



The Application of Multi-hazard Mitigation & Prevention Technology in Taiwan

Taiwan



照片來源-交通部觀光局網站

Taiwan



Taiwan



Geographic location of Taiwan



Geographic location of Taiwan

A satellite map showing the island of Taiwan and parts of the surrounding East Asian landmasses. The island of Taiwan is the central focus, colored in shades of green and brown to represent terrain. To its west, a portion of the mainland is visible. To the east, the Ryukyu Islands are partially seen. Three cities are labeled in white text: Taipei at the northern tip, Taichung in the central-western part, and Kaohsiung at the southern tip. A white rounded rectangle encloses the island of Taiwan. A white box on the left side of the island contains statistical data. The background is a deep blue representing the ocean.

Area: 36,188 km²

Population : 23 million

Density: 639 peop/km²

Taipei

Taichung

Kaohsiung

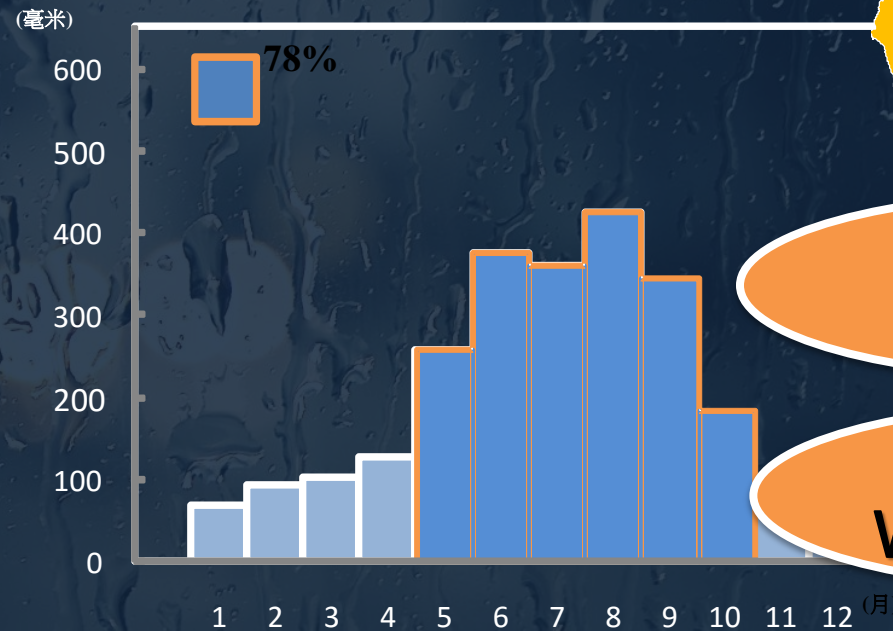
Taiwan

Challenge 1 – Young and Fragile Geology



Stratigraphic age \doteq 2 million years

Average annual precipitation in Taiwan



**8,000 mm in
Mountains**

**2.5 times of
World Average**

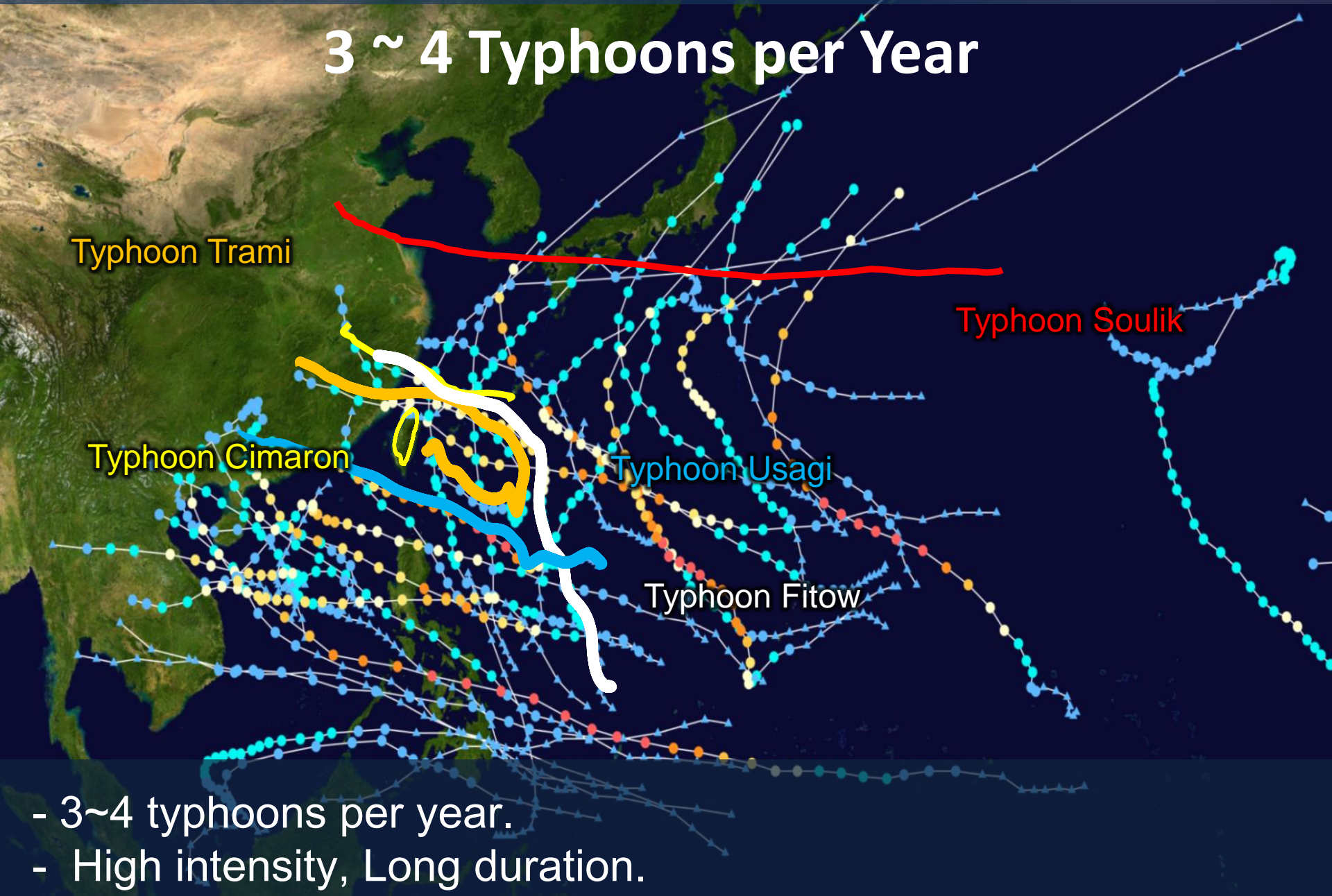
2,502mm

(Average value from 1949 to 2011)

