



國家災害防救科技中心

National Science and Technology Center
for Disaster Reduction

New prospects of science and technology on integrated disaster risk management

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2015/01/15

Tokyo Conference on International Study for Disaster Risk Reduction and Resilience, Tokyo, Japan, 14 – 16 January 2015

Outlines



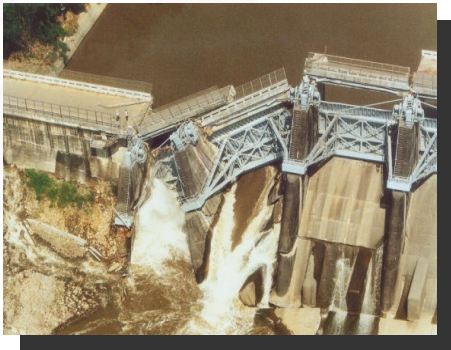
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- **Brief introduction of NCDR's operation model**
 - **A case of applying S&T for disaster risk reduction and management**
- **Challenges found at local governments during emergency operation**
 - **Experiences learned from Typhoon Morakot since 2009**
- **Ways to improve typhoon emergency response**
 1. **Science-and-theology-based emergency operation**
 2. **Information integration: early warning system**
 3. **Common operating pictures**
 4. **Practical case: Early evacuation and enhancement of information coverage**
- **IRDR Flagship Project**
 - **Focus on real application of S&T for reducing risk**
- **Conclusions**

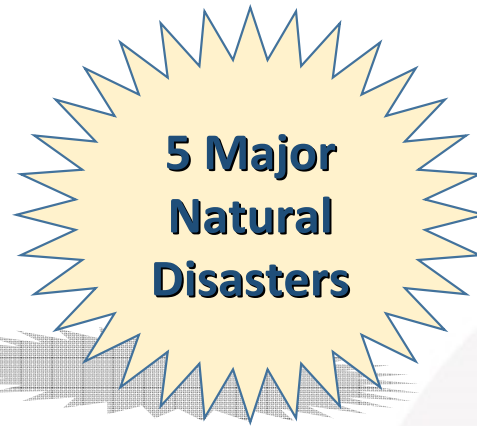
NCDR covers natural hazards



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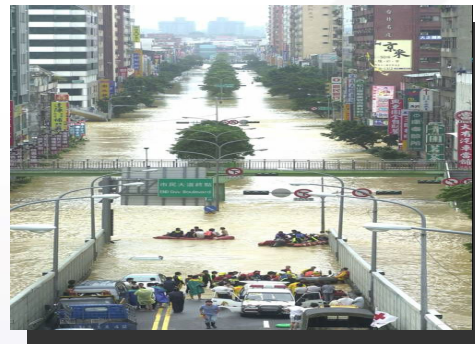
Earthquake (1999)



Landslide



Typhoon (2009)



Flood

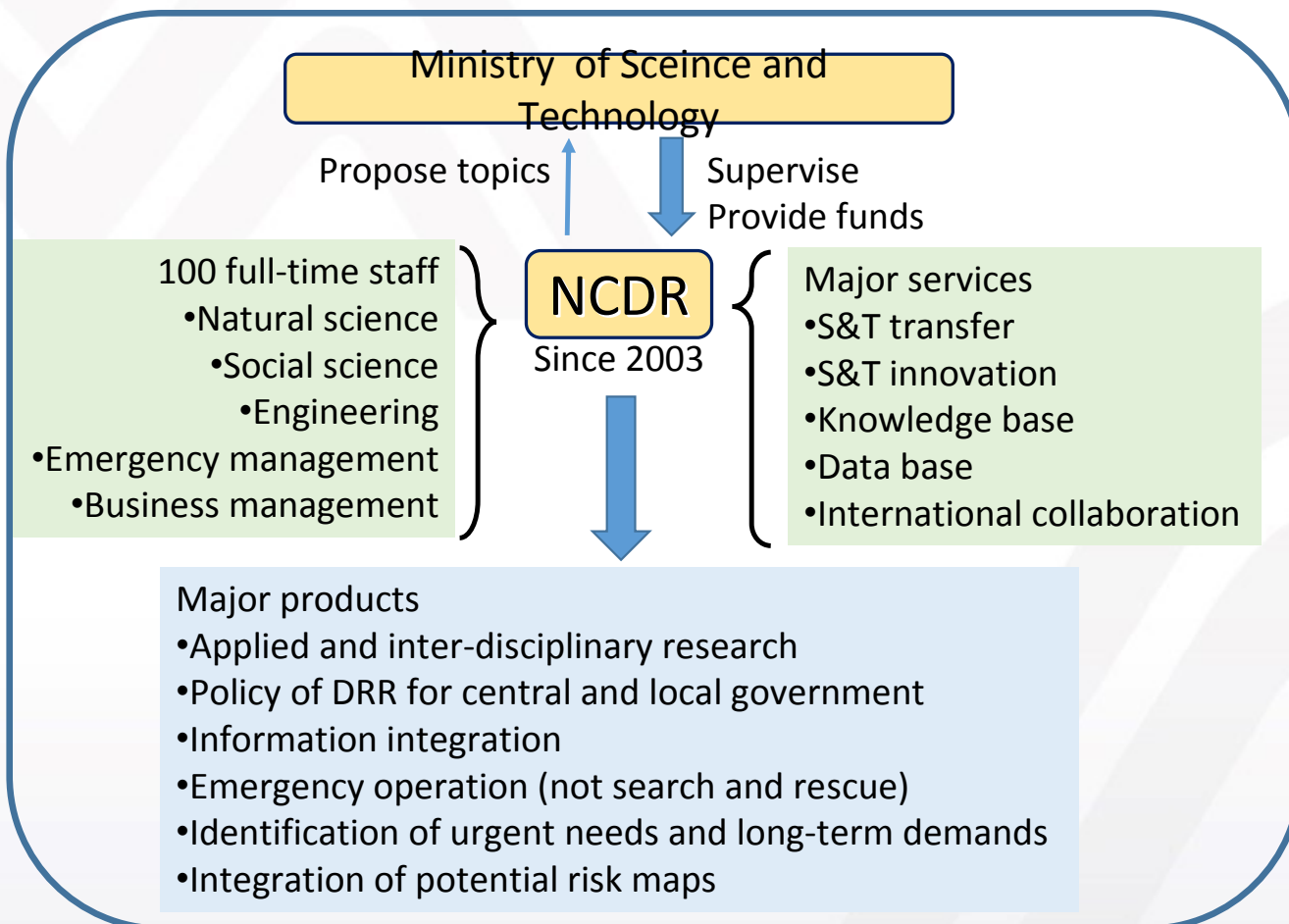


Debris flow

How NCDR applies science and technology for disaster risk reduction and management



