



International Conference on Science
and Technology for Sustainability 2011
-Building up regional to global
sustainability: Asian vision –
14-16 Sep 2011, Kyoto, Japan



United Nations
Educational, Scientific and
Cultural Organization

Disaster Management and Sustainability: Challenges of IRDR

Kuniyoshi Takeuchi

**International Centre for Water Hazard and
Risk Management under the auspices of
UNESCO (ICHARM)**

Public Works Research Institute (PWRI)

Tsukuba, Japan





United Nations
Educational, Scientific and
Cultural Organization

ICHARM

International Center for Water Hazard and Risk Management

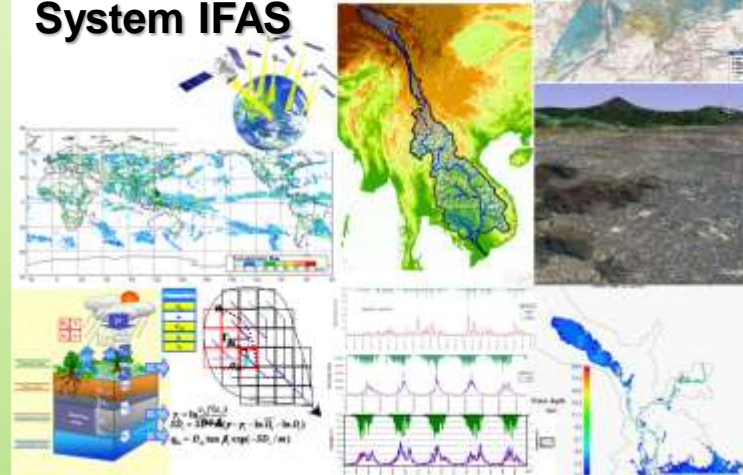
under the auspices of UNESCO
hosted by PWRI, Tsukuba

Objective: To serve as the Global Center of Excellence to provide and assist implementation of best practicable strategies to localities, nations, regions and the world to manage the risk of water related hazards including floods, droughts, land slides, debris flows and water contamination

6 March, 2006
at Tsukuba



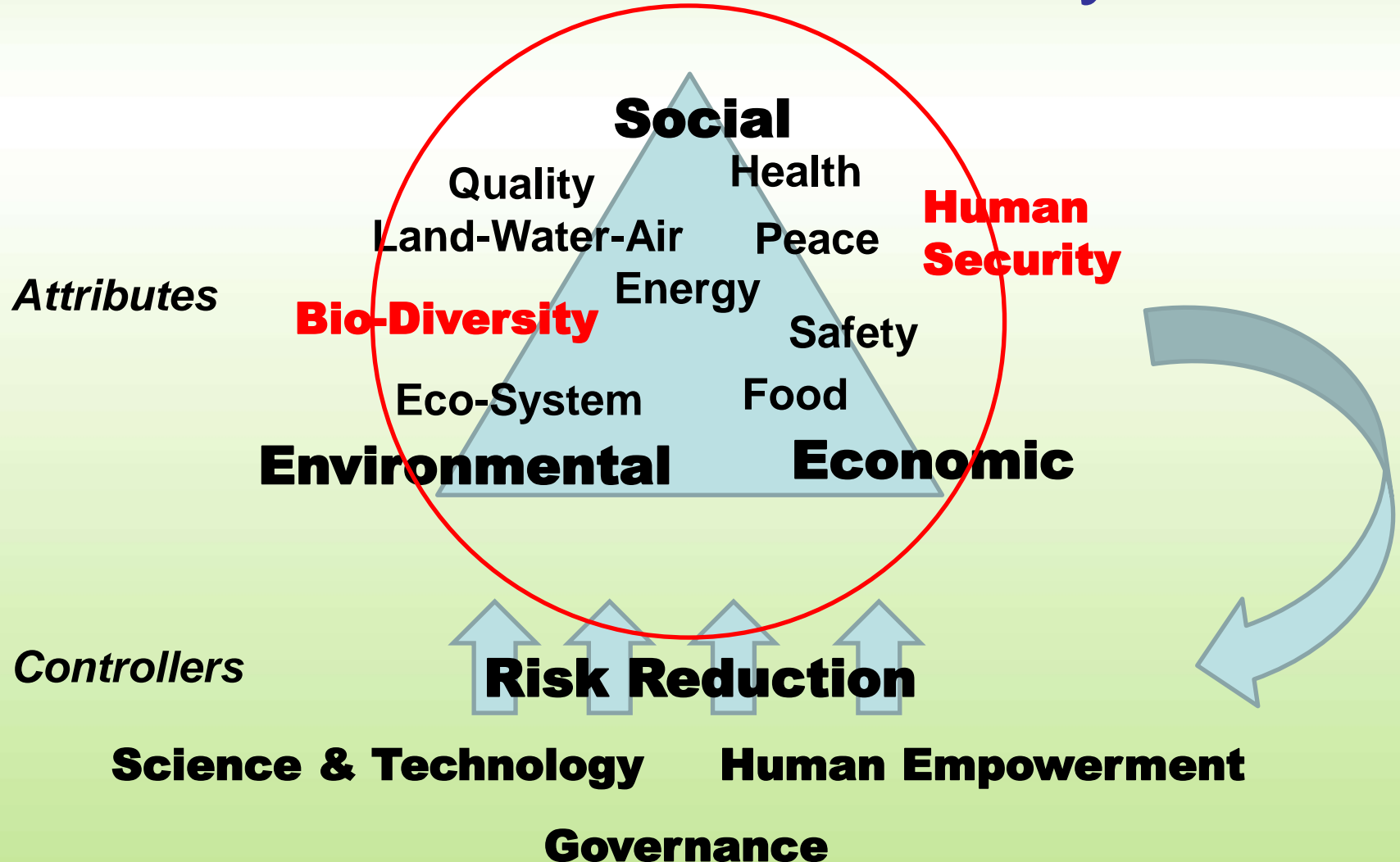
Advanced Early Warning System IFAS



Contents

- Asia is a hotspot of global sustainability concern
- Great East Japan Earthquake and Tsunami
- Integrated Research on Disaster Risk (IRDR)
- Final remarks: 居安思危