Taiwan

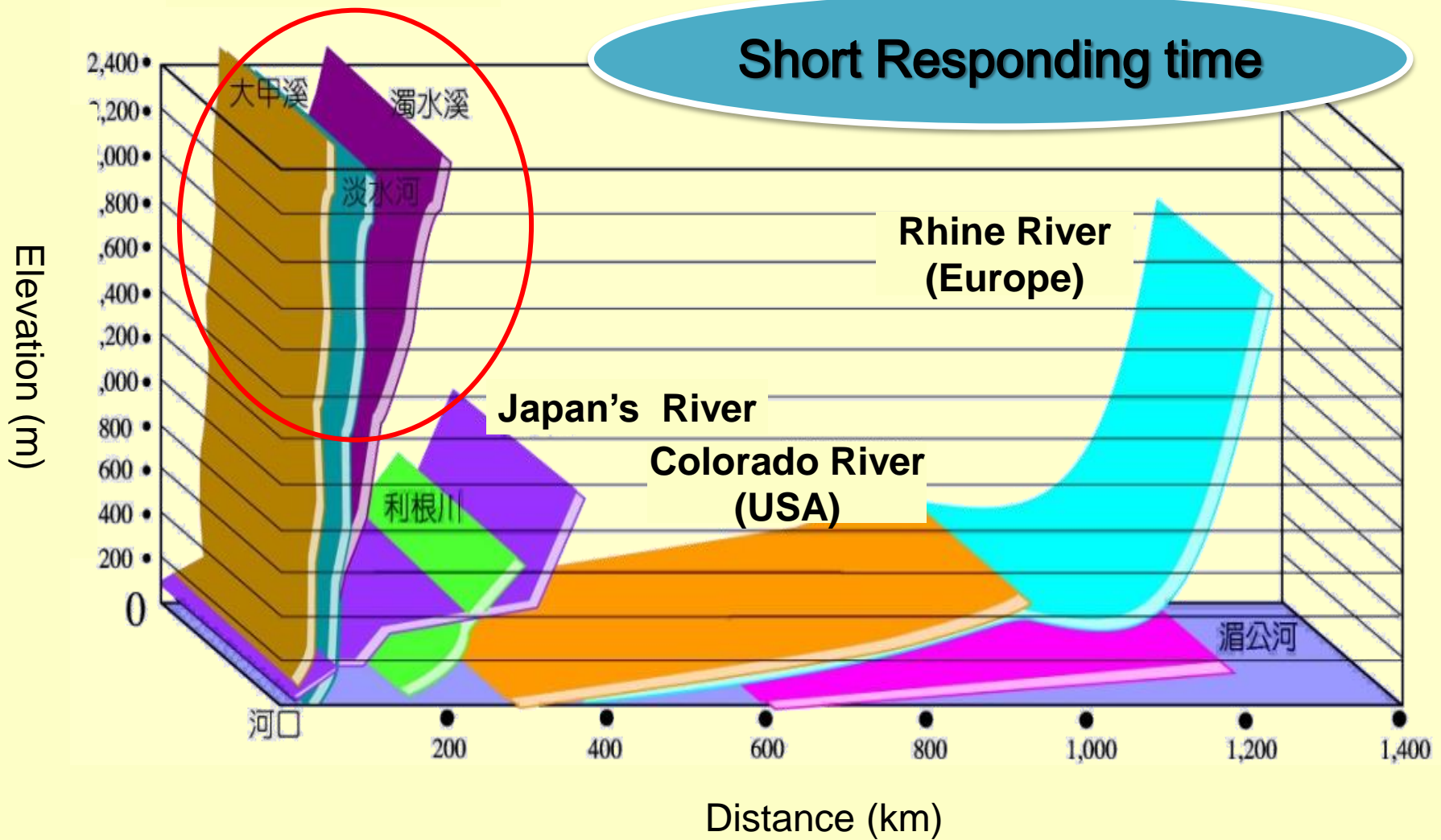
Challenge 2 – Intense Rainfall

3 ~ 4 Typhoons per Year

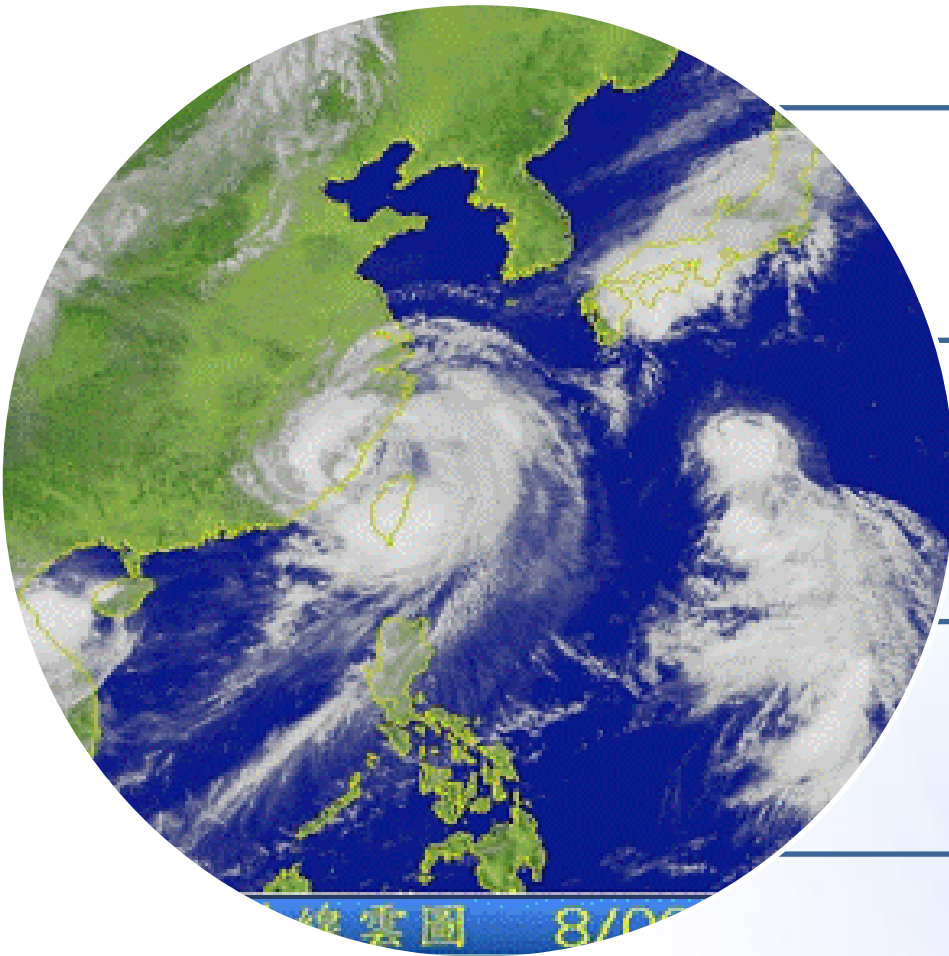


Comparison of River Slope

Taiwan's Rivers



Multi-Hazards



Extremely Torrential Rain



Flooding



Sedimentation



Landslide



Driftwood



- Typical multi-hazards.

Taiwan
東港鎮

2009 Typhoon Morakot



- 2884 mm in 3 days.

