TNA PROJECT REPORT

1. Project Information

Proposal reference number	JN-CALL 1_11
Project Acronym (ID)	FinisGlider
Title of the project	FinisGlider. Pilot experience to incorporate Glider technology to the Finisterre repeated hydrographic section.
Host Research Infrastructure	CNRS-INSU Glider National Facility (GNF) Slocum glider "Bonpland"
Starting date - End date	01/01/2017 – 13/11/2017
Name of Principal Investigator **Home Laboratory** **Address** **E-mail address** **Telephone**	César M. González-Pola Muñiz Spanish Institute of Oceanography Avda Príncipe de Asturias 70 Bis, 33212, Gijón, Spain cesar.pola@ieo.es +34 985308672
User group members	César González-Pola, Marta Álvarez Rodriguez, Alicia Lavín Montero, Manuel Ruiz Villarreal - Spanish Institute of Oceanography, Spain

2. Project objectives

The objectives of the FinisGlider mission are part of a broad long-term monitoring program of the ocean hydrography in the Western Iberia Margin. The VACLAN-RADPROF program maintains continuous observation of ocean climate variability in this region of the North Atlantic eastern boundary. A full-depth hydrography and biogeochemistry sampling is performed yearly through a ship-based deep section perpendicular to the coast, extending to 250 nm off Cape Finisterre into the Iberian Abyssal Plain basin (north-western Iberia, 43ºN, 9-15ºW, > 5000 m). From 2003 to 2010 the section was sampled twice per year around winter and summer, from 2012 only the Finisterre summertime section is conducted on regular basis.

FinisGlider is the first glider occupation of the section. We expect that glider missions should help to (i) study the influence of mesoscale variability on the water mass properties determination by ship cruises and (ii) understand the variability in circulation patterns at the Galician slope and the passage from the shelf to the Galician Bank. The mission also must assess the viability of addressing the repeated hydrographical section west of Finisterre through glider missions.

3. Main achievements and difficulties encountered

The summer 2017 glider mission was scheduled to overlap with the annual ship cruise in order to provide an independent dataset of the hydrographical/biogeochemical conditions. The Slocum glider "Bonpland" from the French Glider National Facility (GNF) was used. Both glider mission and the cruise were successfully accomplished. Logistic and planning of the mission started by a Skype meeting between the CNRS-INSU Glider National Facility and the Spanish Institute of Oceanography (IEO) on January 13, 2017. Tentative dates for the mission were discussed and it was agreed to organize a visit to the GNF in Toulon in late April (finally set to 25-

The activity described in this report has received funding
from European Commission's H2020 Framework Programme
under JERICO-NEXT project, grant agreement No. 654410.

26), where the mission details and glider functioning were further discussed. Soon it was noticed that, based on web documents, we had assumed an unreliable high speed for the glider and the whole section was going to take about 40 days instead of slightly over 20 as we had assumed in the initial proposal. Fortunately, it was possible to increase the extent of the time mission under the JERICO-NEXT agreement.

The Glider Facility team was in charge of deployment and piloting the glider. Due to unexpected very bad weather forecast in the area we had to speed up the deployment and go out at sea the same day that the glider technician arrived from France (June 29). The first days of the mission the glider experienced functioning issues that were solved remotely by the facility team. The recovery was made by the IEO using a zodiac in August 18, in permanent phone contact with the facility team.

4. Dissemination of the results

FinisGlider is a first step in order to incorporate glider-based oceanography sampling at the Finisterre section on a regular basis, while the mission is expected to provide some scientific insights regarding the inter-comparability of both independent sampling systems in the area. The dissemination paths of scientific outcomes should be the standard for science, as conference presentation and/or scientific documents. At the time of writing we have just received the glider dataset (about a month ago), thus it is soon to draw a specific dissemination plan of the results. As agreed within the TNA call, main findings will be presented in the final JERICO_NEXT meeting in 2019.

