Outcomes and Achievements of the Program on Applying Science and Technology for Disaster Reduction, 2011-2014

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Ministry of Science and Technology

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The Program on Applying Science and Technology for Disaster Reduction (ASTDR)

- **Initiation of the Project**

    Due to the impact by **Typhoon Morakot** in 2009, the proposed project was approved on March 4, 2010.
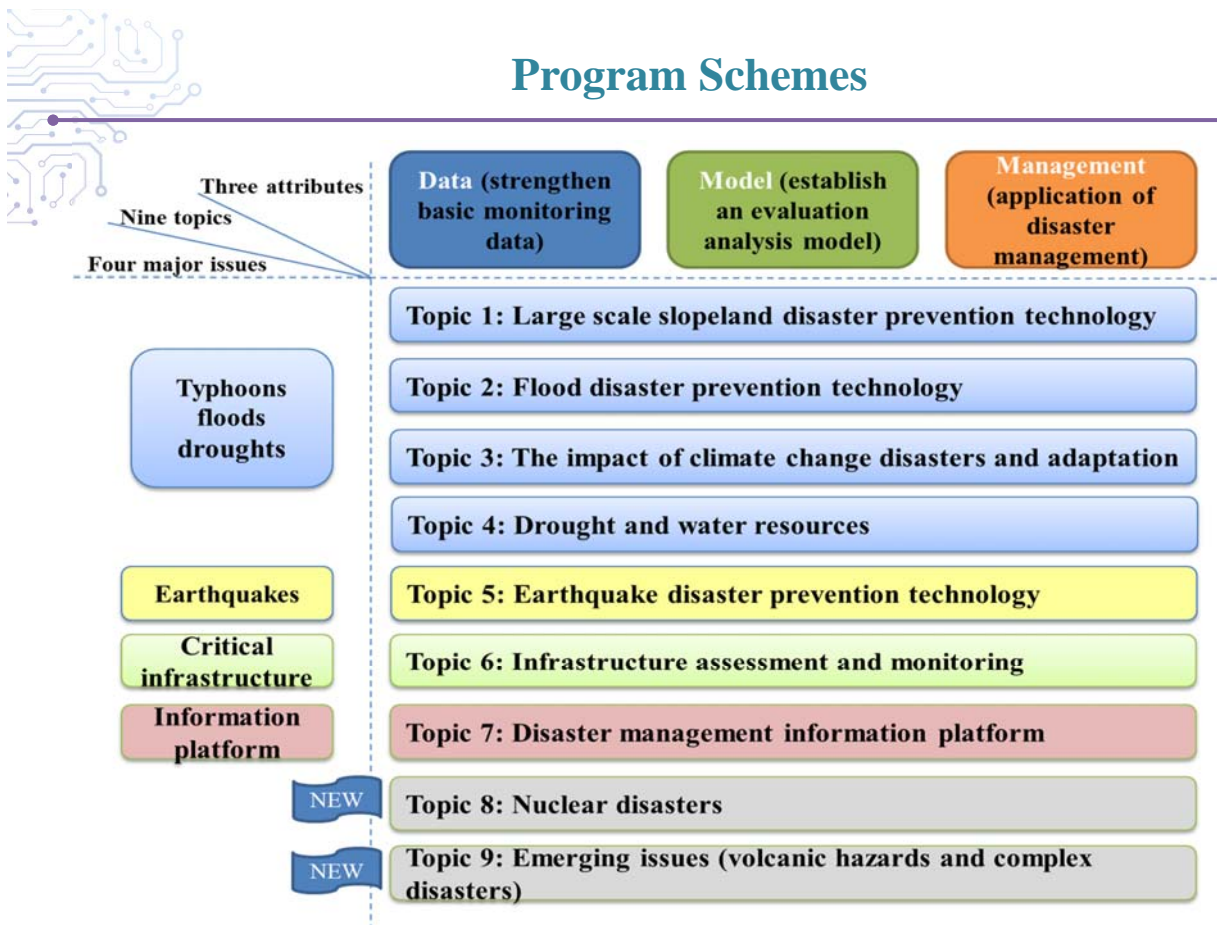
- **Objectives**

    1. To advance technology and R&D capabilities to cope with natural disasters

    2. To enhance the disaster management system and disaster risk assessment

    3. To strengthen information sharing and integration among government agencies

    4. To reinforce risk communication and knowledge cognition related to disaster

- **Participants & Partners**

    23 institutes/agencies subordinated to 7 ministries participated in the program, including Economic Affairs (MOEA), Ministry of Transportation and Communication (MOTC), Ministry of the Interior (MOI), Ministry of Education (MOE)、Council of Agriculture (COA), Atomic Energy Council (AEC), Ministry of Science and Technology (MOST).
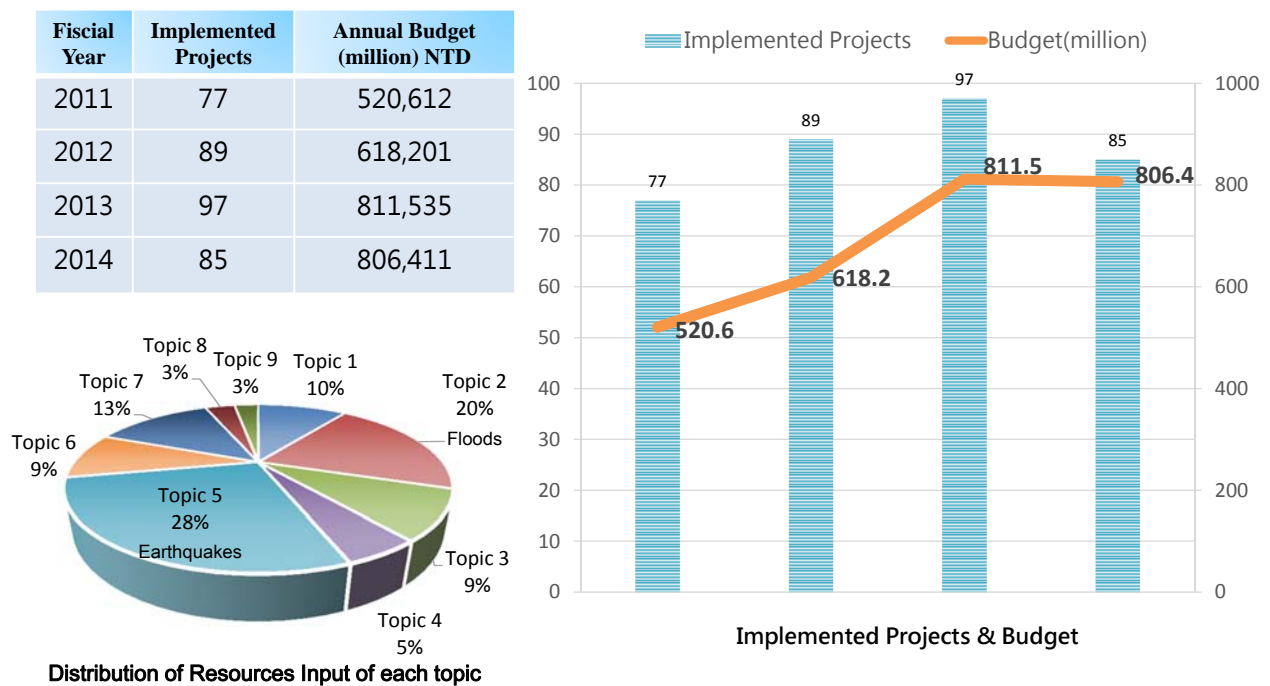
Program Schemes

