

**Online Workshop**

# The era of automation and artificial intelligence for DRR and climate resilience

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Department of Climate Technology Convergence

**12 - 14 May 2026**

14:30 - 18:00 Seoul, GMT+9

12:30 - 16:00 Bangkok, GMT+7

01:30 - 05:00 New York, GMT-5

**Joint Certificate Programme**



Photo from : The Malaysian Reserve

# “The advent of AI era”



# “What is the Role of AI”

# “AI for ALL” (A4A)

# AI for a CONNECTED SOCIETY: TRANSFORMING EVERY SECTOR

AI  
core

### AI-POWERED DIAGNOSIS

AI analyzes:  
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**TELEHEALTH:**  
PERSONALIZED DIAGNOSIS  
& PREVENTATIVE CARE

### SMART AGRICULTURE:

RESOURCE OPTIMIZATION  
& SUSTAINABLE FARMING

### IMMERSIVE LEARNING:

PERSONALIZED & ACCESSIBLE EDUCATION

Emotional Support

- Emotional Support
- Emotional Support
- Emotional Support
- Emotional Support

**EMPATHETIC COMPANIONSHIP:**  
REDUCING ISOLATION

### SMART MOBILITY:

SEAMLESS & INCLUSIVE PUBLIC TRANSPORT

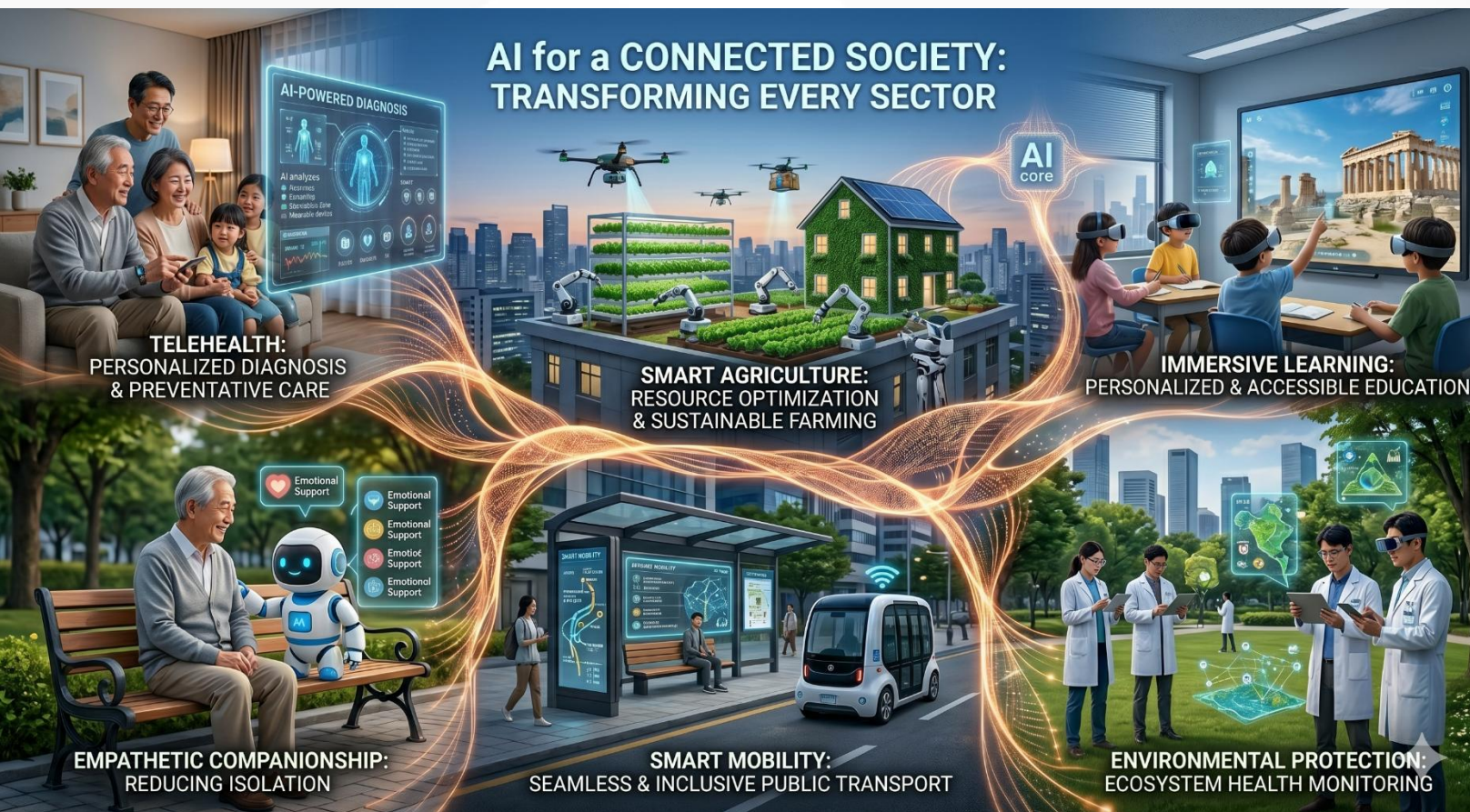
### ENVIRONMENTAL PROTECTION:

ECOSYSTEM HEALTH MONITORING

# “AX (AI Transformation)”

**AX represents a fundamental change that goes beyond technology, impacting social and workflows**

**AX plays the role of spreading AI everywhere, not just in depth**



**If AI for All, AX,  
What can they do for  
Climate Change?**

# “AX in Climate Change”

**In the context of the climate crisis, AX (AI Transformation) represents a fundamental paradigm shift.**

**It moves us beyond simply observing environmental changes to intelligently managing and re-engineering our response to them.**

AX is the process of embedding AI at the heart of climate strategy, allowing it to act as the "central brain" for planetary health.

- **Intelligent Decarbonization:** Moving beyond manual monitoring to automated systems that analyze energy consumption patterns and minimize carbon output in real-time.
- **Predictive Adaptation:** Shifting from reactive measures to proactive ones by using AI modeling to forecast unprecedented weather events with hyper-precision.
- **Discovery Acceleration:** Speeding up the R&D of sustainable materials through AI-driven simulations.

## Key Examples of AX in Climate Change

Sector	AX
Energy	Transitioning to <b>Smart Grids</b> where AI balances the intermittency of renewables.
Disaster Response (DRR)	Securing the " <b>Golden Hour</b> " by simulating floods or wildfires in real-time to minimize loss.
Agriculture	Building <b>Precision Farming</b> systems that select climate-resilient crops and optimize resource use.
Carbon Footprint	Tracking supply chain emissions transparently and having <b>AI suggest the optimal path</b> to Net Zero.

# “Climate AX” (ClimaX)

## **Limitations of Traditional Models:**

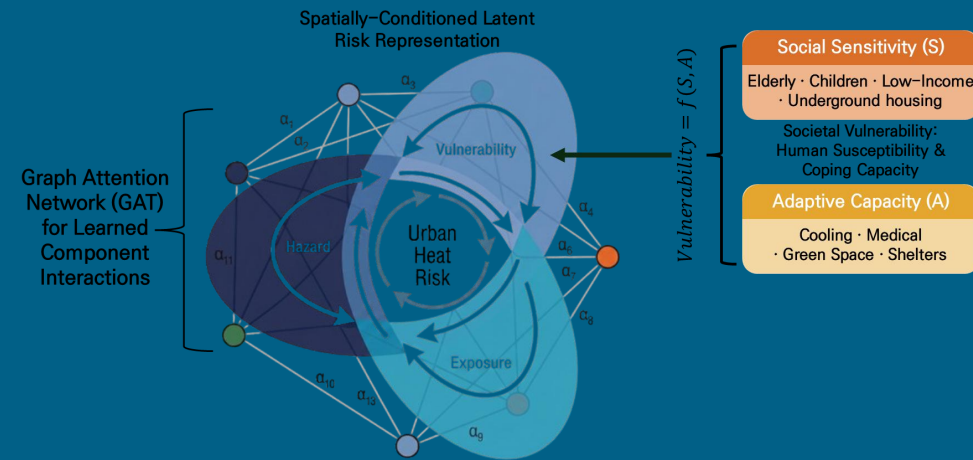
Traditional physics-based models struggle with increasingly complex climate patterns due to computational speed and resolution constraints.

## **A Paradigm Shift with AI:**

Shifting focus from reactive disaster recovery to proactive, anticipatory action powered by AI.