Global Sustainability

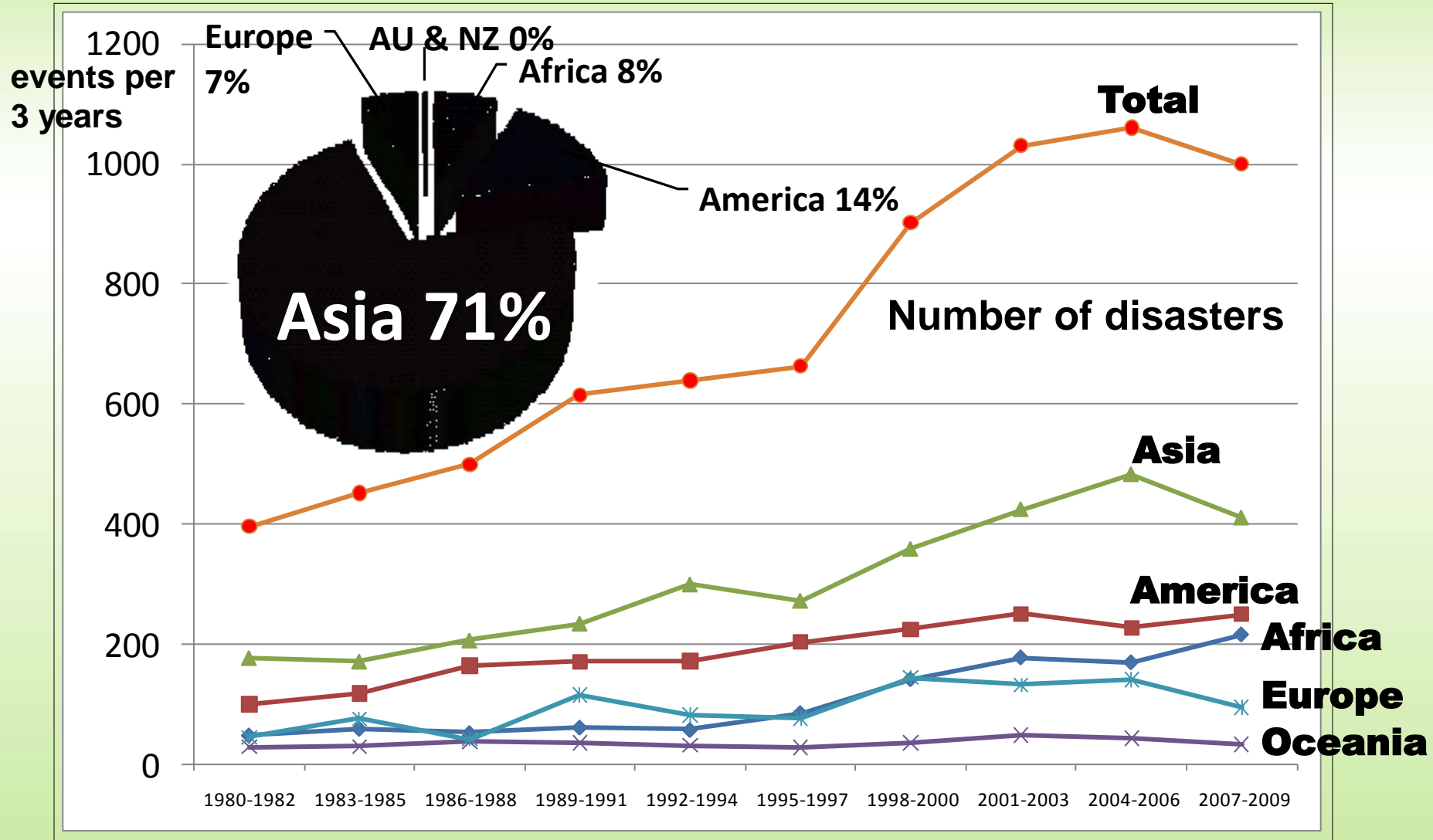


Asia is a hotspot of global sustainability concern

Threats to sustainability in Asia:

- **Society** Population growth & Urban conc.
Poverty, Decline of social capital
- **Economy** Rapid growth of economy and trade
with still weak fundamentals
- **Environment** Deforestation, Pollution, Ecological
degradation, Land subsidence,
Climate change
- **Increasing natural disasters** (frequency & magnitude)
- ...

