Water Level Monitoring: A Core Service to answer societal challenges

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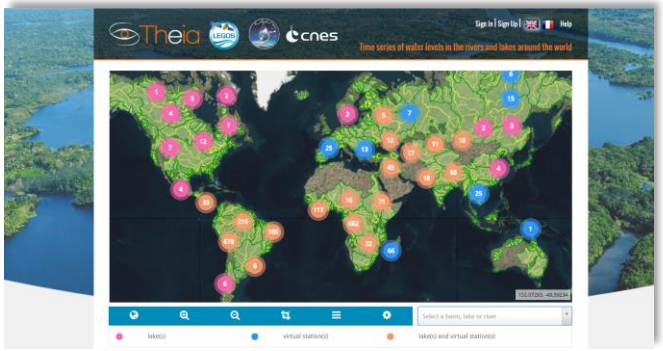
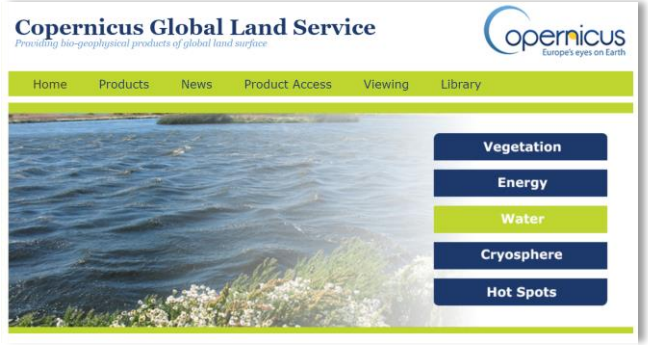


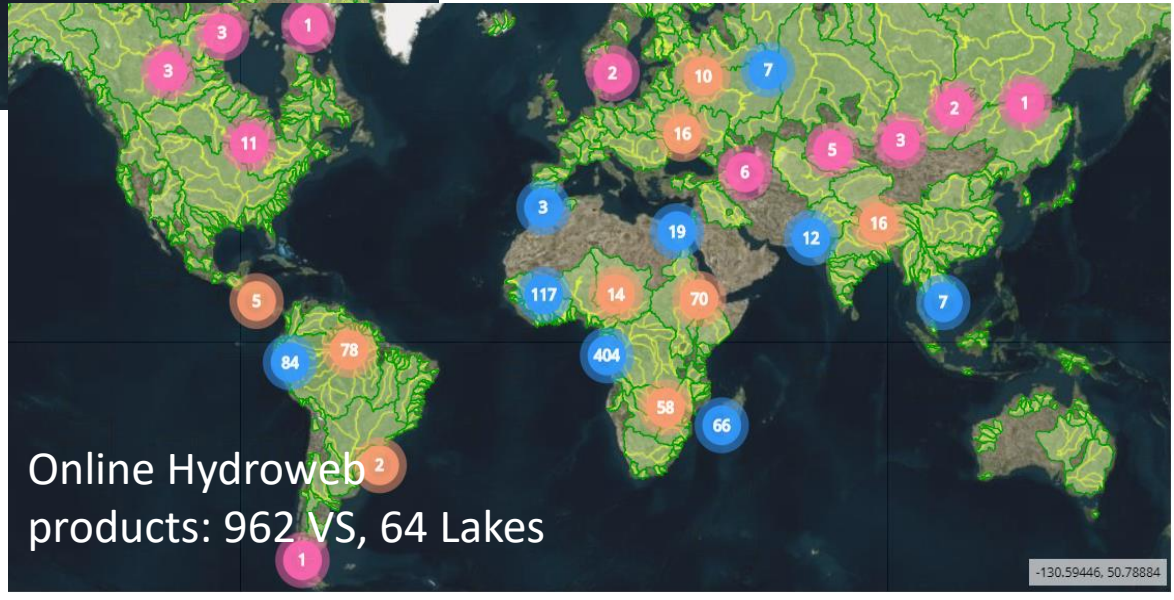
hydroweb.theia-land.fr



land.copernicus.eu/global

Soon in climate.copernicus.eu

Virtual Stations
Lakes
Both




Downstream Services
Water Governance
Estuaries
Risk Management
Health
Agriculture
Civil Engineering
Energy
Transportation
Aquatic Ecosystems
Drinking Water
Theia
Pôle Thématique Surfaces Continentales
Land Monitoring Service
Climate Change Service
climate.copernicus.eu

Water Governance
Facilitate the contributions of the different actors to integrated water resources management.