# AI Tech for Enhancing Climate Resilience and DRR

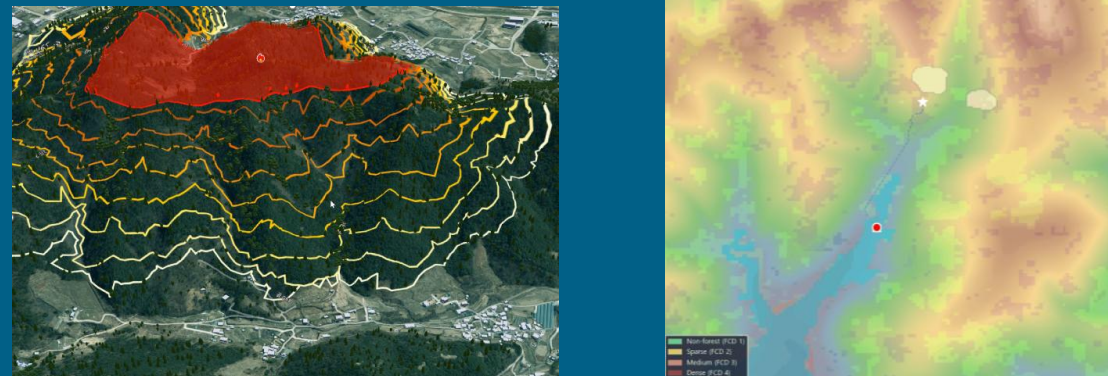
## Automation of climate risk assessment



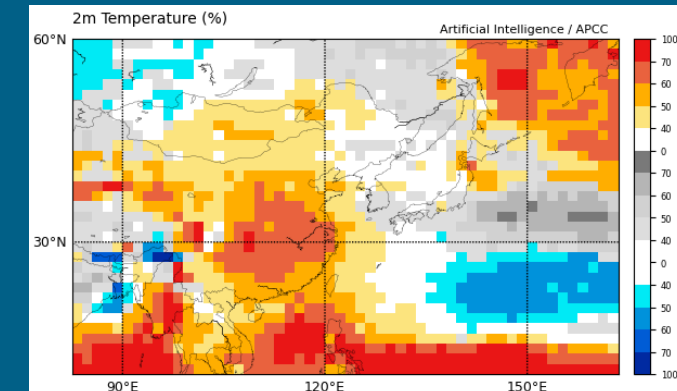
## Automatic detection of habitats and carbon sinks



## Wildfire spread prediction, wildfire suppression optimization



## Advanced weather forecasting (time constraints, spatial resolution)



# AI-Based Automative Climate Risk Assessment

Case

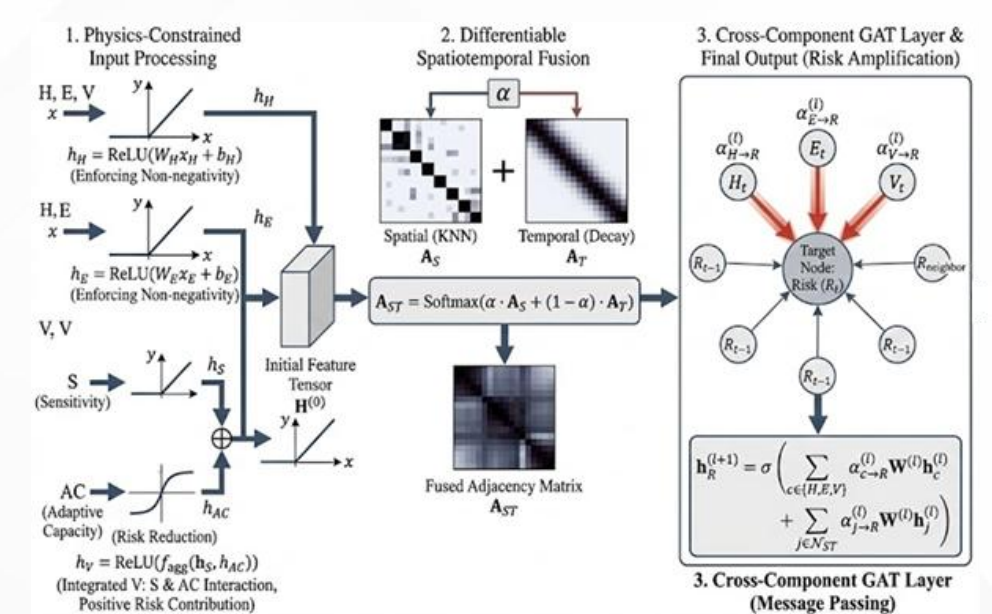
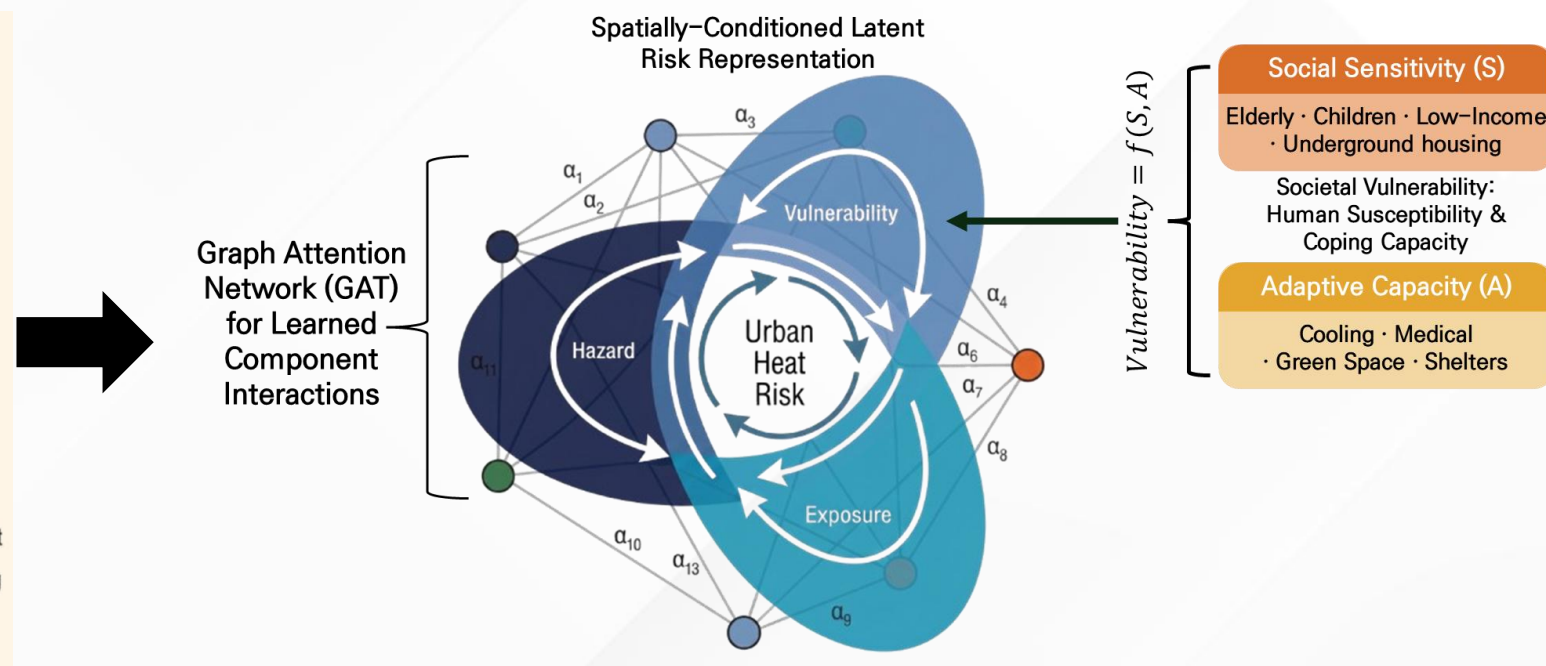
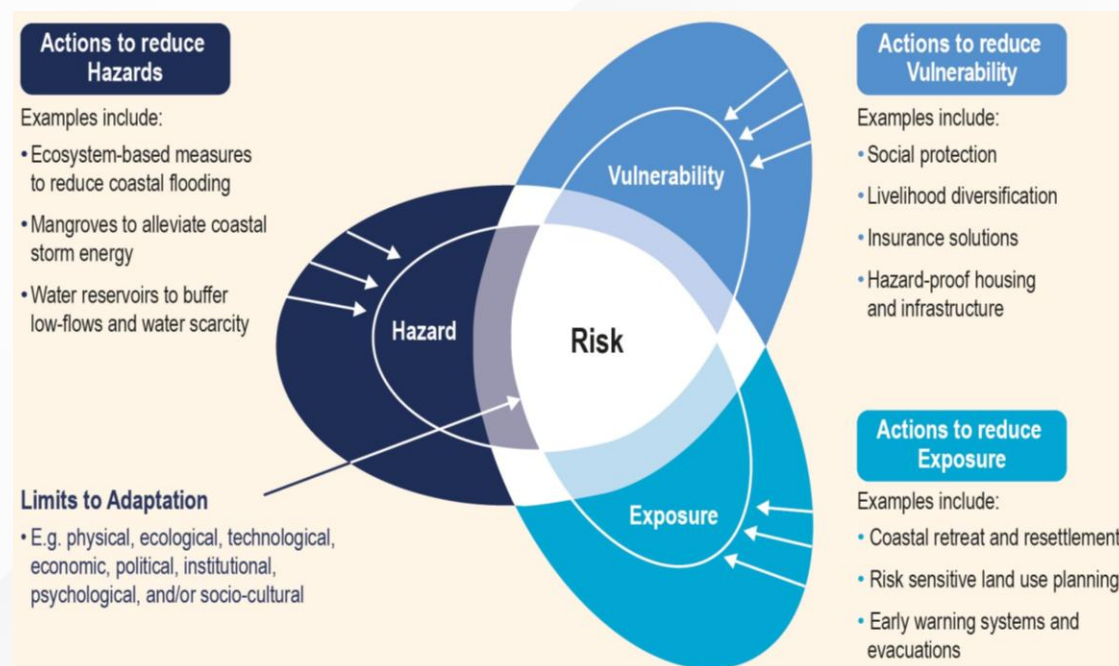
## Paradigm Shift in Region-Specific Risk Assessment for Climate Adaptation

### Conventional IPCC-Based Risk Assessment

- Regional risk quantification is central to climate adaptation, with the IPCC framework remaining the standard methodology.
- Reliance on human induced weighting limits consistent application in regions lacking sufficient data and expertise.

