



國家災害防救科技中心

National Science and Technology Center
for Disaster Reduction

Development of Taiwan's Disaster Prevention and Protection Policy

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Secretary-General, NCDR

Co-Chair, APEC Emergency Preparedness Working Group

2014/10/30

2014 Workshop on National Disaster Prevention and Protection Policy and Practice Schedule, Taipei, Taiwan

你知道以下的趨勢？

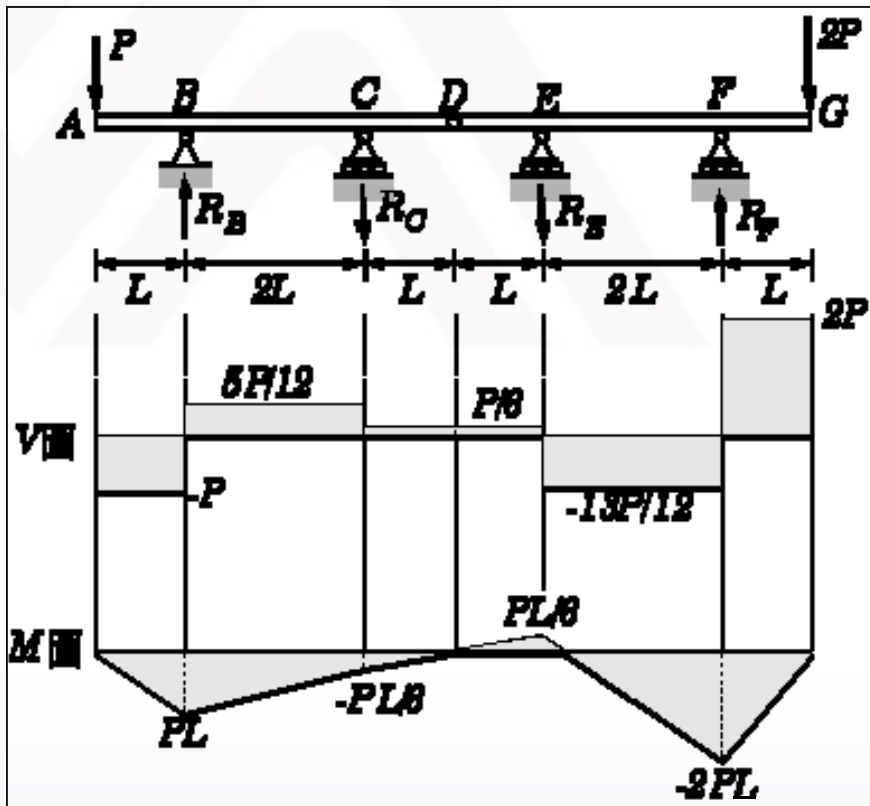


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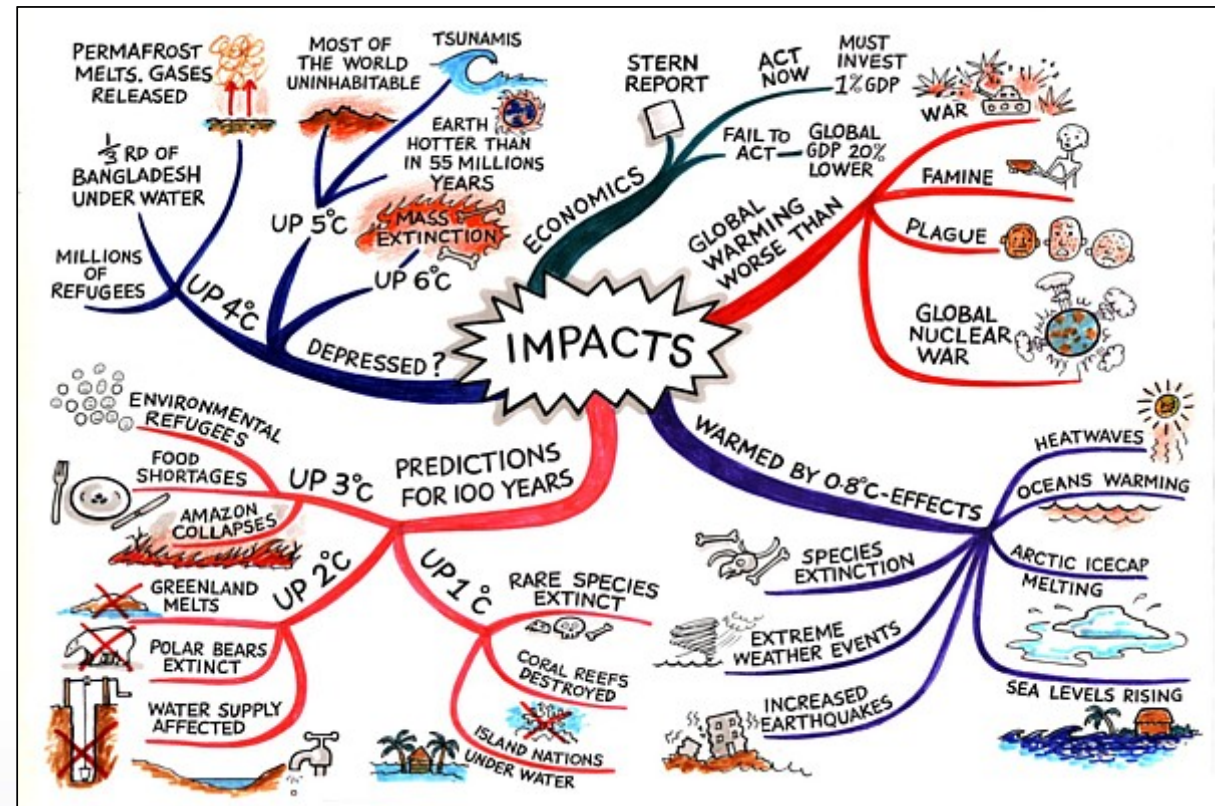
- Risk prevention vs Risk reduction, vulnerability (Social and physical)
- Safe school, safe hospital, safe hotel
- Public-Private partnership
- Business continuity plan/management
- Community-based risk management
- Disaster risk reduction, Climate Change Adaption, Sustainable development
- Hyogo Framework for Action, Hyogo Framework for Action2
- Improve risk governance and accountability
- Insurance, reinsurance
- UNISDR, UNOCHA, UNDEP, IRFC.....



Answer vs. Solution

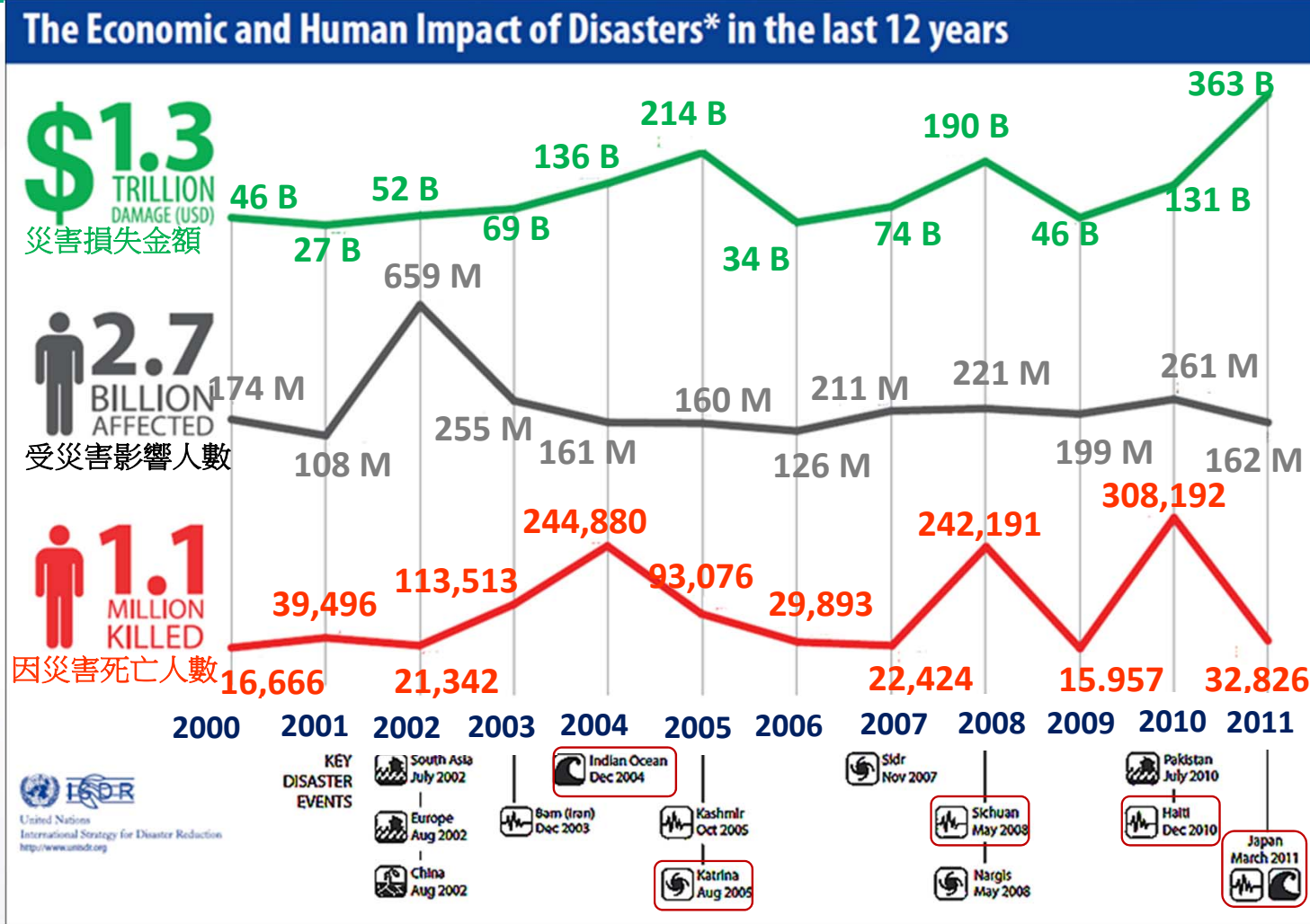


On text book, only one answer

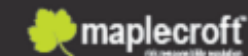


For a solution,
overall understanding is basic

Tendency of disaster impacts since 21st century

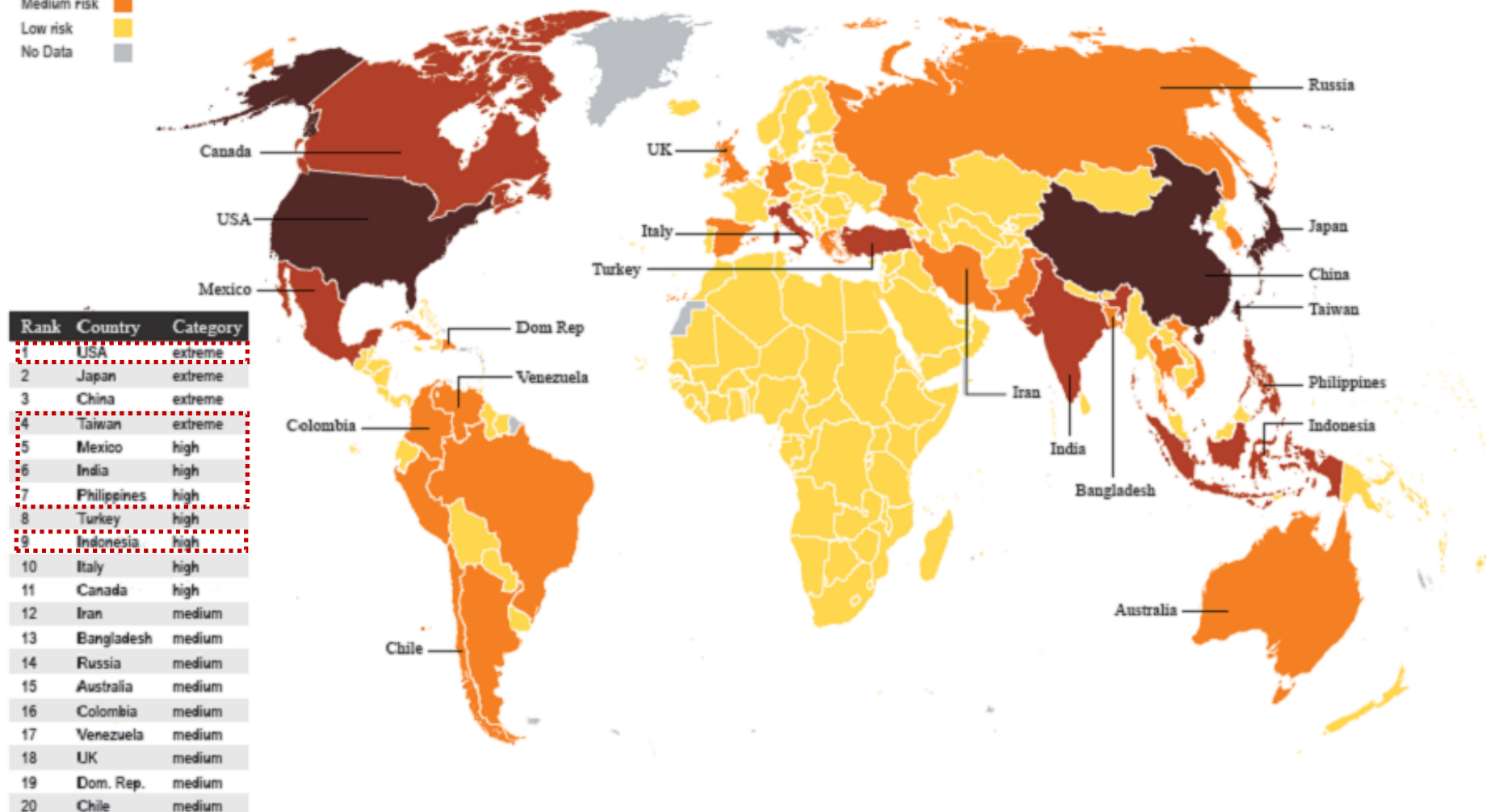


Natural Hazards Risk – Absolute Economic Exposure Index 2011



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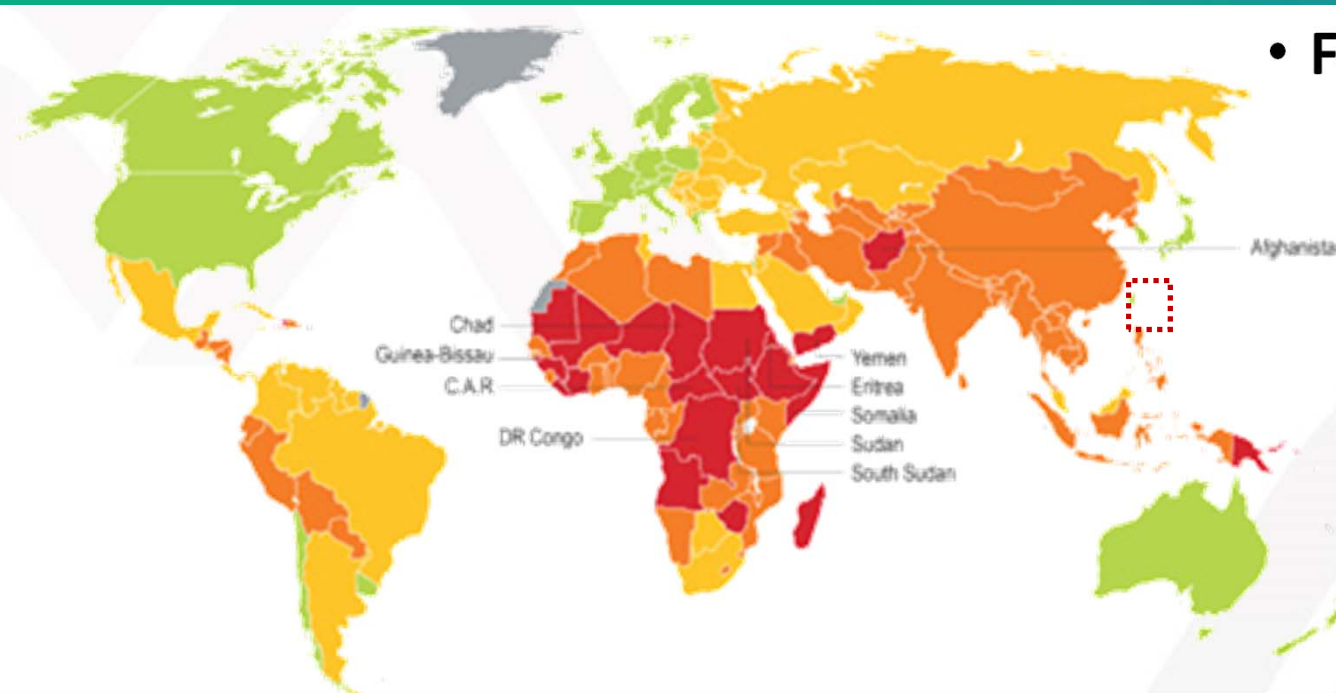
Extreme risk
High risk
Medium risk
Low risk
No Data



Maplecroft's Socio-economic Resilience Index 2013



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• Factors that keep Taiwan resilient

■ Transparent risk

- Website to download Risk maps of flood, landslide and debris flow

■ Well-organized legal frameworks

- Disaster Prevention and Response Act (2000~)
- Office of Disaster Management (2009~)

■ Active participation by private sector

- NGOs and NPOs
- Communities
- Academia, professional groups

| Legend | |
|--------------|--|
| Extreme risk | |
| High risk | |
| Medium risk | |
| Low risk | |
| No Data | |

| Rank | Country | Rating |
|------|-------------|---------|
| 1 | Somalia | Extreme |
| 2 | Afghanistan | Extreme |
| 3 | DR Congo | Extreme |
| 4 | Sudan | Extreme |
| 5 | C.A.R | Extreme |

| Rank | Country | Rating |
|------|---------------|---------|
| 6 | Chad | Extreme |
| 7 | South Sudan | Extreme |
| 8 | Yemen | Extreme |
| 9 | Eritrea | Extreme |
| 10 | Guinea-Bissau | Extreme |

Ways to understand natural hazards, and you belong to which one



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- Engineer says, “Design codes”, “Strength”, “Investment on”
- Scientist says, “Phenomena”, “Global trend”, “Observation”, “Adaptation”
- Sociologist says, “People-centered”, “Vulnerability”, “Gender equity”
- Economist says, “Risk”, “Insurance”, “Subsidy”, “Financial Pool”
- Emergency responder says, “Evacuation”, “Early warning”, “Relief”
- Reporter says, “Unprecedented”, “Blames”, “Scandals”, “Disappointed”
- Politician says, “Step down”, “More budget”, “report”
- Governmental official says, “Apology”, “Do our best”, “Insufficient plan”
- NGO says, “Respect to environments”, “Disaster risk reduction”
- The general say, “Safer home!”