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- Partners and key stakeholders**
- Public sector**
- **Central government**
 - Ministries and agencies
 - **Local Government**
 - Municipalities and townships
- Private sector**
- Universities, research institutes
 - **NGOs, NPOs**
 - **Communities**
- International outreach**
- IRDR, ICoE Taipei
 - ADRC, NIED, DPRI (JP)
 - PDC (US)
 - ADPC (TH)
 - NDMI (KR)
 - APEC EPWG

NCDR has comprehensive teamwork with public and private sector – from top decision makers to local communities



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Challenges found at local-level governments during emergency operation – observations from Typhoon Marokot since 2009



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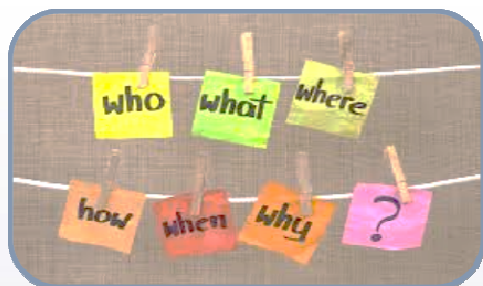
Too much or too little information during emergency response

- Channel to acquire useful information
- System of systems to integrate information



Lack of common operating picture to coordinate actions

- Potential risk maps for planning
- Situation maps for operation



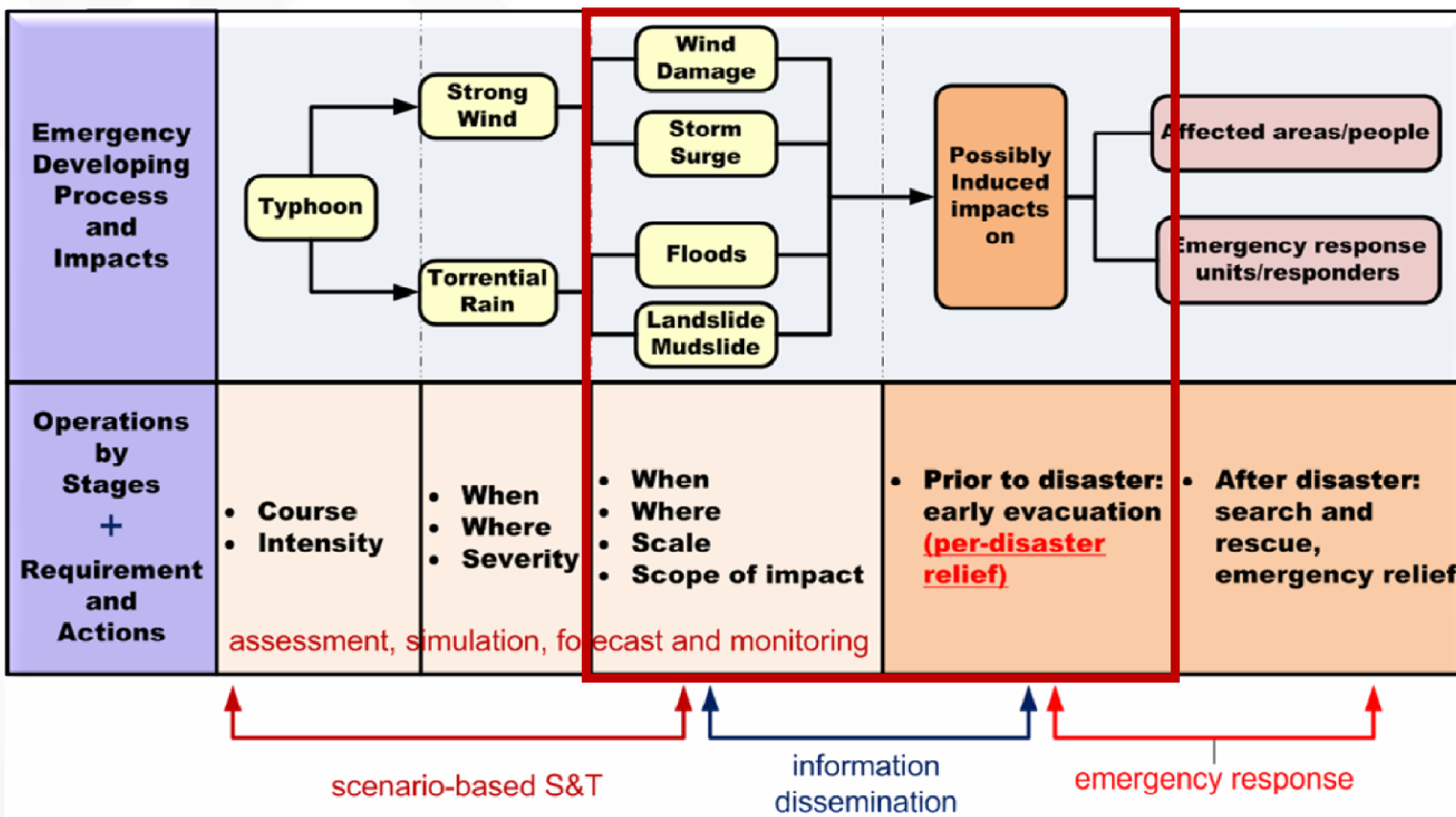
When and how to make timely decisions

- No well-defined plans in advance
- No experienced staff to make suggestions

Demands and supports of S&T according to emergency operation stages



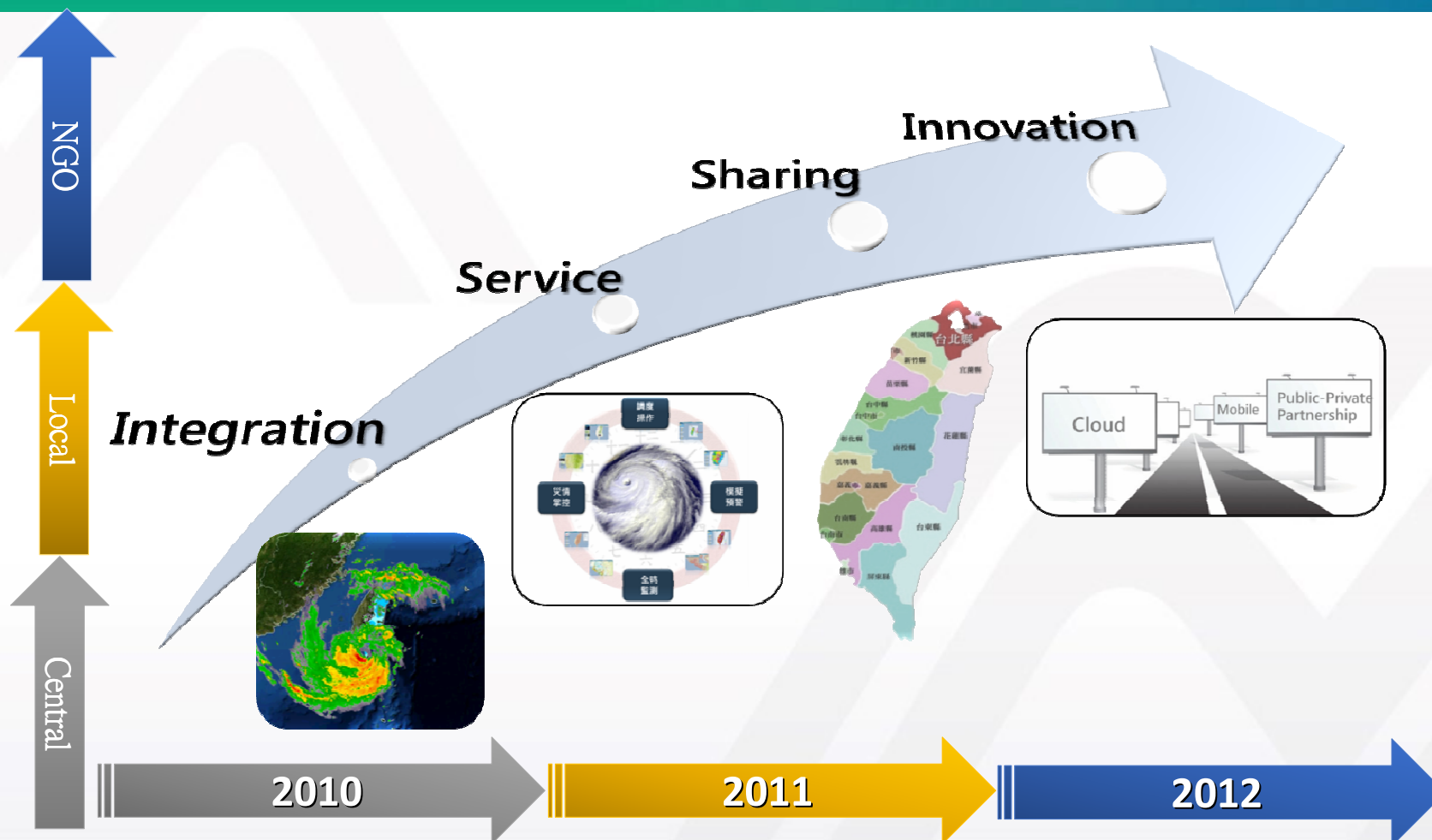
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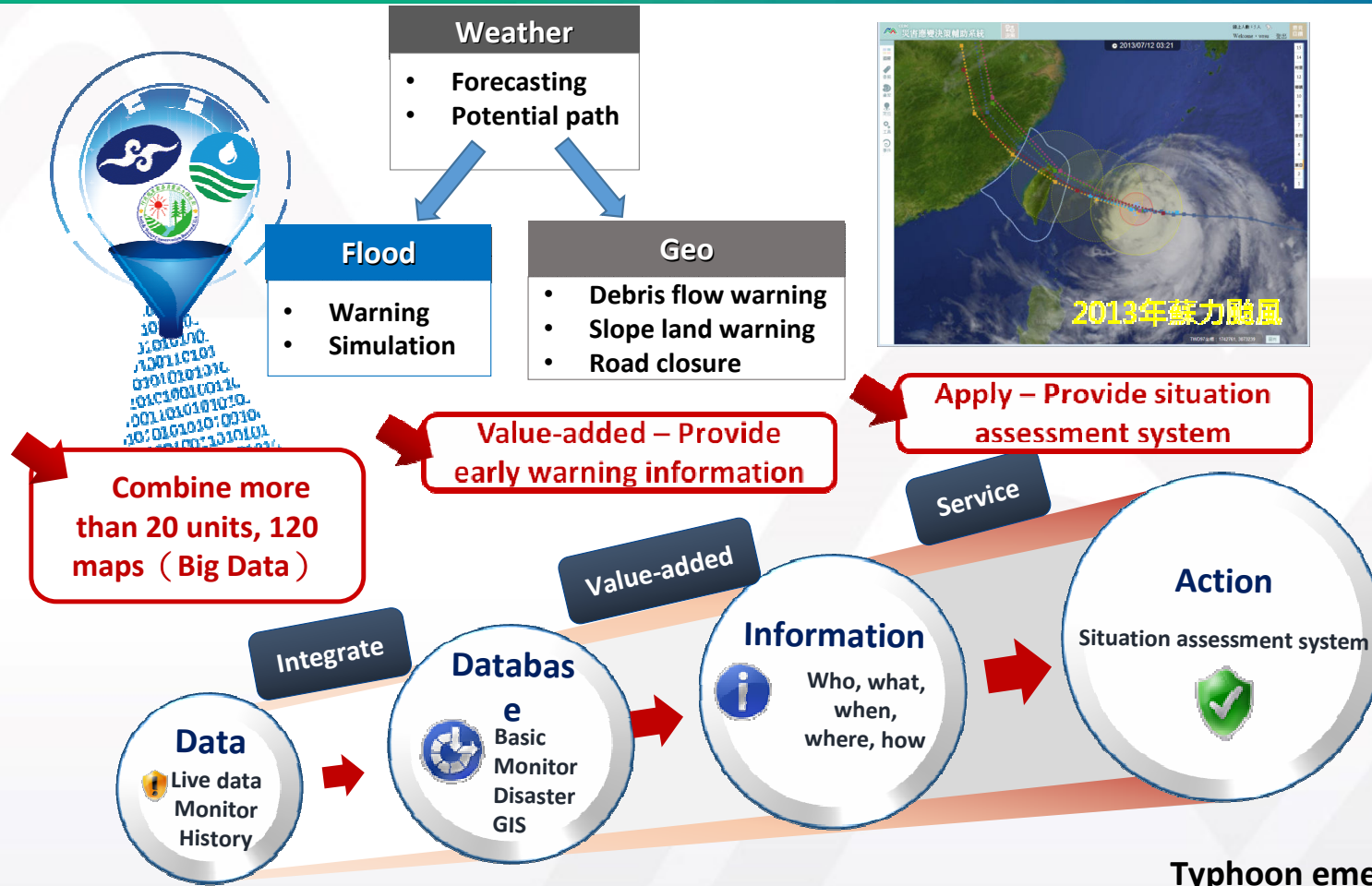
Developments of Decision Support System to build up common operating picture