Three attributes			
Nine topics	**Data (strengthen basic monitoring data)**	**Model (establish an evaluation analysis model)**	**Management (application of disaster management)**
Four major issues			

Topic 1: Large scale slopeland disaster prevention technology

Typhoons floods droughts

Topic 2: Flood disaster prevention technology

Topic 3: The impact of climate change disasters and adaptation

Topic 4: Drought and water resources

Earthquakes — **Topic 5: Earthquake disaster prevention technology**

Critical infrastructure — **Topic 6: Infrastructure assessment and monitoring**

Information platform — **Topic 7: Disaster management information platform**

NEW **Topic 8: Nuclear disasters**

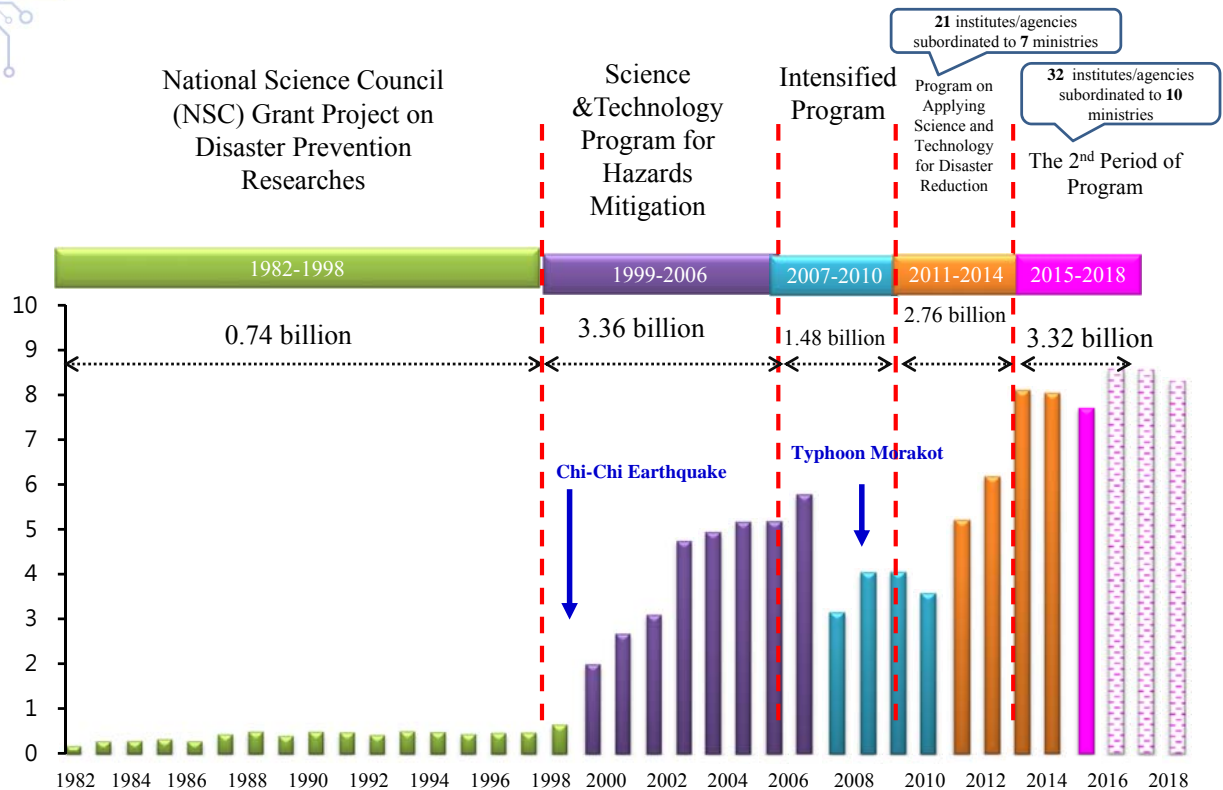NEW **Topic 9: Emerging issues (volcanic hazards and complex disasters)**