Compare earthquake and hydro-meteorological hazards



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- **Minoring**
 - Real/near-real time; forecast; location of impact; long-term monitoring
- **Early warning**
 - Different time scale; way to send warning; steps to lower damage
- **Predictability**
 - Models; return period; point of contact
- **Risk/loss estimation**
 - scenario; types of impacts; way to reduce risk
- **Responses and action to emergency**
 - Before/during/after disaster; required personnel and techniques; challenges to face

Definition of “Mega City”

| Rank | Megacity | Country | Continent | Population |
|------|--|--------------------------------|-------------------------------|------------|
| 1 | Tokyo | Japan | Asia | 34,800,000 |
| 2 | Guangzhou | China | Asia | 31,700,000 |
| 3 | Shanghai | China | Asia | 28,900,000 |
| 4 | Jakarta | Indonesia | Asia | 26,400,000 |
| 5 | Seoul | South Korea | Asia | 25,800,000 |
| 6 | Delhi (India) | India | Asia | 24,000,000 |
| 7 | Mexico City | Mexico | North America | 23,800,000 |
| 8 | Karachi^[20] | Pakistan | Asia | 23,500,000 |
| 9 | Manila | Philippines | Asia | 22,200,000 |
| 10 | New York City | United States | North America | 21,600,000 |
| 11 | São Paulo | Brazil | South America | 21,600,000 |
| 12 | Mumbai | India | Asia | 21,400,000 |
| 13 | Beijing | China | Asia | 19,300,000 |
| 14 | Los Angeles | United States | North America | 17,200,000 |
| 15 | Osaka | Japan | Asia | 16,800,000 |
| 16 | Dhaka | Bangladesh | Asia | 16,300,000 |
| 17 | Cairo | Egypt | Africa | 16,100,000 |
| 18 | Kolkata | India | Asia | 16,000,000 |
| 19 | London | United Kingdom | Europe | 15,500,000 |
| 20 | Buenos Aires | Argentina | South America | 14,500,000 |
| 21 | Bangkok | Thailand | Asia | 14,500,000 |
| 22 | Istanbul | Turkey | Europe/Asia | 14,160,467 |
| 23 | Lagos | Nigeria | Africa | 13,200,000 |
| 24 | Tehran | Iran | Asia | 13,200,000 |
| 25 | Rio de Janeiro | Brazil | South America | 12,900,000 |
| 26 | Lahore^[21] | Pakistan | Asia | 12,500,000 |
| 27 | Shenzhen | China | Asia | 11,700,000 |
| 28 | Moscow | Russia | Europe | 11,510,000 |
| 29 | Rhine-Ruhr | Germany | Europe | 11,316,429 |
| 30 | Paris | France | Europe | 10,700,000 |

• Definition

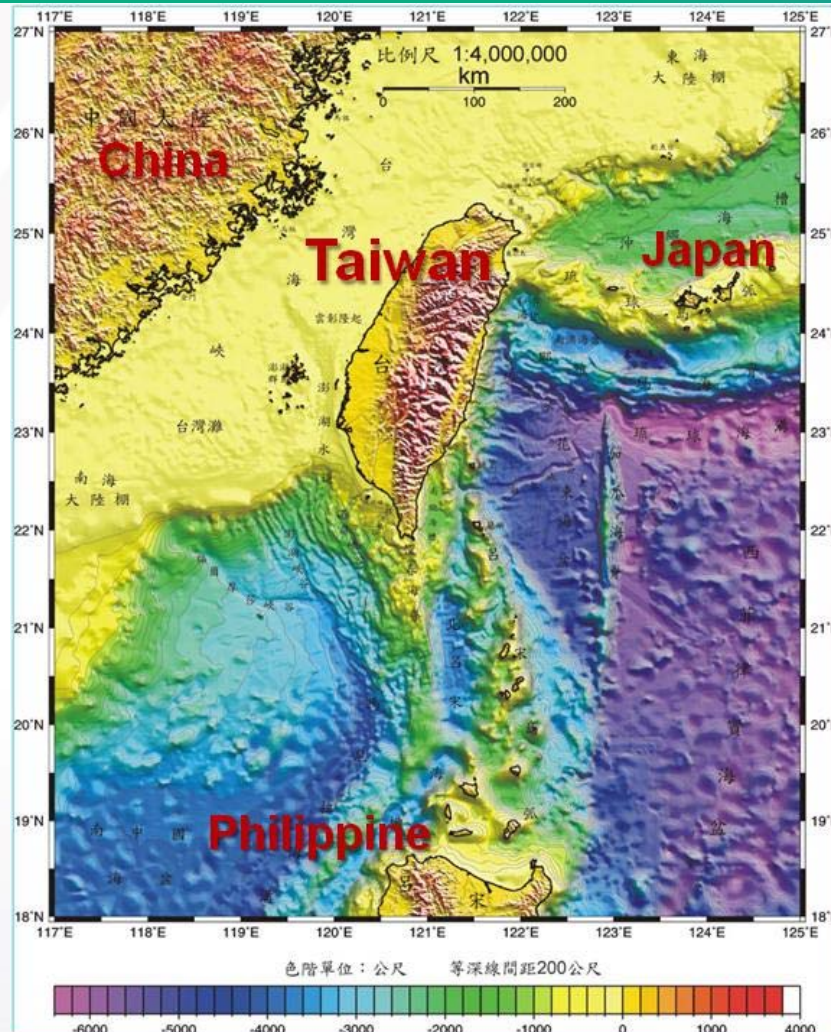
- Population > 10 million

• Challenges

- Slums
- Homelessness
- Traffic congestion
- Urban sprawl
- Gentrification
- Environmental problems
 - Air pollution, Flood utility, Seismic capacity



Basic Information of Taiwan



- **Geographic features**
 - 400 km from north to south
 - 145 km from east to west
 - Area: 36,000 Km² **over 70% in slope land**
- **Population (July, 2014)**
 - 23,398,263 in total, **67.70% in urban areas**
 - **Density: 647/ Km²** ,(but 39,979 in highest district, Chun-her)
- **Tectonic Conjunctions:**
 - **Philippine Sea plate**
 - **Euro-Asia Plate**
- **High risk of tropical cyclones**
 - **3.6 typhoons/year**

Taiwan Suffers More than Others

Countries Most Exposed to Multiple Hazards

Three or more hazards (top 15 based on land area)

| Country | Percent of Total Area Exposed | Percent of Population Exposed | Max. Number of Hazards |
|-------------|-------------------------------------|-------------------------------------|---------------------------|
| Taiwan | 73.1 | 73.1 | 4 |
| Costa Rica | 36.8 | 41.1 | 4 |
| Vanuatu | 28.8 | 20.5 | 3 |
| Philippines | 22.3 | 36.4 | 5 |
| Guatemala | 21.3 | 40.8 | 5 |
| Ecuador | 13.9 | 23.9 | 5 |
| Chile | 12.9 | 54.0 | 4 |
| Japan | 10.5 | 15.3 | 4 |

Source: World Bank, 2005

In 2009, record in history, Typhoon Morakot



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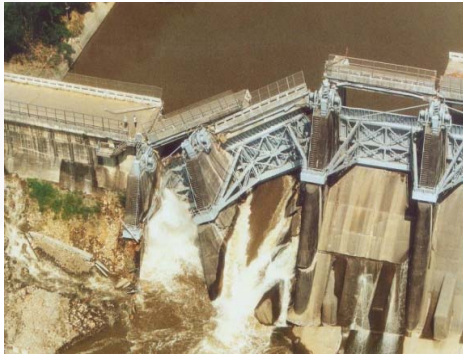
Natural disasters by number of deaths⁽¹⁾ - 2009

| | | |
|---|-------------|-------|
| Earthquake, September | Indonesia | 1 195 |
| Flood, July-September | India | 992 |
| Typhoon Morakot (Kiko), August | Taiwan | 630 |
| Typhoon Pepeng (Parma), October | Philippines | 539 |
| Tropical storm Ondoy (Ketsana), September | Philippines | 501 |
| Extreme temperature, January-February | Australia | 347 |
| Flood, September-October | India | 300 |
| Earthquake, April | Italy | 295 |
| Hurricane 'Ida', November | El Salvador | 275 |
| Extreme temperature, May-August | Peru | 274 |

(1): Includes the reported missing persons

Source: UN/ISDR

Taiwan's Major Natural Challenges



Earthquake (1999)



Landslide



Typhoon (2009)

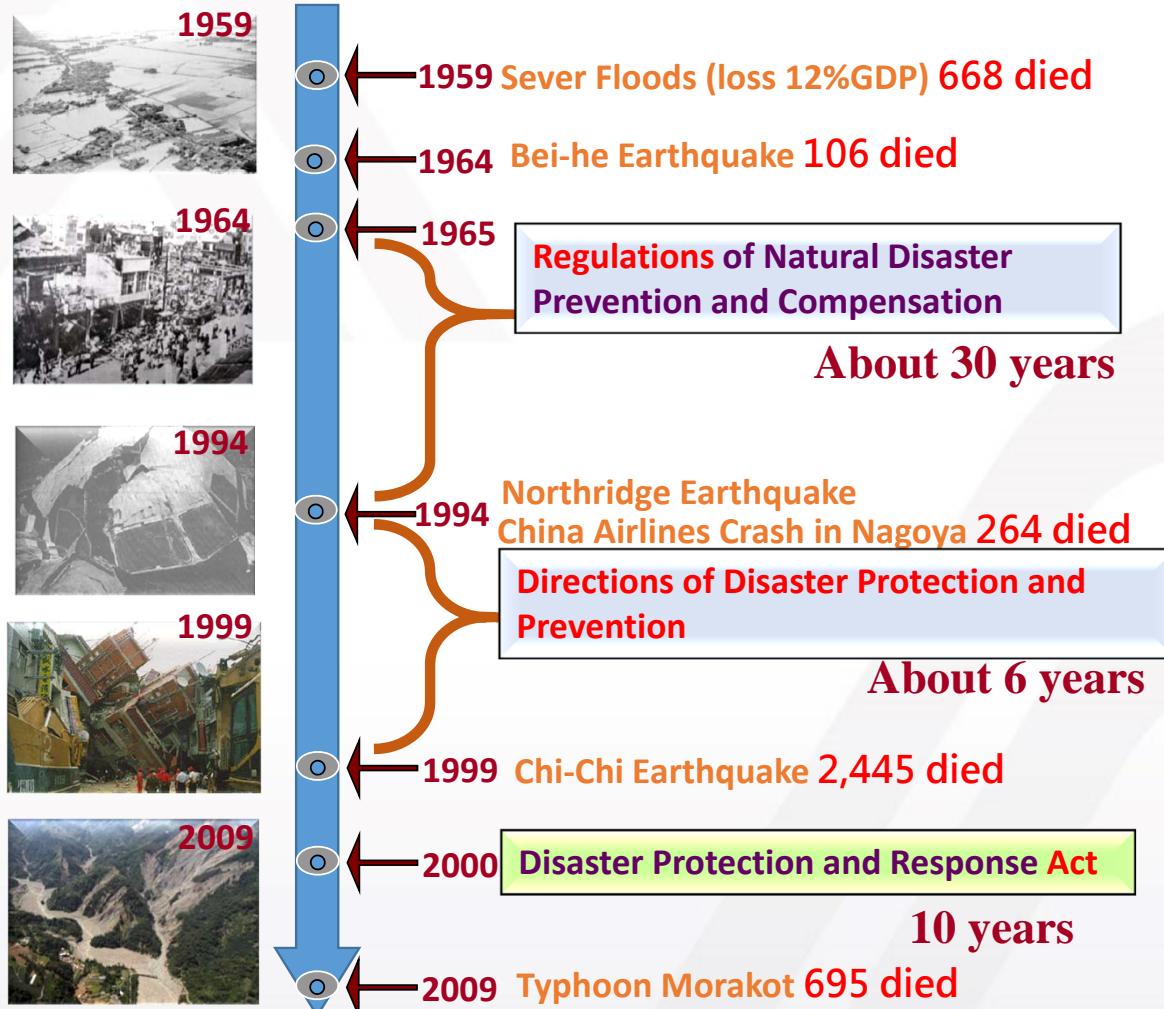


Flood



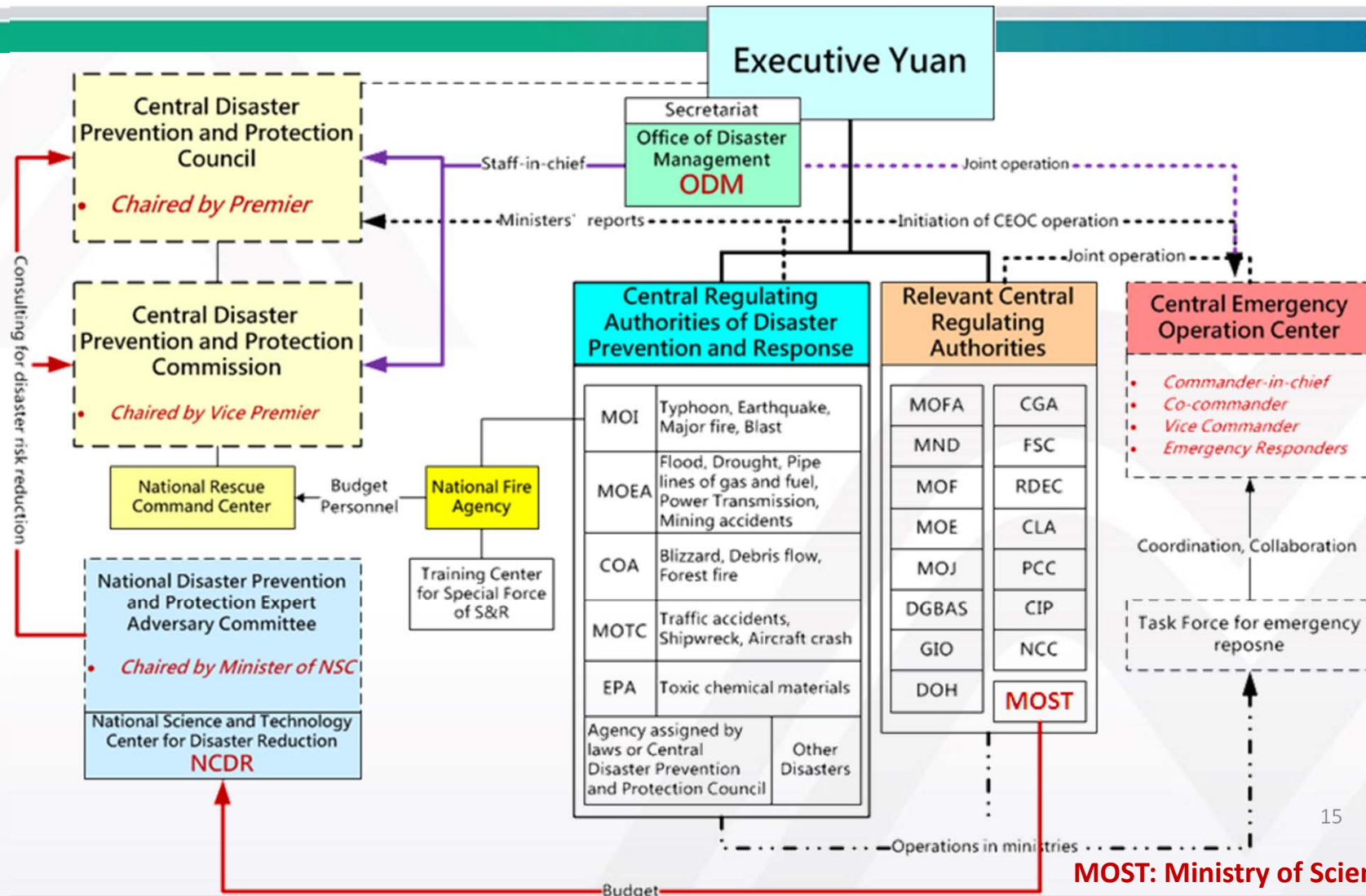
Debris flow

“Windows of Opportunity” in Taiwan

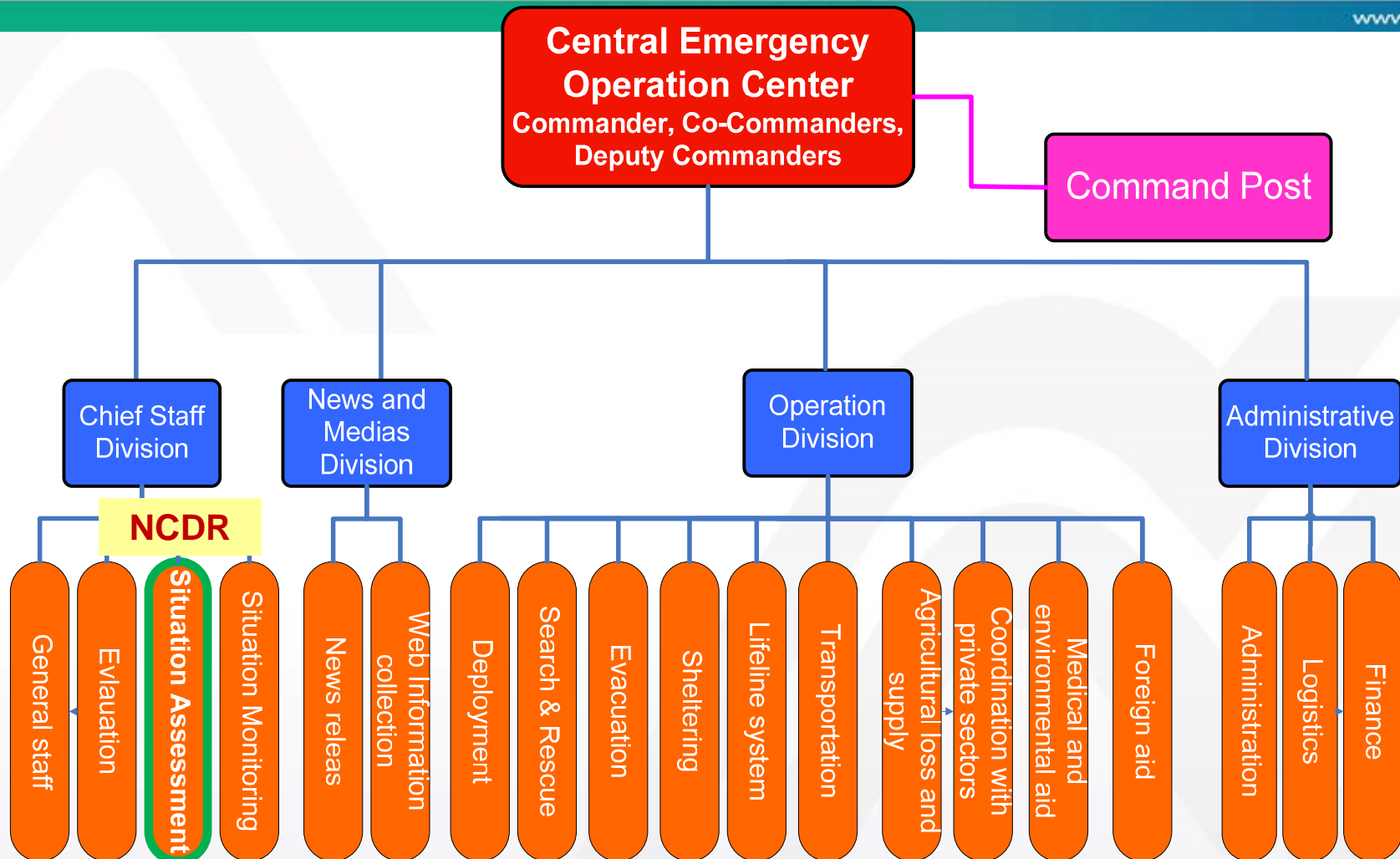


| GNP | Population |
|----------|------------|
| \$122 | 10,484,725 |
| \$189 | 12,325,025 |
| \$203 | 12,698,700 |
| \$10,971 | 21,177,874 |
| \$12,100 | 22,092,387 |
| \$12,961 | 22,276,672 |
| \$15,509 | 22,978,913 |

Structural reform on disaster management

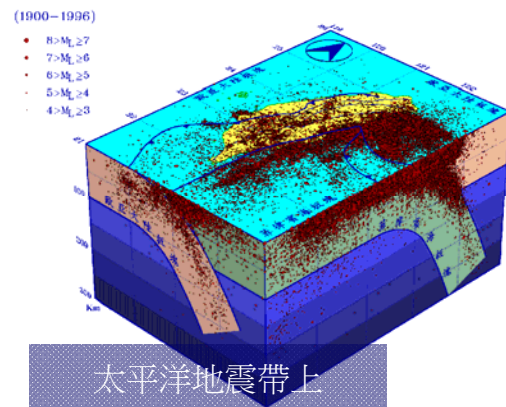
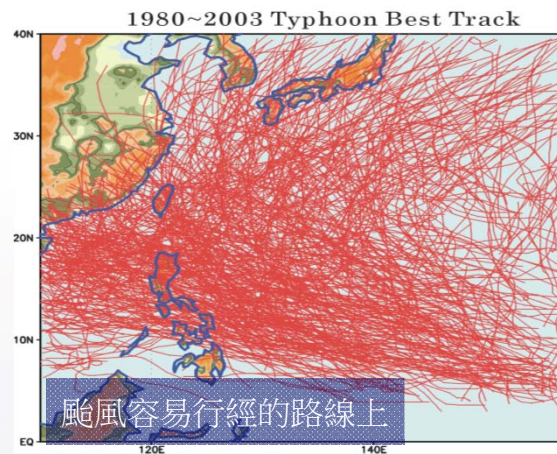


One of the key role: Helping emergency operation



Physical vulnerabilities in Taiwan

- Environmental degradation, land use and sustainability
 - Over ground water extraction leading to land settlement
 - Climate change causing more extreme weather events: droughts and floods
 - Coastal erosion reducing land
 - 73% of total homeland listed as preservation and low cultivation

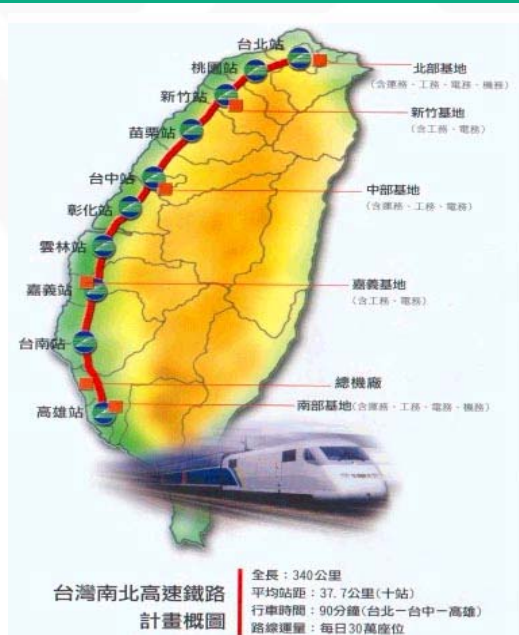


Social vulnerabilities

- Potential social risks gradually increase
 - Very high population density **647/ Km²**
 - Rapid urbanization attracting people to cities
 - Demographic structure changes like aging population
 - Economic growth and development: Business Continuity Plan



Potential risks of urban areas and industry



- Risk due to rapid development

- Aging infrastructure
- More high rising buildings
- Increasing underground space
- Long tunnel
- High-speed rail system
- Transportation networks
- High-tech and traditional industries



