



# 2026 RESILIENCE LEARNING MONTH

KNOWLEDGE SHARING  
AND LEARNING EVENTS  
23 APRIL–7 MAY 2026

## Turning Data into Action: How Risk Information Systems Improve Disaster Resilience and Investment Decisions

28 April 2026 | 2:00-3:30 p.m. (Manila)

Virtual via Teams MEETING ID: 424 748 073 690 59 | PASSCODE: Zd6XE7kL

The session will focus on the importance of reliable risk information for resilient infrastructure and disaster loss reduction, highlighting the role of Risk Information Systems like the National Disaster Risk Information Systems being developed in Armenia with ADB support. Participants will learn about the fundamentals and key data sources of risk information systems, as well as practical applications in disaster risk management and infrastructure planning. Designed as an interactive learning exchange, it aims to demonstrate how improved risk data drives evidence-based policies, cross-sector coordination, and climate- and disaster-resilient investments for professionals in related fields.



### SPEAKERS



**ARTAK PIROYAN**

Head of the Chair of Cartography and  
Geodesy, Department of Geography  
and Geology, Yerevan State University



**YEVA DANIELYAN**

Project Assistant,  
ARRM



MODERATOR

**ALEKSANDR ARAKELYAN**  
Disaster Risk Management  
Officer, CCSD, ARRM

ADB



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# Event Agenda

Time	Topic/Activity	Speaker
2:00 - 2:05 pm	Introduction of session objectives and speakers	Aleksandr Arakelyan (Moderator)
2:05 – 2:30 pm	Risk information role in investment planning and disaster resilience: lessons learnt from 2024 floods in Northern Armenia, best practices and current work in Armenia	Aleksandr Arakelyan
2:30 – 2:55 pm	Case study: disaster risk assessment for major roads in Armenia to support the development of Transport Sector Adaptation Plan	Yeva Danielyan
2:55 – 3:20 pm	Advancements in geospatial analysis and AI for disaster risk management in Armenia	Artak Piloyan
3:20 – 3:30 pm	Q&A, discussion, closing	Aleksandr Arakelyan



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# Session Objectives

Introduce the real value of **data for disaster risk management** and fundamentals of risk information systems (RIS).

Show how risk data can support **better policy and investment decisions**.

Share lessons from recent flood events in Armenia and **ADB's ongoing work on NDRIS development**.

Highlight the role of **geospatial science for DRM**.

Present ADB's work in building **transport sector resilience** to natural hazards.

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MODERATOR

**Aleksandr Arakelyan, PhD**

Disaster Risk Management Officer,  
ARRM/CCSD



# Why This Topic Matters

- Disaster and climate risks are increasing, but decision-making is still constrained by fragmented and inaccessible data.
- Disaster risk is shaped by hazards, exposure, and vulnerability, which means DRM is fundamentally a data-driven discipline.
- Climate change, urbanization, and interconnected infrastructure systems are increasing uncertainty and amplifying the cost of information gaps.
- Better risk information is essential for resilient planning, infrastructure design, preparedness, and investment prioritization.



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## Disaster Risk Management as a Data-Driven Discipline

- Reliable data underpins the full disaster management cycle: risk assessment, early warning, response, and recovery.
- Cross-sector decisions in transport, energy, water, urban development, and agriculture depend on usable risk information.
- Data-driven approaches help institutions shift from reactive crisis management toward proactive risk reduction and resilience.

# What Data Is Needed for Effective Disaster Management

## Hazard Data

- defines the probability, intensity, and geographic extent of natural events like floods and earthquakes.