WISE

Water Notes on the Implementation of the Water Framework Directive

Water Note 1
Joining Forces for Europe's Shared Waters: Coordination in international river basin districts

Katz Castle (Germany) above the Rhine River
Photo: International Commission for the Protection of the Rhine - Dietmar Putscher, Cologne, Germany

The European Union is a land of shared waters. About 60% of the EU's surface area lies in river basins that cross at least one national border, and all Member States except Cyprus and Malta contain sections of at least one international river basin district (IRBD).

Under the Water Framework Directive, each Member State is responsible for implementation in the portion of an IRBD lying within its territory and should coordinate these actions wit the other Member States in the district.

Joint management of Europe's international rivers is not ne as a case study of the Danube shows (see page 4 Cooperation in the Rhine also has a long history. Howeve the Water Framework Directive has accelerated an deepened this process across the EU's 40 international riv basins.

The Water Framework Directive establishes a legal framework to protect and restore clean water across Europe and ensure its long-term, sustainable use. (Its official title is *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.*)

The directive establishes an innovative approach for water management based on river basins, the natural geographical and hydrological units and sets specific deadlines for Member States to protect aquatic ecosystems. The directive addresses inland surface waters, transitional waters, coastal waters and groundwater. It establishes several innovative principles for water management, including public participation in planning and the integration of economic approaches, including the recovery of the cost of water services.

In its Article 3, the directive calls for the creation of international districts for river basins that cover the territory of more than one Member State and for coordination of work in these districts.

WISE

Water Notes on the Implementation of the Water Framework Directive

Water Note 2
Cleaning up Europe's Waters: Identifying and assessing surface water bodies at risk

The Water Framework Directive sets the goal of achieving a "good status" for all of Europe's surface waters and groundwater by 2015. This is a major challenge, as recent assessments estimate that at least 40% of the EU's surface water bodies are at risk of not meeting the 2015 objective. (Many groundwater bodies are also at risk - these are discussed separately in water note no. 3.)

A surface water body is a section of a river, a lake, transitional waters or coastal waters. Transitional waters connect freshwaters such as rivers and marine waters: estuaries are one example.

Each surface water body has distinguishing features - in particular, its geology and the pollution and other pressures it faces - that set it apart from other sections of the same river, lake, transitional or coastal water. Member States identify separate water bodies at the scale needed to manage the objectives of the directive. The box on the following page describes how the various factors are used to identify separate surface water bodies.

River Brathay, Little Langdale, UK

Good status means low pollution levels and ecosystem health

The directive defines "good ecological and chemical status" in terms of low levels of chemical pollution as well as a healthy ecosystem. The second criterion - good ecological status - is an innovative step for EU water legislation. To achieve good ecological status, Member States will have to address the factors harming water eco-systems. Pollution is one, so are morphological changes such as dams built on rivers. The extraction of water for irrigation or industrial uses can also harm ecosystems if it reduces water levels in rivers or lakes below a critical point.

The directive sets separate, less stringent goals for artificial and heavily modified water bodies. Artificial water bodies include man-made lakes, such as mountain reservoirs. An example of a heavily modified water body is an estuary that has been transformed into a major industrial port. (see *Water note no. 6.*)

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Under Article 4(1) of the directive, Member States should aim to achieve good status in all bodies of surface water and groundwater by 2015.

