Eutrophication and Contaminants Black Sea data management in the framework of EMODnet Chemistry

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INTRODUCTION

The European Marine Observation and Data network (**EMODnet**) **Chemistry** (www.emodnet-chemistry.eu/) is the long-term initiative from DG MARE aiming to assemble fragmented marine chemical data into interoperable and publicly available data streams for complete maritime basins, to assess data quality according to common and standardized protocols and to generate suitable data products in agreement with the requests from the MSFD addressing three of the descriptors of Good Environmental Status (GES): Descriptors 5 (Eutrophication), Descriptors 8 (Chemical pollution), Descriptors 9 (Contaminants in seafood) and, starting from 2018, Descriptor 10 (Marine Litter). The third phase of EMODnet Chemistry partnership involves 46 institutes from 27 countries and 3 international organizations (ICES, Black Sea Commission, UNEP/MAP) from all European Seas.

## EMODnet Chemistry approach

- Gathers, with all partners, relevant marine chemistry data sets (with a focus on eutrophication and contaminants), collected by **marine environmental monitoring** activities and by **scientific research** activities, and populates these in the SeaDataNet Common Data Index (CDI) Data Discovery and Access service.

- This way all marine chemistry data sets can be retrieved in a homogeneous way with syntax standards for metadata and data formats, and semantic standards for attributes. Data files (ODV format) also include SeaDataNet quality flags

- Despite all standardisation there is still a lot of heterogeneity which requires further Quality Control (QC) and harmonisation on a regional scale. For this a special module was build-up in the **Ocean Data View (ODV)** software. (SDN Aggregation / Harmonization on parameters and units)

- Individual parameters (SDN P01 vocab) have been grouped into aggregated parameters (P35 vocab), including associated units, using vocab mapping

- Harvests have taken place for **eutrophication related parameters** (nutrients, chlorophyll and oxygen), **ocean acidification** (pH, alkalinity) and **contaminants** (in water, sediment and biota) substances. The harvested data sets have been transferred to the regional coordinators as 'raw' input for further processing.

- Each regional coordinator has been tasked with data QC and preparing regional data products. Data products have been defined as:
  - Interpolated maps of specific parameters in time and depth per sea region;
  - Graphical time series of specific parameters at point locations, including depth (monitoring sites).

Data quality control (QC) is considered as a key element when merging heterogeneous data coming from different sources and a Data Validation Loop has been agreed within EMODnet Chemistry community and is routinely performed. Quality Control and Quality Assurance guidelines are being developed within the project.

Data Interpolating Variational Analysis (DIVA) software has been applied to generate spatial interpolated concentration maps, albeit only for those parameters that have sufficient spatial and temporal coverage at basin scales such as nutrients, dissolved oxygen and chlorophyll-a. Interpolated maps have been generated with a 6-year overlapping moving window (every map is representing the year of the middle 6- year period).

EMODNet Chemistry 3 - Black Sea

The Black Sea is one of the regional seas in EMODnet Chemistry. NIMRD, as Regional leader for the Black Sea, receives harvested data collections as "raw" data for further data quality control and validation and data products.

EMODnet Chemistry 3 – Black Sea data harvest

Eutrophication & Ocean acidification data collection

- ➤ **57575** files in ODV format
- ➤ **24 CDI-partners; 41 data originators**

Contaminants data collection

- ➤ **36295** files in ODV format
- ➤ **14 CDI-partners; 23 data originators**

	Non-restricted	Restricted
Eutrophication & Ocean acidification	82%	18%
Contaminants	60%	40%

EMODnet Chemistry 3 – Black Sea data aggregation and Quality Control

The applied quality controls checks were done on regional data set for: ODV format checks, wrong P01/P06 codes, unit conversions, duplication eliminations, broad range control checks to exclude erroneous high values, negatives, identification of zero values, and comparison of interpolated data with spatially averaged profiles. All errors encountered during aggregation and quality control were documented and corrected (using ODV software and in house developed scripts) in close collaboration with data originators, according to the common project methodology (http://nodc.ogs.trieste.it/doi/documents/EMD2chem_QCreport_V8-072015.pdf).

