NCDR-114-02-A-017

經費來源：☐ 01 當年度公務預算 ■ 02 委託補助計畫
機密(E) ：☐是 ■否
出國類別： ■ A 考察/訪問 ☐ B 學術會議/研討會
☐ C 進修/研究 ☐ D 工作會議

計畫名稱：Cross-boundary Scientific Empowerment on Disaster Resilience through Public-Private-Partnership —訪問慈濟基金會泰國分會暨出席災害管理與人道援助卓越中心人道援助應變訓練－災害課程

出國報告書

單位名稱： 國家災害防救科技中心

出國人姓名職稱： 李維森 主任秘書
蘇文瑞 副組長
陳可慧 助理研究員

出國地點： 泰國曼谷
出國日期： 民國 114 年 08 月 24 日至 114 年 08 月 28 日
報告日期： 民國 114 年 11 月 18 日

摘　要

本中心協助佛教慈濟慈善事業基金會，在亞太地區進行風險管理與防災能力建構、災害防救科技成果落實應用等工作之推動，並協助橋接災害管理實務工作領域中之學界、政府、國際組織與非營利組織等單位，共同串聯區域災害防救網絡、強化防減災效能。

本次國家災害防救科技中心受美國災害管理與人道援助卓越中心(CFE-DM)邀請，出席「災害管理與人道援助卓越中心人道援助應變訓練－災害課程」，擔任講座及會議觀察員，以持續友好交流並促進雙方防災課程之精進。會議期間並就過去本中心與其合作之成果基礎，討論接下來防災能力建構規劃與合作。

會議期間亦訪問慈濟基金會曼谷分會，瞭解近年泰國面對的災害類型及困境，說明災防科技中心及慈濟基金會的合作內容、介紹智慧災防監測儀器及應用方式，與曼谷分會討論其科研需求，進而研議接下來之防災合作。

目　　次

國家災害防救科技中心

1. 目的

依據 2023 年 11 月財團法人中華民國佛教慈濟慈善事業基金會（以下稱慈濟基金會）與國家災害防救科技中心（以下稱災防科技中心）簽訂之「災防科技研究與應用合作共善協議」，協助慈濟基金會在日本、印尼、馬來西亞及菲律賓等亞太地區國家，進行風險管理與防災能力建構、災害防救科技成果落實應用等工作之推動，並協助橋接災害管理實務工作領域中之學界、政府、國際組織與非營利組織等單位，共同串聯區域災害防救網絡、強化防減災效能。

臺灣與美國由駐美國台北經濟文化代表處與美國在台協會，於 2023 年 1 月 17 日簽署「成立人道援助暨災害應變工作小組」合作備忘錄，後續由國科會「國家災害防救科技中心」及美國「災害管理與人道援助卓越中心」(the Center for Excellence in Disaster Management and Humanitarian Assistance, CFE-DM)擔任窗口共同執行相關工作。歷年來雙方共同研議區域防災培訓課程、擔任對方防災培訓講座及會議觀察員，以持續友好交流並促進雙方防災課程之精進。

2. 活動紀要

2.1 訪問慈濟基金會曼谷分會

慈濟基金會曼谷分會位於曼谷 Nong Bon (หนองบอน)區域，為泰國唯一之慈濟分會據點、以難民義診及教育服務為當地和國際週知。8 月 25 日災防科技中心訪問慈濟曼谷分會，會晤副執行長張惠珍師姐及甘佳鑫師兄。會中討論本年泰北水災及緬甸地震時慈濟提供援助的經歷及遭遇之問題，災防科技中心李主秘介紹中心與慈濟基金會近幾年的合作項目、以及在亞太國家推動的智慧災防新南向計畫，蘇博士則展示災害情資網系統和緬甸地震時智慧災防儀器所監測到的地震觀測資料。

透過本次訪問，慈濟基金會曼谷分會首度認識災防科技中心，雙

方皆表示未來合作意願並希冀橋接曼谷當地相關防災學研機構，以作為慈濟災害援助工作之分析基礎。

圖 1 災防科技中心訪問慈濟基金會曼谷分會

2.2 出席災害管理與人道援助卓越中心人道援助應變訓練－災害課程

災害管理與人道援助卓越中心(CFE-DM)隸屬美國印太司令部(U.S. Indo-Pacific Command, USINDOPACOM)。該中心成立於1994 年，設立於夏威夷珍珠港。CFE-DM 職責為促進亞太地區災害整備與防災韌性，主要工作在於災害管理和健康安全方面的教育和培訓，以發展國內外的防災能力建構。

2003 年簽訂臺美「成立人道援助暨災害應變工作小組」合作備忘錄之目的，在促進人道援助、災害應變與災害風險管理之合作，聚焦於強化雙方的溝通、建立合作和分享資訊。具體合作領域包

括：資訊交流與落實、參與境況模擬作業、邀請人員參加相關論壇、會議、工作坊或與共同決定之培訓計畫等相關活動等項目，雙方擔任對方防災培訓講座及會議觀察員，以持續友好交流並促進雙方防災課程之精進。

本次訓練會議由災害管理與人道援助卓越中心副主任 Steve Castonguay 向災防科技中心提出邀請，出席並擔任會議講座。Castonguay 副主任主責管理 CFE-DM 的相關計畫。他在 CFE-DM 的工作包括與美國及外國夥伴合作，例如擔任人道援助應變培訓 (HART) 課程的教員，以及參與亞太地區各地的軍民協調研討會。

