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Using satellite data to monitor lakes and rivers – French Ministry of the Ecological Transition and Territorial Cohesion approach

Who needs water quality data and is therefore likely to use these tools and the Sentinel data behind them? And why?

Who?	Why?	Applications
• Central and local government departments • Public establishments of the State • Decision-makers • Managers of natural environments and river basins • Farmers • Operators of water bodies (energy, irrigation) • Prevention and emergency services • Research teams	• In situ monitoring generally takes place too infrequently to be able to qualify or detect at an early stage temporary deteriorations in water quality (algal blooms, temperature peaks) which can have a considerable impact on biodiversity or the maintenance of uses. • Managing conflicts of usemake projections for water resource management (anticipating droughts, for example) • Assessing the effectiveness of prevention, mitigation or use restriction measures when a deterioration in water quality is observed	• Monitoring, management and control services • Forecasting, warning and management systems • Implementation of public service missions (sanitary control of water intended for human consumption and bathing water, freshwater fishing and fish farming...) • Monitoring crops and vegetation health • Estimating biomass • Monitoring classified installations • Understanding interactions within territories and catchment areas

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Tools under development to meet these needs: example of the France 2030 Project Space for Hydrology

Several projects in France have looked at analysing water quality by satellite, but only in restricted areas or for highly targeted issues

--> Need for tools to cover the whole of France, including overseas territories, treating all territories in the same way to meet the main needs: launch of a large-scale project

Project Space for Hydrology from France2030 program
Since 2023, the Ministry coordinates a project in partnership with French Space Agency (CNES) using space observation data in line with this strategy of deploying decision support tools for management of water at the local level.
These services will be aimed at government departments and all local players involved in the issue.

The tools and services developed focus on the quantitative and qualitative management of surface water. The project is divided into blocks, one of which is specifically dedicated to ***water quality****.*

Others blocks are on quantitative assessment of water resources in lakes and reservoirs, irrigation at farm plot level and the identification of crop and intercrop plant cover

France 2030 Programm in brief : *The France 2030 plan supports emerging players and companies in developing operational services that meet political priorities while positioning themselves in high-growth markets. The products and services developed will mainly contribute to public service missions*

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Project Space for Hydrology: Monitoring the water quality of rivers and lakes

NEEDS

- To have regularly updated information to understand relative, temporal and spatial variations in water quality parameters
- To identify degraded areas and the causes of this degradation, characterize the impact of drought and severe low-water situations, define quality preservation strategies and assess their effect
- To validate data from satellite analysis using field measurements
- To have tools adapted to different user profiles and to become established over time

DATA

In mainland France and overseas departments, bodies of water >3ha and watercourses >30m wide:

- **Surface temperature** (estimated to 1st order from skin temperature),
- **Optical Water** Type OWT
- **Chlorophyll-a content**
- **Reflectance products** and any "water" masks associated with these different products,
- Qualification and quantification of the **uncertainties** associated with these variables for the various

USE OF SENTINEL SATELLITES

Examples of water processing chains:

The OBS2CO chain is designed to monitor several water quality variables at high spatial resolution: turbidity, suspended matter, chlorophyll-a concentration, etc. It uses state-of-the-art atmospheric correction algorithms [Harmel et al., 2018] and biochemical parameter inversion algorithms applied to **Sentinel-2** or Landsat images.

Surfwater is a water surface detection chain based on measurements from the **Sentinel-1 and 2** satellites

SISPPEO a Python package allowing one to extract synthetic information useful for Earth observation from satellite optical imagery (**Sentinel-2 and 3**, Landsat 8...) to treat water colour and quality parameters.

DECISION SUPPORT TOOLS

On-demand summaries of **temporal variations** for each of the variables

Analyses to quantify the impacts

Dashboards for **short-term management**

Weekly spatial **monitoring** of each of the variables

Production of **maps**, synthetic **indicators** that are updated and **detection of anomalies**.

We hope that these tools will lead to a greater number of stakeholders using satellite data, especially those who have not done so before