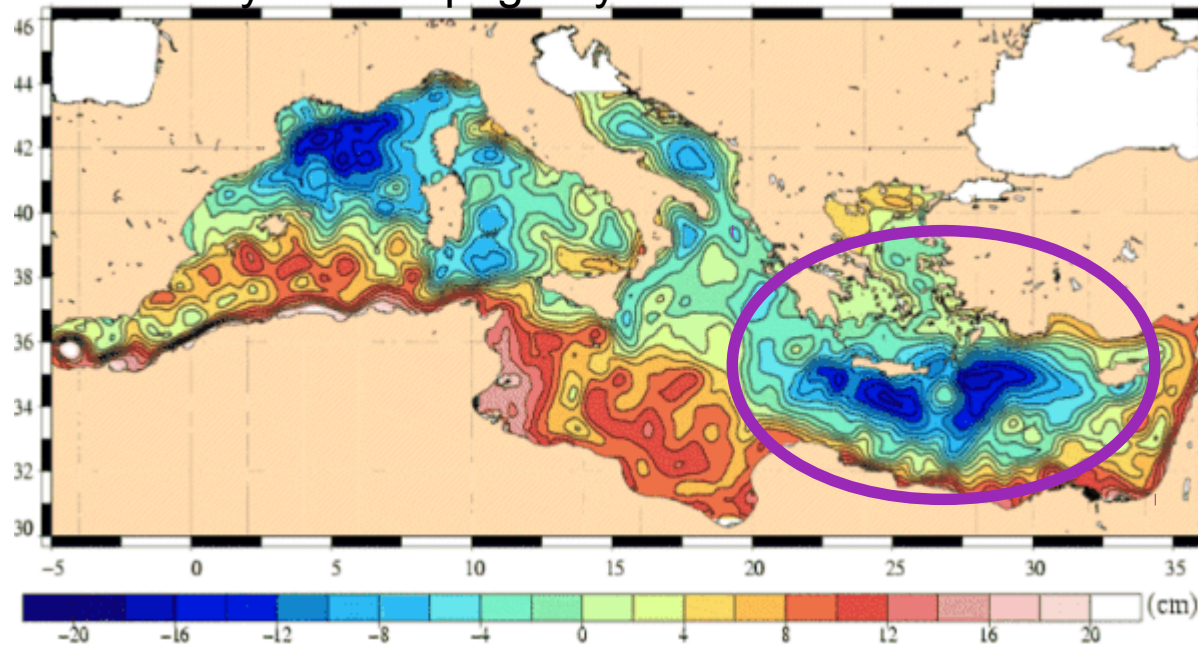


PERLE:

Pelagic Ecosystem Response in the Levant Experiment

Dynamic topography: surface circulation



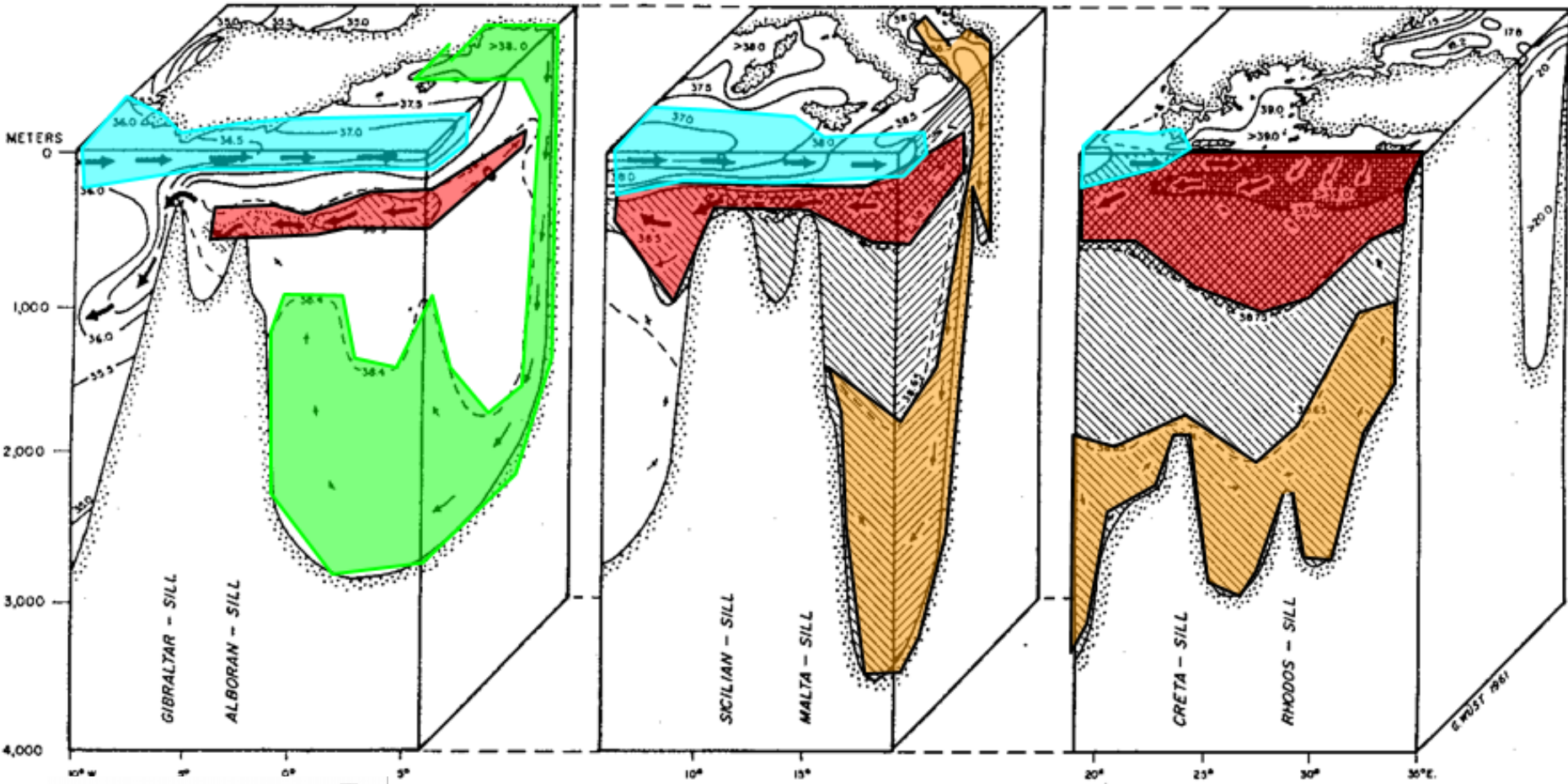
Pierre Testor (CNRS/LOCEAN, Paris, France),

Dan Hayes (CSCS, UC-OCY, Cyprus), **Elena Mauri** (OGS, Italy), **Leonidas Perivoliotis** (HCMR),

Ayah Lazar, Hezi Gildor (IOLR), **Jacopo Chiggiato** (CNR-ISMAR),)

Xavier Durrieu de Madron (CNRS/CEFREM, Perpignan France)

Study of Levantine Intermediate Water (LIW) formation and impacts on marine ecosystem



Review of the Circulation and Characteristics of Intermediate Water Masses of the Mediterranean: Implications for Cold-Water Coral Habitats

Daniel R. Hayes, Katrin Schroeder, Pierre-Marie Poulain, Pierre Testu, Laurent Martini, Anthony Bossu, and Xavier du Madron

18

Abstract
 This chapter describes the main features of the circulation and properties of the intermediate water masses of the Mediterranean. Interaction with other water masses is also briefly summarized. Both observational and numerical studies described in the literature are used, as well as some more recent, unpublished data sets. It is shown that the main water mass responsible for cold-water coral habitats in the Levantine Intermediate Water which forms in the Levantine Sea, Eastern Mediterranean and spreads throughout the entire Mediterranean before flowing via the Gibraltar Strait. This pathway is described as well as the expected temperature and salinity along that pathway. Current speed regimes are estimated from the few studies that exist.