災害管理與人道援助卓越中心人道援助應變訓練(HART)－災害課程(Center for Excellence in Disaster Management and Humanitarian Assistance Humanitarian Assistance Response Training (HART) - Disasters Course)於 8 月 26 至 28 日舉辦於泰國曼谷駐泰美軍安全合作辦公室(JUSMAGTHAI)，此次為 CFE-DM 第四度邀請災防科技中心派員參與課程、分享臺灣於災害防救領域的寶貴經驗。

圖 2 CFE-DM 副主任 Steve Castonguay 為會議致開幕詞

本次課程主要參與對象為軍事人員、外交人員及其合作夥伴，訓練內容強調跨部門協作，特別是軍事機構與國際人道援助組織之間的合作，以能應對災害發生時能夠迅速且有效地展開援助行動。

課程設計內容及進行包含以下三部分：

(一)講題引導

講題包括：

1. 美國對外人道援助架構、
2. 海外災害應變操作環境、
3. 國際人道救援社群、
4. 國際軍民合作規範架構、
5. 應變後勤作業、
6. 海外災害應變規劃考量、
7. 泰國國家災害管理協作、
8. 台灣的國家災害管理協作、
9. 美國大使館災害應變協調。

會中討論到，軍隊與人道援助的後勤定義不同，軍隊強調規劃、移動與力量的支持；人道援助是計畫與執行的過程，必須具有效率、有效的成本控制和考量物資儲存、受災人員的需求。面對的挑戰包括災害現場的複雜性、極度時間壓力、需求導向、交通和通訊等基礎設施的毀壞、無條理的捐助、有限的資源以及人員缺乏後勤管理的技能等。

(二)案例研究及討論

透過幾個國際大型災害案例來進行小組討論及報告：蘇拉威西(Sulawesi，位於印尼東部島嶼)地震與海嘯、2023 巴布亞紐幾內亞地震、2021 年海地地震。

(三)最終災害實作練習

最後以 2015 年尼泊爾地震為題，進行小組實作演練及討論，最後

進行總結報告。

災防科技中心由李維森主任秘書分享講題為「Taiwan National Disaster Management Coordination」，開場先說明台灣風險暴露度高但脆弱度相對較低的原因，以及台灣藉由納莉風災開始意識到關鍵基礎設施防護的重要性。除介紹台灣防災科技的發展進程及其應用外，也說明了軍方、政府各部會、非營利組織等單位如何攜手合作應對災害。會中受到與會者的熱烈響應，會後也紛紛來表示台灣的經驗正是他們所面對的問題，希冀能與災防科技中心洽談進一步的諮詢與合作。

圖 3 災防科技中心李維森主秘分享台灣防災協作經驗

圖 4 本次災害課程訓練會場布置及看板

會議期間，災防科技中心團隊亦與 CFE-DM 副主任及其團隊進行雙邊會議。會中討論台美接下來的合作項目及防災能力建構方向，亦包括國際防災研習營、全球合作暨訓練架構等，希冀就目前之合作基礎，為印太區域防災能力建構共同建立網絡，並持續努力與國際防災及人道援助組織（例如慈濟基金會等）共同進行防災研究及應用。

圖 5 災防科技中心團隊與 CFE-DM 團隊合影

3. 心得及建議

由本次 CFE-DM 人道援助應變訓練課程安排可見，美國國防部、外交單位、國際大型組織、以及民間人道援助團體共同參與訓練。各講題均強調「軍、民、政府、非政府組織與地方社群」之間的協調機制。相較之下，臺灣雖具成熟的跨部會應變系統，但可再強化與國際人道組織的長期合作與共同訓練。

災防科技中心於會中分享「Taiwan National Disaster Management Coordination」受到熱烈迴響。與會者普遍對臺灣的資訊整合、科技監測與預警能力十分感興趣，甚至有意洽談後續合作。這顯示臺灣的防災科技已具區域示範與輸出潛力。

慈濟曼谷分會長期面對難民義診、都市型災害、水患，以及與緬甸邊境相關的地震事件，在地服務經驗豐富。本次互動讓慈濟全面瞭解災防科技中心的技術與服務，雙方對後續合作展現高度興趣，希冀未來在科技監測、資料分析、以及決策輔助工具等方面建立合作。

依據本次出國交流及觀察，提出建議如下：

（一）持續深化台美防災合作，並建立固定年度交流模式，提升臺灣在印太災害治理中的可見度與關鍵性角色。

（二）推動臺灣防災科技部署至慈濟海外據點作為示範場域，可考慮協調亞洲理工學會與慈濟曼谷分會合作，建立當地學研與 NGO 之防災合作，例如佈建簡易型監測儀器（雨量計）、共享災害情資網、或協助建立地方級災害資料整理流程等，以促成本計畫—「透過公私合作實現跨國科學賦能，提升災害韌性」之目的。

（三）持續追蹤印太各國風險議題以強化區域合作策略，例如：泰國都市水患問題、緬甸地震風險需跨境關注、印太地區國家對科技監測有迫切需求等。未來災防科技中心可以「資訊整合」及「科技輸出」為核心，逐步建構區域風險觀測網絡。

4. 出國效益

（一）強化台美在災害管理領域的正式合作基礎

本次出席 HART 課程及交流，使臺灣在 CFE-DM 的國際訓練平台上持續保持能見度，亦促成雙方針對研習營、訓練模組與合作架構之後續討論，有助深化台美在災害能力建構的夥伴關係。

