

# National Science and Technology Center for Disaster Reduction



9F., No. 200, Sec. 3 Beixin Rd., Xindian District, New Taipei City 23143, Taiwan  
<http://www.ncdr.nat.gov.tw>

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## Outline

National Science and Technology Center for Disaster Reduction (NCDR), designed as an all-hazards-approach institute, covers topics related to hydro-metrological hazards, geological hazards, technological hazards, potential hazard maps, social vulnerabilities analysis, application of remote sensing, climate change, policy suggestions of disaster risk reduction to government and development of a decision supporting system for emergency operation, NCDR innovates outputs of science and technology on providing comprehensive and integrated solutions for building disaster resilience and enhancing emergency preparedness by engaging interdisciplinary teamwork with central and local governments, academia, communities, business sector and NGOs. Twelve years since 2003, NCDR has been continuing its unique role to meet demand and supply of disaster reduction in Taiwan. Besides seeking collaboration with domestic research institutes, NCDR keeps close and active interactions with international partners for sharing with experiences and learning from new developments.

## Research Achievements and Challenges

NCDR, a team selected from more than 100 staff, leads the interdisciplinary and integrated research programme to deal with the newly emerging extreme events, cross-cutting issues and compound disasters at national and regional level including the APEC region. Under the authority of the Ministry of Science and Technology (MOST), facilitating and implementing research results yielded by projects funded by MOST are showing NCDR's role in bridging gaps between academia and policy makers. As Taiwan is a disaster-prone country, to introduce science and technology for better enhancing disaster management, especially efficiency of emergency, is one of key mandates for NCDR to continue its efforts.

During typhoon season, NCDR always actively joins the teamwork with emergency operators by offering integrated information and knowledge. For policy making, NCDR plays a role as a major think tank to the Cabinet level and the President by providing in-depth suggestions on disaster reduction and emergency preparedness. According to current operational framework of the Central Emergency Operation Center, NCDR takes the leader position in charge of the situation assessment group at the central level to safeguard Taiwan. In order to effectively operate and maintain the information system for emergency operation, NCDR has integrated big data sets from all stakeholders involved. Since late 2009, an integrated system has been developing to meet operational demands.

In order to cope with data and information related to typhoons, floods and precipitation-triggered landslides, the carried-out countermeasures strongly require decisive decisions based on assistance of science and technology. The evidence-based emergency operation needs implementation of applying improved numerical ensemble models to forecast trajectories and rain of typhoons; producing potential risk maps of inundation providing scenario-based suggestions for commanding; and integrating real-time monitoring data. All the outcomes and information should be displayed on GIS-Web-based system to assist operations of Emergency Operation Center (EOC) by upgrading the whole situation awareness. Therefore, big data is a core behind the scene. During the implementing process, close partnership, mutual trust and interactive collaboration are three key elements to establish seamless linkage between scientists and emergency responders. A typical information is shown on figure 1.