Example: Temporal and spatial distribution & vertical profiles (before and after QC) of aggregated data Dissolved Oxygen
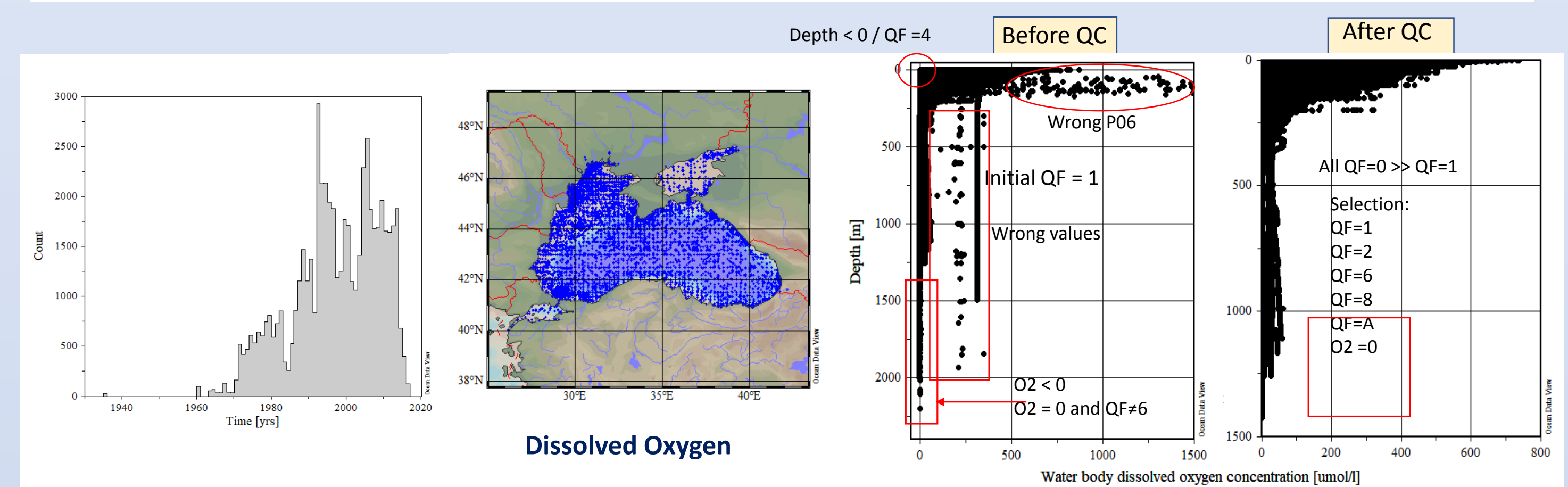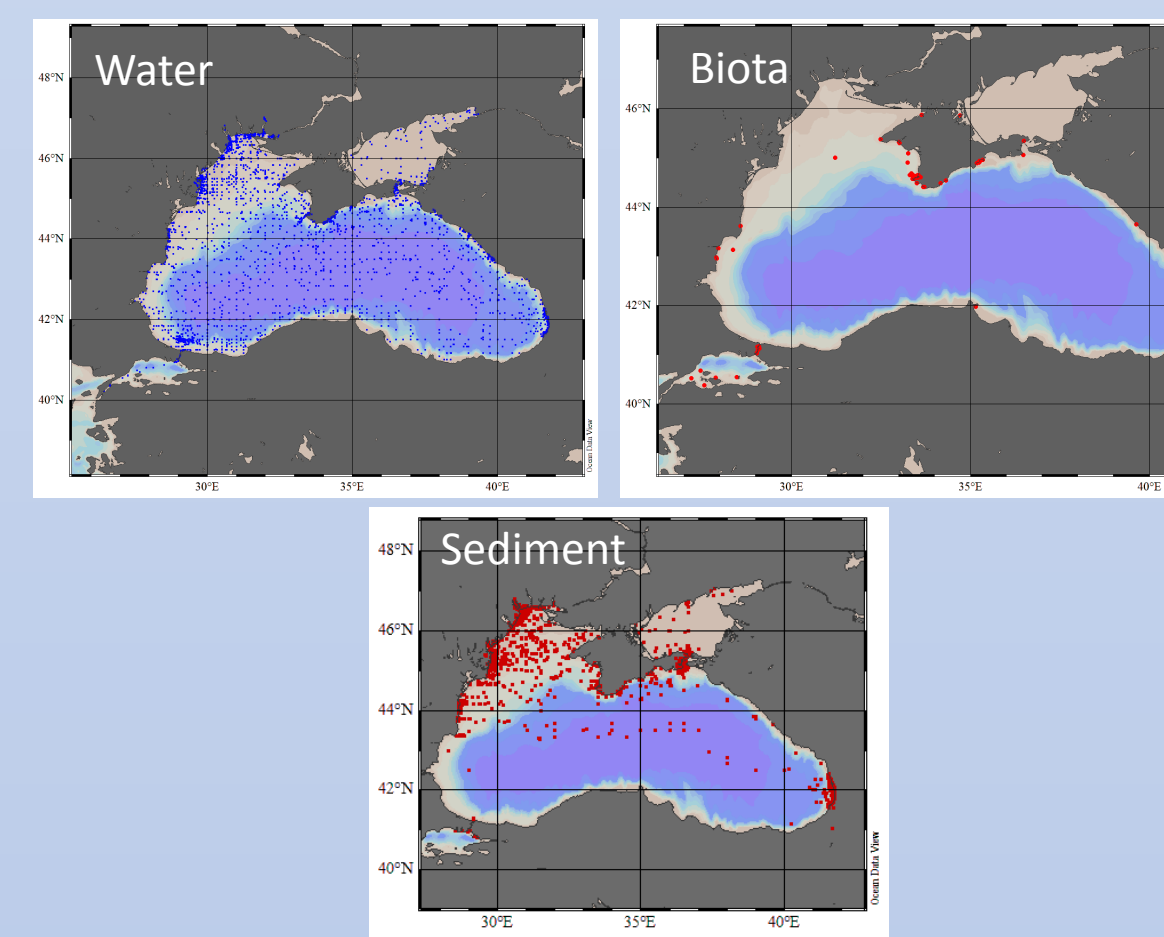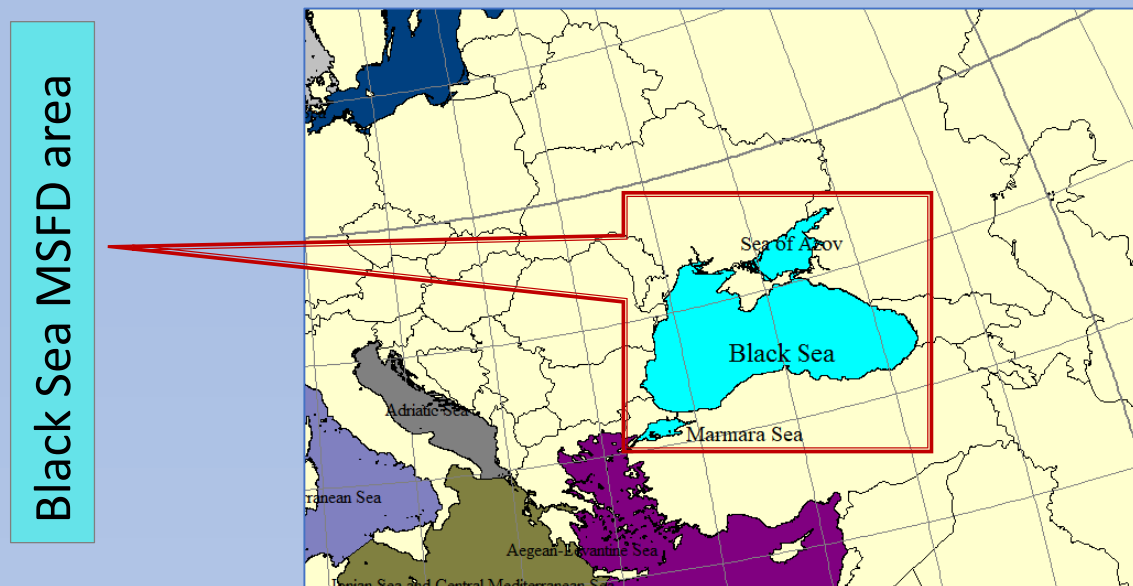