（二）提升臺灣防災科技之國際能見度與區域影響力

災防科技中心的講題內容讓多國軍事與外交官員首次全面接觸臺灣的防災經驗，並產生實際合作意願，展現臺灣在印太地區輸出防災科技與治理模式的實力。

（三）促成慈濟曼谷分會與災防科技中心的首次對談及合作契機

透過拜會學習泰國災情與需求，使雙方建立初步合作願景。未來可作為災防科技中心推動南向防災科技示範應用的重要據點，提升海外能見度與社會影響力。

（四）促進國際人道援助與軍民協作知能之提升、增進本中心研究人員之國際視野

本次訓練以多國大型災害為案例，並涵蓋美軍、地方政府、人道團體的協調流程，深化本中心對海外災害應變的理解，有助中心未來與國際人道援助組織合作的實務及理解能力。

國家災害防救科技中心

附件一 議程－災害管理與人道援助卓越中心人道援助應變訓練(HART)災害課程

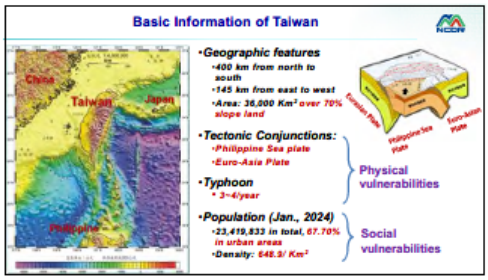
Center for Excellence in Disaster Management and Humanitarian Assistance
Humanitarian Assistance Response Training (HART) - Disasters Course
JUSMAGTHAI, Bangkok, Thailand
26-28 August 2025

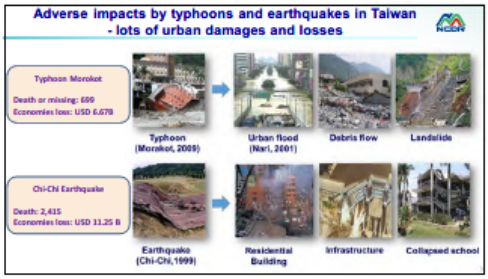
Day 1 - Tuesday - August 26th		
Time	**Subject**	**Instructor**
0800 - 0830	**Welcome and Course Introduction**	Steve Castonguay, CFE-DM Josh Szimonisz, CFE-DM
0830 - 0915	**Module: Framing U.S. DoD Foreign Humanitarian Assistance (FHA)** U.S. Department of Defense Role in FHA	Steve Castonguay CFE-DM
0915 - 0925	**Break**	
0925 - 1015	**Module: U.S. Foreign Humanitarian Assistance Architecture** U.S. Foreign Disaster Response (FDR)	Greg St. Pierre CFE-DM
1015 - 1025	**Break**	
1025 - 1115	**Module: FDR Operating Environment** U.S. Indo-Pacific Command Framework for FHA Options	Greg St. Pierre / Mike Wylie CFE-DM
1115 - 1120	**Break**	
1120 - 1200	**Case Study: Sulawesi Earthquake and Tsunami** Affected State Response and Foreign Disaster Response - Indonesia 2018	Josh Szimonisz CFE-DM
1200 - 1300	**Lunch**	
1300 - 1350	**Module: The International Humanitarian Response Community** Key International Stateholders	Chiara Romano Bosch, WFP Josh Szimonisz, CFE-DM
1350 - 1400	**Break**	
1400 - 1450	**Module: Case Study and Discussion (2023 Papua New Guinea)** Overview of the disaster and small group discussion	Mike Wylie CFE-DM
1450 - 1500	**Break**	
1500 - 1550	**Module: International Civ-Mil Normative Framework** Use of FMA in FDR, Civil-Military Coordination, and Military-Military Coordination	Chiara Romano Bosch WFP
1550 - 1600	**Wrap-up and Review** Group Discussion, Q & A, Review, and Admin	Josh Szimonisz CFE-DM
1600 - 1800	***Optional*** **- No Host - Icebreaker** Location is Golden Teak House Bar & Restaurant, JUSMAGTHAI	All

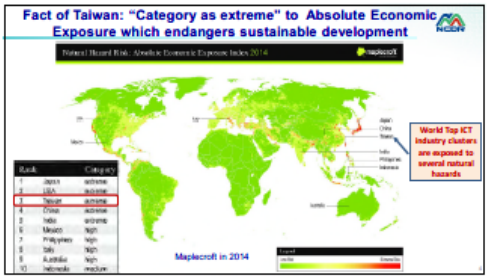
Day 2 - Wednesday - August 27th		
Time	**Subject**	**Instructor**
0800 - 0810	**Opening & Admin** Day 1 Review / Day 2 Agenda	Josh Szimonisz CFE-DM
0810 - 0900	**Module: Response Logistics** DoD Capabilities, Challenges, Coordination, Logistics Cluster	Greg St. Pierre CFE-DM
0900 - 0910	**Break**	
0910 - 1000	**Module: FDR Planning Considerations** Considering the Role of DoD in FDR and FDR Planning Considerations	Mike Wylie CFE-DM
1000 - 1010	**Break**	
1010 - 1100	**Module: Thailand National Disaster Management Coordination** Understanding key civil-military coordination lessons	CAPT Chitsakorn Thai MOD
1100 - 1110	**Break**	
1110 - 1200	**Module: Taiwan National Disaster Management Coordination** Understanding key civil-military coordination lessons	Dr. Wei Sen Taiwan NCDR
1200 - 1300	**Lunch**	
1300 - 1430	**U.S. Embassy Disaster Response Coordination** Role of MDRO, RAS, RSO, ACS, REFCOORD, ODC	Josh Szimonisz, CFE-DM U.S. Embassy BKK reps
1430 - 1440	**Break**	
1440 - 1600	**Module: Case Study and Discussion (2021 Haiti Earthquake Response), Part 1** Overview of the disaster and small group discussion & brief	Gregory St. Pierre CFE-DM
1600 - 1615	**Wrap-up and Review** Group Discussion, Q & A, Review, and Admin	Josh Szimonisz CFE-DM

