An open surface Water Quality Emergency Monitoring Service (WQeMS) for the water utilities' industry leveraging on the Copernicus products and services. Target is an optimized use of resources by gaining access to frequently acquired, wide covering and locally accurate water-status information.

Newsletter V

Copernicus Services Evolution

Ioannis Manakos, project coordinator
(on behalf of the consortium)

This project has received funding from the European Union's Horizon 2020
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Contents

Highlight:

4 October 2022: The 2nd International Stakeholder Workshop (ISW) was held by means of teleconferencing with participants originating from numerous countries and representing various target audiences. The main purpose of the ISW was to illustrate WQeMS project from both the technical point of view and discuss its benefits from the user perspective.

16 December 2022: A Practical School with WQeMS for Professionals was held aiming to provide a guided hands-on tour for the demonstration of the Water Quality Emergency Monitoring Service (WQeMS) Platform with 33 participants. Following its success a second one took place on the 2nd February 2023.

Editorial

Dear Reader,

we kindly welcome you to get acquainted with a Copernicus Service Evolution project within the Research and Innovation Action program of the H2020 framework. Being part of the cluster of projects for Space Research by the European Commission our working team is honoured to inform you about the Copernicus Assisted Lake Water Quality Emergency Monitoring Service (WQeMS).

In this issue, you may enjoy a demonstration of the Water Quality Emergency Monitoring Service (WQeMS) Platform.

Follow us at our social media accounts and visit our website for more information: https://wqems.eu/.

Let us know what you think about our service elements and our platform.

Ioannis Manakos

Project Coordinator

Principal Researcher @ CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

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WQeMS Platform

The WQeMS Platform (Figure 1) provides an operational Water Quality Emergency Monitoring Service to the water utilities industry in relation with the quality of the "water we drink". Exploiting Sentinel data, it provides quality monitoring of open surface water reservoirs (e.g. lakes) valorized for the delivery of drinking water at a fine spatial resolution, following validated processes with in situ data. It focuses on slow and fast developing phenomena by offering Continuous Monitoring for a specified area; Alert Notifications in case some water quality parameter thresholds values are exceeded, and in case water related issues are detected through social media; and On-demand Mapping with one-off geospatial maps of a selected area at a requested date.

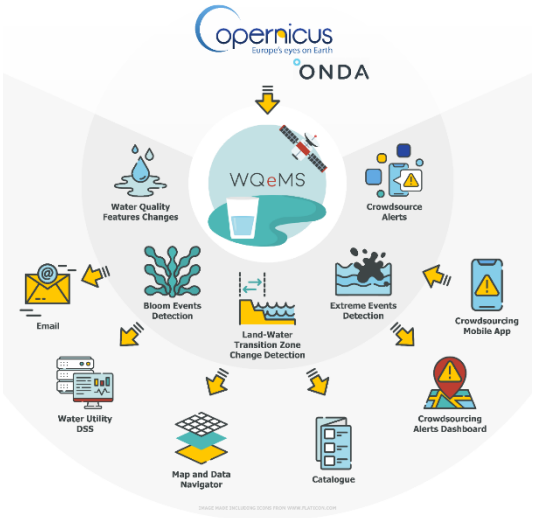

Figure 1. WQeMS supported by Copernicus and ONDA DIAS, providing services (first circle) and products (second circle) to the users.

Thanks to the contribution of all the partners of WQeMS consortium, the WQeMS Platform is now operational (Figure 2). In this volume we are presenting an overview of the platform, with a description of all the main functionalities implemented.