Risk Management

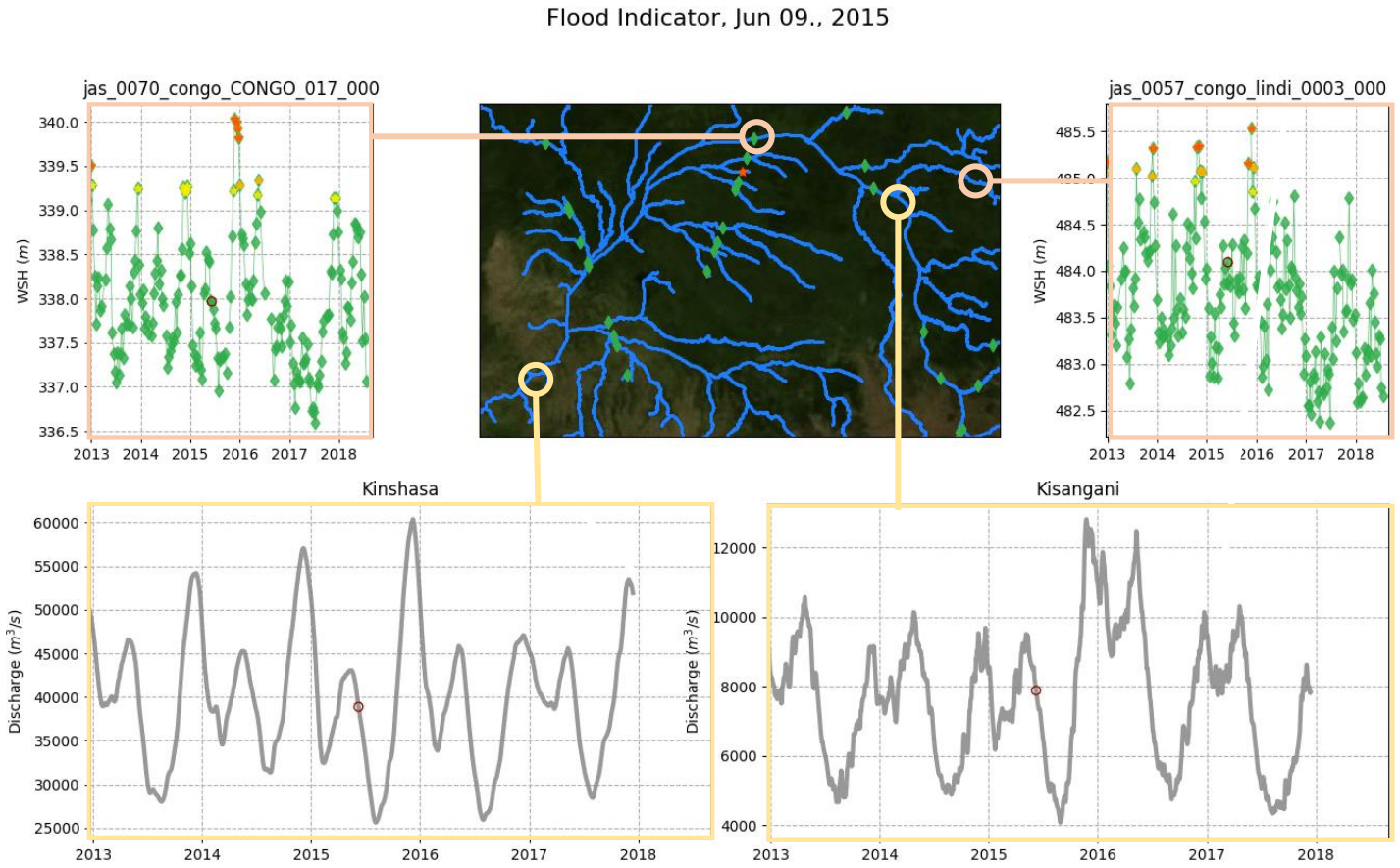
Flood risks prevention to:

- Increase security of exposed populations
- Decrease cost of flood-related potential damages
- Decrease the duration of the recovery process