Shiao-Lin Village



BEFORE



AFTER

官方證實 小林村活埋398人

村民泣「別挖了 讓他們長眠吧」



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災情統計

死亡人數

129人

失蹤人數

約600人

房屋人口

1萬5414人

基本遺失

房屋總數 - 住戶數

房屋數

房屋

2萬6318戶

房屋

73萬8286戶

房屋

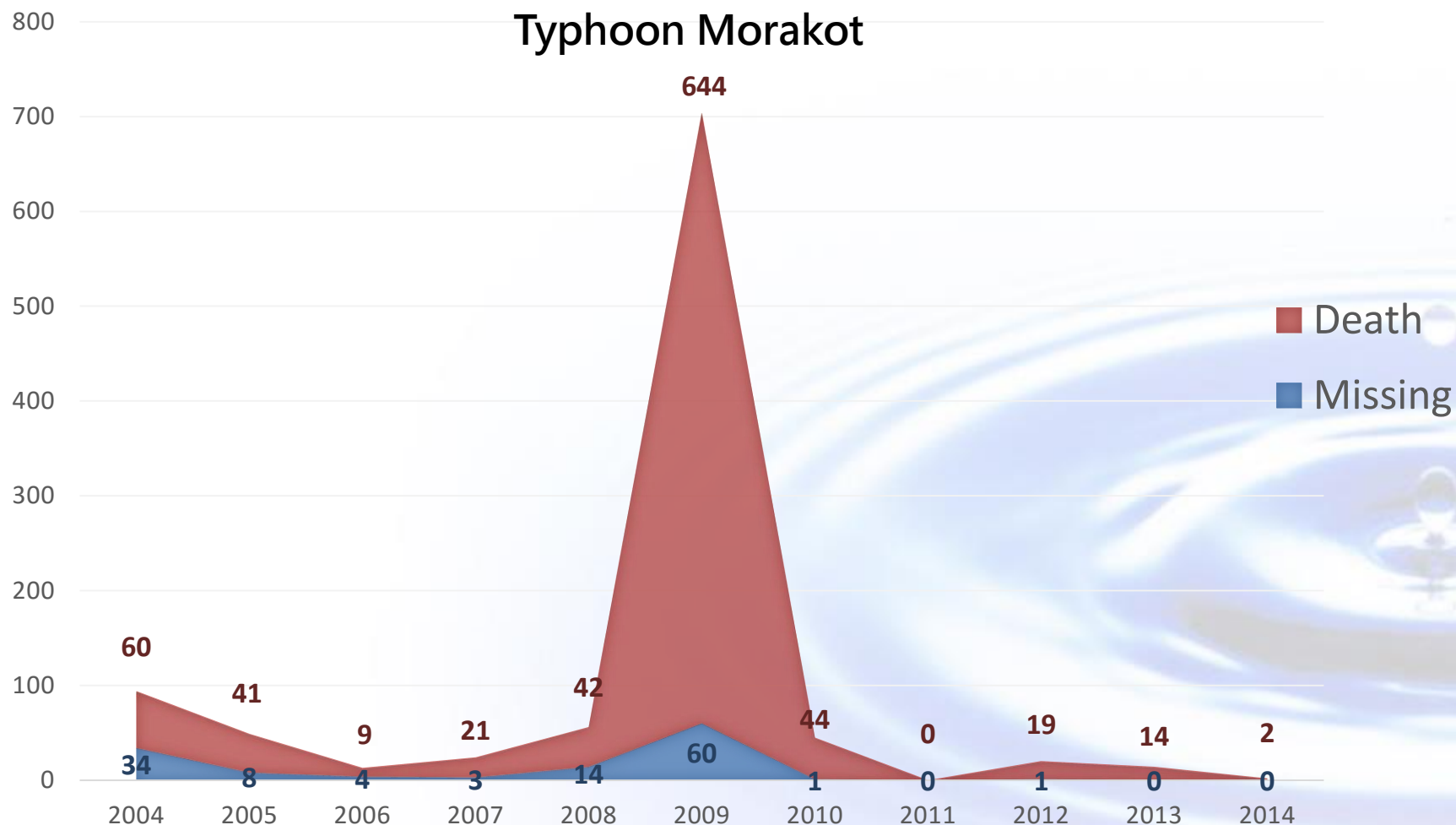
- Apple Daily.
- 398 dead.
- A village in mourning.