A typical risk hot zone Taipei Train Station

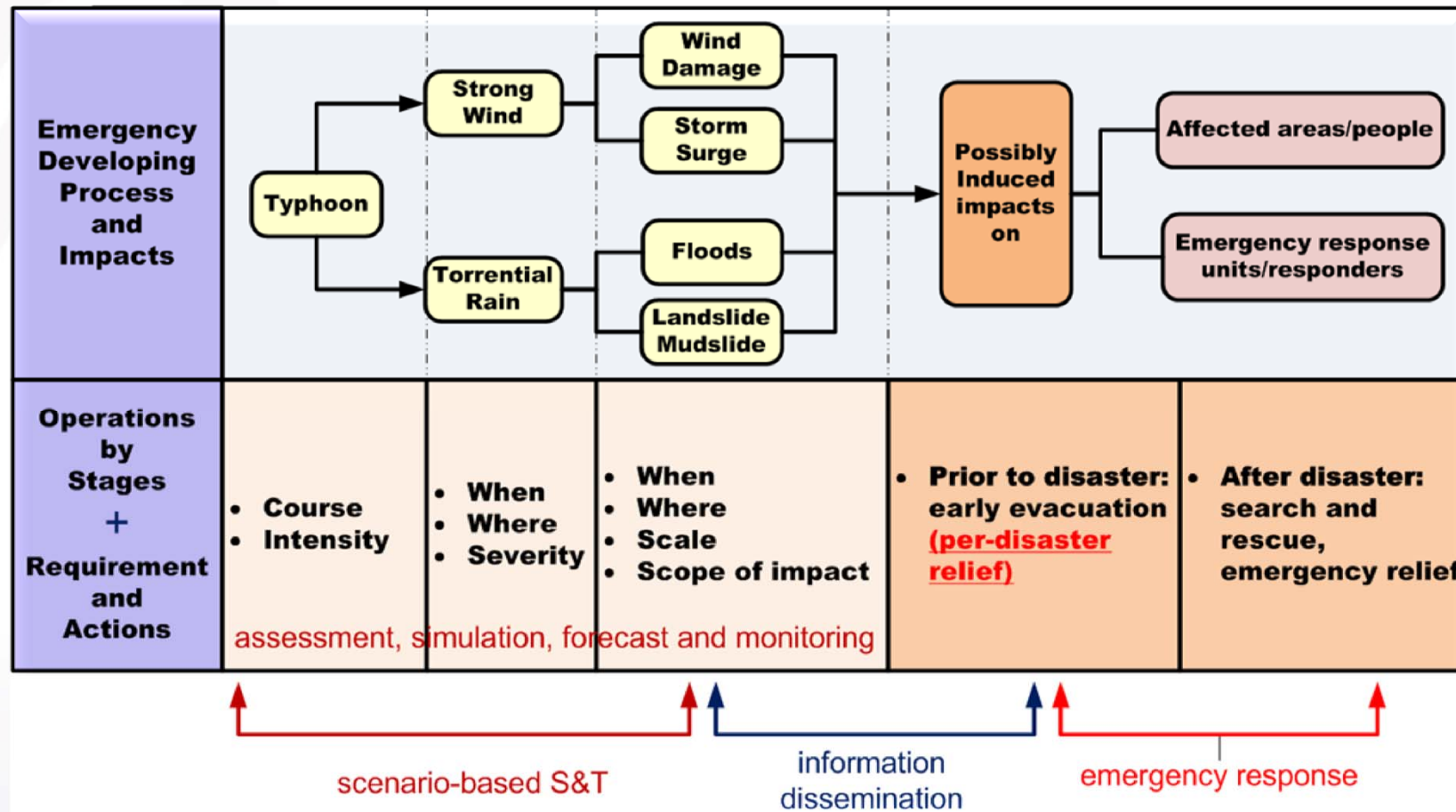


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- Converging Point
 - Railway
 - High speed rail
 - MRT, blue & red
 - Coach bus
 - Shopping malls
 - Underground passage
- Passengers + visitors
 - > 300,000/day
- IF.....
 - Earthquake
 - Operational accident

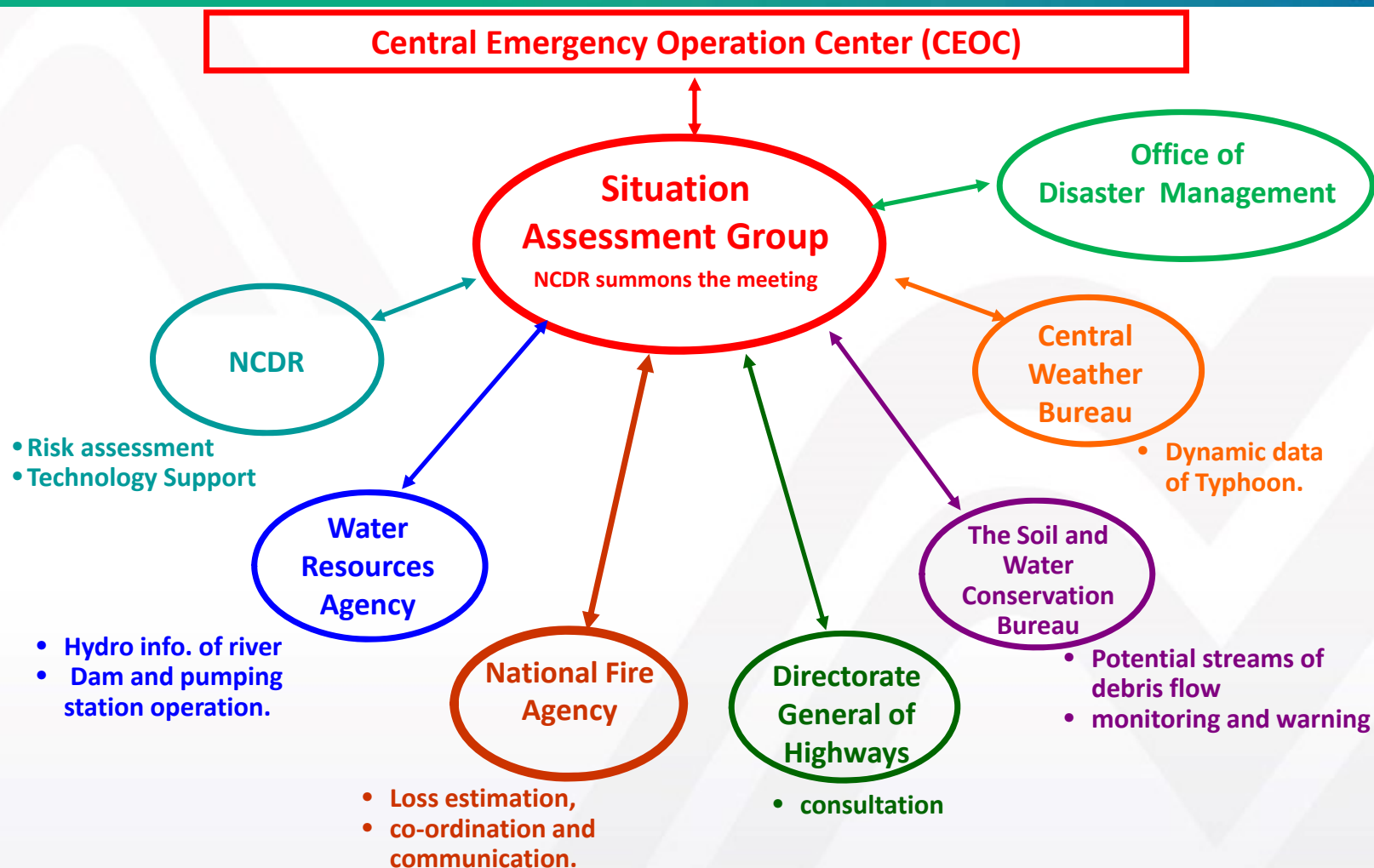
Demands and supports of S&T according to emergency operation stages



Operation of the CEOC Assessment Group (Typhoon)



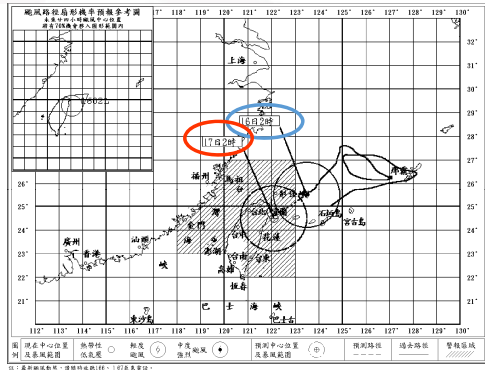
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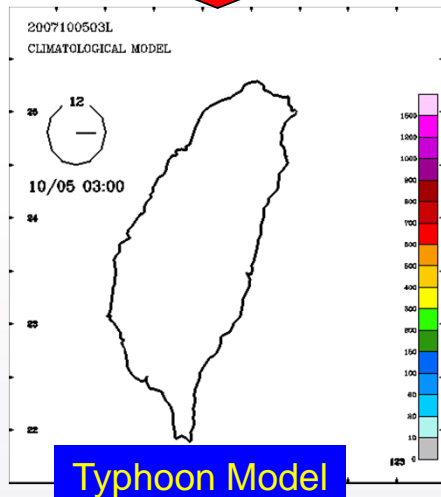
Technological Support to Reduce Possible Damage



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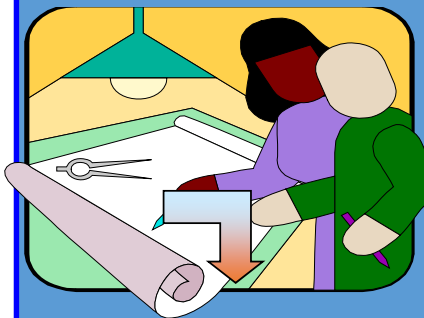


Monitor & Forecasting of CWB

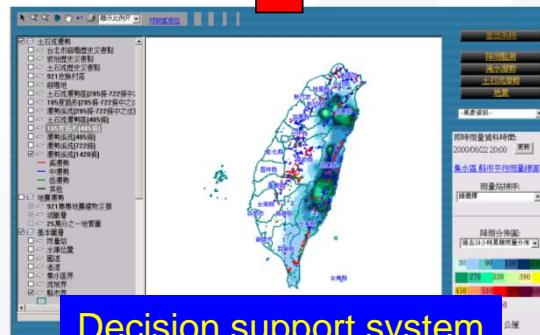


Typhoon Model

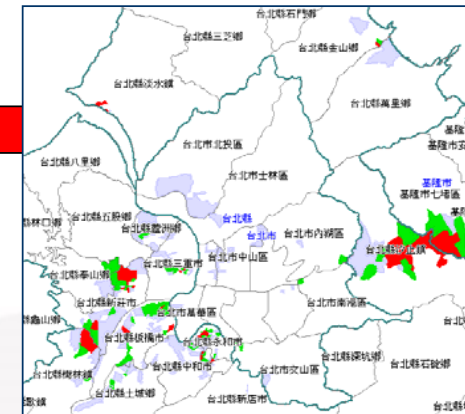
CEOC
Assessment Group



Evaluate the locations & scales of hazards
Early Warning and Evacuating

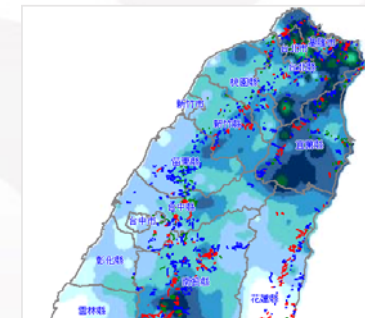


Decision support system
(Hazard potential)



Flood potential areas

+



Landslide & debris flow
potential areas

Progressive Improvements for Typhoons in Taiwan



| Typhoon | Max.Intensity (mm/hr) | Accumulated Rainfall (mm) | Evacuation (Person) | Ceased or Missing (Person) |
|----------------------|--------------------------|------------------------------|------------------------|-------------------------------|
| 2001.07.28 Toraji | 147 | 757 | ---- | 214 |
| 2001.09.17 Nari | 142 | 1,462 | 24,000 | 104 |
| 2004.06.30 Mindulle | 167 | 2,005 | 9,500 | 41 |
| 2005.07.18 Haitang | 177 | 2,124 | 1,208 | 15 |
| 2005.09.01 Talim | 119 | 766 | 1207 | 6 |
| 2005.10.02 LongWang | 154 | 776 | 945 | 2 |
| 2006.07.12 Bilis | 95 | 1,013 | 409 | 3 |
| 2007.08.16 Sepat | 122 | 1,399 | 2,531 | 1 |
| 2008.07.16 Kalmaegi | 161 | 1,027 | 179 | 26 |
| 2008.07.28 Fung-Wong | 121 | 830 | 1,303 | 2 |
| 2008.09.10 Sinlaku | 97 | 1,608 | 1,987 | 22 |
| 2008.09.27 Jangmi | 85 | 1,137 | 3,361 | 4 |
| 2009.08.07 Morakot | 100 | 2,965 | 24,775 | 695 |
| 2010.09.19 Fanapi | 125 | 1,128 | 16,568 | 2 |
| 2010.10.21 Megi | 183 | 1,195 | 3,453 | 38 |

NCDR Joined
EOC

Issue 1: Scenario-based disaster risk management for large-scale compound disasters



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Hurricane Katrina



Typhoon Morakot



Great East Japan Eq

- **Cases of large-scale compound disasters in recent years (Black-Swam Event)**
 - 2005 Hurricane Katrina, 2009 Typhoon Morakot, 2011 the Great Tohoku Kanto Earthquake and Tsunami
- **Problems founds**
 - 1) “Unprecedented and complicated” impacts, 2) continuously developing situations, 3) simultaneous urgent demands, 4) challenges to engineering-based measures, 5) lacks of information integration....
- **Demands for disaster risk management**
 - Tools to build up scenarios for planning and drills
 - Design of information system to provide situation awareness
 - Estimation of urgent relief demands after large-scale compound disasters
 - Study of evolutionary characteristics of compound disasters

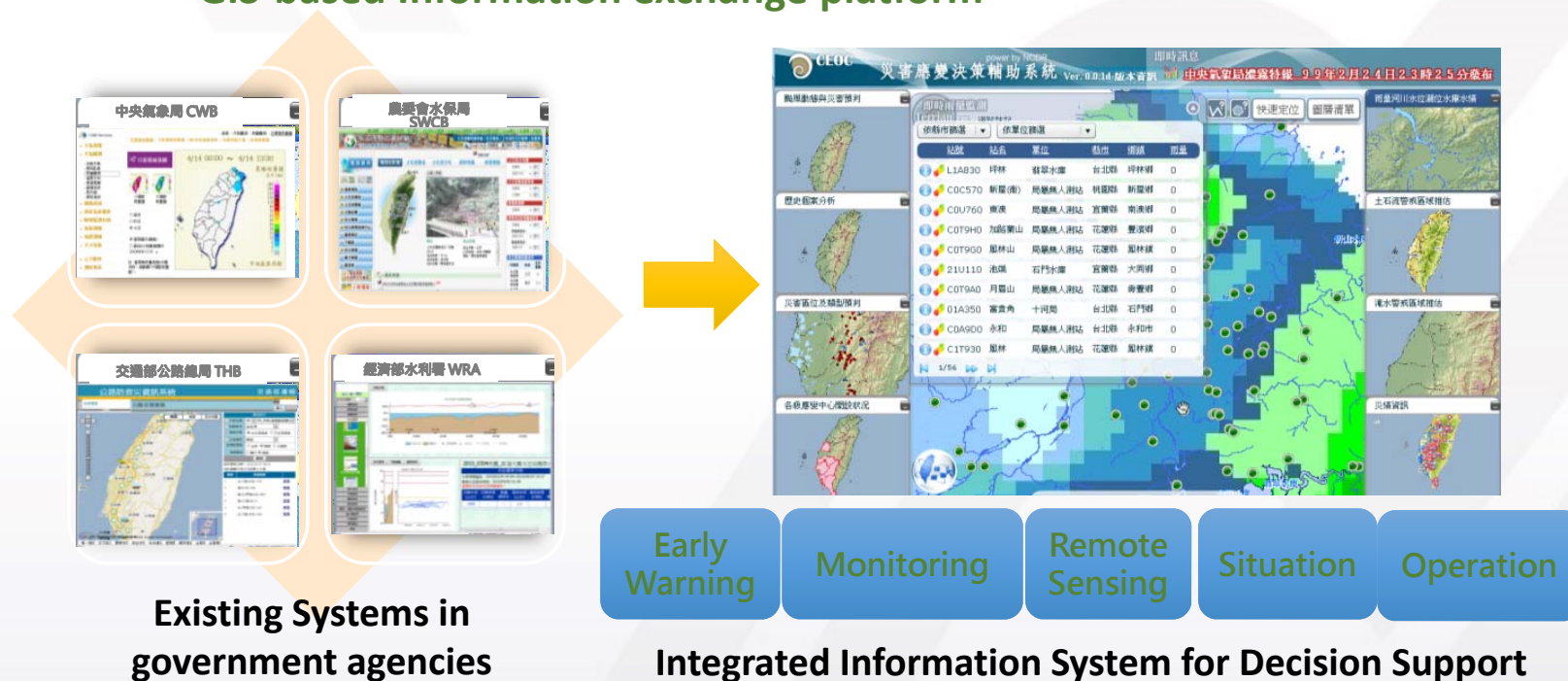
Challenge 1

Challenge 1: Lack of information integration

- ✓ Individual existing systems
- ✓ Hard to have add-ons and comprehensive view 各

Solution:

- ✓ GIS-based Information exchange platform



Challenge 2

Challenge 2: Lack of spatial information

- ✓ Descriptive information not suitable for situation map

Solution:

- ✓ Improvement of information quality
- ✓ Building up an integrated display platform

伍、災情統計

一、人命傷亡 (資料來源: 內政部消防署)

| 縣市別 | 死亡(人) | 失蹤(人) | 受傷(人) | 備註 |
|-----|-------|-------|-------|---|
| 台北縣 | 0 | 0 | 10 | |
| 台南縣 | 0 | 0 | 1 | |
| 宜蘭縣 | 0 | 0 | 4 | |
| 南投縣 | 0 | 0 | 1 | |
| 花蓮縣 | 0 | 0 | 1 | |
| 台東縣 | 0 | 5 | 0 | 7月18日 時民葉某等於成功鎮白守通公海海域被浪吹走不慎落海。連仁鄉南田村民葉某等 7 日早上自嘉義乘運送去約 15 公里路程積浪未歸失蹤。 8 日 18 時太麻里鄉溪水暴漲 3 人失蹤(員警 2 人江文祥、許金次、民某 1 人不詳)。 |
| 屏東縣 | 0 | 2 | 0 | 8 月 7 日 16:00 屏東縣林邊水利國小外海約 100 公尺處, 高雄籍漁船翻覆 3 人落海, 其中 1 人(船長杜明南)自行游上岸, 另 2 人(陳昭強、王德龍)失蹤待援。 |
| 高雄縣 | 1 | 1 | 2 | 8 月 7 日 18:10, 一婦人(林玉月珠, 87 歲)於期內即大湖村大湖社區活動中心東南基地旁溝渠騎乘機車, 遭強風吹落溝渠死亡。 8 日 11:15 獲救女子 50 歲張國英落海入海落溪失蹤待援。 |
| 合計 | 1 | 8 | 19 | |

- 高雄市區老樹壓傷人, 經查證 1 男子(張雲耀, 77 歲)走路不慎拌倒, 本案不列入颱風災情。
- 基隆港和平橋 1 女子(呂怡萍, 39 歲)落海, 故起時即無生命跡象, 因死亡原因不明, 尚待調查, 故未列入本次颱風傷亡案件。

(四) 維生管線災情 (資料來源: 經濟部、國家通訊傳播委員會)

| 項目 | 影響數目 | 搶修完成(戶、處) | 尚待修復(戶、處) | 備註 |
|---------|---------|-----------|-----------|----|
| 自來水 | 54000 | 0 | 54000 | |
| 電力 | 1052330 | 948859 | 103471 | |
| 電信(市話) | 38298 | 837 | 37451 | |
| 電信(基地台) | 3064 | 2178 | 986 | |

Situation Report in text mode



GIS Situation Display

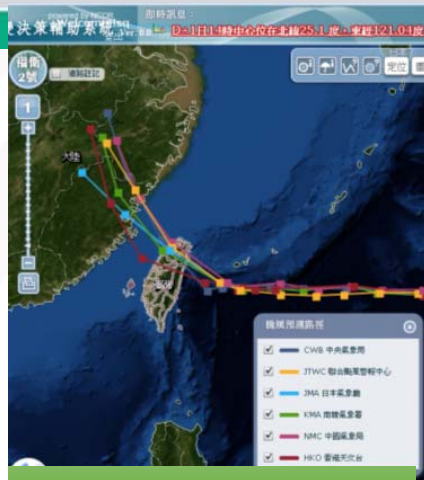
Decision Supporting System



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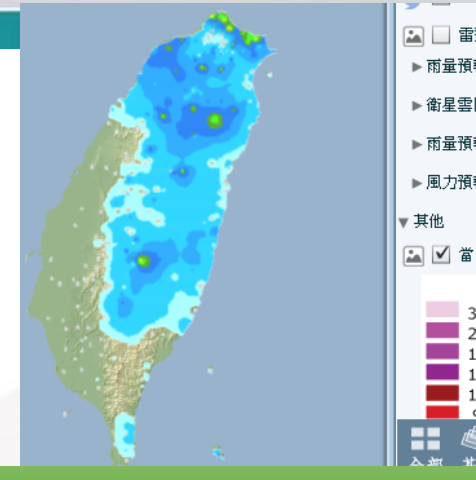
Information Display Module -Weather



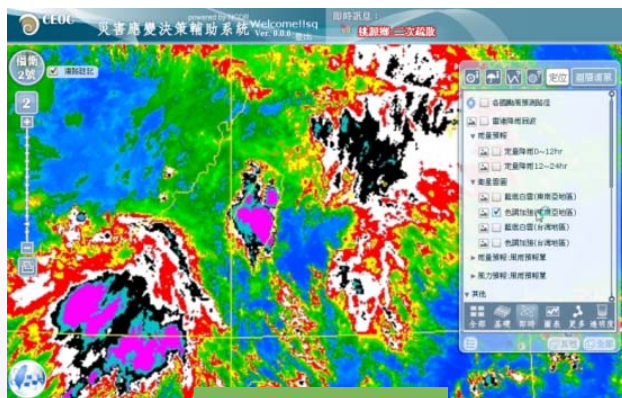
Course Predictions



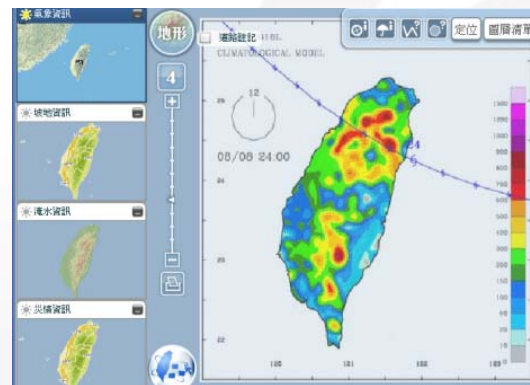
Radar



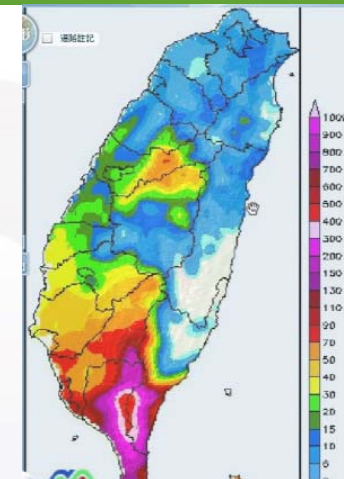
Real-time rain gauge data



Satellite



Climate model



Dynamic model

Issue 2: Climate change adaptation strategies with disaster risk reduction



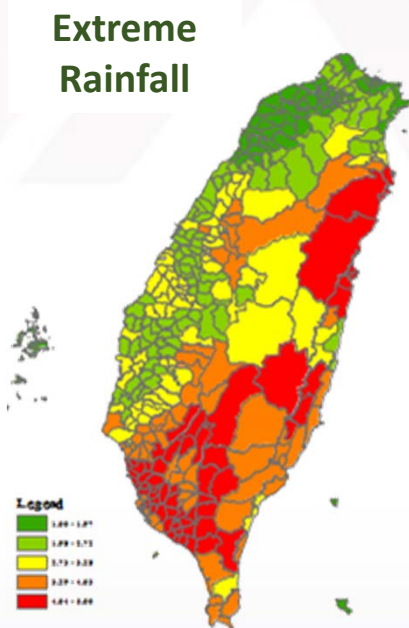
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- **Challenges of climate-change-related disasters in Taiwan**

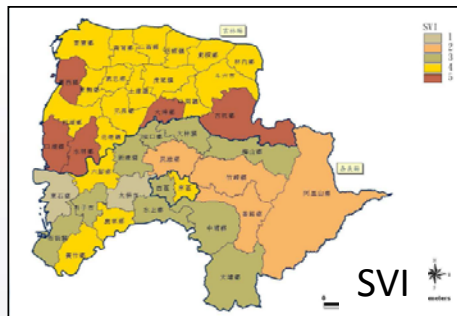
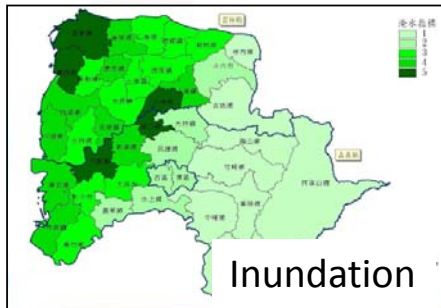
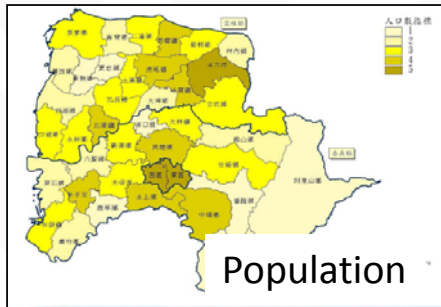
- **Direct impacts:** 1) Higher temperature; 2) Sea level; 3) Rainfall distribution change; 4) More extreme rainfall events; 5) Typhoon and storm surge
- **Evolving impacts:** 1) Slope land disasters; 2) distribution of water resource; 3) investment on new development projects.....

