

Under the High Patronage of His Majesty King Mohammed VI



XIX WORLD WATER CONGRESS
International Water Resources Association (IWRA)
Marrakech, Morocco | 1-5 December 2025

Kingdom of Morocco



Ministry of
Equipment and Water

Development of Geospatial Models for Satellite-Based Monitoring of Water Quality in Drinking Water Sources in Argentina

Atencio, A.G.; Bazán, R. .; Bonansea, M.; Bordet, F.; Caso, M.; Collado, R.; Ferral, A.; German, A.; Minotti, P.; Nemiña, F.; Othaz Brida, A.; Pérez, G.L.; Quáini, K.; Rodríguez, A.; Rodríguez, M.I.; Rossen, A.; Ruibal Conti, A. L.; Ruiz, M.A.; Rydzewski, A. L.; Sánchez Valdivia, A. & Shojjet, V.

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BACKGROUND



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Project developed with a IDB Loan N° 4840/OC-AR

Satellite Technology Development Program PROSAT II- ARGENTINA

- Leading coordination of the National Water Institute.
- Integrated by 40 technical experts representing 11 academia, basin authorities and governmental Institutions from 5 provinces and 10 water bodies.
- Financing support IDB Loan managed by the National Commission for Space Activities (Comisión Nacional de Actividades Espaciales – CONAE)
- Project duration: March 2022 - March 2023

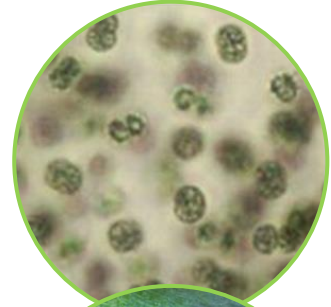


Universidad Nacional de Córdoba



STATE-OF-THE-ART

- ✓ Harmful algae bloom (HABs), primarily caused by cyanobacteria, pose a serious threat to water quality and aquatic life.
- ✓ These blooms release multiple toxins—hepatotoxins, neurotoxins, dermatotoxins, and cytotoxins—affecting both ecosystems and human health.
- ✓ HABs deplete oxygen and block sunlight, leading to fish kills, biodiversity loss, and ecosystem collapse.
- ✓ Their impacts extend beyond ecology, causing economic losses in fisheries, tourism, recreation, and drinking water supply.
- ✓ Nutrient pollution from agriculture and domestic effluents is the main driver of HABs.
- ✓ Climate change intensifies HABs through rising temperatures, stratification, and altered hydrological regimes.
- ✓ Despite their severity, HABs are under-monitored and poorly managed in many regions.
- ✓ **Urgent action is needed: integrated strategies for prevention, monitoring, and nutrient control are essential.**





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PROJECT ADDRESSED OBJECTIVES

DIFFERENT
REGIONS OF
THE COUNTRY
WITH
GEOSPATIAL
MODELS OF
WATER
QUALITY

INTEGRATION OF OPTICAL SATELLITE DATA, RADAR
(SAR-SAOCOM) AND FIELD MEASUREMENTS



1



CONTRIBUTE TO MONITORING
PROVISION OF WATER FOR
HUMAN CONSUMPTION

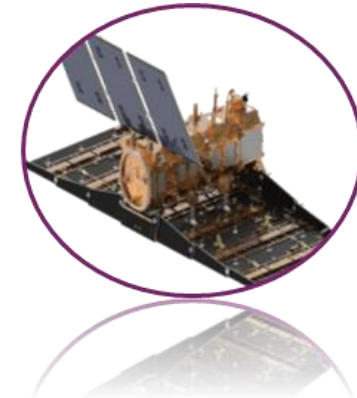
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3



WEB-GIS SYSTEM
DEVELOPMENT





COMPONENTS AND ACTIVITIES



1. FIELD MONITORING DESIGN

Selection of 10 water bodies
Database collection
Defining essential monitoring designs:
-Monitoring associated with the passage of satellites
-Monitoring with radiometer



2. ALGORITHM DEVELOPMENT

Calibrated algorithm collection
Application of general algorithms
Development of new algorithms
Using optical imaging and SAR



3. WEB-GIS SYSTEM DEVELOPMENT

Survey and background collection
Definition of user requirements, software, logical model and architectural design
User manual and administrator of the spatial monitoring system of bodies of water in Argentina