279 rapid mapping activations for flood emergencies since 2012 in the Copernicus Emergency Management Service

→ Flood alert indicator derived from water surface height climatology (here a basic example). (Biancamaria et al., 2011), .(Hossain et al., 2014)

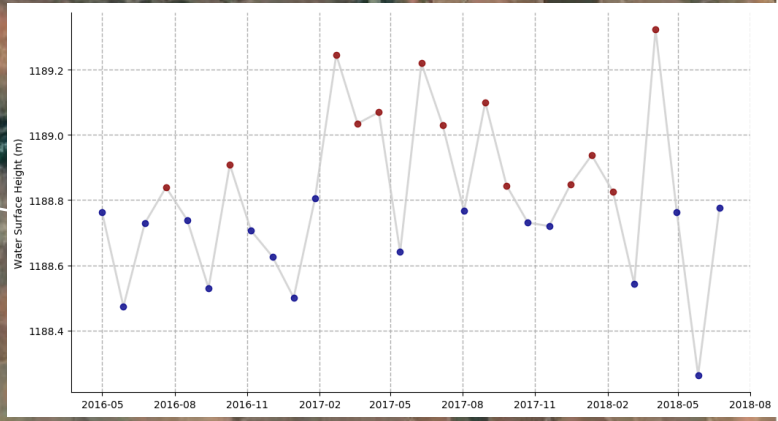
→ Assimilation in / validation of discharge models (Paris et al, *in prep*)

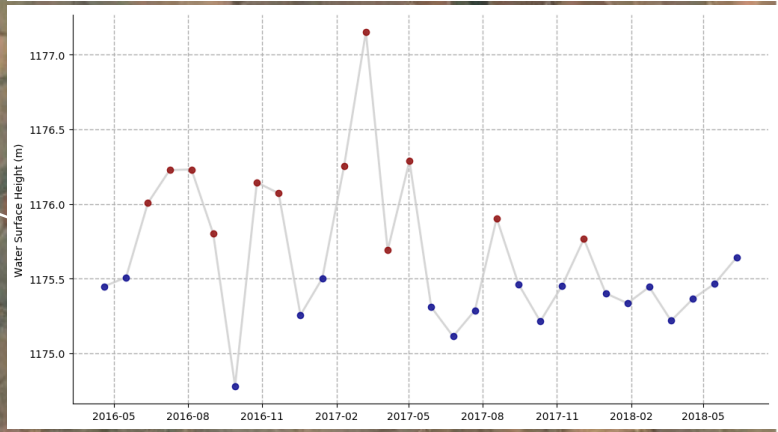


Agriculture

Development of irrigation/ drainages and mitigation of environmental impact.

Vaalharts dam





Water Surface Height derived from Sentinel-3a (operational product)

Use Case: Construction/Rehabilitation of Hydro-electricity sites

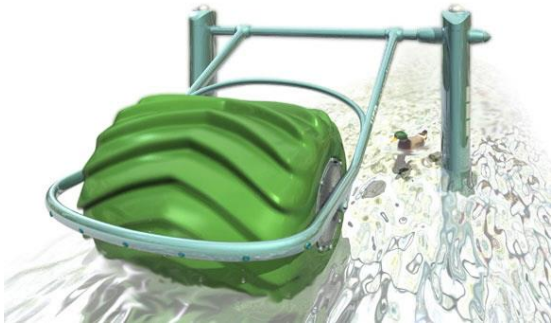
1. Knowledge of upstream/downstream water resources (Hydrologic models) → site's potential, dimensioning

