

World Basin Summit 2026 Session 1 Report

From data to action: modernizing water resources monitoring for resilient basin management



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Thematic Context

The increasing variability of the water cycle due to climate change makes traditional, often sparse, monitoring networks insufficient. Basin organizations face the challenge of making critical decisions—on water allocation, drought management, and pollution control—with incomplete or outdated information. This data gap hinders effective planning, early warning, and the evaluation of management actions, leaving societies vulnerable to water-related risks. Modernizing water resources monitoring is therefore not a technical luxury but a strategic imperative. It involves integrating diverse data sources: from reliable in-situ stations to satellite data & imagery from spatial agencies and other remote sensing tools and methodologies. The challenge is to move from data collection to actionable intelligence by developing user-friendly platforms, robust data analysis tools, and hydrological models. Effective basin management planning must institutionalize these modernized systems, ensuring data is accessible, interoperable, and directly feeds into the assessment of water status, trend analysis, and the selection of cost-effective measures for adaptation and resilience.

Speakers

**FROM DATA TO ACTION: MODERNIZING WATER RESOURCES
MONITORING FOR RESILIENT BASIN MANAGEMENT**

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 Mr. Xavier Lazzaro	 Mr. Nabil Ban Khatta	 Mr. Andrew McConville	 Mr. Hugo Morán Fernández
Limnologist, Binational Autonomous Authority of Lake Titicaca (ALT)	Executive Secretary, Sahara and Sahel Observatory (OSS)	Chief Executive, Murray-Darling Basin Authority (MDBA), Australia	Secretary of State for the Environment, Ministry for the Ecological Transition (MITECO), Spain

Session Report

Challenges and Problems Faced in Resource Monitoring

The opening consensus shared by all speakers is the increasing vulnerability of societies to water-related risks, a situation exacerbated by climate change which is disrupting the global hydrological cycle. Basin organizations face unprecedented technical and political complexity when making critical decisions regarding water allocation, drought and flood management, pollution control, infrastructure planning, and crisis management. A recurring message throughout the session was that the principal challenge is no longer simply generating more data, but transforming data into reliable information and operational intelligence capable of supporting evidence-based decisions.

1. Obsolescence and Insufficiency of Traditional Networks

Conventional monitoring networks, though valuable for their historical data, are often too sparse to meet modern needs for spatial and temporal precision. As highlighted by the Geological Survey of Brazil (SGB), even when stations possess over 70 years of data, they remain insufficient to fully represent long-term climate variability and increasing hydrological extremes. Furthermore, in remote areas like the Amazon, physical access for the installation and maintenance of ground stations presents a colossal logistical and financial challenge. Participants also emphasized the need not only to modernize existing monitoring networks through automation and telemetry, but also to densify them while ensuring continuity of long-term observations.

2. Data Fragmentation and "Siloing"

A major obstacle identified, particularly in transboundary contexts like the Nile (11 countries) and the Amazon (8 countries), is the fragmentation between national datasets. Data is often scattered across different institutions using non-harmonized methodologies, making it impossible to achieve an integrated and coherent vision at the scale of the entire basin. Participants stressed that the real gap is frequently not the availability of data, but the lack of interoperability, institutional capacity, and governance mechanisms capable of transforming fragmented datasets into coordinated management actions. In the Amazon Basin alone, nine priority transboundary issues have been identified, reinforcing the need for regional cooperation and shared monitoring frameworks.

3. Inability for Real-Time Forecasting

At Lake Titicaca, the Binational Authority (ALT) pointed out the limitations of occasional sampling campaigns, which are unable to detect rapid crises such as harmful algal blooms or assess the lake's ecological health in time for public action. Likewise, participants noted that satellite time series remain relatively

recent and cannot yet replace the scientific robustness provided by long-term field observations. Monitoring systems therefore need to evolve from simple data repositories into integrated operational systems capable of generating forecasts, environmental scenarios, and early warning information for planning and emergency response.

Implemented Solutions and Technological Innovations

To bridge these gaps, basin organizations presented modernization strategies based on the integration of new technologies, institutional cooperation, and a shift toward basin-scale governance.

1. The Hybrid Approach: In Situ, Satellite, and Telemetry

The solution no longer lies in choosing between ground stations and satellites, but in their hybrid integration.