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Aggregating big data for open data– “Cross-cutting Synergy” , “Information sharing”, “Actionable”



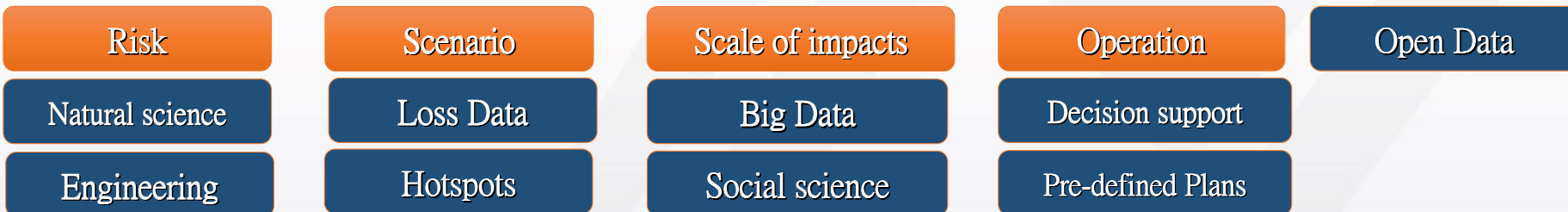
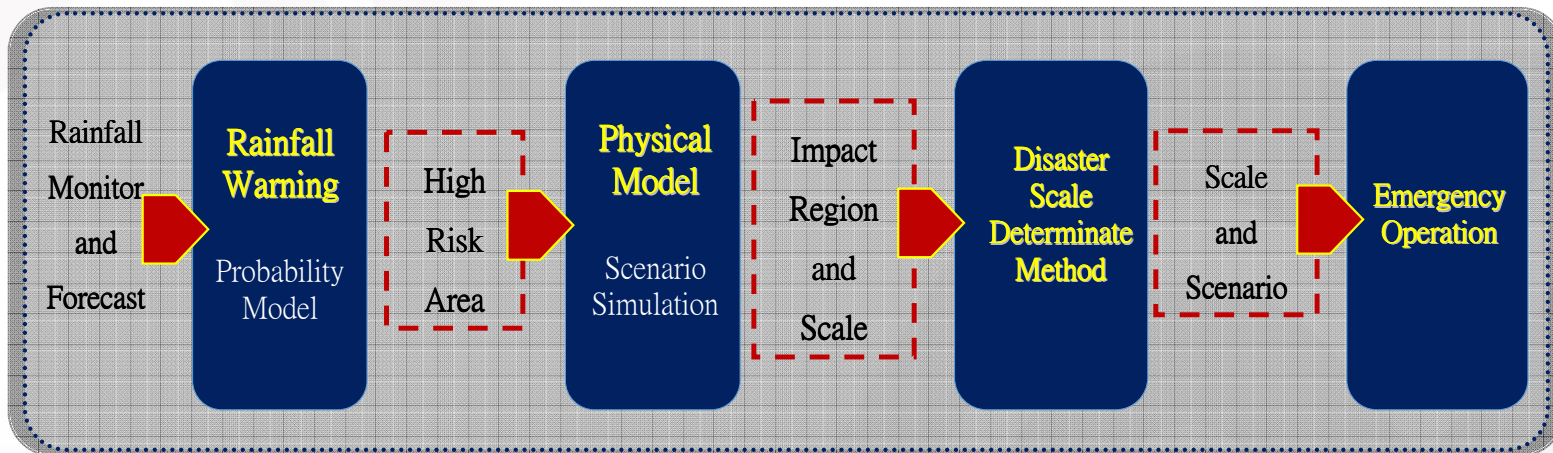
Typhoon emergency operation