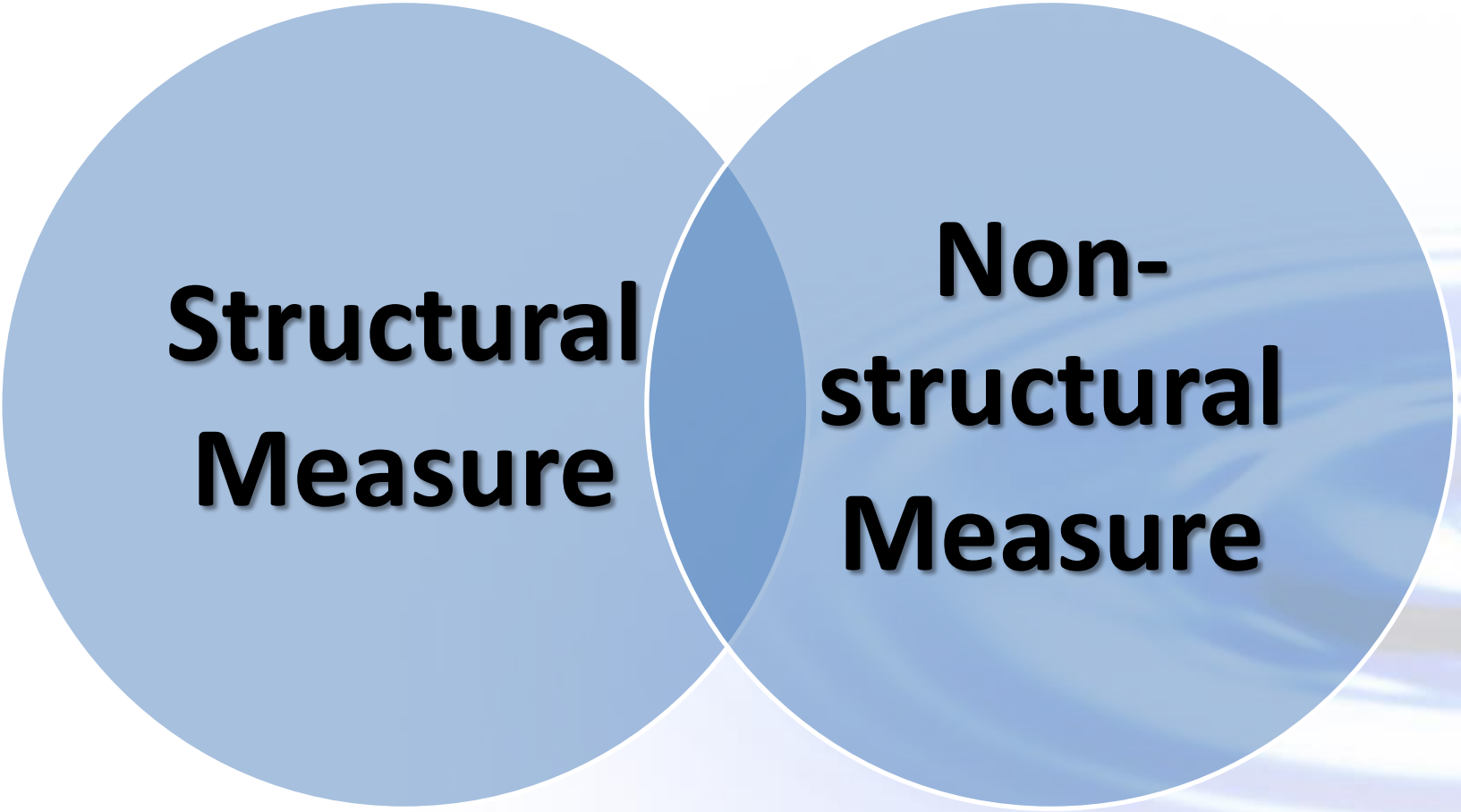
Zero Casualty



Typhoon Casualty



Prevention & Reduction Strategy



**Structural
Measure**

**Non-
structural
Measure**

- Taiwan government invested **\$1 billion dollars/ year** for flood control facilities.
- Facilities such as **levees, drainage system, and river dredging**.
- Adopt new practices: **flood diversion, retention/detention facilities** etc.



Flood Diversion

Yuansantzze Flood Diversion Tunnel

- Drain 1/3 of water volume
- Reduce 1.5 meter of water level

OUTLET



Taiwan



INTAKE



Detention Pond



照片來源-臺中市政府經發局網站

Qiu Honggu Plaza, Taichung

- Total area of 30,000 M³

National Spatial planning
-low impact development

Integrated River basin Management
- run-off distribution and outflow control

Disaster Warning & Response
-Cooperation between private and
public sectors

Prevention Technology

Public Participation

Post-disaster Aid

Disaster Prevention Technologies

2009

2014

2012

1977

WRA Websites/
Multiple-level image
processing system/
Emergency water supply
system Qwater/