Active Engagements and Resourceful Investment

During 2011-2014, the inter-agency engagement and investment include **348 technological research projects** & NTD$2.76 billion budget.
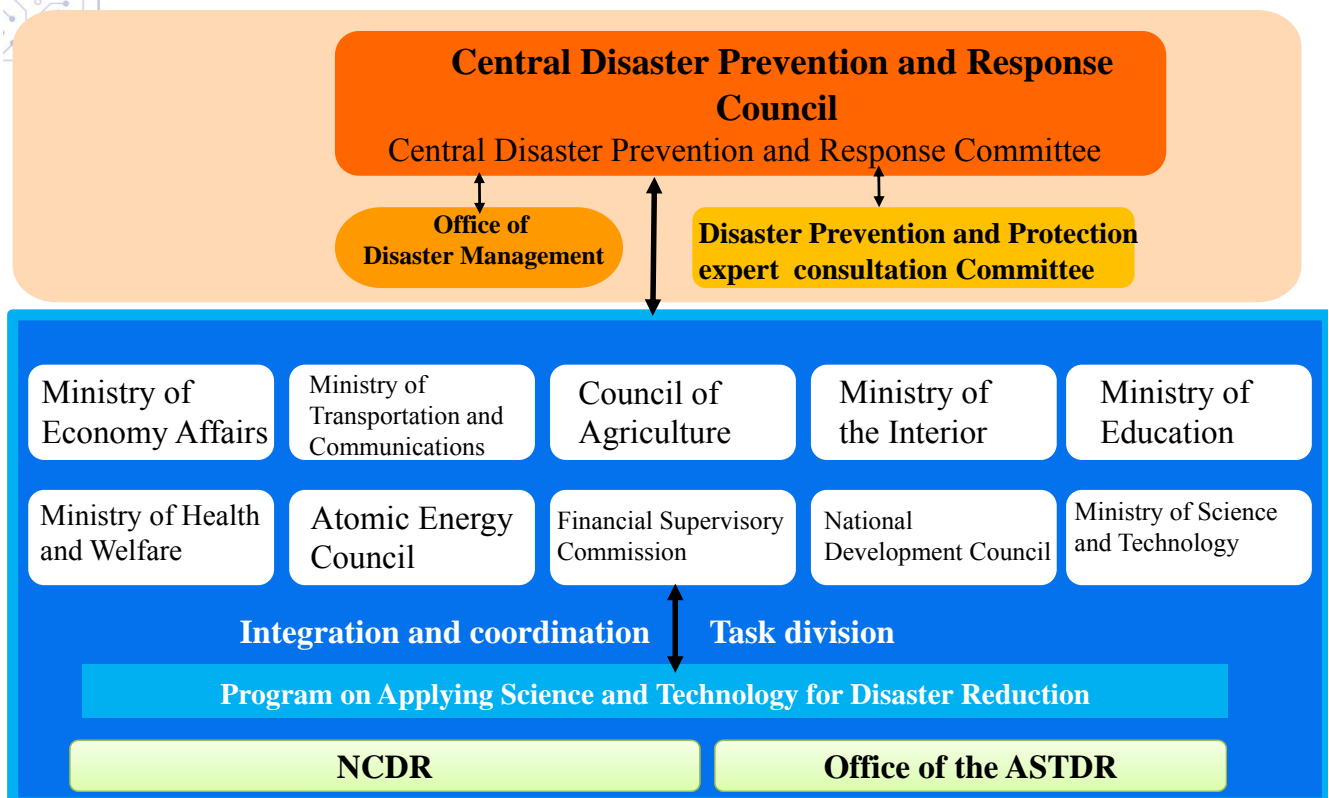
Fiscial Year	Implemented Projects	Annual Budget (million) NTD
2011	77	520,612
2012	89	618,201
2013	97	811,535
2014	85	806,411

Distribution of Resources Input of each topic

Topic 1 10%, Topic 2 20% Floods, Topic 3 9%, Topic 4 5%, Topic 5 28% Earthquakes, Topic 6 9%, Topic 7 13%, Topic 8 3%, Topic 9 3%

Implemented Projects & Budget

Implemented Projects — Budget(million)
77, 89, 97, 85
520.6, 618.2, 811.5, 806.4

Continuous Investment and Promotions on Disaster Risk Reduction since 1982 through 5 large-scale projects
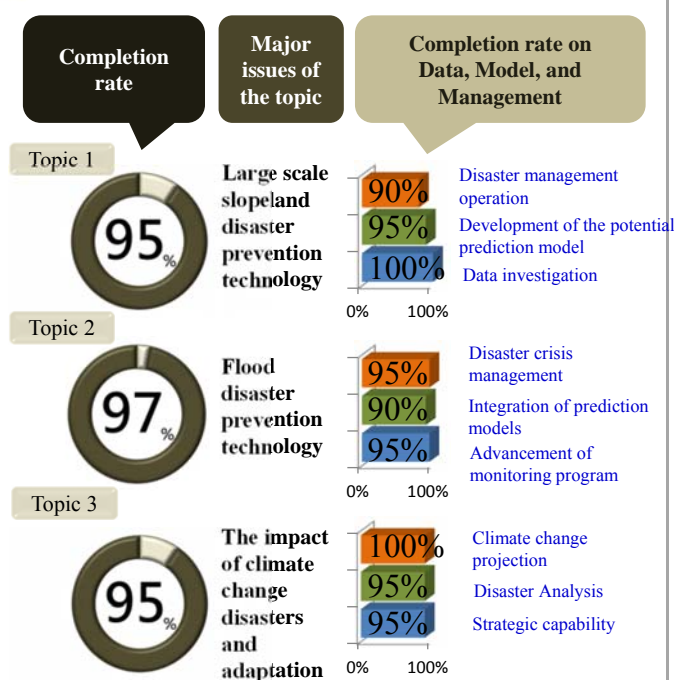
National Science Council (NSC) Grant Project on Disaster Prevention Researches

Science &Technology Program for Hazards Mitigation

Intensified Program

Program on Applying Science and Technology for Disaster Reduction

21 institutes/agencies subordinated to **7** ministries

32 institutes/agencies subordinated to **10** ministries

The 2nd Period of Program

| 1982-1998 | 1999-2006 | 2007-2010 | 2011-2014 | 2015-2018 |

0.74 billion   3.36 billion   1.48 billion   2.76 billion   3.32 billion

Chi-Chi Earthquake

Typhoon Morakot

Operating Mechanism

Central Disaster Prevention and Response Council
Central Disaster Prevention and Response Committee

Office of Disaster Management

Disaster Prevention and Protection expert consultation Committee

Ministry of Economy Affairs	Ministry of Transportation and Communications	Council of Agriculture	Ministry of the Interior	Ministry of Education
Ministry of Health and Welfare	Atomic Energy Council	Financial Supervisory Commission	National Development Council	Ministry of Science and Technology