## Exposure Data

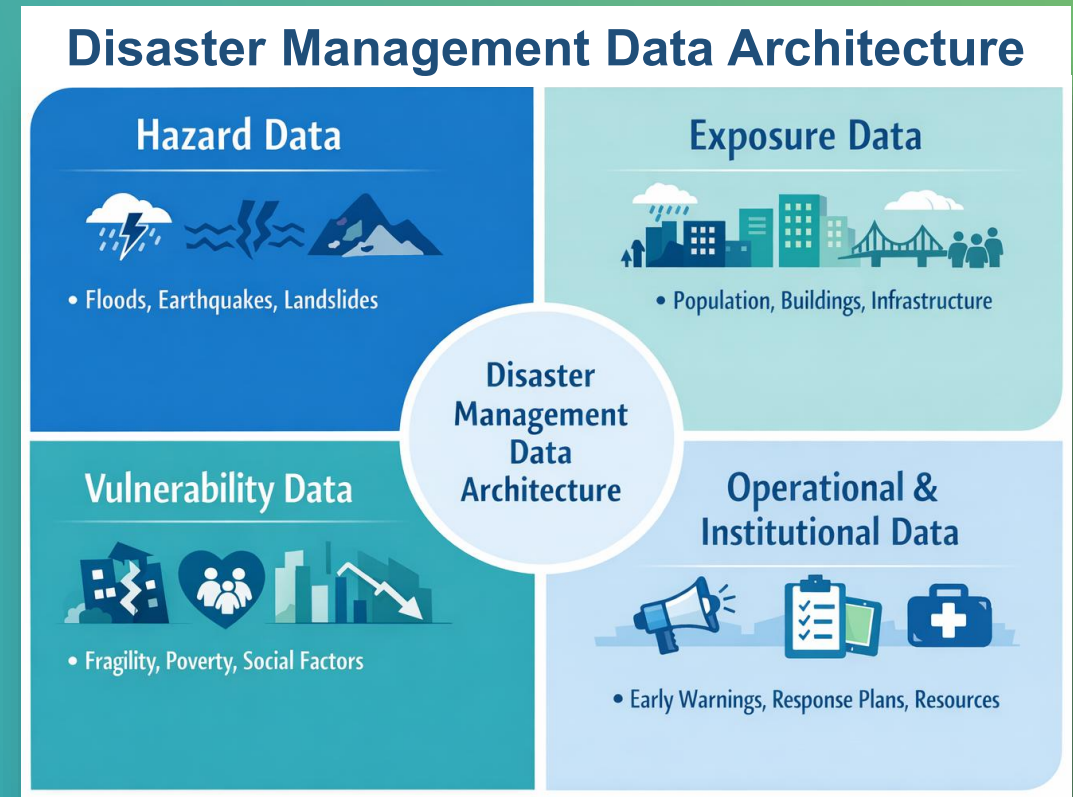
- identifies people, buildings, and assets located in hazard-prone areas and needs frequent updates.

## Vulnerability Data

- assesses physical and social factors affecting how hazards impact exposed elements.

## Operational and Institutional Data

- includes early warnings, evacuation routes, shelters, and response capacity for disaster management.



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# Geospatial Data Sources and Tools for DRM

- Key sources include satellite imagery, topographic and cadastral layers, hydrometeorological observations, infrastructure inventories, and socioeconomic datasets.
- Key tools include GIS platforms, hazard modelling, remote sensing for extent and damage mapping, dashboards, and field validation.
- The real value comes from integrating these sources and tools into operational workflows that support decisions.



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## Question:

In your sector, what type of information is most often missing when important investment or resilience decisions are made?

*Select one option*

- Hazard maps / hazard data
- Exposure or asset inventory data
- Vulnerability or fragility data
- Early warning or forecast information
- Institutional or operational information



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# Risk Information and Investment Planning

Why risk information matters for public investment  
and why it still often fails to shape choices

# Why Risk Information Matters for Public Investment

## Why it matters

- Prevents investments in hazardous locations or to insufficient design standards.
- Improves project screening, cost-benefit analysis, asset management, and climate adaptation planning.
- Helps allocate limited public resources where resilience gains are greatest.

## Typical gaps in practice

- Risk assessments are often produced as standalone studies, not embedded in planning and budgeting processes.
- National data may be too coarse for project-level decisions, while local data may be incomplete or inconsistent.
- Political, budget, and institutional incentives often outweigh risk reduction incentives.



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# Understanding Risk Information Systems

From datasets to decisions, and why risk information often fails to inform action

# From Data to Action

- Data alone does not reduce risk; value is created when data supports risk understanding, prioritization, planning, and action.
- A risk information system is not just a database. It combines datasets, analytics, visualization tools, and institutional processes.
- A useful system helps answer practical questions: where are the hotspots, which assets are most exposed, and what should be prioritized first?



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# Why Risk Information Often Fails and What Good RIS Requires

## Common failure points

- Data fragmentation across agencies and incompatible standards.
- Mismatch between technical outputs and decision-maker needs.
- Weak ownership, maintenance, and long-term sustainability.
- Poor communication of risk information to non-technical audiences.

## Core building blocks

- Clear governance and ownership.
- Common standards and interoperability.
- Multi-source data architecture.
- Analytics and usability tailored to real users.
- Sustainability through regular updating and institutional embedding.



# Who Uses Risk Information Systems?



## Government agencies

- Planning
- DRM
- Emergency management
- Public investment



## Infrastructure sectors

- Asset management
- Resilience design



## Development partners

- project screening
- climate proofing
- prioritization




## Universities and researchers

- Hazard modeling
- Spatial analytics
- Innovation

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# Case Study: The 2024 Floods in Northern Armenia

A real-world stress test of information, preparedness, and institutional coordination

# Transitioning from Theory to Practice



## Real-World Case Study

The 2024 floods in Northern Armenia provide insight into how risk information systems operate under stress.

## Challenges in Mountainous Regions

Armenia's experience highlights issues like aging infrastructure, poor land use planning, evolving climate risks common to many DMCs.