Automated
flooding scope
assessment
system

facebook

Flood Forecasting System

1977 1999 2009 2010 2011 2012 2014 2015

Flooding
trend chart

1999

Smart Phones APP/
Landlines/
Cellular phones
Enterprise/
Communities

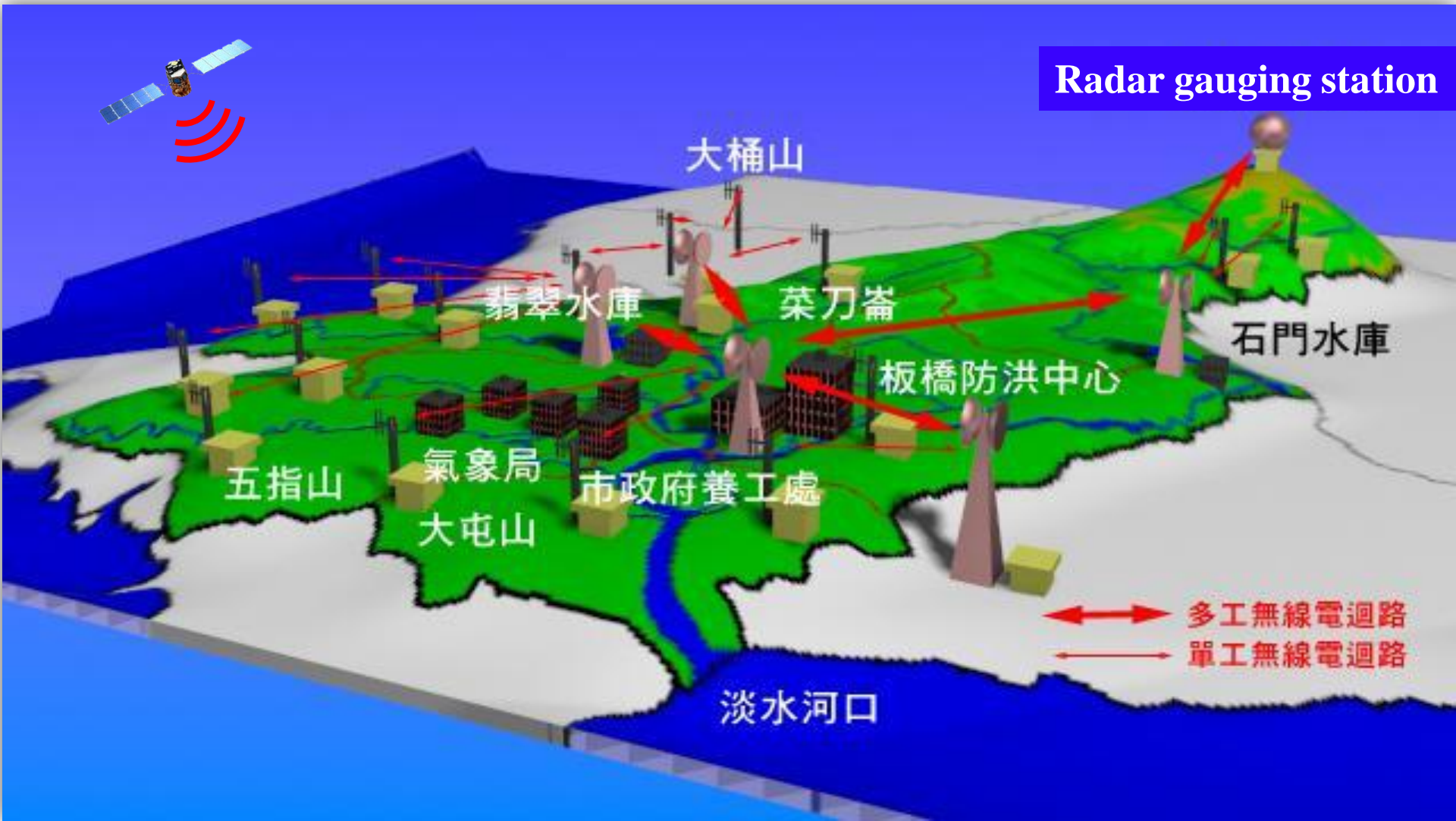
Google.org
7-ELEVEN

2011

2010 Local Basic Service

Flood Forecasting System – collect & transmit data

- Use radar, satellite, etc.
- Provide real-time records of rainfall and water level