Total number of aggregated / harmonized, QControled vertical profiles for Black Sea

Eutrophication & Ocean acidification parameters		No. of vertical profiles
1	Water body dissolved oxygen concentration [umol/l]	44204
2	Water body dissolved oxygen saturation [%]	8549
3	Water body nitrate [umol/l]	16903
4	Water body nitrate plus nitrite [umol/l]	19371
5	Water body nitrite [umol/l]	27660
6	Water body ammonium [umol/l]	21594
7	Water body dissolved inorganic nitrogen [umol/l]	15686
8	Water body total nitrogen [umol/l]	10917
9	Water body phosphate [umol/l]	30769
10	Water body total phosphorus [umol/l]	11777
11	Water body chlorophyll-a [mg/m^3]	3355
12	Water body phaeopigments [mg/m^3]	654
13	Water body silicate [umol/l]	27248
14	Water body pH [pH units]	32104
15	Water body total alkalinity [mEquiv/l]	19658

| Contaminants *		
	Matrices	No. of vertical profiles
1	Water	31626
2	Sediment	3998
3	Biota	498

(*) QC not finished yet

EMODnet Chemistry 3 – Black Sea data products

Based on the MSFD requirements for Descriptors 5 (Eutrophication), seasonal 6-year overlapping moving window maps were produced for the following subset of parameters: Chlorophyll-a, Dissolved Inorganic Nitrogen, Dissolved Oxygen, Phosphate and Silicate. DIVA settings: signal-to-noise ratio and correlation length were estimated using data mean distance as a minimum (for L) and vertically filtered. Background field: the data mean value is subtracted from the data. The OceanBrowser Viewing service (http://ec.oceanbrowser.net/emodnet/) developed and maintained by University of Liege (Ulg), provides access to the DIVA interpolated maps as well as to the and time series plots with links to the station CDI.
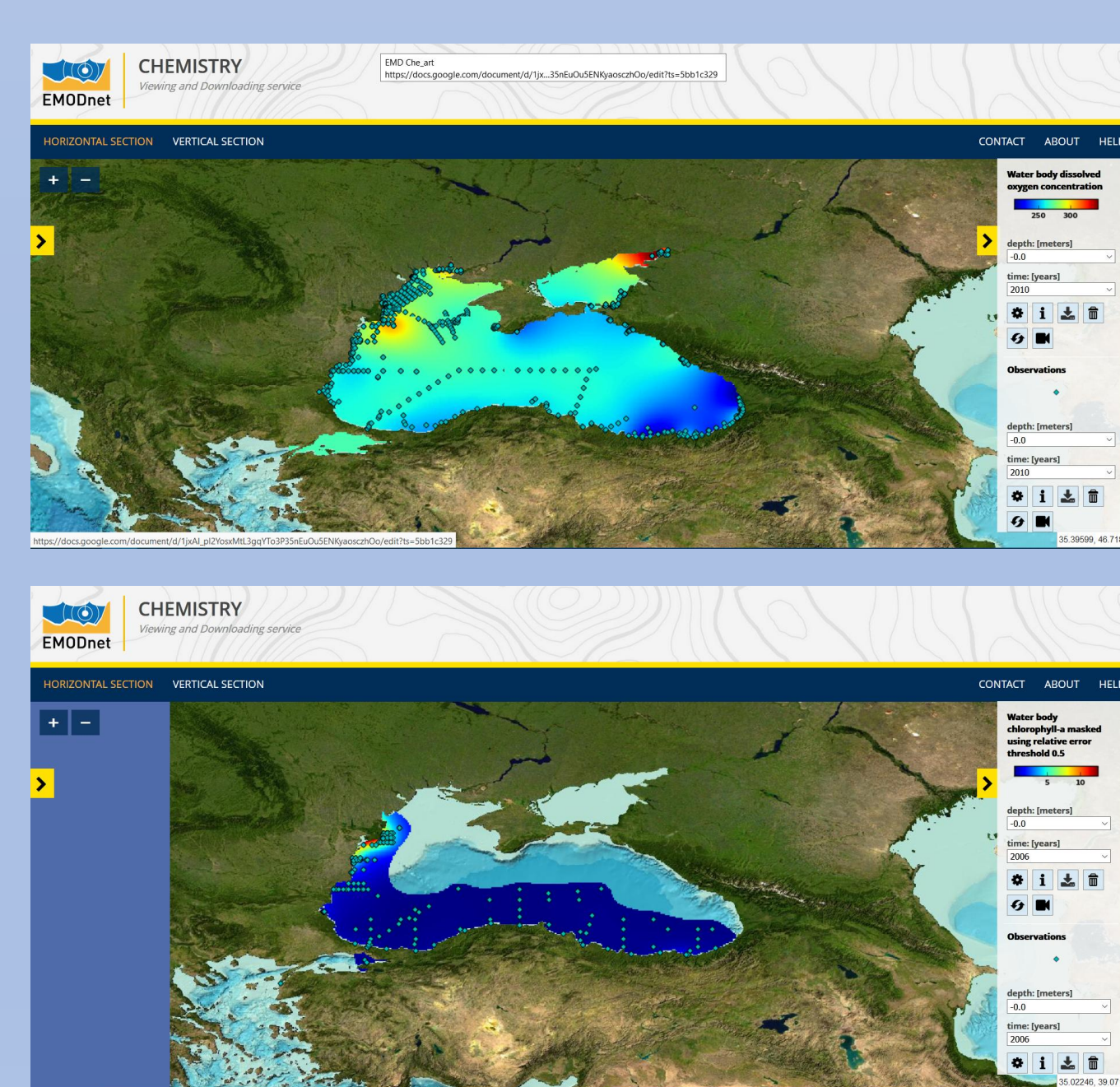
6-year average of Water body dissolved oxygen concentration (μmol/l) in the surface layer for years 2008-2013 (centered in 20010) (upper image); autumn season and

