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International Water Resources Association
IWRA

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

Kingdom of Morocco
Ministry of Equipment and Water

Fast Dam Sitting
An Innovative Tool for Identifying Small Dam Sites in Morocco

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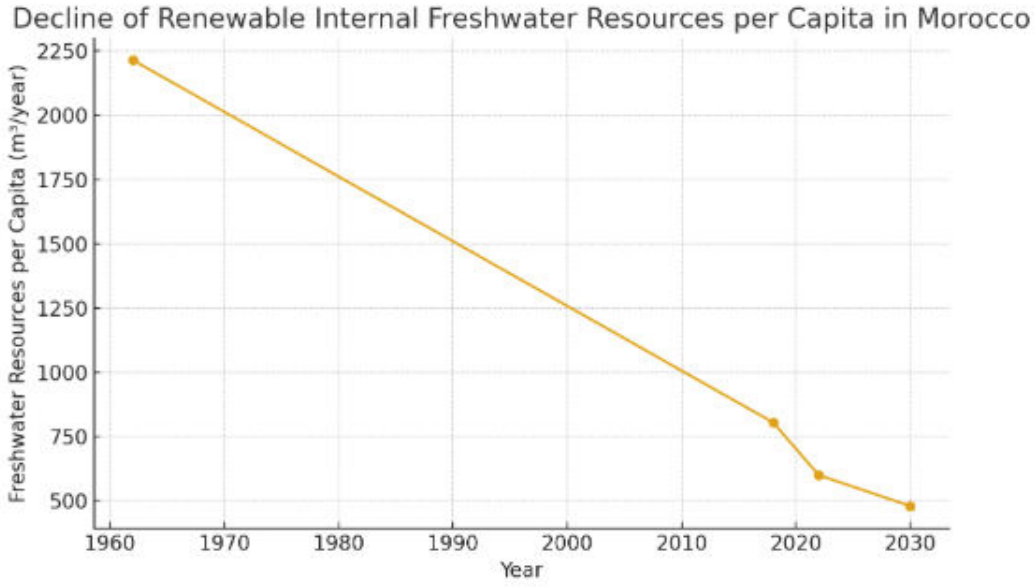
1-5 December 2025

Context & Problem Statement

The Growing Water Crisis in Morocco

- **Increasing Water Scarcity:** amplified by climate change and pressures from population growth and urbanization.
- **The Core Challenge:** A critical need to increase water storage capacity.
- **A Promising Solution:** Small dams offer a practical way to improve water access, especially in arid regions.
- **The Current challenge:** classical site selection methods are **slow, expensive, and not totally efficient.**

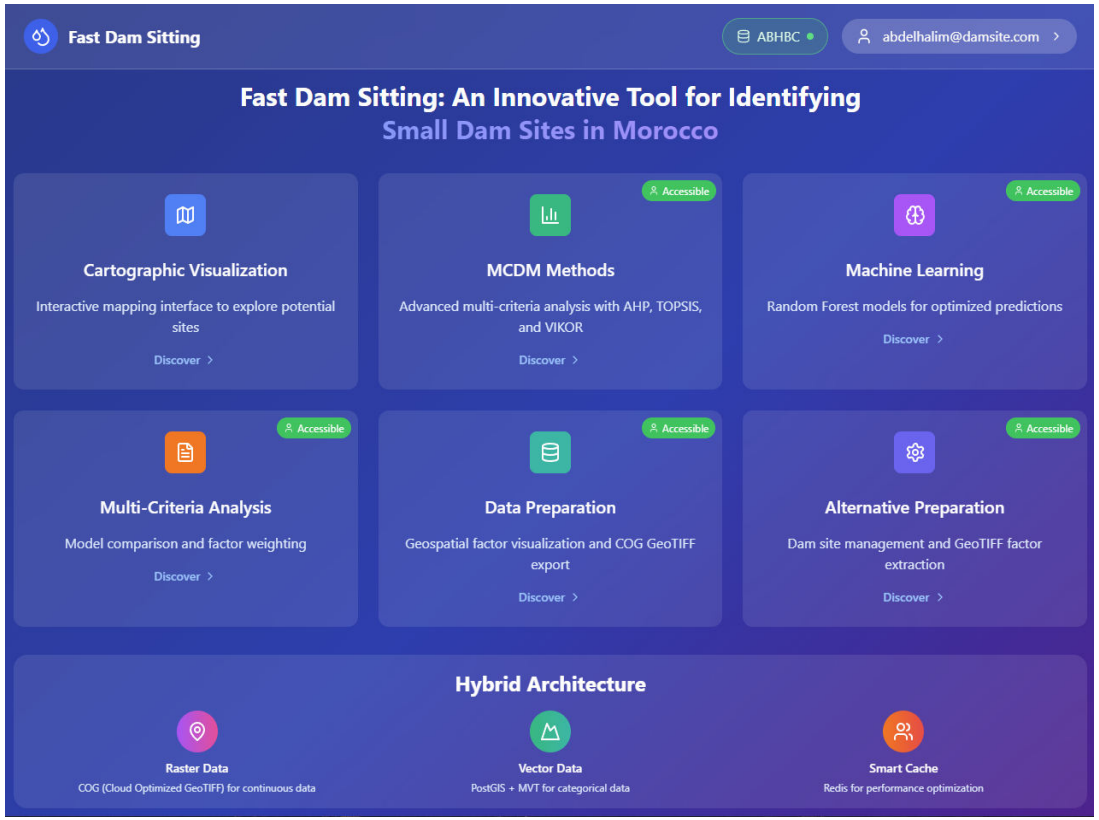


Research Objective

Develop an automated tool **Fast Dam Sitting** to:

- Rapidly identify optimal small dam sites
- Support proactive water resource planning
- Increase hydrological resilience under climate pressure

This approach Combines GIS, MCDM, and AI for decision support.