### Transition to an AI-Based Assessment System

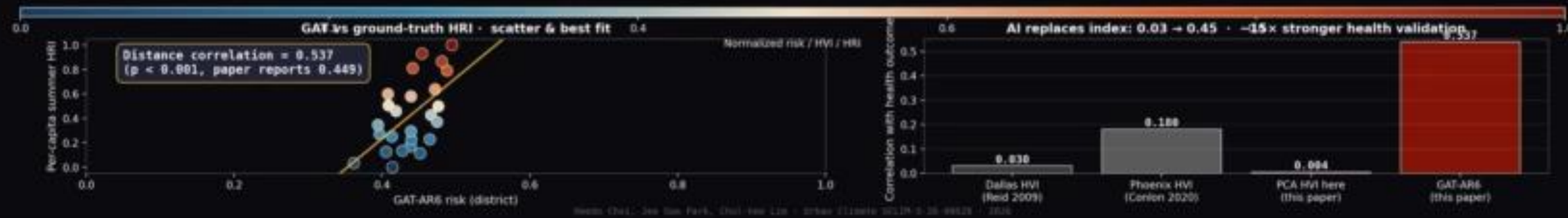
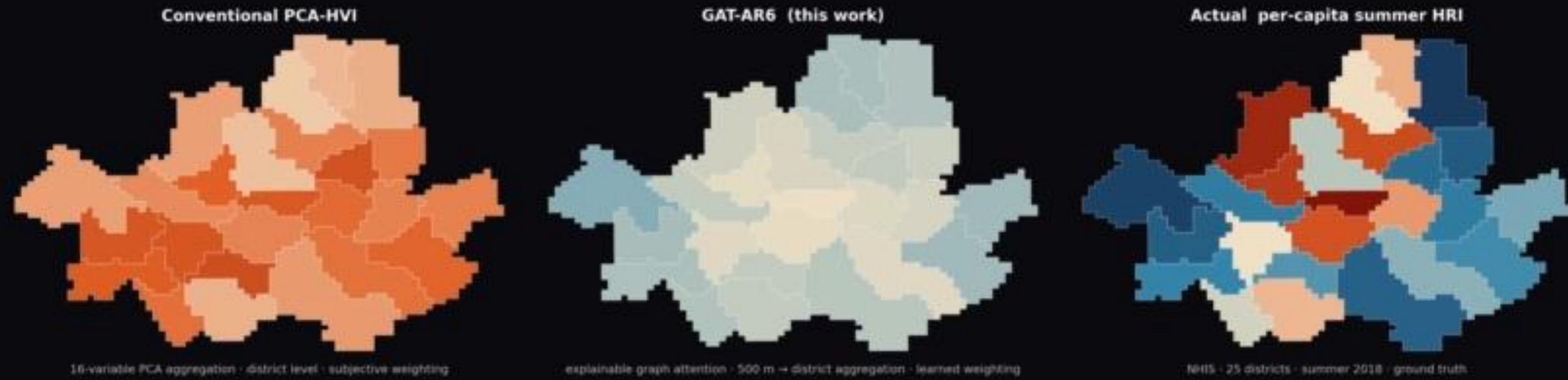
- Regions with scarce data and experts require an AI driven risk assessment framework.
- GAT based assessment delivers both spatial precision and global transferability across constrained regions.



# Heat Vulnerability Index — the conventional approach

## AI replaces the conventional index — and matches actual health outcomes

Seoul · 2018 · 25 districts · GAT-IPCC AR6 vs PCA-HVI vs NHIS per-capita summer HRI



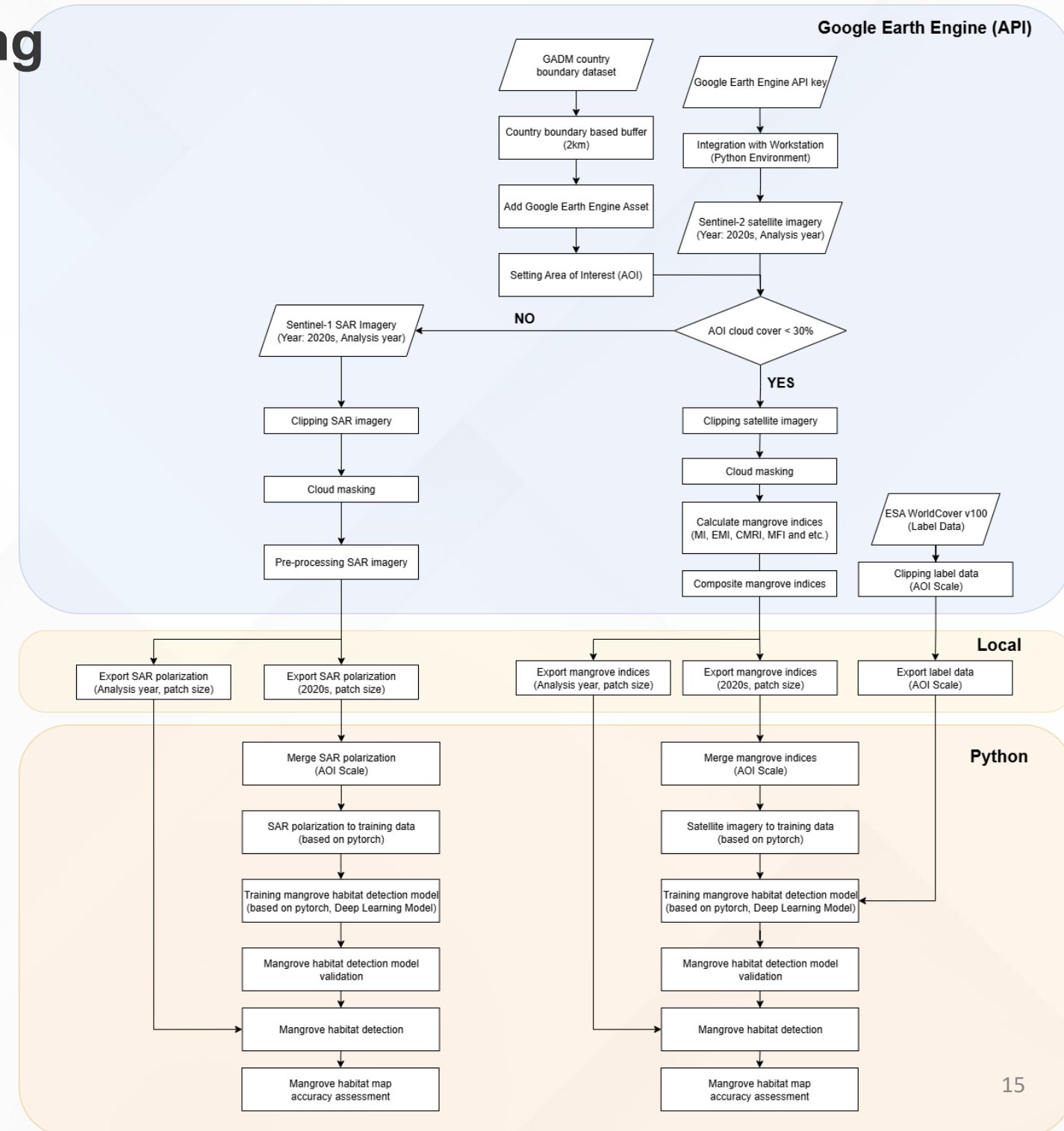
Aggregated, subjectively weighted, weakly validated against actual health outcomes