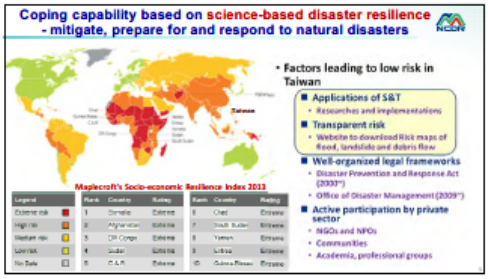
Day 3 - Thursday - August 28th		
Time	**Subject**	**Instructors**
0800 - 0815	**Closing Remarks & Group Photo**	Senior rep, U.S. Embassy BKK
0815 - 0830	**Opening & Admin** Day 2 Review / Day 3 Agenda	Josh Szimonisz CFE-DM
0830 - 0945	**Module: Case Study and Discussion (2021 Haiti Earthquake Response), Part 2** Overview of the disaster and small group discussion & brief	Gregory St. Pierre CFE-DM
0945 - 1000	**Break**	
1000 - 1200	**Final Disaster Exercise (2015 Nepal Earthquake), Part 1** Overview of situation Small Group Discussion and Briefback	Mike Wylie CFE-DM
1200 - 1300	**Lunch**	
1300 - 1400	**Final Disaster Exercise (2015 Nepal Earthquake), Part 2** Overview of situation Small Group Discussion and Briefback	Mike Wylie CFE-DM
1400 - 1500	**Wrap-up, Review, & Evaluation** Q & A, Review, and Course Feedback Evaluation	Josh Szimonisz CFE-DM

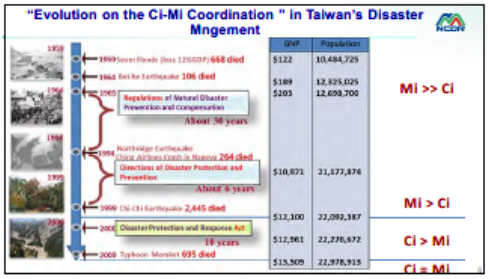
附件二　演講簡報

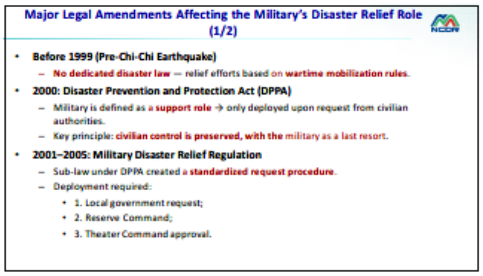


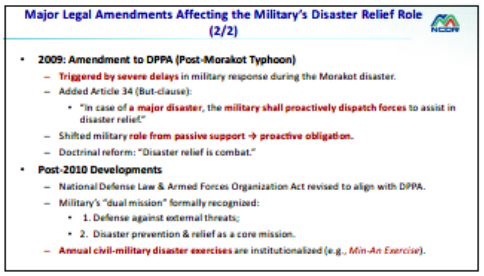


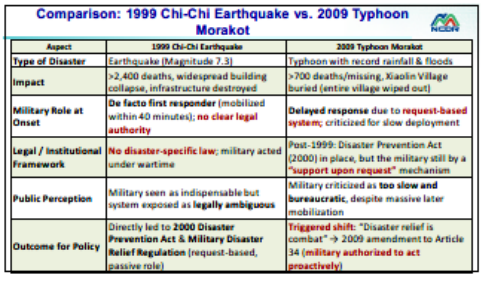










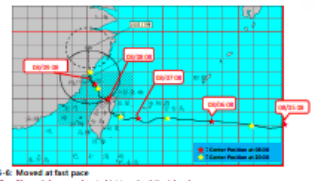


Aspect	1999 Chi-Chi Earthquake	2009 Typhoon Morakot
Type of Disaster	Earthquake (Magnitude 7.3)	Typhoon with record rainfall & floods
Impact	>2,400 deaths, widespread building collapse, infrastructure destroyed	>700 deaths/missing, Xiaolin Village buried (entire village wiped out)
Military Role at Onset	De facto first responder (mobilized within 40 minutes); no clear legal authority	Delayed response due to request-based system; criticized for slow deployment
Legal / Institutional Framework	No disaster-specific law; military acted under wartime	Post-1999: Disaster Prevention Act (2000) in place, but the military still by a "support upon request" mechanism
Public Perception	Military seen as indispensable but system exposed as legally ambiguous	Military criticized as too slow and bureaucratic, despite massive later mobilization
Outcome for Policy	Directly led to 2000 Disaster Prevention Act & Military Disaster Relief Regulation (request-based, passive role)	Triggered shift: "Disaster relief is combat" → 2009 amendment to Article 34 (military authorized to act proactively)

U.S. Assistance in Taiwan's Major Disasters

Feature	1959 Flood	1999 Chi-Chi Earthquake	2009 Typhoon Morakot
US Participating Agencies	US Aid Mission (USOM)	USAID/OFDA, Fairfax County Urban Search and Rescue	US Marine Corps, US Navy
Core Deployed Assets	Surplus Agricultural Products (flour, cooking oil), Economic Aid	Disaster Assistance Response Team, Heavy USAR Equipment, Experts	LPD-9, Heavy-lift Helicopters, Heavy Transport Aircraft
Nature of Assistance	Long-term Material and Economic Support	Technical Urban Search and Rescue, Financial Aid	Heavy Logistics Transport, Delivery of Heavy Equipment and Supplies
Legal and Policy Framework	Formal Diplomatic Relations / Mutual Security Act	Taiwan Relations Act (TRA)	Taiwan Relations Act (TRA)

