

Creating products and knowledge for the Mediterranean



MARINOMICA WATER QUALITY RELATED SERVICES

Hydrodynamical and water quality modeling based on the Marinomica platform

14-15 July, Egypt

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727277



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- Researcher / Advisor Deltares | Data Science and Water quality, Marine & Coastal Systems
- PhD Delft University of Technology | Dept. of Applied Statistics

'Climate change induced uncertainties in future coastal ecosystem state'

Keywords

Coastal Working Group

Data science

Uncertainty quantification

Copernicus based downstream information services

Downscaling to coasts

H2020 ODYSSEA

Deltares



Water quality and relevant policies

Water quality indices











Pinterest: BYOjet

Mostly not, but there are problem areas...



Macias, D., Garcia-Gorriz, E. and Stips, A. (2018), Major fertilization sources and mechanisms for Mediterranean Sea coastal ecosystems. Limnol. Oceanogr., 63: 897-914. <u>https://doi.org/10.1002/lno.10677</u>

Sustainable Development Goals





Target 14.1: preventing every form of marine pollution including nutrient pollution leading to eutrophication

Intergovernmental Oceanographic Commission

- Link: http://www.ioc-unesco.org/
- **Objective:**

"to promote international cooperation and to coordinate programmes in research, services and capacity-building, in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States."

- High level Objectives:
 - 1. **Ecosystem Health**
 - **Marine Hazards** 2.
 - **Climate Change** 3.
 - **Enhanced Scientific Knowledge** 4.









ODYSSEA

EU Marine Strategy Framework Directive



- Link: <u>http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm</u>
- Objective:

"The Marine Directive aims to achieve **Good Environmental Status (GES)** of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend."





MSFD Descriptors



- Descriptor 1 BIOLOGICAL DIVERSITY
- Descriptor 2 NON-INDIGENOUS SPECIES
- Descriptor 3 COMMERCIAL FISH
- Descriptor 4 FOOD WEBS
- Descriptor 5 EUTROPHICATION
- Descriptor 6 SEA-FLOOR INTEGRITY
- Descriptor 7 HYDROGRAPHICAL CONDITIONS
- Descriptor 8 CONTAMINANTS AND POLLUTION EFFECTS.
- Descriptor 9 CONTAMINANTS IN FISH AND OTHER SEAFOOD
- Descriptor 10 MARINE LITTER
- Descriptor 11 UNDERWATER NOISE/ENERGY

OSPAR Convention



- Link: <u>https://www.ospar.org/convention</u>
- [OSPAR Convention = Convention for the Protection of the Marine Environment of the North-East Atlantic]
- Entered into force on 25 March 1998
- Specific OSPAR Areas:
 - Prevention and elimination of:
 - pollution from land-based sources;
 - pollution by dumping or incineration;
 - pollution from offshore sources;
 - Assessment of the quality of the marine environment;
 - protection and conservation of the ecosystems and biological diversity of the maritime area.







Data on Eutrophication status

Barcelona Convention - IMAP



Barcelona Convention Ecological Objective 5 - Common indicators 13 and 14

EO 5 Eutrophication

Common Indicator 13: Concentration of key nutrients in water column Common Indicator 14: Chlorophyll-a concentration in water column

- Link: <u>https://www.rac-spa.org/sites/default/files/ecap/ig22_inf7.pdf</u>
- Objectives:
 - Human-induced eutrophication is prevented,
 - especially adverse effects thereof:
 - losses in biodiversity,
 - ecosystem degradation,
 - harmful algal blooms,
 - oxygen deficiency



Mediterranean Action Plan Barcelona Convention



Eutrophication in international policies

- Do you know other policies / laws / directives on:
 - Local;
 - National;
 - Regional;
 - International level ?

Please type it in the chat!



Water quality indices in Marinomica

So far...

Primary VS derived



Primary variables

- Nutrients (phosphate and nitrate)
- Dissolved oxygen
- Chlorophyll-a concentration

Secondary (derived) indices

- Eutrophication Index in sea water
- TRophic IndeX in sea water
- UNscaled TRophic IndeX in sea water
- Efficiency Coefficient in sea water

Primary variables



Derived indices



Water quality data sources in Marinomica

Data sources





Downstream service for water quality



• From Copernicus Marine Service to local (high resolution) operational water quality simulation





Delft3D Water quality (Delwaq)



CMEMS to Delwaq







Applications

1) Historical assessment

2) Early warning: Real time and forecast (operational)

1) Historical assessment



• ENI-SEIS II:

https://eni-seis.eionet.europa.eu/south

 Horizon 2020 Assessment Technical Med report (EEA)

https://eni-seis.eionet.europa.eu/south/communication/news/eeaunep-map-launch-country-consultation-on-executive-summary-ofthe-eea-unep-map-2nd-horizon-2020-indicator-based-assessmentreport



Coastal waters





Identification of hotspots

Using satellite data..









arinomica





Using model data..





Regional analysis - Egypt

Using model data...



