Scientific Approach to Natural Disaster Mitigation

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Outline

1. Introduction
2. Approach to Major Natural Disasters
3. CEODE’s Involvement in Natural Disaster Reduction
4. Further Perspectives
1. Introduction
(9) Great Drought in Southwest China, in the Spring 2010
> ¥ 35 billion loss, 220 million affected

(10) Yushu Earthquake March, 12, 2010
2698 died, 246,842 affected

(1) Tsunami in the Indian Ocean
on 26 December, 2004
Total fatalities: near 300,000

(2) Disaster of Hurricane Katrina
Economic loss: US$ 100 - 200 billion

(3) Huge earthquake in South Asia
in Oct. 2007 caused:
a death toll of 76,000, 4.0 million people homeless

(4) Blizzard in South China in Feb, 2008
Economic losses: 150 Billion RMB

(5) Hurricane Nargis in Myanmar
in May, 2008
Over 130,000 people killed

(6) Wenchuan Earthquake in May 12, 2008
Death toll: 69197, Injured: 374176, Missing: 18222,
Homeless: 4.8 million; The direct loss: 845.1 billion RMB

(7) Haiti Earthquake in May 12, 2010
about 300,000 died

(8) Chile Earthquake Feb. 27, 2010
> 400 died, 2 million affected
Natural Disasters in China

Sensitive to almost all types of natural disasters

6 of the world's top 10 deadliest natural disasters

Most severest: flood, drought, typhoon, earthquake

Affecting more than 200 million people every year

Economic losses: taking 3-5% of the annual GDP

Natural disaster has become a key restricting factor for economic and social development.
From 1950 to 2008, the great natural disasters have resulted in:

- **A death toll of up to 2 million**
- **Economic losses up to US$ 1950 billion**

(Source: Munich Re Group, 2008)
2. Approach to Major Natural Disasters
**Progresses:**

Earthquake Monitoring network  
Tsunami Monitoring & early-warning network  
Globally efficient disaster data sharing  
Earthquake tectonic dynamics  
Long term Prediction of earthquakes  
Disaster assessment and zoning

**Problem:**

The mechanisms of earthquakes  
The tsunami mechanisms  
The medium-term and short-term predictions  
The monitoring and detecting technologies
Scientific issues of Earthquake & Tsunami Disasters

Focusing on:

- Experimental Field Construction for Earthquake Prediction
- Present Structural Dynamics and Earthquake Mechanism on a Global Scale
- Earthquake-induced Tsunamis and Warnings
- Earthquake and Tsunami Disaster Prevention
- Emergency Management and Rescue
Tropical cyclones in the Northern hemisphere are more active than in the Southern hemisphere, about 65% of the global total.
With the development of global economy, disasters related to tropical cyclones and storm surges are influencing the economy and society more and more.

Their impact has crossed borders and become a common global concern. This is especially felt in developing countries.
Focusing on:
Prediction, monitoring, pre-warning, assessment on Hurricane (track, intensity, impact) & Enhancements to disaster observation systems:

- Dropsonde
- Airborne Doppler radar
- EO technology
- (satellites, ground-based radars.....)
- Numerical Weather Prediction
Flood and Drought

Among the Affected People: Half by Flood, 1/3 by Drought

By All Natural Disasters (Left)

By Flood-Related Disasters (Right)

Global Total Fatalities of All the Natural Disaster from 1986 to 2006

Data source: EMDAT

Global Total Fatalities of Flood-related Disaster from 1986 to 2006

Data source: EMDAT

Flood-related disaster: Flood, Slides, Windstorm and Wave/surge

People in Developing Countries Suffer More Fatalities, especially in Asia
Scientific Issues

- Reconsideration of Relationships Between Man and Nature
- Water adjustment and water-related Risk Management:
  - Between Man and Nature
  - Among Peoples of Different Regions
- Non-Engineering Measures (Integrated Risk Assessment, Disaster Prediction and Monitoring Methods, etc.)
- Emergency Response System Construction
Modern S&T application in Disaster mitigation
- Weather watch web, seismic measurement network,
- marine observation systems, Tsunami monitoring systems......

International activities
- UN → IDNDR (1990-2000)
- ISDR (2000—)

International cooperation agreements & mechanisms
- UN-SPIDER, CHARTER, CEOS, GEOSS, WMO......
- UN-International Center for Drought Risk Reduction (ICDRR) (April, 2007, Beijing)
Global Earth Observation Systems & Telecommunication Networks

Global Observation System
Global Data Processing and Forecasting
Global Telecommunication System

Coordinated Satellite Activities
Increasing Risks under a Changing Climate

- Intensity
- Frequency

- Strong Wind
- Coastal Marine Hazards
- Tropical Cyclones
- Heavy rainfall / Flood
- Heat waves

Exposure is increasing!