Typhoon Morakot: #8 in 2009 triggered the process to integrate information

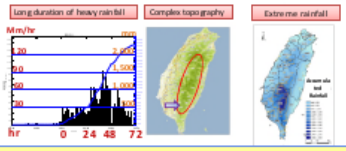


Aug 5-6: Moved at fast pace
Aug. 7 : Slowed down and out skirt touched the island
Aug. 8 : Made landfall at 00:0; Center left the island at 14:00; at very low pace; Cast influence on the whole island

Siaolin Village the hardest-hit area

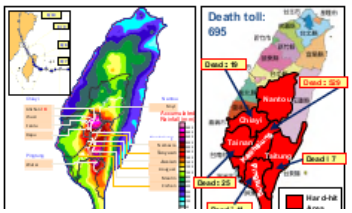
- In Jiasian Township of Kaohsiung City
- 400 buried alive and 53 missing
- Landslide, barrier lake (dammed lake) and mudslide

Recipe of disaster: topography and intensity - Typhoon Morakot



- Heavy rainfall(50-60mm/hr) lasts for over 24 hours.
- Topography : Area of Taiwan is about 36,000 Km^2, **over 70% in slope land.**
- High intensity of rain : *Extreme rainfall concentrated mainly in mountain areas.*

Hard-hit Areas and Accumulated Rainfall



Review on what led to systematic failures in 2009

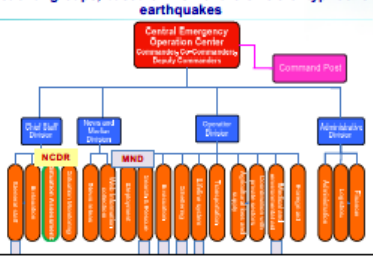
learned lessons actions after Typhoon Marokot in 2009

Too much or too little information in emergency operations
- Channels to acquire useful information – multiple sources
- A system of systems to integrate information – demand-oriented

Lack of common operational pictures to coordinate actions
- A speak-on-the-same-page environment– reduce information gaps
- Situation maps for operation – decisive support to operations

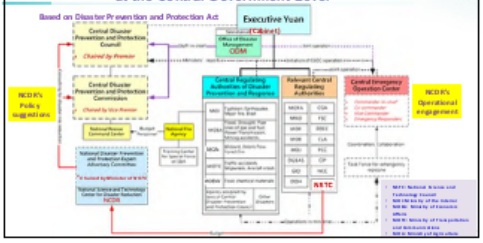
When and how to make timely operations
- Well-organized teams – evidence-based decisions
- Digital emergency preparedness – information intelligence sharing

Functional groups, based on ESF of the CEOC of typhoons or earthquakes



NCDR builds up close S&T partnerships with emergency responders

Disaster Management Framework at the Central Government Level



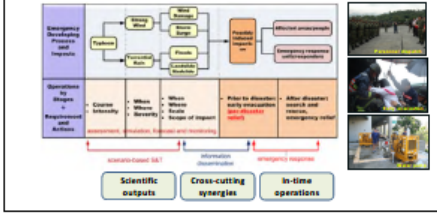
Based on the "Central Disaster Response Center Operations Directions," the Ministry of National Defense (MND)

- Support and coordination roles within the functional groups, based on ESF of the Central Emergency Response Center (CEOC).
- CEOC at operation, MND's missions
  1. Supervise the armed forces to proactively support the rescue and relief efforts for major disasters.
  2. Provide disaster information collected by the armed forces' command and control systems.
  3. Supervise military units in disaster information collection and reporting.
  4. Supervise military police units in assisting with the maintenance of public order in disaster areas.
  5. Supervise the support and deployment of the armed forces' disaster relief equipment and machinery.

Operation of the CEOC Assessment Group (Typhoon)

Using science and technology during typhoon emergency operation

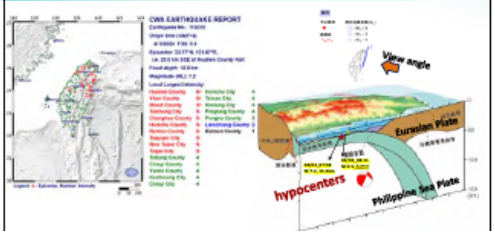
Teamwork and dialogues among scientists, emergency responders and decision makers



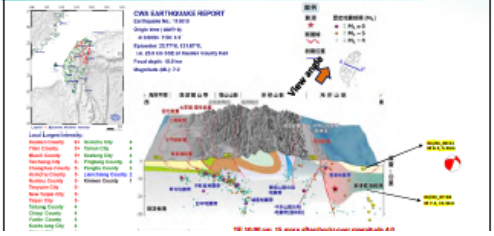
Case study: Earthquake on April 03, 2024

0403 Hualien Earthquake
1st Impacts Assessment Report at CEOC
NCDR
2024.04.03 10:00
(2 hours after the quake)

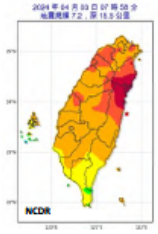
Geological profile (1) near the hypocenters



Geological profile (2) near the hypocenters

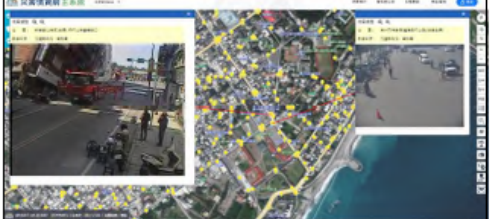


Shake Map



Area	Intensity	PGV (cm/s)	PGA (gal)
Hualien	6+	84.0	1109
Yilan	5+	49.21	418.64
Nantou	5-	25.84	184.74
Hsinchu	5-	26.23	184.74
New Taipei	5-	22.47	172.76

Damaged building in Hualien



0403 Damages after Hualien Earthquake (crowdsourcing)

Damages in Tongmen Village, Xiulin Township, Hualien County.