# Near-Real Time Mangrove Detection Using AI

## Case

### Advancing Mangrove Ecosystem Mapping for Climate Reporting

- Limitations of Conventional Monitoring Approaches
- ✓ Mangrove ecosystems play a vital role in coastal carbon storage and climate adaptation, yet efficient tools for systematic large-scale monitoring remain limited
- ✓ In regions with insufficient data and expertise, maintaining consistent and regular monitoring continues to present practical challenges
- Transition to a Deep Learning-Based Detection Framework (AMAP)
- ✓ A U-Net based segmentation model enables automated, pixel-wise mangrove classification from satellite imagery at regional scale
- ✓ Outputs are readily compatible with existing GIS environments and national forest monitoring systems, supporting integration into carbon reporting workflows

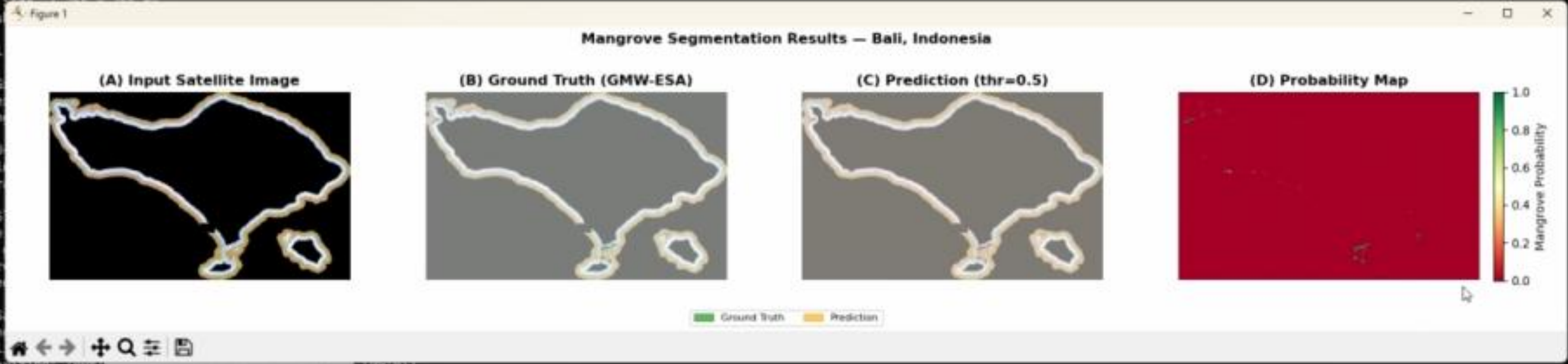


(isrs) D:\Lab\2025\Mangrove>python preview.py

MANGROVE SEGMENTATION INFERENCE DEMO

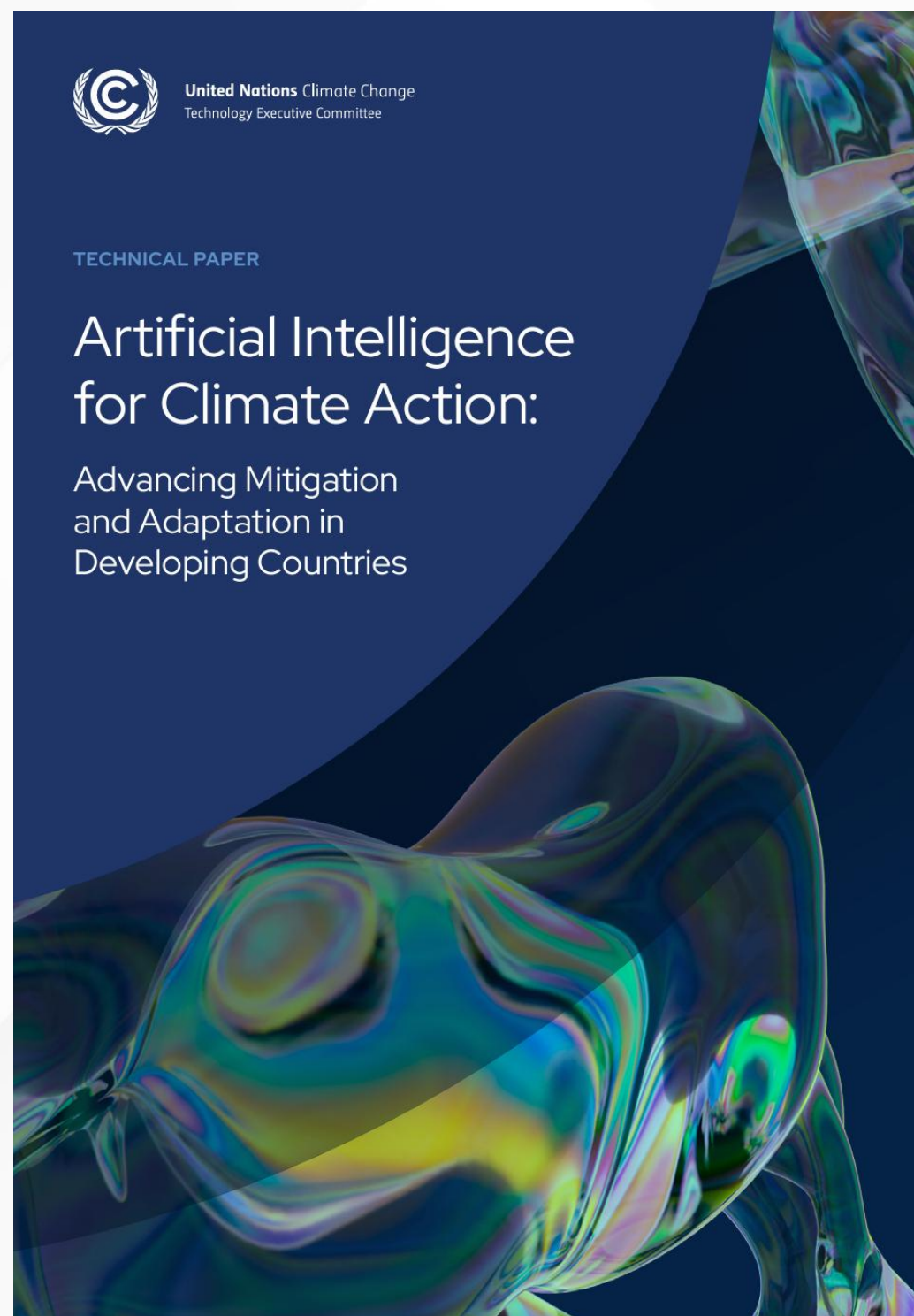
Model : U-Net (ResNet34 encoder)  
Study Area : Bali, Indonesia  
Device : CPU  
Tile Size : 256 x 256  
Thresh

✓ ALL  
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Raster  
✓ Man  
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[6/7] Static Visualization (4-panel PNG)  
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# Near-Real Time Mangrove Detection Using AI

Case



### CASE STUDY

#### SAFEGUARDING COASTAL ECOSYSTEMS: SOLOMON ISLANDS' INTEGRATED COASTAL ZONE MANAGEMENT (ICZM) WITH AMAP

**Country:** Solomon Islands

**Entities involved:** Government of the Solomon Islands, CTCN

#### Brief description

The degradation of coastal ecosystems, such as mangroves, poses a significant threat to the country's biodiversity, food security, and resilience to climate change. Mangroves play a crucial role in coastal protection, providing a natural barrier against storms and erosion. To address these challenges, the G Government of the Solomon Islands, with support from the CTCN's technical assistance project, has implemented ecosystem-based adaptation solutions for mangrove protection. The development of AI-based Mangrove Adaptive mapping tools in Pacific Island regions (AMAP), the output of the CTCN technical assistance (TA), represents a significant step in this direction.

AMAP processes satellite images, filtering out those with excessive cloud cover and removing clouds from the remaining images. It then calculates a mangrove-specific index to facilitate mangrove detection. The U-Net deep learning algorithm is employed to classify mangroves based on the mangrove-specific index. This enables the generation of detailed maps illustrating mangrove distribution, aiding in conservation, restoration, and management efforts. AMAP leverages historical climate data and climate change scenarios to develop models using various machine learning algorithms. These models are then combined through an ensemble approach to predict changes in vegetation species, including mangroves.