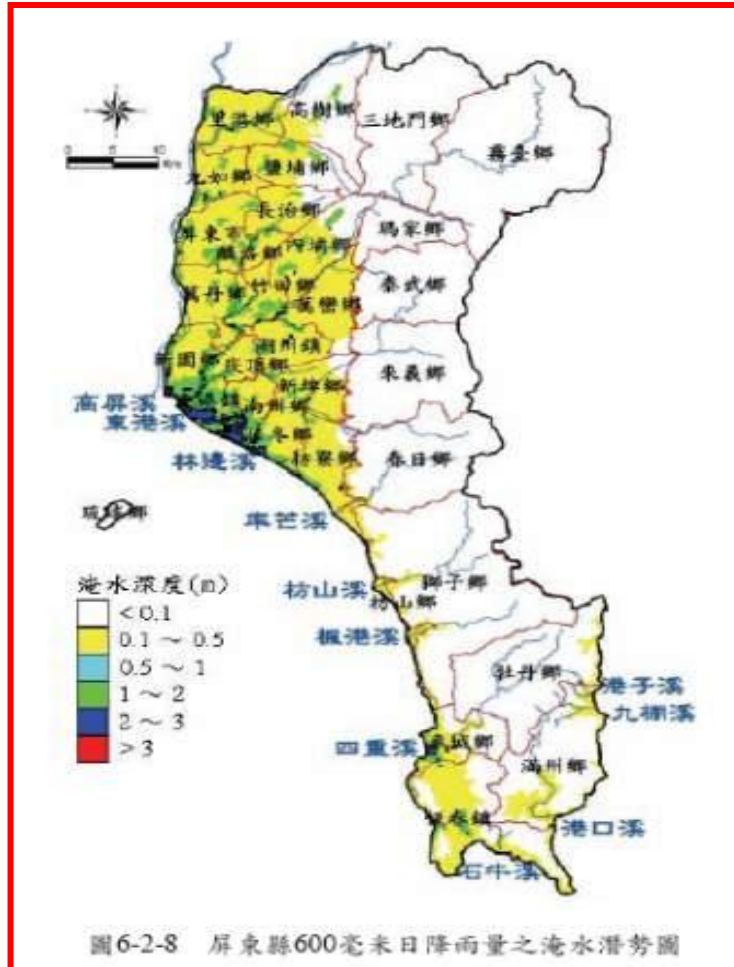


- Predict water level 1-6 hours in advance
- Locate potential overtopping sites



Flood Forecasting System – Residential area

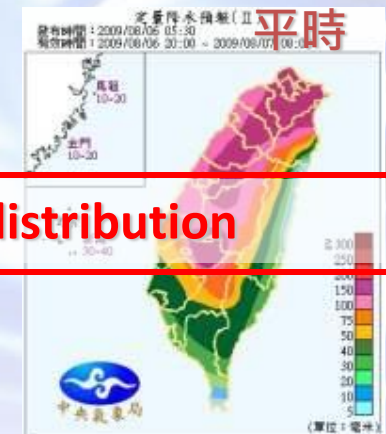
24-hour potential inundation map



Forecast

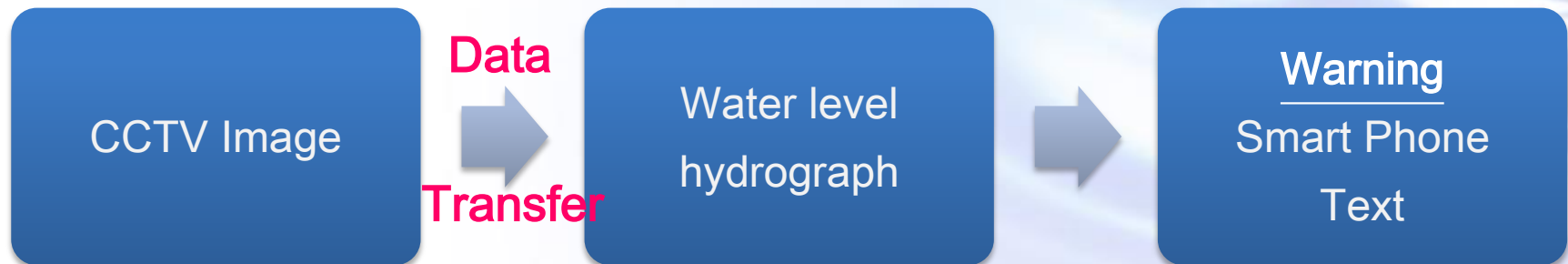
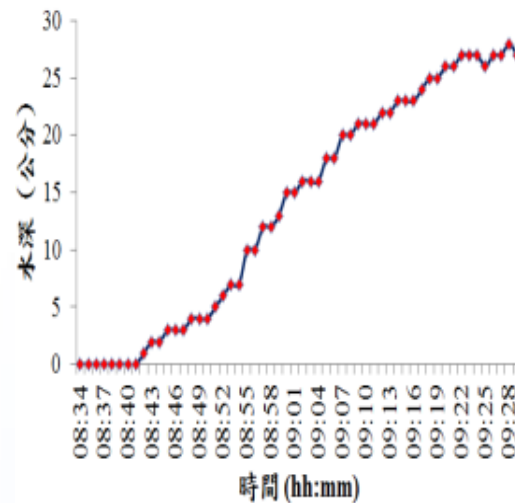
97年第07號颱風各地區24小時雨量預測 Land Typhoon Warning

分 區	台 北	台 北	桃 園	新 竹	苗 栗	台 中	彰 化	雲 林	嘉 義	南 投	台 南	高 雄	高 雄	屏 東	恆 春	基 隆	宜 蘭	花 蓮	台 東	蘭 嶼	澎 湖	金 門	馬 祖
雨量	<50	<50	<50	<50	80	100	100	200	300	150	300	200	250	250	200	<50	100	100	100	<50	<50	<50	<50
地形	50	50	50	50	80	100	-	-	400	300	300	-	300	200	-	-	50	50	80	-	-	-	-
雨量 (毫米)	100	100	100	100	150	200			600	500	500		500	400			100	100	150				