Damage to the elevated subway bridge in New Taipei City

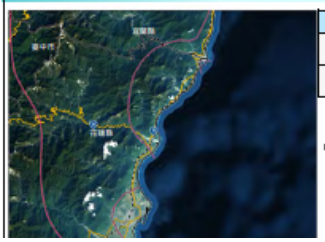
Damage to HW#9 at Daqingshui Tunnel

Falling-rock damages in HW#8 and HW#14

Fault lines near the epicenter

Num.	Fault
1	Lingding
2	Milun
3	Rueyshui

Transportation systems under high shaking intensity



Highway	HW#8, HW#9, HW#9C, HW#9D,HW#11
Railway	North Link Line Hualien Taitung Line

Intensity

Highway

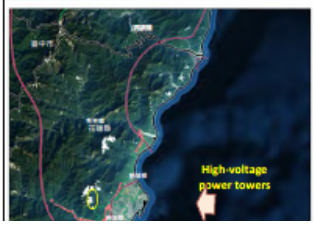
Railway

Facilities under high shaking intensity

	Facilities
Hualien	Heping Industrial Park, Hualien Airport, Hualien Fuel Service Center (Hualien Depot), Hualien Fuel Service Center (Beipu Depot)

Intensity

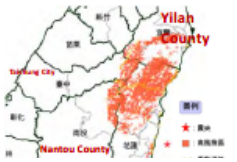
High-voltage power towers under high shaking intensity



Intensity

Areas with a high risk of landslides

- Landslide hotspots by county or city: Taichung City, Nantou County, Yilan County, Hualien County
- Landslide hotspots by highway: HW#8, HW#9, HW#9C, HW#9D, HW#11, HW#14, and some rural roads



Aeras	Hotspots
Taichung City	Heping District
Nantou County	Ren'ai Township
Yilan County	Su'ao Town, Su'ao Town, Nan'ao Township, Datong Township
Hualien County	Wanrong Township, Ji'an Township, Guangfu Township, Fengbin Township, Hualien City, Shoufeng Township, Xiulin Township

MND's immediate response and operations on 04/03

Time	Event
07:58	Hualien earthquake occurred (magnitude 7.2–7.4)
Around that time	The Central Emergency Operation Center was activated at Level 1 operation, commanded by the Minister of the Interior (Ministry of National Defense personnel attended)
Morning	2nd and 3rd Theater Command emergency centers set up; Lt. Gen. Yu conducted an on-site inspection in the disaster area, dispatched 37 troops
Around 09:05	Deputy Chief of the General Staff Lt. Gen. Yang arrived in Hualien to coordinate and integrate rescue resources
Afternoon	Air Force deployed C-130 transport aircraft carrying special search-and-rescue teams and rescue dogs to Hualien
April 3 (same day)	Armed Forces deployed about 250 personnel for disaster relief, with about 5,000 on standby

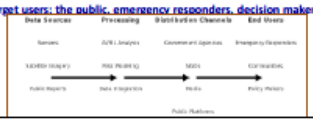
MND's immediate response and operations during the quake

Comparisons between 2024 and 1999

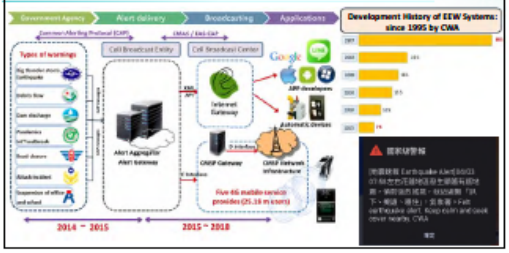
Aspect	Hualien Earthquake (2024) April 03 @ 07:58 am	Chi-Chi Earthquake (1999) September 21 @ 01:47 am
Magnitude	7.2	7.3
Epicenter Location	Near Hualien City, offshore(in-land), 15 km south(14.9 km south-southwest)	Near Chi-Chi, Nantou County, central Taiwan
Depth	15.5 km (22.5km)	8 km
Quake Mechanism	Tectonic movement	Thrust faulting along the Chelungpu Fault
Affected Area	Primarily eastern Taiwan	Central Taiwan
Casualties	18 dead, over 1,115 injured	2,400 dead, over 11,000 injured
Damage	Severe damage to 84 buildings, widespread infrastructural damage, temporary utility disruptions	Destruction of over 100,000 buildings, extensive infrastructure damage
Secondary Effects	Triggered a small tsunami with waves up to 1 meter, leading to tsunami warnings	Extensive landslides, ground liquefaction, widespread power outages
Mitigation Efforts	Extensive seismic retrofitting programs initiated after the 1999 Chi-Chi earthquake	Limited compared to the present day, leading to greater damage and higher casualties
Emergency Response	Quick activation of emergency operations and deployment of emergency relief	Initial response efforts overwhelmed, leading to long-term recovery challenges
Reconstruction Efforts	Ongoing, significant focus on rebuilding and strengthening infrastructure	Extensive, led to the establishment of comprehensive seismic safety programs
Economic Impact	Estimated in billions, mitigated by improved preparedness and rapid response mechanisms	The costliest disaster in Taiwan's history prompted building codes and disaster preparedness reforms.