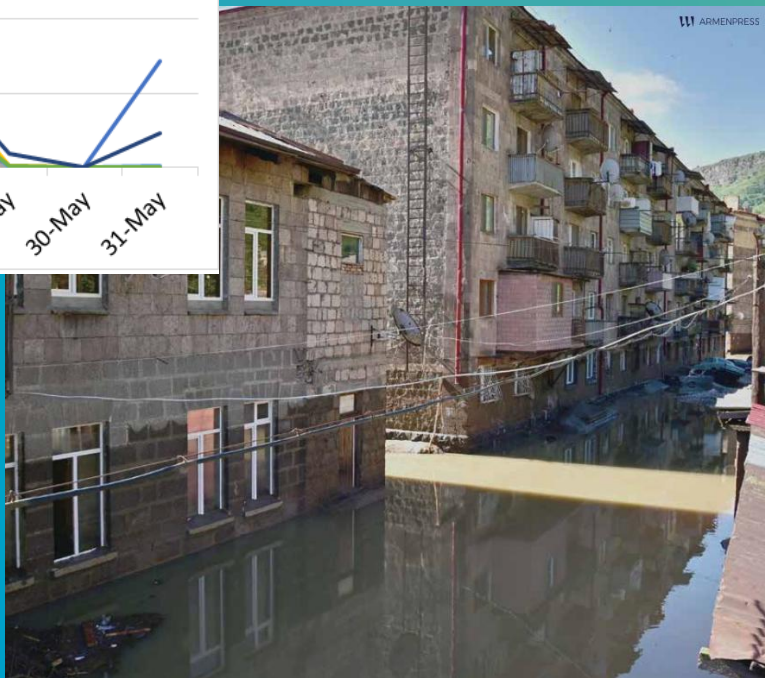
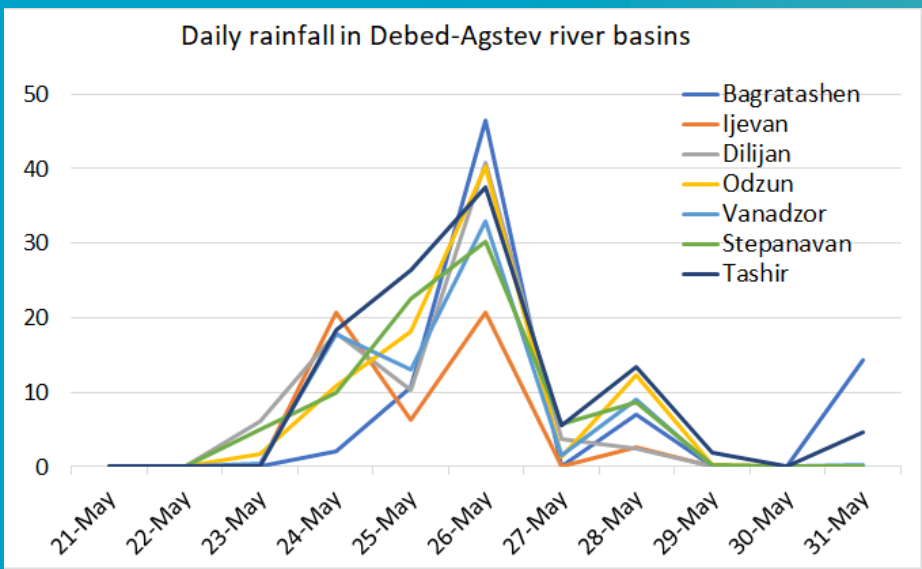
## Learning from Information Gaps

Gaps in information availability, inefficient data management, and inter-institutional collaboration has limited effective disaster response and planning.

## Supporting Resilience Investments

Insights from this case study can guide development partners on strengthening data systems for disaster management and investment planning.

# Overview of the 2024 Flood Event



## Flood Causes and Conditions

- Intense prolonged basin-wide rainfall and river overflow caused severe flooding on 25–26 May 2024.
- Local hydraulic conditions and saturated soils increased impacts even at lower discharges.
- Debed basin experienced a >100-year return period rainfall event.
- Sediment transport and debris significantly amplified damage.

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# Lori Floods – Damage and Losses

- Total damage estimated at approximately USD 49 million.
- Total economic losses estimated at approximately USD 33 million.
- Floods caused **transport disruptions and utility damage**, affecting connectivity and increasing recovery costs for communities.
- Significant impacts on **transport housing, agriculture, business, and environment**.



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# Information Management Challenges

## Early Warning and Emergency Response

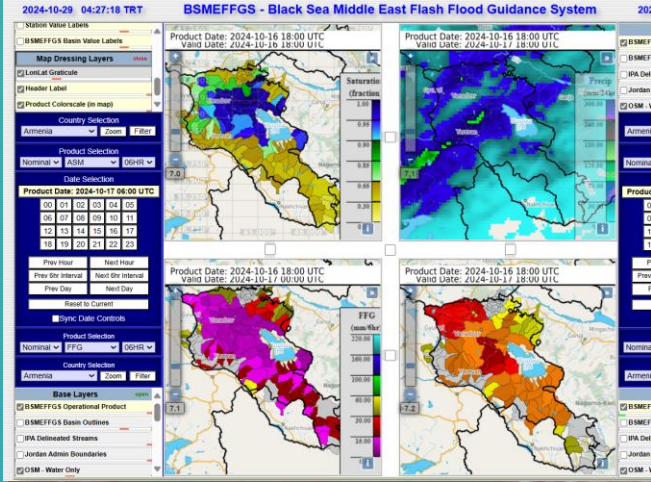
Early warning systems provided forecasts but translating them into actionable local guidance remained difficult. Response efforts faced challenges with access, coordination, and information flow during the flood event.