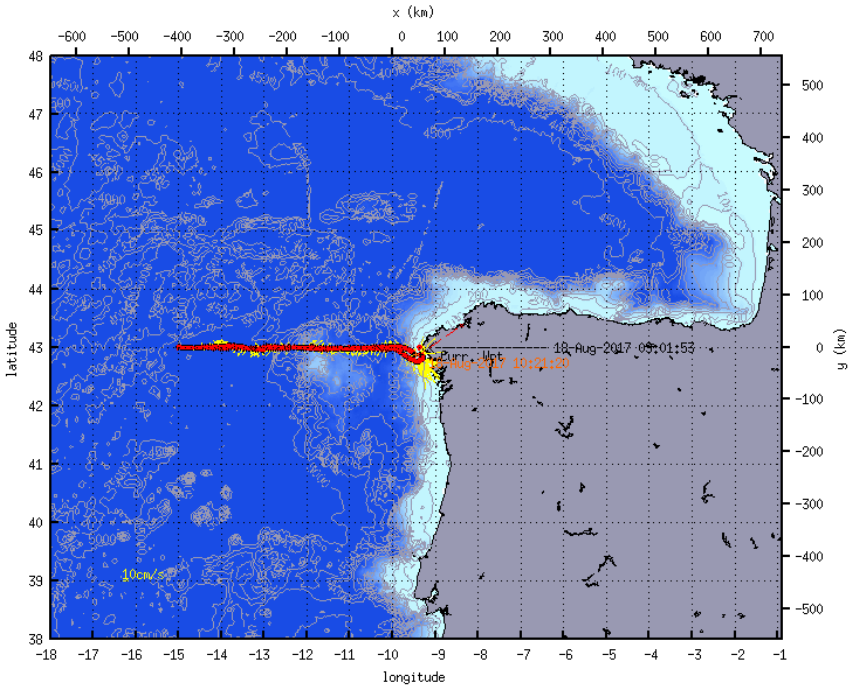
Currently, the Finisterre section contributes to the ICES yearly status report on ocean climate (http://ocean.ices.dk/iroc/). Within this framework, gliders are starting to be implemented in different regular sections across Europe. A close example is the so called "Extended Ellet Line" from Scotland to Iceland (http://prj.noc.ac.uk/ExtendedEllettLine/). The next Working Group on Ocean Hydrography meeting will take place in Norwich, March 20th, 2018. The results from the FinisGlider mission will be firstly presented there. Also an internal report for IEO on the potential of a fleet of gliders for regular monitoring will be issued.

The data set gathered by the glider were processed by CORIOLIS under SEOANE Service (Sea scientific open data publication), and made public through the next link:
Gonzalez-Pola Cesar, Ruiz Manuel (2017). FinisGlider deployment (EGO glider : Bonpland) (Atlantic Ocean). JERICO-NEXT TNA. SEANOE. http://doi.org/10.17882/52032 (http://www.seanoe.org/data/00409/52032/).

5. Technical and Scientific preliminary Outcomes

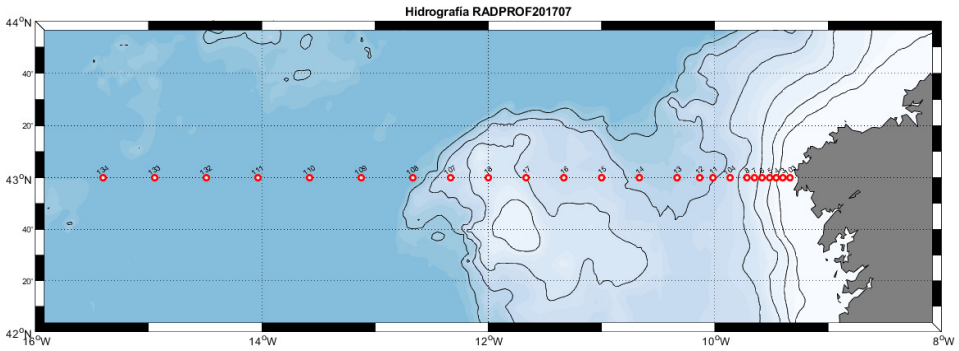
After the glider mission ended in late August, it took some weeks before the glider was sent back to the CNRS-INSU GNF for data downloading and processing. The whole record, as processed by the GNF team, was sent to the IEO on October 20. The whole record as processed by SEOANE was released on November 11. Therefore at the time of writing the scientific analysis of the dataset is in a preliminary stage.

Bonpland glider took slightly over 20 days each way, from June 29 to July 19 the forward journey and July 19 to August 12 the backwards leg. The glider was recovered on August 18 due to logistics. Its sensor payload provided pressure, temperature, salinity, dissolved oxygen, chlorophyll-fluorescence, coloured dissolved organic matter (CDOM) and turbidity backscattering. CNRS-INSU processed record split the glider track into 320 downcast and another 320 upcast profiles, covering the whole section down to about 1000 m depth.