18.1 Introduction
 In this topic the current understanding of the flow and characteristics of intermediate Mediterranean Sea water masses is described. The motivation to include oceanographic studies in this book is that ocean flows and water properties establish the basic environmental conditions to which corals organisms are subjected. If conditions are favorable, in terms of temperature, salinity, dissolved oxygen, and organic matter, all of which are sustained subsequently by the currents, then cold-water corals (CWCs) can thrive. Johnson and Lawson (this volume) explain how the formation and connectivity of CWCs are driven both by physical and biological processes, merged through biophysical modeling. Before robust results can be derived from biophysical modeling, the performance of the flow models must be evaluated against the existing observational and numerical bodies of work presented in this chapter.

In the Mediterranean, as will be described below, evaporation exceeds precipitation when averaged over the basin, and the "reverse estuarine" circulation that results implies a net inflow into the basin through the Gibraltar Straits. This low speed of river runoff, combined with the vertical stability of the thermohaline circulation, make the waters relatively quiet in response. Thus, any process that injects materials into the ocean, such as deep or intermediate water formation,

Keywords:
 Mediterranean sea; Hydrography; Circulation; Intermediate water; Deep water; Cold-water corals

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LIW review paper in press:
https://doi.org/10.1007/978-3-319-91608-8_18

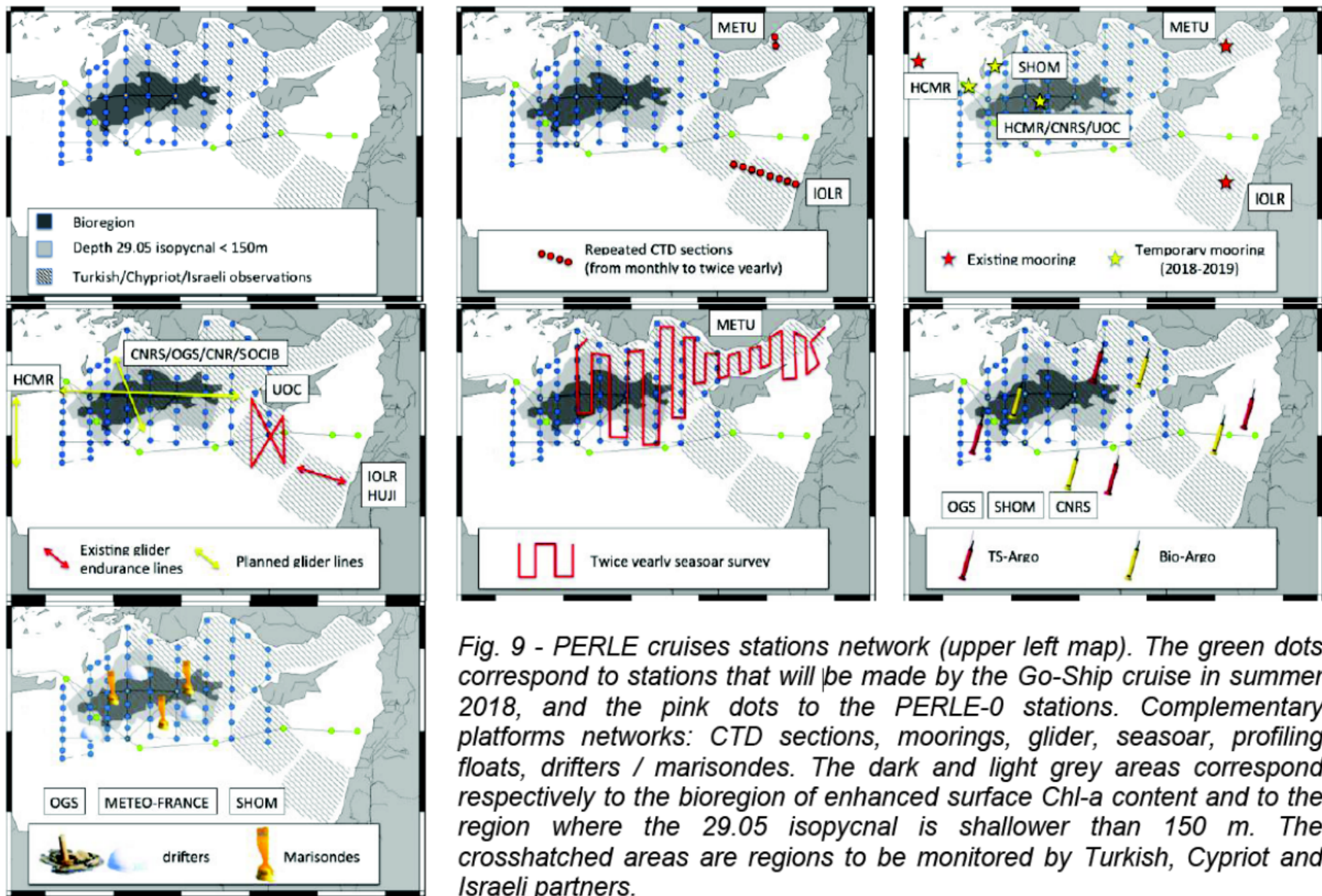
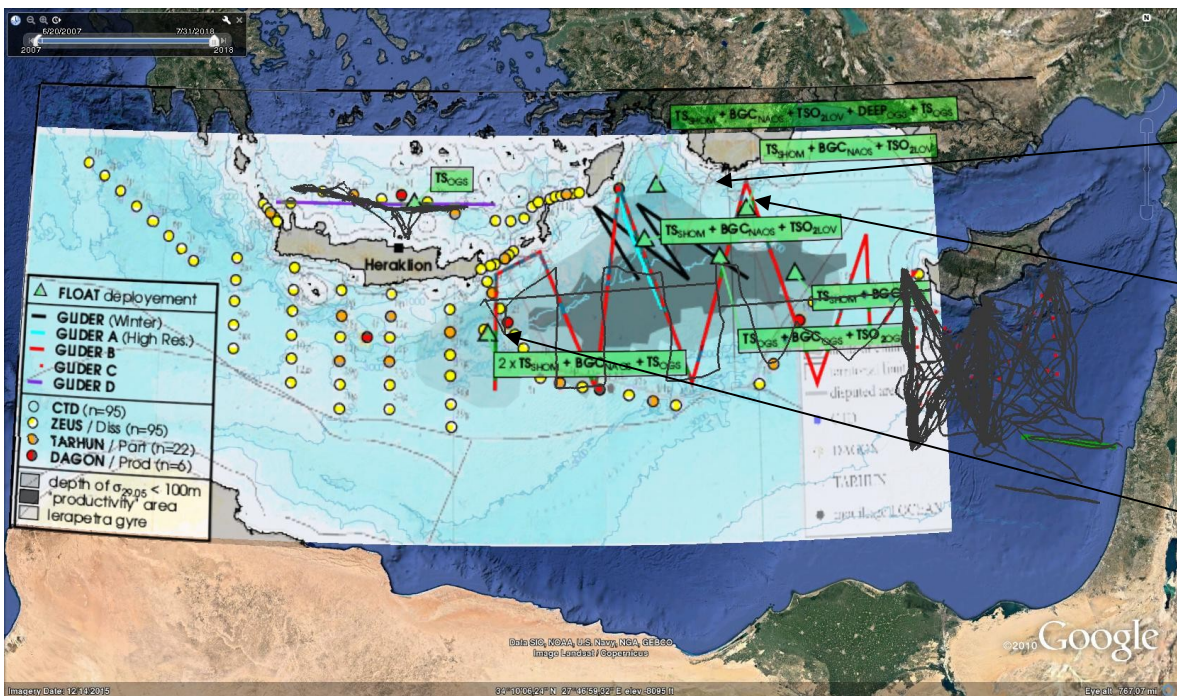


Fig. 9 - PERLE cruises stations network (upper left map). The green dots correspond to stations that will be made by the Go-Ship cruise in summer 2018, and the pink dots to the PERLE-0 stations. Complementary platforms networks: CTD sections, moorings, glider, seasonar, profiling floats, drifters / marisondes. The dark and light grey areas correspond respectively to the bioregion of enhanced surface Chl-a content and to the region where the 29.05 isopycnal is shallower than 150 m. The crosshatched areas are regions to be monitored by Turkish, Cypriot and Israeli partners.