6-year average of Water body chlorophyll-a (mg/m^3) masked using relative error threshold 0.5 for years 2003-2008 (centered in 2006) (lower image); spring season.
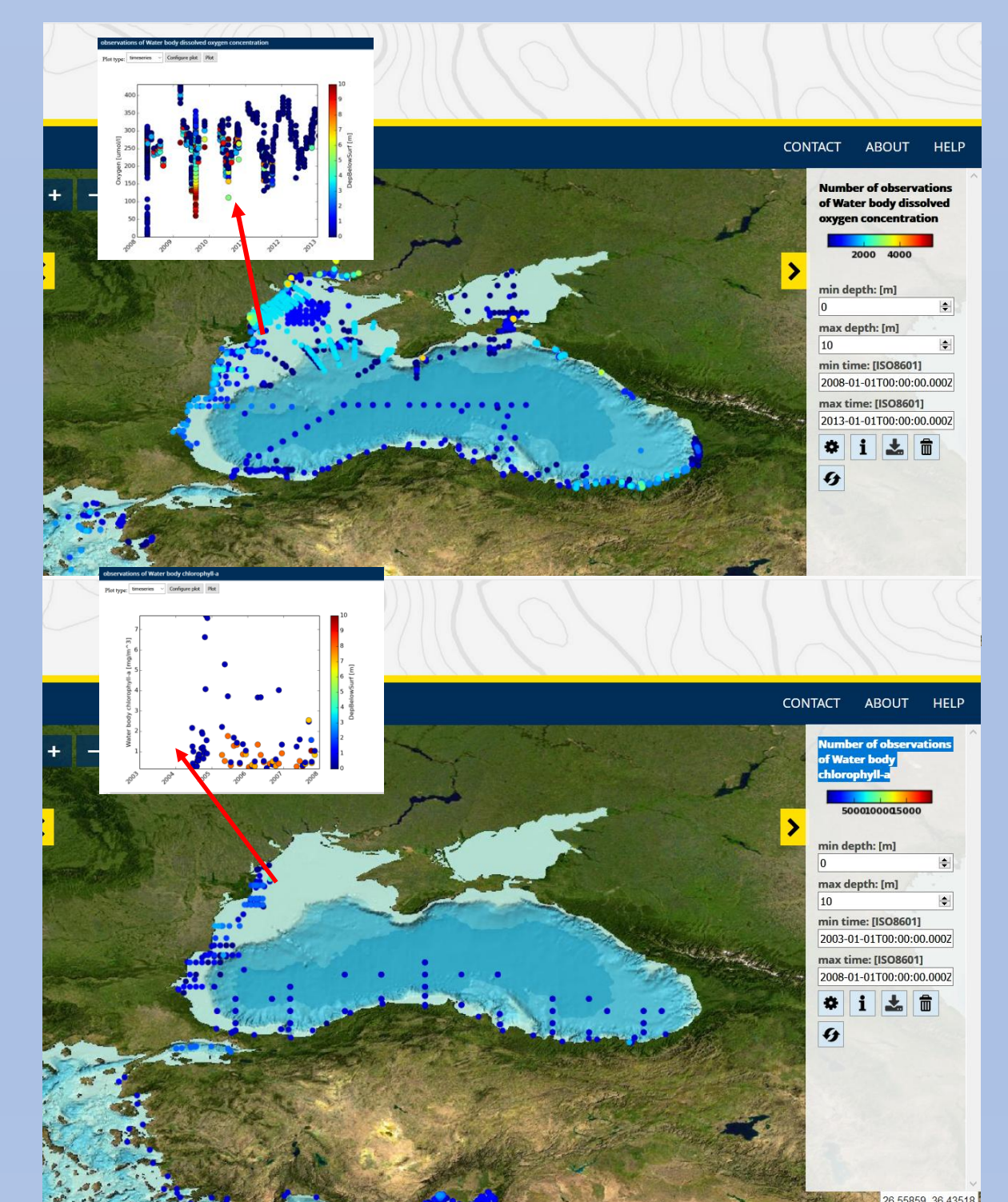
Number of observations and Time series plots of Water body dissolved oxygen concentration (2008-2013) (upper image); and of Water body chlorophyll-a (2003-2008) (lower image)

References:
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