- **Demands for develop CCA and DRR**

- **Download scaling techniques to produce scientific projection for coming decades**
- **Risk map to identify risk potential based on impacts by hazards like flood, slope land, land subsidence, vulnerability of costal areas**



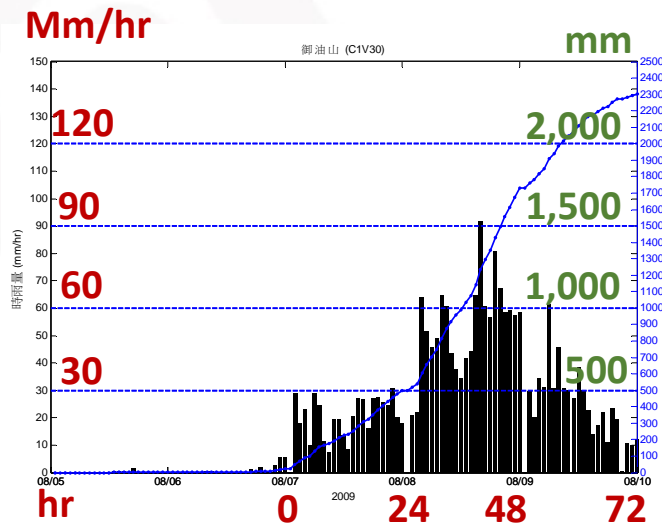
Issue 3: Social risk vulnerability assessment



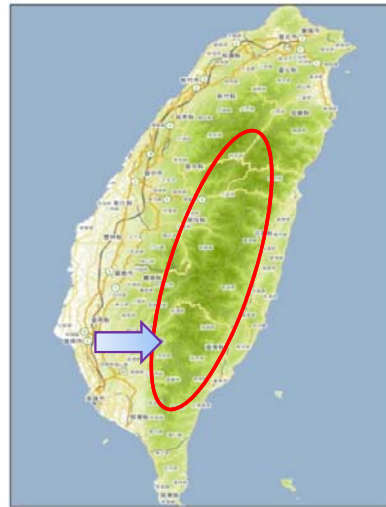
- **Overlapping of hazard map and population exposure to identify “hot spots”**
 - Considered social factors: 1) population density and structure, 2) education and income, 3) economic activities, 4) past events and perception, 5) social support, 6) insurance
- **Problems founds due to social development**
 - 1) Rapid urbanization, 2) land use management, 3) aging society, 4) vulnerability of indigenous tribes, 5) tools for risk communication, 6) disaster resilience at community level
- **Products to be delivered**
 - Models for loss estimation
 - Establishment of Social-economic Vulnerability Index (SVI) and Human Development Index (HDI)

Typhoon Morakot in 2009

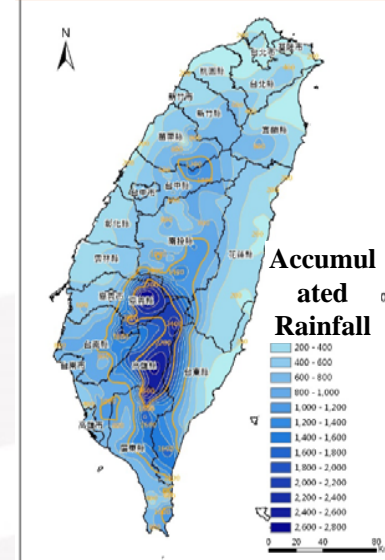
Long duration of heavy rainfall



Complex topography



High concentration

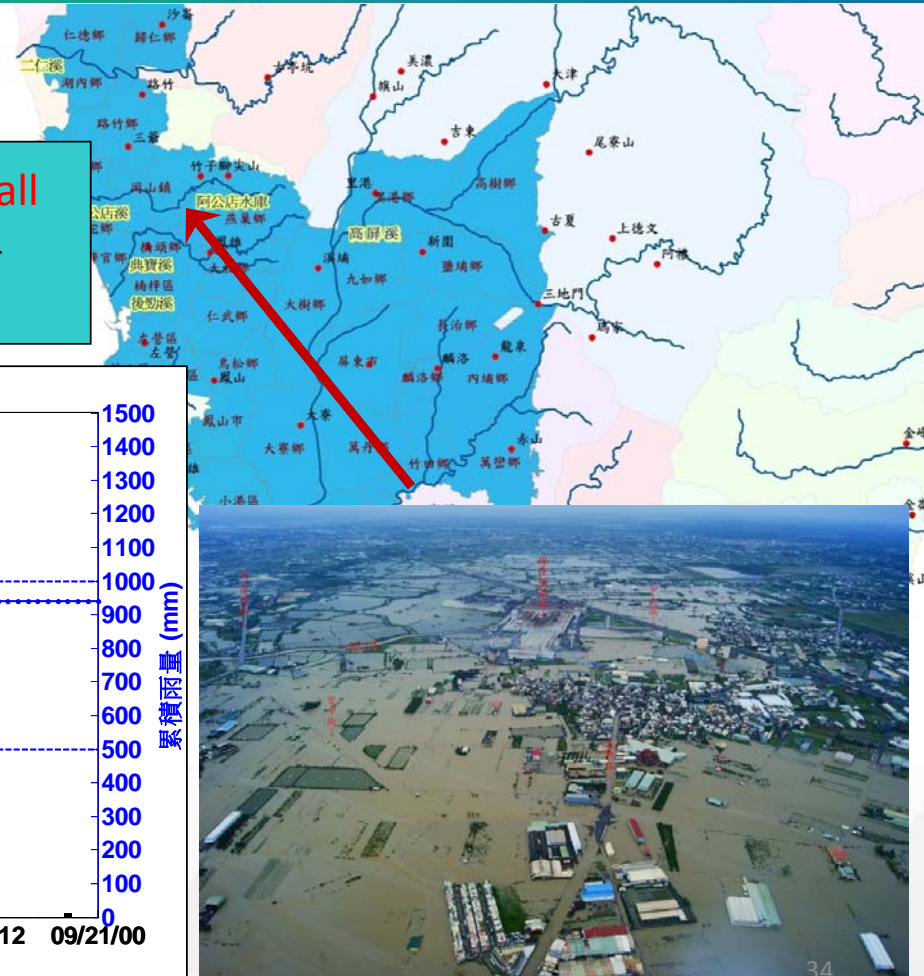
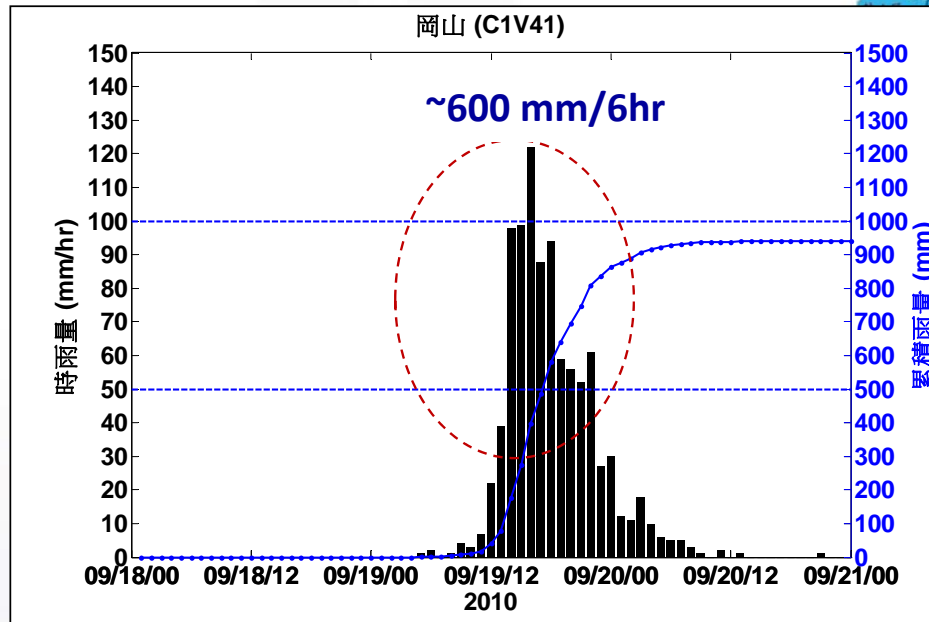


- **Long and intensive rainfall:** 50-60mm/hr precipitation lasts for over 24 hours.
- **Topography:** Area of Taiwan is about 36,000 Km^2 , **over 70% in slope land.**
- **High concentration:** *Extreme rainfall concentrated mainly in mountain areas.*

More and More Extreme Events in Taiwan ?

- Typhoon Fanapi (2010), urban flood

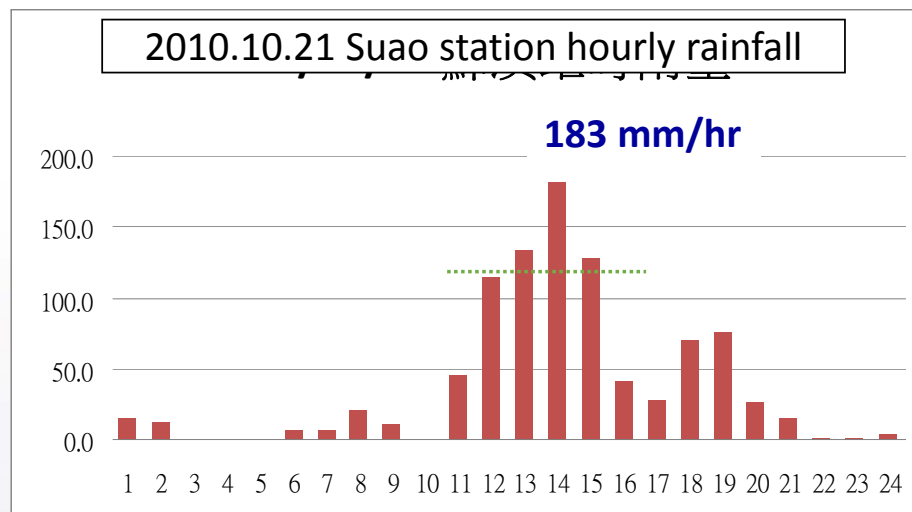
■ Totally 600mm accumulated rainfall during 6 hours was found at Gang-Shan station.



More and More Extreme Events in Taiwan ?

- Typhoon Megi (2010), 400 more tourists trapped in costal highway
- New type of highly vulnerable people- tourists coming from China

- The rainfall with the magnitude over 100 mm/hr over 4 hours.
- The peak value is reach 183 mm



Issue 4: Critical infrastructure protection under threats from natural hazards



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- Threats

- According to the World Bank's report, exposure rate of land is over 90%, considering at least two natural hazards likewise CIs.

- Problems founds due to CI's failures

- National security
- Government and business operation continuity
- Basic civil protection
- Direct impacts to people's livelihood.

- Current developments for improving critical infrastructure protection

- Failure modes to individual hazards by risk assessment
- Impact evaluation of system(s) failure
- Status indicators for monitoring system satiability



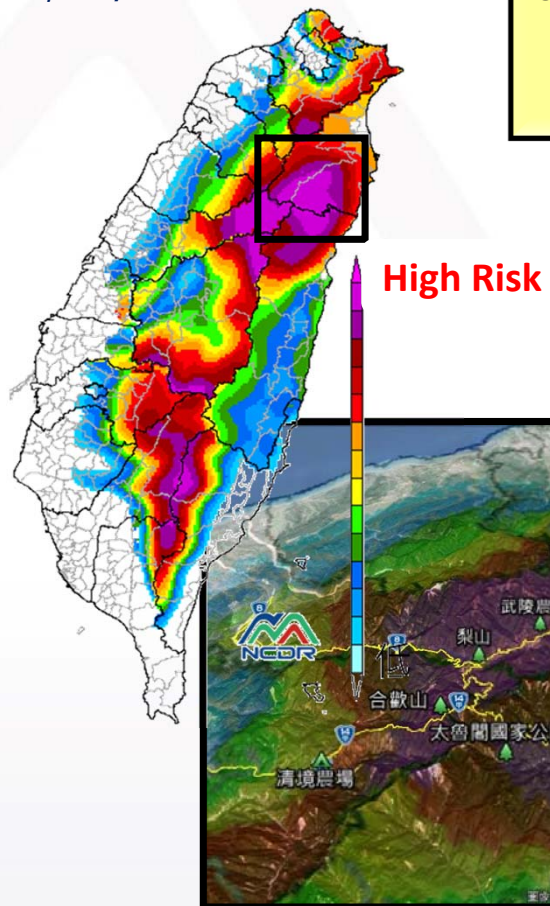
Typhoon Aere, 2004



Chi-Chi Earthquake,
1999

Three principles to integrate information for typhoon emergency operation

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



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

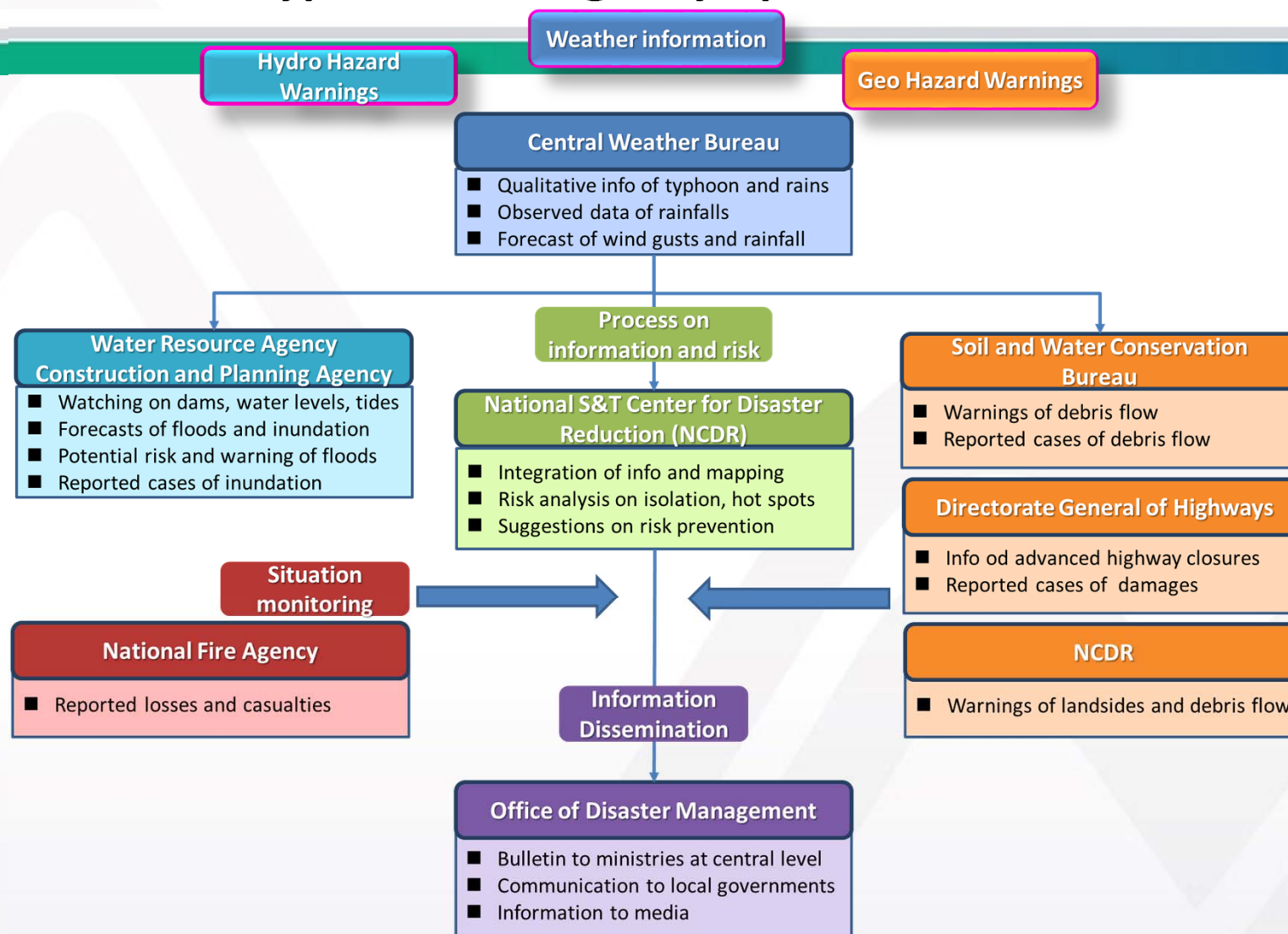
- **Cross-cutting information exchange** to monitor evolving situations

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

Information flows and synergy for typhoon emergency operation

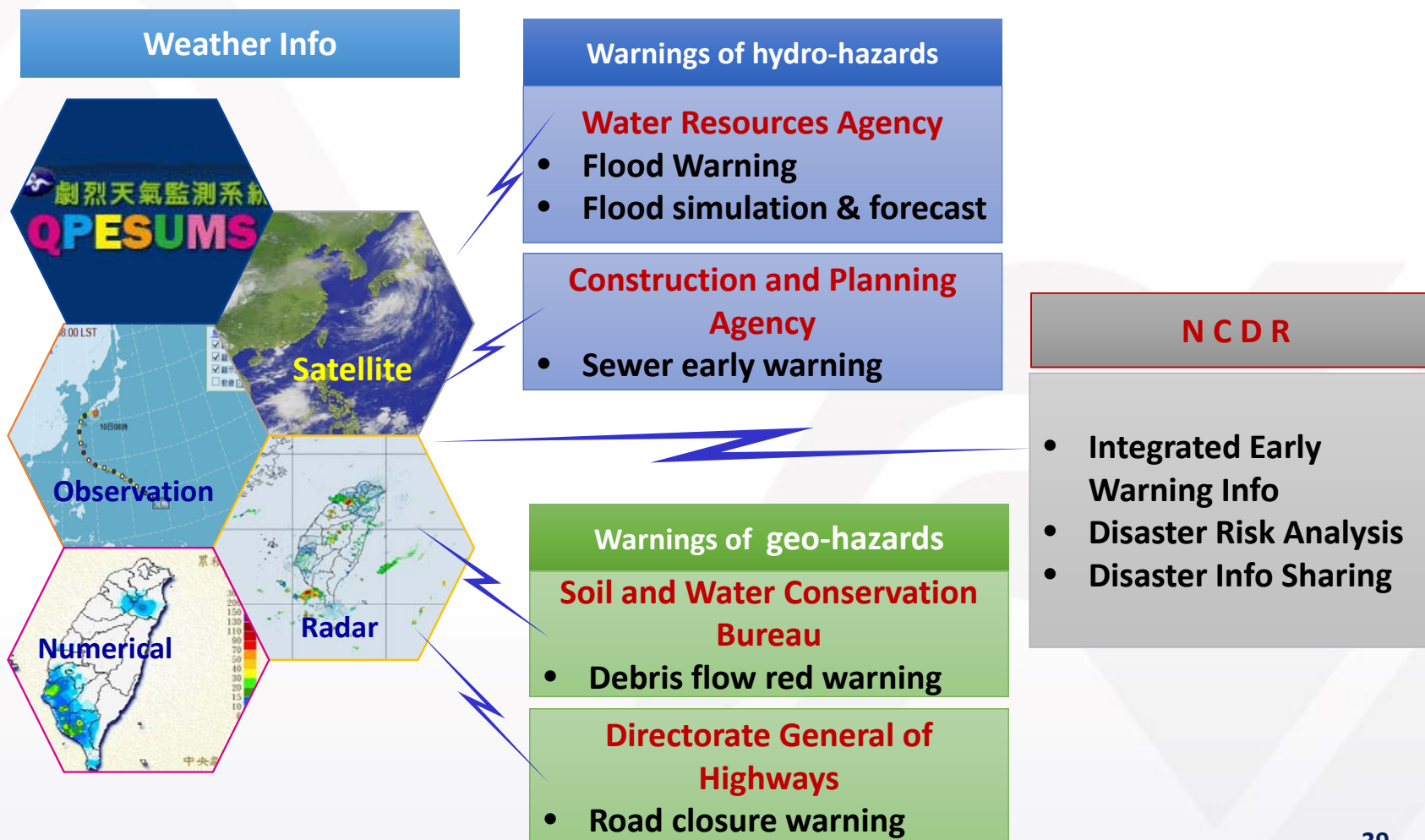


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Value-added applications of weather information