## Data and Information Gaps

Incomplete exposure and vulnerability data complicated damage assessments and slowed recovery efforts after the floods.

## Need for Integrated Systems

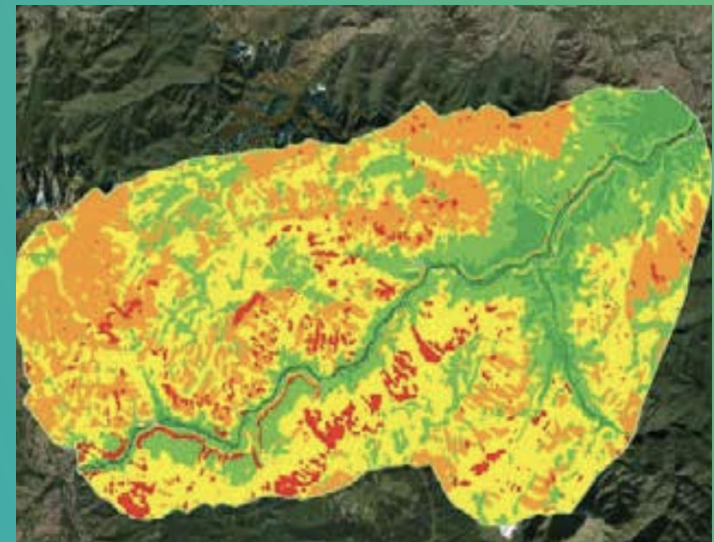
The event highlighted vulnerabilities in preparedness and gaps in risk information use before and during flooding. Integrated risk information systems are essential to reduce delays, improve recovery, and support affected communities effectively.



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# Recommendations for Better Flood Management

- Modernize hydrometeorological monitoring and forecasting systems (real-time data, high-altitude observations).
- Strengthen early warning and risk communication (translate to actionable alerts).
- Develop flood hazard and risk maps and integrated risk databases to support land-use planning.
- Improve infrastructure design, maintenance, and river management.
- Strengthen institutional coordination and data sharing.
- Establish unified disaster risk information system which would support preparedness, early warning, and response for similar events.



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## Question:

Based on the 2024 floods in Northern Armenia, what was the single biggest gap exposed?

*Choose the option that best reflects your view*

- Early warning and risk communication
- Infrastructure design and maintenance
- Land-use planning and construction control
- Risk data integration across institutions
- Local preparedness and community capacity



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# ALTER in Armenia: From Dam-Failure Risk Analysis to Local Preparedness

## Why this case matters

- ALTER addressed flood risks associated with water reservoir and mine tailings dam failures in Armenia.
- Pilot areas included Southern and Northern mining areas in Armenia.
- The project combined risk modelling, GIS analysis, WebGIS, monitoring and alerting, local planning, and exercises.
- It demonstrated that risk information becomes valuable when it supports preparedness, coordination, and practical decisions.