2) Early warning: Real time and forecast



Open Marinomica and check the forecast for tomorrow



17-02-2021

00:00:00.000Z ¥

Yesterday

Today

Tomorro

Privacy Policy



Exercises

Eutrophication exercise



Create Eutrophication dashboard

Test your shareable dashboard here: <u>http://www.csgnetwork.com/htmlcodetest.html</u>

Products			
My Dashboards	Background The problem of eutrophication on the Egyptian Mediterranean coast is mainly due to large amounts of wastewater discharged by land-based effluents from the Nile River, agriculture and sewage water directly or	o2 Latitude: 31.57268555072041, Longitude: 30.697174072265632	
- New Cashoonu	indirectly linked to the Mediterranean coastal region via coastal lakes.	234.814158	17.045947 253.331990
) Time series Data	The coastal area of Egypt on the Mediterranean sea extends for about 1,200 km. It hosts a function of important residential and economic centres like the cites of Alexandria, Port Said, Damietta, Rosetta, Matruh, and Al-Arish. The coastal strip between Alexandria and Matruh hosts tens of tourist villages, which are usually crowded by visitors during summer. Many activities are known in the coastal area, including fishing, industria, tourism, trading and agricultural, oil and gas production, and transportation. There are five large ecologically different coastal lagoons connected to the sea coast, representing together about 25% of the total area of the Mediterranean wetland. These lagoons are considered as reservoirs for agricultural, industrial, and municipal wastes, which are discharged from surrounding cities and cultivated lands. The Egyptian Mediterranean coast receives huge volumes of wastewaters every year through the coastal alagoons and from other land-based effluents. These wastes are loaded by variable amounts and types of pollutants, in addition to great amount of nitrogenous and phosphorous compounds, which in turn cause high level of eutrophication along a significant part of the Mediterranean coast, particularly of both the NIIe Delta region and Alexandria coast. Eutrophication is an importunate problem to the Egyptian Mediterranean coast, resulting in fundamental changes in the structure of the planktonic and benthic communities as well as fish mortality. Eutrophication was accompanied by the appearance of several hamful algal species at several hot spots along the coast. The level of eutrophication demonstrated wide variation along the Egyptian coast relative to the variations in the volume and contents of discharged wastes.	200 200 200 200 200 200 200 200 200 200	
	Read this paper	Oxygen map 33/00/00740	
	To place an image use this code and replacethe image address:		
	<img alt="Eutrophication" height="333" src="https://www.medqsr.org/sites/default/files/styles/wide_full/public/2017-12/114%20-
%20Chlorophyll%20concentration-01.png?itok=t5W7na-t" width="600"/>		
	Image	131 00700710	262
	Chiorophyll a concentration pattern		27 29 29 29 20 20 20 20 20 20 20 20 20 20 20 20 20

Eutrophication exercise



 Export TRIX as csv and plot in Excel

https://marinomica.com/

 Export chlorophyll-a as netcdf and post-process in Jupyter notebook:

https://mybinder.org/v2/gh/lorincmesza ros/chl_analysis.git/main

💭 Jupyter	simple_chlorophyll_analysis_Egypt (autosaved)	Visit repo Copy Binder link
File Edit	View Insert Cell Kernel Widgets Help	No kernel Trusted Python 3
+ % (A ↓ ► Run ■ C ► Code ↓ □ ▲ Download ▲ ▲ O GitHub & Binder	Memory: 275.8 MB / 2 GB
In [1]:	# _*- coding: utf-8 -*-	
	ODYSSEA Egypt Workshop 2021	
	@author: Lorinc Meszaros (Deltares) """	
	# #Import packages	
	from netCDF4 import Dataset	
	import os	
	import cartopy.crs as ccrs	
	<pre>import cartopy.teature as creature from cartopy.mpl.gridliner import LONGITUDE_FORMATTER, LATITUDE_FORMATTER</pre>	
	import cartopy.io.img_tiles as cimgt import matplotlib	
	<pre>import matplotlib.pyplot as plt import numpy.ma as ma</pre>	
	import warnings	
In [2]:	<pre>#Dataset path nc.nath.chll = os.nath.absnath('sv83-med-ogs-nft-rean-m_1613583524278_nc');</pre>	
	#Detect	
	<pre>#Ducuset dataset_chl1 = Dataset(nc_path_chl1) #chl</pre>	
In [3]:	#Interrogate netCDF file	
	warnings.filterwarnings('ignore') print (dataset chl1.file format)	
	<pre>print (dataset_chl1.dimensions.keys()) #dimensions print (dataset_chl1.dimensions['time'])</pre>	
	print (dataset_chl1.variables.keys()) #variables	
	print (dataset_chll.Variables[time]) print (dataset_chll.Conventions) # Get conventions attribute	
	<pre>attr=dataset_chl1.ncattrs() #find all NetCDF global attributes</pre>	
	<pre>print (attr, '=', getattr(dataset_chl1, attr))</pre>	
	NETCDF3_CLASSIC	
	<pre>dict_keys(['time', 'depth', 'latitude', 'longitude']) <class 'netcde4,="" dimension'="" netcde4,="">: name = 'time', size = 240</class></pre>	
	<pre>dict_keys(['depth', 'chl', 'latitude', 'time', 'longitude']) cclass 'metCDE4 /metCDE4 Variable')</pre>	
	float64 time(time)	

Questions





https://www.menti.com/sd684hwgtx



Go to www.menti.com and use the code 1357 1644

🔰 Mentimeter

Plaftorm feedback and interest in Water Quality Services

PLATFORM VALIDATION AND CAPACITY DEVELOPMENT WORKSHOP



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