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 mana
- Overall lack of funding & coordination

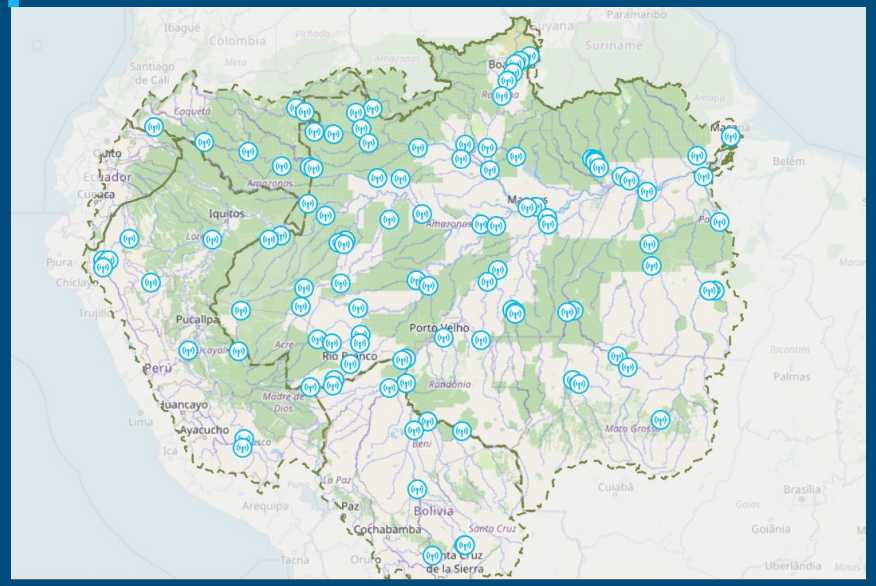
Climate change and environmental threats

- Extreme floods and increasing dry periods
- Deforestation, illegal mining

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

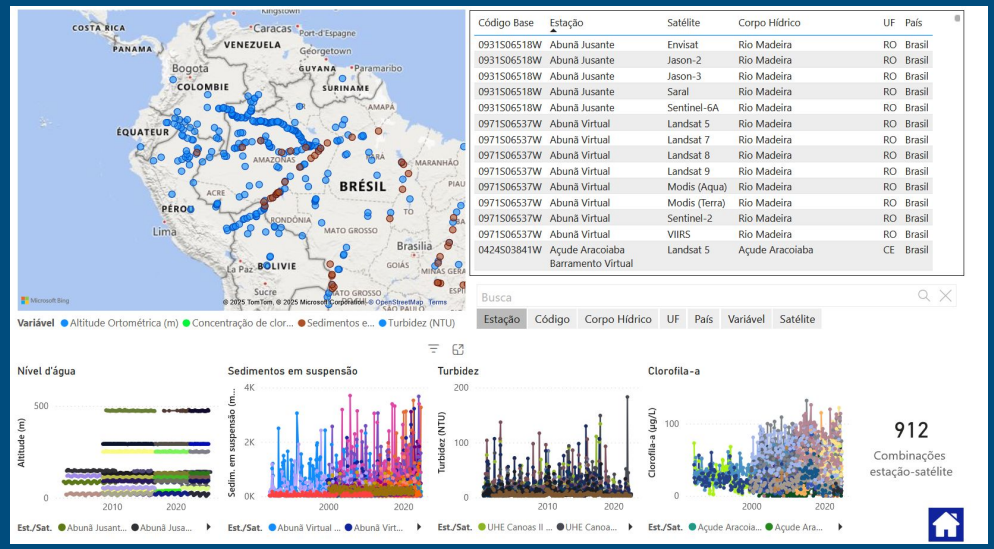
- Cooperation with national and regional stakeholders to include remote sensing based information in hydrologic monitoring
  - Brazilian Water Agency (ANA)
  - Amazon Cooperation Treaty Organization (ACTO)
  - BioPlateaux initiative (French Guiana, Surinam, Brazil)

- 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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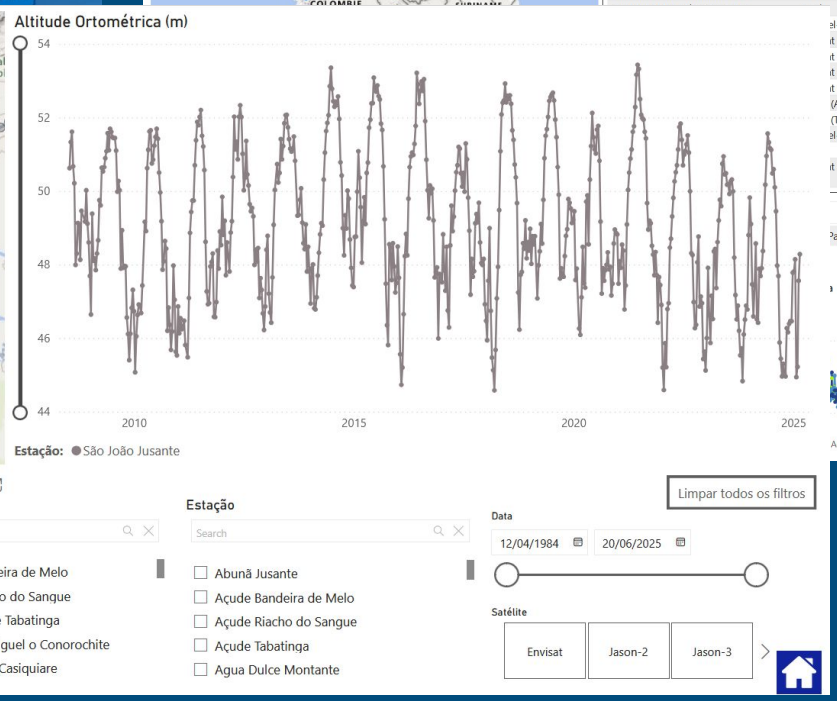