Methodology : An Integrated Approach

A Powerful Triangulation of Methods : The tool integrates three powerful components:

- **Geographic Information System (GIS)**

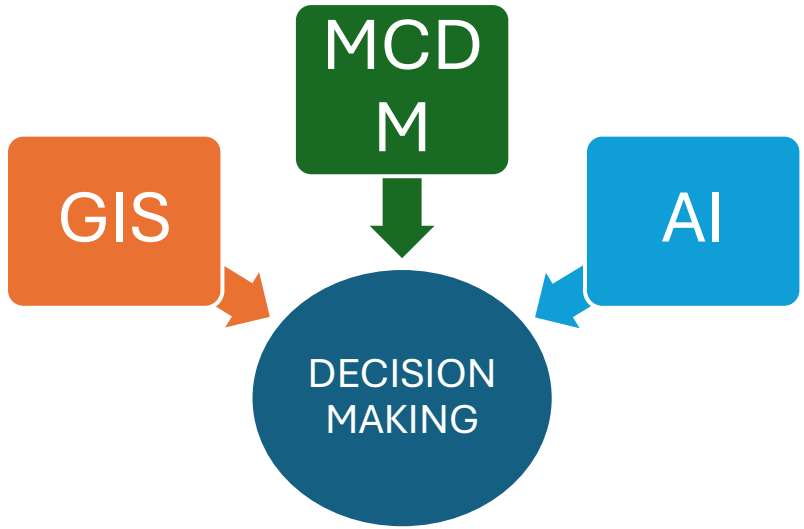
  For advanced geospatial data processing.

- **Multi-Criteria Decision Making (MCDM)**

  For structured evaluation and weighting of factors.

- **Artificial Intelligence (AI) Algorithms**

  For sophisticated optimization and pattern recognition.



Methodology : Technical architecture

Modern Technology Stack:

Frontend :

- React.js + TypeScript + Leaflet.js (web mapping)
- Tailwind CSS for responsive design

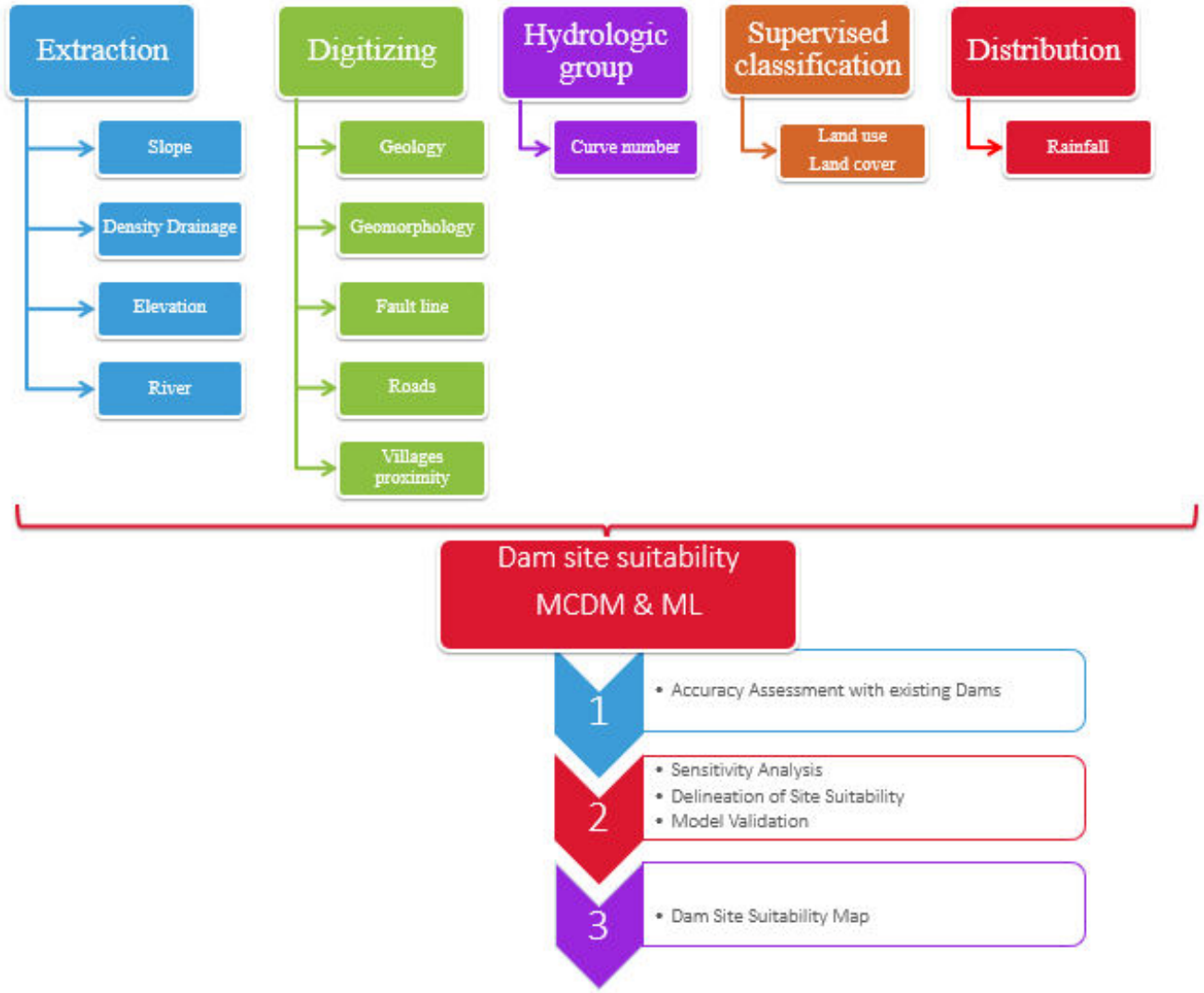
Backend:

- FastAPI (Python) for REST APIs
- PostgreSQL for geospatial database
- Cloud Optimized GeoTIFF for geographic raster data

Artificial Intelligence:

- Random Forest for machine learning
- Multi-Criteria Decision Making (MCDM) with AHP, MIF
- Automatic data normalization

Methodology: Flowchart of decision framework



Technical Evaluation

Refinement Stage:

- Preliminary dam design: storage volume, dam height & length
- Hydrological validation: runoff potential, catchment yield
- Feasibility assessment: environmental & socio-economic factors

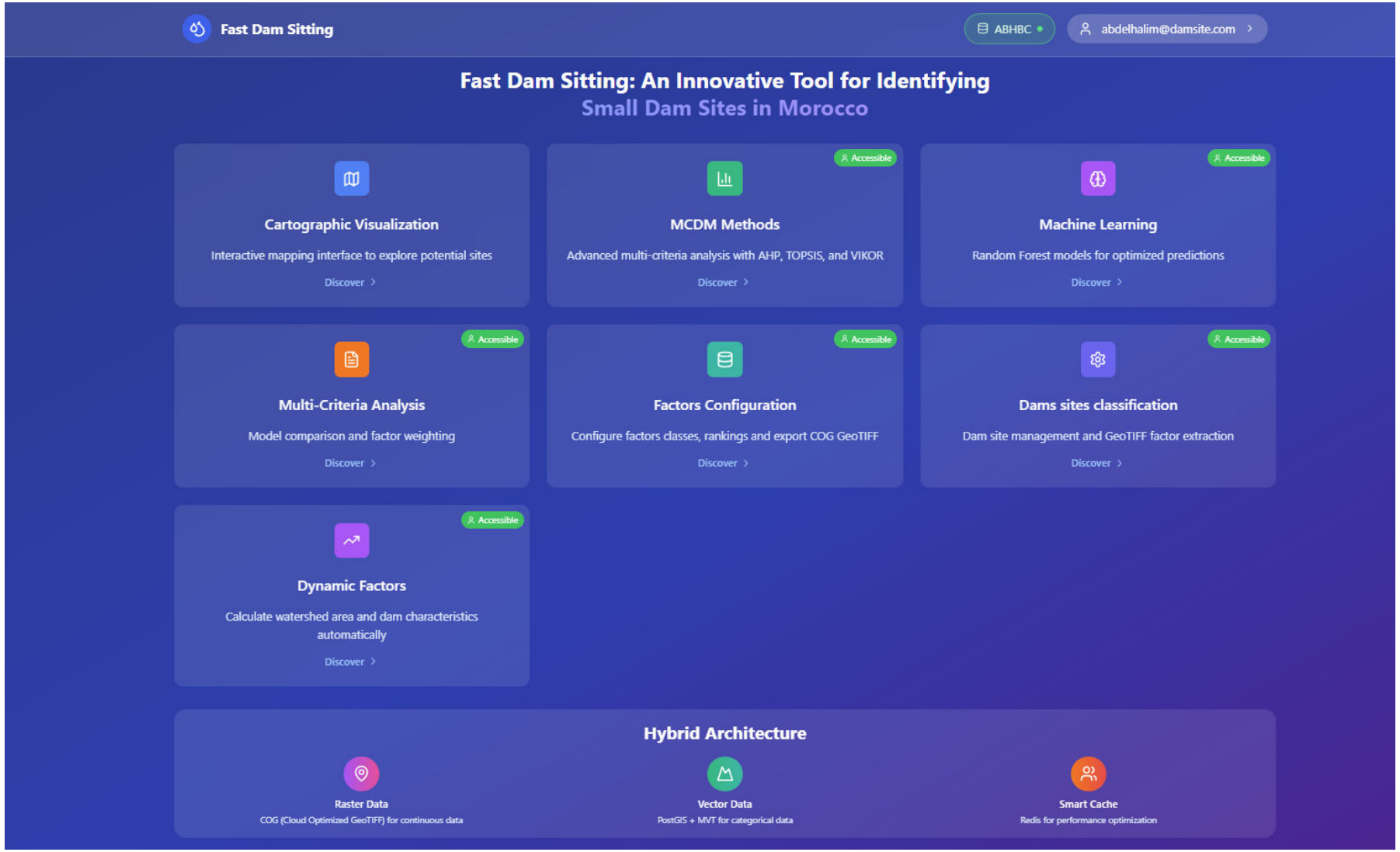
Result: Data-driven and technically robust site prioritization.