Integration and coordination   **Task division**

Program on Applying Science and Technology for Disaster Reduction

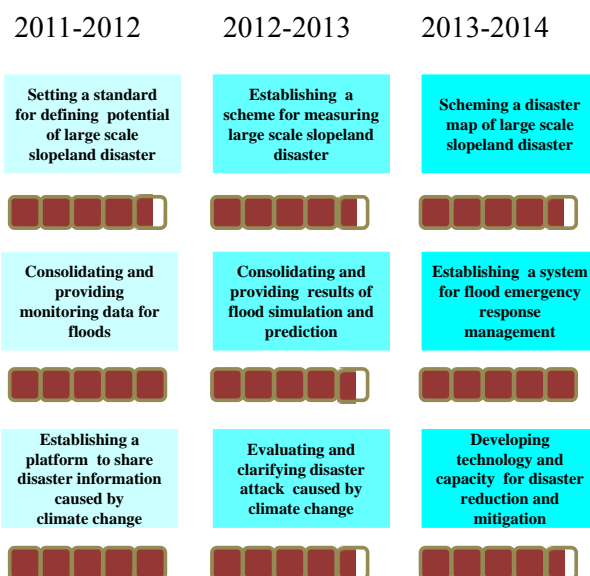| **NCDR** | **Office of the ASTDR** |

Reviewing and Evaluation on Project Implementation

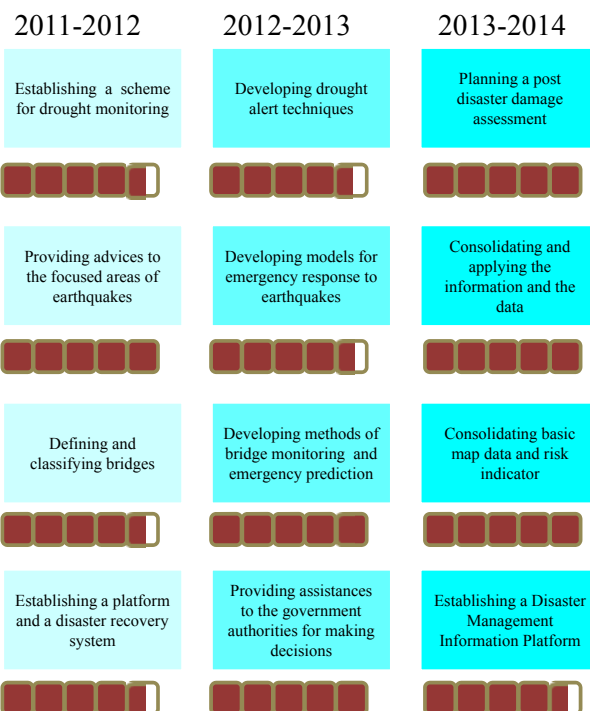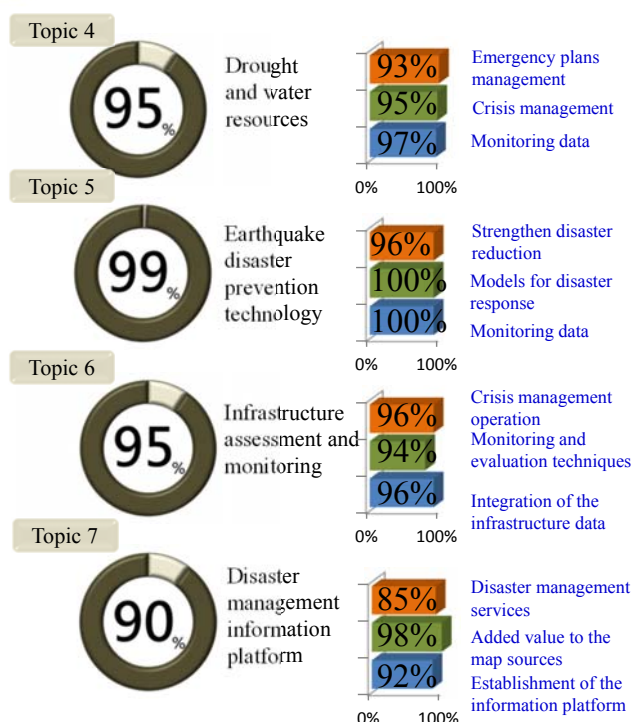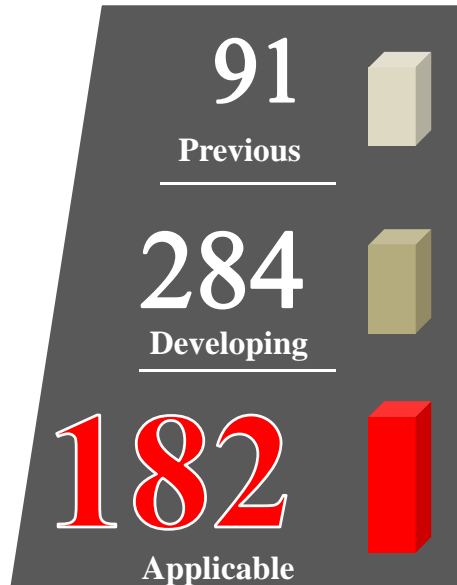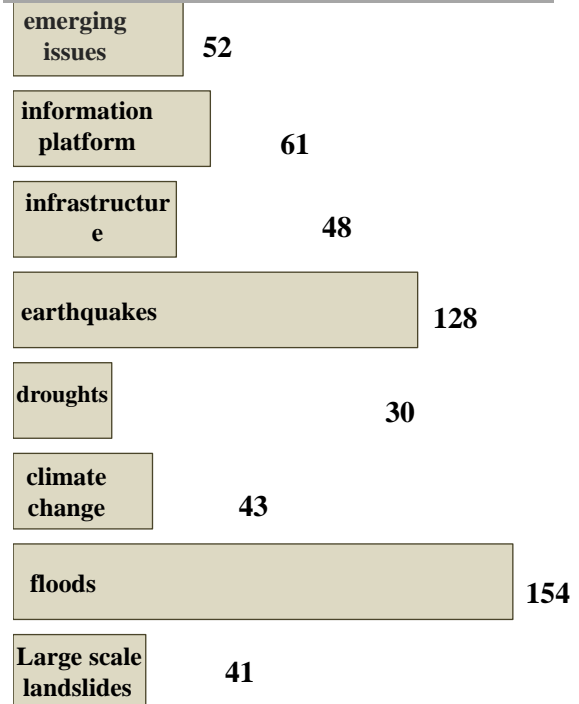## Major issues of the topic and each reaching rate of the achievements

Completion rate	Major issues of the topic	Completion rate on Data, Model, and Management		Expected performances and Evaluation		

Expected performances and Evaluation

2011-2012 | 2012-2013 | 2013-2014

Topic 1

95%

Large scale slopeland disaster prevention technology

- 90% Disaster management operation
- 95% Development of the potential prediction model
- 100% Data investigation

0% — 100%

Setting a standard for defining potential of large scale slopeland disaster | Establishing a scheme for measuring large scale slopeland disaster | Scheming a disaster map of large scale slopeland disaster

Topic 2

97%

Flood disaster prevention technology

- 95% Disaster crisis management
- 90% Integration of prediction models
- 95% Advancement of monitoring program

0% — 100%

Consolidating and providing monitoring data for floods | Consolidating and providing results of flood simulation and prediction | Establishing a system for flood emergency response management

Topic 3

95%

The impact of climate change disasters and adaptation

- 100% Climate change projection
- 95% Disaster Analysis
- 95% Strategic capability

0% — 100%

Establishing a platform to share disaster information caused by climate change | Evaluating and clarifying disaster attack caused by climate change | Developing technology and capacity for disaster reduction and mitigation

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Reviewing and Evaluation on Project Implementation

Major issues of the topic and each reaching rate of the achievements

2011-2012 | 2012-2013 | 2013-2014

Topic 4

95%

Drought and water resources

- 93% Emergency plans management
- 95% Crisis management
- 97% Monitoring data

0% — 100%

Establishing a scheme for drought monitoring | Developing drought alert techniques | Planning a post disaster damage assessment

