

ABSTRACT

The Sustainable Development Goal (SDG) 14 “Oceans”, targets at the stability and sustainability of marine ecosystems and their resources. Its first target 14.1.1 currently is composed of two sub-indicators: Index of Coastal Eutrophication (ICEP) and concentration of floating plastic debris. According to the Oslo-Paris Convention (OSPAR), “eutrophication means the enrichment of water by nutrients causing an accelerated growth of algae and higher forms of plant life”.

In this study a novel automated methodology is showcased for the calculation of the ICEP in the regions of Iberia-Biscay-Ireland Seas and the provision of trend-based geo-analytics through a cloud application platform. The methodology exploits Copernicus Marine Environment Monitoring Service (CMEMS) products to calculate a weighted ICEP that segments the Contiguous Economic Zones of the countries included in the region into different eutrophic categories.

STUDY AREA AND DATASETS

The area of interest is the Contiguous Economic Zones buffer (24 nautical miles from the coastline) regions over the included in the “Atlantic-Iberian Biscay Irish Ocean Biogeochemical Analysis and Forecast” CMEMS product, which is the Iberia, Biscay and Ireland Regional Seas

CMEMS product identifier		IBI_ANALYSIS_FORECAST_BIO_005_004
Spatial	Coverage	Lat: -19°, 5°, Lon: 26°, 56°
	Resolution	3 km
Temporal	Coverage	01/01/2016 - +7 days forecast
	Resolution	Daily, Monthly

WATER AREA CLASSIFICATION

The first step of the methodology contains the normalization of all the products to the parameters used in the algorithm. The used CMEMS products are the: chlorophyll-a concentration, nutrients concentration (phosphate, nitrates and silica) and euphotic zone. The latter is converted into Secchi Depth, a measure of water transparency. Afterwards each parameter is classified into the four categories: non-problem areas, low potential problem areas, high potential problem areas and problem areas.

Corresponding studies show that if Silica is present in excess than Nitrates and Phosphate concentrations, this characterizes the absence of eutrophication. As for the classification of chlorophyll's concentration and SD, based on several studies, the adopted thresholds are showed in the table on the left.

Eutrophication Level	Chl-a [mg/m3]	SD [m]
0	< 2.2	> 6
1	2.2-3.2	3-6
2	> 3.2	< 3

ICEP CALCULATION

Having as input the above four classes and the contiguous zones' borders, the algorithm calculates a monthly mean, which can be converted into area estimation in km².

The final step is the ICEP calculation addressed to each country. The suggested ICEP ranges between 0-100, which can be translated as “0 no evidence of eutrophication” and “100 high eutrophication layer” respectively.

