

Argo App for data reading, plotting and comparison

by

G. Notarstefano and N. Creati

Deliverable 4.4.3 of the EU MOCCA project

Approved for release by:

Dr. Cosimo Solidoro Director, Department of Oceanography



Table of Contents

1	. 1	INT	FRODUCTION	4
2	. 7	THE	E ARGO APP	5
	2.1		TECHNICAL DESCRIPTION	. 5
	2.2	•	HOW TO USE THE ARGO APP	6
3	. (CON	NCLUSION	24



Table of Figures

FIGURE 1: LAUNCH OF THE ARGO APP IN THE MATLAB COMMAND WINDOW	5
FIGURE 2: MAIN DASHBOARD OF THE ARGO APP.	7
FIGURE 3: WINDOW FOR FLOAT PROFILES SELECTION.	3
FIGURE 4: STEPS FOR FLOAT PROFILES SELECTION.	9
FIGURE 5: "PLOT DATA" BUTTON IN THE MAIN DASHBOARD)
FIGURE 6: SELECTED FLOAT PROFILES IN THE MAIN DASHBOARD	1
FIGURE 7: TS DIAGRAM OF THE SELECTED FLOAT PROFILES.	2
FIGURE 8: SELECTION OF A PARTICULAR FLOAT PROFILE (PROFILE 055 IN BOLD RED) IN THE MAIN DASHBOARD AND IN THE	
TS DIAGRAM13	3
FIGURE 9: SETTING UP THE THRESHOLDS FOR THE COMPARISON BETWEEN THE SELECTED FLOAT PROFILE AND THE	
REFERENCE DATASET	4
FIGURE 10: LOCATION OF THE FLOAT PROFILE (BLACK DIAMOND) AND LOCATION OF THE REFERENCE PROFILES, COLOR-	
CODED PER TIME DIFFERENCE WITH THE FLOAT PROFILE	5
FIGURE 11: FLOAT AND REFERENCE SALINITY PROFILES COLOR-CODED AS DEFINED IN FIGURE 10	5
FIGURE 12: FLOAT AND REFERENCE TS PROFILES COLOR-CODED AS DEFINED IN FIGURE 10	7
FIGURE 13: SALINITY FLOAT PROFILE (BLACK LINE) AND THE CLOSEST (IN TIME) REFERENCE PROFILE (RED LINE)	3
FIGURE 14: TS FLOAT PROFILE (BLACK LINE) AND THE CLOSEST (IN TIME) REFERENCE PROFILE (RED LINE)	9
FIGURE 15: LOCATION OF THE FLOAT PROFILE (BLACK DIAMOND) AND THE CLOSEST (IN TIME) REFERENCE PROFILE (RED	
DIAMOND))
FIGURE 16: SALINITY FLOAT PROFILE (BLACK LINE) AND THE CLOSEST (IN SPACE) REFERENCE PROFILE (RED LINE)	1
FIGURE 17: TS FLOAT PROFILE (BLACK LINE) AND THE CLOSEST (IN SPACE) REFERENCE PROFILE (RED LINE)	2
FIGURE 18: LOCATION OF THE FLOAT PROFILE (BLACK DIAMOND) AND THE CLOSEST (IN SPACE) REFERENCE PROFILE (RED	
DIAMOND)	3



1. INTRODUCTION

This document describes the application that has been developed by OGS to support the activities related to the Delayed-Mode Quality Control (DMQC) of the MOCCA Argo fleet in the Mediterranean and Black Seas.

The DMQC of MOCCA floats is performed by Euro-Argo MOCCA delayed-mode operators according to the area of deployment and taking into account their areas of expertise. It is further described in the deliverable D4.1.1 "Organization of Float Data Management among DAC and DM-operators".

OGS is responsible for the DMQC of the temperature and salinity data of the MOCCA floats deployed in these two marginal seas and it is co-responsible in the Southern Ocean.

The DMQC processing is described in the deliverable D.4.3.1 "Report on Delayed-Mode processing on the MOCCA fleet".