#### Climate Change Mitigation and/or Adaptation Impacts and Results

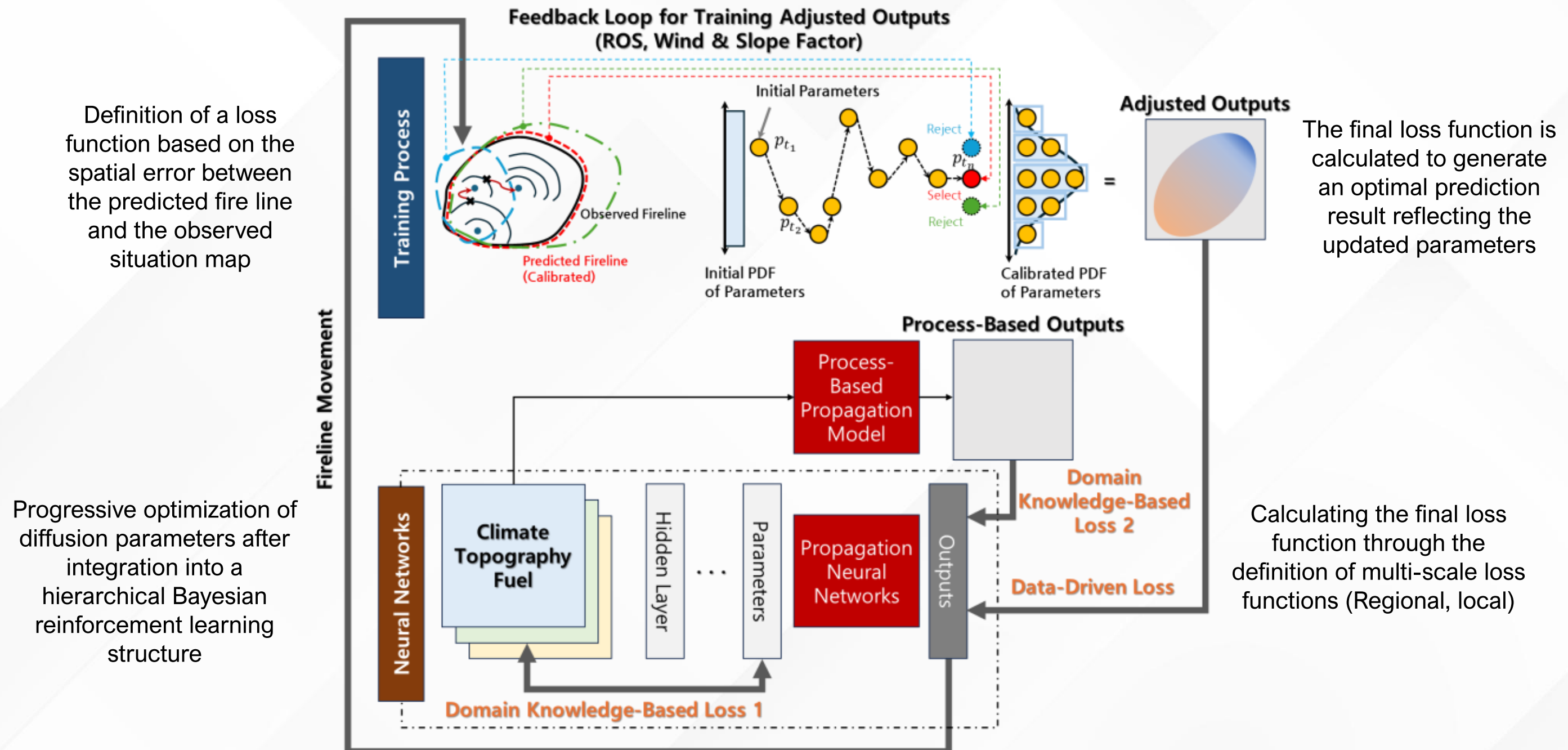
**Improved Monitoring:** AMAP facilitates the assessment of mangrove health and distribution over time, supporting the identification of areas requiring protection or restoration. **Enhanced Management:** The system equips managers with the information needed to make informed decisions about conservation and adaptation strategies, which ensures the sustainable management of mangrove ecosystems.

**Climate Change Adaptation:** AMAP's ability to predict future habitat distributions under different climate change scenarios supports the development of proactive adaptation measures to protect mangroves and the communities that depend on them. **Resource Optimization:** By automating the analysis of satellite imagery and providing detailed mangrove maps, AMAP saves valuable time and resources, allowing for more efficient and effective conservation efforts.



# AI based Wildfire Expansion Forecasting

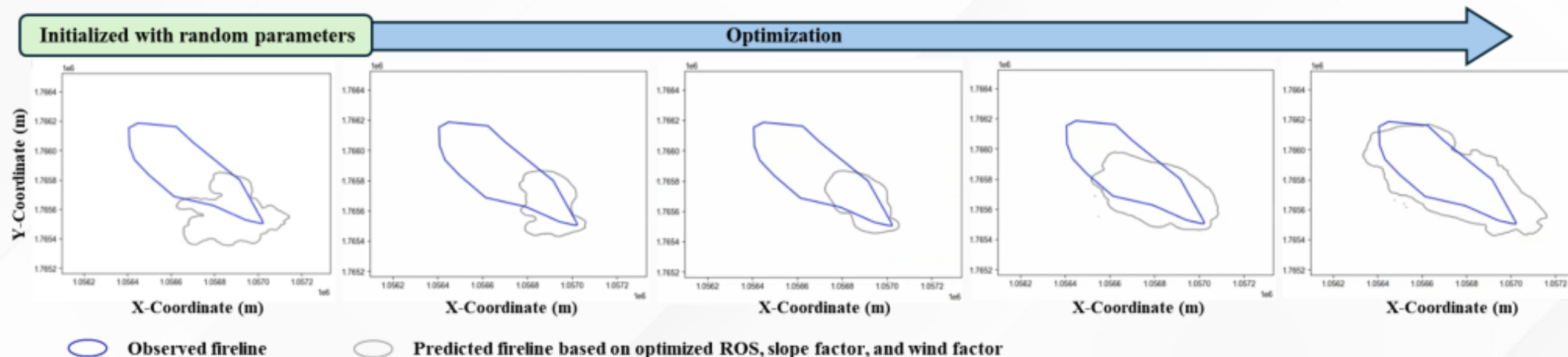
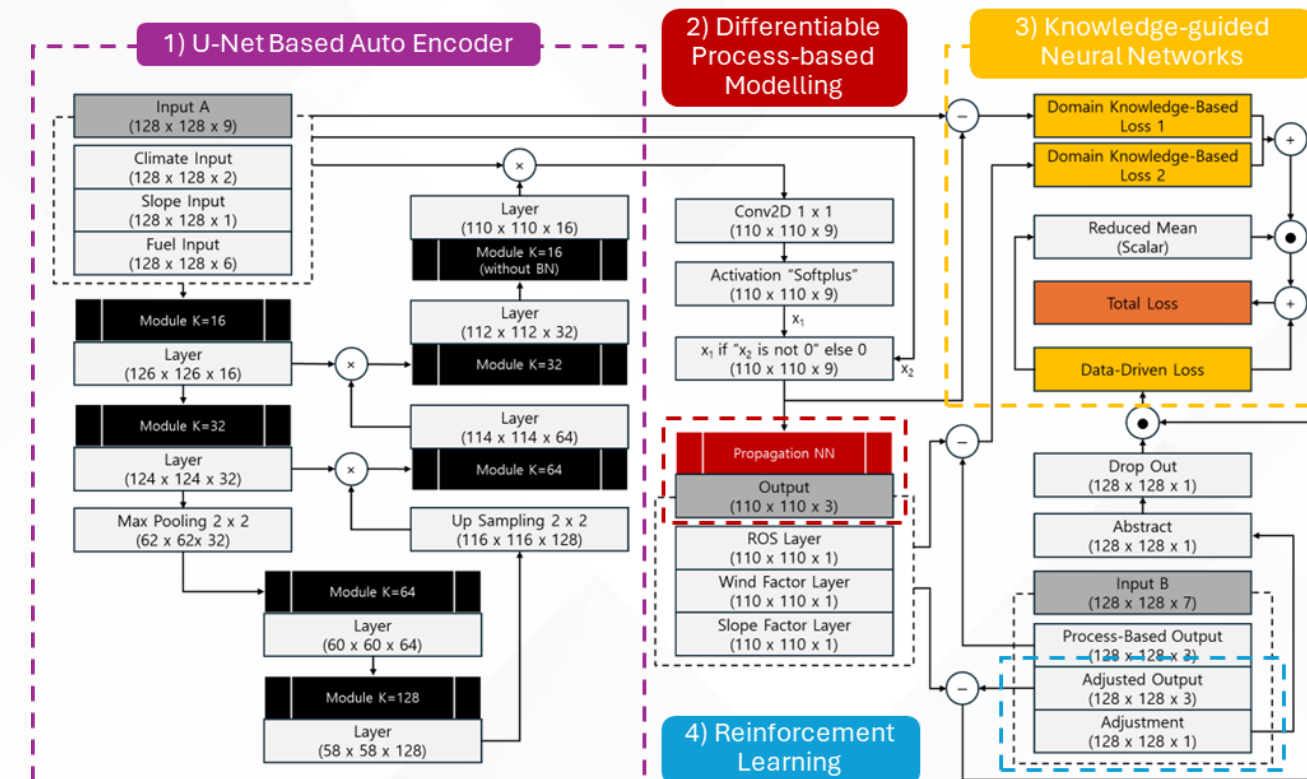
- knowledge-based artificial neural network structure and training process for wildfire spread prediction