2. Knowledge of the ecosystem to estimate environmental and societal impacts

3. Operational monitoring (optimisation, monitoring…)

Gibe III Hydropower Plant

Micro hydro-electricity



Source: hydroturbine.info

Use Case: Construction/Rehabilitation of a Hydropower plant

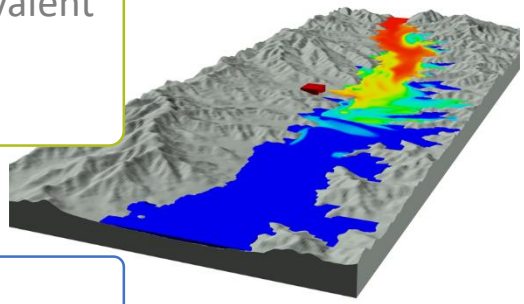
1. Knowledge of upstream/downstream water resources (Hydrologic models) → site's potential, dimensioning

2. Knowledge of ecosystem to estimate environmental and societal impacts

3. Operational monitoring (optimization, monitoring…etc)

Historical data:
- Water Level
- Snow Water Equivalent
- Discharge (in situ)
- Rain

Local Models:
- Hydrologic
- Hydraulic



Source: FLOW-3D

Application of this use case performed by CNR for the CICOS (International Commission of the Congo-Ubangui-Sangha basin)

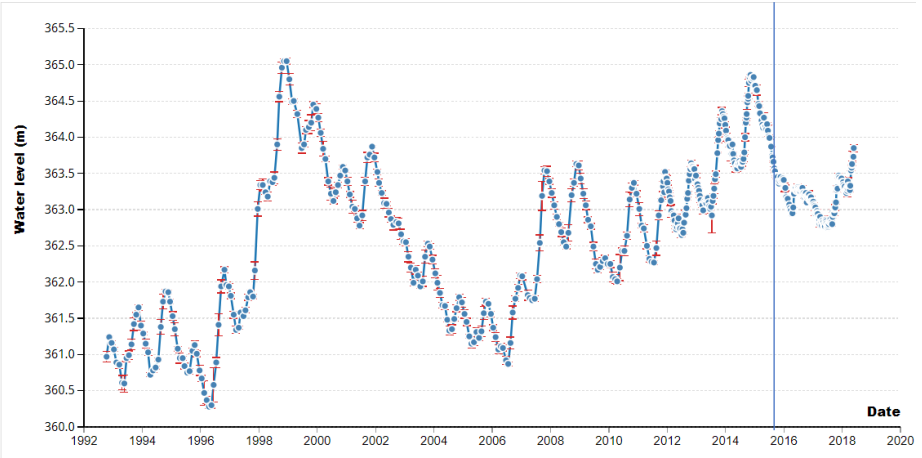
Use Case: Construction/Rehabilitation of a Hydroelectric plant

1. Knowledge of upstream/downstream water resources (Hydrologic models) → site's potential, dimensioning

2. Knowledge of ecosystem to estimate environmental and societal impacts

3. Operational monitoring (optimization, monitoring…etc)

Historical data: Water Level, Lake Water Quality/temperature, …etc



Water Level of Lake Turkana before and after construction of the Gilgel Gibe III Dam

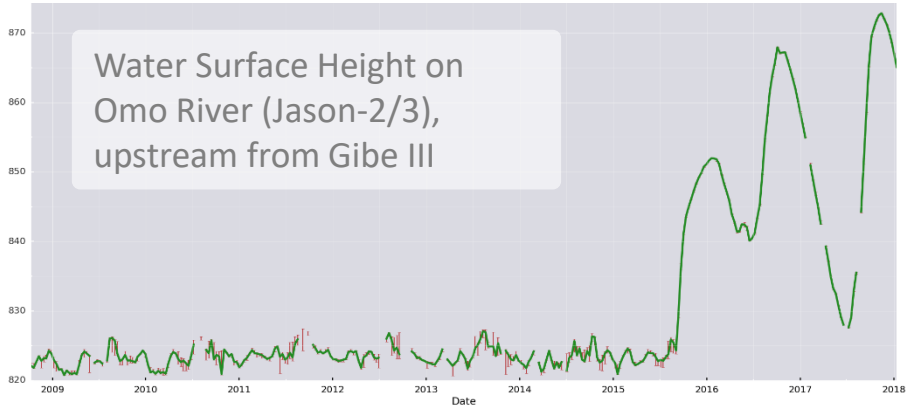
Use Case: Construction/Rehabilitation of a Hydroelectric plant