Topic 5

99%

Earthquake disaster prevention technology

- 96% Strengthen disaster reduction
- 100% Models for disaster response
- 100% Monitoring data

0% — 100%

Providing advices to the focused areas of earthquakes | Developing models for emergency response to earthquakes | Consolidating and applying the information and the data

Topic 6

95%

Infrastructure assessment and monitoring

- 96% Crisis management operation
- 94% Monitoring and evaluation techniques
- 96% Integration of the infrastructure data

0% — 100%

Defining and classifying bridges | Developing methods of bridge monitoring and emergency prediction | Consolidating basic map data and risk indicator

Topic 7

90%

Disaster management information platform

- 85% Disaster management services
- 98% Added value to the map sources
- 92% Establishment of the information platform

0% — 100%

Establishing a platform and a disaster recovery system | Providing assistances to the government authorities for making decisions | Establishing a Disaster Management Information Platform

Outcomes of the program

The outcomes of the program in terms of **Data Sets, Models, and Management Systems** during 2011-2014: **total of 557 items**
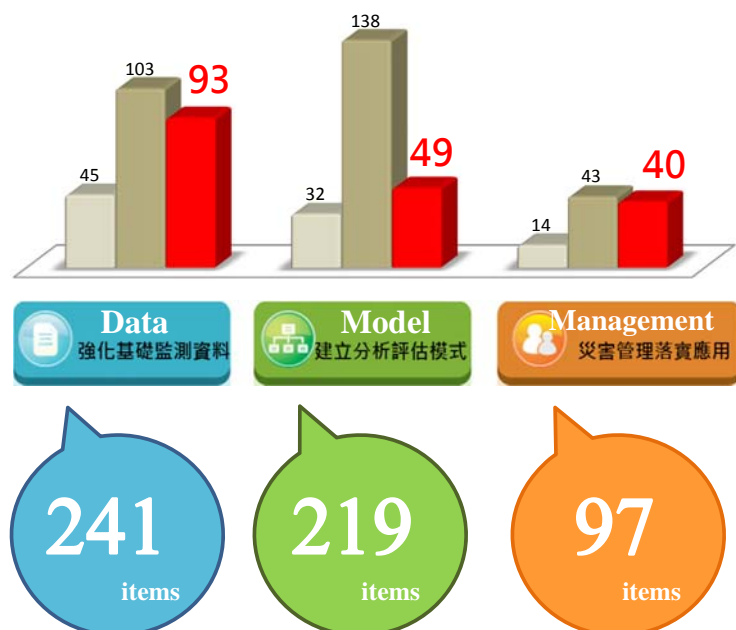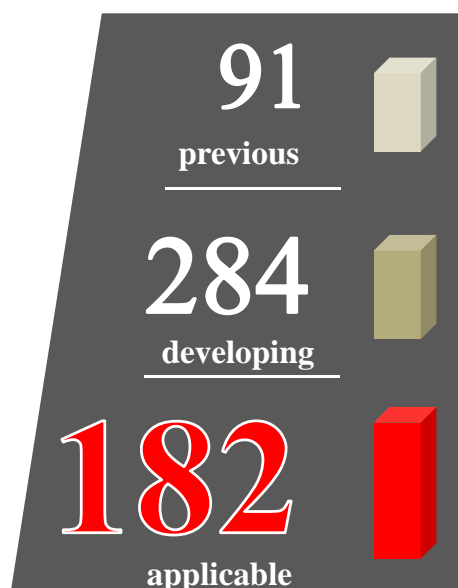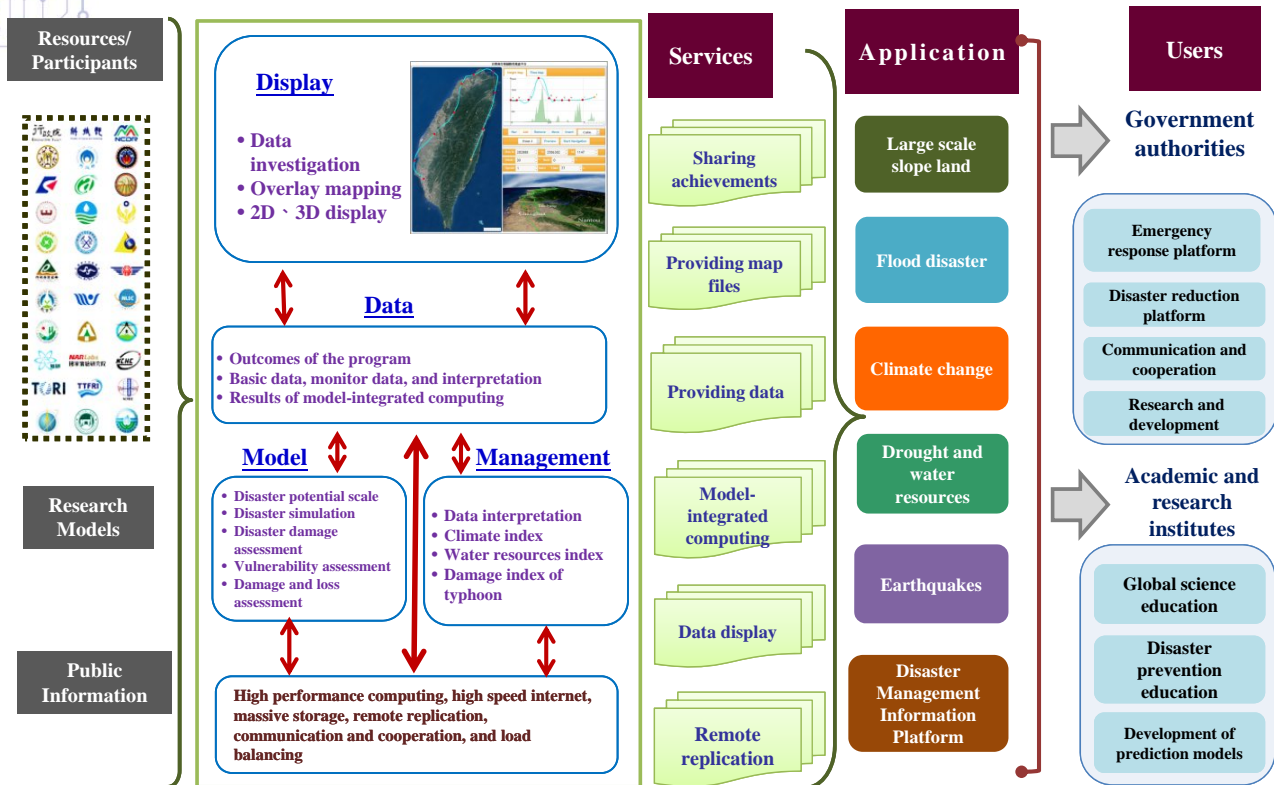
557 items