A- Live demonstration (if possible):

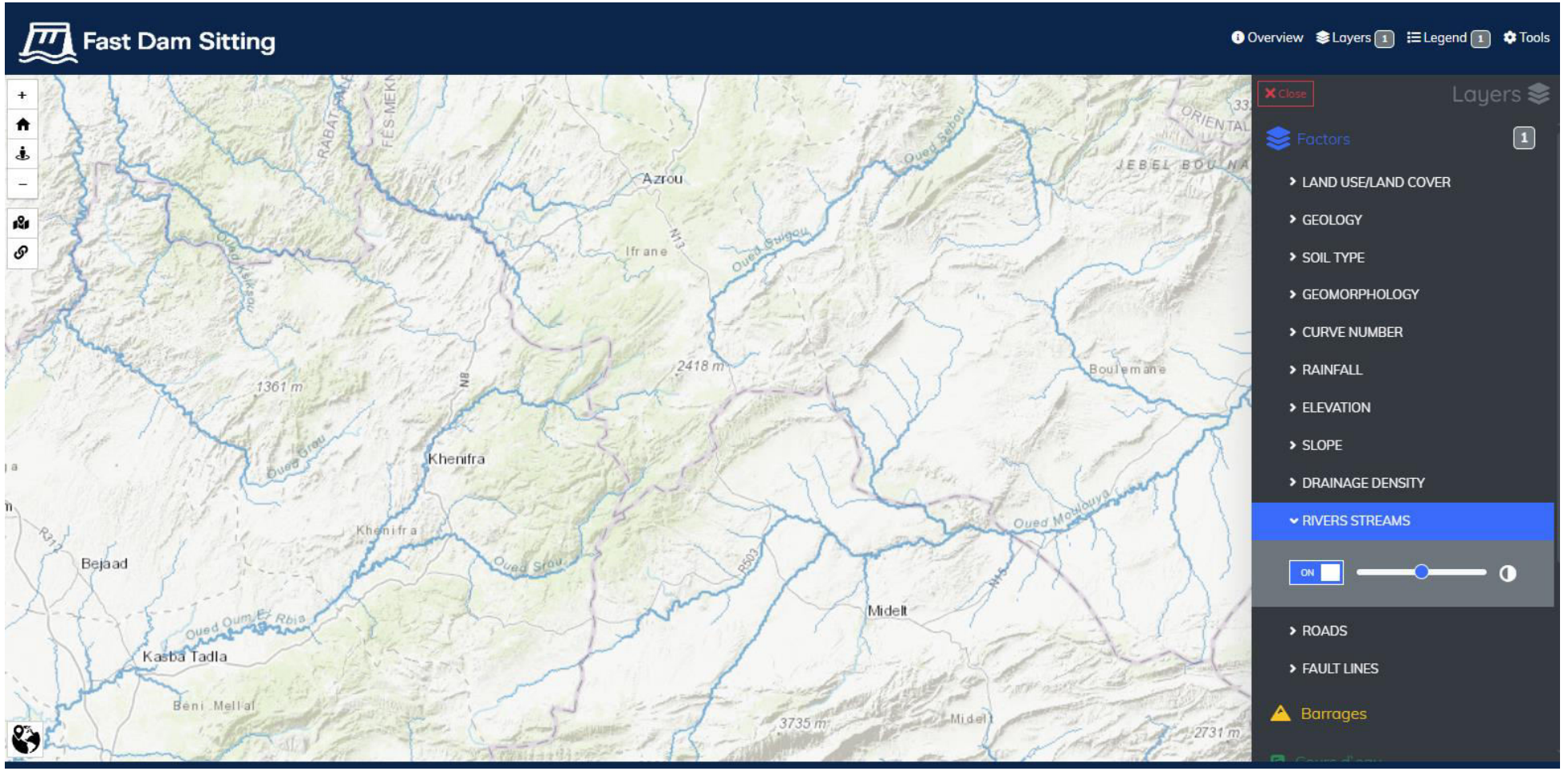
Our Fast Dam Siting Application is hosted on our server and requires only an internet connection.