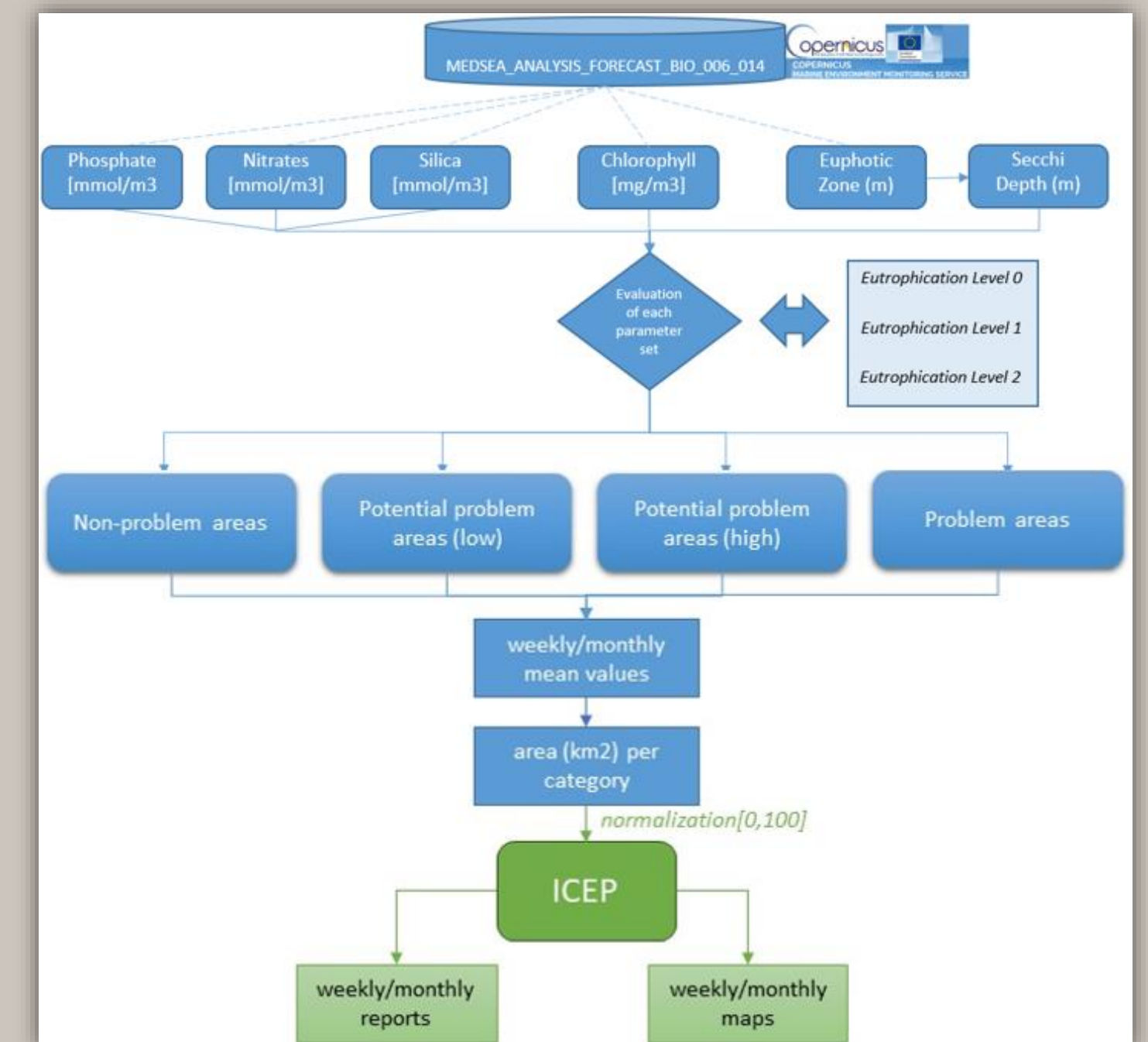
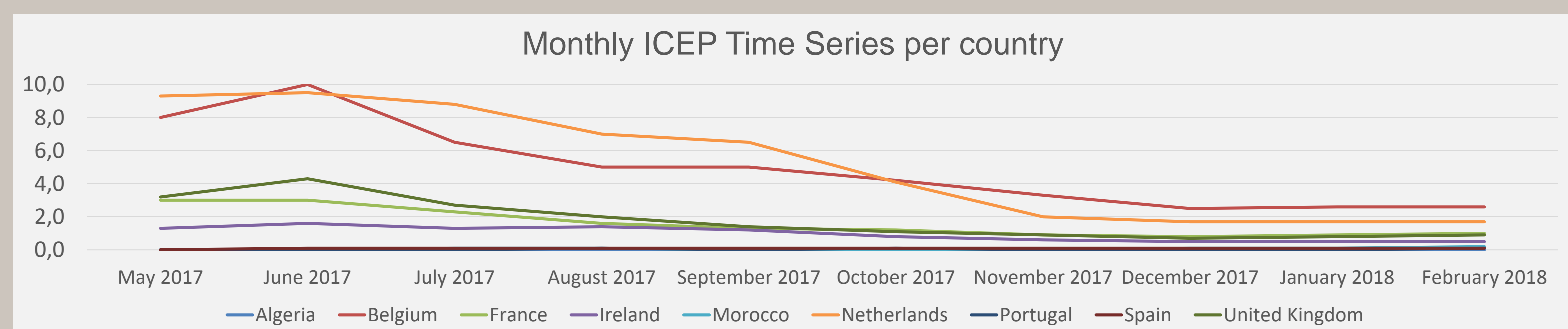


Figure 1 – Water classification and ICEP calculation workflow

CLASSIFICATION RESULTS



Figure 2 – Monthly means variations of the proposed ICEP over the study area.



The algorithm's result consists of maps, showing the spatial distribution of the eutrophic and potentially eutrophic areas extracted from the classification algorithm and statistics for the predefined period of a specific country.