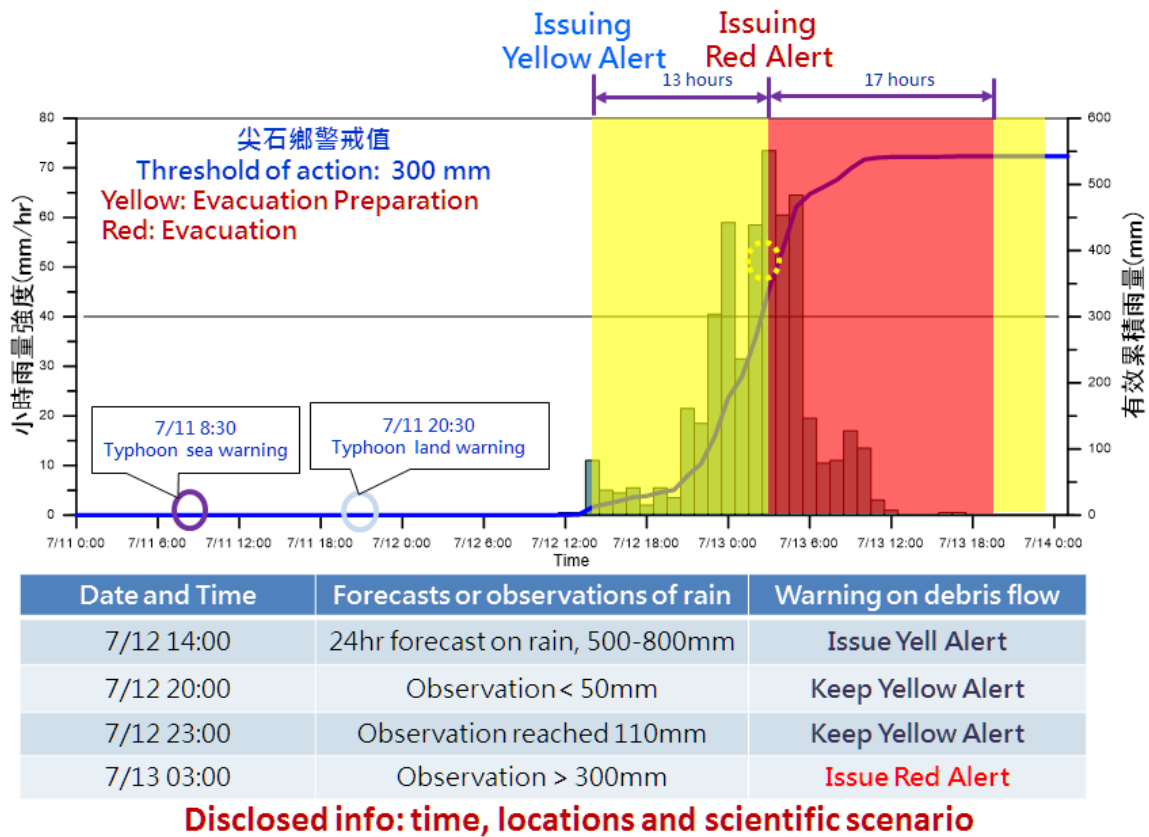


Figure 1. Information for decision support of debris flow warning

About regional participation, NCDR is also making contributions to the APEC Emergency Prepared Working Group (EPWG) through working on enhancing capacity building and strengthening regional collaboration on emergency preparedness and disaster reduction. From 2012, NCDR also coordinated the cross-fora multi-year project on Improving Natural Disaster Resilience of APEC SMEs to Facilitate Trade and Investment between APEC Emergency Preparedness Working Group and Small and Medium Size Enterprises Working Group (SMEWG). With carry on NCDR's endeavors in SMEs capacity building and Business Continuity Planning, NCDR is currently the focal contact point of APEC EPWG project - 'Application of Big Data and Open Data to Emergency Preparedness Phase 1' to implement and coordinate a better digital preparedness on natural hazards and benefit SMEs and vulnerable groups by offering transparent and action-based information which is aimed to enabling the potentially vulnerable groups to quick respond to emergency and secure trade an investment in the APEC region.

The most challenging tasks are how to make full use of interdisciplinary knowledge to deliver suggestions to decision makers based on the following principles: (A typical outlook of information-based suggestion is shown on Fig.2)

1. Scenario-based description for deployment and response in advance: impact analysis based on the worst and least cases will give a range of possible damages and casualties.
2. Cross-cutting information exchange to monitor evolving situations: Overlaying different sources of data is able to provide a picture of inter-relation among hazardous factors like intensity and accumulation of rainfalls, geological surveys along hillsides and threshold values. The outcomes server as a best estimation of landslide or debris flow.
3. Graph and table plus GIS to show spatial and time-dependent factors: Amid emergency operation, commanding officers have limited time to catch situations. Therefore, simple and neat information with one chart and table certainly helps commanding officers make decision.

