From AI Prediction to Local Action

Building Decision-Ready Intelligence for Disaster Resilience

KEYNOTE SPEECH · IDRLF 2026

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Theme: Translating locally-led resilience into action

IDRLF 2026 | Why this talk matters

The forum question is operational, not just technological

- The goal is to turn locally led resilience into real action.
- In disaster management, technology alone is not enough.
- AI should help officials understand risks, issue warnings, make decisions, and respond quickly.
- Rather than focusing only on the AI technology itself, it is important to focus more on how AI can actually be used in real disaster-response situations.

The purpose is not to celebrate AI itself.
It is to show how AI can become useful local action.

Core message

AI itself does not create resilience.

AI creates resilience only when information becomes a decision, and a decision becomes action.

Data multisource observations → **Intelligence** risk understanding → **Decision** priorities & options → **Action** response & warning → **Resilience** safer communities

Disaster becomes more complex

Complex disasters are not isolated events

- Disasters cascade through infrastructure, services and communities.
- Rainfall becomes runoff, river overflow, landslides and urban inundation.
- A damaged bridge becomes traffic delay, delayed rescue and supply disruption.
- This is what we mean by cascading risk.
- Disaster AI needs to understand not only individual events, but also how those events are connected to each other.

Hazard → Infrastructure → Mobility → People → Response

Before disaster AI: understand the nature of AI

General AI succeeds because examples are abundant

Most AI systems learn patterns from many examples of the world.

In ordinary situations, data are repeated, diverse and relatively easy to collect.

AI model
learns common patterns

General situation
future cases often resemble past examples

Many normal examples

Key message
- **AI needs examples.**
- **The quality, diversity and relevance of training data determine whether AI can be trusted.**

The disaster-data paradox

The most important situations are often the least observed

Disaster AI must explain abnormal, rare and fast-changing situations.

- Disaster situations such as flood, landslide, fire are difficult to collect repeatedly.
- They are short-lived, unsafe, local and highly variable.

Normal data
abundant · repeated · well labeled

Disaster data
rare · incomplete · biased · time-critical

Therefore
- Disaster AI cannot depend on one sensor or one dataset.
- It needs multiple observations of the same event.

One disaster, many viewpoints

Robust disaster AI needs multi-perspective evidence

When a disaster happens, no single sensor can describe the full situation.

We need to observe the same event from space, air, street, vehicle, camera and citizen level.

Satellite
regional footprint

Aircraft
wide-area damage

Drone
local detail

CCTV
continuous change

Ground vehicle
street geometry

Smartphone
field evidence

Operational goal

Turn fragmented views into one shared picture for decision-makers.

Even with good data and good predictions, there is still one more problem.

Prediction ≠ Decision Making

A flood-depth forecast is valuable only when it changes what people do next.

Local governments do not need more predictions.

- They need better decisions: which road to close, where to evacuate, what to inspect, and what to prioritize in the next 30 minutes.

Last-Mile AI Gap

The gap between AI capability and operational action

Last-Mile AI Gap

Research → Prototype → Pilot project → Operational integration → Local-government use

- Many AI projects are scientifically strong but institutionally weak.
- Some of the hardest problems in disaster AI are not really AI problems at all.

Key framework

Decision-ready intelligence: intelligence that can be used directly to support decision-making

Data — multisource observations → **Intelligence** — risk understanding → **Decision** — priorities & options → **Action** — response & warnings → **Resilience** — safer communities

Should provide

Should increase

A resilient AI system must complete the chain, not stop at model output.

01

OBSERVE

First task is creating a real-time picture of risk situation.

Observe | Multi-scale sensing

Disaster situations need to be observed at multiple spatial scales.