The application developed is called Argo App (AA) and it is part of a deliverable in WP4 of the MOCCA project. The AA is a user friendly tool that reads the Argo NetCDF files, converts the files in MATLAB format, allows Argo profiles selection, produces graphs of temperature and salinity, performs a tailored comparison between the float and reference profiles and provides the main information of float profiles.



2. THE ARGO APP

The AA tool has been developed with MATLAB (version R2017b) and it has been tested on both LINUX and Windows platforms. It requires the use of the MATLAB Mapping Toolbox (*https://it.mathworks.com/products/mapping.html*). The AA has been built in MATLAB environment using an Object-Oriented Programming (OOP). The App allows to select specific float profiles to be compared with the reference dataset. Moreover, it provides with several diagrams in support of the DMQC analysis. Technical details are given in chapter 2.1 and a description on how to use the app and its outputs is provided in chapter 2.2.

2.1. Technical description

The AA exploits the OOP features of MATLAB to couple analysis algorithms with a Graphical User Interface (GUI). The program differs from common MATLAB scripts since it creates a user-driven space where a user can interact with the app, for instance, by entering text or by clicking a button. Every action is followed by a function call (callback function) and the execution of some code. Callbacks are short functions that must obtain some data to do their job, update the app if necessary and store results for other callbacks. The app is just a container and a manager of small functions needed to get a larger task. MATLAB offers a GUIDE, an interface to create interactively the GUI but it provides only a small set of widgets. AA has been built from scratch by hand and depends on two main classes:

- ArgoUI: it is the main GUI object that creates the main graphical interface and provides the user with every options and information needed to load, visualize and analyse data.
- ArgoPlot: it manages plots of profiles and the interaction with them through the user mouse pointer. For instance, plotted profiles can be selected with the mouse and compared with reference profiles.

The plotting windows are standard MATLAB figure plots. Custom plot windows could be created but they provide less features of the standard MATLAB ones. ArgoUI and ArgoPlot use some external callback functions (defined in a separate source file) to operate on profiles.



2.2. How to use the Argo App

The AA is launched by typing "argo" in the MATLAB Command Window (Figure 1).

MATLAB R2017b				1	
HOME PLOTS APPS				Search Documentation	🔎 Log In
New New New Open Data Workspace	New Variable Image: Analyze Code Open Variable • Image: Run and Time Image: Clear Workspace • Image: Clear Commands •	Image: Simulink Image: Simulink <td< td=""><td> Community Request Support Learn MATLAE </td><td>ort 3</td><td></td></td<>	 Community Request Support Learn MATLAE 	ort 3	
FILE VA	RIABLE CODE	SIMULINK ENVIRONMENT	RESOURCES		*
Current Folder	app_argo > app_argo		0	Workspace	• •
Name A ArgoPlot.m ArgoPlot.m Collar Compare.m Setfinam	A ≫ argo			Name - Val	ue
argo.m (Script)	~			د	>

Figure 1: launch of the Argo App in the MATLAB Command Window.

The main dashboard (Figure 2) appears after a while and allow to load the NetCDF files of a specific float.



🔺 Argo				×
	Load data	Profiles		
	Plot data			
	Pick curve			
TUTTI	•			
	10 year 🌲			
	250 km 🌲			
	750 dbar 🚖			
	Compare			
Log				
	Re	eset		

Figure 2: main dashboard of the AA.

The user has to click the "Load data" button. A window for the float selection is shown (Figure 3).



Kelect Pro	ofile					9 <u>–</u>		×
File Filter	Reg. Exp	, Filter						
*.nc				Show All Files				
NetCDF File			~	RE Filter Dirs	Colorind Items			
	Current F	older			Selected Hems			
C:\Programmi	MATLAB work	k\float\medarg	o\data\cc					
coriolis all			v t		Remove duplicates (as per full path)			
▲ Name	Date	Size	Test Huter		Show full paths		Re	call
 1900024\ 1900025\ 1900025\ 1900028\ 1900029\ 1900030\ 1900031\ 1900031\ 1900593\ 1900593\ 1900602\ 1900605\ 1900605\ 1900605\ 1900606\ 1900630\ 1900832\ 			~	Open Add→ Remove Move Up Move Down Done				~
1900848			~	Cancer				~

Figure 3: window for float profiles selection.

