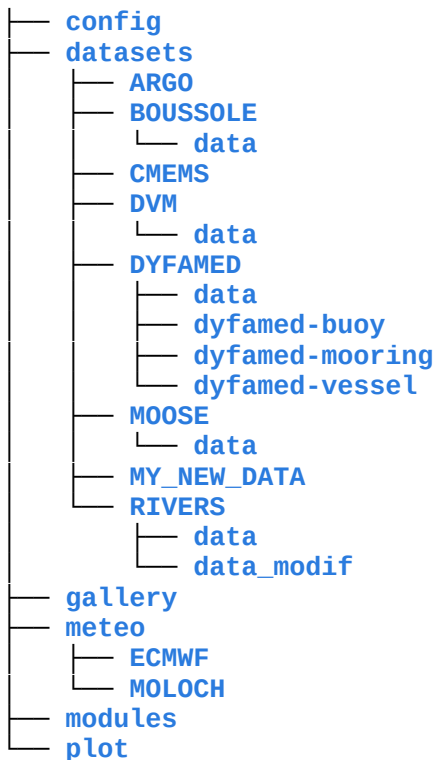
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# 1 Introduction

This document presents the architecture and instructions to process oceanographic model outputs and data in the Mediterranean Sea using the MITgcm model.

Using other models remain possible through simple nomenclature/format conversion. Contact me for any questions.

## 2 General arborescence



## 3 Setup

git clone [git@github.com:cfontana00/DATA\\_MED](https://github.com/cfontana00/DATA_MED)

### Required Python toolbox

Core : numpy, scipy, cartopy, matplotlib, xarray

Optional : copernicusmarine (CMEMS), cdsapi (ECMWF)

## Environment variables

\$ set \$DIR/modules to your PYTHONPATH in ~/.bashrc

\$ export env variable DATA\_MED\_DIR as /path/to/DATA\_MED

\$bash

## Create your own configuration file

\$ cd config

\$ cp config\_TEMPLATE.json config\_MYCONFIG.json

\$ cp variables\_mit\_TEMPLATE.dat variables\_mit\_MYCONFYG.dat

(Tag MYCONFIG can be anything)

## 4 Parameters description

**Tune your config MYCONFIG.json file considering parameters below**

"\_\_\_\_": "GENERAL PARAMETERS",

"date_ini": "2021-12-11",	# Initial date of model data
"date_end": "2021-12-12",	# Final date of model data
"outdir": "/path/to/OUTPUT_SMP",	# Directory containing outputs
"diagdir": "/path/to/diags/dir",	# Directory to save diagnostics files

"\_\_\_\_": "RIVER PARAMETERS",

"french_list": ["Argens", "Var"],	# French rivers list (see README)
"italian_list": ["Arno", "Magra", "Ombrone", "Serchio"],	# Italian rivers list (see README)
"river_ini": "2021-01-01",	# River initial date
"river_end": "2021-12-31",	# River final date

"\_\_\_\_": "METEO PARAMETERS",

"meteo_ini": "2015-03-10",	# Starting date for meteo data processing
"meteo_end": "2015-03-11",	# Ending date for meteo data processing
"day_cycle": 2,	# Number of days per cycle
"n_cycle": 3,	# Number of cycles

```

"imin": "500",                # I index minimum cut
"imax": "600",                # I index maximum cut
"jmin": "350",                # J index minimum cut
"jmax": "450",                # J index maximum cut

"_____": "ARGO",

"argo_ds": "phy",             # Argo data set (phy or bgc)

"_____": "DYFAMED PARAMETERS",
"some_par": "some_par",      # To be defined

"_____": "BOUSSOLE PARAMETERS",
"some_par": "some_par",     # To be defined

"_____": "PLOT PARAMETERS",

"resol": "10m",               # Cartopy coast/land resolution
"fig_proj": "ccrs.PlateCarree()", # Cartopy projection
"fig_sx": "8",                 # Horizontal 2D figure size
"fig_sy": "8",                 # Vertical 2D figure size
"fig_fmt": "jpg",              # Output figure format
"fig_res": "300",              # Output figure resolution
"tight": "False",              # Crop white space (time-consuming)
"fig_tck_size": "10",          # Figure tick size
"fig_tcklbl_size": "10",       # Figure tick label font size
"fig_lbl_size": "10",          # Figure label font size
"cb_fraction_2D": "0.02",      # Python colorbar fraction parameter
"cb_pad_2D": "0.12",           # Python colorbar padding parameter

"_____": "SECTION PLOT PARAMETERS",

"fig_secx": "8",               # Horizontal in-depth section figure size
"fig_secy": "4",               # Vertical in-depth section figure size
"sec_lon1": "8.5",             # Longitude starting point for section
"sec_lat1": "43.",              # Latitude starting point for section
"sec_lon2": "10.",             # Longitude ending point for section

"sec_dep": "600",              # Maximum depth for section
"sec_resH": "0.05",            # Horizontal resolution for interpolation
"sec_resV": "1",               # Vertical resolution for interpolation
"cb_fraction_sec": "0.025",    # Python colorbar fraction parameter for section plot