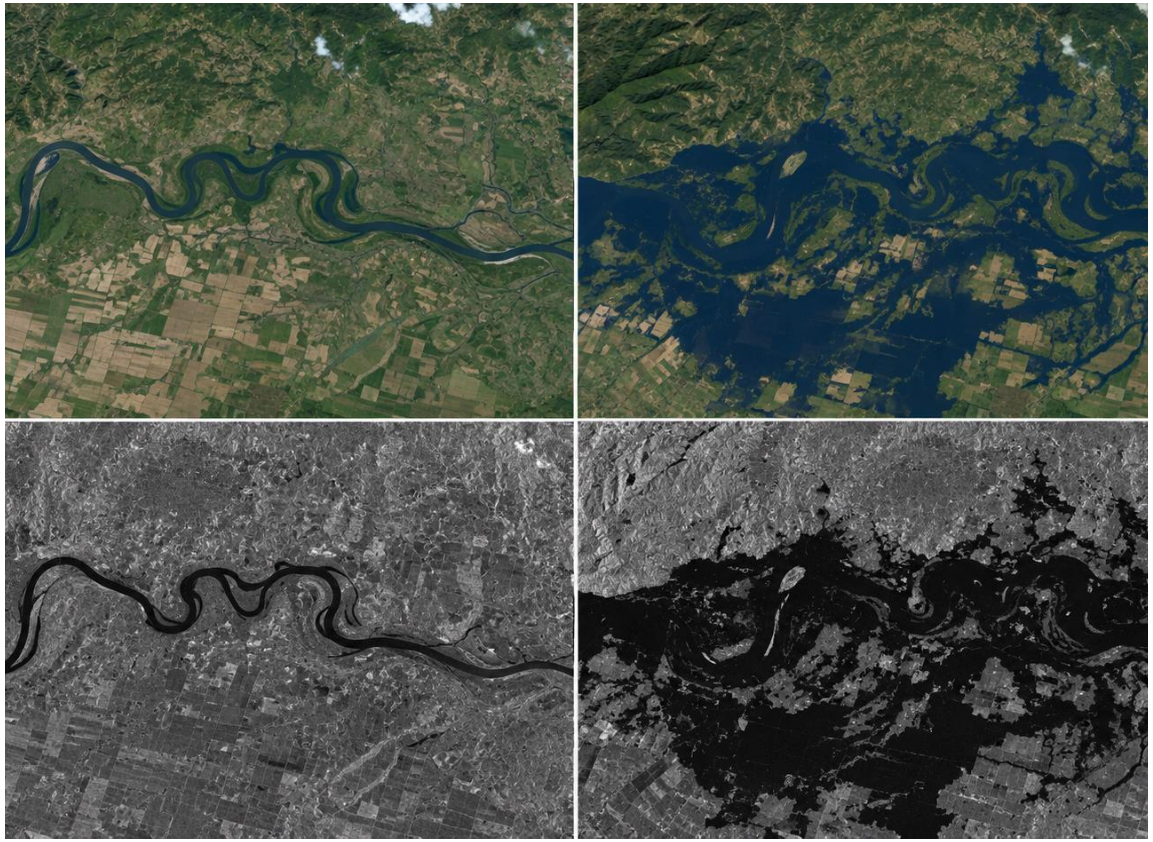
Macro	**Satellite / aircraft**	Where is the regional footprint?
Meso	**UAV / ground vehicle**	What is damaged locally?
Micro	**CCTV / smartphone**	What is changing now?
Dynamic	**Rainfall / water gauges / IoT**	How fast is risk evolving?

Operational challenge: align space, time, semantics and uncertainty across sensors.

Observe | Satellite AI

Wide-area flood awareness in severe weather

- SAR is valuable because flood events often occur under clouds and heavy rain.
- Regional overview when ground reports are delayed or incomplete.
- Rapid flood extent extraction over large areas.
- Useful for river, agricultural and peri-urban flooding.



Practical direction

Combine SAR, DEM, drainage logic and AI extraction to reduce operational confusion.

Observe | Terrain-aware mapping

Topography-aware SAR flood mapping

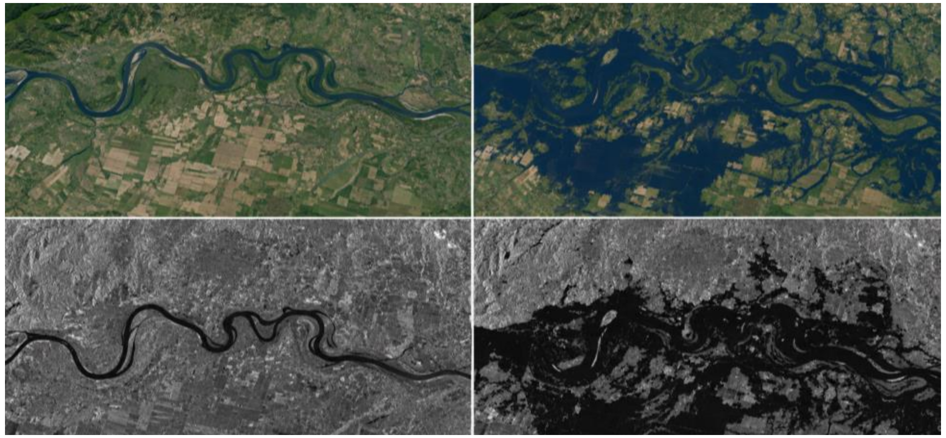
AI-derived masks become useful when constrained by physical and terrain logic.