B- Continue with screen shots

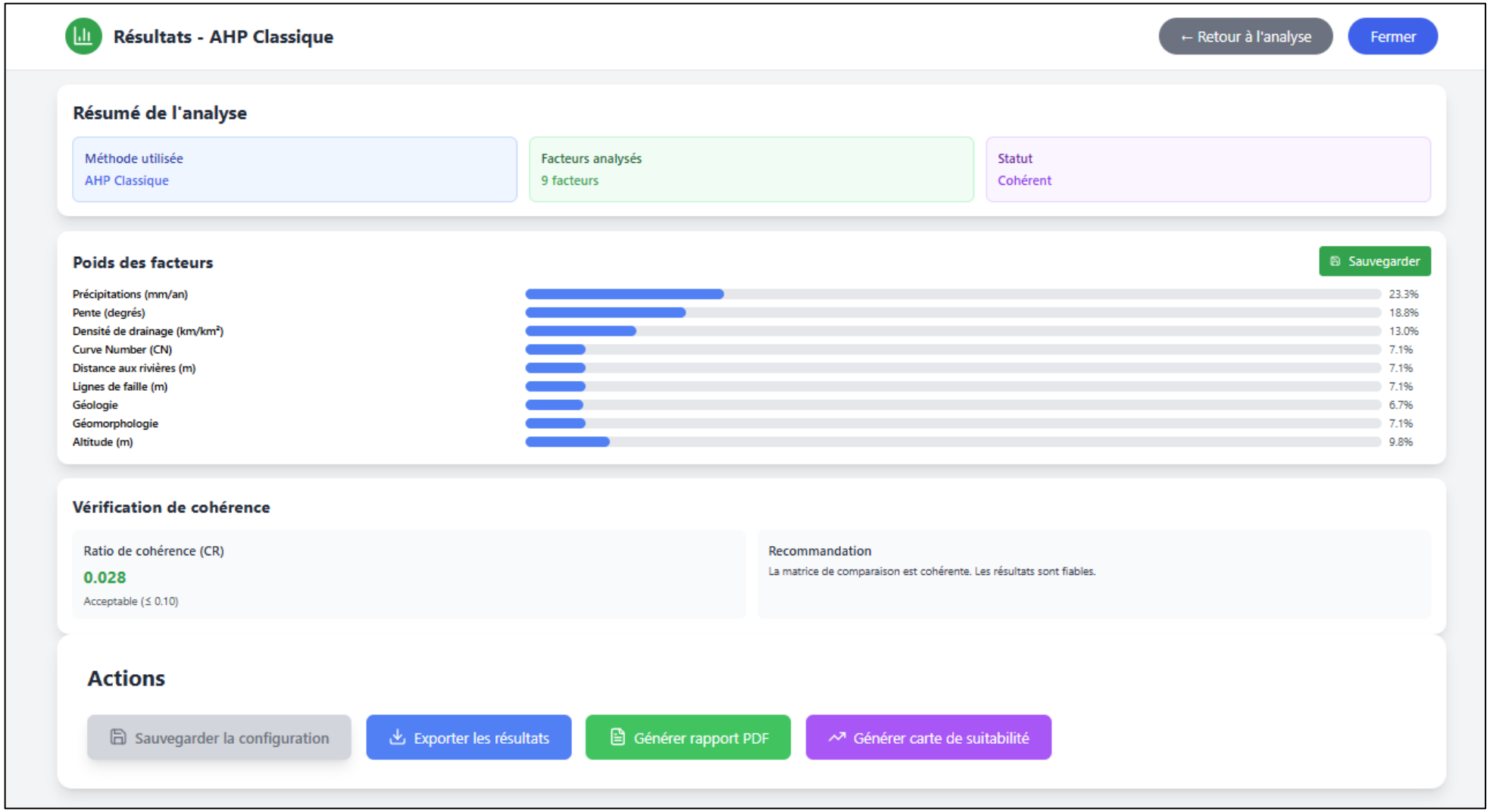
Principal page



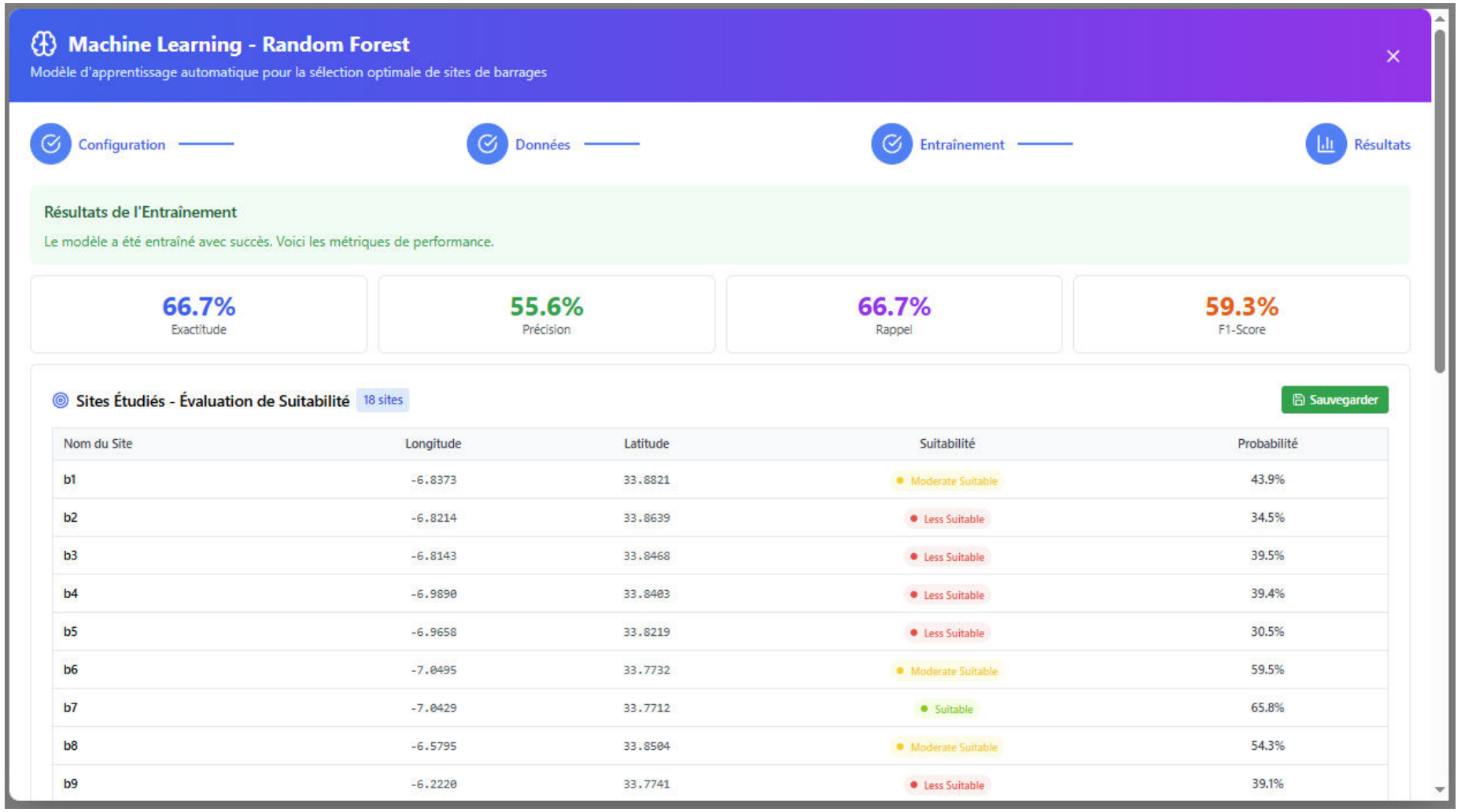
Geographic visualization



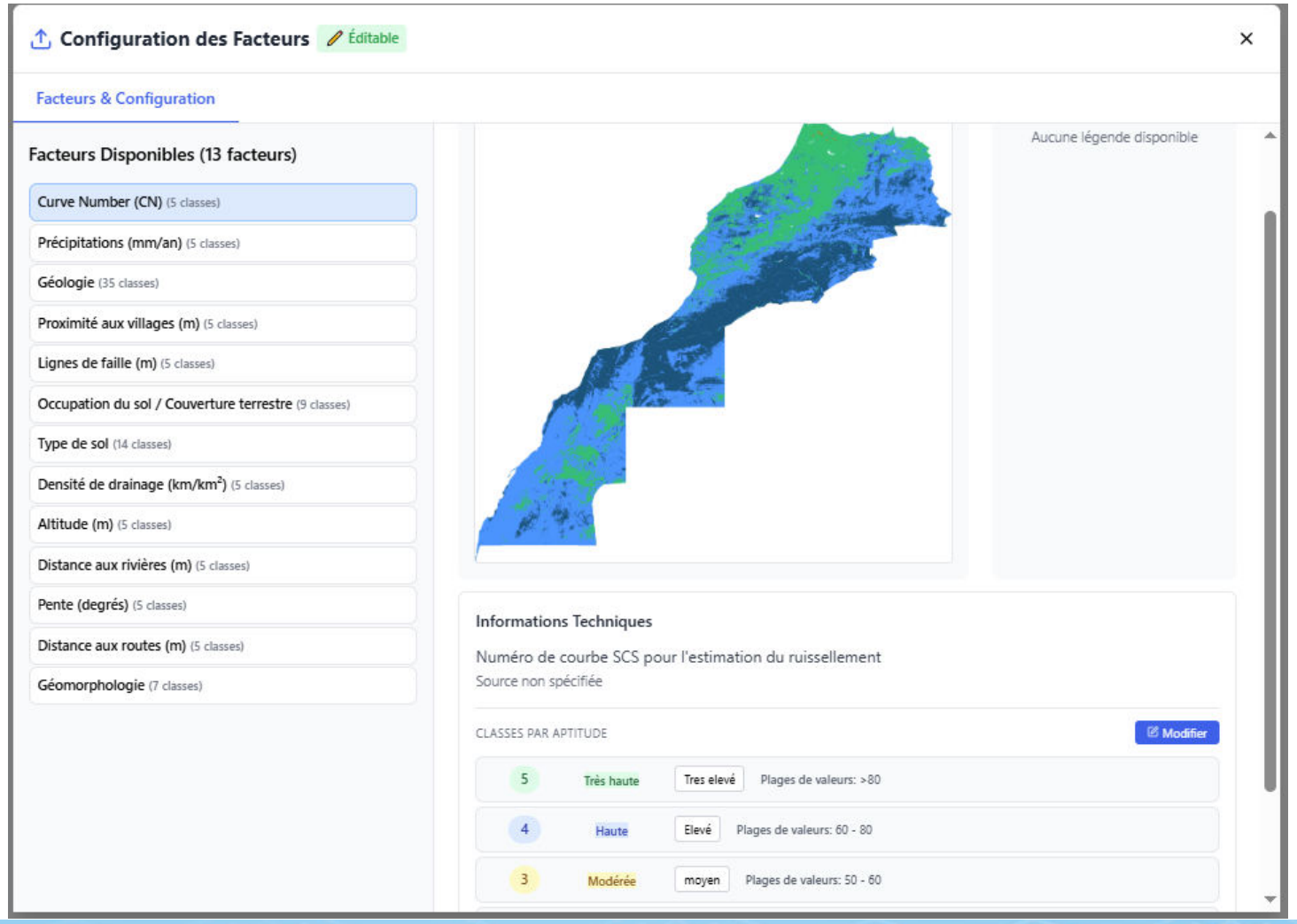
MCDM Module


Résultats - AHP Classique
← Retour à l'analyse
Fermer
Résumé de l'analyse
Méthode utilisée
AHP Classique
Facteurs analysés
9 facteurs
Statut
Cohérent
Poids des facteurs
Sauvegarder
Précipitations (mm/an) 23.3%
Pente (degrés) 18.8%
Densité de drainage (km/km²) 13.0%
Curve Number (CN) 7.1%
Distance aux rivières (m) 7.1%
Lignes de faille (m) 7.1%
Géologie 6.7%
Géomorphologie 7.1%
Altitude (m) 9.8%
Vérification de cohérence
Ratio de cohérence (CR)
0.028
Acceptable (≤ 0.10)
Recommandation
La matrice de comparaison est cohérente. Les résultats sont fiables.
Actions
Sauvegarder la configuration
Exporter les résultats
Générer rapport PDF
Générer carte de suitabilité

