

# Elbe Estuary case study

The Elbe River flows through the German Bight into the North Sea. This region is under pressure from significant human impacts, yet contains sensitive ecosystems like the Wadden Sea, the largest unbroken intertidal wetland system worldwide.

The Port of Hamburg, located 110km up the Elbe from the North Sea, is the third busiest port in Europe and fifteenth globally. In 2014, it handled 9.73 million TEUs (twenty-foot equivalent units), a standard container shipping measurement. All vessel traffic must transit through the German Bight and Elbe to reach Hamburg.

Balancing intensive port uses, coastal development, and ecosystem preservation in the heavily trafficked Elbe remains an ongoing challenge. Evidence-based management utilising timely and accurate data is essential to protect unique habitats like the UNESCO World Heritage Wadden Sea.

## CERTO in the Elbe

CERTO has advanced water quality monitoring in the Elbe Estuary by developing new indicators tailored to this highly dynamic environment. Stakeholder needs drove the development of an indicator for the maximum sediment zone location, which relates strongly to river runoff patterns.

A key CERTO achievement was enhancing optical water type models to better characterise the Elbe's highly dynamic, turbid waters and expansive intertidal flats. By integrating *in situ* measurements with satellite data interpretation, CERTO significantly improved monitoring of this complex estuarine environment.

CERTO provides new insights into the Elbe ecosystem, which faces pressures from intensive port traffic and coastal development. The advanced monitoring tools developed through CERTO's stakeholder-driven approach will help balance economic uses with preservation of fragile ecosystems like the Wadden Sea.

## Benefits

### For regulatory authorities:

- Access to statistical analysis and monitoring tools utilising novel ocean colour data
- Near real-time tracking of water quality indicators to inform policy decisions
- Improved monitoring in highly complex and dynamic environments
- High resolution satellite-based products and indicators reducing the need for *in situ* monitoring

### For local residents:

- Assurance of clean, safe water for recreation and livelihoods
- Access to information on water quality status
- Sustainable management for tourism and the local economy





## What is CERTO?

CERTO (Copernicus Evolution - Research for harmonised and Transitional water Observation) is an EU Horizon-2020 project that aims to improve water quality monitoring in support of EU directives. The project brings together industry, monitoring agencies, and scientists to develop innovative cross-cutting indicators that can be applied to coastal, transitional, and inland waters. By integrating *in situ* sampling, satellite data, and historical records, CERTO advances water quality data collection and interpretation across diverse aquatic environments.

## Advancing water quality monitoring

The CERTO project has advanced water quality monitoring through innovative use of water colour data from the Copernicus satellites. By categorising water types based on optical signatures, CERTO has significantly improved water quality assessment. This approach, currently being used across six European estuaries, has the potential to extend globally, creating a comprehensive network of water monitoring.

CERTO is progressing water quality monitoring by offering near-real-time and on-request data through its portal. It meets the immediate needs of researchers and stakeholders while enriching the pool of assessment tools with new indicators for more accurate and precise evaluations. CERTO contributes to scientific inquiry through shared insights in publications, continually informing and enhancing practices in water quality monitoring.



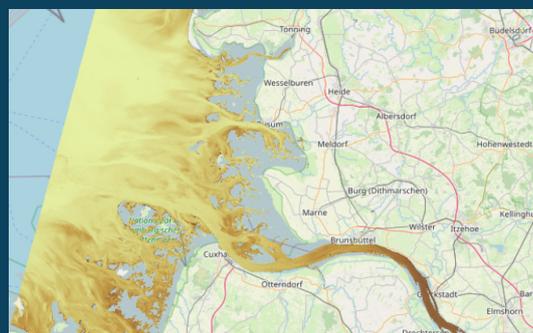
*Sentinel 2 satellite image of the Elbe Estuary.*

## The CERTO data portal

CERTO has created a prototype system, designed to integrate seamlessly with existing Copernicus services. This innovative system demonstrates the potential to enhance and expand Copernicus services and their broader impact.

CERTO data can be accessed through a dedicated data visualisation portal, providing up-to-date information and crucial insights into water quality. This offers near-real-time data in an easy to access format.

Whether you're conducting scholarly research, supporting environmental initiatives, or seeking knowledge about the state of local water systems, the portal is a valuable resource that enables active participation in water quality monitoring and conservation efforts.



*Suspended particulate matter in the Elbe Estuary from the CERTO data visualisation portal:  
<https://engage.certo-project.org/data/>*



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