SAR image
signal under clouds

Baseline AI mask
fast extraction

Terrain & drainage logic
remove implausible areas

Operational flood map
more credible action map



Observe | Drone and 3D mapping

Drones and smartphones fill local observation gaps

- They provide detail that fixed sensors or satellites may miss.
- Rapid mapping of blocked roads, damaged buildings and inundated zones.
- 3D reconstruction supports situational awareness and recovery planning.

Operational message

AI must connect the physical world and the decision world.

Observe | Smart frame selection

Video is abundant; useful evidence is sparse

- AI can select frames that improve mapping, not merely reduce data volume.

Video stream
large volume

Quality / overlap scoring
AI evaluates usable frames

Key-frame selection
keep mapping-ready frames

3D mapping / analysis
improve reconstruction and review

Value: better image geometry, more stable reconstruction, less manual review.

Observe | CCTV as disaster sensor

CCTV can become a real-time disaster sensor

- Existing city infrastructure can be converted into operational intelligence.
- Detection → boundary → water level → road closure / warning.
- Especially useful in underpasses, roads, streams and low-lying urban zones.

Key insight

Existing urban infrastructure can be utilized as intelligent disaster infrastructure without installing completely new systems.

Observe | Pixels to physical meaning

Pixel-level AI must be projected into the physical world

Water segmentation (AI) becomes operational only when linked to geometry, elevation and location.

CCTV frame
visual evidence

AI segmentation
water / boundary

Geometry & elevation
project to scene

Operational meaning
depth, location, action zone

- Given the depth of water in this road section, we need to control traffic on this road.
- This is the process of translating pixel information from CCTV video into operational intelligence.

02

UNDERSTAND

From fragmented data to shared risk intelligence

Understand | Ontology and knowledge graph

AI must understand relationships, not only individual objects.

- It is not enough for AI to simply recognize individual objects; it must also understand the relationships between them.

Rainfall → River → Water level → Road / Bridge / Building → Population → Evacuation route

- By clearly expressing these relationships, data from different organizations can share the same semantic framework.
- This enhances data interoperability and helps AI reason about risks more structurally.
- In other words, shared meaning enables coordinated action.

Understand | AI-ready data

AI-ready data is a resilience asset

Ingest	Standardize	Georeference	Link	Validate	Share
collect from many sources	common formats & semantics	space and time alignment	cross-dataset relationships	quality control	reusable services

- **This kind of work may not look as glamorous as a brand-new AI model.**
- **It is actually crucial.**
- **Without a stable data pipeline, even a great AI system is likely to remain just a temporary pilot project.**

Understand | Local data foundation

- **Consequently, a reusable data foundation is essential at the local government level.**

- First, a physical network is required—comprising rivers, watersheds, monitoring stations, roads, and critical infrastructure.
- We then layer observational data on top, such as rainfall, water levels, CCTV feeds, IoT sensors, and field reports.
- Furthermore, we need metadata, ontologies, data lineage and provenance, and explicit relationships between data points.
- Ultimately, this information must be accessible via APIs, dashboards, and AI services.

- Local governments should not have to reinvent the wheel and rebuild their entire data infrastructure for every new AI project.
- What we need is a reusable foundation built for the long term.

03

DECIDE

From prediction AI to decision intelligence

The question must shift from 'What is going to happen?' to 'What should we do right now?'

Decide | From model output to action options

Local governments need decisions, not only predictions

Prediction AI

- “Water level may reach 0.8 m.”
- “Flood extent may expand in the next 2 hours.”
- Strong at estimating what may happen.