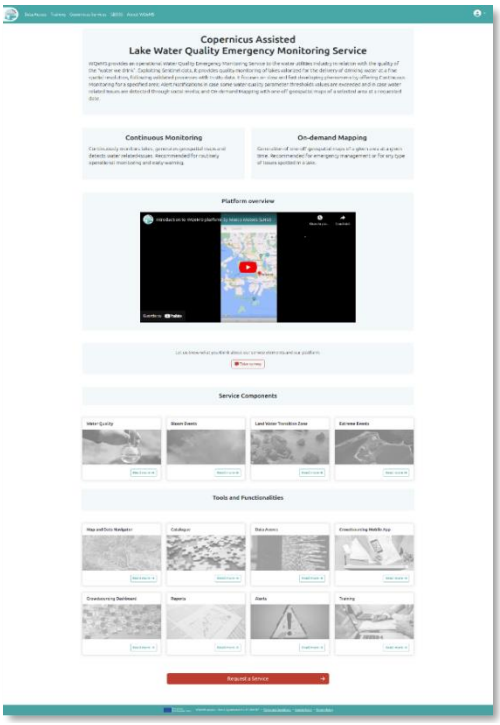

Figure 2. WQeMS platform entry page interface.

Web Portal

The main access point to the platform for the user is the Web Portal. Each of the services, functionalities and tools are described in a dedicated page, which is reachable by clicking on the related cards on the homepage.

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Discover

The **Catalogue** is a web application that enables users to search and visualize the data products generated in the platform, by providing an open view of the metadata referred to data products (i.e., geospatial maps) per monitored water body and service (Figure 3). Upon accessing the

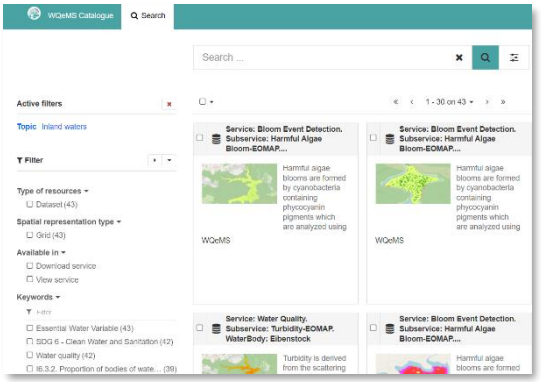

Figure 3. Snapshot of the WQeMS Catalogue page.

catalogue, the user is able to view WQeMS resources (i.e., products' description and metadata related to the different monitored open surface water bodies) grouped by themes and categories. The Catalogue is useful to understand the kind of information the WQeMS platform can generate and access to data products.

Visualize/ download

The **Map and Data Navigator**, based on the MiraMon Map Browser software, allows users to navigate on a world map, and visualize data products generated by the platform, through a web browser (Figure 4). The MiraMon Map Browser is a long-term developing effort to create a visualization, analysis and download tool based only on HTML5 and JavaScript. It applies Open Geospatial Consortium service protocols to connect to web services and show the information to the user. The JavaScript client is able to combine AJAX, binary arrays, and the WMS/WMTS protocol. In the case of remote sensing data, the information is structured in coverages, that is digital geospatial information representing spatially varying phenomena. In the WQeMS this has been updated to the direct reading and visualization of real tiff images by using Cloud Optimized GeoTIFF (COG). The browser is the direct responsible to create the visualization on-the-fly, based on the raw data generated by the platform, allowing the WQeMS user to change visualization properties, perform analysis, statistics, or build time series directly in the client side.

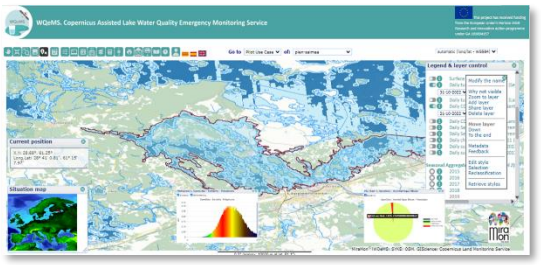

Figure 4. Snapshot of the WQeMS Map and Data Navigator.

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Through the adoption of the OGC Geospatial User Feedback standard, the tool also allows to provide comments, ratings, questions, etc. about specific data layers, addressed to the public or to the data providers (Figure 5).

Figure 5. WQeMS feedback provision page.

Generated geospatial maps and related metadata (TIF and XML files) are also exposed through a **Web File Server**, which enables registered users to search, navigate and download the files, organized hierarchically in directories for each of the four main service components of the platform (Figure 6).