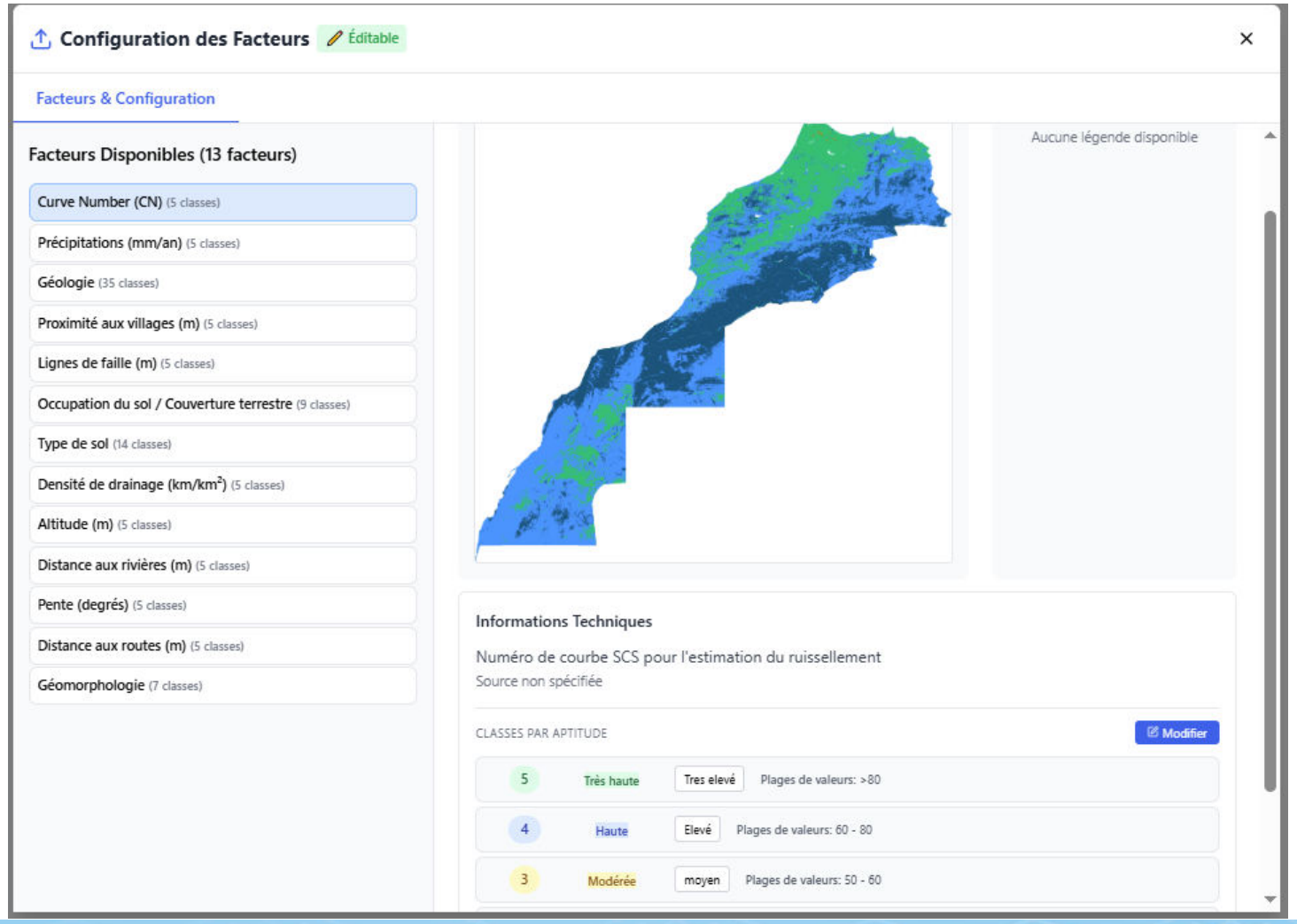
Machine Learning Module



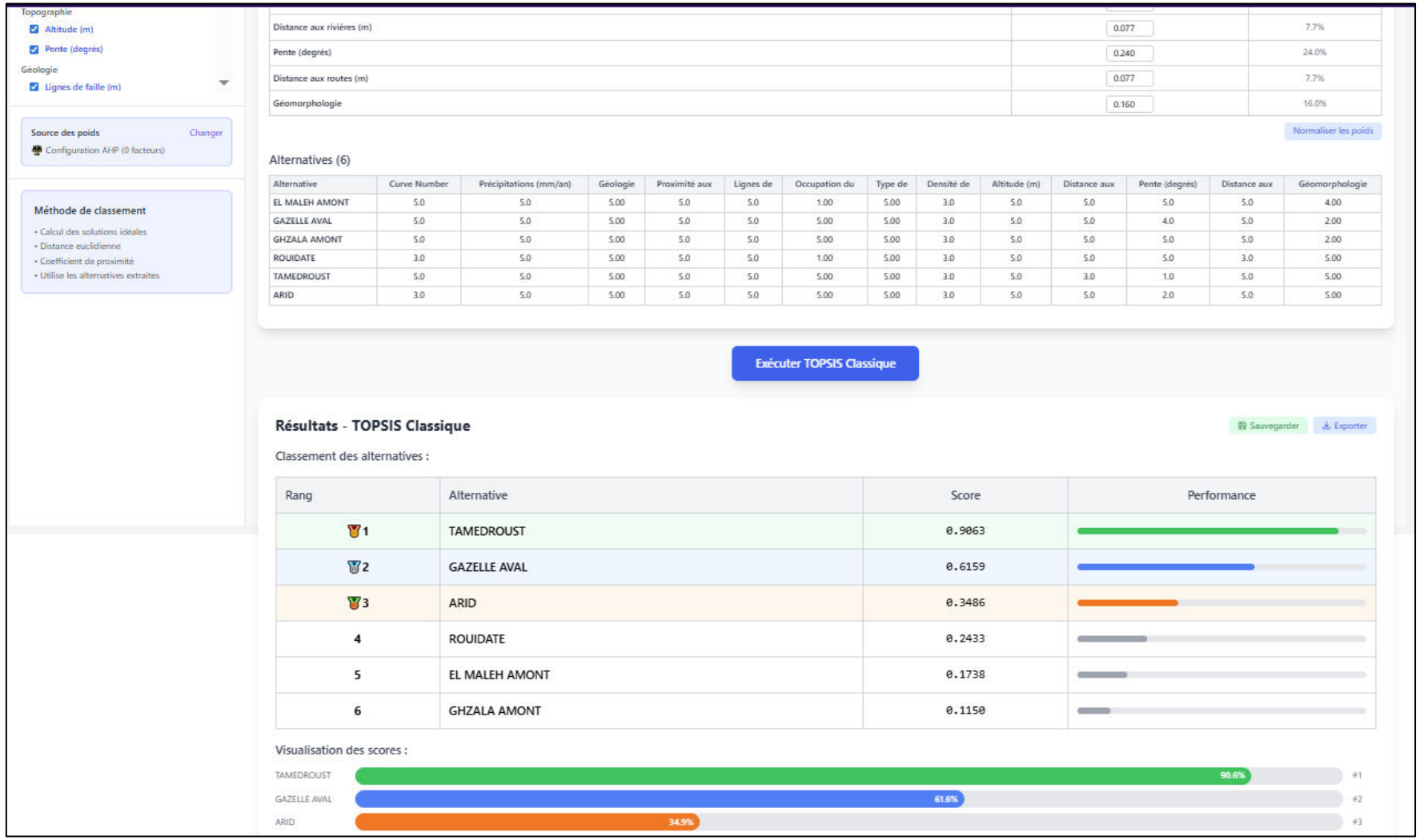
Factors configuration Module



Factors configuration Module



Dam site classification module



Dynamic factors module

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Dynamic Factors Calculator

← Retour

Sites de barrages (6)

Ajouter manuellement | Importer CSV | Exporter CSV

EL MALEH AMONT	-7.34254351	33.50551887	
GAZELLE AVAL	-7.24221961	33.71272309	
GHZALA AMONT	-7.24558813	33.71838084	
ROUIDATE	-6.96761453	33.73342322	

Facteurs dynamiques

Délimitation des BV

Axes de barrage interactifs (Tous modifiables)

Profils en travers (Extraction élévation)

Volume de la retenue | Hauteur de barrage

Longueur du barrage | Apport en eau

Calculer tout | Afficher dans la carte

Carte interactive

Couches géographiques:

Bassins versants ✓ | Réseau hydrographique ✓

Résultats de l'analyse

ID	Nom du site	Longitude	Latitude	Superficie (km²)	Volume retenue max (m³)	Largeur (m)	Hauteur (m)	Apport d'eau (m³/s)
1	EL MALEH AMONT	-7.342544	33.505519	1960.00	-	-	-	-
2	GAZELLE AVAL	-7.242220	33.712723	46.90	-	-	-	-

Conclusions & Perspectives

- **A Significant Advancement:** "Fast Dam Sitting" represents an innovative, data-driven decision-support system for hydro-infrastructure planning.
- **Climate Adaptation:** The tool is perfectly aligned with the need for **decentralized** water storage solutions.
- **Proven & Adaptable:** The framework's demonstrated efficacy and inherent flexibility suggest **considerable potential for application in other water-stressed regions globally.**
- **Final Message:** A direct contribution to sustainable water resource management under increasing environmental uncertainty.
- **Next Steps:** Integration with real-time hydrological datasets; policy and planning adoption.

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Thank you!

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