Death tolls 1991-2010



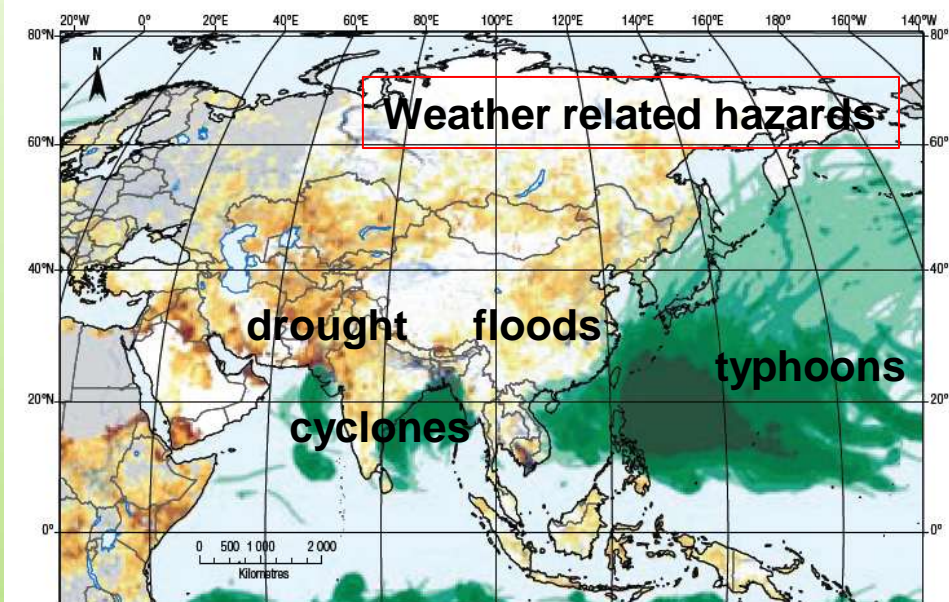
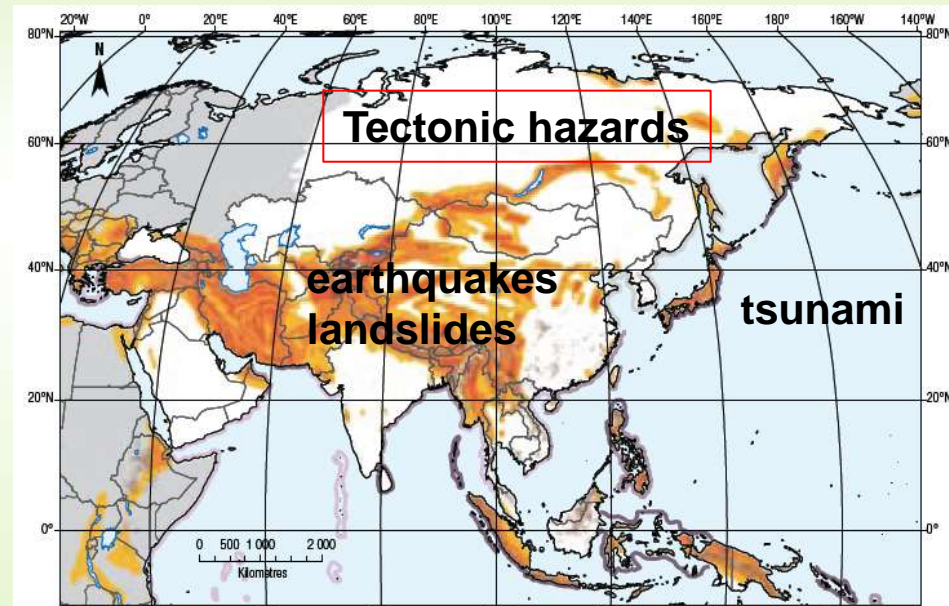
Trend of water-related disasters by continent for 3-year period from 1980 to 2009

Source: "EM-DAT: The OFDA/CRED International Disaster Database

Created on: Sep-11-2011. - Data version: v12.07

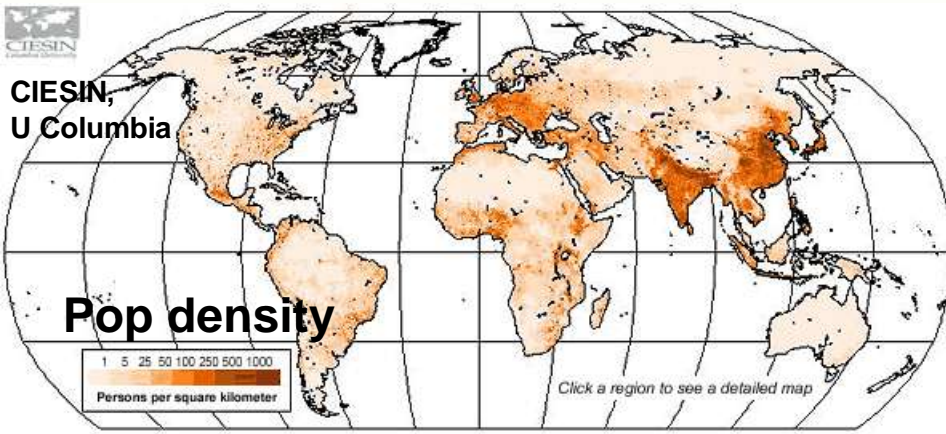
Increasing disaster risk in Asia

- **Basic conditions**
- **Hazards**
 - **Plate subduction & orogenic zone**, alluvium
→ EQ, Vol, LS, Tsunami,
 - **Asian Monsoons, Typhoons/cyclones**
→ FL, Torr R, Debris F
- **Vulnerability (life style)**
 - **Rice paddy agriculture**
→ Lg pop, Live in floodplain
 - **Habitation in risky lands**
→ Foothills, steep lands, nearby volcanoes,



Increasing disaster risk in Asia

- **Basic conditions**
- **Hazards (natural condition)**



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Increasing disaster risk in Asia

- **Accelerating factors**

- **Poverty** & delay in infrastructure investment
- Poor **governance**
- **Crowded** habitation, urban expansion to **unsafe areas**
- **Land subsidence** by GW pumping
- **Climate change**, GLOF, torrential rain
- Rapidly growing & changing society, **decline** of traditional **social capital**
- Depopulation and aging society

Poverty & Governance: Illegal housing over rivers



Jakarta, May 2007



Source: BBC, Jakarta, 3 Feb 2007

Increasing disaster risk in Asia

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GLOF threatened
Mt. Everest Area



Imja Tsho (lake)