Essential Variables

1. AREA
2. Chl a
3. SUP. TEMP.
4. SECCHI DISK
5. TURBIDITY
6. TSS
7. CDOM

Complementary Variables

- 8) PHYCOCYANIN
- 9) TOTAL ALGAE
- 10) CYANOBACTERIA
- 11) P AND N - NUTRIENTS



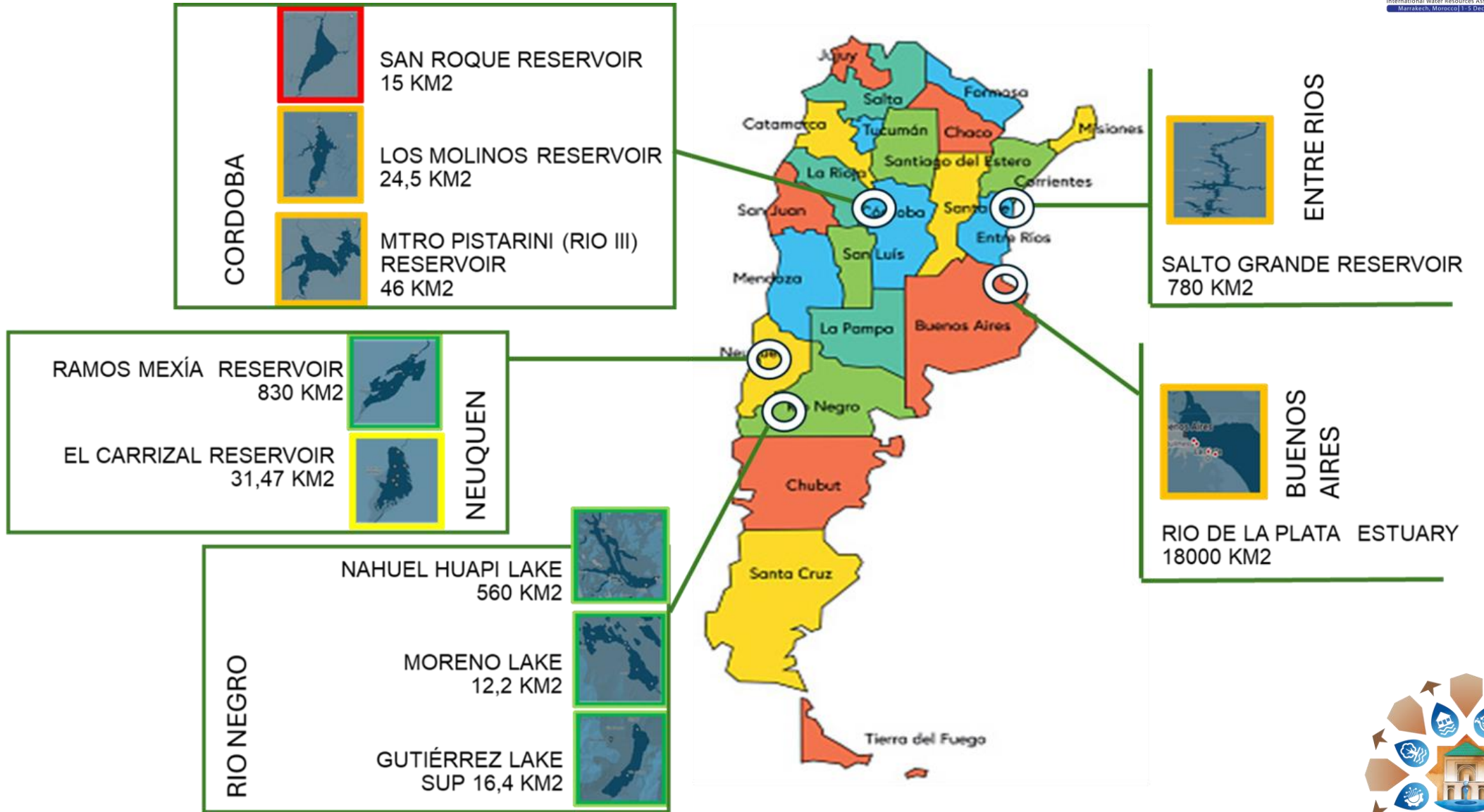


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SELECTED BODIES OF WATER





MAIN RESULTS AND CONCLUSION

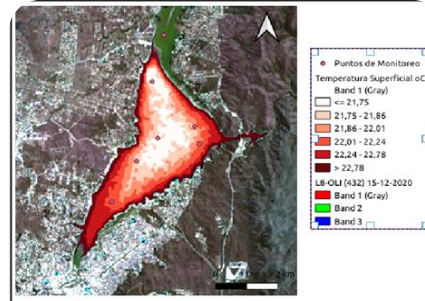
SIGNIFICANT CONTRIBUTION IN FIELD MEASUREMENTS. 70 campaigns, 2500 measurements (in situ and laboratory measurements).

CDOM MEASUREMENTS in 7 bodies of water, for the first time in Argentina. There were only few precedents

PHYCOCYANIN quantification technique

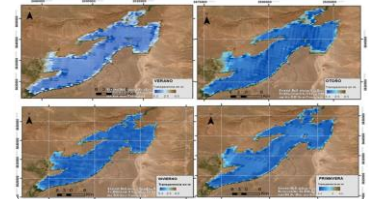


RADIOMETRIC MEASUREMENTS and characterization of reflectance in 8 bodies of water. Protocol optimization.



ALGORITHMS Proofs of concept for general products and for customer models designing adequate monitoring and developing own models for each body of water.

ALGORITHMS Compilation of 18 validated algorithms:

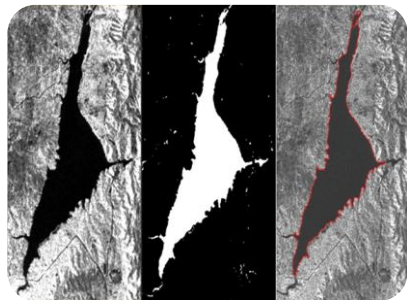


SAR IMAGES: Extraction of the surface of the water body from SAOCOM and Sentinel-1 images is a good alternative to generate water level time series in water bodies with high cloud cover.