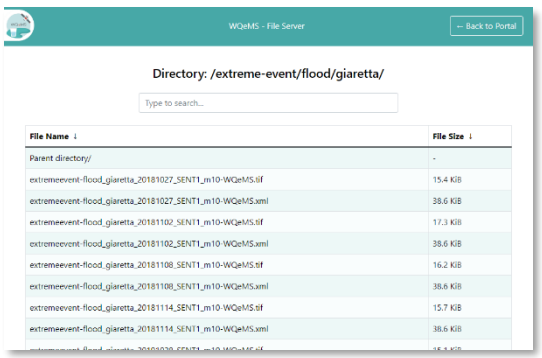

Figure 6. WQeMS File Server.

To increase the interoperability capabilities of the platform, an **FTPS directory** is implemented, providing access to the generated data. The structure of the remote directory is the same as for the Web File Server (Figure 7).

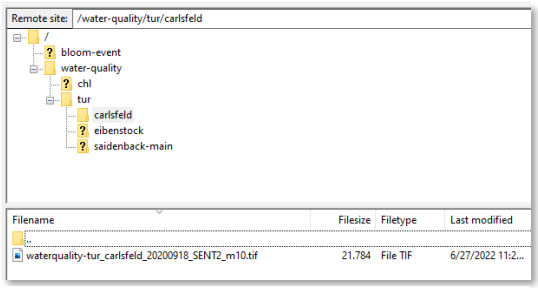

Figure 7. WQeMS FTPS directory.

Crowdsourcing

The platform is able to listen and collect data from the crowd, leveraging also the human factor for the detection of water-related issue.

The **Crowdsourcing Mobile App** is an Android application that offers citizens an intuitive way to report water-related issues by filling a simple form with the description and the location of the water issue and possibly attach/take an associated photo (Figure 8). Instead of a possibly lengthy conversation on the phone, the water operator will instantly have the complete necessary details as posted via the app. Thus, the water company will save human resources (operators

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that have to answer the calls) and, at the same time, improve its outreach, since it will facilitate water consumers to submit their reports/complaints.

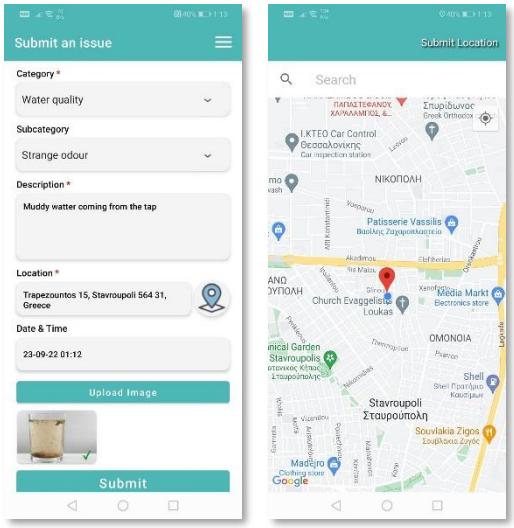

Figure 8. WQeMS Crowdsourcing Mobile App snapshots.

Complaints are stored by the **Alerting module**, which collects crowdsourcing data also from Twitter, by utilizing the **Social Media Crawler**, and from the citizen observation database CitObs of the Finnish Environment Agency, SYKE, through a dedicated API parser. All this data is elaborated for the identification of potential water issues and alerts are generated and notified to the water utility operators.

The Alerting module comes along with the **Crowdsourcing Dashboard**, a friendly Web interface that visualizes the alerts from the Alerting Module on a map and offers filtering capabilities (Figure 9). The user decides to visualize or not alerts from Twitter, the Crowdsourcing Mobile App, and CitObs by toggling the switches on the Graphical User Interface. Additionally, the user can specify the timeframe to visualize alerts. Also, the user can visualize alerts based on the Event type and the Tweet Language.

Figure 9. WQeMS Crowdsourcing Dashboard.

Alerts

Users can receive alerts based on i) statistical values sent by processing chains modules, obtained by the analysis of the produced raster files (e.g., when the mean turbidity of a water body exceeds a predefined value of Nephelometric Turbidity Units), and ii) crowdsourcing notification generated by the Crowdsourcing Alerting module. In order to activate the alerts for a specific area of interest (AOI) and features, the user can access the alert configuration page and complete the dedicated form (Figure 10). When the phenomena is detected,

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alerts are sent to the user-specified email address or to an external system owned by the user, through a push API notification (Figure 11).