Increasing disaster risk in Asia

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土石流発生

9月4日発生



Typhoon 12 (Talas)
30 Aug-2 Sep, 2011
Kii Peninsula, Japan
1800mm

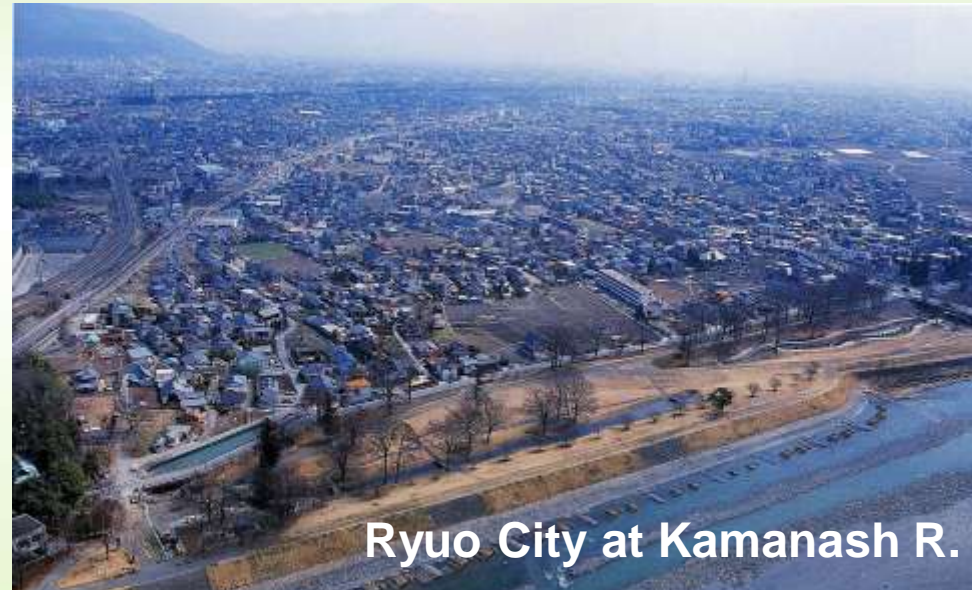
和歌山県田辺市熊野



Increasing disaster risk in Asia

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Ryuo City at Kamanash R.



Omiyuki Festival

Some success stories

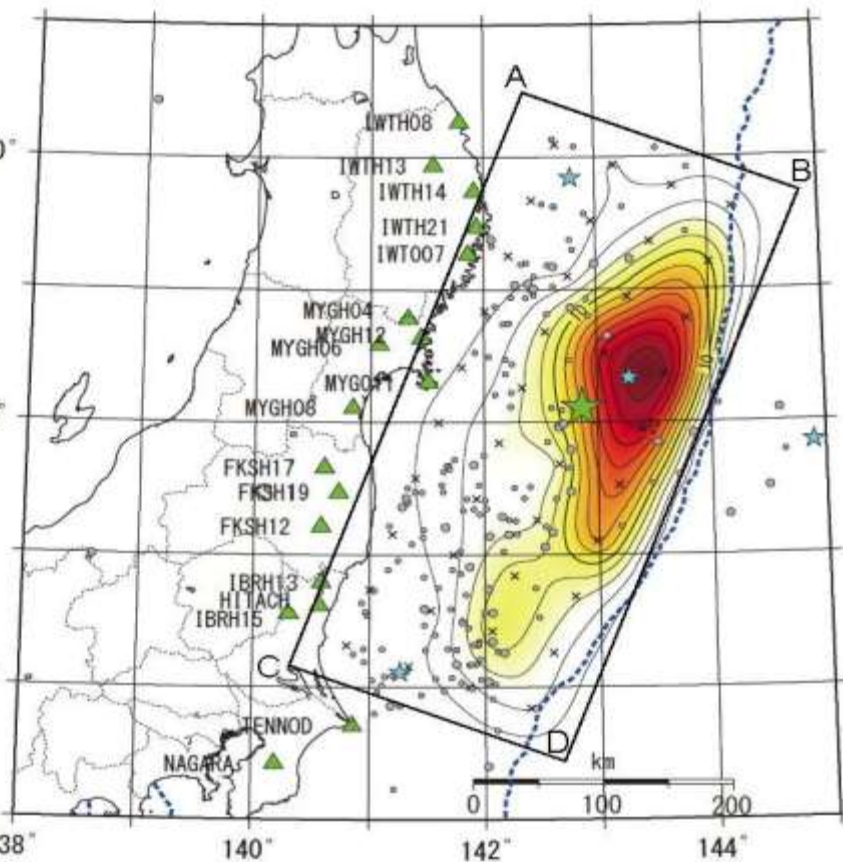
| China Floods | | Bangladesh Storm Surges | | Myanmar Nargis | |
|--------------|-------------------------|-------------------------|----------------------|----------------|-------------|
| Year | Death Tolls | Year | Death Tolls | Year | Death Tolls |
| 1931 | 3 700 000 (400 000*) | 1970 Bola | 300 000 | 2008 Nargis | 138 000 |
| 1954 | 30 000 | 1991 Gorky | 139 000 | | |
| 1998 | 3 700 Mt 40%** | 2007 Sidr | 4 200 | | |
| 2010 | 3 185 Mt 91%** | 2009 Aila | 190 Sundarbans*** | | |