- service-oriented information

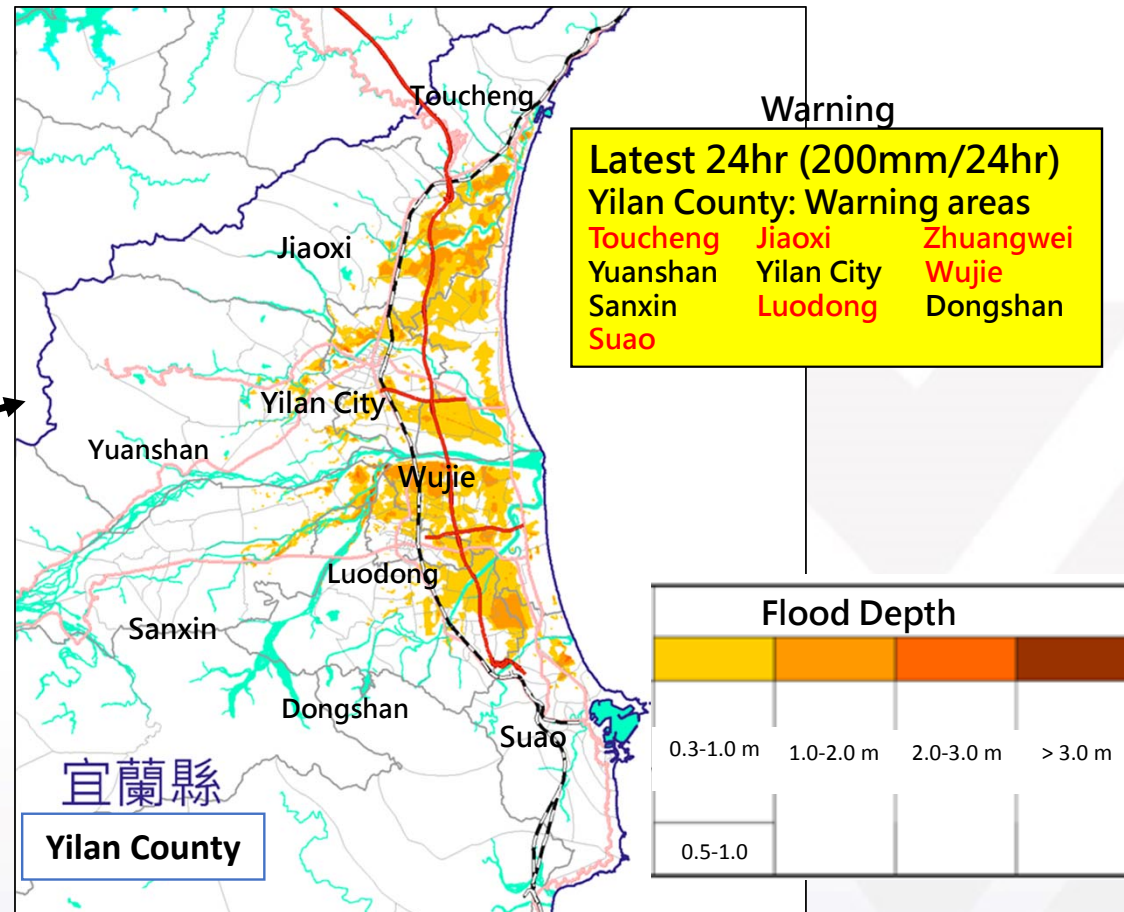
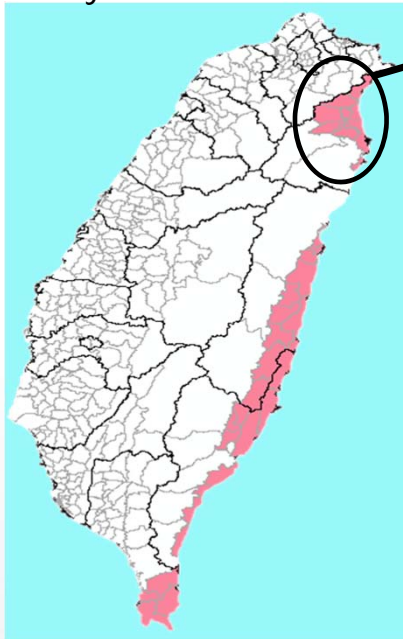


Application 1: Water Resources Agency

– Flood Warning

Estimated floods in 24hrs based on forecast issued by CBW

Major flooded areas

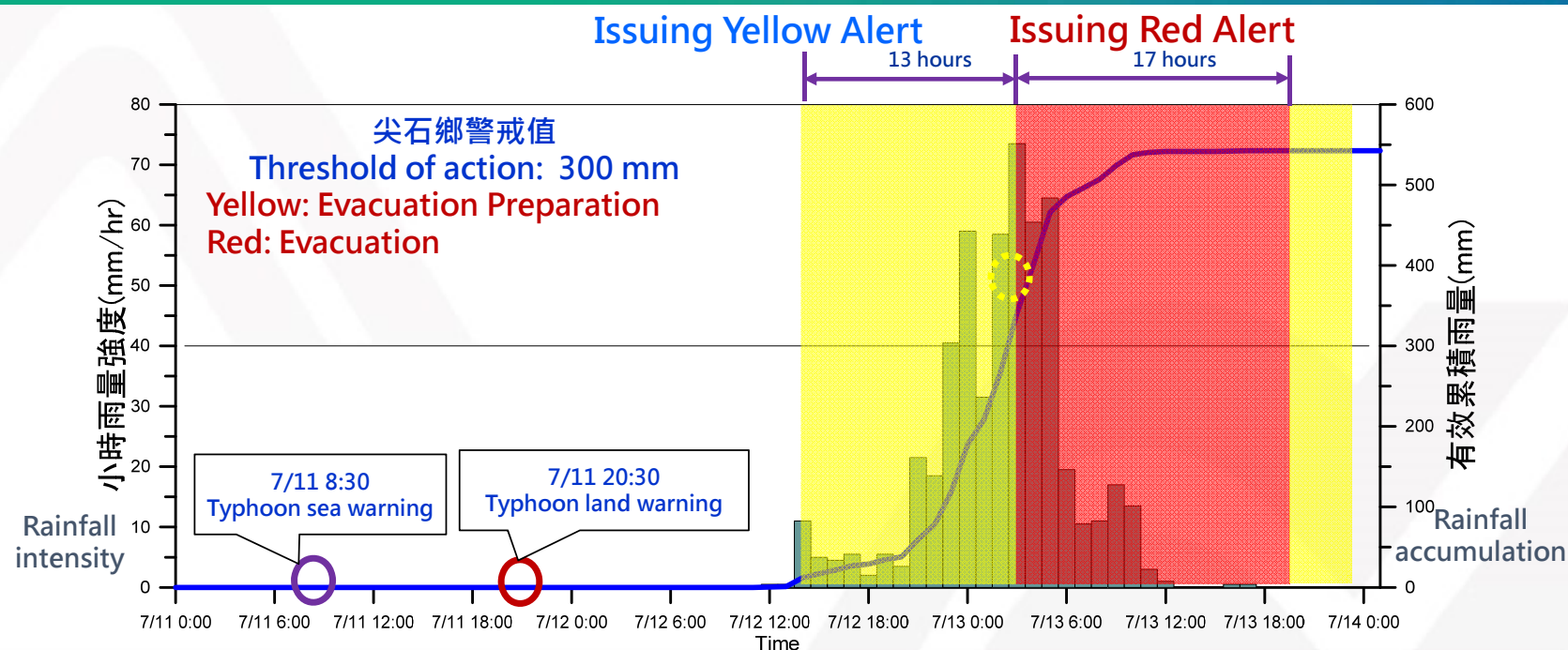


Disclosed info: time, locations and scientific scenario

Application 2: Soil and Water Conservation Bureau – Warning on debris flow



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| Date and Time | Forecasts or observations of rain | Warning on debris flow |
|---------------|-----------------------------------|------------------------|
| 7/12 14:00 | 24hr forecast on rain, 500-800mm | Issue Yell Alert |
| 7/12 20:00 | Observation < 50mm | Keep Yellow Alert |
| 7/12 23:00 | Observation reached 110mm | Keep Yellow Alert |
| 7/13 03:00 | Observation > 300mm | Issue Red Alert |

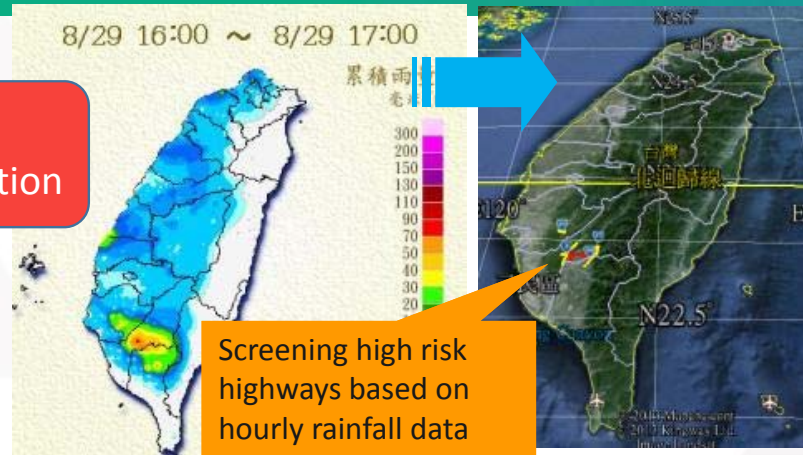
Disclosed info: time, locations and scientific scenario

Application 3: Directorate General of Highways – Automation on monitoring risk highways



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Stage 1
Risk identification



Screening high risk highways based on hourly rainfall data

Sorting sensitive slopes

Stage 2
Alert dispatch

Monitoring risks

If risk reaches level B, send alert

“台21線那瑪夏210k”路段現“紅色”強降雨,該路段屬“A”級邊坡,最近一次致災記錄係“102潭美颱風便橋沖毀”

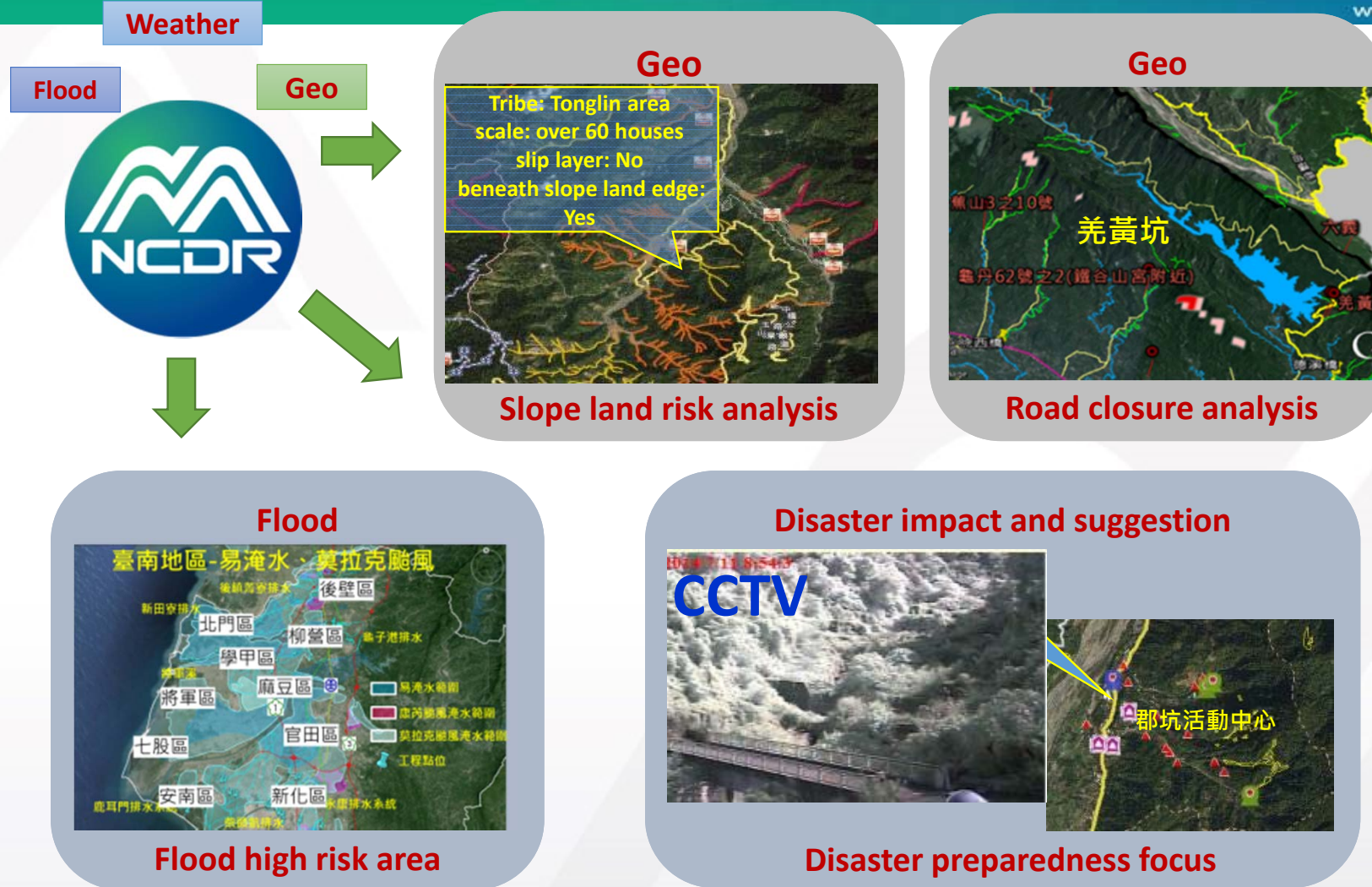
Alert

Application 4: NCDR

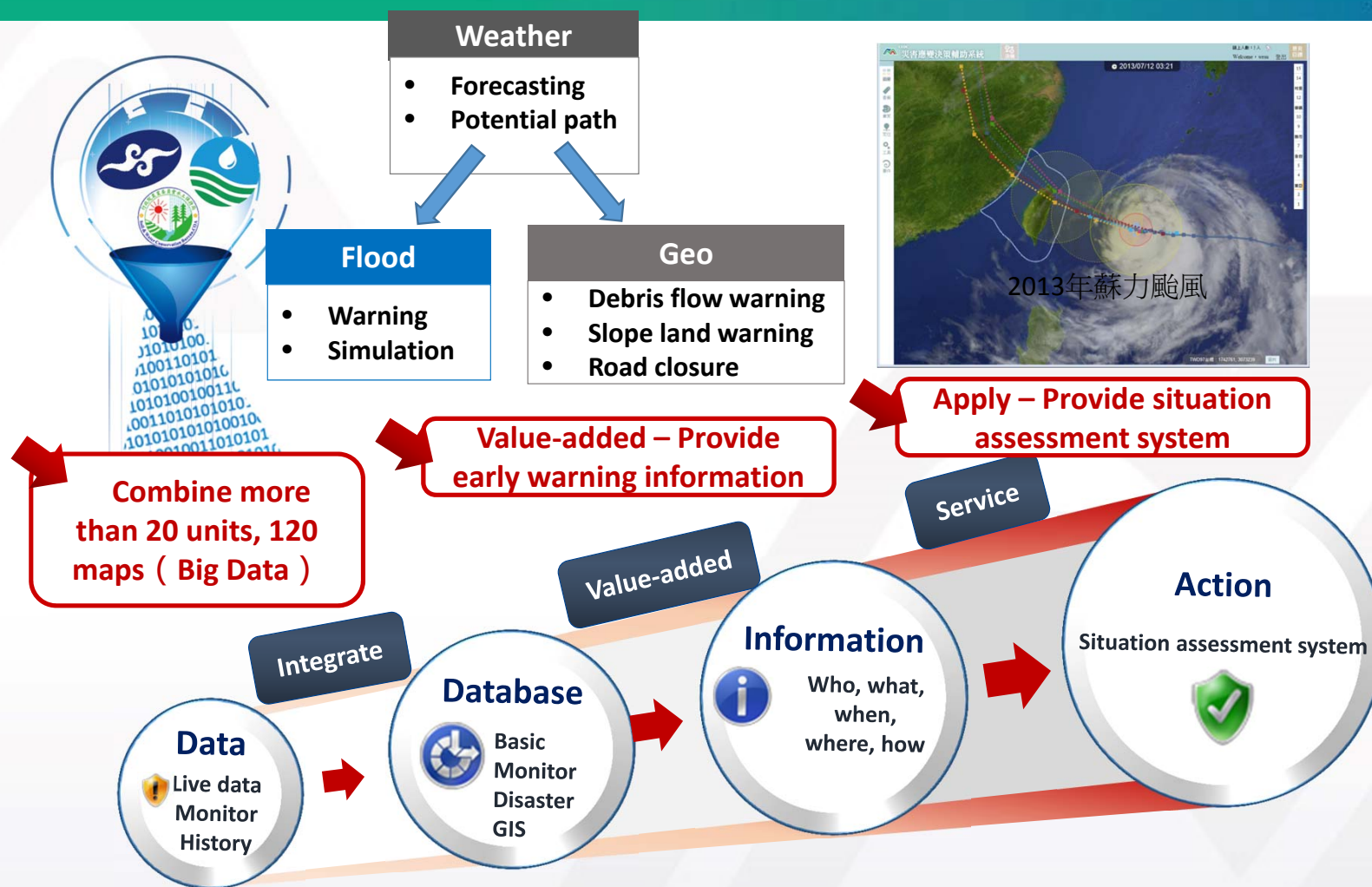
- Information Integration and Risk Analysis



