1. Project Information

Proposal reference number[1]	JS3_CALL_1_REF_4030_ABACUS 2021
Project Acronym (ID)[2]	ABACUS 2021
Title of the project[3]	Algerian Basin Circulation Unmanned Survey 2021
Host Research Infrastructure[4]	SOCIB - *Balearic* Islands *Coastal* Ocean Observing and Forecasting System GLIDER SOCIB Glider Facility
Starting date - End date[5]	**Total project duration**: 01 December 2021 – 30 July 2023 **Glider Mission**: ABACUS 2021 LEG 1 01/12/2021 – 23/12/2021 FALL 1 ABACUS 2021 LEG 2 18/05/22 – 10/06/22 SPRING ABACUS 2021 LEG 3 26/09/22 – 24/10/22 FALL 2
Name of Principal Investigator[6] **Home Laboratory** **Address** **E-mail address** **Telephone**	Yuri Cotroneo Università degli Studi di Napoli "Parthenope" Centro Direzionale Isola C4 – Napoli, Italy yuri.cotroneo@uniparthenope.it

[1] Reference number assigned to the proposal by the TA-Office.

[2] User-project identifier used in the proposal.

[3] Title of the approved proposal. The length cannot exceed 255 characters

[4] Name of the installation/infrastructure accessed with this project. If more than one installations/infrastructures are used by the same project, please list them in the box.

[5] Specify starting and end date of the project (including eventual preparatory phase before the access).

[6] Fill in with the full contact of the Principal Investigator (user group leader).

2. Project objectives[7] (250 words max.)

ABACUS focuses on the physical and biochemical characteristics of the Algerian Basin (AB) circulation. The AB is dominated by the presence of energetic mesoscale structures that usually develop from meanders of the Algerian Current to isolated cyclonic and anti-cyclonic eddies.
The project aims at confirming the importance of the ABACUS monitoring line across the AB between Palma de Mallorca and the southern part of the Algerian basin.
Main objectives are:
•To continue the time series of oceanographic data collected in the AB along the endurance line between Mallorca and Algeria;
•To identify the physical and biochemical variability of the different water masses that are present between Balearic Islands and Algerian coasts at surface and intermediate depth;
•To collect in-situ observations in the late spring where mesoscale high mesoscale activity take place.
•To collect high resolution data able to describe the sub-basins dynamics;
•To assess the ocean description capabilities of several satellite products when approaching coastal areas, also comparing them to glider in situ data;
•To validate the new along-track (L3) and gridded interpolated maps (L4) altimetry products provided by the Sentinel-3 altimetry mission and other satellites overflying the western Mediterranean Sea;
•To contribute at the creation of a composite dataset to be used for the SWOT satellite mission preparation and calibration;
•To acquire ground truth for satellite retrievals of particulate backscattering (bbp) which are widely used in studies of ocean ecology and biogeochemistry, but have been historically difficult to validate due to the paucity of available comparative field measurements;
•To explore the potential of glider measurements for ecosystem monitoring (fish stocks to cetaceans).

3. Main achievements and difficulties encountered (250 words max.)[8]

After the deployment of the ABACUS2021 glider in May 2021, some issues in navigation and data collection were encountered, probably due to a shark attack to the glider. The latter, led to the recovery of the glider and to revise our sampling strategy and glider mission planning with the SOCIB glider team for the ABACUS 2021.
Sea activities were re-scheduled over three glider missions of the approximate duration of 20 days each to navigate the monitoring line during two different years, including both spring and fall season, as follows:
ABACUS 2021 LEG 1 December 2021
ABACUS 2021 LEG 2 May/June 2022

[7] Write the short-term, medium and long-term objectives of the project. Use no more than 250 words.

[8] Describe briefly the main achievements obtained and possible impacts, as well as possible difficulties encountered during the execution of the project. Use no more than 250 words.

ABACUS 2021 LEG 3 September/October 2022

Data collected during the ABACUS 2021 allowed:

- The monitoring of the main physical and biochemical properties of the water column;
- To extent the glider datasets in the AB;
- The collection for the first time of acoustic data across the AB to identify wind and rain patterns, as well as the presence of marine mammals

From a more technical point of view, the glider mission has covered the following for each leg:

- spent 23 days in water for ABACUS 2021 LEG 1 – collecting 199 profiles along the transect
- spent 24 days in water for ABACUS 2021 LEG 2 – collecting 162 profiles along the transect
- spent 29 days in water for ABACUS 2021 LEG 3 – collecting 173 profiles along the transect

During each leg the glider realized 2 complete transects across the AB and was overflown by the Sentinel 3 satellite.