# AI based Wildfire Expansion Forecasting

- knowledge-based artificial neural network structure and training process for wildfire spread prediction

- Applied AI models
- ✓ U-Net Based Auto Encoder
- ✓ Differentiable Process-based Modelling
- ✓ Knowledge-guided Neural Networks
- ✓ Reinforcement Learning





확산시간 0 ~ 480 분

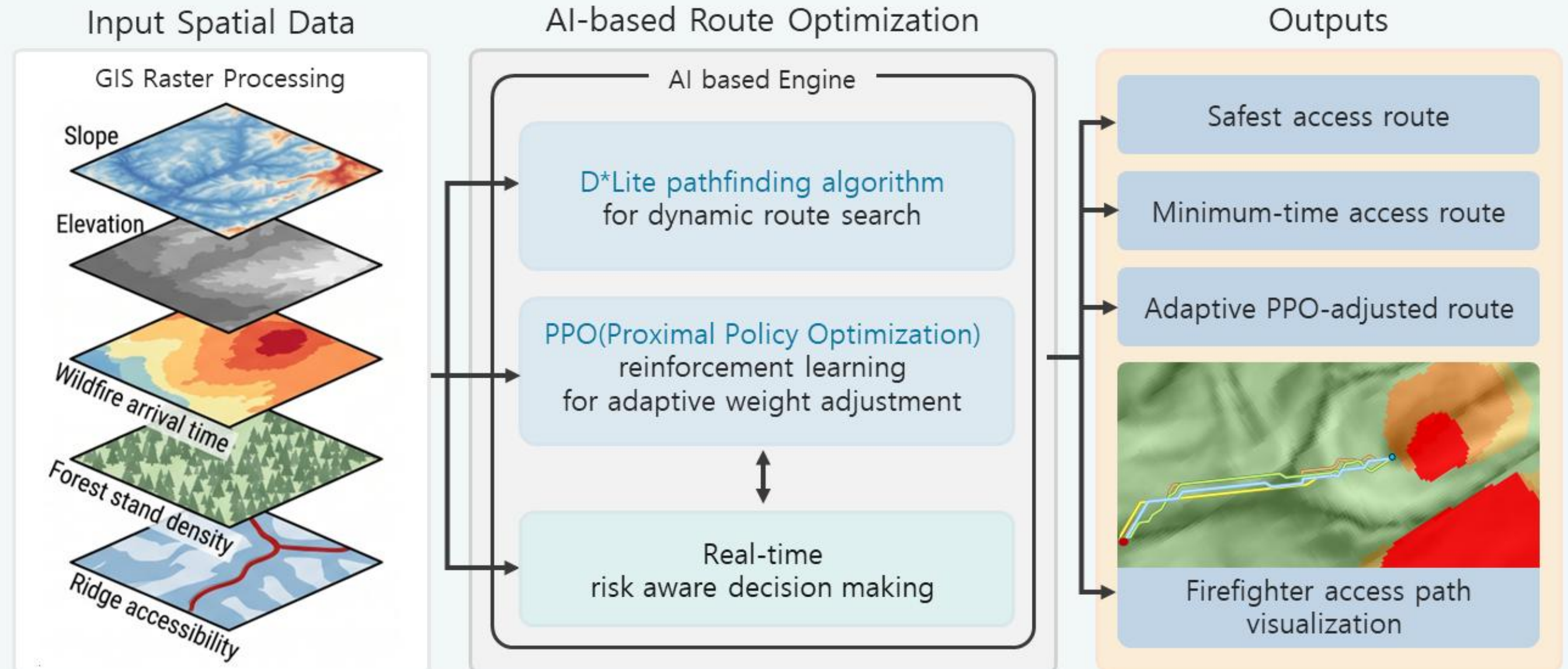
# AI based Firefighter Route Optimization

Case

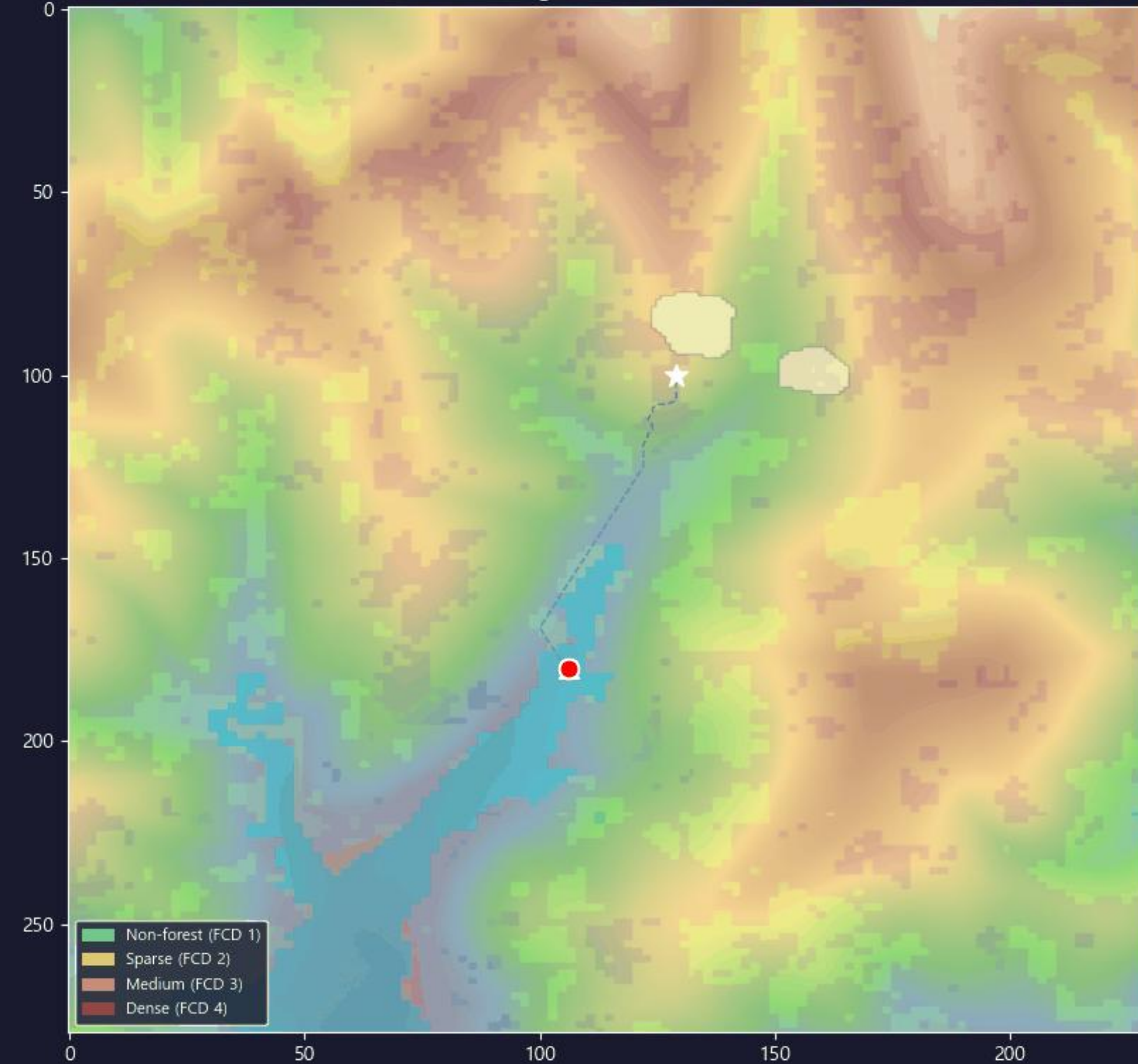
## Enhancing Firefighter Safety and Operational Efficiency Through Intelligent Pathfinding

- Operational Challenges in Wildfire Suppression
  - Wildland firefighters are often required to traverse mountainous terrain on foot, as fire lines frequently extend beyond existing trail and road networks.
  - The absence of established routes in affected areas necessitates real-time, adaptive pathfinding solutions to ensure both safety and efficiency.
- Proposed AI-Based Pathfinding Framework
  - Trail and forest road networks are prioritized where available, an algorithmic pathfinding system enables real-time route calculation for off-trail terrain navigation.
  - Reinforcement learning dynamically adjusts weighting factors such as safety and travel speed, enabling real-time route adaptation.