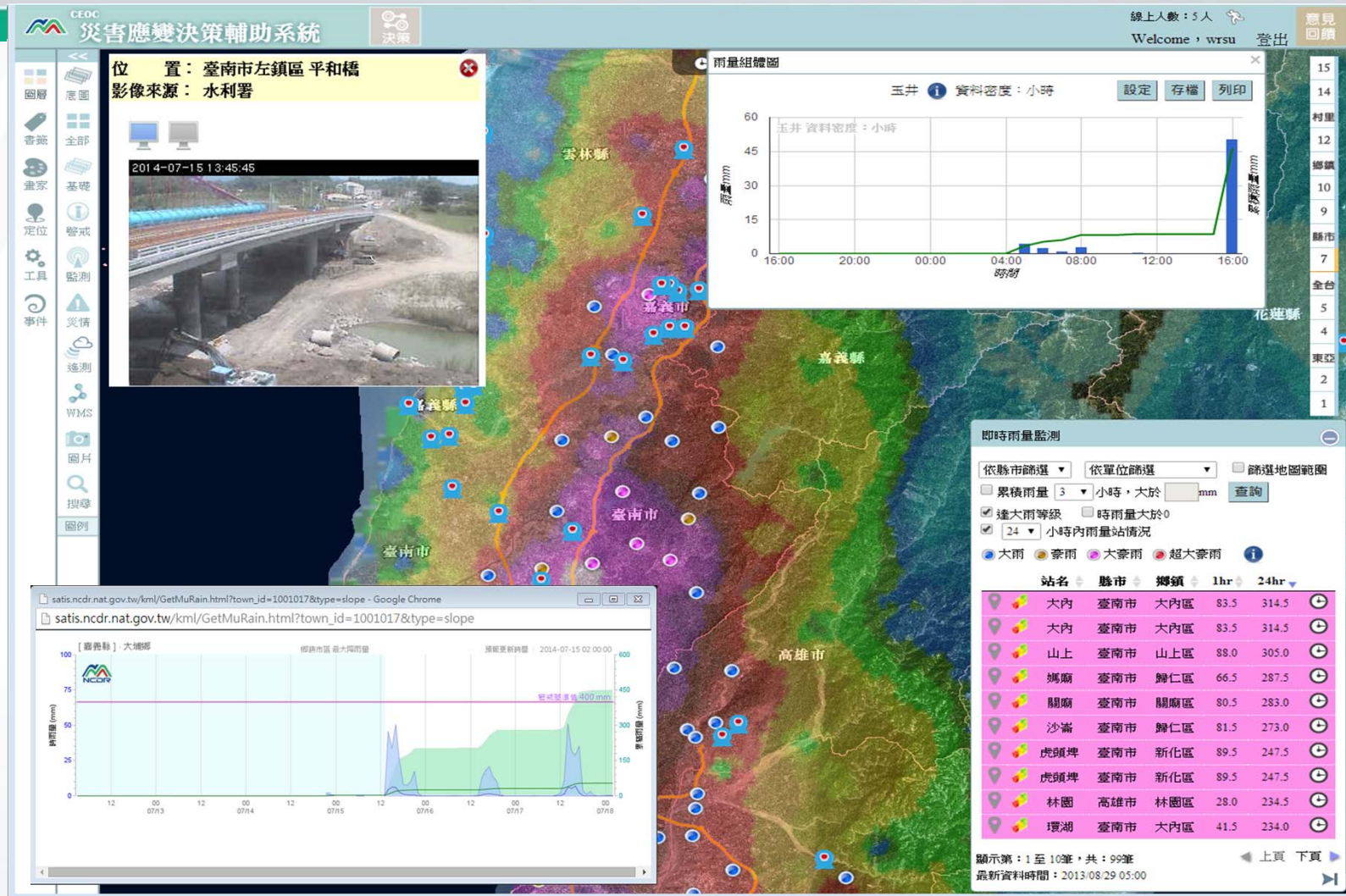
www.ncdr.nat.gov.tw



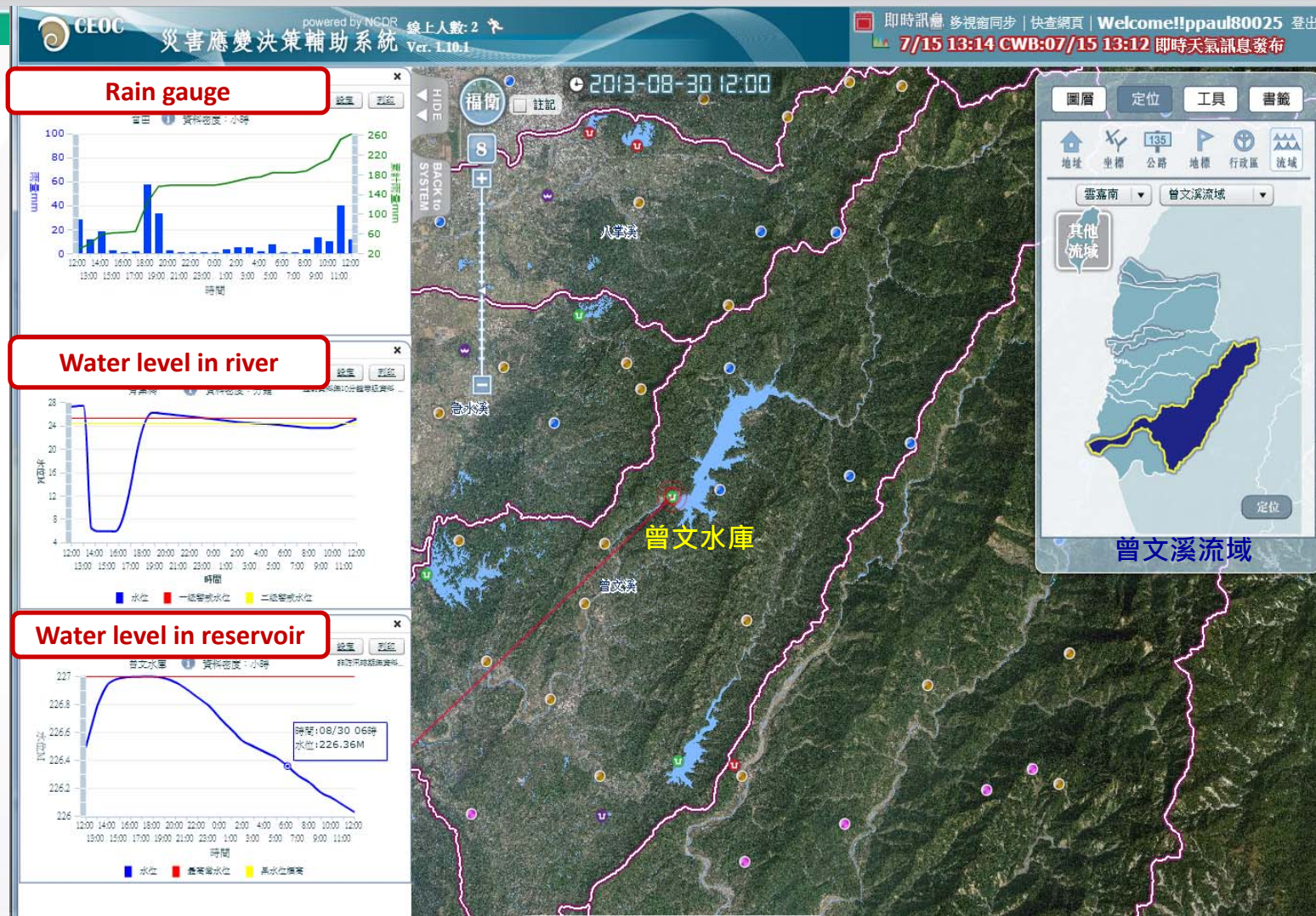
Elements to succeed decision support – “Cross-cutting Synergy” and “Information sharing”



Decision support system to forecast floods- By monitoring on reading of gauges and real-time video



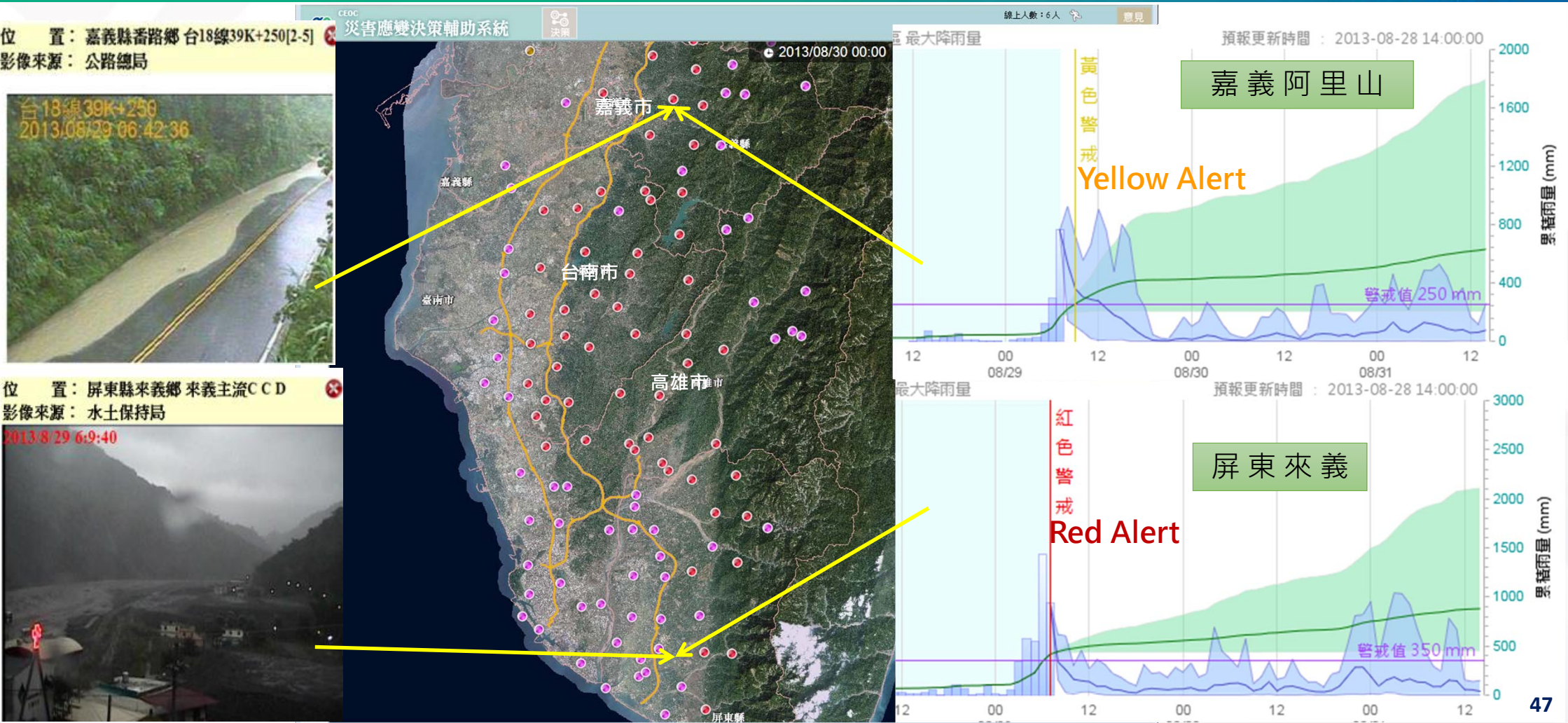
Decision support system to watch a river basin- Integrating different real-time data



Decision support system to provide integrated risk- weather forecast + numerical model + real-time inputs **Integrate forecasting & observation**



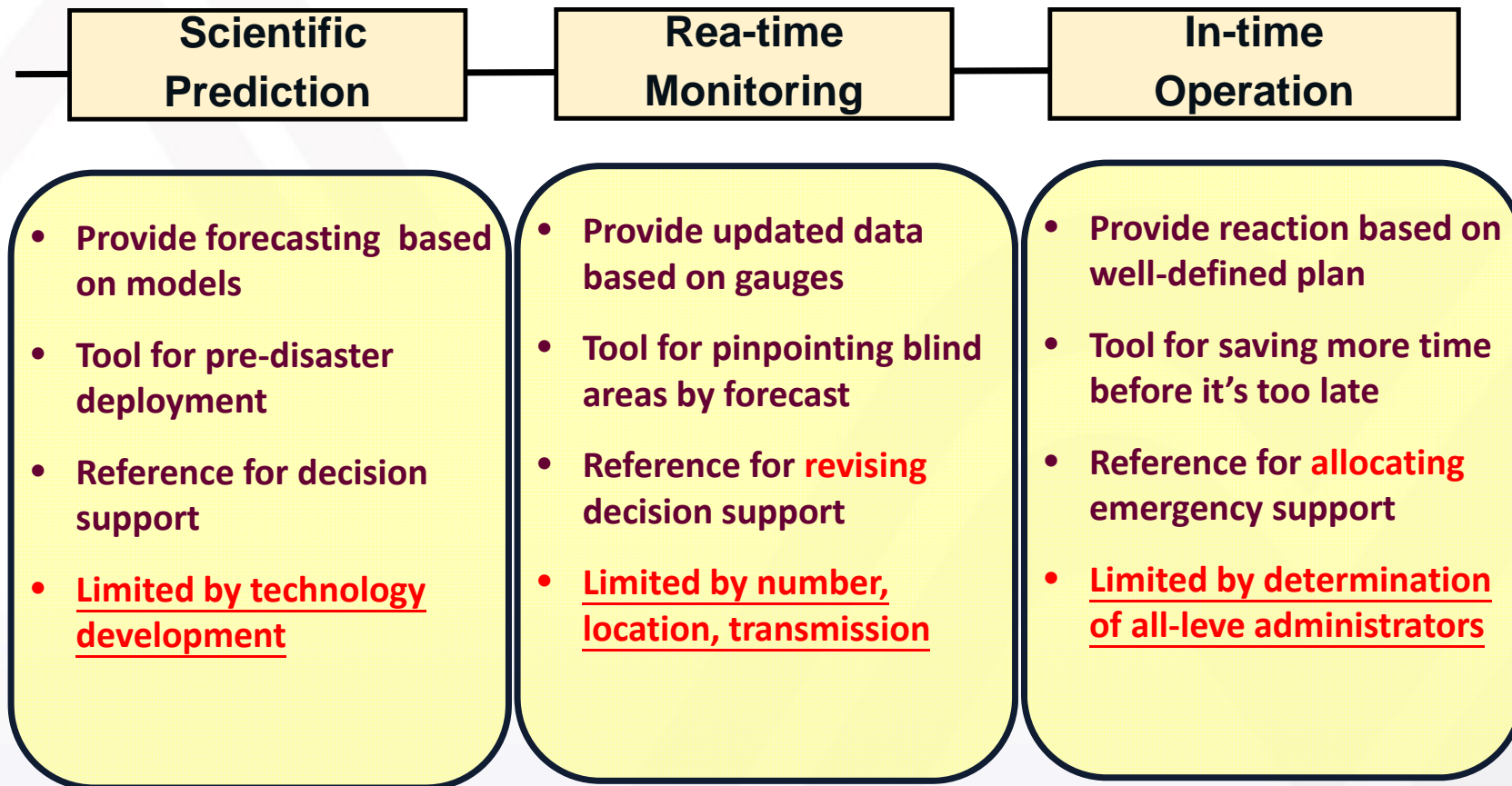
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Three elements to succeed emergency response



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Responses and actions for emergency Prior-to and after disaster



Personnel dispatch



Vehicle deployment



Water pump

**Prior to
disaster**



Early evacuation



Road closure



Preparedness



Emergency
evacuation



Cleaning



Sterilization

**After
disaster**

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



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2009 after Typhoon Morakot



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

05:30

14:00

15:00

9/19

08:40

23:00

Issue land
warning

Early
warning

Evacuation
operation

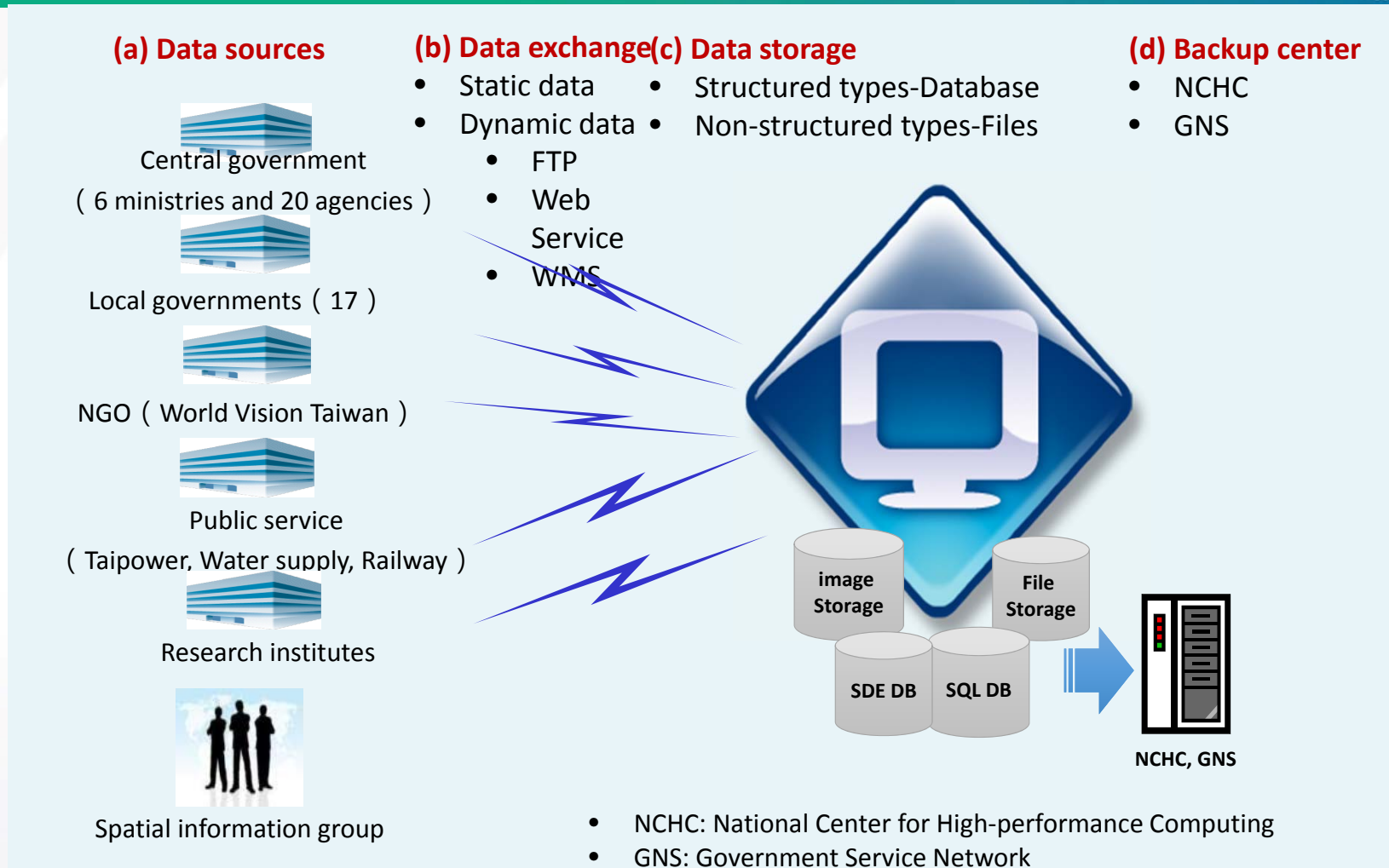
Typhoon
landfall time

Landside
in Lai-Yi

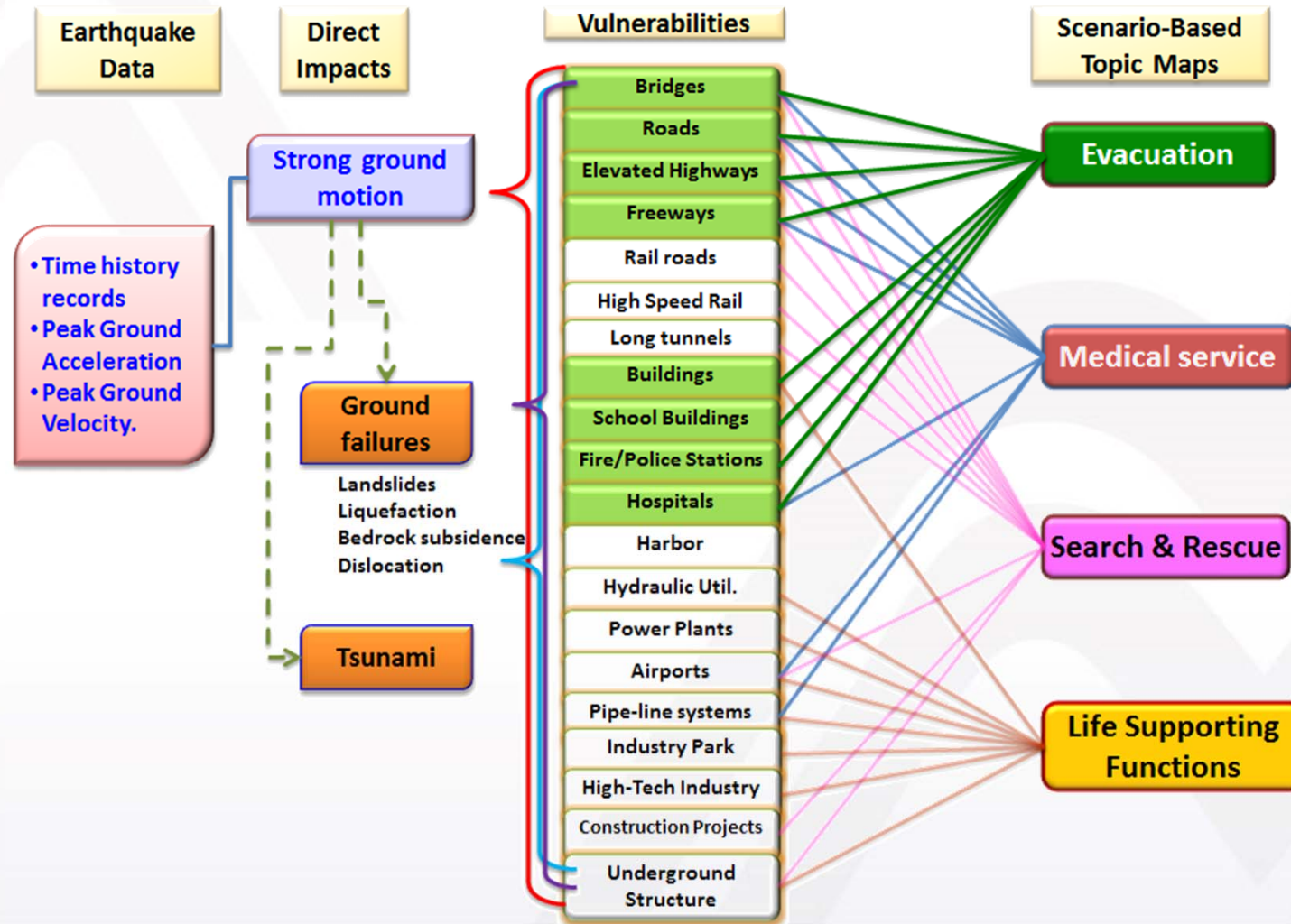
32 hours ahead



Big data backbone to support decision support system



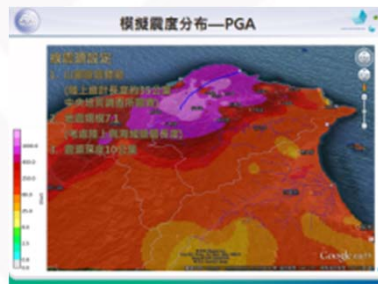
Using big data to develop information-based preparedness and scenarios on earthquakes



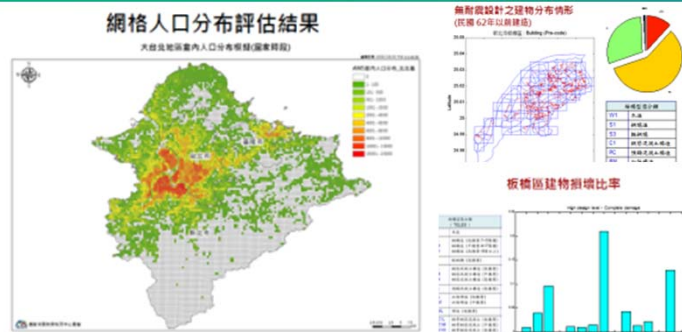
Scenario-based analysis for urban area by grid method