After EMDAT

*Chinese estimate

** XT Cheng

*** Mangrove forest



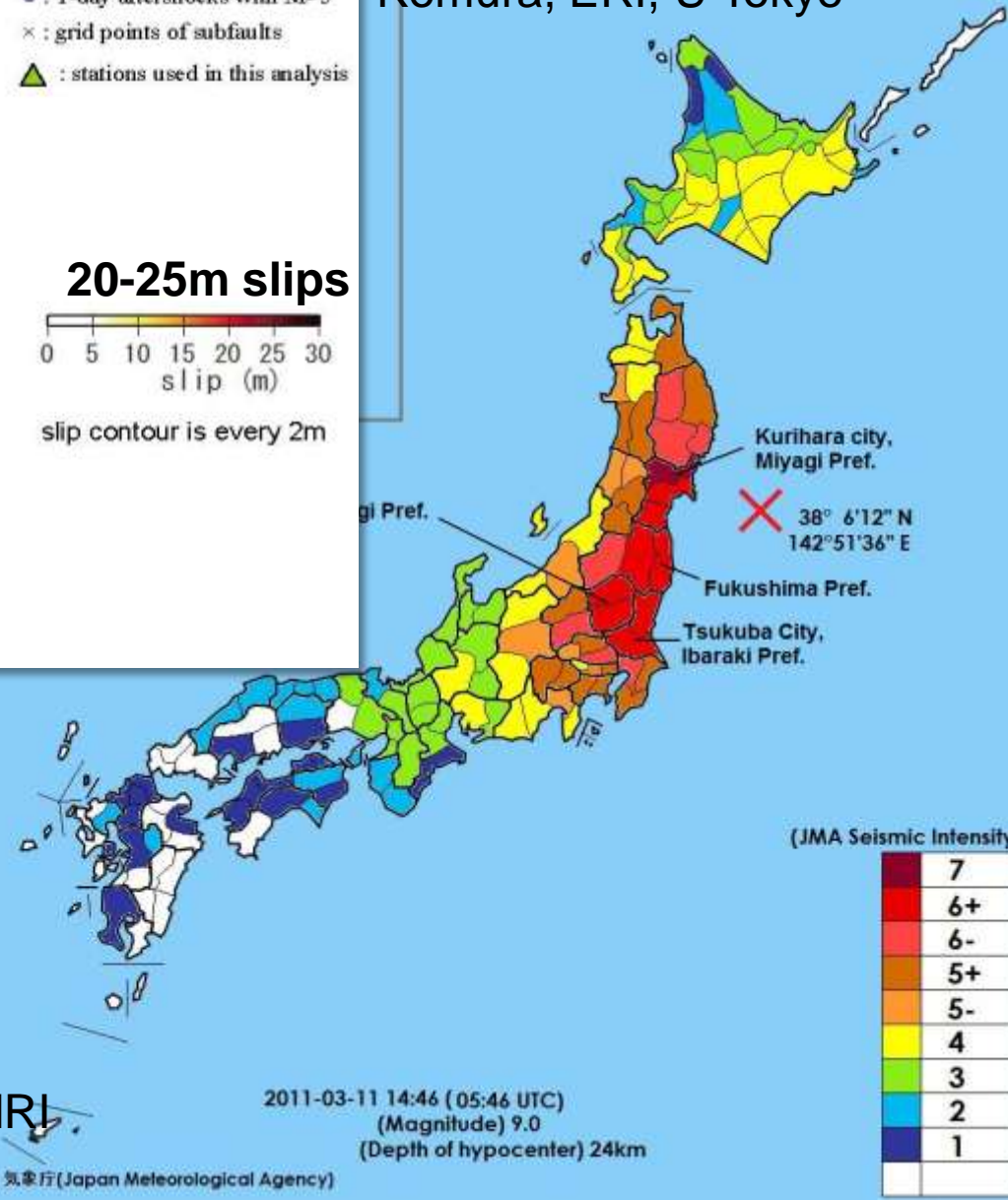
- ★ : starting point of rupture
- ★ : epicenter of aftershocks with $M > 7.0$
- : 1-day aftershocks with $M > 5$
- × : grid points of subfaults
- ▲ : stations used in this analysis

20-25m slips



slip contour is every 2m

Ohotsuku plate slipped
max 55m to SE
Simulation by Takashi
Komura, ERI, U Tokyo



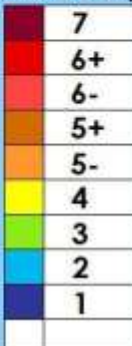
14:46 JST 11 March 2011
The main fault: 450km in
length and 150km in width.

@MRI

2011-03-11 14:46 (05:46 UTC)
(Magnitude) 9.0
(Depth of hypocenter) 24km

Source : 気象庁 (Japan Meteorological Agency)

(JMA Seismic Intensity)