1. Knowledge of upstream/downstream water resources (Hydrologic models) → site's potential, dimensioning

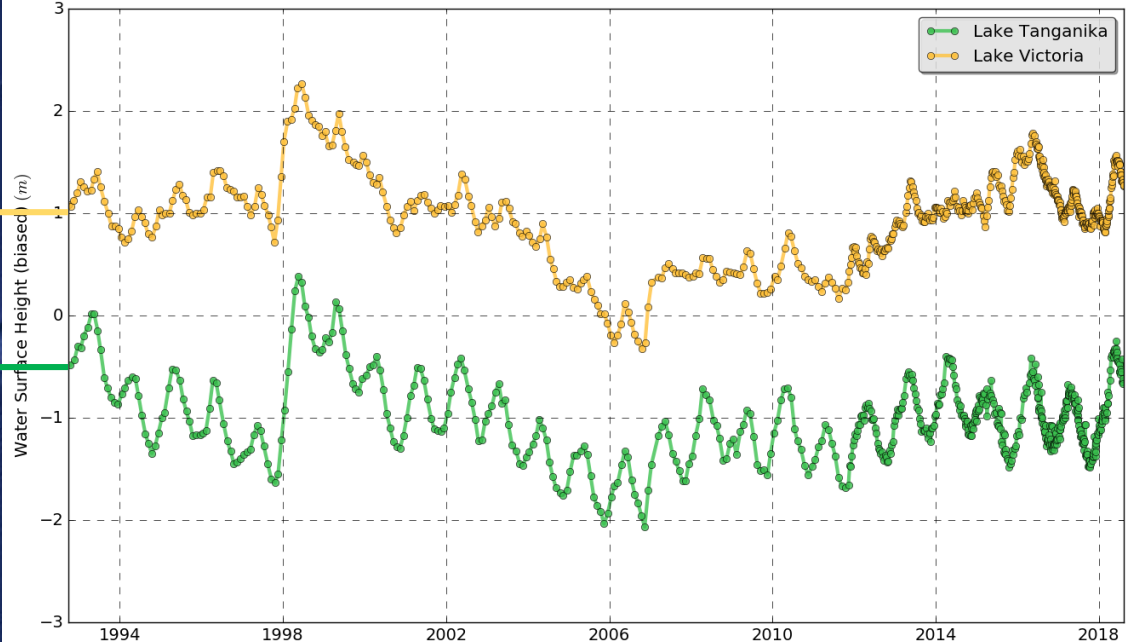
2. Knowledge of ecosystem to estimate environmental and societal impacts