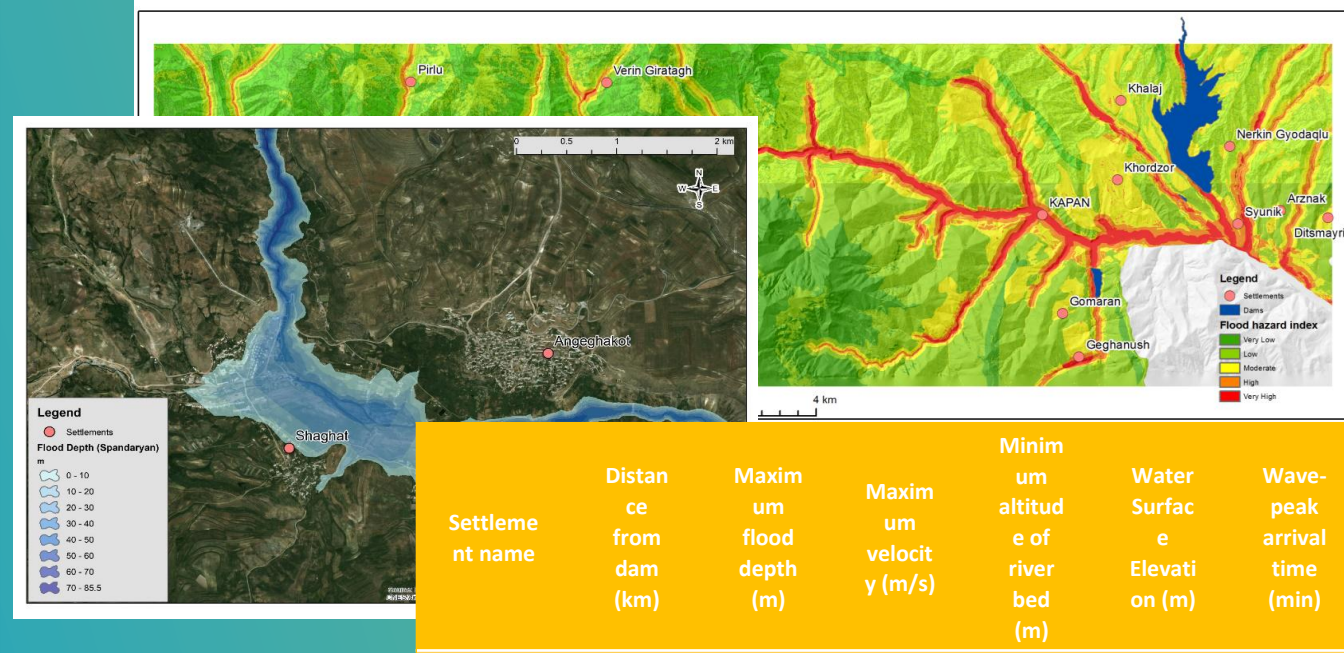


## ALTER in one view

Pilot areas → risk analysis and  
WebGIS → preparedness and  
partnerships

# ALTER Technical Outputs: Modelling, Mapping, and WebGIS

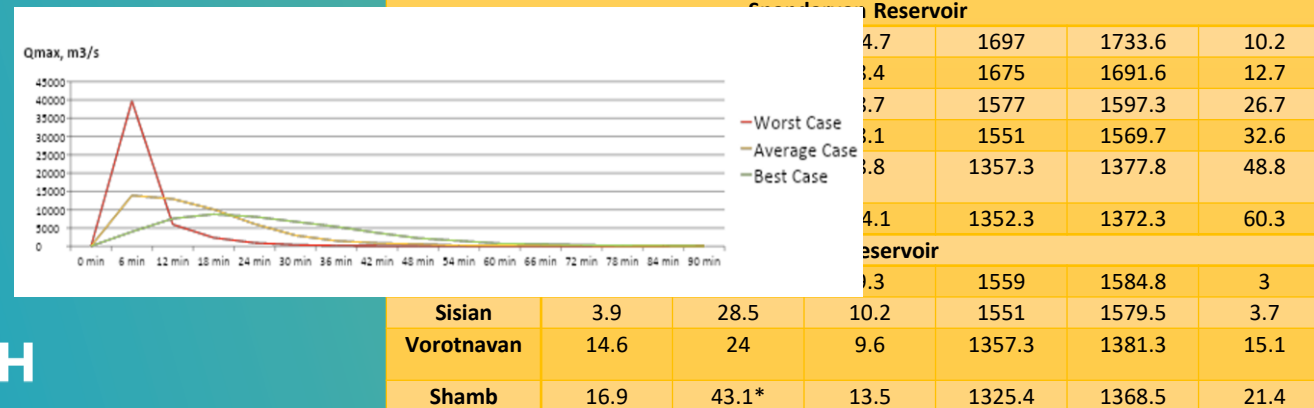
- Dam-break flood modelling was carried out for Geghi Reservoir, Geghanoush TSF, and the Vorotan Cascade dams.
- Outputs were translated into maps, GIS layers, flood characteristics tables, and summary products for downstream settlements.
- The analysis used HEC-RAS and Volna 2.0 for dam-break calculations and ArcGIS for flood extent and depth mapping.
- Results were prepared for full-failure, half-failure, and 10% failure scenarios and made available through an ALTER WebGIS platform.