The Concepts of Early Warning Framework



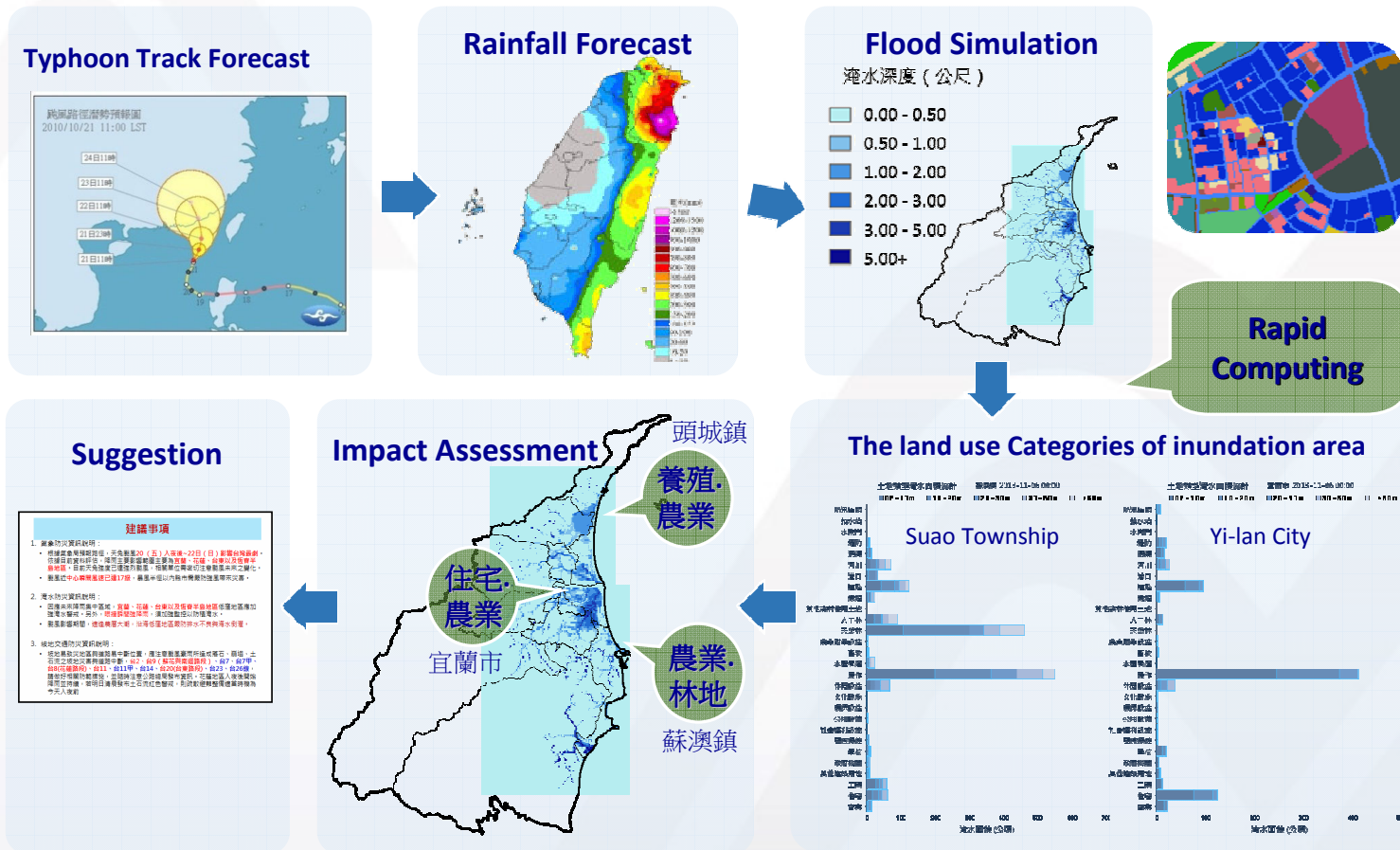
To fulfill the needs for early warning, disaster monitoring, and information analysis, NCDR then processes outcomes of forecast and retrieves useful information.

The framework of early warning for the disasters of typhoon and flood



Early Warning System

The early warning Process for the disasters assessment



Three principles to integrate information for typhoon emergency operation by assistance of S&T



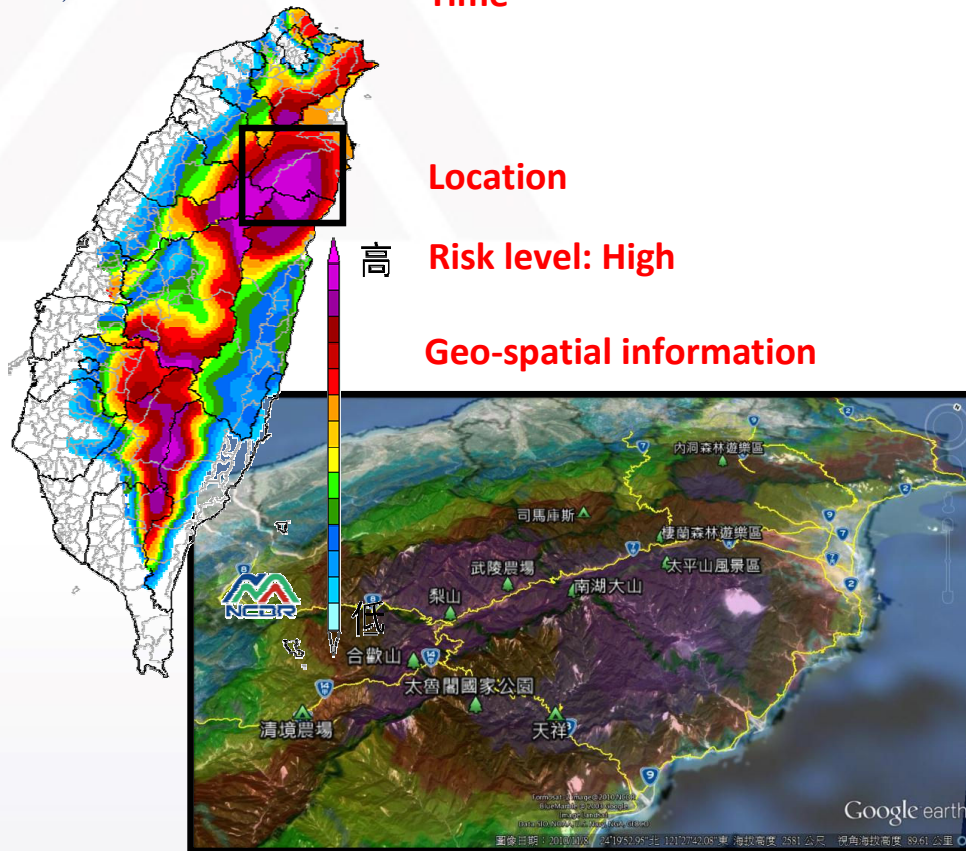
Estimate potential risk of landslide
2014, 07/23 06 : 00 am