R/V cruises and gliders sampling plans



National waters borders

Profiling floats deployments
October 2018 (PERLE-1 cruise)
March 2019 (PERLE-2 cruise)

Mooring deployed in October 2018 (PERLE-1 cruise)

Glider sampling repeated from October 2018 to June 2020

- Red: East-West (E-W)
- Cyan: High Frequency (HF) in Rhodos Gyre
- Black: Adaptive sampling (winter-spring period)
- Long term observations

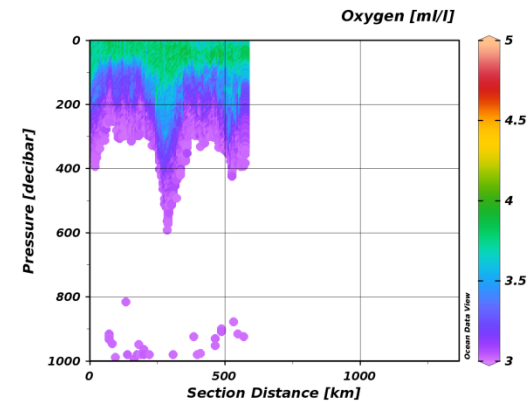
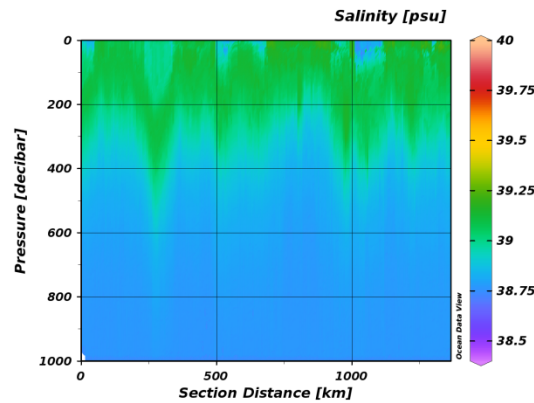
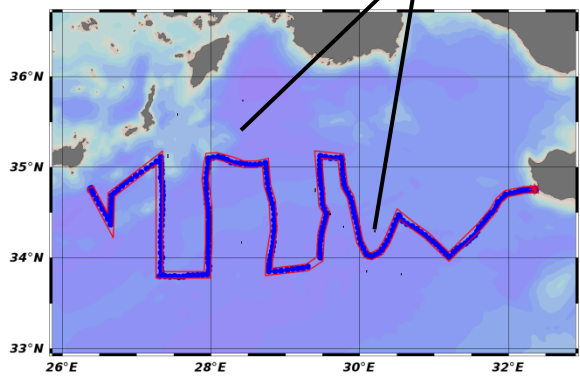
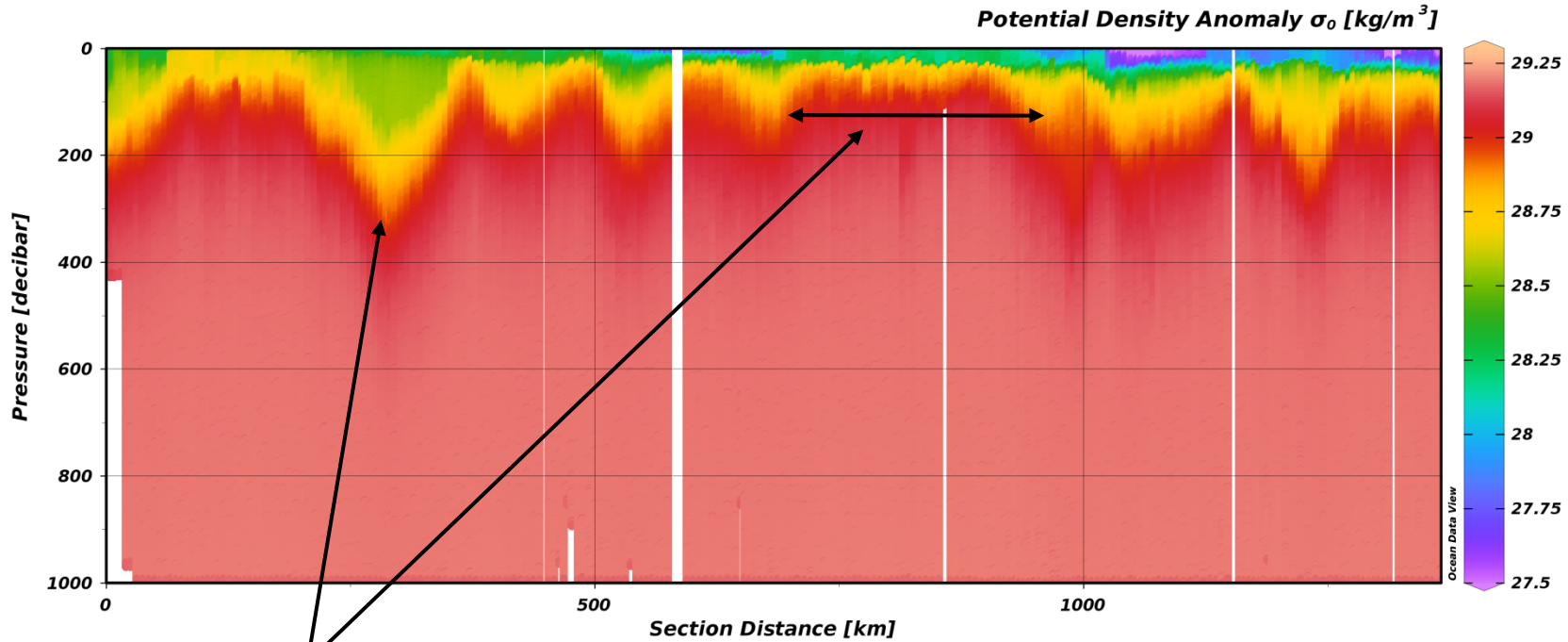
- with gliders from
- CNRS national pool of gliders (France)
 - **OC-UCY (Cyprus) = glider hub**
 - OGS (Italy)
 - CNR-ISMAR (Italy)
 - HCMR (Greece)
 - IOLR (Israel)

	2018			2019												2020						
	Oct	Nov	Dec	Jan	Fev	Mar	Avr	Mai	Juin	Juil	Aout	Sept	Oct	Nov	Dec	Jan	Fev	Mar	Avr	Mai	Juin	
Radiales Long terme (Chypre, Grèce et Israël)																						
Radiale E-O																						
Radiale HF																						
Radiale Adaptative																						
Radiale Adaptative																						

- Gliders OC-UVY
- Gliders OGS
- Gliders CNR-ISMAR
- Gliders Chypre, Israël, Grèce
- Gliders DT-INSU