After a double click on the preferred float folder and a double click on the "profiles" folder, the user can select a group of profiles with the mouse and then click the "Add" button. To complete the procedure, click on "Done" button (Figure 4).



承 Select Profile	\star Select Profi	le	Select Pro	ofile				
File Filter	File Filter	Re	File Filter	Reg. Exp	o. Filter			
*.nc	*.nc	Γ	*.nc				Show All Files	
NetCDF File	NetCDF File		NetCDF File			~	RE Filter Dirs	
		Cu		Current F	Folder			Sele
C:\Programmi\MA	C:\Programmi\M	ATLA	C: \Programmi	MATLAB\wor	k\float\meda	rgo\data\cc		
coriolis_all	6901862	_	profiles			v t		Remove duplicates (as per fu
▲ Name	▲ Name	Dat	▲ Name	Date	Size			Show full paths
1900024	Dirofiles)	_	D6901862_04	1.nc				D6901862_001.pc
1900025	6901862 meta.r	nc l	D6901862_04	2.nc		^	Open	D6901862_002.nc
1900026	6901862 prof.p	~	D6901862_04	3.nc			open	D6901862_003.nc
1900027	6901862_tech.n	c	D6901862_04	4.nc				D6901862_004.nc
1900028		-	D6901862_04	5.nc				D6901862_005.nc
1900029			D6901862_04	6.nc				D6901862_006.nc
1900030			D6901862_04	7.nc				D6901862_007.nc
1900031			D6901862 04	8.nc				D6901862_008.nc
1900032			D6901862 04	9.nc			Domovo	D6901862_009.nc
1900589			D6901862 05	0.nc			Remove	D6901862_010.nc
1900590			D6901862 05	1.nc				D6901862 011.nc
1900591			D6901862_05	2.nc			Move Up	D6901862_012.nc
1900592			D6901862_05	3.nc				D6901862_013.nc
1900593			D6901862_05	4.nc			Move Down	D6901862_014.nc
1900602			D6901862_05	5.nc				D6901862_015.nc
1900603			D6901862_05	6.nc				D6901862_016.nc
1900604			D6901862_05	7.nc				D6901862_017.nc
1900605			D6901862_05	8.nc				D6901862_018.nc
1900606			D6901862 05	9.nc			Done	D6901862 019.nc
1900629			D6901862 06	0.nc				D6901862_020.nc
1900630			D6901862 06	1.nc				D6901862_021.nc
1900832			D6901862 06	2.nc			Cancel	D6901862_022.nc
1900848			D6901862 06	3.nc			Cancer	D6901862 023.nc
1900849			D6901862 06	4.nc				D6901862 024.nc
A 10000451		_	D6001962 06	E.oc		~		D6001962 025 pc

Figure 4: steps for float profiles selection.

At this point, the "Plot data" button in the main dashboard is clickable (Figure 5).



		Participant and a second		
Load d	ata	Profiles		
Plot da	ata			
Pick cu	rve			
TUTTI	¥			
	10 year 👻			
	250 km 🌲			
	750 dbar 💂			
Compa	are			
Log		21	 	
Log			 	

Figure 5: "Plot data" button in the main dashboard.

Once the "Plot data" has been clicked, the selected profiles are converted in MATLAB files and are shown on the right side of the dashboard (Figure 6) and a TS diagram color-coded per time (cycle number) is produced in a MATLAB figure (figure 7).



D6901862_002 D6901862_003 D6901862_004 D6901862_005 D6901862_006 D6901862_007 D6901862_007	
D6901862_003 D6901862_004 D6901862_005 D6901862_006 D6901862_007	
D6901862_004 D6901862_005 D6901862_006 D6901862_007	
D6901862_005 D6901862_006 D6901862_007 D6901862_008	
D6901862_006 D6901862_007	- 1
D6901862_007	
D6001062 000	
D0901002_000	
D6901862_009	
D6901862_010	-
D6901862_011	
D6901862_012	
D6901862_013	
D6901862_014	
D6901862_015	
D6901862_016	
D6901862_017	
D6901862_018	
D6901862_019	
D6901862_020	
D6901862_021	
D6901862_022	-
	D6901862_009 D6901862_010 D6901862_011 D6901862_012 D6901862_013 D6901862_014 D6901862_015 D6901862_016 D6901862_017 D6901862_018 D6901862_019 D6901862_020 D6901862_021 D6901862_022

Figure 6: selected float profiles in the main dashboard.