Time

Location

Risk level: High

Geo-spatial information



- **Scenario-based description** for deployment and response in advance

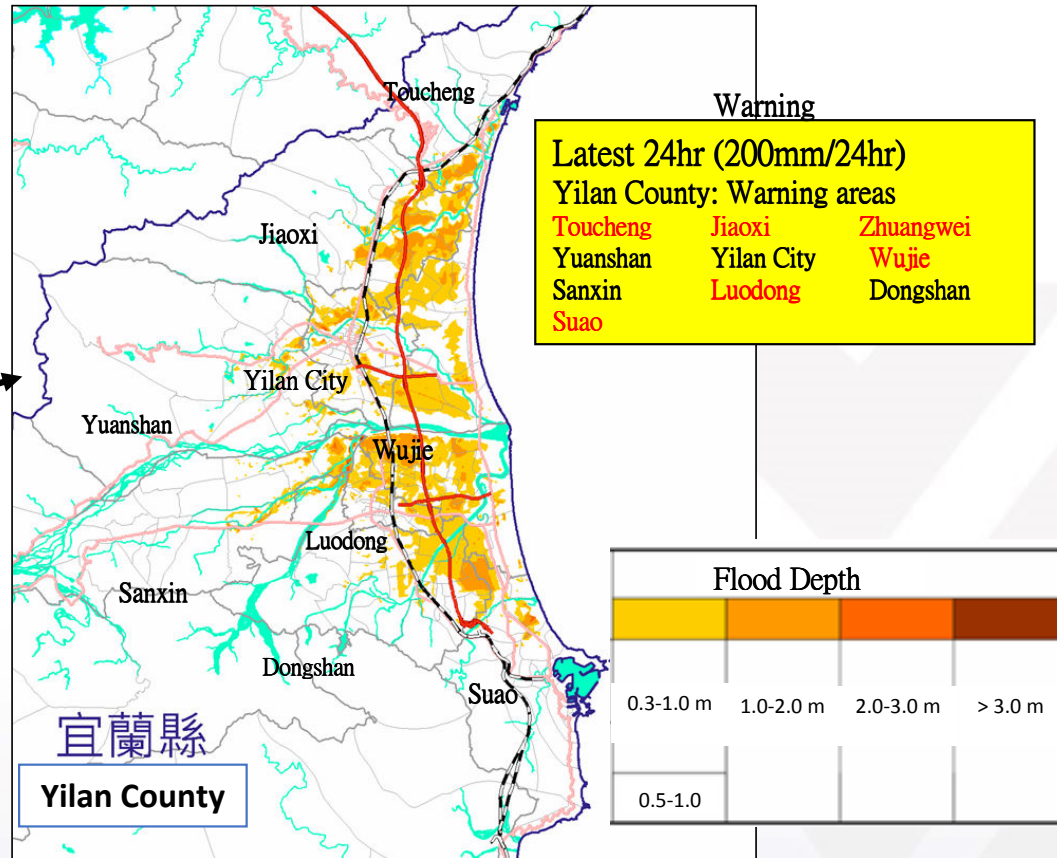
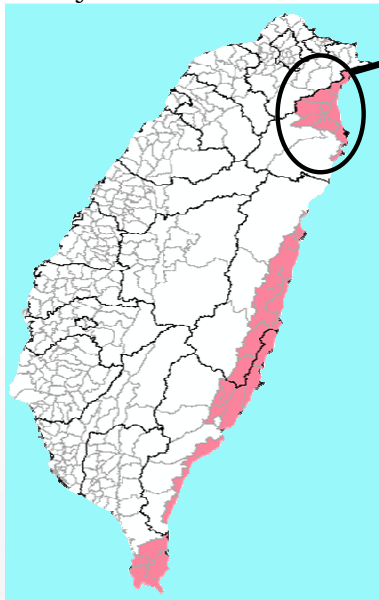
- **Cross-cutting information exchange** to monitor evolving situations

- **Graph and table plus GIS** to show spatial and time-dependent factors

Example: Flood Warning

Estimated floods in 24hrs based on forecast issued by CBW

Major flooded areas



Disclosed info: time, locations and scientific scenario

Case of successful early evacuation during Typhoon Fanapi , in Lai-Yi village, Sep. 2010