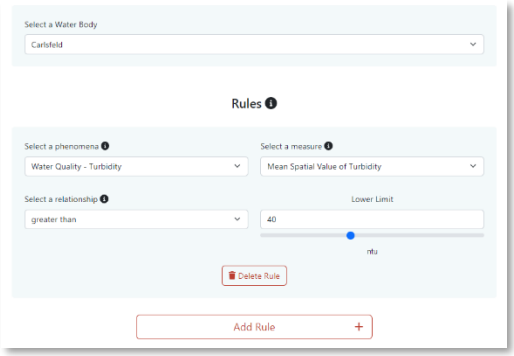

Figure 10. Alert configuration page.

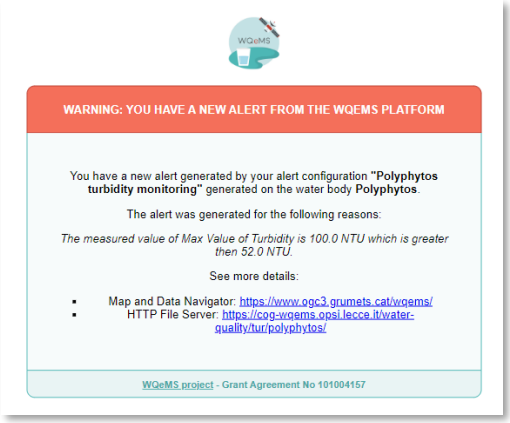

Figure 11. Warning note for the identified alert (sent per e-mail).

Generate Reports

The platform enables users to generate PDF reports, sent by email, containing aggregated statistical data about one or more features and services applied on an AOI during a specific time interval. The report generated by this component is structured in several sections: i) an introductory sentence summarizing the water body and the period specified by the user when requesting the report; ii) tables, in which each row is a statistical measure related to the service components aggregated over the specified period; iii) time-series graphs that show the trend of each measure during the period specified by the user (Figure 12).

Figure 12. WQeMS Report snapshots.

Request Services

The Web Portal enables a registered and authenticated user to indicate one or more open surface water reservoirs (OSWR) to be monitored, choosing to activate one or more services. For each

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service the user can specify up to two monitoring methods, which are the ON-DEMAND and the CONTINUOUS, adopting an approach similar to the one provided by the Copernicus Emergency Management Service (i.e., On demand mapping and Early warning & monitoring) (Figure 13).

The CONTINUOUS mode continuously monitors OSWR, generates geospatial maps each day and detects water related-issues, recommended for routinely operational monitoring and early-warning. On the other hand, the ON-DEMAND mode is about the generation of one-off geospatial maps of a given area at a given time, recommended for emergency management or for any type of issues spotted in an OWSR.

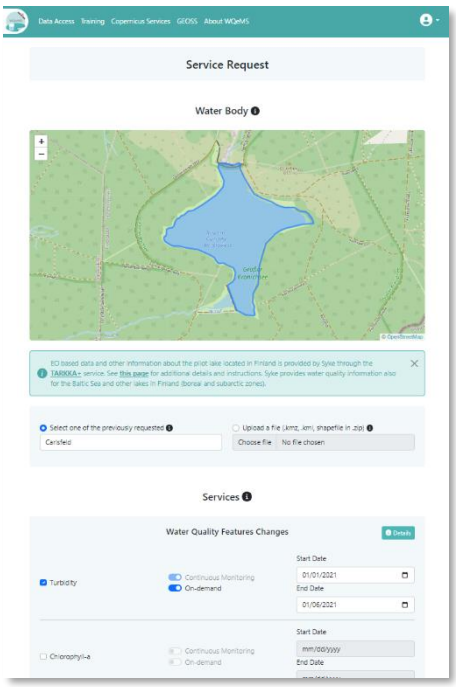

Figure 13. WQeMS Service request page sample.