LONG TIME SERIES ANALYSIS



The use of cloud technologies allows to change the paradigm of processing large quantities of EO data. In this methodology, CREODIAS functionalities are exploited to access long time series of CMEMS data with no need of local downloading, to implement the algorithm and the required processes for the calculation of the innovative ICEP proposed and to host Hexagon Smart M.App. With Hexagon Smart M.App, the generated ICEP is integrated into a smart geo-analytics web application. On-the-fly visualization of the ICEP is performed, with its illustration as time-series for a selected country and the classification results of the corresponding water region.

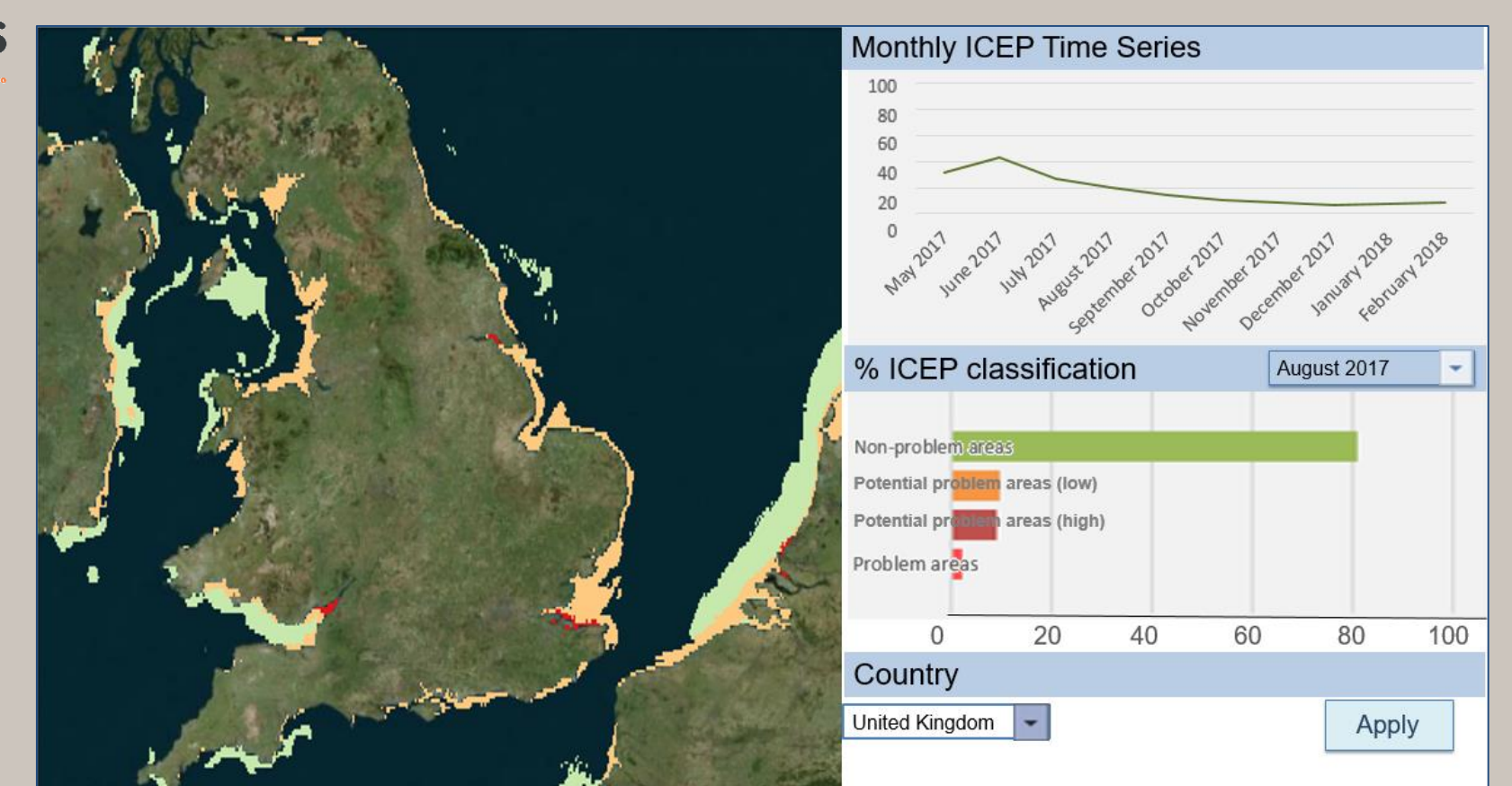


Figure 3 – Smart M.App preview of the ICEP SDG 14.1.1 sub-indicator over the UK Contiguous Zone (map & geo-statistics)



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