Background 2016 - 23 March to 5 June

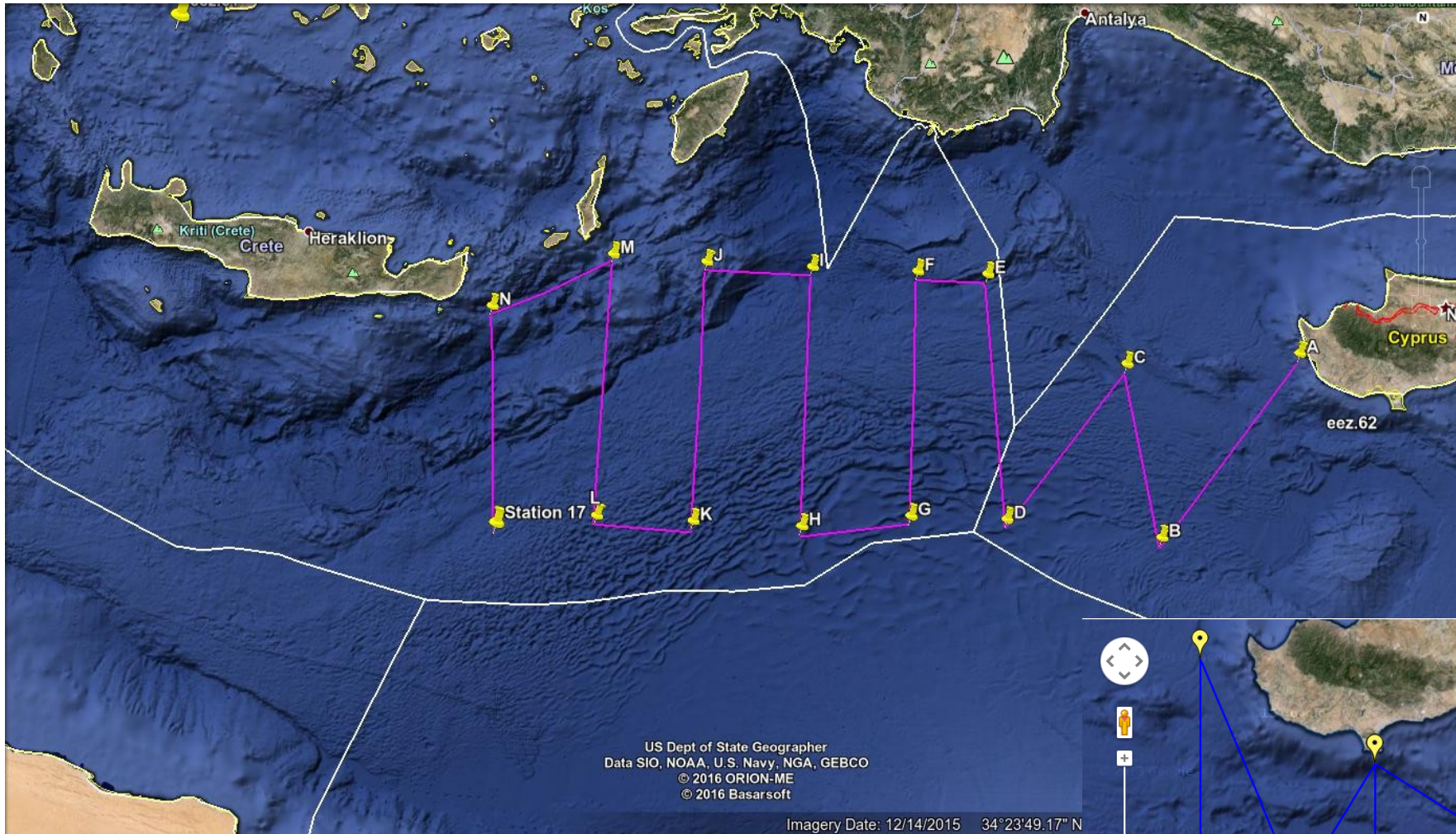
Rhodes Gyre with surface and intermediate currents, eddies



Warm-salty anticyclone and cool cyclonic gyre where water column preconditioned for LIW

Background: Permit request and MOU

UCY manages glider missions from partners: CNRS, OGS, CNR-ISMAR

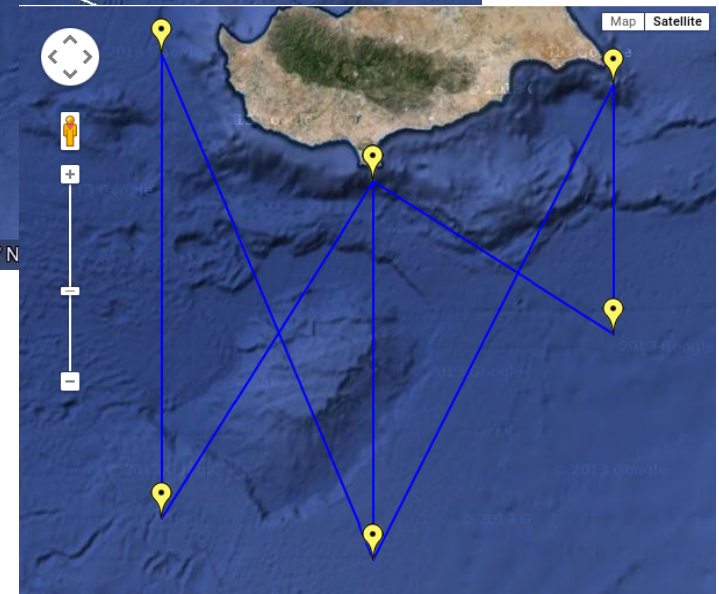


Data Policy: “Process and provide to the public, including the permitting authorities and research partners listed here and in the PERLE consortium, the glider data in near real-time and delayed mode.”

Requests in June 2018

signed only early 2019, for Oct 2018-Dec. 2019.