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Simulated EQ



Casualties cause by collapsed buildings



Transportation



Liquefaction



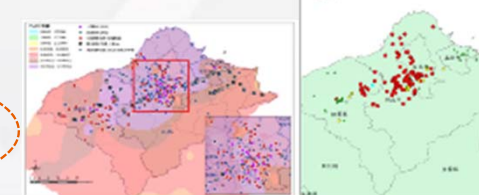
Water supply



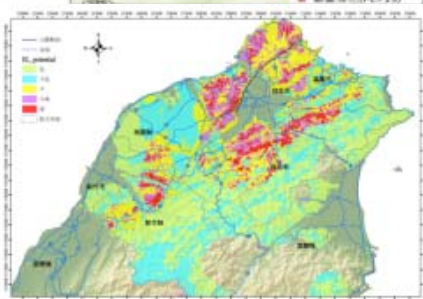
Power supply



System failures



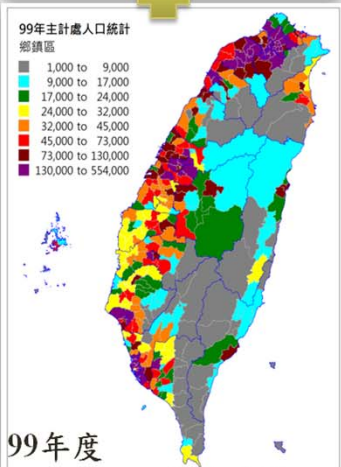
Landslides



Digitalized Population Density Distribution: stationary and dynamic characteristics

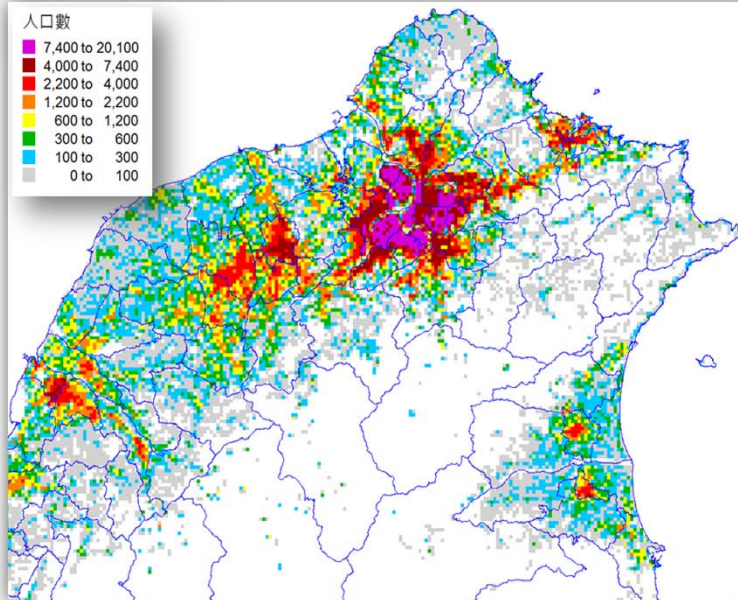
Floor areas of
buildings

建物基地



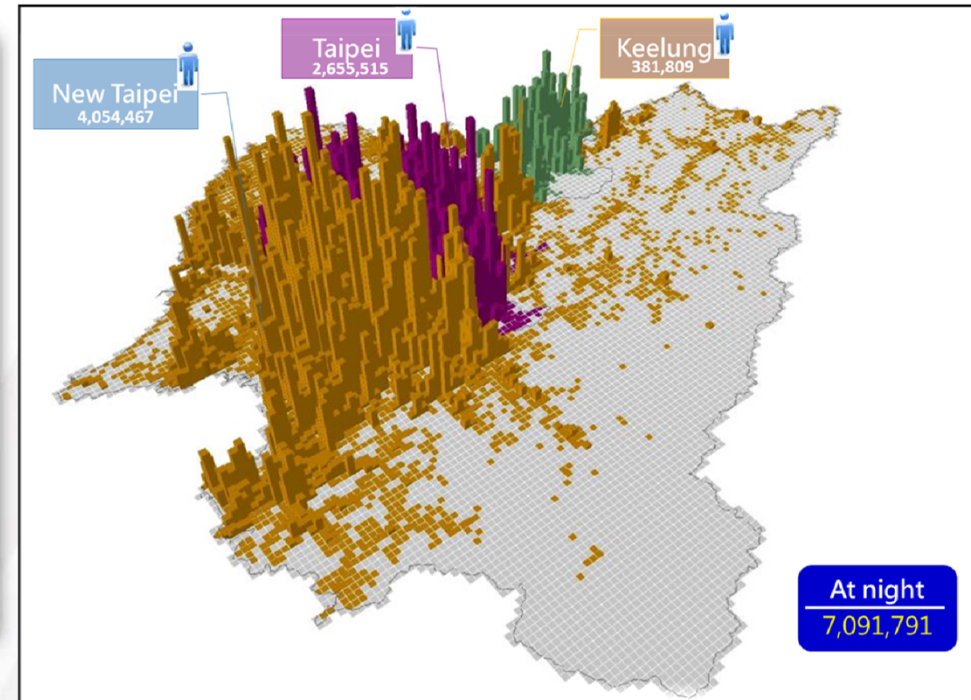
人口
均化

Mesh size: 500m X 500m



Proportioned Population Distribution

Population
Distribution, 2010



Population distribution proportional
to flood area at night

CAP Promotion in Taiwan 2013-2014: to make big data open and actionable



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CAP : Common Alerting Protocol

- **Goals:**

- Connect to international PWS
- Using easy and simple common standard language to send alerts in different network, users can receive latest alerts

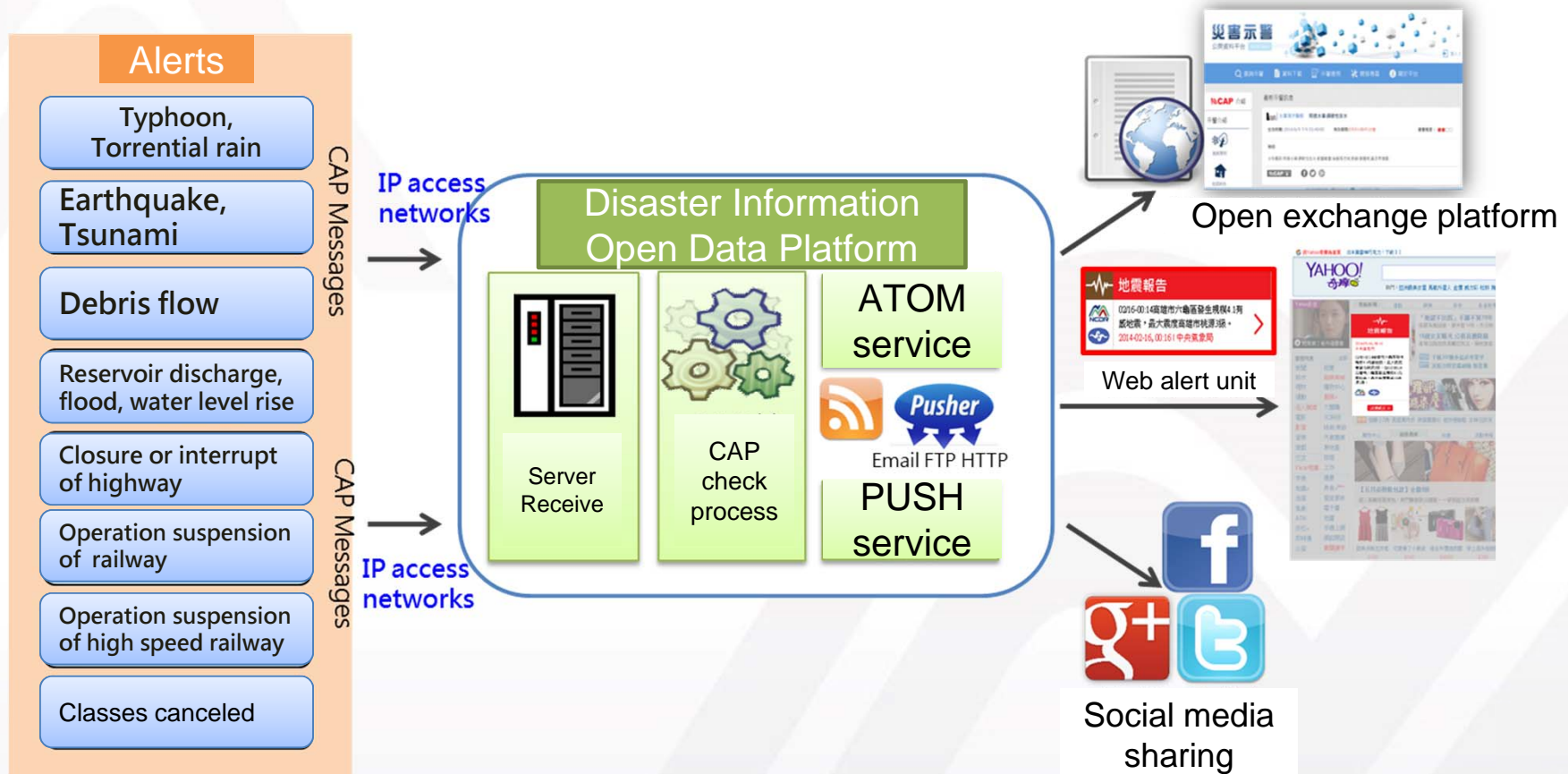
- **Outcomes:**

- From 2013, NCDR collaborated with CWB, DGPA, SWCB, WRA, THB, TRA, THSRC
- Using OASIS CAP v1.2
- NCDR combines 7 departments, 12 kinds of alerts in one formation, for companies, government, academia and research sectors use

Synergy between public and private sector on alert dissemination



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Business, App developers and industry are welcome to receive and use the open information

Open Data Platform for Disaster Information: An open platform to diverse users



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The screenshot displays the '災害示警' (Disaster Alerts) public information platform. The header includes the NCDR logo and the text '公開資料平台' (Public Information Platform). A navigation bar contains links for '查詢示警' (Search Alerts), '資料下載' (Download Data), '示警應用' (Alert Application), '開發專區' (Development Area), and '關於平台' (About Platform). The main content area is divided into a left sidebar and a central panel. The sidebar lists 13 alert types with corresponding icons: 颱風警報 (Typhoon Alert), 地震報告 (Earthquake Report), 豪大雨特報 (Heavy Rain Special Report), 海嘯資訊 (Tsunami Information), 淹水警訊 (Flooding Alert), 土石流警戒 (Landslide Warning), 河川水位警戒 (River Water Level Warning), 水庫淹洪警戒 (Reservoir Flooding Warning), 公路封閉警戒 (Road Closure Warning), and 停止停課通知 (Stop School Notice). The central panel, titled '最新示警訊息' (Latest Alert Information), shows three active alerts. The first is a '水庫淹洪警報' (Reservoir Flooding Alert) for 鯉魚潭水庫 (Liyutan Reservoir) with a validity of 0 days 0 hours 39 minutes. The second is a '降雨警報' (Rainfall Alert) for '大雨特報' (Heavy Rain Special Report) with a validity of 0 days 15 hours 39 minutes. The third is a '道路封閉警報' (Road Closure Alert) for 台8線 (National Freeway 8) with a validity of 3 days 8 hours 39 minutes. Each alert entry includes its generation time, validity period, severity level (indicated by colored squares), and a brief description.

Released a total of 13 kinds of instant supporting information

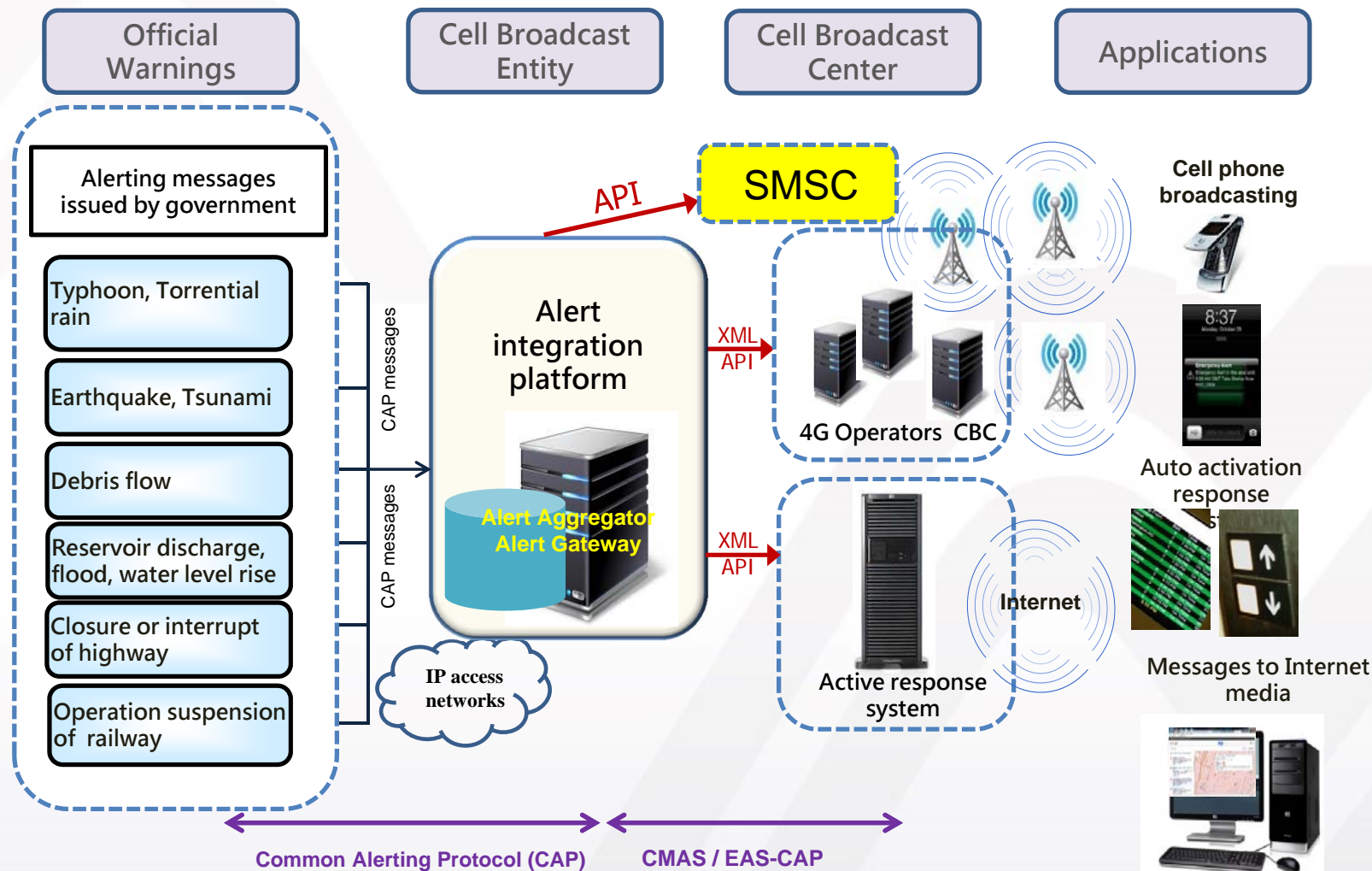
Combine 12 kinds of alerts from DGPA, CWB, SWCB, WRA, THB, TRA, THSRC

Develop disaster information open data platform
(<https://alerts.ncdr.nat.gov.tw>)

Next step: Taiwan PWS (Public Warning System) To increase alert coverage to the general public



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Key elements to build up disaster-resilient community



Risk and vulnerability assessment



Monitoring and early warning

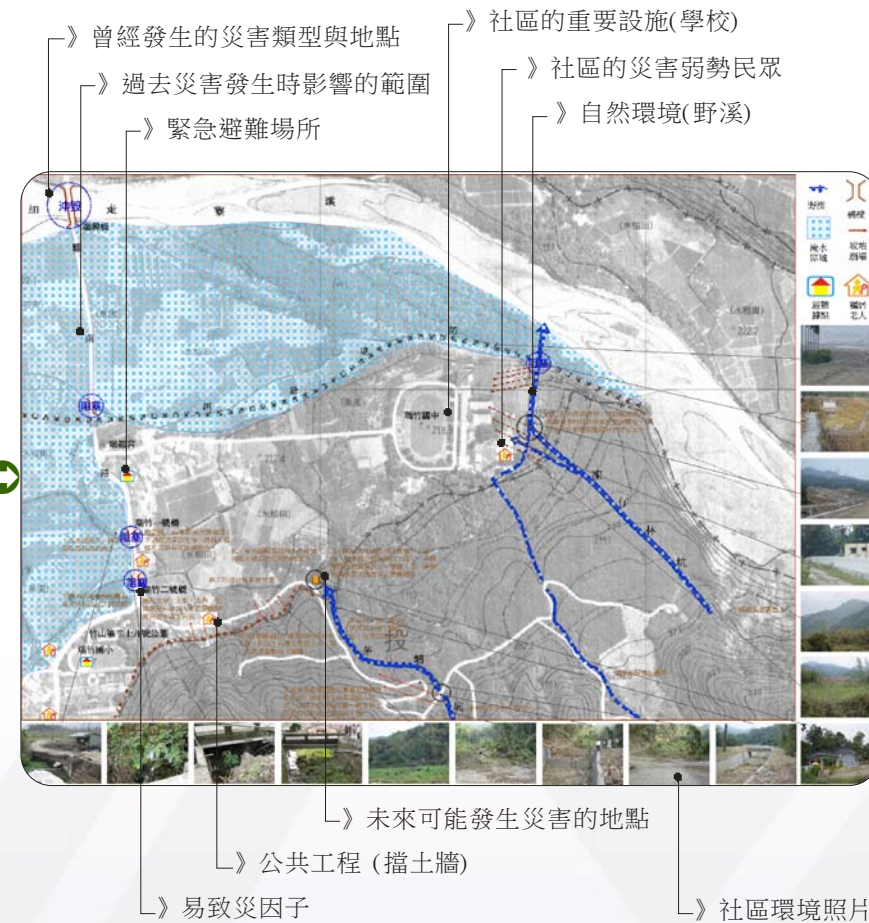
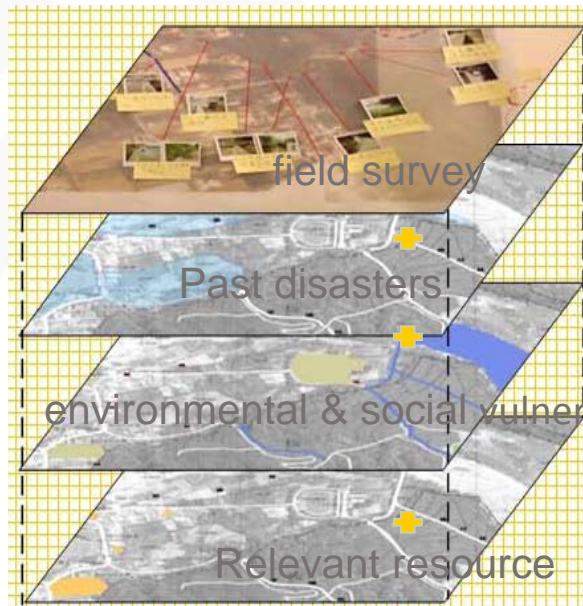