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Online Databases

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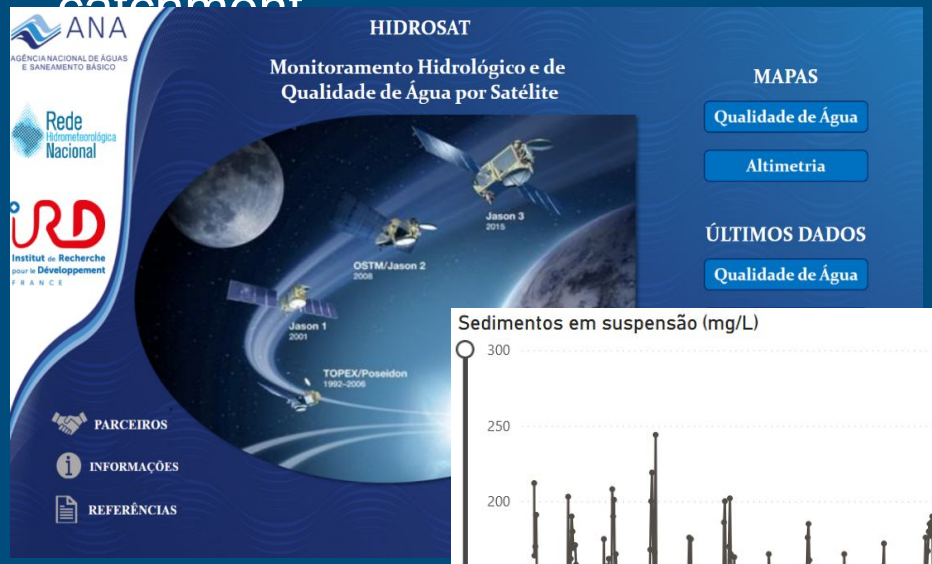
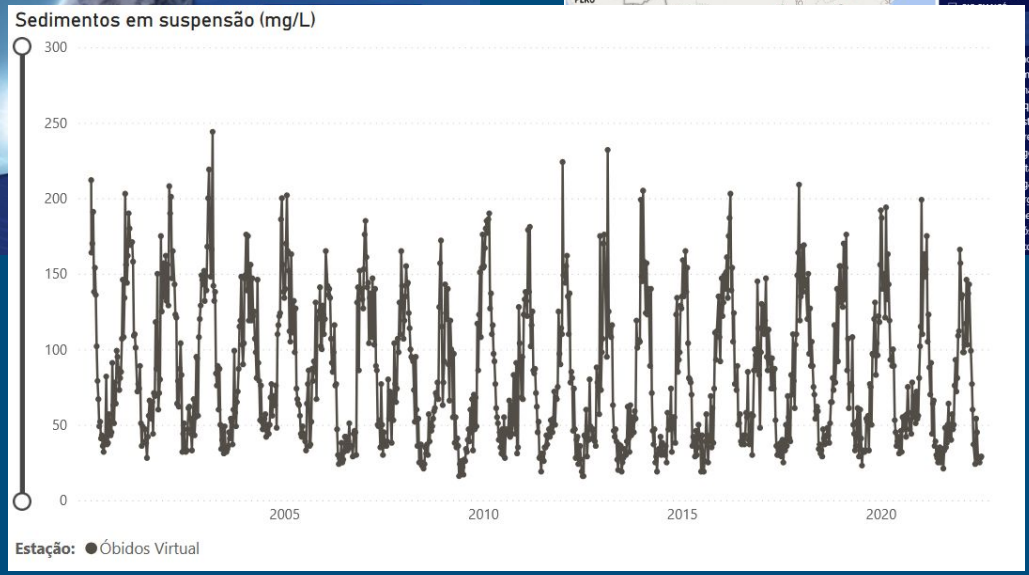
  - Altimetric and **water quality earth-observation derived data** over the Amazon catchment





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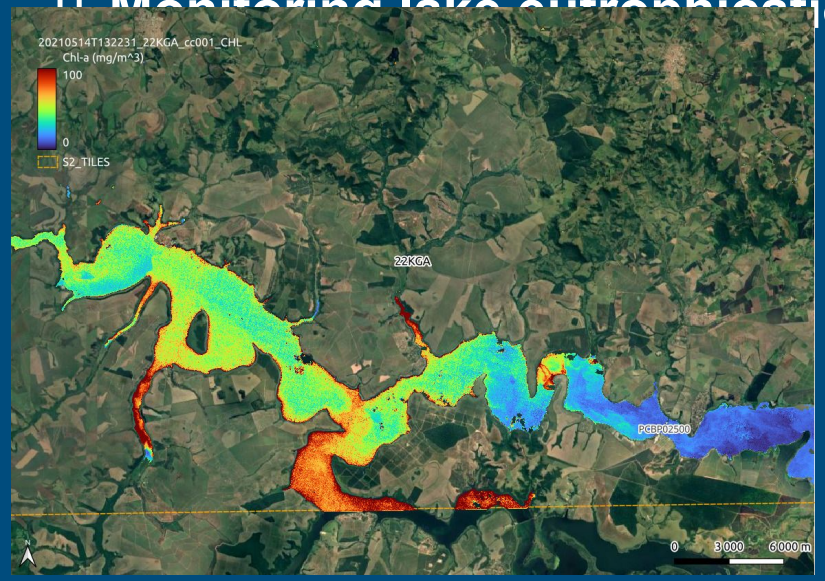
Remote sensing-derived information

- **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 t

ACTO situation room for hydrological monitoring over the Amazon Basin