Need for Prevention and Mitigation

Water Resource Management
Energy
Food security
Transport
Health
Industry
Urban areas

Increasing Risks under a Changing Climate
3. CEODE’s Involvement in Natural Disaster Reduction
National Large-Scale Facilities
Remote Sensing Satellite Ground Station

Miyun, Kashi and Sanya Ground Stations cover 70% of Asia
Receiving and processing data from 12 satellites:

One of the largest ground station in the world receiving, processing and distributing international satellite data; 15TB satellite data being archived annually;

Over 2.30 million scenes of satellite data have been preserved in CEODE since 1986, providing a precious database for the Earth Observation in China.
Optical Satellite Configuration

SAR Satellite Configuration

Disaster, Environment Monitoring and Forecast Small Satellite Constellation in orbit

Two optical satellites were launched on Sept. 6, 2008

CEODE receives HJ-1A, HJ-1B (optical sat.) and HJ-1C (SAR) data

CEODE — A National Satellite Data Centre
Airborne Remote Sensing Centre operates two Cessna Citation S/II Airplanes and will have two new advanced Airplanes ARJ 21-700ER with 10 new sensors.
<table>
<thead>
<tr>
<th>序号</th>
<th>Sensors</th>
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<tbody>
<tr>
<td>1</td>
<td>Airborne Pushbroom Digital camera</td>
</tr>
<tr>
<td>2</td>
<td>Airborne Large Frame Digital camera</td>
</tr>
<tr>
<td>3</td>
<td>Multiple Mode Digital camera</td>
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<tr>
<td>4</td>
<td>Wide Band Imaging Spectrometer</td>
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<td>5</td>
<td>Airborne Whiskbroom imaging spectrometer</td>
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<tr>
<td>6</td>
<td>Airborne 3-D light detection and ranging</td>
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<tr>
<td>7</td>
<td>High resolution Polarization InSAR</td>
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<tr>
<td>8</td>
<td>Multi-Band and Multi Polarization SAR</td>
</tr>
<tr>
<td>9</td>
<td>Full Polarized Microwave Radiometer/Scatterometer</td>
</tr>
<tr>
<td>10</td>
<td>Airborne atmospheric laser SAR</td>
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Best Practice of Wenchuan Earthquake rush response

Data acquiring

Emergency Assessment

National and international Cooperation Mechanism

IAP-NDM

Emergency response system

Airborne optical remote sensing covered above 20,000 km, and data amounted 5.3 TB

Beichuan County Town

Before the Earthquake

Beichuan County Town

After the Earthquake

Assessment of Collapsed Buildings and Houses

Road damage assessment and SoS location

Barrier Lakes

Earthquake Impact on Panda’s Habitat
Grade I of emergency drought relief was stared by the national headquarters on inspection of flood control and drought relief, right after severe DROUGHT happened in Feb. 2009.

CEOSE set up the Emergency-Group for Remote Sensing Monitoring of drought relief immediately.

Drought distribution chart in Henan Province made by the group in Late Jan, 2009
Assessment of Ice & Snow Disaster in South China, 2008

Snow Disaster in Hunan
Jan. 29, 2008

Comparison analysis of Collapsed Houses in Anhui

Airborne SAR Monitoring for Railway and highway
Air Pollution Monitoring (OMI Data)

NO2

SO2
EO Monitoring and Assessment for Yushu Earthquake (April 2010)
Bushfire, Australia

The analysis chart of Murmunggee fire scene from Feb. 8 to Feb. 11

The dark red map spot means fire area on Feb. 8, the purple map spot means new fire area from Feb. 8 to Feb. 11, and the yellow map spot means unfired area like isolated island.
Program -  
Response to Natural Disaster Mitigation

**IAP NDM Launch**

As proposed by IAP in Feb., 2005, IAP initiative on “Natural Disaster Mitigation” was launched as IAP’s response to the tsunami and, more generally, to natural disaster mitigation.

**Targets**

- Studying the up-to-date S&T in NDM
- Probing the scientific and practical approach of NDM
- Highlighting the significant science viewpoints and recommendations for NDM
Foreword by Prof. Chen Zhu
Prof. Howard Alper

Scientific Outputs of IAP Initiative of Natural Disaster Mitigation
PRESS RELEASE
Friday 13 November 2009. For immediate release.

China to host new international disaster research programme

Paris, France—The International Council for Science (ICSU) today announced that China will host the office of the new international programme, Integrated Research on Disaster Risk (IRDR). The International Programme Office for IRDR will be established in Beijing at the Headquarters of the Center for Earth Observation and Digital Earth (CEODE)—the first time an international office of this type has been hosted in Asia.

The IRDR is a major new 10-year international research programme that aims to provide answers to the growing global problem of disasters and how countries can reduce the root causes of disaster risk. In a break from past approaches, it will combine diverse expertise and perspectives into one coordinated effort, drawing on the natural, socio-economic, health and engineering sciences.

ICSU, along with the other IRDR co-sponsors—the International Social Science Council (ISSC) and the United Nations International Strategy for Disaster Reduction (UN ISDR)—selected Beijing following an international call for offers. The office will be jointly funded by the China Association for Science and Technology (CAST) and the Chinese Academy of Sciences (CAS).
4. Further Perspectives

– The basic research and multi-disciplinary study on the mechanisms of natural disasters and methodologies of disaster mitigation need to be strengthened on the basis of understanding disaster phenomena against the background of global environmental change and earth system science.

– The communication and cooperation should be promoted among relevant organizations including the International Council for Science (ICSU), The World Federation of Engineering Organizations (WFEO), The Global Earth Observation (GEO) and International Strategy for Disaster Reduction (ISDR) for information exchange on effective policies and best practices of disaster mitigation.
4. Further Perspectives

Governments and Non-Government-Organizations should work towards bilateral or multilateral sound policy agreements on disaster information collection and sharing to strengthen cooperation in disaster management.

CAS and CEODE are happy to host IPO of IRDR, ICSU, and would like to cooperate with EU and other potential countries and organizations in natural disaster reduction.
Thank You !