- **91** Previous
- **284** Developing
- **182** Applicable

Outcomes of each topic

- emerging issues: **52**
- information platform: **61**
- infrastructure: **48**
- earthquakes: **128**
- droughts: **30**
- climate change: **43**
- floods: **154**
- Large scale landslides: **41**

Practical Application

Practical application on disaster prevention work: **total of 182 items**

- **91** previous
- **284** developing
- **182** applicable

Data 強化基礎監測資料: 45, 103, **93**

Model 建立分析評估模式: 32, 138, **49**

Management 災害管理落實應用: 14, 43, **40**

- Data **241** items
- Model **219** items
- Management **97** items

Framework of the Disaster Management Information Platform (DMIP)

Resources/Participants

Research Models

Public Information

Display
- Data investigation
- Overlay mapping
- 2D、3D display

Data
- Outcomes of the program
- Basic data, monitor data, and interpretation
- Results of model-integrated computing

Model
- Disaster potential scale
- Disaster simulation
- Disaster damage assessment
- Vulnerability assessment
- Damage and loss assessment

Management
- Data interpretation
- Climate index
- Water resources index
- Damage index of typhoon

High performance computing, high speed internet, massive storage, remote replication, communication and cooperation, and load balancing

Services
- Sharing achievements
- Providing map files
- Providing data
- Model-integrated computing
- Data display
- Remote replication

Application
- Large scale slope land
- Flood disaster
- Climate change
- Drought and water resources
- Earthquakes
- Disaster Management Information Platform

Users

Government authorities
- Emergency response platform
- Disaster reduction platform
- Communication and cooperation
- Research and development

Academic and research institutes
- Global science education
- Disaster prevention education
- Development of prediction models

Application and Promotion (1/10)

- **A platform established to better consolidate disaster reduction technology from different agencies**

23 institutes/agencies subordinated to 7 ministries participated in the program, including Economic Affairs (MOEA), Ministry of Transportation and Communication (MOTC), Ministry of the Interior (MOI), Ministry of Education (MOE)、Council of Agriculture (COA), Atomic Energy Council (AEC), Ministry of Science and Technology (MOST).

A COMPLETE DATABASE: piles of more than 1800 reports of the project outcomes during 1988-2014

NAPHM
Science &Technology Program for Hazards Mitigation
≒1080projects

2007-2010 Intensified Program
≒440projects

2011-2014 Program on ASTDR
≒340projects
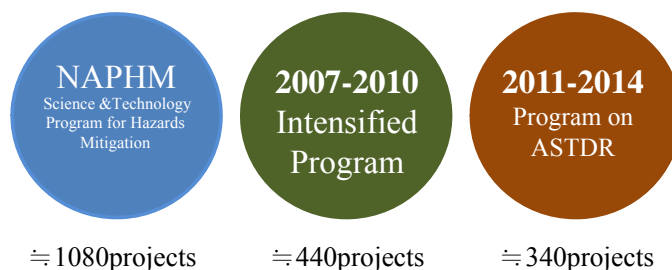
Providing around 36.4TB of hazard maps and big data sets

The operating mechanism of the ASTDR
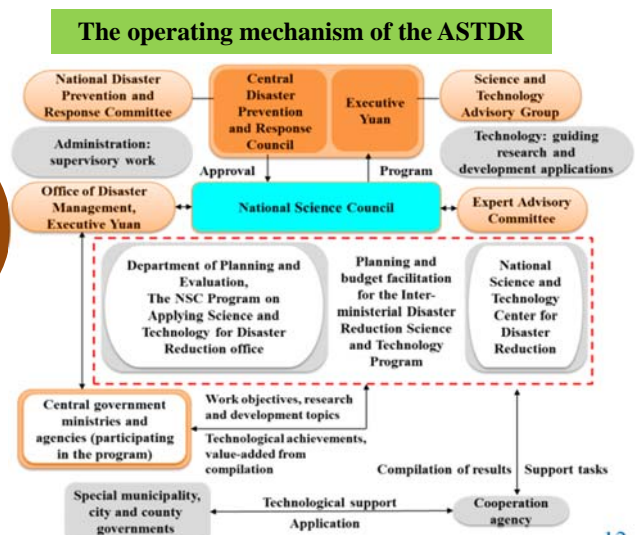
Application and Promotion (2/10)

- **Advance and strengthen monitoring capability on hazards**

Central Geological Survey, MOEA: Monitoring Results
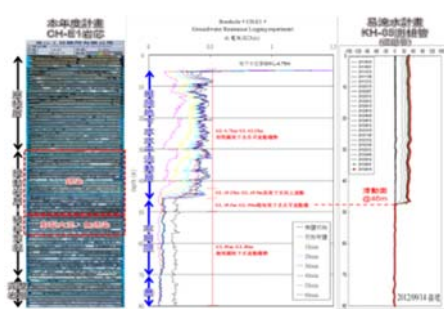
Central Weather Bureau: Monitoring results of extreme rainfall during the plum rain season
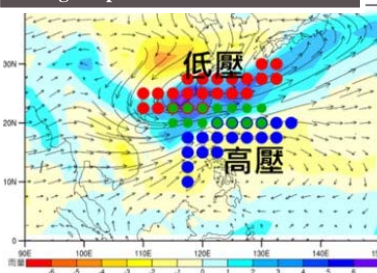
Directorate General of Highways, MOTC: Monitoring spots and alerts

Water Resource Agency, MOEA: Monitoring system of floods

Central Weather Bureau: Database of the earthquake and the detecting system of the earthquake source

Atomic Energy Council: Monitoring system of radioactive sources

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Application and Promotion (3/10)

- **Make the information easily understood through visualization, such as alert related to floods, rainfall, SPI, etc.**

- **Practical applications of remote sensing on evaluating damages and destruction**

Analysis of driftwood after Typhoon Morakot on Aug. 8, 2009

The intelligence team applies the data and consolidates resources during disasters.
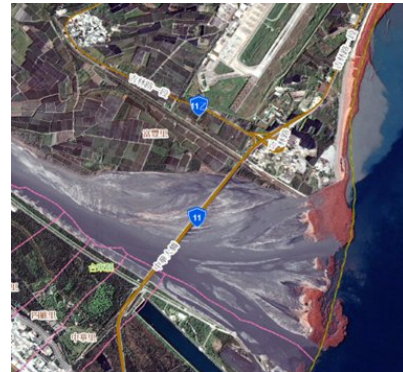
臺東縣蘭嶼鄉開元港漂流木分析
- 高屏溪流域的漂流木，藉由沿(近)岸流場往南漂，進入巴士海峽，再經由黑潮往北，過程中漂到蘭嶼鄉開元港
- 東部漂流木最為嚴重的富岡漁港，則來自卑南溪流域