Figure 7: TS diagram of the selected float profiles.

The user can then select a particular profile in two ways: clicking the "Pick curve" button on the main dashboard and then selecting the profile in the TS diagram with the mouse or simply selecting the profile in the dashboard with the mouse (Figure 8).



Figure 8: selection of a particular float profile (profile 055 in bold red) in the main dashboard and in the TS diagram.

The selected profile is highlighted in the dashboard and is depicted as a bold line in the TS diagram (profile 055 in this example). The main profile information is given in the middle-left part of the main dashboard.

The float profile can also be compared to a reference dataset. The comparison criteria can be defined on the left side of the main dashboard: the user has to select the sub-basin in which the float profile is located, the maximal distance in time and space between the float and the reference profiles, and the minimal depth of the reference profiles (Figure 9).



D6901862 034	
D6901862 035	
D6901862 036	
D6901862 037	
D6901862 038	
D6901862 039	
D6901862_040	
D6901862 041	
D6901862_042	
D6901862_043	
D6901862_044	
D6901862_045	
D6901862 046	
D6901862_047	
D6901862_048	- 1
D6901862_049	- 1
D6901862_050	- 1
D6901862_051	- 1
D6901862_052	- 1
D6901862_053	- 1
D6901862_054	_
D6901862_055	
	D6901862_036 D6901862_037 D6901862_039 D6901862_040 D6901862_041 D6901862_042 D6901862_042 D6901862_043 D6901862_044 D6901862_045 D6901862_045 D6901862_045 D6901862_045 D6901862_049 D6901862_050 D6901862_051 D6901862_053 D6901862_054 D6901862_055

Figure 9: setting up the thresholds for the comparison between the selected float profile and the reference dataset.

Once the criteria have been defined, the comparison is done by clicking the "Compare" button. Several figure are produced:

- 1) Location of the float profile (black diamond) and location of the reference profiles, colorcoded per time difference with the float profile (Figure 10);
- 2) Float and reference salinity profiles color-coded as defined before (Figure 11);
- 3) Float and reference TS profiles color-coded as defined before (Figure 12);
- Salinity float profile (black line) and the closest (in time) reference profile (red line) (Figure 13);
- 5) TS float profile (black line) and the closest (in time) reference profile (red line) (Figure 14);
- 6) Location of the float profile (black diamond) and the closest (in time) reference profile (red diamond) (Figure 15);
- Salinity float profile (black line) and the closest (in space) reference profile (red line) (Figure 16);
- 8) TS float profile (black line) and the closest (in space) reference profile (red line) (Figure 17);
- 9) Location of the float profile (black diamond) and the closest (in space) reference profile (red diamond) (Figure 18);





Figure 10: location of the float profile (black diamond) and location of the reference profiles, color-coded per time difference with the float profile.





Figure 11: float and reference salinity profiles color-coded as defined in figure 10.











Figure 13: salinity float profile (black line) and the closest (in time) reference profile (red line).





Figure 14: TS float profile (black line) and the closest (in time) reference profile (red line).





Figure 15: location of the float profile (black diamond) and the closest (in time) reference profile (red diamond).





Figure 16: salinity float profile (black line) and the closest (in space) reference profile (red line).





Figure 17: TS float profile (black line) and the closest (in space) reference profile (red line).





Figure 18: location of the float profile (black diamond) and the closest (in space) reference profile (red diamond).



3. CONCLUSION

The AA is helpful for having a quick view of the float behavior before using the OW software and to check the consistency of the delayed-mode profiles. In particular, the float salinity profiles can be rapidly visualized and compared to the closest reference profiles to look for any potential drift or offset of the conductivity sensor. In this way, the DMQC operator can better organize his work, giving the priority to the floats that need to be checked sooner. The AA is in beta version and hence further tests and improvements are needed.