2009 after Typhoon Morakot



1. Buried house: 50
2. Causality: 0
3. 400 residents evacuated

部分土堤遭
洪水沖毀

東部落東側土堤遭洪水沖毀並淤埋沿岸民宅

2010.09.21

照片來源：水保局

9/18

9/19

05:30

14:00

15:00

08:40

23:00

Issue land
warning

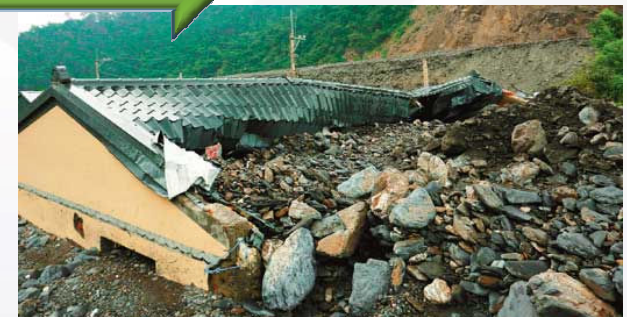
Early
warning of risk

Evacuation
operation

Typhoon
landfall time

Landside
in Lai-Yi

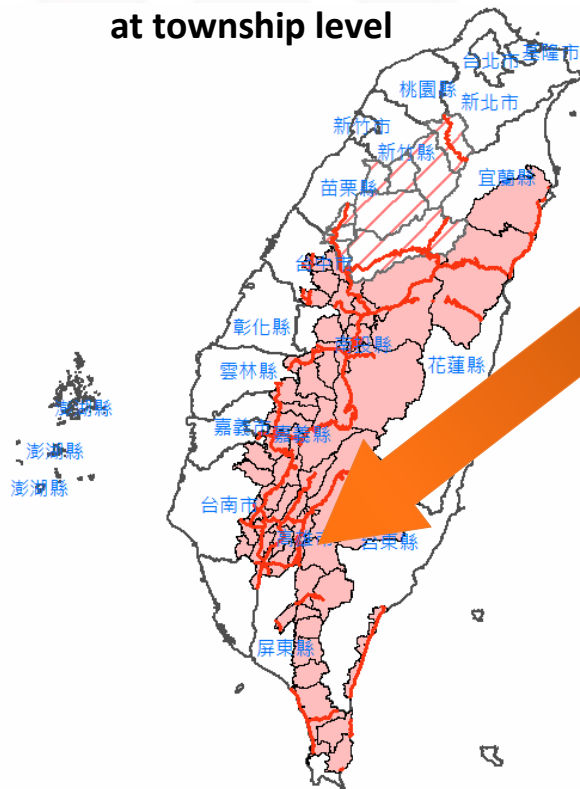
32 hours ahead



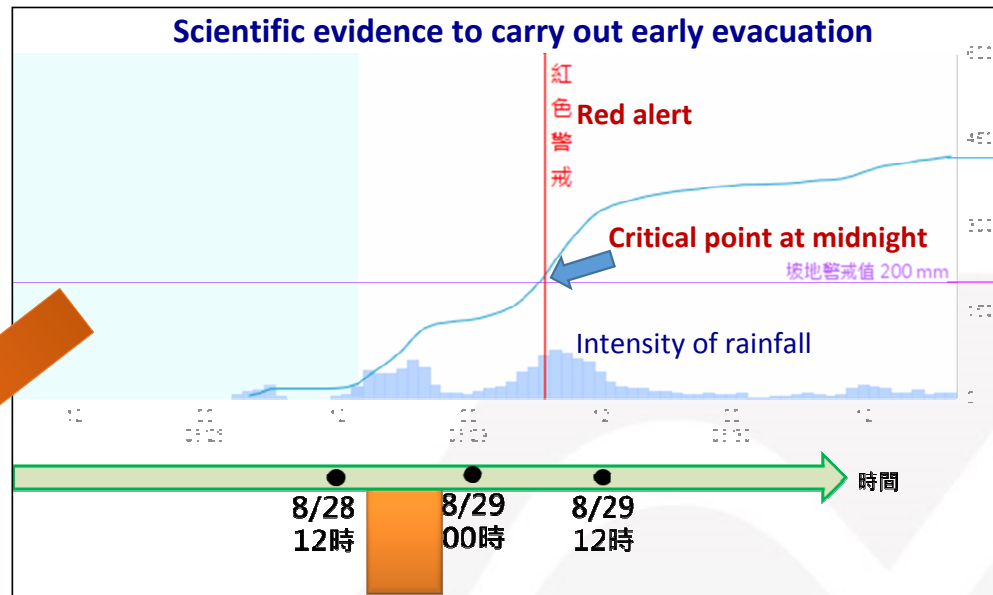
Evidence-based emergency operation – Early evacuation Typhoon Kong-Rey in 2013



Potential Risk Map of debris flow at township level



Accumulated rainfall up to 400-600mm



Forecast of rainfall

Critical point at midnight

板地警戒值 200 mm

Threshold value of debris flow

200 mm accumulated rainfall in 24hrs

8/28 12時 8/29 00時 8/29 12時

時間

The best period of time to evacuate residents

- Day time
- Arranged transportation

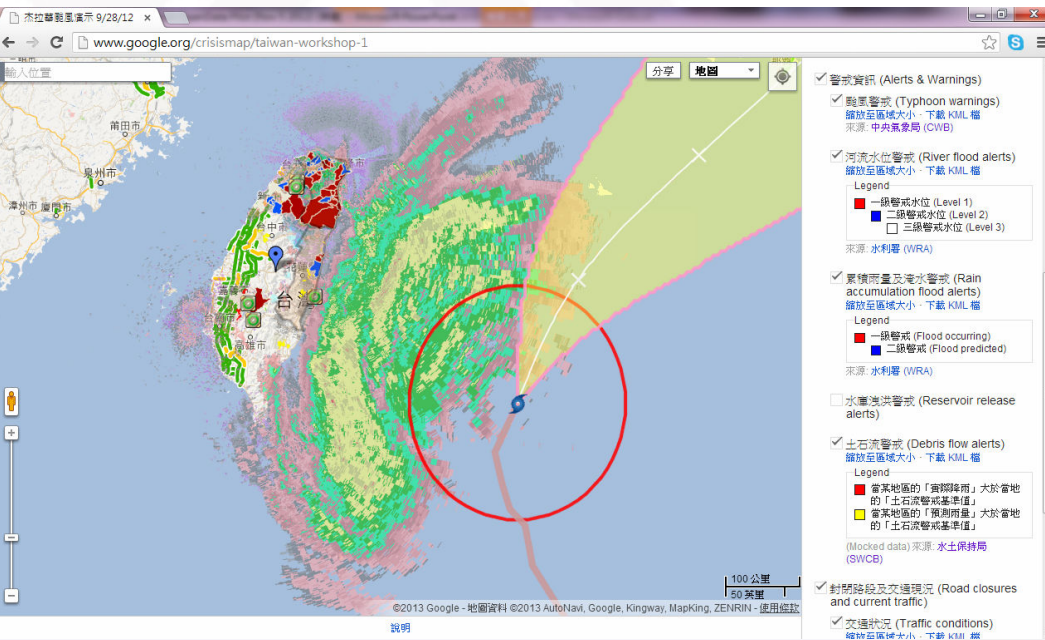
Information to the general public – collaboration with Google’s services