```

```
"cb_pad_sec": "0.06",                # Python colorbar padding parameter for section plot

"_____": "PROFILE PLOT PARAMETERS",

"fig_prox": "4",                      # Horizontal profile figure size
"fig_proy": "8",                      # Vertical profile figure size
"col_bcg": ["g", "b", "r"],          # Colors
"col_phy": ["b", "r"],                # ( /\ refer to the argo_ds parameters tuning)

"_____": "INTERPOLATION PARAMETERS",
"dump": "0.05",                      # Margin kept around point to fasten interpolation (5/10 grid points)
"itp_meth": "nearest",               # Interpolation method, set nearest for tests, or linear
```

**The configuration is read dynamically and its variables are global inside the system once loaded**

## 5 Variable options description

```
$ cp /config/variables_mit_TEMPLATE.dat /config/variables_mit_MYCONFIG.dat
```

Description	Name	File tag	Colormap	Log plot	Limit mode	Plot min value	Plot max value	Label	Units
Options				True/ False	set/auto				
Example	Chl	PFTC	cmc.imola	True	Set	0.05	0.25	Chlorophyll	mg.m-3

## 6 Plot directory routines

This directory contains routines to perform plots. Diagnostics arborescence is automatically created and name of file saved prompted.

=> Routine make\_plot\_2D.py :

**Description** : Plot 2D spatial maps on the domain

**Arguments :** *configuration\_name variable\_name z-level*



Bash utilization with *make\_plot\_2D.ksh*

=> *Routine make\_plot\_section.py :*

**Description :** Plot vertical section on the domain

**Arguments :** *configuration\_name variable\_name direction coordinate\_value*

*direction* argument can be horizontal or vertical

If *direction* is horizontal, routine plots the section from ‘*sec\_lon1*’ to ‘*sec\_lon2*’ at latitudinal ‘*coordinate\_value*’

If *direction* is vertical, routine plots the section from ‘*sec\_lat1*’ to ‘*sec\_lat2*’ at longitudinal ‘*coordinate\_value*’



Same possible bash utilization as *make\_plot\_2D.py*

## 7 RIVERS datasets routines

This routine create river runoff input files at the MITgcm format

The data can be downloaded from <https://www.hydro.eaufrance.fr/> for french rivers and <http://www.sir.toscana.it/consistenza-rete> for italian ones.



Get csv files from both sites and save them as *rivername.csv* in the */datasets/RIVERS/data*

```
$ python3 read_rivers.py NWMED
```

=> **produces** MITgcm ready to read files in */diagdir/MYCONFIG/RIVERS/*

The routine raises an error if data are not continuous. In this case you must pre-process the data (e.g. interpolation/climatology) and save the processed file in *data\_modif/rivername\_modif.csv*



The routine checks for existence of the file \*\_modif.csv before reading the original one.

## 8 METEO routines

### ECMWF toolbox

These routines download and process CERRA data from :

<https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-cerra-single-levels?tab=overview>



Tune "METEO PARAMETERS" section in your configuration file

#### **Get the data :**

Go to DATA\_MED/meteo/ECMWF

Run :

```
$ python3 get_data.py MYCONFIG
```

The routine download data between “meteo\_ini” and “meteo\_end”, months are fully download regardless the defined day of the date

=> NetCDF files are **stored** in diagdir/MYCONFIG/METEO

Two methods are then available to create atmospheric forcing files.

The first method create one unique file for each variable and over the whole period defined by parameters “meteo\_ini” and “meteo\_end” (Method 1 below).

The second method creates separate files over temporal cycles starting on “meteo\_ini”(Method 2 below), this method is adapted for long simulations that have to be performed in several runs.