- **Remote Sensing:** Sentinel-3 imagery (Copernicus Programme) enables frequent monitoring of water quality over large areas.
- **Cross-Validation:** The ALT combines in situ chlorophyll-a measurements collected by multiparameter sondes with satellite observations, transforming remote sensing products into reliable information for early warning.
- **Automation:** Brazil is modernizing its National Hydrological Network by expanding telemetric stations, while Spain is investing approximately €1 billion in the modernization and digital transformation of water monitoring, including about €225 million dedicated to the automation and digitalization of monitoring systems and the deployment and integration of more than 4,000 sensors into European monitoring networks.
- **Predictive Modelling:** The Nile Basin Initiative is developing digital twin technologies that integrate real-time monitoring, satellite observations and environmental modelling to support basin-wide planning and operations.

2. Creation of Data Hubs and Regional Observatories

Several initiatives aim to transform raw data into actionable intelligence.

- **Amazon Regional Observatory (ARO):** Acts as an interconnectivity hub, integrating hydrological, forest, wildfire and climate information generated by governments, research institutions and civil society without replacing national databases, thus providing a systemic vision of the basin.
- **Digital Twin of the Nile Basins Initiative and the GOTA Observatory of Spain:** These digital platforms promote interoperability, transparency and public access to information, strengthening confidence in water governance while supporting forecasting, planning and decision-making. Participants emphasized that these observatories are not simply data repositories, but operational platforms that convert monitoring information

into knowledge for water allocation, infrastructure management and risk reduction.

3. Inclusion of Citizen and Cultural Knowledge

The Murray-Darling Basin Authority (MDBA) in Australia presented innovative approaches to enriching information systems.

- **Participatory Science:** The eDNA project mobilizes volunteers to monitor fish biodiversity at a scale no single agency could achieve independently.
- **Cultural Knowledge:** The digitization of the Darling Scrolls and the incorporation of Indigenous and local knowledge strengthen river restoration and basin planning.
- **Institutional Partnerships:** Long-term cooperation among governments, research institutions and international organizations, together with regional capacity-building initiatives, was recognized as fundamental for sustaining monitoring systems and improving technical capabilities.

Suggested Recommendations for Resilient Management

The session concluded with a series of strategic recommendations to sustain modernization efforts.

1. Institutionalize Sharing and Transparency

Data sharing in transboundary basins should not be viewed as a technical option, but as a fundamental political act to build trust, strengthen cooperation in territories and across national domestic basins and transboundary basins, improve legal certainty, prevent conflicts and ensure regional stability. Water data should be treated as a strategic public good, supported by interoperable information systems and transparent governance arrangements. Technical knowledge and a clear definition of responsibilities (who does what, where, how, and when) are fundamental.

2. Preserve the Foundation of Ground Stations

A key message is not to succumb to "satellite-only" approaches. It is imperative to maintain, modernize and strengthen in situ monitoring networks, as long-term field observations remain indispensable for calibration, scientific validation and the reliability of digital models, forecasts and decision-support systems.

3. Invest in Human Capital and Governance

Technology alone is not enough. Speakers recommended:

- **Training:** Engaging young professionals and regional expert groups to ensure technical continuity.

- **Institutional Strengthening:** Building institutional capacity to interpret monitoring information and transform data into management decisions.
- **Sustainable Funding:** Moving from one-off investments to permanent financial mechanisms that ensure long-term operation, maintenance and modernization of monitoring systems.
- **Harmonization:** Adopting common regional protocols and indicators so that monitoring results are comparable across countries sharing the same basin.

4. Align Data with Public Action

Every monitoring system must be designed to directly meet the needs of managers and society. Rather than simply collecting data, monitoring should generate actionable information that supports water allocation, infrastructure operation, drought and flood preparedness, pollution control, ecosystem restoration and public health. To this end, the population's expectations need to be considered. Ultimately, transforming data into effective action is essential to strengthen water security and build more resilient river basins under a changing climate.

Key messages:

- Modernizing water resources monitoring is no longer a choice—it is a strategic imperative for resilient basin management.
- The challenge is no longer collecting more data, but transforming data into actionable information that supports evidence-based decision-making.
- Reliable, interoperable, transparent, and openly shared data create value by building trust, strengthening partnerships, improving coordination, and enabling effective water governance.
- Monitoring data are not a cost, they are strategic assets that support investment, reduce risks, and strengthen water security and climate resilience.
- Strong institutions, sustained political commitment, and long-term investment are essential to transform data into effective action.
- Transboundary cooperation and institutionalized data-sharing agreements are indispensable for integrated basin management.
- Climate resilience depends on shared data, robust monitoring networks, international cooperation, scientific evidence, stakeholder participation, knowledge exchange, transparency, and stronger connections between technical institutions and society.



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