Information Supply Chain for Disaster Risk Management - DRR information supply chain

- Required elements to build tiers of DRR information supply chain
  - Sensors: rain, earthquake, tsunami, human behavior (full coverage by IoT)
  - Data: physical data, social data, unformatted data (big data)
  - Tools: GIS platform, AI, data mining (process big data)
  - Channels: Public warning system, TV, instant messenger (efficiency)
  - Information intelligence: evacuation, decision making (action-based)
  - Risk communication: facilitators (fill the gaps)
  - Target users: the public, emergency responders, decision makers (diversity)



Earthquake Early Warning System and Public Warning System



Implement public warning through Public-Private-Partnership

- Public sector
  - 7 government agencies + local governments
- Private sector
  - All five 4G system operators
  - Free to users and government
  - Contract request for bidding bandwidth
- Coverage over users
  - 25.18 million 4G users (2018 Q3)
- Types of warnings
  - Big thunderstorm, Earthquake, Debris flow, Dam discharge, Pandemics, Int'l outbreak, Road closure, Attack incident, Suspension of office and school
  - Mainly using 4370 and 911 channels
  - Area definition: Geo Code, Circle and polygon (location-based)

2016/05/12, Channel 4370

How Earthquake Early Warning System (EEWS) saves lives

- location-based warnings pushed to NCDR LINE channel

- 70 more alerts at 4 categories (free)
- Subscribers over 1.8 m since March 2018
- 180 million messages shared through LINE in April, 2024

A 25-year preparedness for a big one

- Within 25 years of the 1999 Chi-Chi Quake, seismic enhancements were implemented to better prepare our society for future events.
- Main takeaways
  1. Building Codes and Infrastructure Resilience (less interruptions to operations)
  2. Early Warning Systems and Public Preparedness (PWS and education)
  3. Disaster Response and Management (integrated emergency operation)
  4. Community and International Support (the whole society involvement)
  5. Continual Improvement and Learning (learning from Japan and the US)
  6. Public-Private-Partnership (help for "Build back better")

Analysis and Application on Seismic Impacts

- Earthquake Impact Information Platform
  - 500mX500m mesh
  - Multi-layer interpretation
  - Topic maps for disaster risk management
- Dynamic 3D building simulation
  - Building attribute database
  - 3D polygon
  - Dynamic damage assessment
- Scenarios of Large-scale Earthquake
- Application on Annual National Quake Drill
  - Transportation routes
  - Allocation of rescue teams
  - Recovery of tele-communication systems

NCDR's missions and mandates

- An "interface" to apply science and technology for disaster risk management

National Science and Technology Council

Propose topics / Supervise / Provide operation funds

NCDR
Since 2014

150 full-time staff
- Natural science
- Social science
- Engineering
- Emergency management
- Business management

Major services
- S&T transfer
- S&T innovation
- Knowledge base
- Data base
- International collaboration

Major products
- Applied and inter-disciplinary research
- Policy of DRR for central and local government
- Information integration
- Emergency operation (not search and rescue)
- Identification of urgent needs and long-term demands
- Integration of potential risk maps

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, Tsukuba U, R2EC (JP)
- PDC, CFE-DM (US)
- ADPC (TH)
- NDMI (KR)
- APEC EPWG

Administrative Structure of NCDR

- inter-disciplinary and evidence-based disaster risk management

National Science and Technology Council

Formally established in 2014
Mandates:
1. Research promotions
2. Technology supports
3. Practical implementations

Board of Directors

NCDR Director's Office

Academic Convenors

International Collaboration

NCDR aims at existing and future risk
- Meteorology Division
- Slopeland and Hydrology Division
- Policy and Socio-Economics Division
- Earthquake and Man-made Disaster Division
- Information Division
- Climate Change Division
- Planning Division
- Administration Division
- Accounting

NCDR, A Model of Scientific Disaster Manager

– to facilitate DRR S&T for actions at different levels

Decision supports
- Information intelligence
- Common operational picture

Practical implementations
- Knowledge transfer to co-work on hazard map
- Table-top exercise to raise leadership

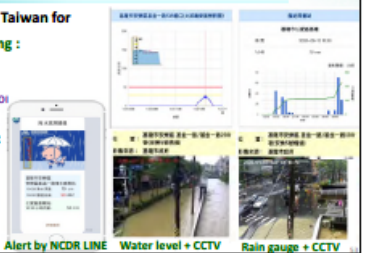
Smart Disaster Risk Management – Information integration

- Value-added applications for DRR technology & information to support governments on DRM

- Over 620 types of monitoring data from agencies Value-added applications over 100

Applications of Civil IoT Taiwan on Disaster Risk Management

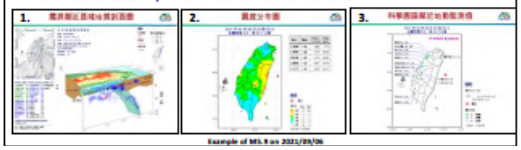
- NCDR uses Civil IoT Taiwan for
- Real-time monitoring :
  - Flood sensors – WRA
  - Rain gauges – CWB
  - Digital terrain mode – MOI
  - CCTV – Multi agencies
- Instant intelligence:
  - Disaster alters
  - Up-to-date situation
  - Necessary actions
  - Multi channels



Alert by NCDR LINE | Water level + CCTV | Rain gauge + CCTV

Graphics-oriented Rapid Reporting System

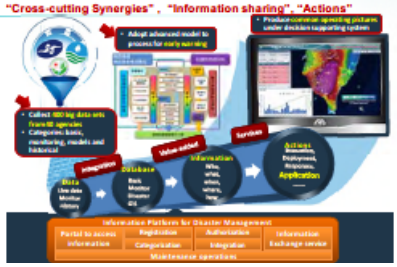
- Soon after any earthquake hit, in 5 minutes, NCDR collects information from the Central Weather Bureau and P-Alert network to produce
  1. Geological-profile of hyper center
  2. Shake-make
  3. Data collected by P-Alert network at Science Parks



