# Satellite observation for integrated water resource management in transboundary basins

## Amazon basin water resources monitoring from space

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# Context: The Amazon basin

## The world's largest catchment shared by 8 different countries

- Asymmetric investment for monitoring capacities and water management
- Overall lack of funding & coordination

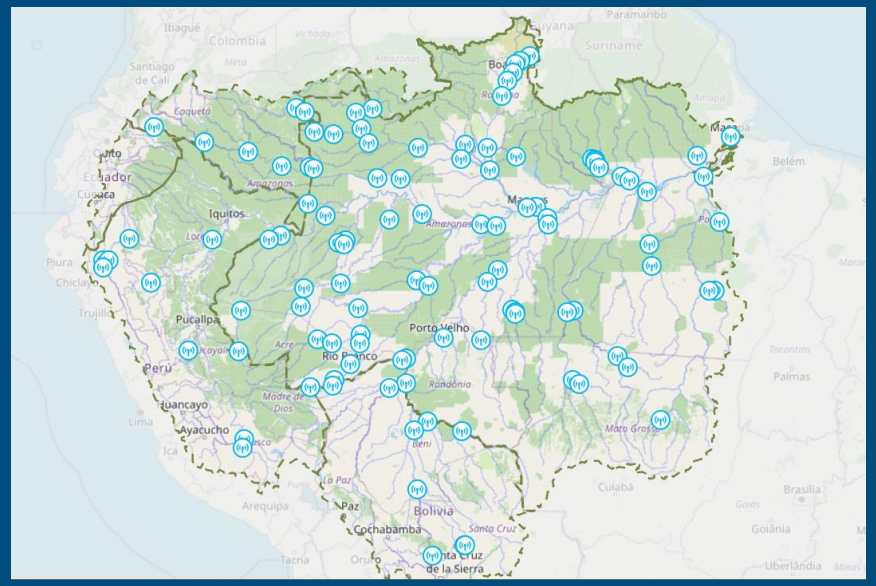
## Climate change and environmental threats

- Extreme floods and increasing dry periods
- Deforestation, illegal mining
- Very limited access to safe drinking water


# Context: The Amazon basin

## Lack of information on the water cycle…

- Insufficient gage density
- Short time series
- Inhomogeneous measurement protocols
- Delays in data delivering
- Reduced data exchange




## …undermine the water governance

- Scarce information available for population and socioeconomical sectors
- Limited water resources planning and environmental enforcement at national and regional levels
- Inefficient strategies for impact mitigation and adaptation to CC

Source : ORA - OTCA

# Three-part cooperation:
# Science, space agencies and stakeholders

- Academics develop remote sensing data processing methods

- Space agencies provide satellite constellations and support the development of operational processing chain


- Stakeholders and scientists define information needs for integrated management
  - Stakeholders to maintain conventional monitoring network for reference baseline
  - Definition of monitoring requirement in relation to water policies

# Three-part cooperation: The Amazon Basin example

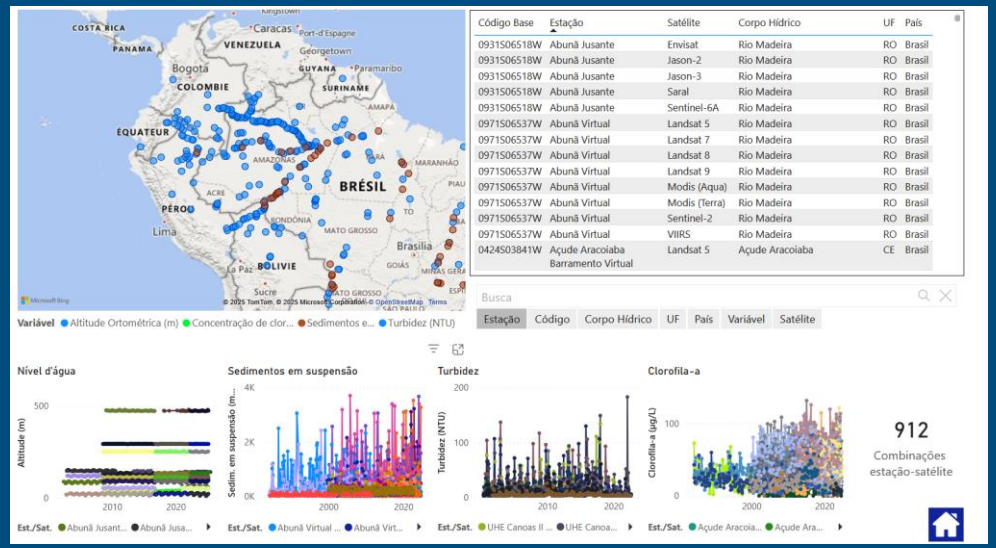

- Cooperation with national and regional stakeholders to include remote sensing based information in hydrologic monitoring
  - Brazilian Water Agency (ANA)
  - Amazon Cooperation Treaty Organization (ACTO)
  - BioPlateaux initiative (French Guiana, Surinam, Brazil)

