Finanziato dall'Unione europea NextGenerationEU

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OGS National Institute of Oceanography and Applied Geophysics

EGU General Assembly 2025

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RECONTRUNCTING THE LONG-TERM TIME SERIES OF OCEAN ACIDIFICATION DATA IN THE GULF OF TRIESTE: THE IMPORTANCE OF METADATA FOR DATA HARMONIZATION AND STANDARIZATION.

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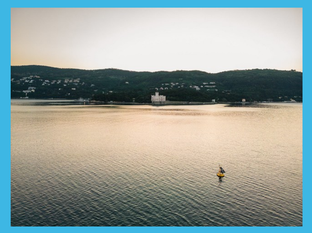
SCAN ME

MAMBO1 history

Consistent long-term observations of pH, temperature and salinity are crucial to assess ocean acidification (OA) trends and vulnerability of an area under climate and anthropogenic stress. The Meteo-Oceanographic coastal station MAMBO1 (*Monitoraggio AMBientale Operativo*) buoy installed in the northern Adriatic sea transmits in near-real time [1]. The buoy is anchored at about 17 m at the limit of the Marine Protected Area of Miramare, in the Gulf of Trieste (45.6976667 °N and 13.7083333 °E) and has been operative since January 1999 [2]. The configuration, instrumentation and data management of the site has changed over the years, posing a challenge to compare data over the long term time series. However, besides configuration, also data management has changed over the years.

From 1999 to 2004 the system operated in profiling mode performing a vertical profile along the water column every three hours. Since 2005, the sensors have been anchored at fixed depths with the latest configuration being 2 m, 10 m and 15 m depth (see figure 1). The time resolution for each depth has also changed within the years and depends also on each instrument set up [2]. Table 1 shows the operating period of the MAMBO1 station since the first deployment.



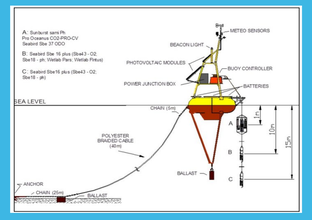


Figure 1: Top panel shows the location of the buoy (taken from http://meta.icos-cp.eu/resources/stations/OS_48MB). Bottom panel shows MAMBO1 latest configuration.

	J	F	M	A	M	J	J	A	S	O	N	D
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Table 1: Mambo1 operating period showing 25 years of Meteo-Ocean data acquisition. Green represents acquisition as profile, grey as time series and blue not in operation.

(Meta) Data puzzle

Part of the challenge to reconstruct the long-term time series is to gather all the pieces of the puzzle i.e., the information needed from each parameter and its provenance. The funnel in figure 2 shows the major issues encountered as drops and the stages of the proposed data life cycle (DLC) to produce the harmonized and standardized dataset. As this stage, the work will focus on phase 1 of the funnel.

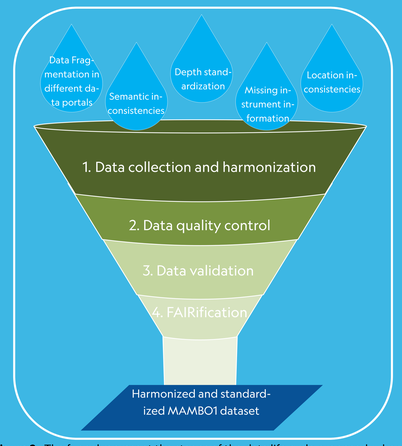

Figure 2: The funnel represent the stages of the data life cycle proposed, where major issues encountered at stage 1 are represented as drops. Stages 2-4 of DLC in are still under development.

Data Fragmentation

From 1999 to 2021 MAMBO1 data is available though the SeaDataNet portal (https://cdi.seadatanet.org/search). From 2021 up to date the dataset is made available through OGS-NODC ERDDAP (https://nodc.ogs.it/erddap/index.html).

SeaDataNet + NODC's ERDDAP Easier access to OGS's data

Location inconsistencies

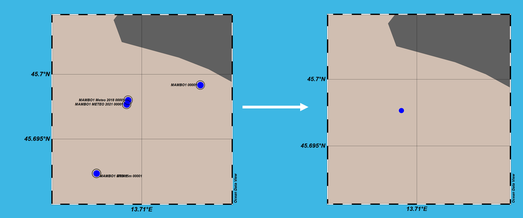

Figure 3: Before and after the coordinate harmonization using the latest ERDDAP configuration.