1. Hei River, Miyako; 2. Kamaishi Harbour; 3. Fukushima Daiichi by TEPCO

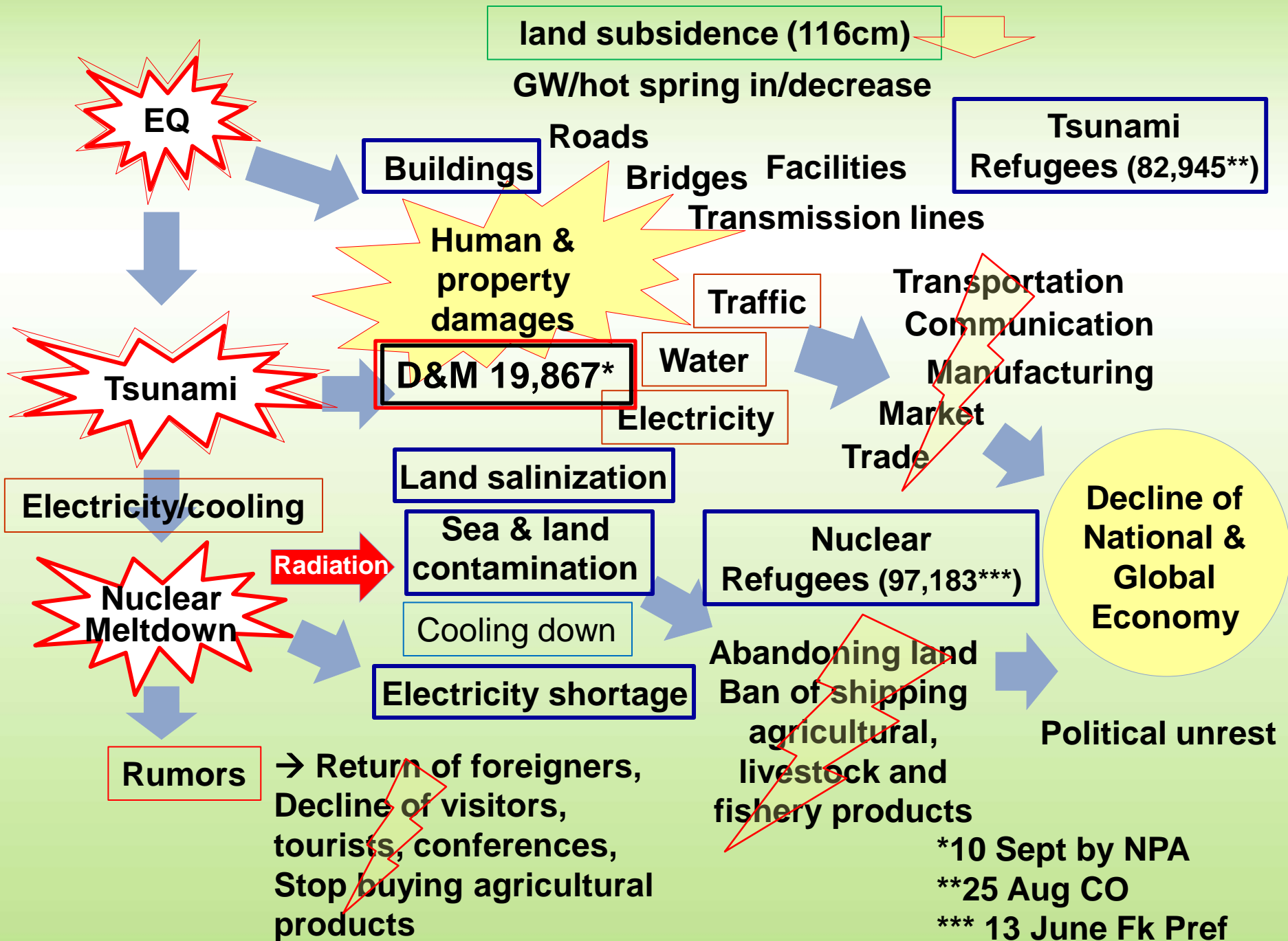
Disaster losses and impacts

NPA 10 Sept

- **Dead *** 15,781
- **Missing*** 4,086
- **Evacuees**** CO 25 Aug 82,945
- Houses damaged * 642,000
- **Inundated** 561km2
- Inundated paddy/field 236km2
- **Debris** 23.92Mt
- Roads * 3,559 pls
- Bridges* 77
- Landslides * 197
- River banks 4 pls

- Shinkansen damaged 1,200 pls
- Other JR trains 6,000 pls
- Highways 15 major lines
- National road stopped 161 intvls
- Fishing boats lost 18,880
- Fishery harbours damaged 325
- *Nuclear effects*
- Nuclear plants stopped 14
- eventually (35+5)/54
- **Area evacuated** 1,595km2
- **Evacuees***** 97,183

Fk Pref 13 June



Why it happened?

- Hazards were **extra large**: Mw9.0, run-up 38.9m, since 869
 - It was “Beyond expectation (**Soteigai**)”:
63m submerged Guinness wall, 123/959 evacuation centers
- “Beyond expectation” was not prepared which was a violation of **law of living with nature**.

➡ **False comfort & Black Swan events**

(Taleb, 2007)



Rare, probability difficult to identify but extremely large consequences

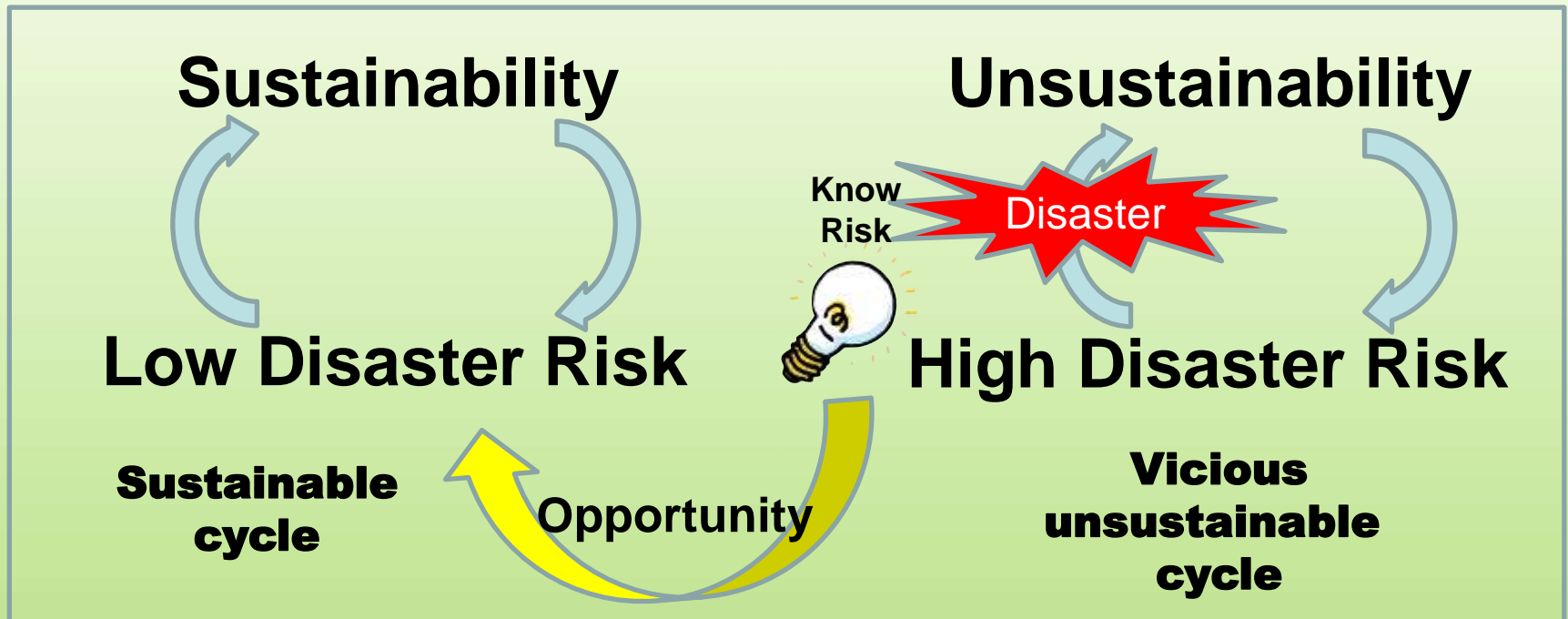
Strong amplifier: Societal change

- **Dependence on modern services & international supply chain**
 - Total dependence on **electricity, IT,** massive & long-distance **transportation.**
 - Highly linked and less redundant society with nationwide & international **supply chain** of often **irreplaceable high-tech parts** or materials in production system.