To be amended for 2020

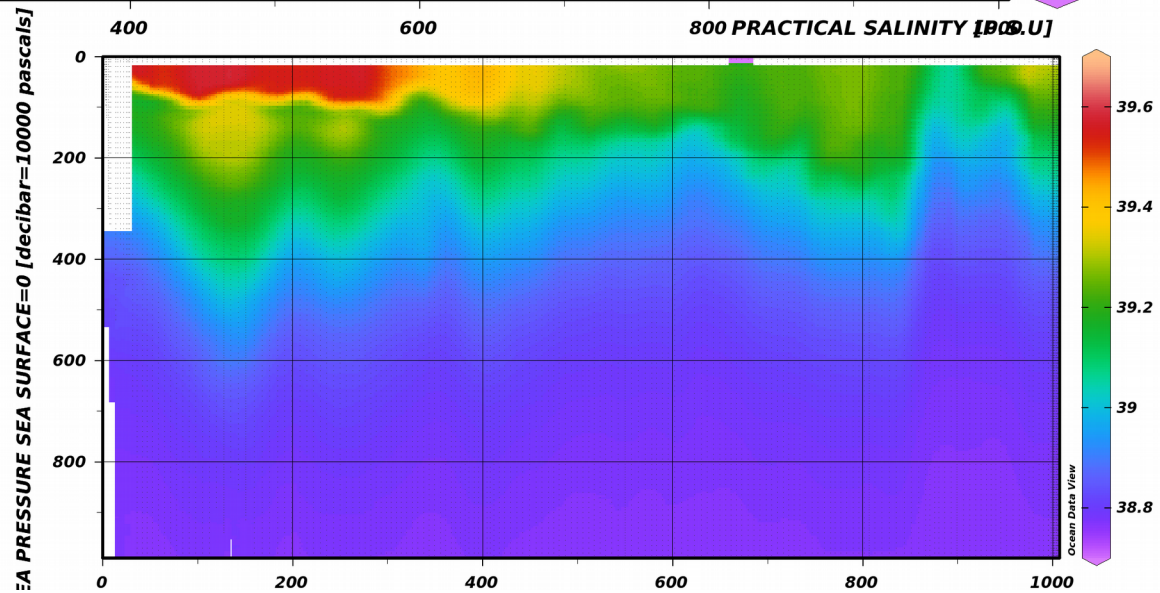
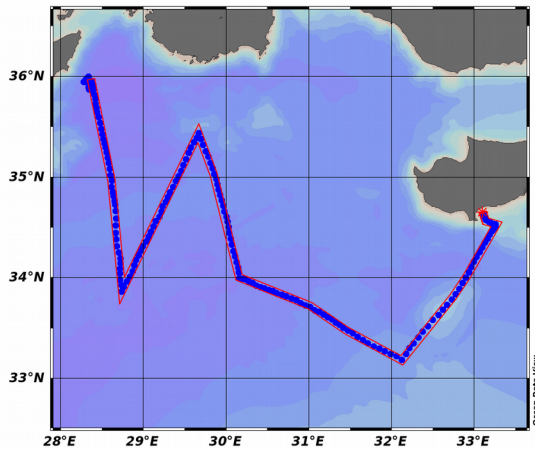
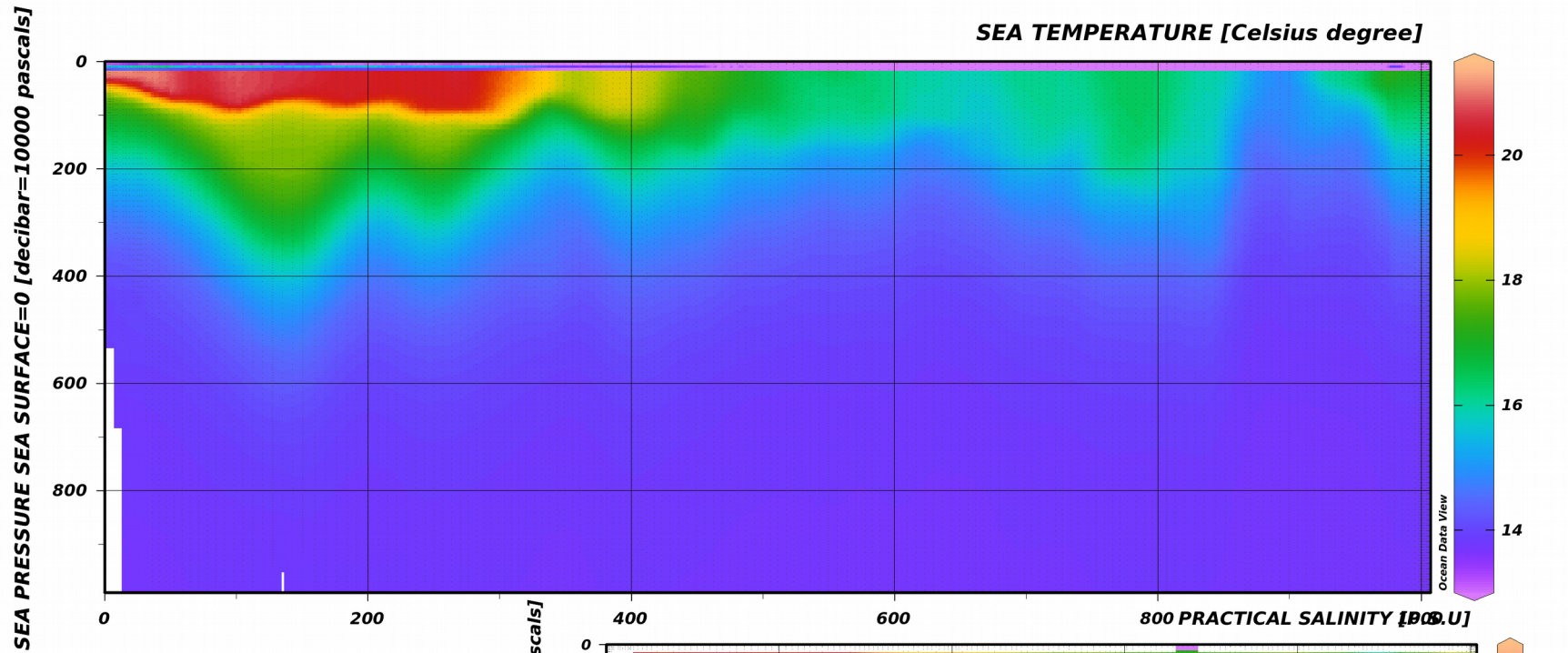


Timeline

- June 2018:** we got informed that no glider would be available in 2018 from national pool of gliders because of lack of personnel. We proposed to repair and deploy Conti with the help of OC-UCY and CSCS (world-class seaglider expert licensed by Kongsberg). → No :(→ 2 gliders from the national pool normally planned for February 2019
- October 2018:** **PERLE-1 cruise**
- December 2018:** update on availability of gliders from the national pool: one glider (Himilcon) planned for February March 2019. Deployment of Pheidippides (OC-UCY)
- January 2019:** Himilcon tests failed :-(.
- February 2019:** failure on Pheidippides (emergency recovery with the help of HCMR)
- March 2019:** **PERLE-2 cruise**
- Avril 2019:** Himilcon tests successful
- 02 May 2019:** Himilcon sent
- 03 June 2019:** deployment request sent to OC-UCY (but 30 days delay for permit acceptance → no deployment before 4th July 2019)
- 15 June 2019:** Himilcon arrived in Cyprus
- 21 June 2019:** difficulties travel plans with LOCEAN, alternative found by DT-INSU ealy July.
- 10 July 2019:** Paul arrives in Cyprus, bad weather conditions
- 19 July 2019:** Deployment of Himilcon off Paphos, 9 months after the beginning of PERLE operations
- 17 August 2019:** Himilcon reaches Rhodos turn back
- 25 August 2019:** sensors turned off! :-(
- 10 Sept. 2019:** recovery planned