## Geghi Reservoir – full failure example

Wave-peak arrival: ~3.4 min at Kavchut; ~27 min at Kapan

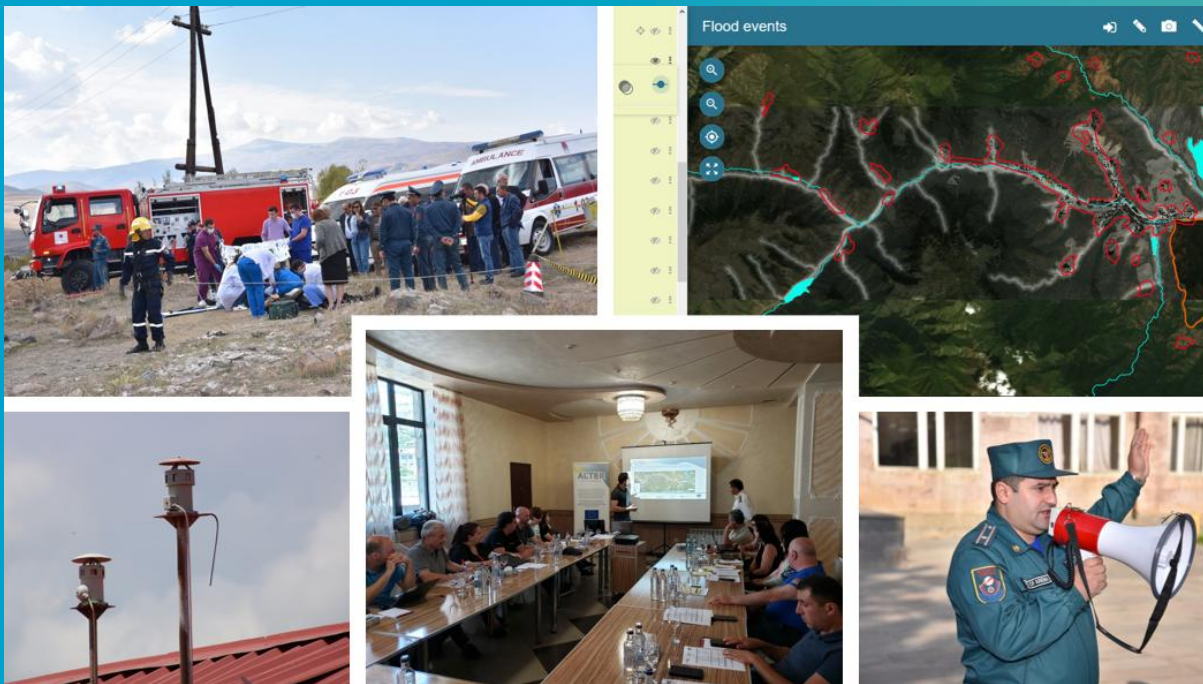
Maximum flood depth:  
~12.5 m at Kavchut; ~8.3 m at Kapan



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# ALTER's Legacy: Why It Matters for RIS




- ALTER linked risk analysis with monitoring and warning, including an early-warning system at Geghi dam and alerting installations in Sisian.
- It supported local disaster preparedness and response planning in Kapan, Sisian, and Akhtala through tabletop and field exercises.
- The project directly involved over 1,000 participants, trained more than 300 people, and implemented field exercises involving more than 1,300 participants.
- It also supported public-private partnership agreements, showing that institutional coordination is essential for sustained use of risk information.

## Key lesson

Risk information creates the most value when it is connected to institutions, operational procedures, and sustained data access - not only to technical modelling.

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The illustration depicts a professional meeting in a control room or office. In the foreground, three people are seated at a desk with multiple computer monitors. One monitor displays a bar chart with an upward-pointing arrow. In the background, a man in a dark suit and red tie stands, pointing towards a large screen. The screen shows a bar chart with a downward arrow and a yellow bar. Above the screen, there are several icons: a map of Australia with a blue line graph, a warning triangle with a red exclamation mark, a stack of four brown cylinders representing data, and three yellow person icons. The overall color scheme is dark blue with accents of brown, yellow, and red.

# **ADB's Ongoing Support in Building the National Disaster Risk Information System (NDRIS)**

# ADB's Ongoing Work on NDRIS

## Current problem

- Armenia faces major risk from earthquakes, floods, landslides, and other hazards.
- Risk data, models, and asset information are fragmented across institutions.
- Datasets are stored in different systems and formats, with inconsistent metadata and limited interoperability.
- Systems often focus too much on technology and too little on user needs.

## What NDRIS changes

- Creates one web-based multi-hazard platform for hazard, exposure, vulnerability, and risk data and models.
- Standardizes integration, analytics, dashboards, and reporting, with interoperability with the National Geoportal.
- Supports preparedness, emergency planning, investment prioritization, and monitoring of risk reduction outcomes.
- Provides a scalable digital foundation for future hazards and sectors.



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# What the system is

## NDRIS concept

- A national web-GIS platform owned and coordinated by the Ministry of Internal Affairs.
- **Initial hazard modules:** seismic, flood, and landslide (to be expanded).
- **Initial priority sectors:** education, health, transport, water, and other critical public infrastructure (to be expanded).
- **Main information layers:** hazard data, exposure inventories, vulnerability attributes, risk analytics, dashboards, and reports.
- Designed for **interoperability, transparency, and future expansion.**



**Consolidated risk-relevant datasets** in one interoperable environment.  
**Maps and dashboards** for visualizing risks and hotspots.  
**Analytics** to support prioritization and scenario-based decisions.  
**Cross-sector applications** for DRM, planning, infrastructure, and local government.  
**Accessible outputs** for both technical and non-technical users.

# NDRIS Use Cases: What the System Enables

## **Multi-hazard risk assessment**

Integrated assessment across hazards, sectors, and geographies.

## **Risk-informed investment planning**

Prioritization of resilience investments and appraisal support.

## **Preparedness and response**

Scenario-based emergency planning and response needs versus capacities.

## **Financial risk management**

Fiscal exposure, annualized losses, and support for disaster risk financing.

## **Risk communication**

Dashboards, public awareness, and consistent national messaging.