Integration with DSSs

A set of mechanisms have been implemented to integrate WQeMS functionalities into existing Decision Support Systems (DSS) in use by water utilities. The platform provides APIs for service execution requests; alerts configuration and retrieval; request reports generation; data product and associated statistics gathering. Moreover, to be compliant with legacy systems, the platform provides OGC Web Services endpoints (e.g., WMS/WCS), which enable to access data using popular, well-established standards.

What's next

In the last month of the project, the effort will focus to integrate the platform with pilot use cases' systems and validate the functionalities and services realized with stakeholders. These last steps will provide breeding ground for the fine-tuning of the platform and its proposition as an effective Copernicus evolution service for the monitoring of water quality in OSWRs used for drinking water production.

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Participation in Conferences:

1. WQeMS was an invited guest in SnapEarth's Final Conference on November 28, 2022, with an oral presentation given by Philipp Bauer from EOMAP. The presentation with the topic: "Observing potentially harmful algal blooms on waterbodies from space" is well received by the audience, who placed a series of questions.

2. WQeMS is invited by the Copernicus Support team and represented by Marco Matera from ENG at the Copernicus Academy Monthly Videoconference on December 7, 2022. WQeMS presented "The WQeMS project, a Copernicus assisted monitoring platform for the water we drink" and demonstrated the functionality of the WQeMS service platform in detail.

3. WQeMS colleagues, Ioannis Manakos from CERTH and Ivette Serral from CREAF, participated in EuroGEO workshop 2022 with the following outreach activities:

- Participation in the Ecosystems and Biodiversity Action Group, presenting project results with the title: "Copernicus assisted mapping for seasonal inundation monitoring". The discussion took place as a parallel session of the EuroGEO workshop on 7th December for the community to coordinate and shape collaborations

Figure 14. WQeMS participation in the Ecosystems and Biodiversity Action Group.

- Two (2) posters were presented on December 8 during the poster exhibition. The first poster provided an overview of the project: "A Copernicus evolution service component towards monitoring of the open surface water reservoirs for the production of the Water We Drink" and the second poster focused on the products: "Closing the gap in Water Quality datasets for Copernicus Services. The WQeMS solution for harmonized and FAIR product" (Figures 15, 16).

Figure 15. Ivette Serral in front of the poster.

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Figure 16. Discussion in front of the posters.

- One (1) oral presentation was given on December 8 during the parallel session: Pathways to sustainable development through use cases in the Athens metropolis. Presentation topic was "WQeMS: a Copernicus assisted monitoring platform for the water we drink in Athens" (Figure 17).

Figure 17. WQeMS towards the colleagues in Athens.

- An oral contribution and a poster presentation from EYDAP, partner of the Monocle project, showcased the synergy between WQeMS and Monocle projects. The oral contribution in the session revolved around the topic: "Unmanned Vehicles as a complementary tool for water quality of Reservoirs", given by Sachinis Georgios & Giorgos Katsouras (EYDAP), in the same session and back-to-back with WQeMS's oral contribution (Figure 18). The poster presentation provided further details on the topic focusing on Lake Marathon.

Figure 18. Giorgos Katsouras showcasing results of the in situ campaign.

The synergy with the Monocle project for the Marathon Lake was discussed between partners in front of the poster (Figure 19).

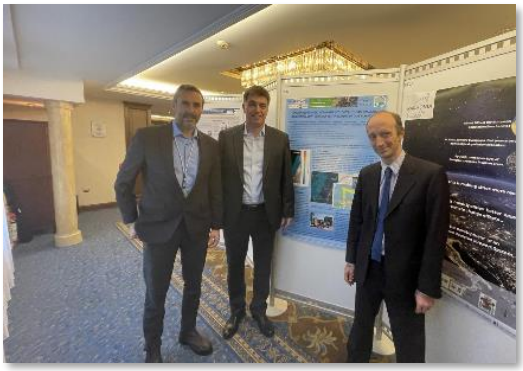

Figure 19. Sachinis Georgios & Giorgos Katsouras (EYDAP – project Monocle {on the right and left}) and Ioannis Manakos (CERTH – project WQeMS {in the centre}) discussed the aspects of the achieved synergies on site.

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