



PROGRAMME OF THE
EUROPEAN UNION



COPERNICUS4REGIONS 2025

WATER QUALITY INFORMATION FOR URBAN AREAS FROM SPACE

Kerstin Stelzer, Pia Laue, Werner Blohm, Maren Jarosch

Brockmann Consult GmbH | Institut für Hygiene und Umwelt der Stadt Hamburg |
Behörde für Umwelt, Klima, Energie und Agrarwirtschaft (BUKEA) Hamburg | Germany

“

Satellite data help us to detect algal blooms at our bathing water sites and in our decision of taking additional samples and declaring a bathing prohibition.

Maren Jarosch

BUKEA, Bathing Water Monitoring

”

✓ Hamburg Harbour | Canva

Water quality information derived from satellite data helps to understand spatial and temporal patterns in inland water bodies such as lakes, reservoirs and rivers. Monitoring these water bodies is needed to achieve a good ecological status and to support people's health and well-being.

THE CHALLENGE

Water in cities is crucial for drinking water supply, recreation and industry. Therefore, comprehensive water quality monitoring is essential for public health and environmental protection. Across Europe, keeping waters in good condition is also a shared legal obligation under the EU Water Framework Directive. Existing monitoring programmes allow for spot monitoring of water quality. A good example is the water quality monitoring network operated by the Institute for Hygiene and Environment in Hamburg, Germany. Its stations at the city's main surface waters continuously measure water quality parameters. The obligation to maintain good water quality extends beyond drinking water sources. It also includes recreational waters such as bathing lakes. The parameters measured include the detection of cyanobacteria, which can be potentially toxic to humans and animals such as dogs. Exposure can cause various health problems, from skin irritation to severe symptoms such as liver damage.

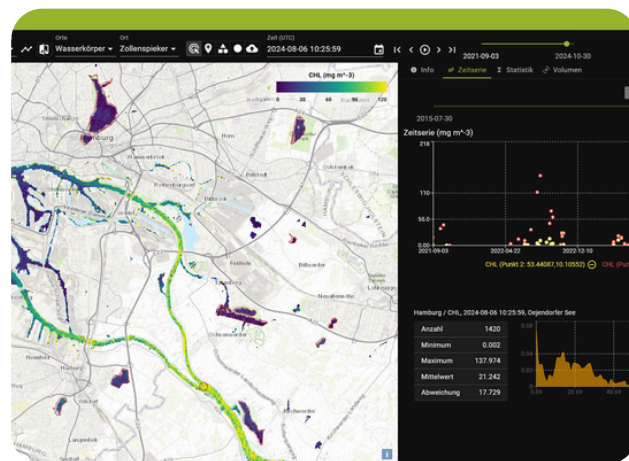
THE SPACE SOLUTIONS

Satellite data provide spatial information on water quality in water bodies. This information shows the distribution of e.g. algal blooms or plumes of river inflows.

Key parameters for water quality assessment from satellite data include turbidity, suspended matter, chlorophyll-a concentration, harmful algal bloom detection and trophic state classification. The data need dedicated processing, including atmospheric correction, cloud detection and retrieval of the water quality parameters; only constituents that change the water colour are visible to optical sensors.

The processing chains run operationally on cloud systems. Within our CyanoAlert® service, data products are delivered daily through an online viewer, so users can easily assess the current water quality situation. These updates let the authorities act on the latest conditions, for example, when deciding on additional in-situ sampling or temporary bathing restrictions.

In addition to spatial information, alerts are sent to the authorities in the case of unexpected events such as severe algal blooms. The service was developed in the EU project CyanoAlert, specialised to urban waters in City Water Watch (CIWAWA) and extended in BIGFE (both co-funded by the German Space Agency).



- ✓ **CyanoAlert online Viewer for easy access to the satellite-based information and the assessment of the environmental situation |** The map shows the chlorophyll concentration for the 06.08.2025 and the time series the chlorophyll concentration for the past 3 years.