A total of about 530 complete profiles were collected along the 6 planned transects;

4. Dissemination of the results[9]

1) Data collected during ABACUS 2021 can be downloaded through the SOCIB DAPP.
2) Data collected during all the ABACUS missions since 2014, can be downloaded from the webpage http://apps.socib.es/data-catalog/#/data-products/abacus that is regularly updated

A DOI was assigned to this dataset that can be cited asMiralles, A., Rubio, M., Rivera, P., Zarokanellos, N., Charcos, M., Férnandez, J. G., Budillon, G., Cotroneo, Y., Aulicino, G., Balager, P., Wirth, N., Casas, B., Baeza, J., Calafat, N., Juza, M., Notario, X., Heslop, E., Ruiz, S., Muñoz, C., … Tintoré, J. (2018). SOCIB TNA Abacus (Version 1.0) [Data set]. Balearic Islands Coastal Observing and Forecasting System, SOCIB. https://doi.org/10.25704/B200-3VF5

3) The results achieved during this and the previous ABACUS glider missions have been presented at international conferences, e.g., the EGU general assembly 2023 (Vienna, April 2023):

Cotroneo, Y., Aulicino, G., Fusco, G., Ruiz, S., Pascual, A., Testor, P., Cauchy, P., Zarokanellos, N., Miralles, A., Zerrouki, M., Tintoré, J., and Budillon, G.: ABACUS – a repeated glider monitoring line across the western Mediterranean Sea , EGU General Assembly 2023, Vienna, Austria, 24–28 Apr 2023, EGU23-6024, https://doi.org/10.5194/egusphere-egu23-6024, 2023”

4) We realized seminars for graduate and post-graduate students, at Università degli studi di Napoli “Parthenope”

[9] Describe any plan you have to disseminate and publish the results resulting from work carried out under the Transnational Access activity in JERICO -S3: scientific articles, books - or part of them -, patents, as well as reports and communication to scientific conferences, meetings and workshops. Highlight peer-reviewed publications. **Note that any publications resulting from work carried out under the JERICO -S3 TA activity must acknowledge the support of the European Commission – H2020 Framework Programme, JERICO -S3 under grant agreement No. 871153.**

5)	Three master degree students did their intership using and analysing the ABACUS data in the framework of their course.

5. Technical and Scientific preliminary Outcomes (2 pages max.)[10]

ABACUS 2021 project contributed to data collection in the Southern European Seas, one of the main EU maritime policy objectives, as outlined in the Marine Strategy Framework Directive (MSFD). In particular, the high resolution of glider data and the efforts to get simultaneous satellite altimetry data along the same groundtrack, allowed us to observe and describe the oceanographic characteristics of the area at several time and spatial scales.

Additionally, the innovative use of a passive acoustic recorder allowed us to analyse the sounds associated to wind, rain, and marine mammals in the study area.

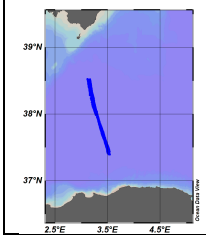
ABACUS 2021 allowed us to realize a glider mission in the Algerian Basin organized into 3 legs during autumn 2, spring 2021 and autumn 2022 sampling the water column up to 1000 m depth with the spatial resolution of about 2 Km.

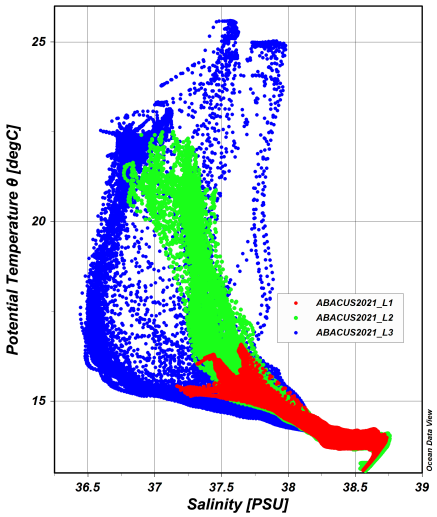
In the framework of the project, during last in person access (July 2023) a productive discussion among the partners led to a definition of a new shared quality control protocol. It can be summarized as follows: After the mission, data are transferred from the internal glider memory to the SOCIB Data Center where pre-processing, quality control and validation are carried out and production of level 1 and level 2 data occurred. Then at University Parthenope a second quality control process is applied to identify any persistent spike in the data and reduce the possible noise of the signal. A final visual check is performed on the single profiles and on the θ/S diagram. In a next future, glider data will be compared with the available Argo floats for cross calibrations.

The ABACUS 2021quality-controlled datasets are then used to realize a preliminary analysis focused on the identification of the different water masses characteristics and on their location along depth and latitude.

Figure 1 shows the map of ABACUS2021 glider mission and the associated Theta/S diagram color coded for each leg.

It is evident from this diagram the existence of a strong seasonal variability during the three legs repeated along the same Sentinel 3 groundtrack.

