THE CIESM HYDROCHANGES NETWORK (2002-2016)

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Abstract
The long-term monitoring of temperature and salinity, collected as time series with adequate temporal resolution in key places of the Mediterranean Sea (straits and channels, zones of dense water formation, deep parts of the basins), constitute a priority in the context of global changes. This led CIESM to support, since 2002, the HYDROCHANGES programme, a network of autonomous conductivity, temperature, and depth (CTD) sensors, deployed on mainly short and easily manageable subsurface moorings, within the core of a certain water mass. The network already supported the study of water exchanges at Gibraltar, exchanges across Mediterranean channels, dense water formation processes, climate-change related warming trends. Here we present a review of the achievements of the Programme and will discuss our future commitments.

Keywords: Mediterranean Sea, Salinity, Temperature

HYDROCHANGES has become over the years one of the emblematic CIESM programmes, as it well reflects key characteristics of the Commission engagement: limited but guaranteed funding over a long-term horizon, donation and maintenance of material (CTDs in this case) provided to developing Mediterranean countries, north-south cooperation with continuous capacity building (training of local engineers and physicists), cross-basin scale with a gradual but sure extension of the network towards eastern and southern waters, in-depth discussion of HC at each CIESM Congress, etc.

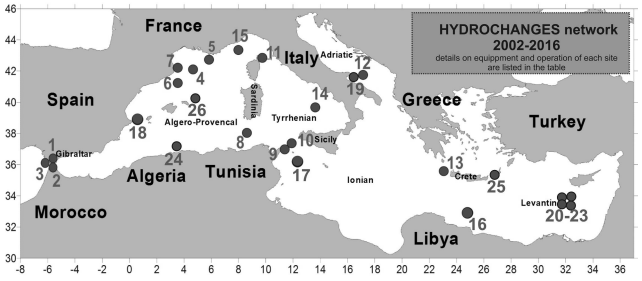

Fig. 1. The *HYDROCHANGES network*

With the focus on trend detection, the HYDROCHANGES coordinated action is thus aimed at (i) addressing problems on the long term, (ii) focusing on temporal variability, using eulerian data at few selected key locations and from the surface layer down to the greatest depths, (iii) achieving the necessary time and space resolutions (i.e. to resolve all important variations, at least in time), which requires autonomous instrumentation collecting data at high temporal resolution over decades in as many places as possible (a sort of sea-wide experiment), (iv) using instrumentations as cheap and simple as possible [1].
Many of the collected time series are providing important first-quality "material" for scientific papers that have been published throughout the years by the network partners. These studies range from the in-depth description of Mediterranean Outflowing and Inflowing waters at Gibraltar, to the assessment of interbasin exchanges through the main Mediterranean channels, to the monitoring of the dense water formation processes occurring in the north-western Mediterranean Sea as well as in the southern Adriatic Sea, and to the assessment of long-term temperature and salinity trends potentially related to climate change.
Future commitments and open issue that are being discussed within the community range from optimal location of monitored and planned sites, data policy, databases, sampling and calibration protocols, data format and harmonization, financial and customary issues, to the role and extension of the CIESM support. All discussions will be further tackled during the upcoming Congress in 2016.