【Auto-Monitoring】

Using CCTV images to monitor and give warning



■ Platforms to transmit warning information



● Water Information APP



Rainfall
Information



Monitoring
Image



River/Reservoir
Water Level



Flood/Inundation
Alert

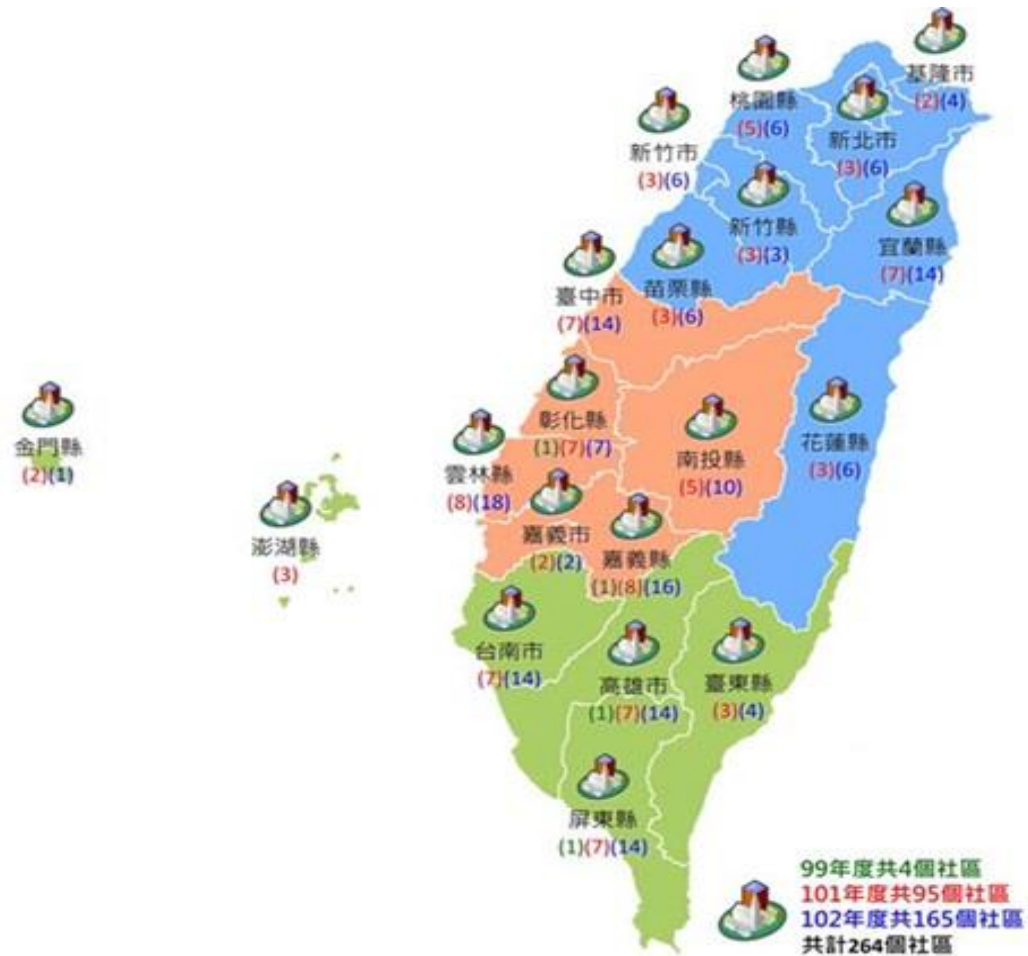
Public Participation

● Public & Private Cooperation

264

Voluntary
Communities

- Training
- Self-help



● Public & Private Cooperation

1,594

Volunteers

- Patrol River
- Report Back



● Public & Private Cooperation

8,600
Stores

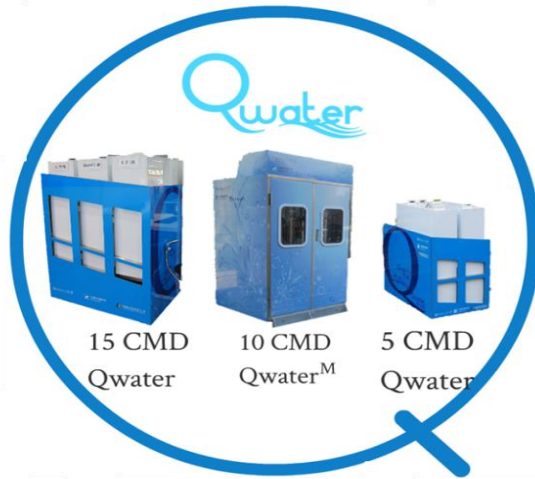
- Disaster Status Inquiry & Report
- Distribute Information



2011.04台灣各區店數



Post-disaster Aid



Emergent Water treatment System

- **Quick** 快組:

Assembled within **20** mins by **2** persons

- **Quality** 優質:

Treat high turbidity water (~3000NTU),
Conform to drinking water standard

- **Quantity** 豐沛:

Small unit for high volume production
(15 ton/day, by 2.5 m³, for **7,500** people)



Qwater淨水模場
(桃園市羅浮國小)

上圖：車載Qwater
下圖：船載Qwater

八八八



Qwater

[Disaster relief with clean water]

The Mission to clean water during typhoon Haiyan







Conclusions

Technology

- Forecasting system
- CCTV image transforming
- Information Platform

Public Participation

- Community
- Volunteer
- Enterprise

Post-disaster Aid

- Emergent Water Treatment system Qwater

safe home





***Thank You for
your Attention!***