Survey 2018-19

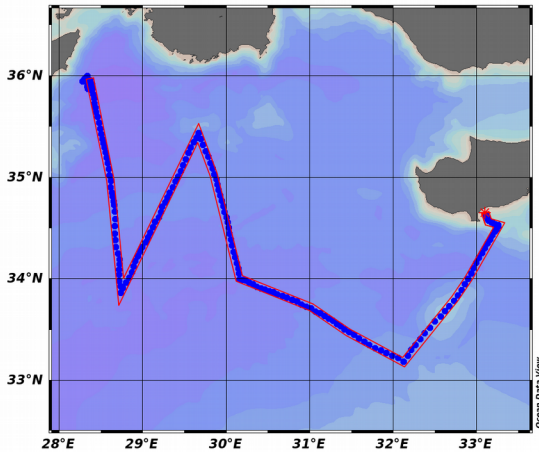
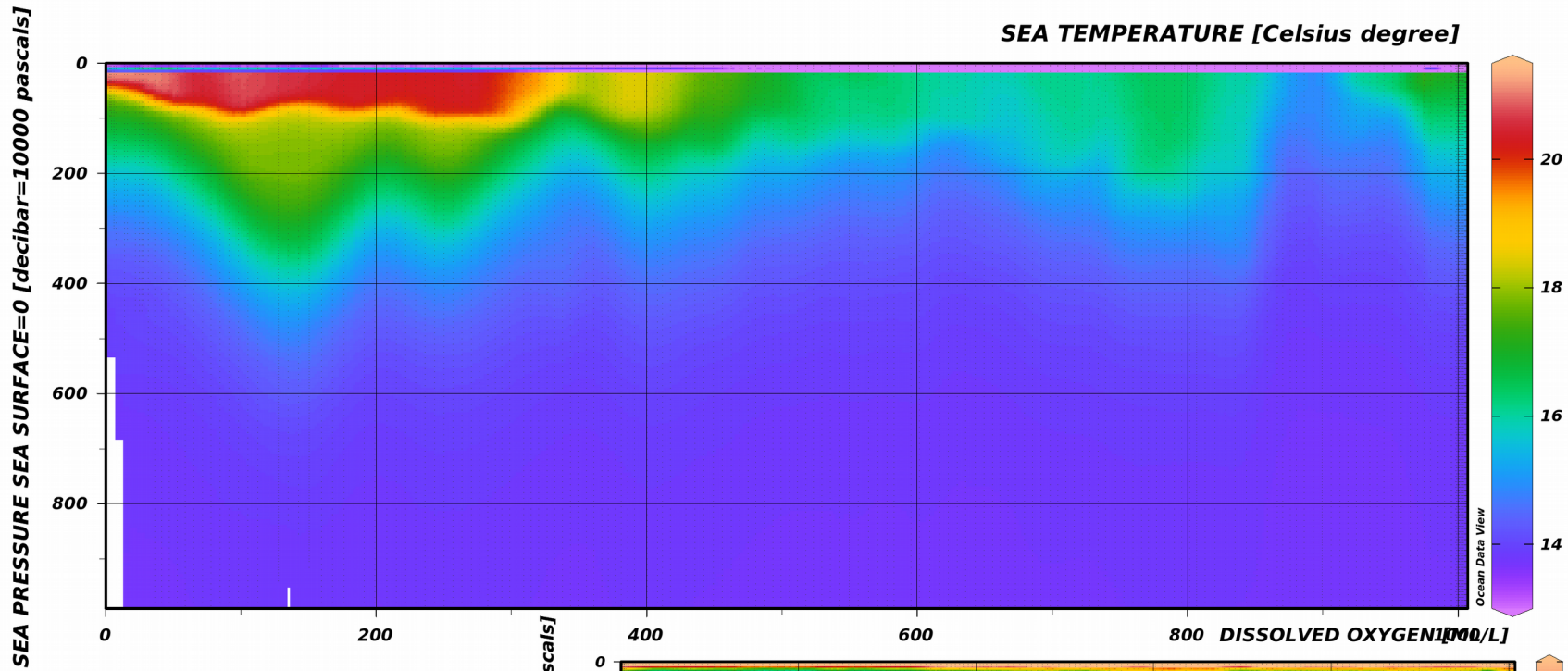
Temperature, salinity, oxygen from 10 Dec. 2018 to 14 Feb. 2019.



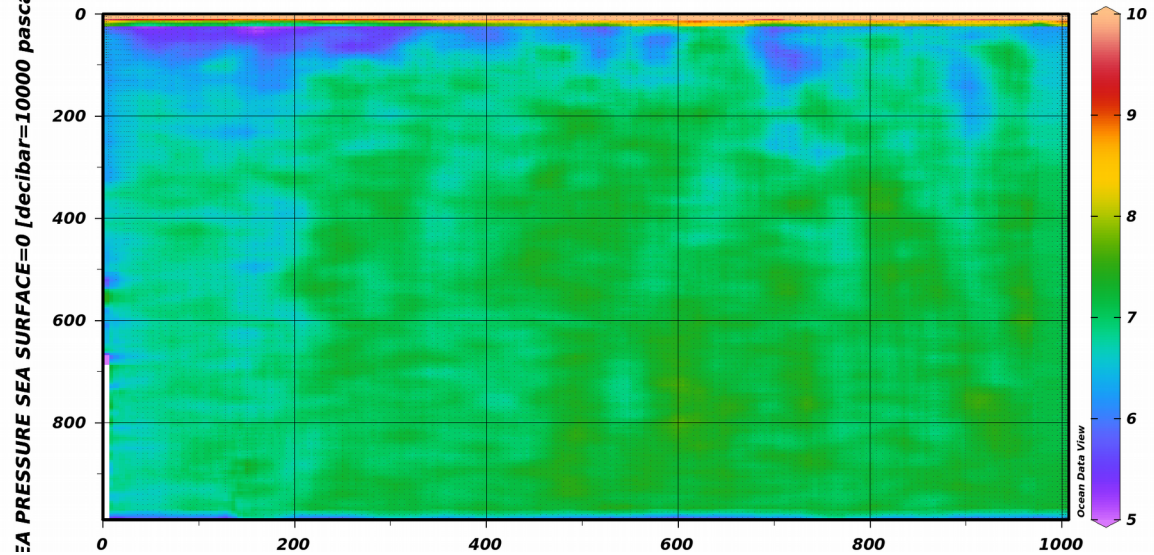
Survey 2018-19

Temperature, salinity, oxygen from 10 Dec. 2018 to 14 Feb. 2019.

SEA TEMPERATURE [Celsius degree]