WEB-GIS-USER SURVEY: 60 potential organization users

WEB-GIS PLATFORM: Obtain thematic maps on different dates of quality indicator variables, generating time series of them and issue alerts defined by thresholds.





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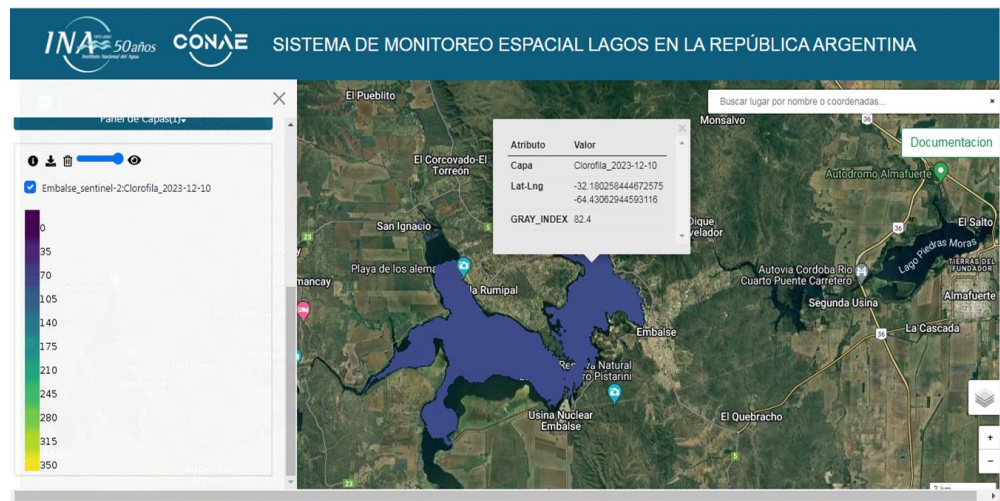
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SIGNIFICANT OUTCOMES OF THE PROJECT

Represent a significant contribution to the simultaneous acquisition of radiometric field data and optically active water quality variables that are fundamental for the future operational implementation of a WEB-GIS.

Strengthened COOPERATION for acquisition of field data and satellite information sharing with the technical and operational coordination and complementation of more than 10 academia and government institutions.

Spatial monitoring system



Researchers and project data



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Thank you!



PROJECT

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MEMBERS

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