3. Operational monitoring (optimization, monitoring…etc)

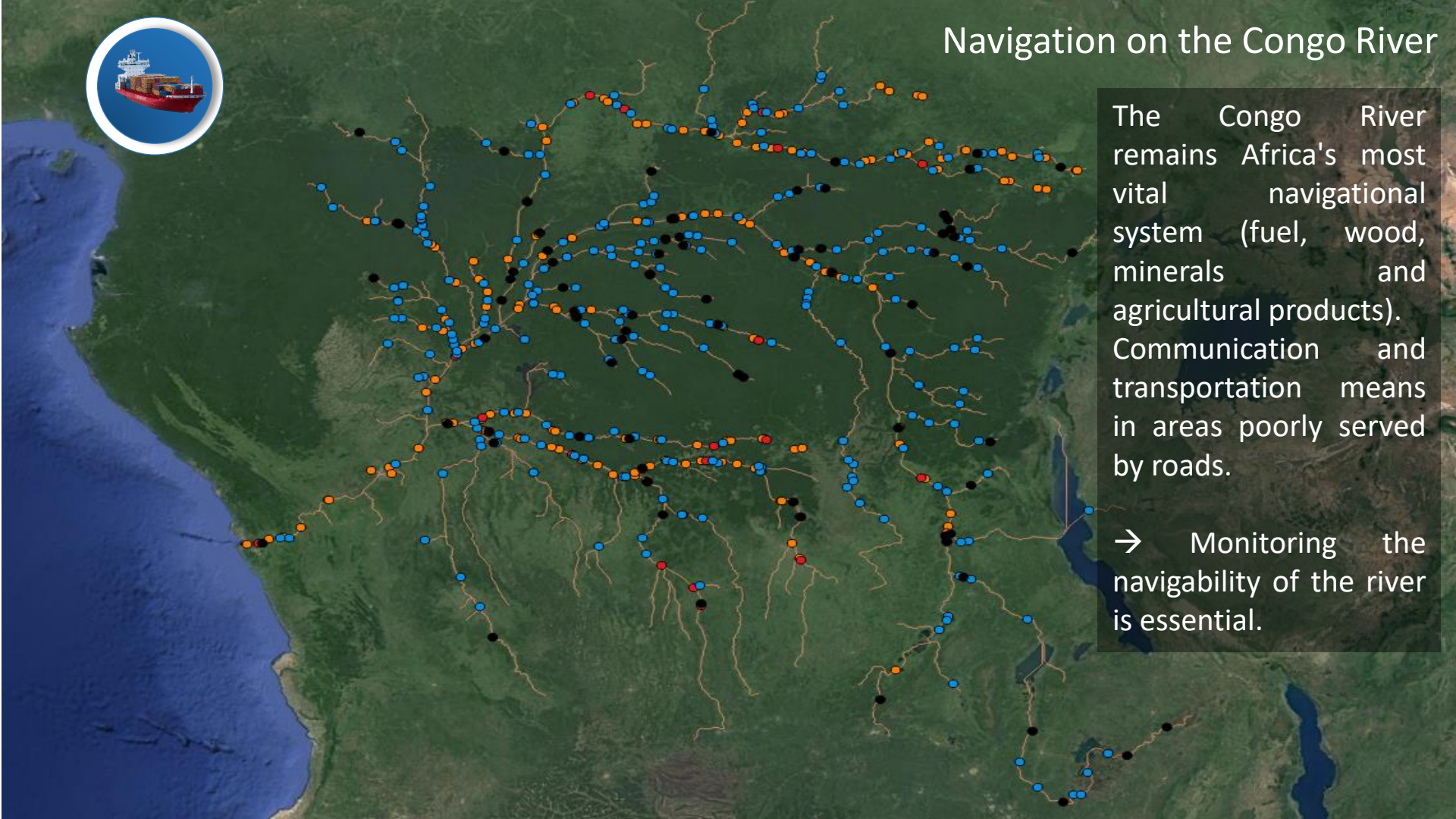
Near Real Time data:
- Water Level
- Discharge from local model
- Lake Water Quality/Temperature
- Surface Water Extent
- ….



Freshwater Resources



Navigation on the Congo River



The Congo River remains Africa's most vital navigational system (fuel, wood, minerals and agricultural products). Communication and transportation means in areas poorly served by roads.

→ Monitoring the navigability of the river is essential.

User Uptake

A high potential of downstream applications

- Large variety of thematic areas (downstream applications)
- Strong impact in the socio-economic sector (drinking water, energy, transport…)
- Objective:
  - Maximise the benefit of the Water level service to applications and end users
  - Ensure that products and services are fit for purpose

Developing the link with the user community

- Awareness about this Service
- Engage users in the Service definition and validation process: User workshops, User Requirement Documents, Gap analyses, Surveys, External reviews

Consider needs at different levels:

Member States, Decision Makers, Intermediate Users, End Users

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Theia Pôle Thématique Surfaces Continentales

hydroweb.theia-land.fr

Land Monitoring Service

land.copernicus.eu/global

Climate Change Service
climate.copernicus.eu

Soon in climate.copernicus.eu