## [AI-based Wildland Firefighter Route Optimization Framework]



# Wildfire Fighter Path Simulation



## Fire Fighter Route Info

entry: entry\_path\_20260428\_163956 geojson  
evac : 없음

Step: 1 / 53

Cell: (1643, 1094)

Elapsed: 0.00 min (0 sec)

SAFE: Fire in 9999.0 min

Distance: 0 m

### [Entry Path]

Progress

[████████████████████] 0.0%



# Deep Learning-Based 1-Month Temperature Forecasting System: A Pipeline for Forecast Innovation

A Hybrid Forecasting Workflow Combining ERA-5 Reanalysis Data and Deep Learning Models to Improve 1-Month Temperature Forecast Accuracy

## Deep Learning Research and Forecasting Pipeline



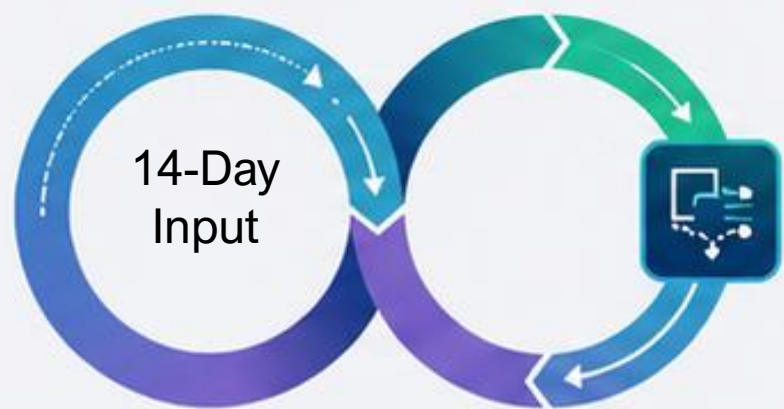
Data Preparation and Preprocessing

Construction of Training Datasets by Processing Daily ERA-5 Reanalysis Climate Data Accumulated Since the 1960s

**1-Month Temperature Forecasting Deep Learning Model**  
Learning Spatiotemporal Features of Climate Data by Combining Bi-directional ConvLSTM and U-NET Architectures

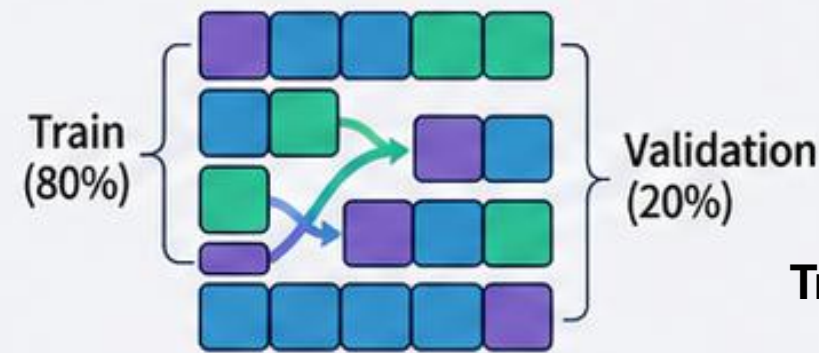
**Operational Forecast Application and Evaluation**  
Generating Probabilistic Forecasts Applicable to Real-World Forecast Operations Using ECMWF 51-Member Ensemble Climate Data as Input

## Rolling Prediction Method



### Rolling Prediction Method

1-Day Prediction



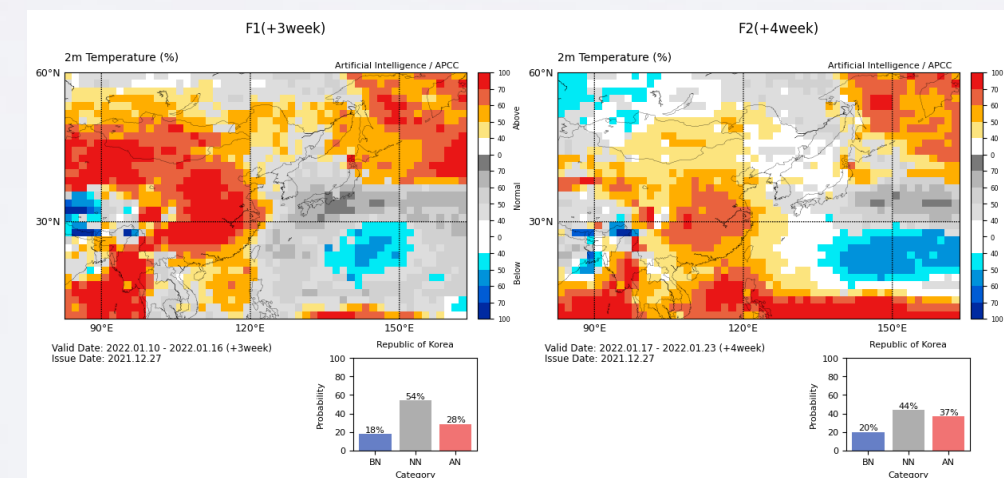
### Data Shuffling Strategy



Traditional climate forecasting

Deep learning

### Hybrid Approach



The model takes 14 days of input data to predict 1 day ahead, and the predicted result is recursively reused as input for repeated forecasting over n iterations

During model training, the data are randomly shuffled to construct Training (80%) and Validation (20%) datasets, improving learning efficiency and model generalization.

By combining traditional climate forecasting methods with deep learning, the forecasting limit is extended from the conventional 2-week range to up to 1 month

# Core of Climate Crisis Response: High-Resolution Climate Prediction

## Why Do We Need More Precise Climate Prediction?



### Limitations of current Global Climate Models

- Spatial resolution is too coarse
- Limited usability for regional risk assessment and adaptation planning



### Rising Urgency of Climate Crisis

- Increasing frequency and intensity of heatwaves, floods, and droughts
- Immediate, localized responses are required

## Solution: High-Resolution Downscaling Approaches

### High-Resolution Climate Data Generation

- Converts low-resolution climate data into high-resolution information
- Accurately reflects local topography and regional characteristics

### Multivariate Downscaling (Cokriging)

### Satellite-based AI Models (XGBoost)

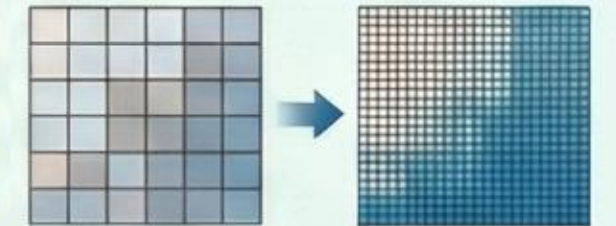
### Deep Learning Super-Resolution (EDSR)

### AI-Enhanced Prediction Accuracy

- Combines artificial intelligence and statistical methods
- ERA5 (0.25) data downscaled up to 4x higher resolution
- Significant improvement in spatial detail and reliability

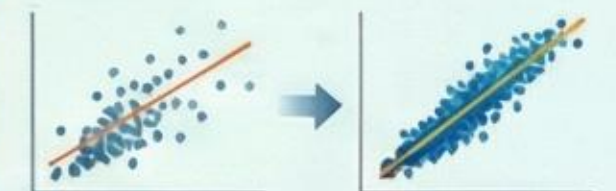
## Key Results: Accuracy and Usability Verified

### Higher Resolution, Better Performance



- 500 m outperforms the 1 km model

### Improved Rainfall Prediction



- Machine learning (XGBoost) applied
- Correlation coefficient improved from 0.65 to > 0.80