Decision AI

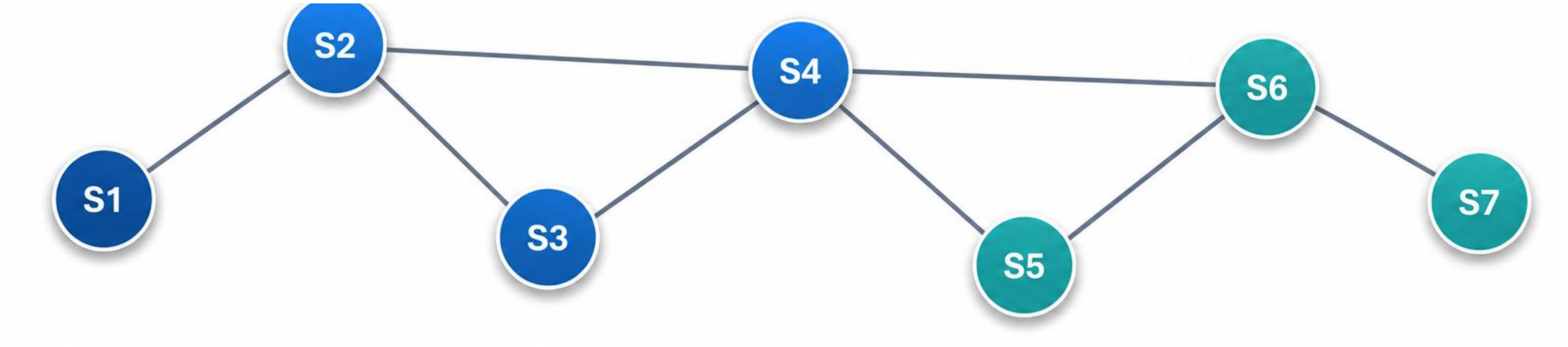
- Which road should we close first?
- Which neighborhood should receive warning first?
- Which bridge, hospital or shelter is exposed?
- What actions should we prioritize in the next 30 minutes?

- Therefore, prediction is still essential.
- However, an additional decision-making support stage is needed to connect prediction results to actual actions.

Decide | Network-aware prediction

Small-stream flooding is a great example of why network relationships are important.

- Rivers are inherently interconnected networks.
- What happens upstream affects downstream
- Analyzing each monitoring station independently can cause us to miss these critical relationships.



- In graph-based AI models, monitoring stations or river segments are represented as nodes, and river connections as links.
- Information can then flow along this network.
- This approach is especially useful in areas with a limited number of monitoring stations.

Decide | Multi-agent decision support

AI agents can organize evidence into decision workflows

Sensor agent

ingests observations

Forecast agent

runs predictive models

Knowledge agent

queries ontology / KG

Explanation agent

summarizes risk rationale

Report agent

prepares action brief

Agents should orchestrate data, models and explanations—not replace human authority.

04

ACT

- Disaster management is a critical decision-making environment that directly impacts human safety.
- Human-in-the-loop operation for accountable resilience

Act | Human-in-the-loop

High-stakes disaster AI must keep people accountable

AI recommends
risk assessment and options

Officials decide
situational judgment and accountability

Institutions act
warning, closure, evacuation, dispatch

Communities respond
protective action and recovery

- The fundamental principle is straightforward.
- AI recommends. Decision-makers decide. Agencies act. Communities respond.
- Accountability must ultimately rest with human operators and institutional frameworks.

Act | Cascading risk

AI can detect cascading risk earlier than reporting chains

The value increases when AI connects hazards, assets, routes and communities.

Flood forecast
hazard

Road exposure
mobility

Shelter accessibility
protection

Resource priority
Response action

Integrated framework - Summary

Local Disaster Intelligence Ecosystem

A practical architecture for translating AI into local resilience.

Physical world	people · buildings · roads · rivers
Observation	satellite · drone · CCTV · IoT
Disaster intelligence	AI · forecasting · digital twin · KG
Decision intelligence	priorities · scenarios · recommendations
Local action	warning · closure · evacuation · recovery

However, this entire system must be underpinned by governance, human judgment, and communities.

Five principles

Five principles for AI-enabled local resilience

1
we must start from decision-making, not technology.

2
we must connect data before building more AI.

3
we must evolve from simple prediction to decision support.

4
we must always keep humans in the decision-making loop

5
we must design systems from the beginning with real local government operations in mind

- **The system must be easy to understand, maintainable, cost-effective, and practically usable.**
- **To reiterate, many of the hardest problems are not purely technological.**
- **Governance, capacity, and sustainable operations are just as important as technology.**

Closing

From Prediction
to Decision
to Action
to Resilience

- **Our objective is not merely to build an AI-led disaster management framework.**
- **The ultimate aim is to foster safer, more resilient communities empowered by AI.**

Thank you