- Development of a transboundary field network used for remote sensing method calibration & validation
  - National water gage networks
  - HYBAM network (France/IRD and national institutions)

- Expertise from the academic community is transferred to water resource stakeholders with support of space agencies
  - Open sources softwares for satellite data processing (MODIS, Sentinel-2, etc…)
  - Implementation at the stakeholder facilities
  - Web server delivers remote sensing-derived data
  - Capacity building

# Online Databases

- **Hidrosat database hosted by the Brazilian Water Agency**
  - ➢ **Water level** and water quality **earth-observation derived data** over the Amazon catchment


hidrosat.ana.gov.br

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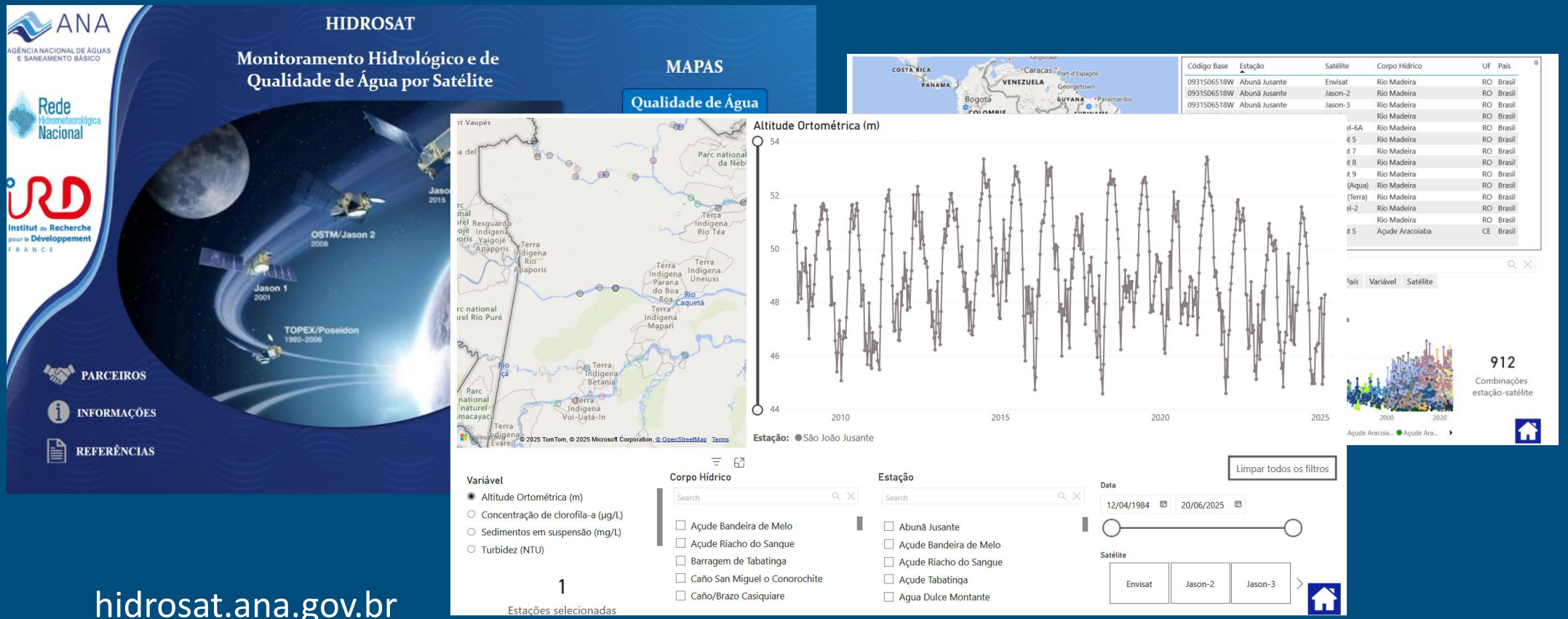