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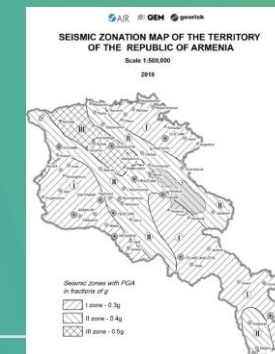
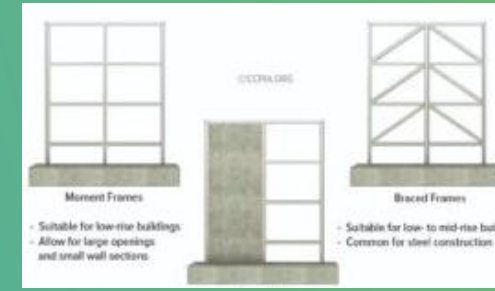
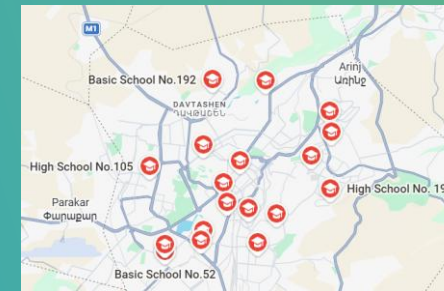
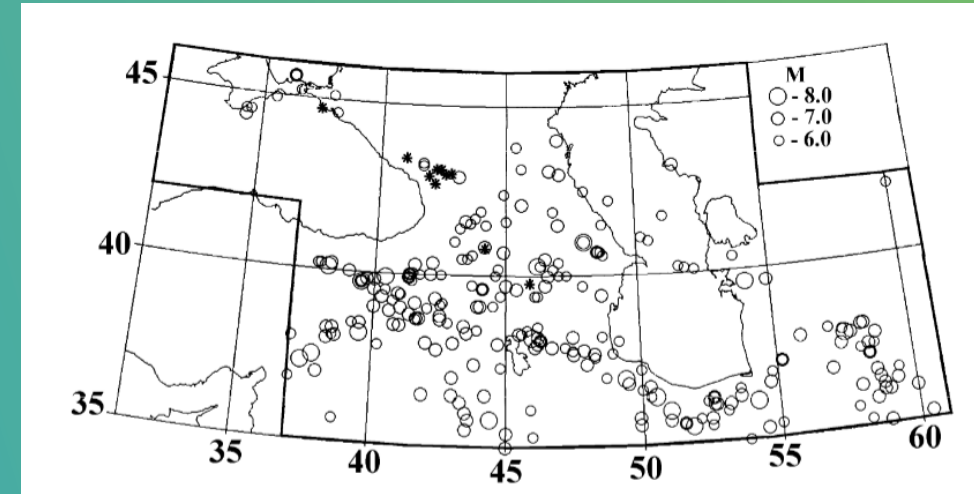
# Use case: Multi-Hazard Risk Assessment

## Objectives

- Assess disaster risk across **seismic, flood, and landslide hazards** within a unified national framework.
- Support preparedness, emergency planning, and resilience actions.
- Provide a **consistent national risk baseline** across hazards, sectors, and geographies.
- Enable scenario-based analysis for individual events and long-term risk planning.

## Required data

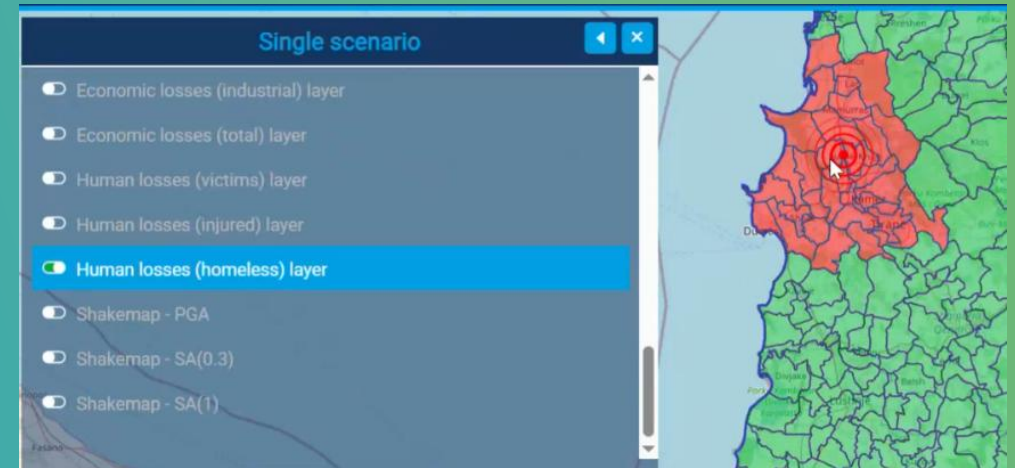
- Seismic, hydrological, and geological hazard models and datasets.
- Exposure inventories for buildings, infrastructure, and population.
- Vulnerability attributes of exposed assets.
- Base layers and national geospatial datasets.
- Interoperable institutional data flows and regular updates.