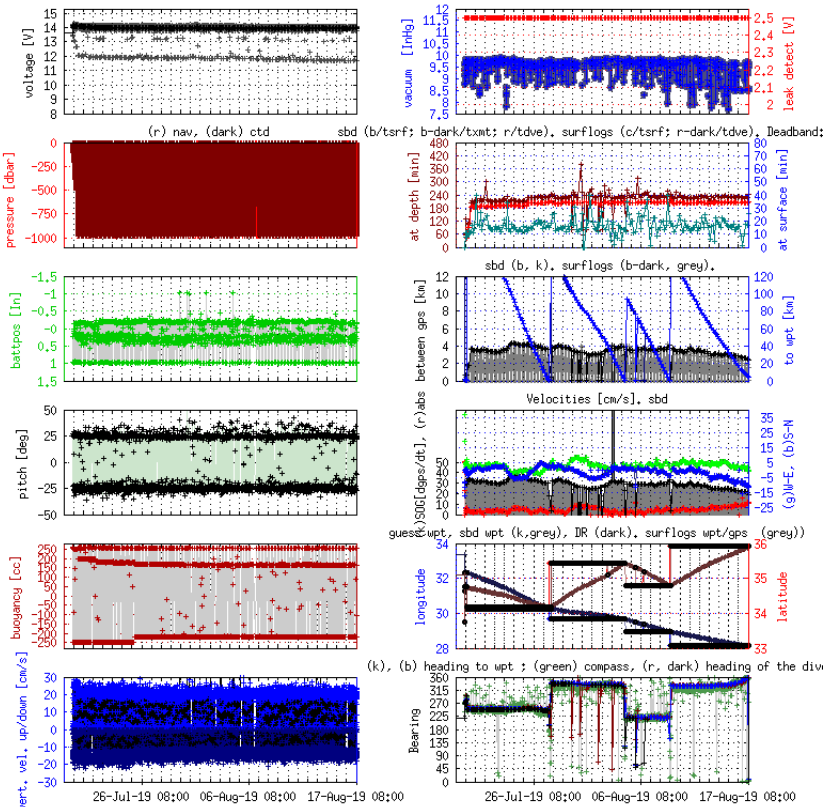
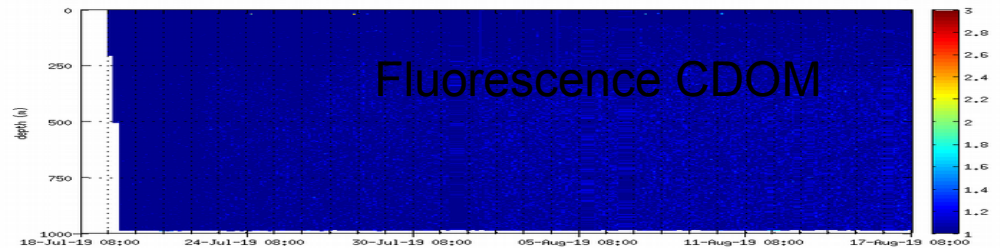
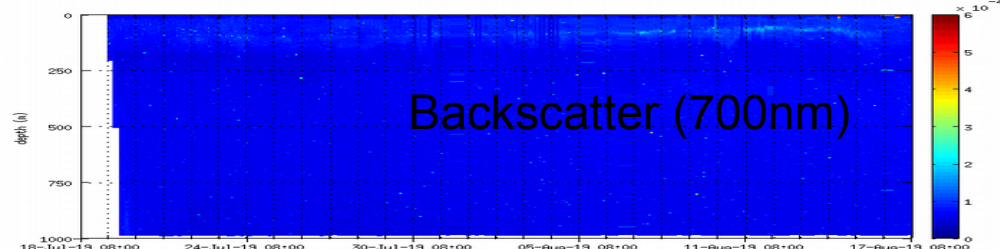
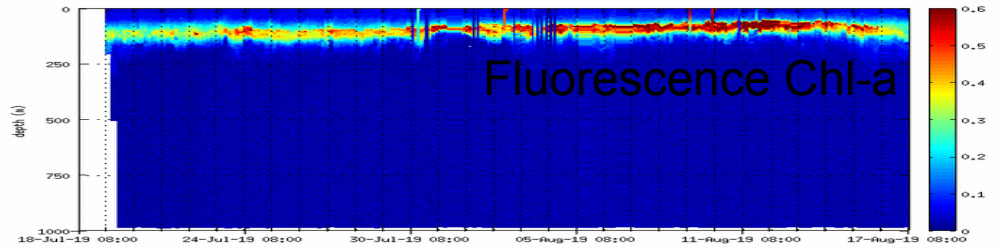
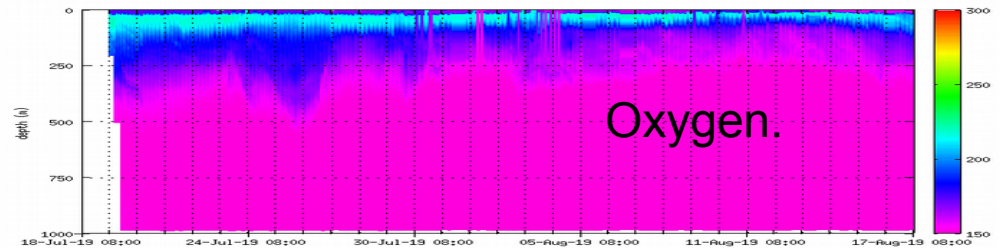
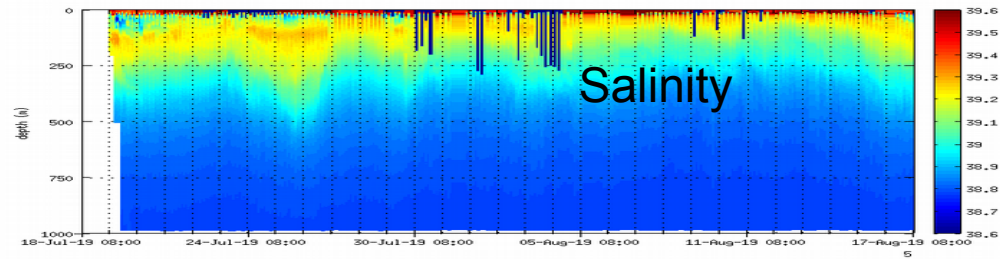
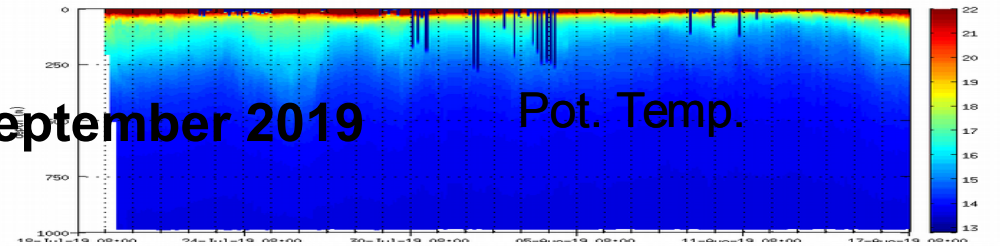
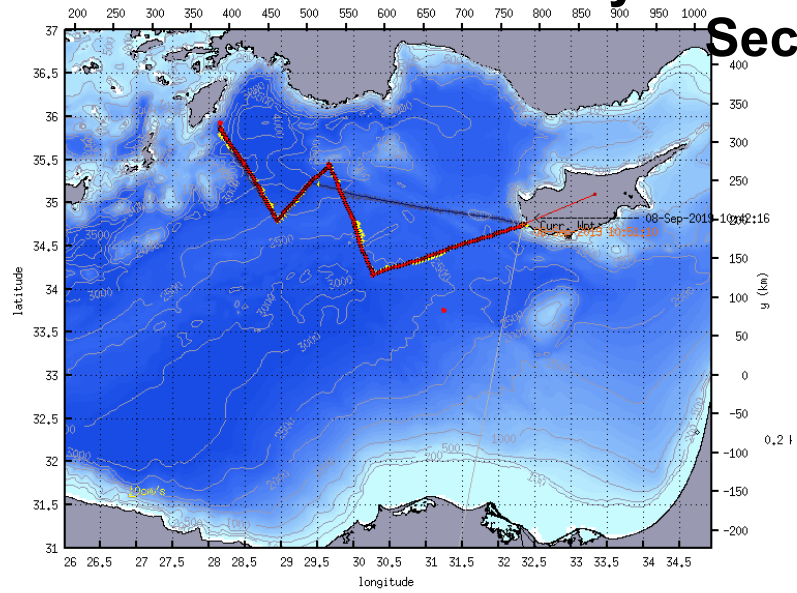
SEA PRESSURE SEA SURFACE=0 [decibar=10000 pascals]