Mature and reliable knowledge

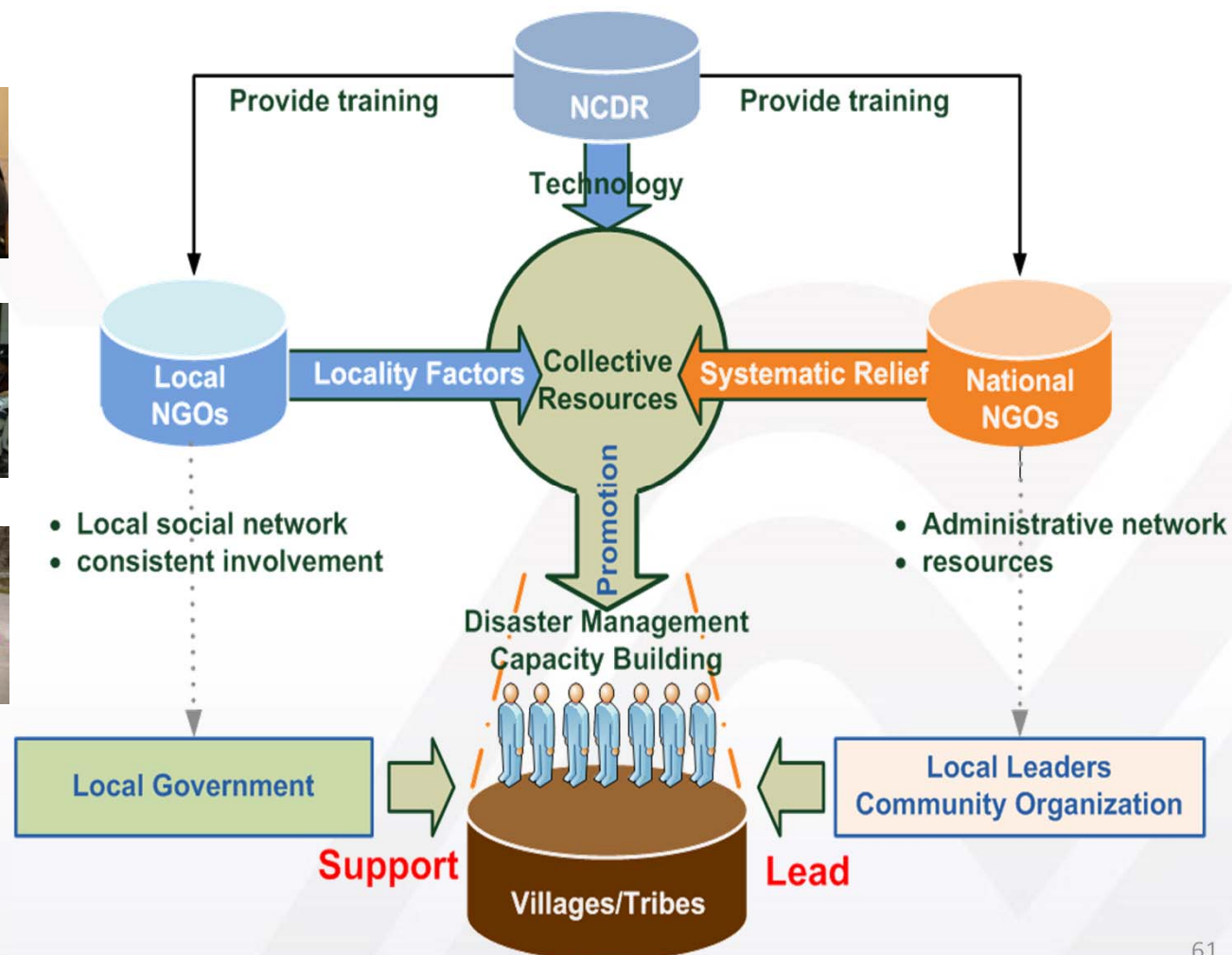


Preparedness plan

Mapping community vulnerability



Operational Model partnership with NGOs



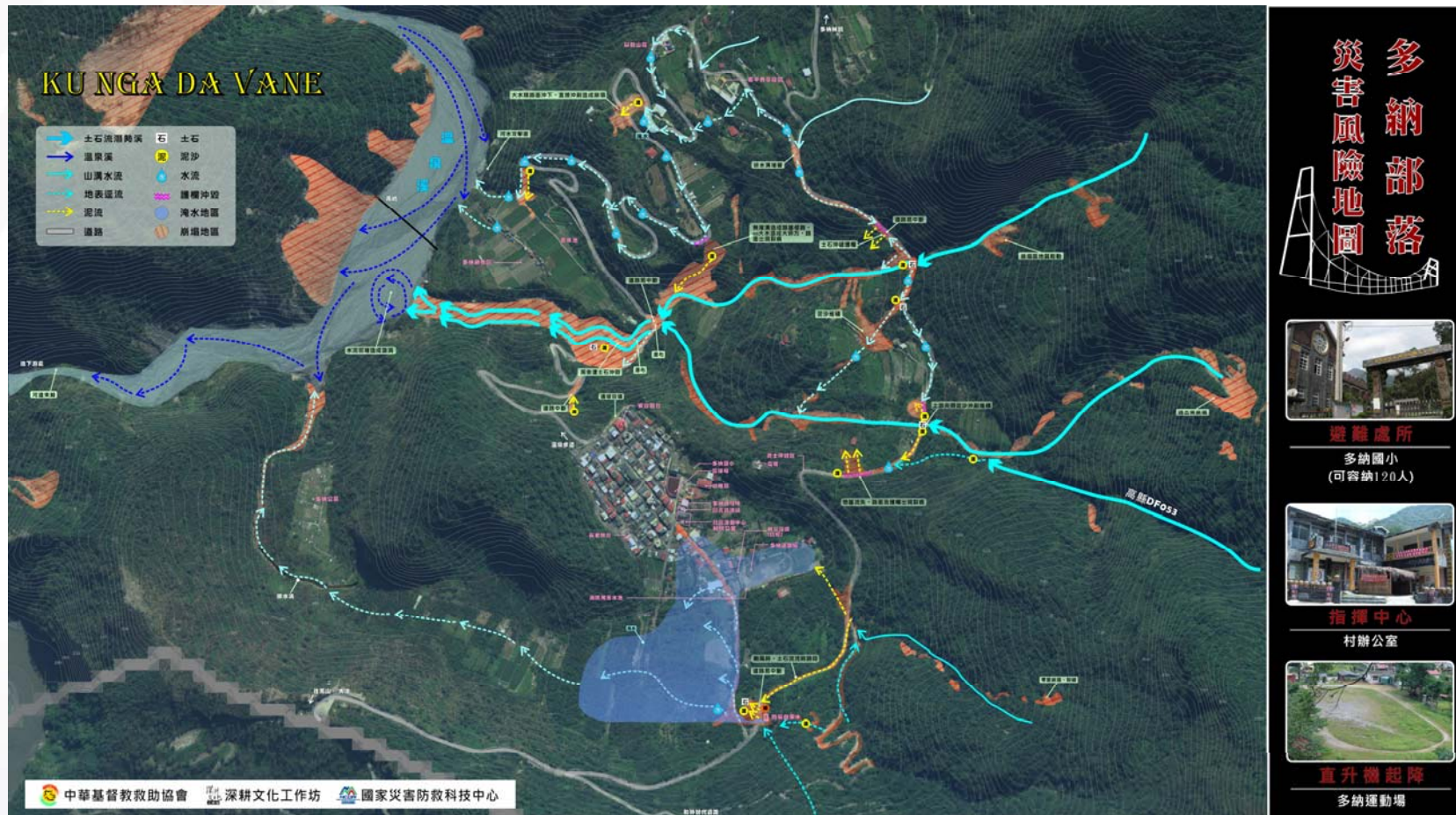
Risk Identification



Dialogues, Assessment, Training and Scenario-based drill



Community-level hazard map for a indigenous tribe after Typhoon Morakot



Two cases of post-disaster recovery in Taiwan



1999, Chi-Chi Earthquake



2009, Typhoon Morakot

- Within 13 years, Taiwan had been seriously affected by two major disasters
 - 1999, Chi-Chi Earthquake
 - 2009, Typhoon Morakot
- Through process of recovery from two large-scale disasters, it identified why Public-Private Partnership is so important in a modern society.

Major stakeholders for post disaster recovery



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- **Government sectors**
 - Central and local governments
- **Private sectors**
 1. **Organized groups**: religious or charity organization, professional community like civil engineers
 2. **Individual (Volunteer)** : the general public, people with professional expertise
 3. **Business sector**: Small and medium enterprise or international enterprises
 4. **Academia**
 5. **Organizations initiated by the affected people**

Roles of private sector: assistance in emergency response phase

- **Emergency Relief :**
 - Search and rescue operation by professional groups
 - Experts, human resource and heavy machinery
 - Donation and delivery of emergency materials
 - Distribution of condolence allowance
 - Mental Intervention



Roles of private sector : quick recovery phase

- Transitional relocation
 - Organizing and coordinating NGOs to jointly provide services like **meals, education and mental intervention**
 - Setting up **operation centers** in the affected areas
 - Constructing **temporary housing for family-unit shelters** and schools
 - Participating in **rehabilitation of livelihood**



Roles of private sector: contributions for long-term recovery

- **Recovery :**
 - Collaboration between NGOs, business sectors and government for rebuilding school, house and community reconstruction
 - Organizing centers for livelihood rehabilitation
 - Monitoring the allocation of charity donation



Successful Example of PPP: Taomi Village after Chi-Chi Earthquake, 1999



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- Community-centric training courses:
 - cooking, painting and construction skill
- Local Organization
 - Establishment of Association of Community Development and Tour Association of Natural Conservation and Ecological Protection.
- Promotion of Taomi eco-community :
 - reservation of wetland, maintaining of eco-pounds
 - protection of original species, **frogs[23(79%)] and dragonflies [49(34%)]**

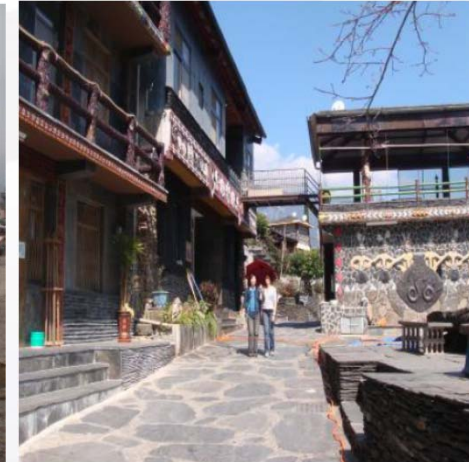
Damages, losses and casualties

- **Leading factor: extremely excessive rainfall**
 - **Accumulated rainfall in 3 days reached 2,854mm (Alishan Area)**
- **Affected population: 510,668 people**
 - **By floods, landslides and debris flow**
- **Casualties: 699 people died and missing**
- **Heavily damaged houses: 1,766**
- **Total direct lose: USD\$ 6.66 b (1.6% GDP)**
- **Declared inhabitant areas: over 161 unsafe sites**



Difficulties of recovery - social response and expectation

- High expectation of refugee
- Pressure of upcoming flooding season
- High unemployment rate in affected communities
- Threat of epidemic distribution of H1N1 in 2009
- A comprehensive solution for recovery required
 - Relocation, disaster risk reduction and wide-scope post-disaster reconstruction



Difficulties of recovery - physical challenges

- Huge amount of debris: how to clean and remove
- Loosing land (slopes, riverbeds etc.) tends to be potential risk
- Possibly isolated communities after Morakot
- The frequent evacuation and relocation of evacuees
- High reconstruction budget



Public budget allocation and donation for recovery



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Public Budget

138.5 billion NTD

- Special Budget: 116.5
- Reallocated Budget: 22

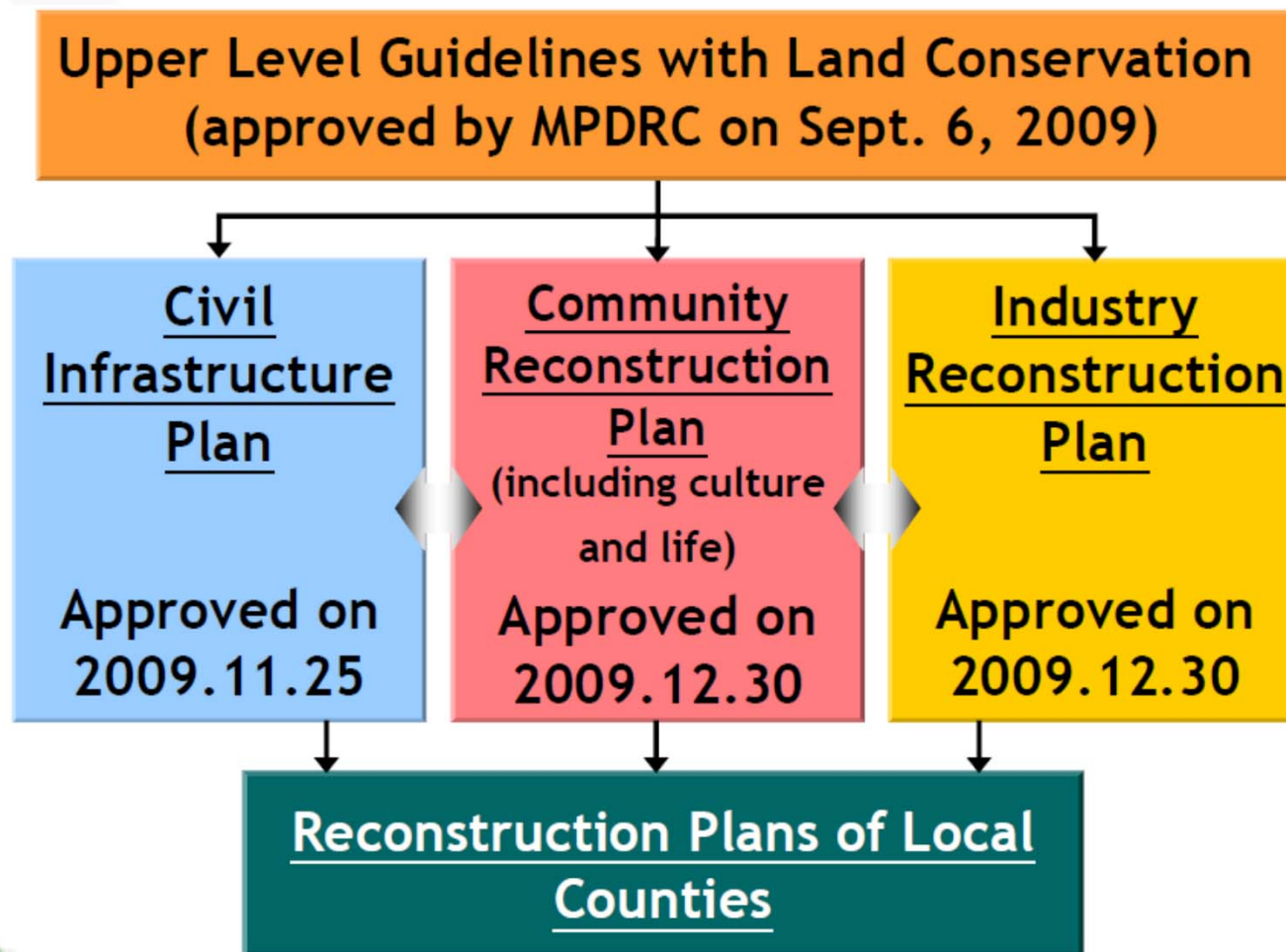
Donation

25.1 billion NTD

- Tzuchi Foundation: 4.6
- Red Cross: 4.2
- World Vision: 1.3
- Others: 15

**Total: 163.6 b NTD (5.5 b USD)
for 3 years**

Framework of recovery plan



Way to rebuild a community back



Rinari Permanent Housing Base



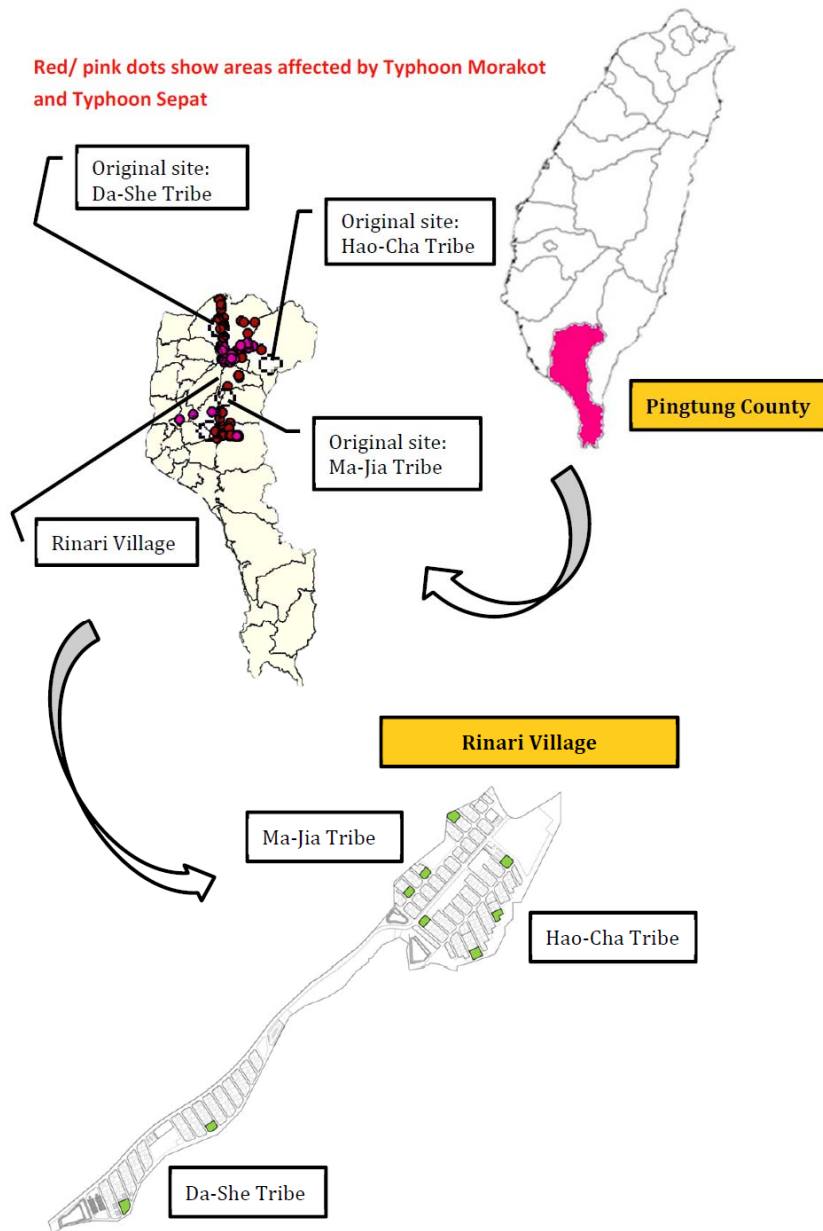
Photo by World Vision Taiwan

Basics of Rinari



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- World Vision Taiwan is in charge of construction and livelihood recovery.
- Total area: 27.8 hectares.
- Total number of house units: 483 units of 1,152 square feet.
- Land owner: State-Run Taiwan Sugar Corporation.
- To accommodate 336 flood-stricken families
 - Rukai tribe of **Haocha** Village in Wuta Township
 - Paiwan tribe from **Dashe** Village in Sandimen Township,
 - Paiwan tribe from **Maja** Village in Maja Township.



- to represent the vivid indigenous cultures, history and diversified life experiences, a number of facilities are built, including:
 - image design of the tribe entrance
 - the “story wall”
 - three comprehensive activity centers
 - children recreation rooms
 - leisure square
 - sports court
 - youth club
 - tribal reconstruction
 - Pavilion
 - sales shop.

Respect to individual religion



9 churches are planned in Rinari

Arial view of Rinari in July 2013. (World Vision Taiwan)



Arial view of Rinari in July 2013. (World Vision Taiwan)



Arial view of Rinari in July 2013. (World Vision Taiwan)



Permanent house



Permanent house



Definition of “full recovery”



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- Fast one or Time-consuming one
- Economy and Ecology
- Where and How
- By whom?
- Culture preservation?
- Change in social connection
- Future for young generation
- Feeling of ownership
- Role of outsiders?
- Government and NGOs
- How long it takes to say, “We build back better’

International outreach to implement scientific outcomes evidence-based disaster management



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| | |
|---|--|
| ● APEC: Emergency Preparedness Working Group | Senior disaster management officials, FEMA |
| ● ICSU: Integrated Research on Disaster Risk (IRDR) | Forensic investigation, Loss Data |
| ● Asian Disaster Preparedness Center (ADPC) | South-East Asia capacity building |
| ● Asian Disaster Reduction Center (ADRC) | Area Business Continuity Management |
| ● START International | Pan-Asian Risk Reduction (PARR) Fellowship |
| ● UNISDR, UNCOHA, UNSPIDER, UNFCCC (COP) | Hyogo Framework for Action 2 |
| ● Pacific Disaster Center (PDC) | Decision Support System for Disaster |



IRDR
Integrated Research



global change SysTem for Analysis, Research & Training



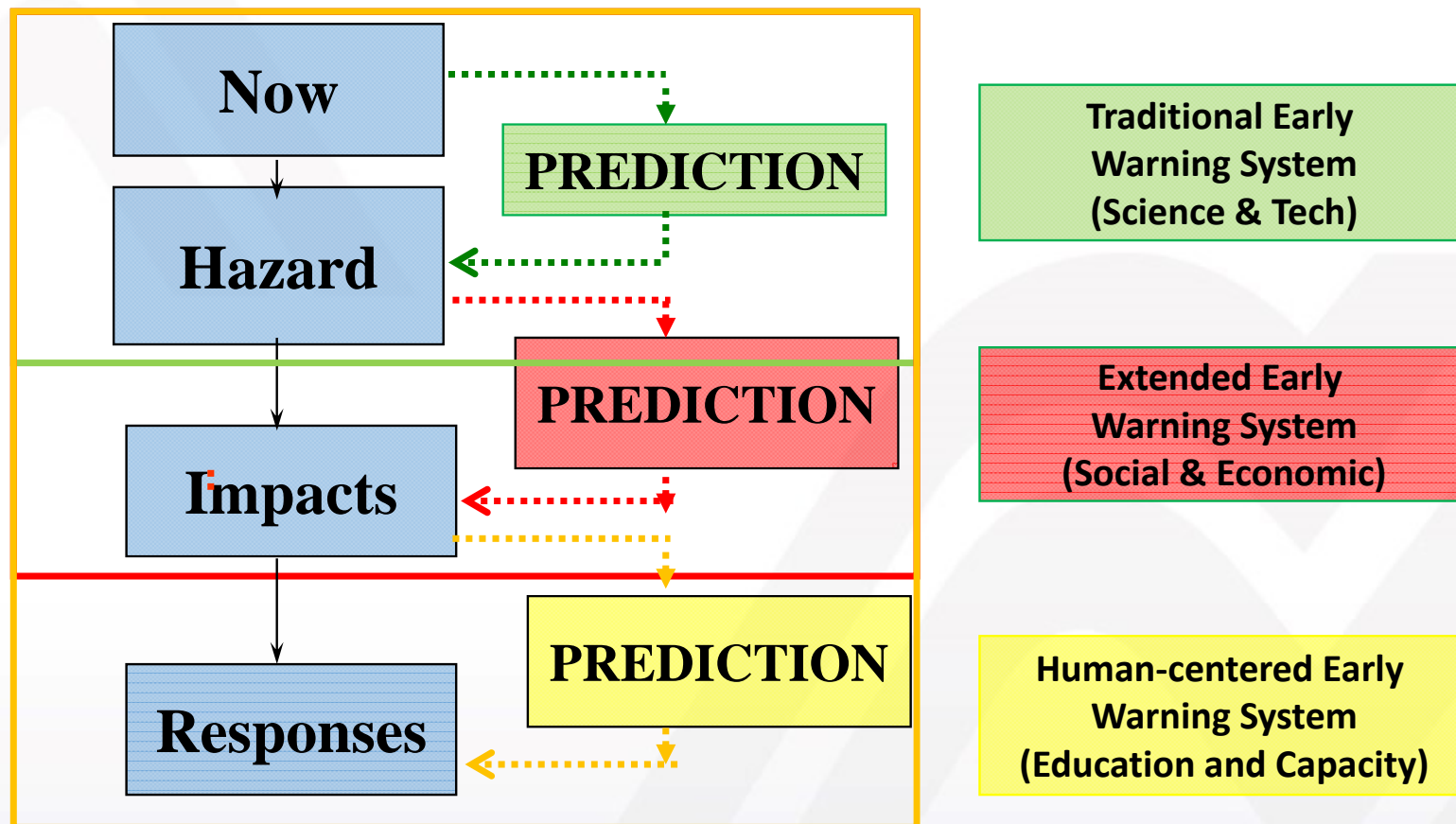
UNISDR

The United Nations Office for Disaster Risk Reduction



PACIFIC
DISASTER
CENTER

Innovation of disaster resilience building in civil society



Thanks

Learning from disasters and living with them

Wei-Sen Li

E-mail: li.weisen@ncdr.nat.gov.tw