#### **Method 1 :**

```
Run : $ python3 process_data.py MYCONFIG
```

#### **Method 2 :**

```
Run : $ ./run_cycles.ksh MYCONFIG
```



### Files storage :

=> Interpolated NetCDF files are **stored** in diagdir/MYCONFIG/METEO/ITP\_NC

=> Interpolated binary files are **stored** in diagdir/MYCONFIG/METEO/ITP\_BIN

Binary files are ready to be read by MITgcm



So far, longitude/latitude 1-D array are read from an output file :

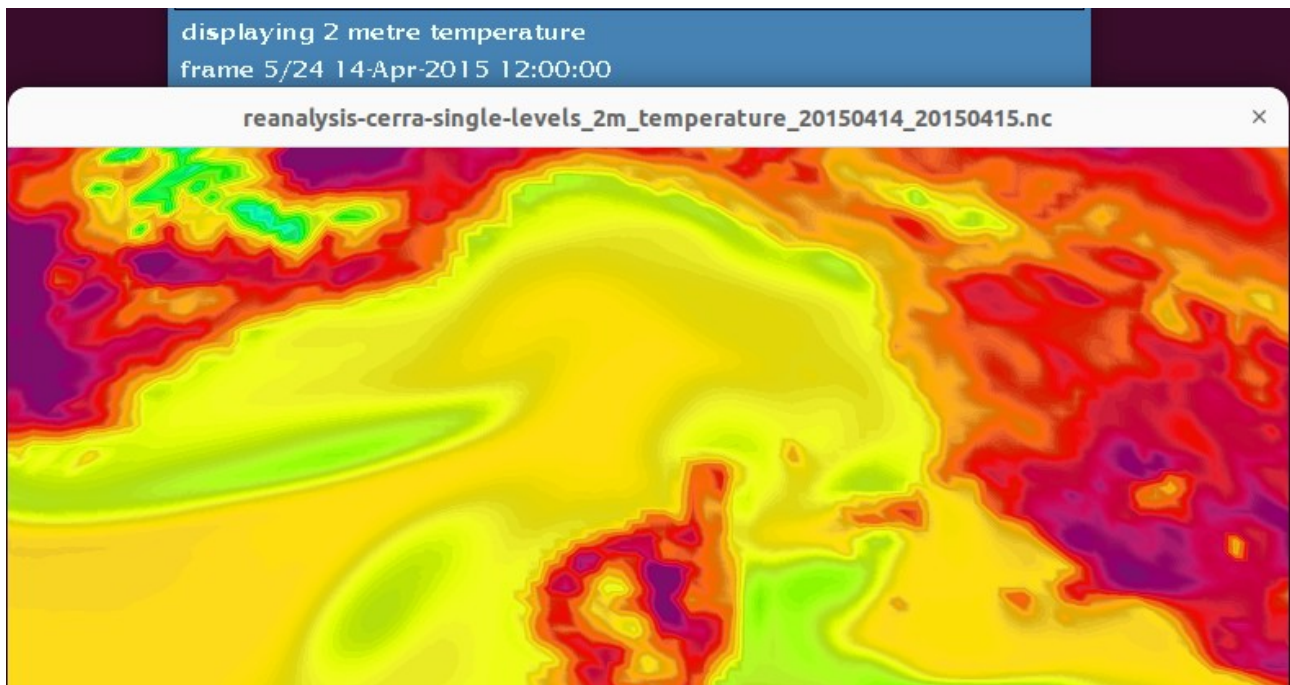
```
lon,lat,levels = load_coords()
```

```
# Mesh model lon/lat
```

```
LAT,LON = np.meshgrid(lat,lon)
```

TO DO : For a first model initialization, modify this section to read lon/lat elsewhere (bathy, mask ...) if outputs are not found.

Example :





## 9 ARGO

Comparison with Argo data, the module needs argopy installed

(<https://argopy.readthedocs.io/en/latest/>)

Tune in configuration file “argo\_ds” to “phy” (physical Argo TS) or “bgc” (biogeochemical Argo)