THEMATIC AREA



Climate, Water and Energy

REGION OF APPLICATION



City of Hamburg

SENTINEL MISSION USED



S2, S3

COPERNICUS SERVICE USED



CCM

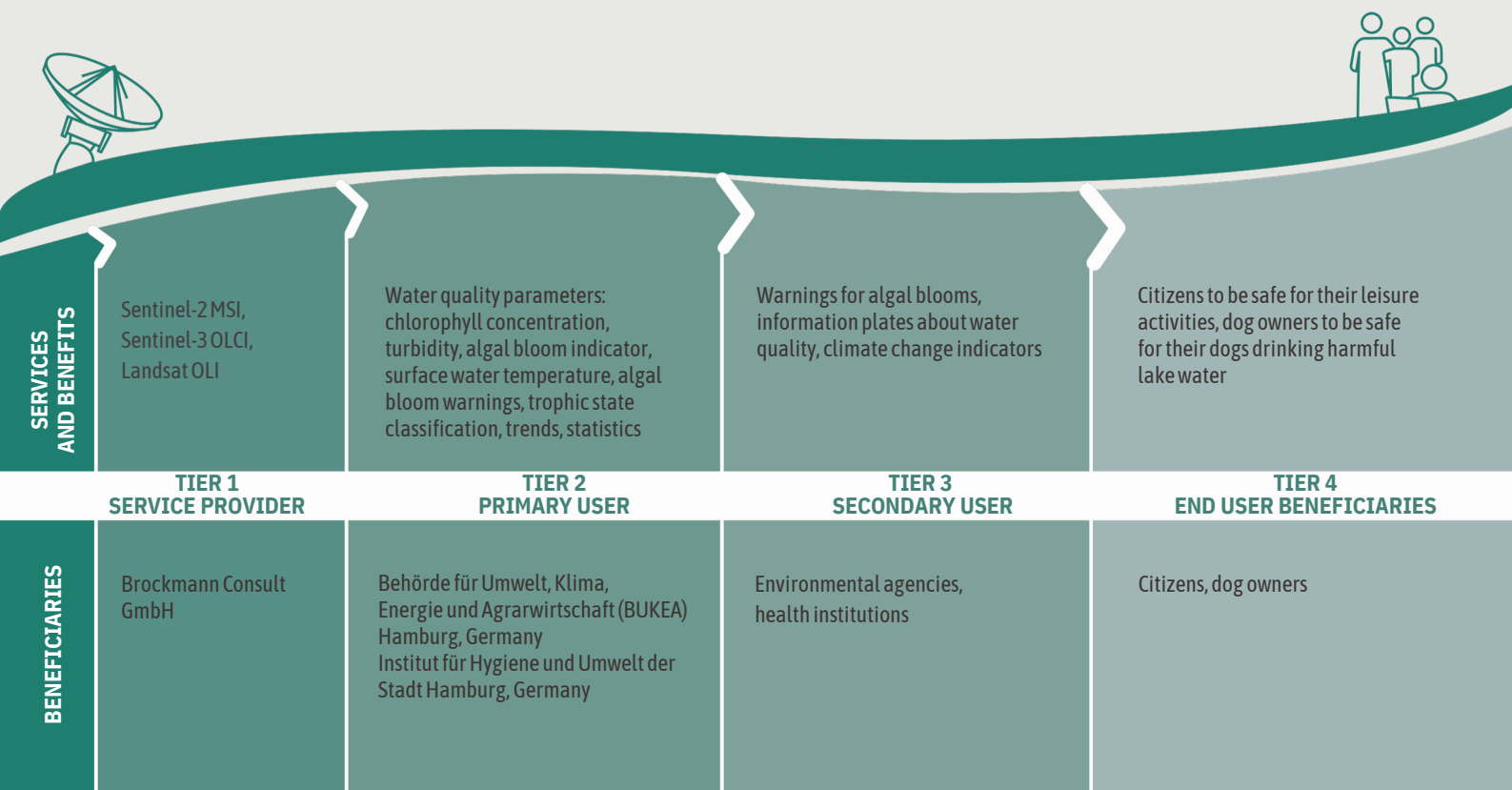
THE BENEFITS AND THE BENEFICIARIES

Satellite-derived water quality products have become a well-received tool for complementing on-site monitoring programmes by addressing spatial and temporal data gaps. The products can reach stakeholders within a day of acquisition, giving timely insight into environmental conditions. However, they are only available in cloud-free conditions.

One important application of this technology is the detection of exceptional and potentially harmful algal blooms (HABs). When a satellite-based warning flags a potential toxic bloom, it triggers the in-situ water sampling procedure as soon as the threat is detected. This lets the authorities react quickly, warn the public and, where necessary, close the affected bathing areas.

The satellite-derived monitoring services provide valuable insights into the ecological status, dynamics and trends of inland waters. These services help stakeholders understand environmental conditions by providing the missing link of spatial distribution of algae blooms and enabling comparison of water quality trends between different years. The satellite products can be used to support the reporting e.g. for the EU Water Framework Directive.

Different interfaces between information and users are provided to serve the requirements of different stakeholders. Some users require programmatic interaction, while others need information in the form of interactive maps and diagrams.



EU POLICY / DIRECTIVE



EU Water Framework Directive

TYPE OF SERVICE PROVIDER



Commercial Service

TYPE OF FUNDING SOURCE



EU Research Programme, National Space Programmes,
National or regional non-space Programme

USAGE MATURITY LEVEL



5



A FUTURE WITH COPERNICUS

Yes! Copernicus missions are already being utilised to support bathing water and environmental monitoring through water quality services. In the future, Copernicus is expected to continue supporting it with enhanced capabilities and opportunities. These services aim to maximise the value of their spatial and temporal resolution, supporting a fuller understanding of water quality and EU water legislation at national, regional and local levels. The continuity of the programme is essential for the sustainability of the services.



DID YOU KNOW?

Water quality products derived from satellite data are not limited to urban areas! The information can be retrieved for a wide range of water bodies, provided they are resolvable by the sensors onboard the satellites. This capability extends to lakes, reservoirs, and rivers as well as coastal areas and open ocean in many different spatial resolutions, telling us about water constituents.



Acknowledgements

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Contacts

Kerstin Stelzer | kerstin.stelzer@brockmann-consult.de

Pia Laue | pia.laue@brockmann-consult.de

Werner Blohm | werner.blohm@hu.de

Maren Jarosch | maren.jarosch@bukea.hamburg.de

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