Map resources of gas blasts in Kaohsiung on Aug. 1, 2014

15
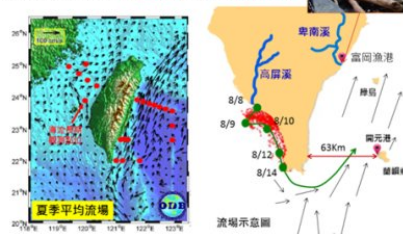
- **Typhoon Emergency Operation improved by sharing and integration of information**

To advance the capacity for data compiling, disaster analysis, evaluation, decision-making, etc.

Analysis of high risk flood area

Weather

(Central Weather Bureau, MOTC)

Weather analysis (typhoon, heavy rainfall, etc.)

Monitoring of rainfall

Wind speed and rainfall prediction

Forecast models and analysis of typhoon tracks

Soil

(Soil and Water Conservation Bureau, Council of Agriculture & Directorate General of Highways, MOTC)

Debris flow alerts

Traffic alerts: road closed

Traffic situation display

Water

(Water Resources Agency, MOEA & Construction and Planning Agency, MI

Monitoring of water stage and tide level

Alerts for potential floods

位　置：臺南市左鎮區 平和橋
影像來源：水利署

Application of CCTV

邊坡口卡調查系統

Analysis of traffic alerts

羌黃坑

Analysis of debris flow alerts

Disaster information platform

16

- **Innovation and invention to measure or monitor essential factors affecting intensity of possible impacts**

Dept of Land Administration, MOI: Multiplatform of cartographic technique

Central Geological Survey, MOEA: Multiple Point Borehole Extensometer

NARL system for bridge safety

Water Resources Agency: Qwater

Water Resources Agency: Artificial precipitation enhancement technology

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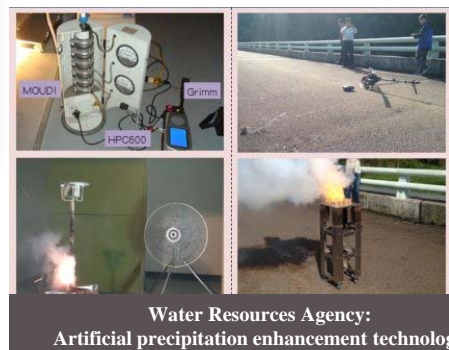
Application and Promotion (7/10)

- **Cooperate with private sectors, e.g. Google, to enhance coverage of information and alerts during typhoon emergency**

Since 2013 ,

the disaster information platform has presented the data in a form of **Google Crisis Map** and **Google Public Alerts**.

- **Typhoon Soulik** (7/10-14)
  total number of data ≒ 1.3 million

In 2014→ total number of data ≒ 12 million

applying Google Search and Google Now

- **Typhoon Matmo** (7/21-23)
  total number of data ≒ 4.5 millions

- **Typhoon Fung-wong** (9/19-22)
  total number of data ≒ 4.9 millions

Google Public Alerts

Google Crisis Map
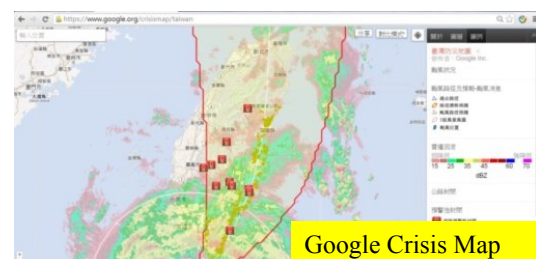
We expect to mitigate disaster damage and to create a low-risk environment.

- **Develop cost-effect methods to retrofit existing school buildings**

- **Integrated research on disaster risk reduction and climate change adaptation**
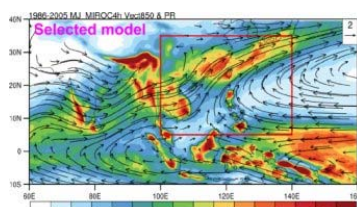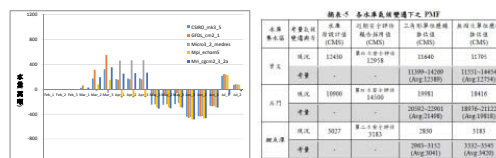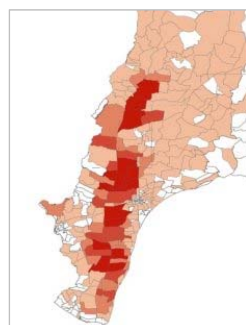
- **Better risk communication with the general public**

Large scale slopeland disaster prevention technology

Flood disaster prevention technology

Disaster management information platform

The impact of climate change disasters and adaptation

Earthquake disaster prevention technology
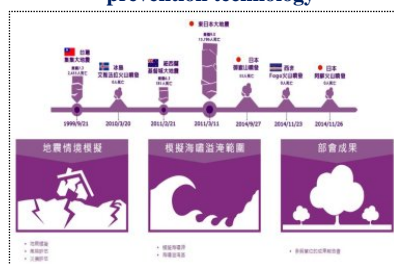
Drought and water resources

Threats of Disasters and Solutions for Damages (1/2)

1 Disaster impacts under global extreme climate

2 Land development and natural disaster resistance evaluation

3 Insufficient information of flood and complete prevention

Threats of Disasters and Solutions for Damages (2/2)

4 Treats and impacts of heavy earthquake in the metropolitan area

5 Influences of catastrophe to the government authorities and the industries

6 Urgent needs to consolidate and to apply the latest disaster information

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Objectives and Research Topics of the 2nd Phase Program (1/2)

Based on the outcomes of the 1st phase program (2011-2014) and advices from the professionals and government authorities, the 2nd phase program (2015-2018) has been approved.