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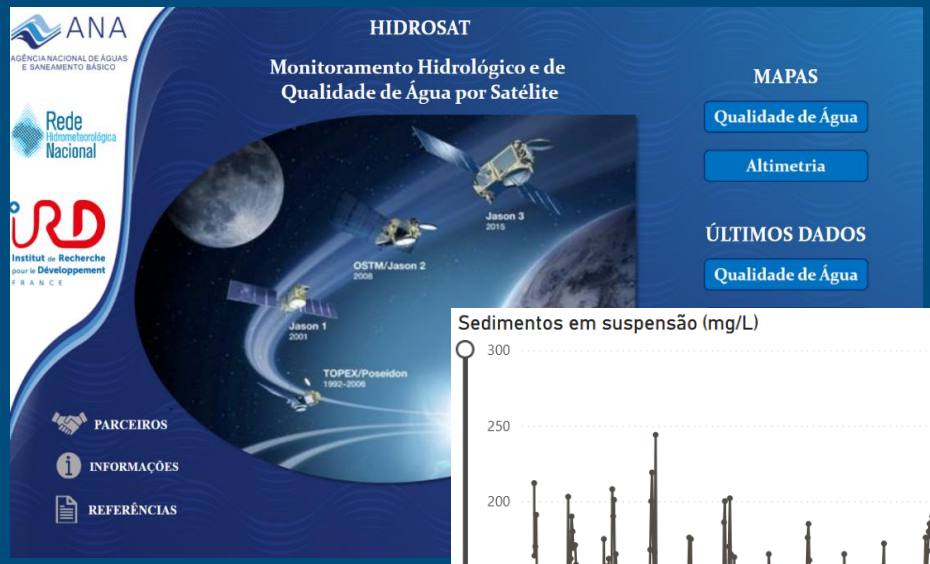
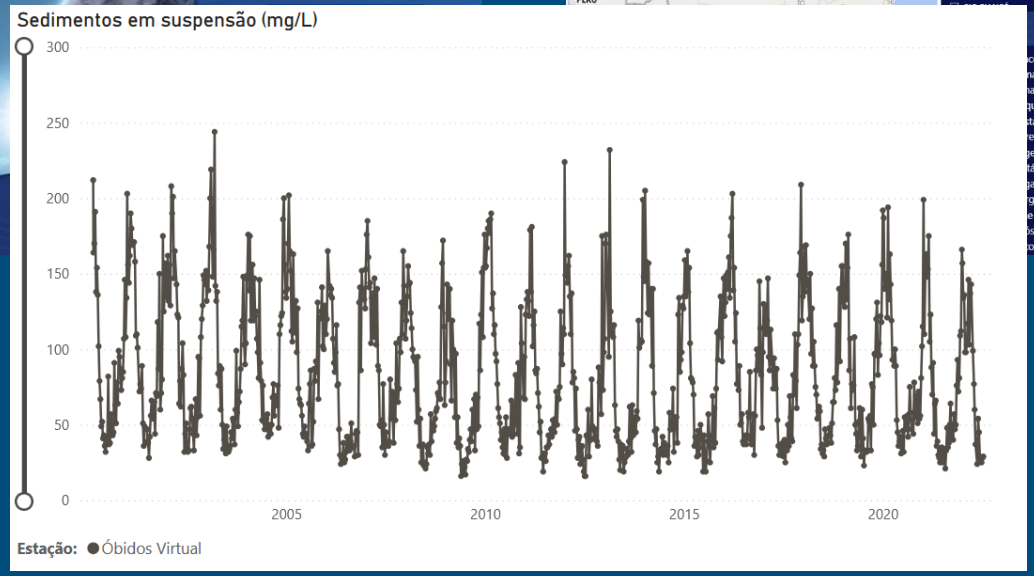
# Online Databases

- **Hidrosat database hosted by the Brazilian Water Agency**
  - Altimetric and **water quality earth-observation derived data** over the Amazon catchment