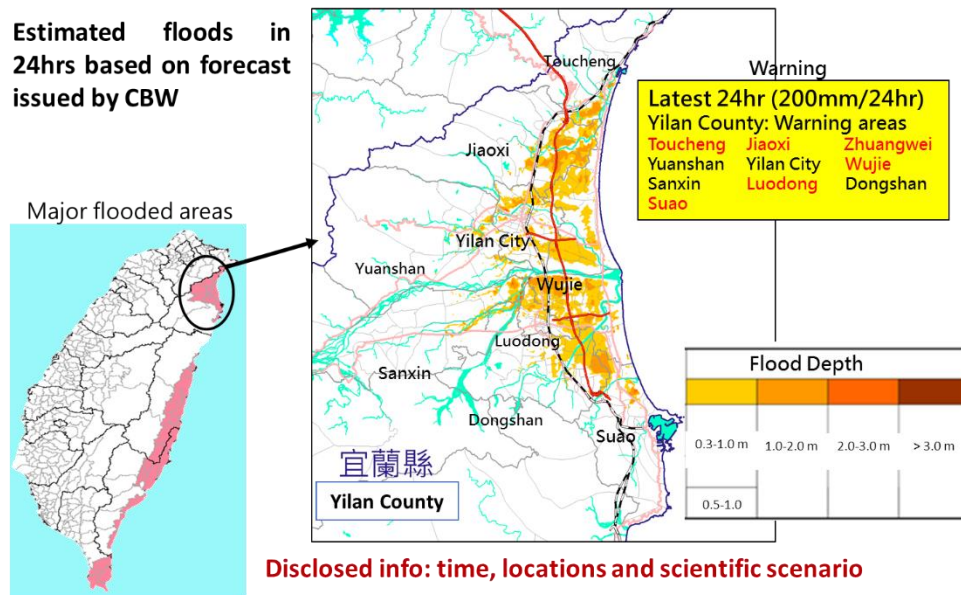


Figure 2. An example of decision supporting suggestions

An increasing and rising trend - eagerly seeking knowledge, expertise and best practices for environmental and natural disaster management- appears in civil society as more extreme weather events and large-scale disasters have brought devastations to many countries, especially in south-east Asia. Therefore, it is about time to integrate lessons learned before, science, technology, policy makers and practitioners together; and develop a solution-based platform to promote vertical and transverse collaboration through trans-boundary research partnership. The proposed trans-boundary partnerships will pursue a cross-cutting mechanism to lavage and connect the existing regional and international programs by a value-added operation of emphasis on policies, management, operations based on inter-disciplinary researches. The main goal of the proposed project is to breed mature disaster managers and capable practitioners who will operate disaster management, respond to emergency and conduct ground work by following well-organized knowledge base produced by regional collaboration.

In the Asia-Pacific region, hydro-meteorological hazards - like typhoons, monsoon, droughts and floods - and earthquakes are two major types of natural hazards claim casualties and properties loses. Based on common interests and demands, tow natural hazards are priorities to collect regional partnerships. A typhoon could bring trans-boundary impacts along its trajectory. With this regards, sharing research results of natural science, social since, management and technology will accelerate regional improvement on disaster risk management (DRM) which should be accepted by and applied for both public and private. The triple play of academia, policy makers and practitioners should create a new research approach to bring all stakeholders together from initial stage for applicable methodologies and feasible solutions.

The following items should form the cores to facilitate promotion and operation of trans-boundary partnerships:

1. **Knowledge for implementation:** Now abundant knowledge - from academia and local communities- are helping to mitigate, prepare for, respond to, recover from and adapt for emergency/natural disasters. But gaps exit between academia, policy makers and practitioners that obviously prevent DRM from solving practical problems. Therefore, the trans-boundary partnerships will definitely bridge the gaps by screening knowledge mature enough for implementation, not an experimental study.
2. **Lesson-learned operation:** “Learn from disasters” and “Live with disasters” is well known to people, but behind the two slogans means accumulation of experiences and collection of best practices will help disaster manager grow to face new challenges. The

partnerships will build a learning mechanism to shorten learning processes to breed an experienced disaster manager.

3. **Knowledge with management:** To meet real surging demands of DRM, a knowledge tree will assist in data mining of DMR expertise and function as a pathfinder to access the demanded knowledge.
4. **Value-added feedbacks:** Outcomes and feedbacks contributed by policy maker and practitioners are valuable to develop a key element of life cycle of DRM knowledge management. A “two-way” communication will certainly shorten the knowledge gaps among stakeholders.
5. **Multi-stakeholders’ participation:** The proposed partnerships will encourage broad-spectrum participation of multiple stakeholders on an equal basis. Cross-cutting dialogues and proactive interaction will build up a concrete integration.