### Data-Driven Policy Support

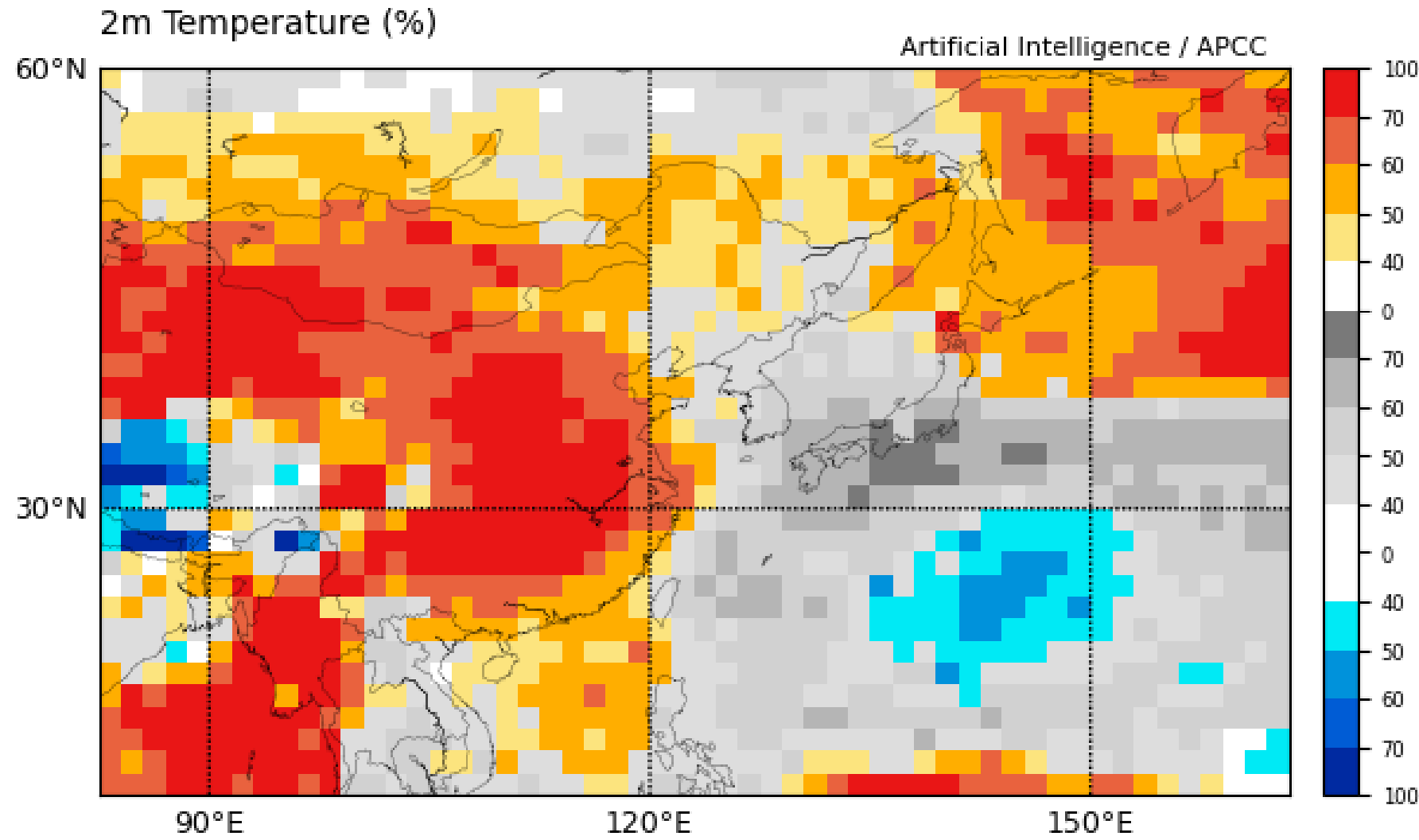


- Integrated impact indicators
- Supports evidence-based decision-making
- Enhances practical usability for climate adaptation policies

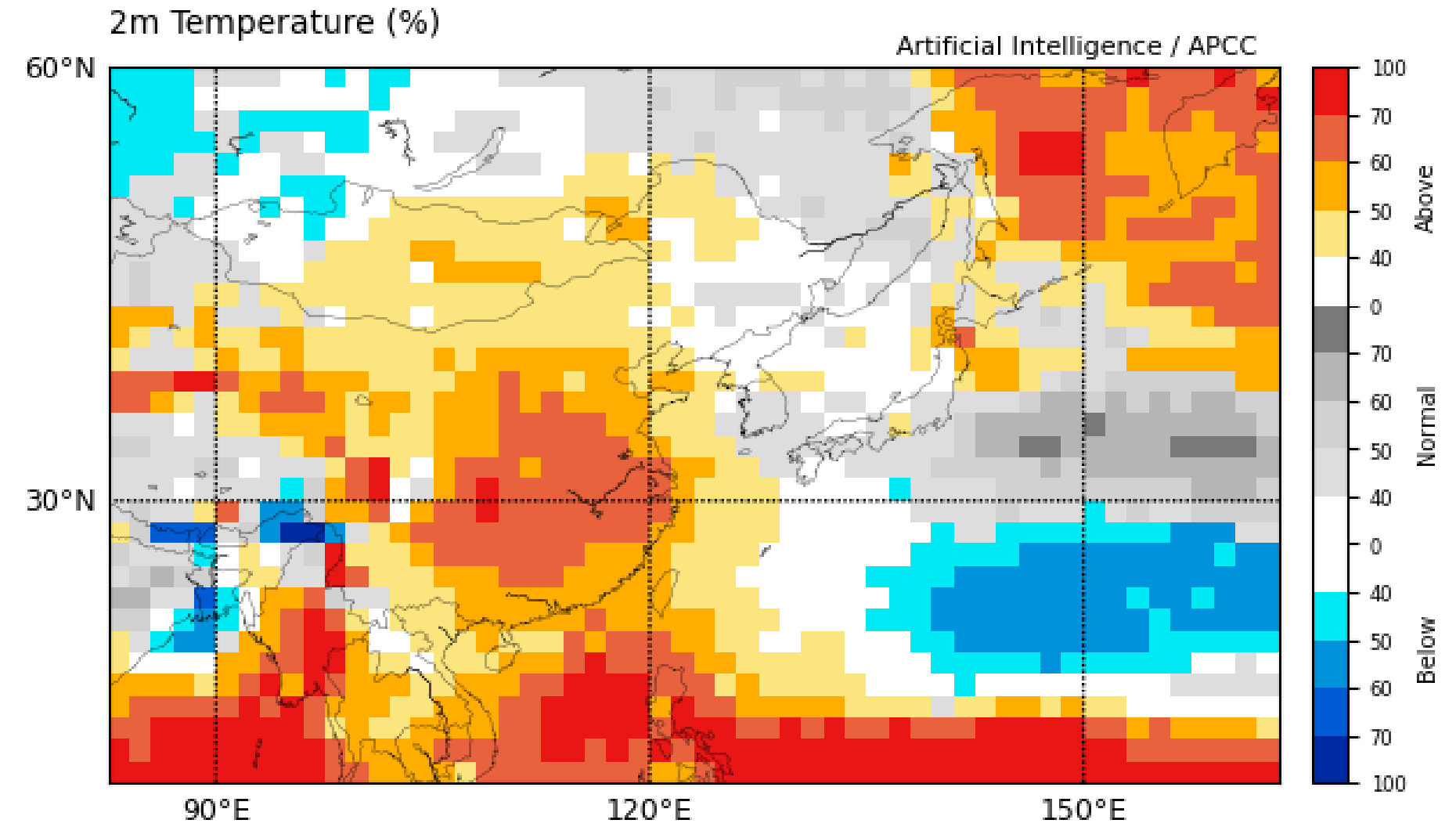
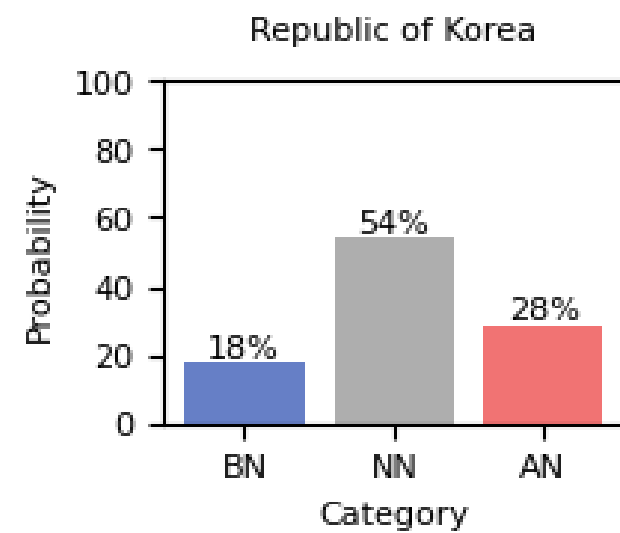


F1(+3week)

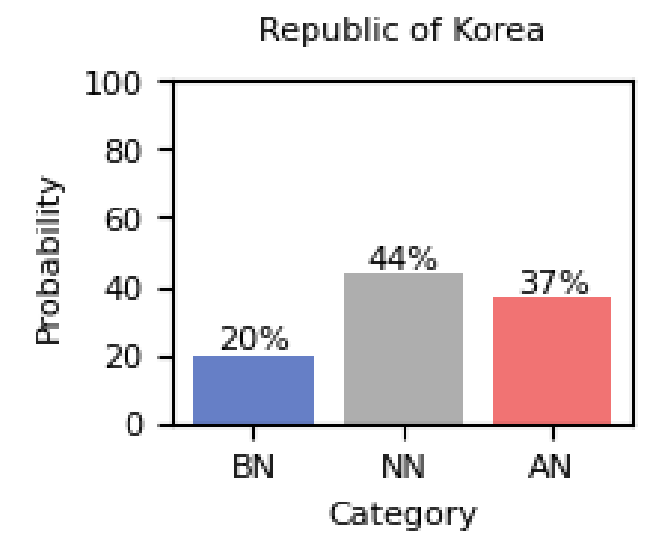
F2(+4week)



Valid Date: 2022.01.10 - 2022.01.16 (+3week)  
Issue Date: 2021.12.27



Valid Date: 2022.01.17 - 2022.01.23 (+4week)  
Issue Date: 2021.12.27



### AI for ALL

Artificial intelligence has become a technology for everyone, no longer limited to specific individuals or fields

### “ClimaX”

AI transforming climate change response, more effective and quickly

### Automative tools

AI-based automated tools contribute to improving climate resilience and DRR (Rapid Assessing & Alert, Optimizing Solutions etc.)

### Accessibility

The activation of AI leads to the development of easy-to-use tools and provides significant assistance in capacity building

# Take-home Messages



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