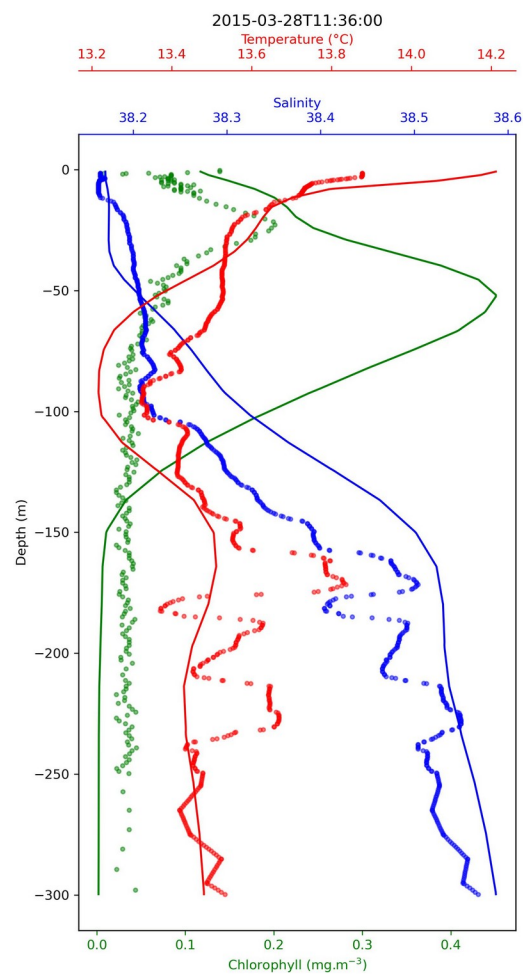
Run :

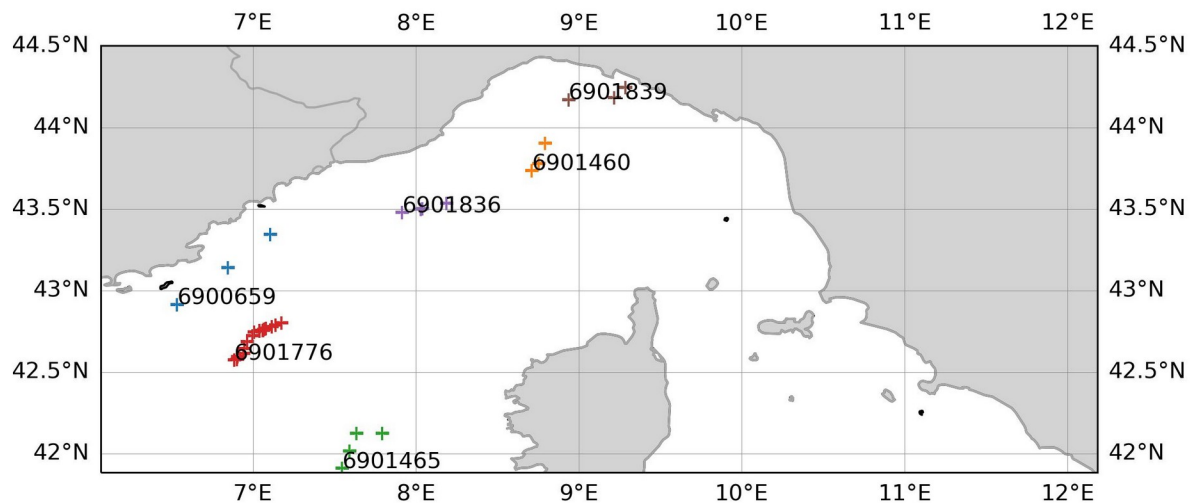
```
$ python3 get_data.ksh MY_CONFIG
```

```
$ python3 compare_argo.py MY_CONFIG
```

Data and graphs stored in diagdir/ARGO/MY\_CONFIG

Example :





## 10 Test data set

You can perform tests using MITgcm NetCDF outputs available here :

[https://drive.google.com/drive/folders/1zeqUdXv5-6zCRw\\_ok9OOMxth2WrHNgRI?usp=sharing](https://drive.google.com/drive/folders/1zeqUdXv5-6zCRw_ok9OOMxth2WrHNgRI?usp=sharing)

Just set the *outdir* and *diagdir* variables in your configuration file.

## 11 Create your own directory

You can easily access existing functions and create your own directory to process data.

For an example of use :

```
$ cd datasets/MY_NEW_DATA
```

```
$ python3 my_new_routine.py MYCONFIG
```



**TIPS :**

- You can add your own configuration parameters in a file `/config/config_CUSTOM.json` and load it using `load_config(CUSTOM)` in your routines. We could include them in the general file later.
- You can also create your own functions in `/modules` and load them as others.
- Check for `/module/fun_*` for already existing functions (e.g. *write\_nc*, *savefig* in `fun_io.py`)

# ENJOY !

# 12 Gallery