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ANA AGÊNCIA NACIONAL DE ÁGUAS E SANEAMENTO BÁSICO

IRD Institut de Recherche pour le Développement FRANCE

ABC AGÊNCIA BRASILEIRA DE COOPERAÇÃO MINISTÉRIO DAS RELAÇÕES EXTERIORES

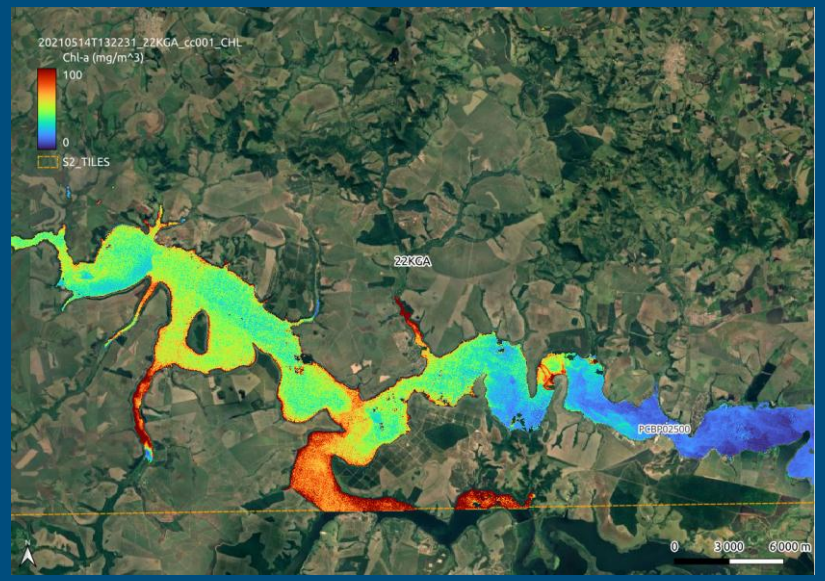
# Remote sensing-derived information

- **Examples of applications:**
  - ➢ **Extreme flood propagation monitoring during catastrophic floods across large watersheds**
  - ➢ **Extremely water low level periods (2023 & 2024 cases)**
  - ➢ **Lake eutrophication and regulation of nutrient inputs**
  - ➢ **Mining-induced impacts on stream water quality**

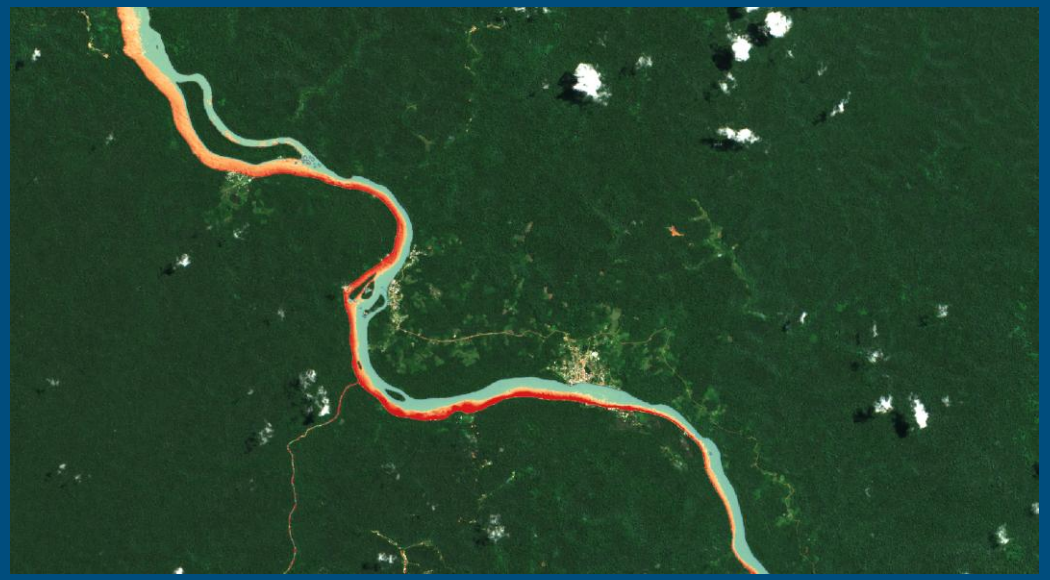
# Sharing experiences:

- **Bioplateaux: Office International de l'Eau (Oieau) & French Space Agency (CNES)**
  - **Monitoring gold mining impact**

- **Maru: Oieau & water agencies (AGEVAP – PCJ)**
  - **Monitoring lake eutrophication**




Degraded lake water quality in urban areas (Rio Tietê)



Sediment released by gold mining activities are monitored from space

# Take-home messages

- **Integrating earth-observation data for water cycle monitoring in transboundary basins:**
  - ➢ Innovative method allowing faster data exchange between agencies & countries
  - ➢ Unprecedented volume of information for monitoring & regulation
  - ➢ **Importance of training and capacity building of stakeholders staff**
  - ➢ Calibration programs
- **Towards integrated earth-observation and conventional monitoring data with ACTO**
  - Erosion and sediment transport processes at the regional scale

ACTO situation room for hydrological monitoring over the Amazon Basin