Tab. 1. List of station details

ID	Managing Institute/Group (country)/Point of contact	Site (lon, lat) Acronym used in figures	Period	Bottom depth/ mooring length
1	SHOM AR&CNRS/COM (Morocco, France)/Bouchta El Moumni, Lahoucine Bengara, Gilles Rougier, Isabelle Taupier-Letage	Camarinal Sill – Gibraltar, (35° 55.2'N, 5° 44.9' W)	Jan 2003-Jun 2010	270 m/10 m
2	SHOM AR&CNRS/COM (Morocco, France)/ Bouchta El Moumni, Lahoucine Bengara, Gilles Rougier, Isabelle Taupier-Letage	Moroccan shelf – Gibraltar (35° 52.9 N, 5° 43.6' W)	January 2003- October 2008 & discont. to July 2012	80 m/10 m
3	University of Malaga, UMA (Spain)/Jesus Garcia-Lafuente	Espartel Sill – Gibraltar (35° 51.709' N, 5° 58.217' W)	October 2004 – Aug 2011 & Aug 12 - present	355 m/18 m
4	CNRS/COM (France)/Gilles Rougier, Isabelle Taupier-Letage	Gulf of Lion (41° 59.0' N, 04° 55' E)	October 2006 - 2012	2400 m/10 m
5	ANTARES Group (France)/Dominque Levefre, Christian Tamburini	Offshore Toulon (42°45 N, 6°10 E) ANTARES	Dec 2007 – 2011 may2013-Sept2014 Sept 2013-present	2500 m/350 m 2500-1000 m
6	ICM-CSIC (Spain)/ Pere Puig, Jordi Salat	Catalan Slope (41° 28.0' N, 03° 40.4' E)	October 2003 - present	1890 m/30 m
7	ICM-CSIC (Spain)/Pere Puig	Cap de Creus Canyon (42°23.4' N, 3°19.3' E)	November 2009 - 2012	315 m/15 m
8	INSTM & CNR ISMAR (Tunisia, Italy)/ Cherif Sammari, Sana Ben Ismail, Katrin Schroeder	Sardinian Channel (38° 20.047' N, 09° 19.959' E)	July 2008 - present	1900 m/10 m
9	CNR-ISMAR (Italy)/Katrin Schroeder, Mireno Borghini	Sicily Channel (37°17.120'N, 11°30.019' E)	Since 1993	530 m/273 m
10	CNR-ISMAR (Italy)/Katrin Schroeder, Mireno Borghini	Sicily Channel (37°22.836'N, 11°35.636' E)	Since 1993	450 m/365 m
11	CNR-ISMAR (Italy)/Katrin Schroeder, Mireno Borghini	Corsica Channel (43°02.021'N, 9°41.154' E)	Since 1985	440 m/370 m
12	OGS (Italy)/Vanessa Cardin	Southern Adriatic (41° 30.4' N, 18° 5' E)	November 2006 - present	1185 m/840 m
13	HCMR (Greece)/Harilaos Kontoyiannis	Antikythira Strait (35° 36.8 'N, 23° 32.2' E)	Nov07-May09 & Jun10-Feb 13 & Dec 15 - present	890 m/15 m
14	Univer. Parthenope DiST, & CINFAI-CoNISMa (Italy)/Giorgio Budillon, PierPaolo Falco	Central Tyrrhenian (39° 30.008' N, 013°34.012' E)	August 2010 - present	3350m/40 m
15	Observatoire Oceanologique de Villefranche-sur-mer (France)/Laurent Coppola	Ligurian subbasin (43.4185° N, 7.903° E)	June 2009 - present	2350 m/2200 m
16	COM/LOB (France)/Gilles Rougier, Isabelle Taupier-Letage	South-western Levantine (32.296°7' N, 25.6018° E)	April 2006 - March 2007	3225 m
17	INSTM & CNRS/COM (Tunisia, France)	Central Sicily Channel		
18	IEO (Spain)/Rosa Balbin	Ibiza Channel (39° 03.733 N, 00° 27.745 E)	June 2014 - present	860m/30m
19	CNR-ISMAR (Italy)/Leonardo Langone, Stefano Miserocchi	Southern Adriatic (41° 20' N, 17° 12' E)	March 2010 - present	600/114 m
20	Oceanography Center University of Cyprus /(Nicosia, Cyprus)/ George Zodiatis, Dan Hayes	Levantine Sea (33 22' 10.31'N, 32 12' 34.95' E)	October 2008 - April 2009	1612m/ 1010m
21	Oceanography Center University of Cyprus /(Nicosia, Cyprus)/ George Zodiatis, Dan Hayes	Levantine Sea (33 10' 51.624401' N, 31 49' 00.00'E)	October 2008 - February 2010	1790m/1507m
22	Oceanography Center University of Cyprus /(Nicosia, Cyprus)/ George Zodiatis, Dan Hayes	Levantine Sea (33 32' 18.045629'N, 31 47' 35.991 5'E)	October 2009 - December 2012	2304m/2007m
23	Oceanography Center University of Cyprus /(Nicosia, Cyprus)/ George Zodiatis, Dan Hayes	Levantine Sea (33° 39.993'N, 32° 9.478'E)	October 2007 - October 2008	2700m/2500m
24	Ecole Nationale Supérieure des Sciences de la Mer et de l'Amenagement du Littoral, ENSSMAL(Algeria)/ Ferial Louanchi	South Algero-Provencal basin (37° 6.027'N, 3°14.55'E)	August 2014 - present	2430m/15m
25	HCMR (Greece)/Harilaos Kontoyiannis	Kasos Strait (35° 15.3' N, 26° 40.3' E)	May 2015 - present	1050 m/15 m
26	IEO (Spain)/Rosa Balbin	NE Menorca (40° 09.919 N, 04° 36.914 E)	September 2015 - present	2500 m/2500 m

References
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