This is a universal change but especially rapid in Asia

- Asian sustainability is difficult to achieve but can be made achievable by disaster risk reduction.
- But conversely, disaster risk reduction needs economic, environmental and social sustainability
- Whenever an unknown **risk** becomes known, it is an indispensable **opportunity** to make a change from a unsustainable vicious cycle to a sustainable cycle.





Integrated Research on Disaster Risk



IRDR Conference 2011

Oct. 31 - Nov. 2, Beijing

www.irdrinternational.org/conference2011

Why, despite advances in the natural and social science of hazards and disasters, do losses continue to increase?

To what extent is the world-wide growth in disaster losses a symptom and indicator of unsustainable development?



Disaster Risk: Integrating Science & Practice

SAVE
THE DATE

A Science Plan for Integrated Research on Disaster Risk (IRDR)

Addressing the challenge of natural and human-induced environmental hazards

An integrated approach to research on disaster risk through: an international, multidisciplinary (natural, health, engineering and social sciences, including socio-economic analysis) collaborative research programme. - Sept/2008



www.irdrinternational.org

A Science Plan for Integrated Research on Disaster Risk
Addressing the challenge of natural and human-induced environmental hazards

Preparatory Committee in 2004
Final report adopted © ICSU 2008



Co-Sponsors

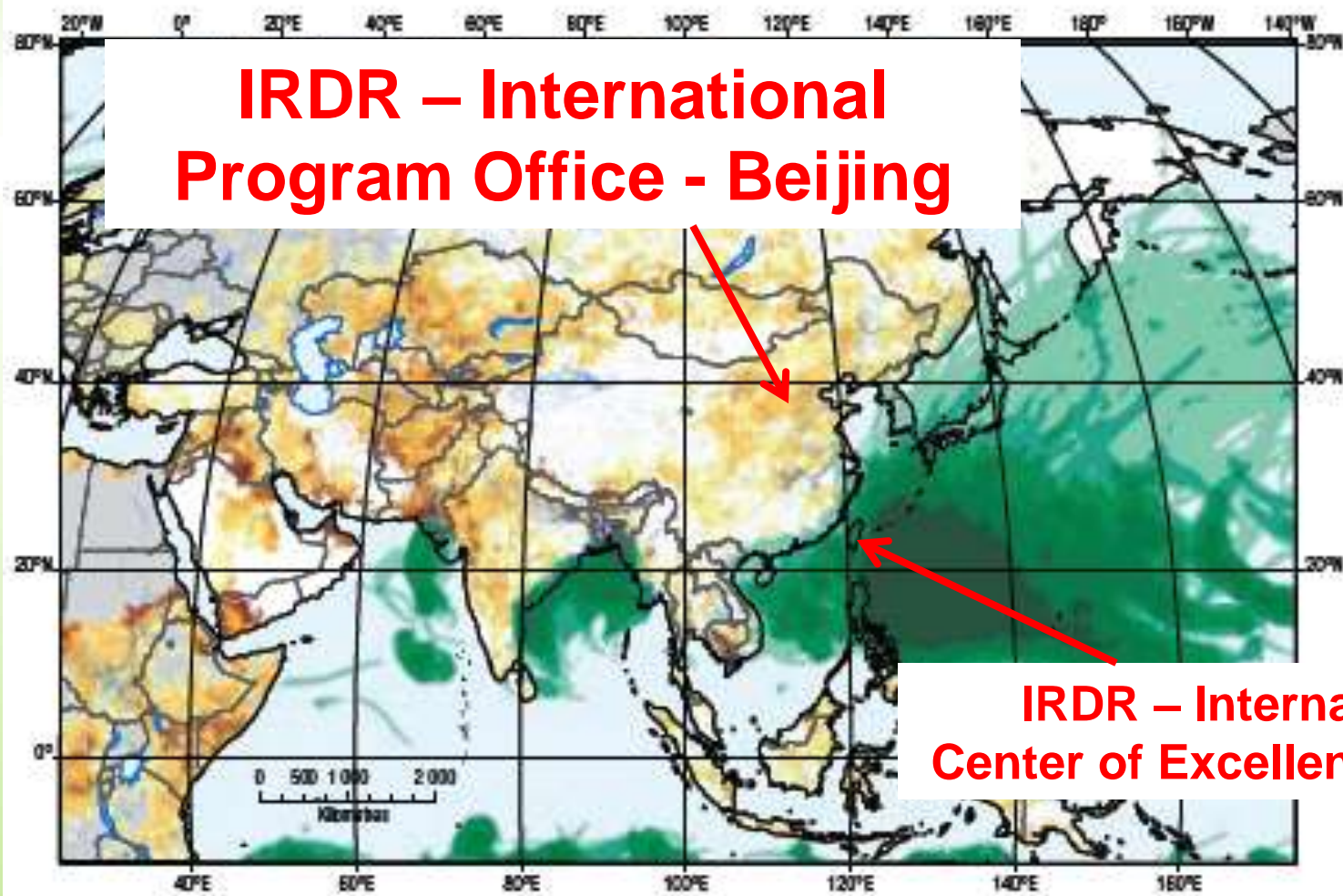


Leaders

- Chair (~Oct. 2011):
Gordon McBean
meteorologist, former
WCRP chair
- Next Chair (Oct. 2011~):
Salvano Briceno, political
scientist, former director
of UNISDR
- IPO Executive Director:
Jane Rovins, formerly at
FEMA

**IRDR – International
Program Office - Beijing**

**IRDR – International
Center of Excellence- Taipei**





Objectives

1: Characterization of **hazards, vulnerability and risk**

- 1.1: identifying hazards and vulnerabilities leading to risks;
- 1.2: forecasting hazards and assessing risks; and
- 1.3: dynamic modelling of risk.

2: Effective **decision making** in complex and changing risk contexts

- 2.1: Identifying relevant decision-making systems and their interactions
- 2.2: Understanding decision making in the context of environmental hazards; and
- 2.3: Improving the quality of decision-making practice.