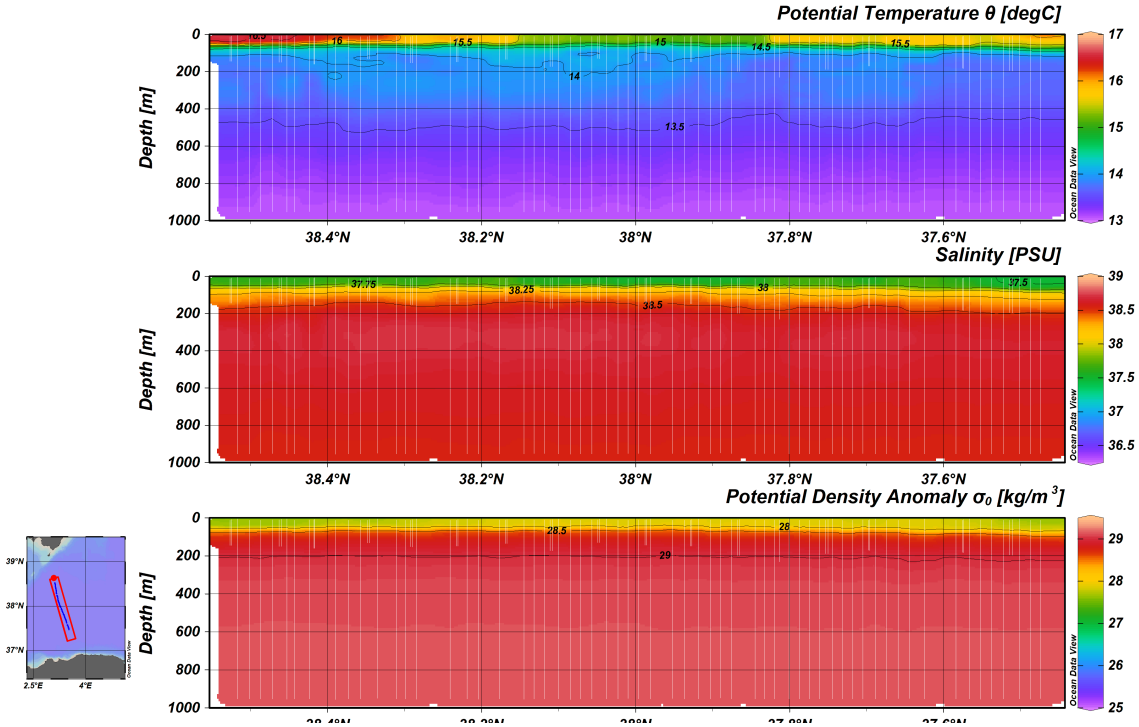




ABACUS 2021 observations are characterized by high spatial and temporal resolution, which is allows us to identify the different physical and biochemical processes. Figure 2 shows the vertical transect along the monitoring line of early December 2021 for Potential temperature, Salinity, Potential Density anomaly. Analogous figures have been realized

[10] Describe in detail results and main findings of your experiment at the present stage.

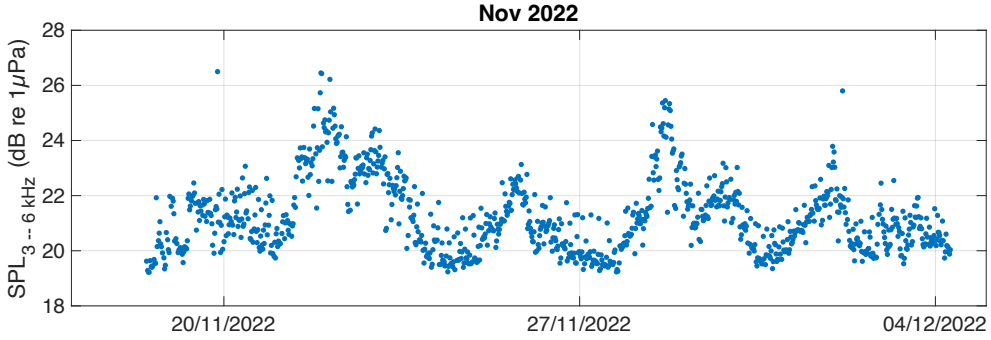
for the other 5 transects realized and for the Chlorophyll concentration, turbidity and Oxygen concentration data collected by the glider.



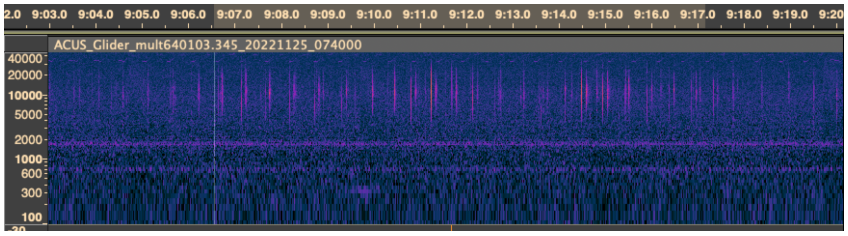
One of the most innovative aspects of the ABACUS 2021 project consists in the use of an ACOUSONDE passive acoustic recorder installed on the glider.

Figures 3 and 4 show some preliminary results of the acoustic data analysis.

The analysis of the acoustic data requested an additional effort. This is mainly due to the large amount of data collected and to the different analyses that need to be performed to identify the sound originated by the different sources.



The first figure shows the signal associated to wind noise during the November 2022 leg, while figure



4 shows the noise associated to Sperm whale echolocation sounds, characterized by very regular trains of clicks at about~ 10 kHz, 2 clicks/s. Similar analysis highlighted the presence of Dolphin echolocation clicks as rapid and variable click patterns ~ 30 kHz, 10 – 20 clicks/s.

Napoli, 31/07/2023

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Location and date	Signature of principal investigator