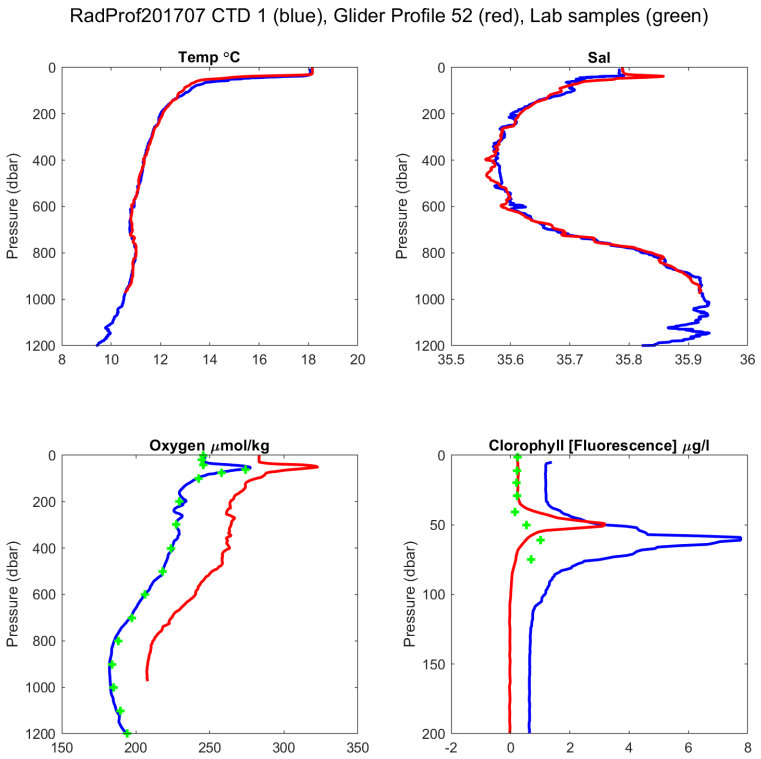
Mission track from *https://gfcpdsi.ego-network.org/plot/plot_deployment.php?glider=bonpland&deployment=FinisGlider*

Cruise occupation of the section lasted 5 full working days from July 4 to July 8, covering the 24 planned stations from the continental shelf to the inner Iberian Abyssal Plain. The CTD had the standard hydrographical payload plus external sensors for chlorophyll-fluorescence and dissolved oxygen. The rosette sampler had 24 10-litter bottles from where several biogeochemistry variables were determined, among them chlorophyll, dissolved oxygen, nutrients and organic matter. A dual 300-kHz LADCP was included and the ship had a 150 kHz VMADCP running continuously.



A primary scientific target of this first mission is thus the quantification of short-term variability influence on the representativeness of one-per-year hydrographical cruise series. Thus, it was considered convenient to perform inter-calibration dives for a direct comparison of CTD Sbe911. On cruise start, July 3, we sailed directly to the last known position of the glider to make a first inter-calibration profile. A first CTD was performed on July 3 at 20:57 UTC at 42º 59.95'N, 010º 19.80'W matching with glider dive #52 (43º 00.05'N, 010º 21.16'W, 22:50 UTC), i.e. separated by 2.5 km and less than 2 hours. 3 days later the cruise overtook the glider close to 011º W providing a second inter-calibration dive (2.5 km and 4 hours of difference). After finishing the sampling, the ship returned along the same line recording an additional track of velocity field.

The inter-calibration dive shows clear matching among samplers but highlights the need to calibrate carefully the oxygen and chlorophyll sensors both in CTD and glider payload. Vertical displacement seen in chlorophyll-fluorescence is consistent with vertical shift of overall hydrographical structure due to the local internal wave field.



So far we are assuming that we can estimate the hydrographical state of regional water masses through classical one-per-year CTD sections. This assumption seems weaker as we deal with Mediterranean Water levels, where there is strong mesoscale and submesoscale activity. The next step to be carried out from the FinisGlider record is analyzing the differences among the cruise and the glider sections (forward and back tracks), that will allow quantifying the influence of intrinsic short-term variability of hydrographical properties and mesoscale structures on the determination of the background state.

The overlapping of a cruise and a glider mission provides a rare opportunity to make these same estimates for biogeochemical variables, as dissolved oxygen and chlorophyll, whose spatial structure depends strongly on hydrography but also on biological factors. Finally, it is well-known that shelf-slope dynamics as well as mesoscale structures evolve in timeframes of weeks, so it is anticipated that, in terms of recirculation structures, outcomes will vary among different records. The differences with regard to geostrophic circulation will be explored, taking into account regional meteorological forcing and altimetry.

FINAL REVISION, 14 DECEMBER 2017