Survey 2019

From 19 July 2019 to 10 September 2019

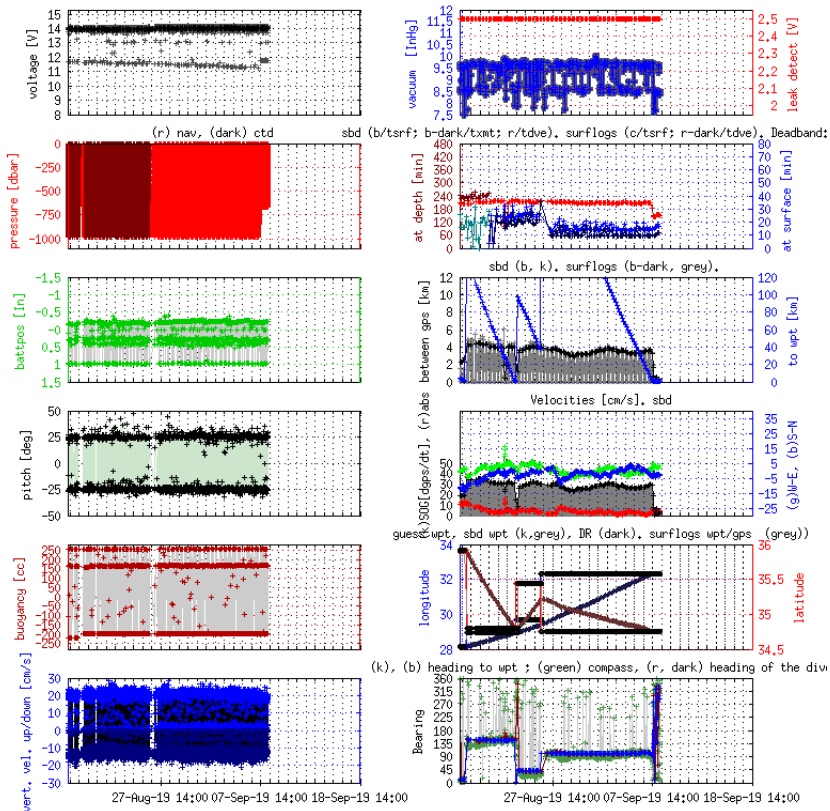
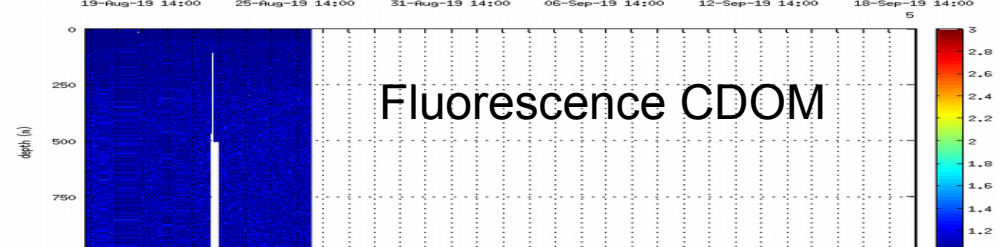
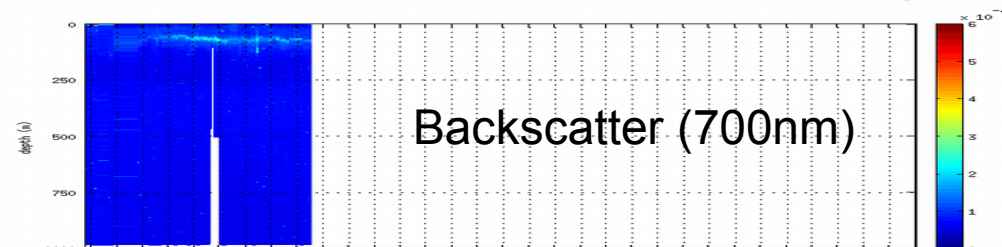
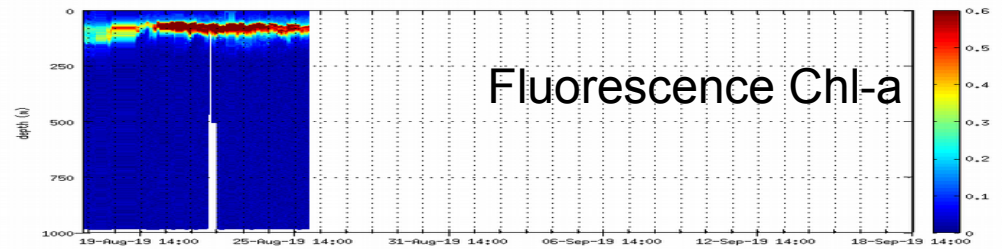
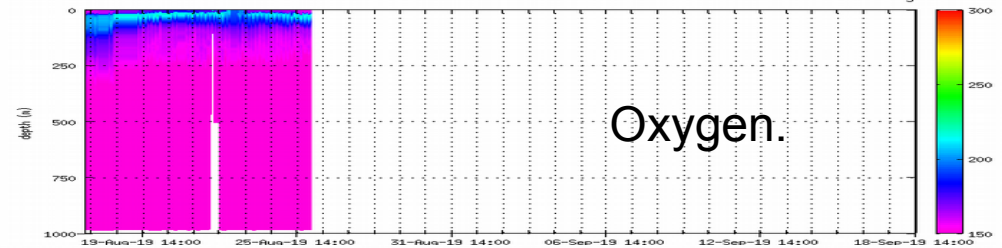
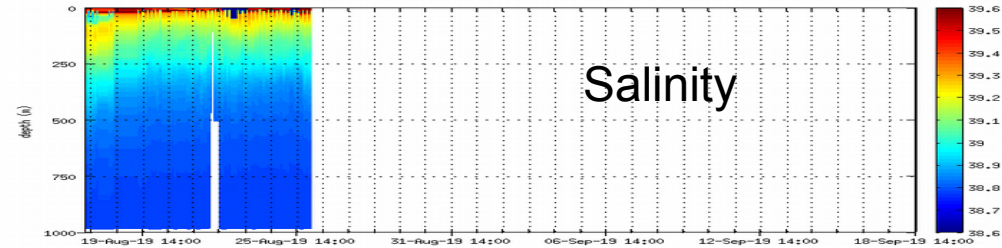
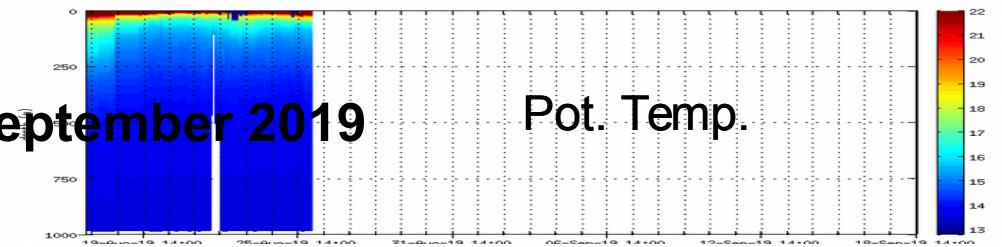
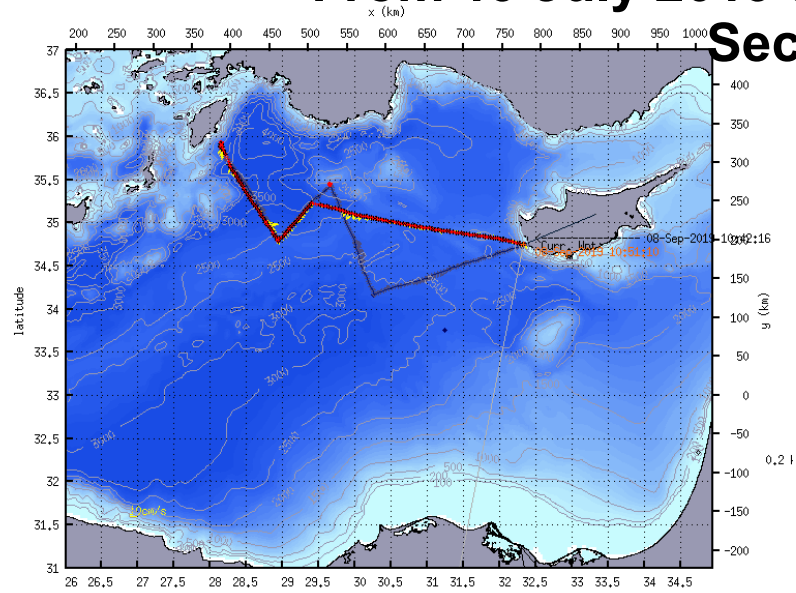
Section 1.



Survey 2019

From 19 July 2019 to 10 September 2019

Section 2.



Conclusions

Some difficulties...

9 months delay

only 1 glider, 2/3 section...

→ Scientific impact MISTRALS (gliders and profiling floats only way to make measurements in the Rhodos gyre)

Next operations ?

- E-W section continued until May 2020?
- HF section and adaptive in Winter-Spring 2020?