# Expected Results from Multi-Hazard Risk Analytics

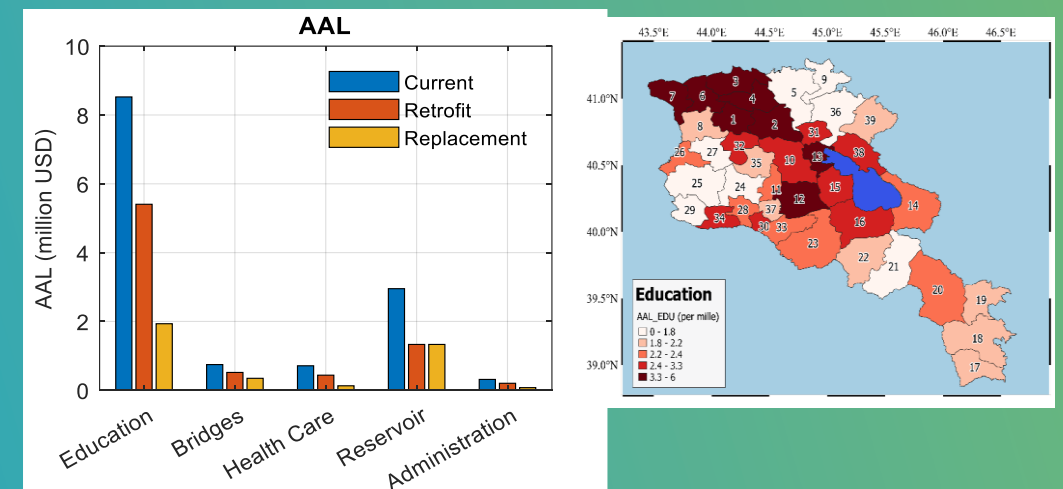
## For a single event scenarios:

- Expected damage to buildings and infrastructure.
- Expected affected population, fatalities, injuries, displacement, and service disruptions.
- Emergency response needs versus available capacities.



## For national-scale risk management:

- Average annual losses by hazard, sector, and region.
- Spatial distribution of risk hotspots.
- Prioritization of risk reduction and resilience investments.
- Cost-benefit analysis of risk reduction and mitigation options.



# Use Case: Financial Risk Management

## What NDRIS enables:

- Quantifies government exposure to disaster-related losses.
- Estimates fiscal impacts under different disaster scenarios.
- Supports annual budgeting and medium-term expenditure planning.
- Helps assess contingent liabilities and sovereign disaster risk exposure.
- Provides analytical basis for disaster risk financing and risk transfer options.

## Why this matters:

- Disaster losses are not only humanitarian and physical - they also create fiscal pressure.
- NDRIS can help translate hazard and risk information into actionable financial planning inputs for government.



## Financial Risk Management

# Use Case: Risk Communication

## What NDRIS enables:

- Transforms complex risk information into clear, decision-ready dashboards and maps.
- Supports rapid briefings for senior government leadership and councils.
- Facilitates consistent communication across ministries and agencies.
- Provides authoritative risk information for public awareness and preparedness.
- Strengthens risk literacy and shared understanding of disaster risk.

## Why this matters:

- Better decisions depend not only on analytics, but also on the ability to communicate risk clearly and consistently.
- NDRIS can provide one trusted national reference point for disaster risk information.



## Risk Communication

# Institutional Arrangement

## Ministry of Internal Affairs

- System owner and national coordinator; leadership, governance, and sustainability

## Information Systems Agency / State Cadastre / digital authorities

- National IT standards, interoperability (incl. with the National Geoportal), hosting approach, and cybersecurity support

## Sectoral and scientific institutions (NSSP, Armhydromet, IGS and others)

- Hazard models, scientific validation, asset data, calibration, and periodic updates

## ADB technical assistance

- Project implementation support, quality assurance, and implementation coordination



# Lessons and Implications

What Armenia's experience suggests for stronger risk information systems and future investment planning



# Lessons for Risk Information Systems



- **Integration matters:** linking hazard monitoring with exposure and vulnerability data improves preparedness and response.
- **Usability matters:** information must be tailored to the needs of different users, from planners to responders.
- **Institutional arrangements matter as much as technology:** clear roles, data sharing, and sustainable funding are essential.
- **Post-disaster analysis** should feed back into better data, models, and preparedness.

# Implications for Future Investment Planning



- **Risk information should be embedded** early and systematically in project identification, design, appraisal, and portfolio management.
- **Development partners** can support harmonized data standards, capacity building, and institutional reforms that promote risk-informed choices.
- **Advances in technology** can improve timeliness and granularity, but they must be matched by investments in governance, skills, and user engagement.
- **Better data** leads to better decisions only when it is embedded in systems designed to support real-world choices.

**Investing in risk information systems is not a parallel activity.  
It is a foundational enabler of resilient development.**

## Question:

**What would make risk information most usable for DMC ministries, sectors, and local governments?**

*Select the most important factor*

- Better access to data
- Better data quality and regular updating
- Better visualization and dashboards
- Better inter-agency coordination
- Better technical capacity and training
- Stronger links to investment and planning processes

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