Objectives

1. Activate the DMIP and advance the efficiency of disaster prevention
2. Accelerate the communication and interaction through the DMIP
3. Designate high risk disaster areas and mitigate disaster attacks
4. Develop practical technologies for disaster prevention and add values to the industries

research topics

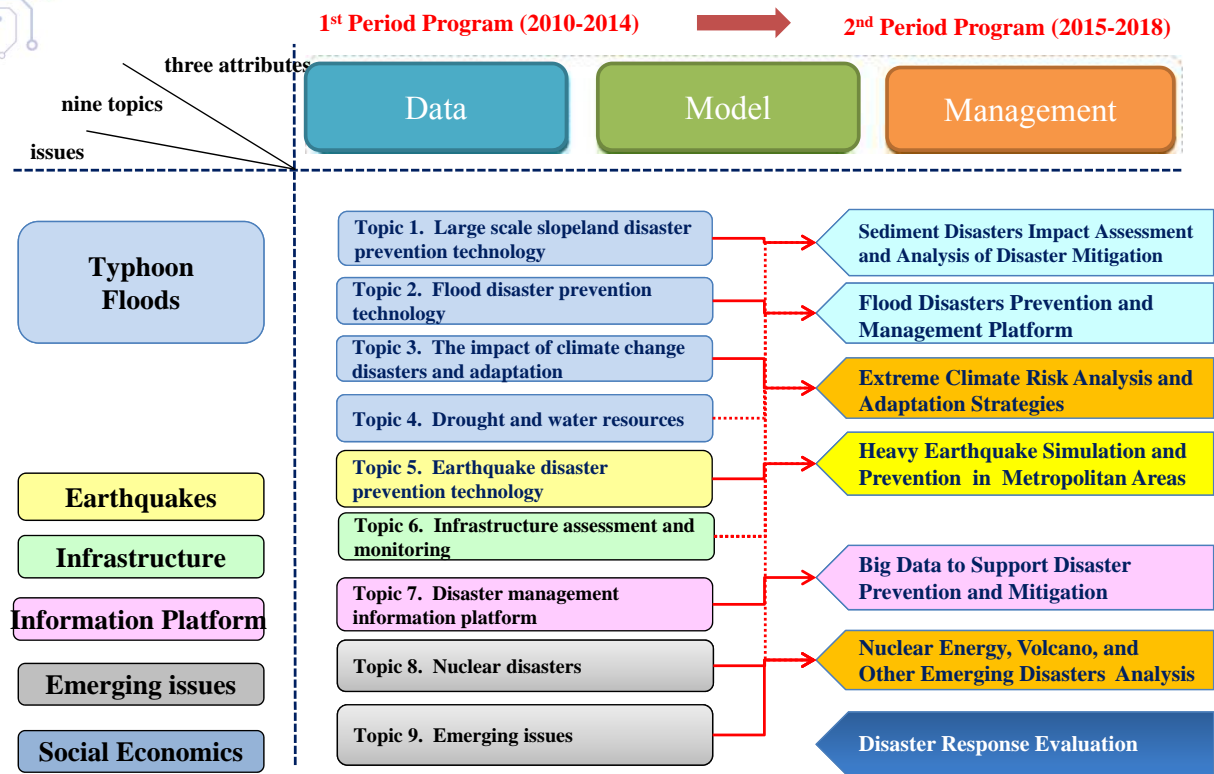|	
Typhoon Flood Slopeland	Topic 1. Sediment Disasters Impact Assessment and Analysis of Disaster Mitigation
	Topic 2. Flood Disasters Prevention and Management Platform
Earthquake	Topic 3. Heavy Earthquake Simulation and Prevention in Metropolitan Areas
Emerging issues	Topic 4. Extreme Climate Risk Analysis and Adaptation Strategies
	Topic 5. Nuclear Energy, Volcano, and Other Emerging Disasters Analysis
Social economics	Topic 6. Disaster Response Evaluation
Information	Topic 7. Big Data to Support Disaster Prevention and Mitigation

1st Period Program (2010-2014) → 2nd Period Program (2015-2018)

three attributes
nine topics
issues

Data **Model** **Management**

Typhoon Floods

Topic 1. Large scale slopeland disaster prevention technology → Sediment Disasters Impact Assessment and Analysis of Disaster Mitigation

Topic 2. Flood disaster prevention technology → Flood Disasters Prevention and Management Platform

Topic 3. The impact of climate change disasters and adaptation → Extreme Climate Risk Analysis and Adaptation Strategies

Topic 4. Drought and water resources

Topic 5. Earthquake disaster prevention technology → Heavy Earthquake Simulation and Prevention in Metropolitan Areas

Topic 6. Infrastructure assessment and monitoring

Topic 7. Disaster management information platform → Big Data to Support Disaster Prevention and Mitigation

Topic 8. Nuclear disasters → Nuclear Energy, Volcano, and Other Emerging Disasters Analysis

Topic 9. Emerging issues

Disaster Response Evaluation

Earthquakes

Infrastructure

Information Platform

Emerging issues

Social Economics

25

Research Topics and Participants

- **32 institutes/agencies subordinated to 10 ministries** participated in the 2nd period program while only 23 institutes/agencies subordinated to 7 ministries in the 1st period .

Research topics \ participants	MOEA	COA	MOI	MOTC	MOE	MOHW	AEC	FSC	NDC	MOST
Topic 1. Sediment Disasters Impact Assessment and Analysis of Disaster Mitigation	•	•								•
Topic 2. Flood Disasters Prevention and Management Platform	•	•	•	•						•
Topic 3. Heavy Earthquake Simulation and Prevention in Metropolitan Areas	•		•	•						•
Topic 4. Extreme Climate Risk Analysis and Adaptation Strategies	•		•	•	•				•	•
Topic 5. Nuclear Energy, Volcano, and Other Emerging Disasters Analysis	•			•			•			•
Topic 6. Disaster Response Evaluation			•			•		•		•
Topic 7. Big Data to Support Disaster Prevention and Mitigation	•	•	•	•						•

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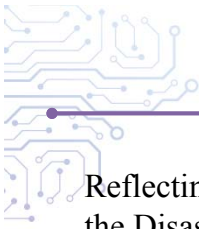
Importance of the DMIP

Reflecting on problems, such as inefficient data, divergent forms, and so forth, we establish the Disaster Management Information Platform (DMIP) to：

1. **Promote and develop disaster prevention technology.**

2. **Consolidate technologies and researches on disaster prevention.**

3. **Provide achievements of the disaster prevention technology.**

4. **Collaborate with the government authorities (information providers) and advance the platform based on the needs of the users.**

Benefits of the Outcomes

To Advance — **Monitoring and predicting on severe disasters**

To Strengthen — **Consolidating disaster reduction technology among different agencies**

To Implement — **Applying and promoting research achievements for a evidence-based disaster management**

To Apply — **Adding values to the disaster prevention information and data**

Thank you for your attention

Please link to the website of the ASTDR for more information
http://astdr.colife.org.tw/

Disaster Management Information Platform (DMIP)
http://dmip.tw/