Semantics

Data have been managed according to SeaDataNet standard vocabularies and protocols.

Depth: Pressure to depth conversion and unit harmonization:

SDN:P01::DEPHPREN SDN:P06::ULAA & SDN:P01::ADEPZZ01 SDN:P06::ULAA

pH: Since 1999 the codes associated with the parameter were too generic and did not include information about the instrument or the pH scale e.g.,

SDN:P01::PHXXZZXX ———> pH (unspecified scale) of the water body

SDN:P06::UUPH ———> pH units

Tracking back the instruments used for measuring pH [2]we can asses the scale and suggest a narrower and more accurate vocabulary:

Operating period	Depth	Instrument	L22	Original Units	Suggested P01	Suggested pH scale
1999-2004	Profiles, 0-15 m	Idronaut Ocean Seven 316 multiparameter probe	TOOL1306	pH units	PHNBISGE	NBS scale
2012-2014	10 m	Sea Bird Sea Cat SBE 16 v2	TOOL0870	pH units	PHNBWCAL	NBS scale
2015-2020	1 m	SAMI pH PRO	TOOL1493	pH units	PHXXSP02	Total scale
	10 m	Sea Bird 18	TOOL0069	pH units	PHNBISGE	NBS scale
	15 m	Sea Bird Sea Cat SBE 16 v2	TOOL0870	pH units	PHNBWCAL	NBS scale
2020-2024	2 m	SEAFET	TOOL1493	pH units	PHXXSP02	Total scale
	10 m	Sea Bird Sea Cat SBE 16 v2	TOOL0870	pH units	PHNBWCAL	NBS scale
	15 m	Sea Bird Sea Cat SBE 16 v2	TOOL0870	pH units	PHNBWCAL	NBS scale

Data collection and harmonization

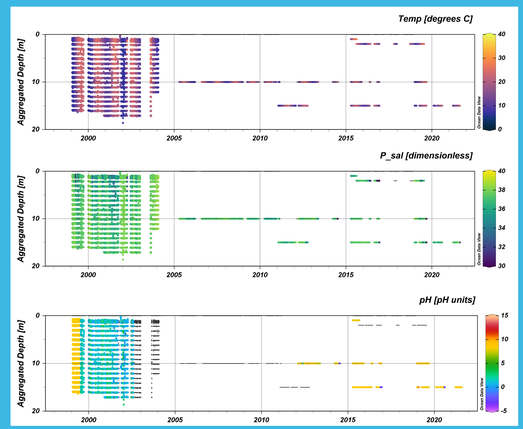

Figure 4: Complete MAMBO1 OA time series in SeaDataNet.

Take home messages

- The importance of consistent data management practices and data standardization.
- The important role of metadata in documenting how the data was collected in addition to where, when, who and what.
- The experience gained with ocean acidification data can be applied to the other ocean and meteorological parameters in the time series.
- FAIR data can be collected once and used for different purposes.

Acknowledgements

The work has been funded by EU - Next Generation EU Mission 4 "Education and Research" - Component 2: "From re-search to business" - Investment 3.1: "Fund for the realisation of an integrated system of research and innovation infrastructures" - Project IR0000032 – ITINERIS - Italian Integrated Environmental Research Infrastructures System - CUP B53C22002150006. The authors would like to thank Michele Giani and the colleagues of the Oceanography Section for their valuable suggestions and help in various forms.

References

[1] Partescano, E., et al. (2014). A (Near) Real-time Validation and Standardization System Tested for MAMBO1 Meteo-marine Fixed Station. DOI: 10.13140/2.1.2788.4800.

[2] Lipizer, M., et al. (2017). Sistema di Monitoraggio AMBientale Operativo Boa MAMBO1: revisione protocolli di acquisizione dati e registro tarature. DOI: 10.13120/7d9c292f-bc91-467d-a380-0483e814c000

[3] French, Megan Anne et al. *EMODNet Chemistry: Importing a profile dataset into a time series dataset in ODV to create a merged file.* OGS, Internal report. 17 March 2023.

[4] Schlitzer, Reiner, Ocean Data View, https://odv.awi.de, 2024.