Example of M5.9 on 2021/09/06

Preparation: aggregating big data for open data–

"Cross-cutting Synergies", "Information sharing", "Actions"



Common Operational Picture through Web-GIS platform to bridge information gap at local level

NGOs play a critical role in disaster resilience and HA/DR

- PPP plays a vital role in improving disaster risk management by leveraging resources, knowledge, and expertise from multiple sectors, including
  - Policymakers
  - NGOs and Civil Society
  - Scholars and Researchers
  - Corporations and Business Leaders
- Initiating collaboration across these sectors is essential for achieving more effective humanitarian operations.

Example: Tzu Chi Innovation of Disaster Response and Relief System

- Container
- Truck
- Boat
- Luggage

Water
- Instant Rice/Noodles
- Nutrition Bar

Food
- Mobile Kitchen
- Rocket Stove

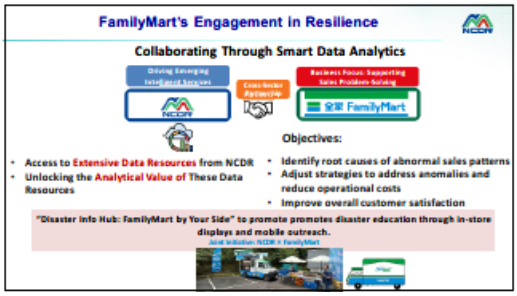
Accessory
- Foldable Bed
- Solar LED Street Light
- Eco Blanket
- All-Terrain Vehicle

Shelter
- Temp schoolhouse
- Quick setup house

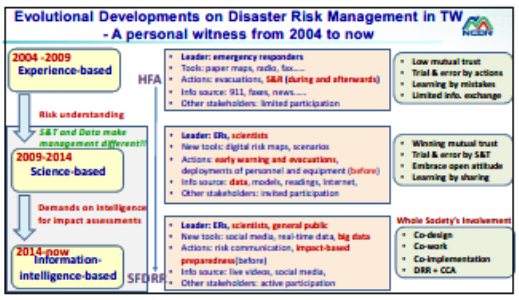

Tzu Chi's innovations for HA/DR
Water Purification Systems
Mobile kitchen
Instant food

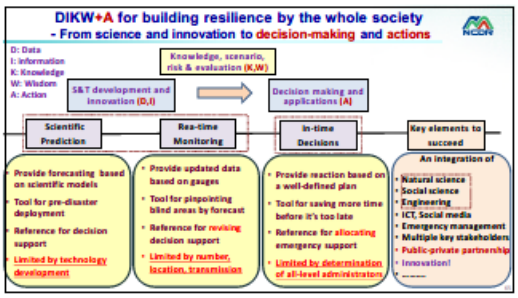

Tzu Chi's Improvements in Shelter Management

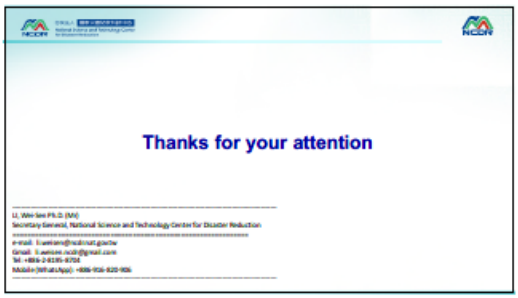

DRR Technology, Capacity Building, and ICT for Resilience Alliance (Tzu Chi, NCDR, and Partners)
2019 (MoU)
2023 (MoU renewal)
2024(Info. Platform)
Leverage S&T and Power of Mercy
2024
2022
2023
Youth Leadership Camp on Disaster Risk Management


FamilyMart's Engagement in Resilience
Collaborating Through Smart Data Analytics
FamilyMart
Objectives:
Access to Extensive Data Resources from NCDR
Unlocking the Analytical Value of These Data Resources
Identify root causes of abnormal sales patterns
Adjust strategies to address anomalies and reduce operational costs
Improve overall customer satisfaction
"Disaster Info Hub: FamilyMart by Your Side" to promote promotes disaster education through in-store displays and mobile outreach.


Three interrelated plans to make a society continue and resilient
Operation Continuity Plan (OCP) at government level
Lifeline systems, public health, education, finance, critical infrastructure
Business Continuity Plan (BCP) at private sector
Employees, customers, contractors, supply chain
Livelihood Continuity Plan (LCP) at communities
Food, water, sanitation, incomes
OCP
BCP
LCP
Supporting functions


Evolutional Developments on Disaster Risk Management in TW
- A personal witness from 2004 to now
2004 -2009
Experience-based
HFA
Risk understanding
S&T and Data make management different!
2009-2014
Science-based
Demands on intelligence for impact assessments
2014-now
Information-intelligence-based
SFDRR
Whole Society's Involvement


DIKW+A for building resilience by the whole society
- From science and innovation to decision-making and actions
D: Data
I: Information
K: Knowledge
W: Wisdom
A: Action
Knowledge, scenario, risk & evaluation (K,W)
S&T development and innovation (D,I)
Decision making and applications (A)
Scientific Prediction
Real-time Monitoring
In-time Decisions
Key elements to succeed
An integration of
Natural science
Social science
Engineering
ICT, Social media
Emergency management
Multiple key stakeholders
Public-private partnership
Innovation!


Thanks for your attention