Common Alerting Protocol



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- Industry, government, academia and personal APP developer, all apply for interfacing alert data
- Google services starts in 2013/07/10, using our platform’s service
- In 2014, 15 million of users ever visited to check during two typhoons



Google Crisis Map



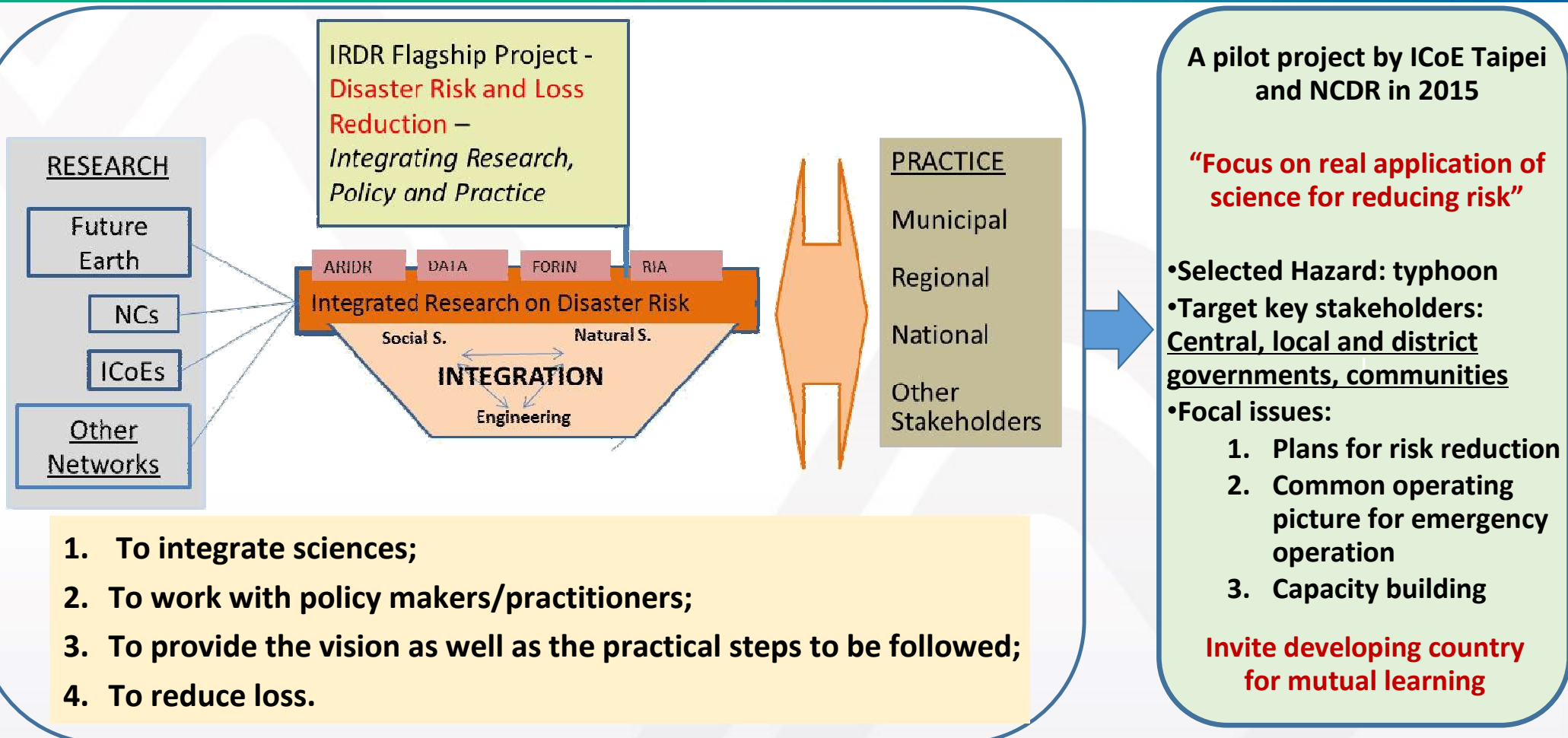
Google Alerts

“big data” “open and actionable”

IRDR Flagship Project based on outcomes of all scientific research achievements and four IRDR groups



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Conclusions: Roles of S&T to reduce loss Science to decision making



Scientific Prediction

- Provide forecasting based on scientific models
- Tool for pre-disaster deployment
- Reference for decision support
- Limited by technology development

Rea-time Monitoring

- Provide updated data based on gauges
- Tool for pinpointing blind areas by forecast
- Reference for **revising** decision support
- Limited by number, location, transmission

In-time Operation

- Provide reaction based on well-defined plan
- Tool for saving more time before it's too late
- Reference for **allocating** emergency support
- Limited by determination of all-level administrators

Key elements to succeed

An integration of

- Natural science
- Social science
- Engineering
- Emergency management
- Multiple key stakeholders
- Public-private partnership
-

Thanks

Learning from disasters and living with them

Wei-Sen Li

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