3: Reducing risk and curbing losses through **knowledge-based actions**

- 3.1: Vulnerability assessments;
- 3.2: Effective approaches to risk reduction

Cross-Cutting Themes

1. Capacity building
2. Case studies and demonstration projects
3. Assessment, data management and monitoring



Sponsors: ICSU, ISSC,
UN-ISDR

IPO

Scientific Committee

Consultative
Forum

**Working Group-
Task Teams:**

- FORIN: Forensic disaster investigation
- RIA: Risk Interpretation & Action
- Disaster Loss Data
- Global Assessment of IRDR

International Centres of Excellence

Taipei

National Committees

Canada

China

France

Germany

Japan

New Zealand

Capacity building



Regional Programmes

ICSU-
ROAP,
ROA,
ROLAC

Partners in research:

- Unions and National Members of ICSU & ISSC
- IUGG – ENHANS
- WMO
- UNESCO
- CoDATA
- JRC
- WCRP- Extremes
- WWRP
- IHDP-IGBP-LOICZ-IRG
- ICL
- Int. Floods Initiative
- IOC tsunami prog.
- ...



Forensic Disaster Investigations (FORIN)

- **Probe further into complex and underlying causes of growing disaster loss**
- **Fundamental cause of disasters**
- **Trace out and assign causal explanation of losses**
- **Intervening conditions that increased or reduce losses**

- **Series of case studies**
- **Common template and methodology**



Risk Interpretation and Action (RIA)

- **How actors attempt to make sense of experience and information from various sources as a basis for decision.**
- **Estimation of the likelihood, magnitude of event & vulnerability of physical infrastructure**
- **Social and behavioural factors leading to greater or lesser risk**



Disaster Loss Data WG

- **Can we improve the existing data quality?**
- **Can we make the data landscape more transparent?**
- **Can we strengthen the data platform efforts?**
- **What are the synergies with CoDATA and World Data System?**
- **Leave a legacy of coordinated and integrated global data and information sets across hazards and disciplines, with unprecedented degrees of access.**

Assessment of Integrated Research on Disaster Risk (AIRDR)

Purpose: to undertake the first systematic and **critical global assessment of published research on disaster risk under the auspices of the IRDR—new knowledge**

Approach:

- 1. Documentation and critical assessment of extant literature on disaster risk**
- 2. Identification of what is known well and empirically supported, what is less well known, and what gaps exist in our research knowledge base, and what opportunities exist for new research in the co-production of knowledge**
- 3. integrated research assessment report similar to the “Disasters by Design” concept and similar in style to the IPCC.**

www.irdrinternational.org



IRDR

Integrated Research on Disaster Risk



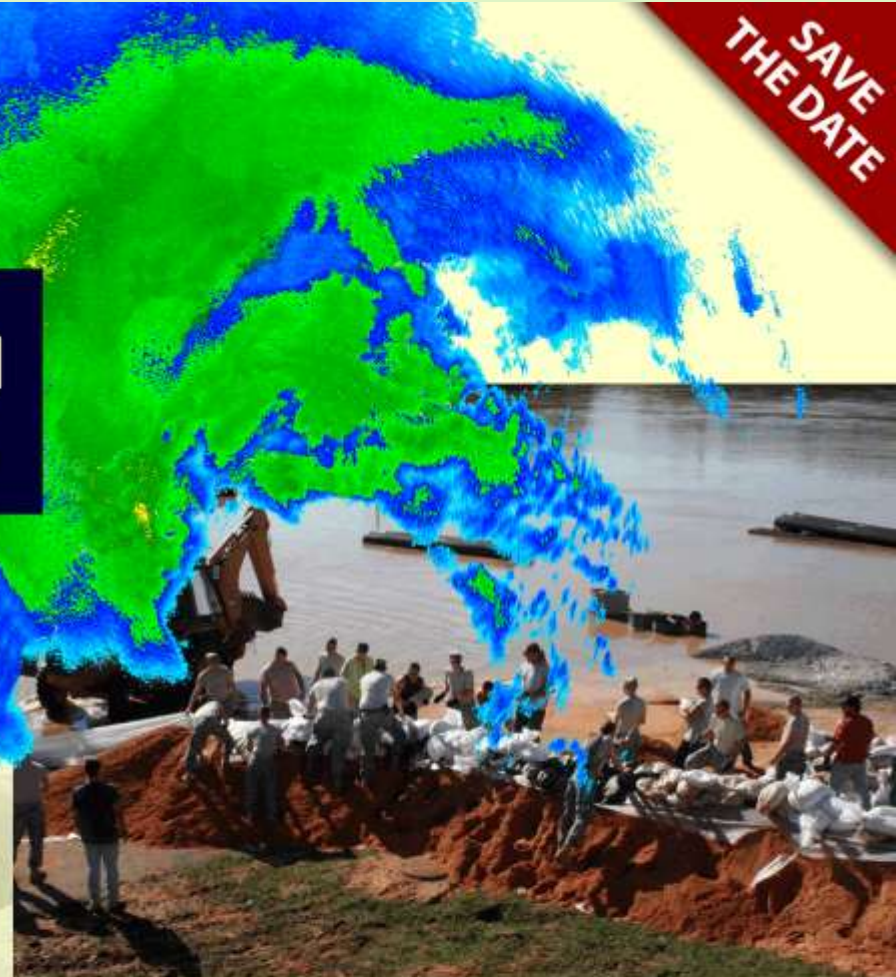
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Disaster Risk: Integrating Science & Practice

Final Remarks

- **Disaster is an evidence of unsustainability of society.** Let us make disasters happen within a designed framework of sustainable society.
- **No global sustainability without Asian sustainability.**
- Asian sustainability is not achievable without disaster risk reduction.
- In order to reduce disaster risk, it should **take a risk as an opportunity** *to make a track change from a vicious cycle to a sustainable cycle.*

危機が
好機

居安思危 Be aware of risk while you are safe
思則有備 Awareness leads you preparedness
有備無患 Preparedness leaves you no worry

「春秋」左氏伝

Source: Zuo Qiuming “Zuoshi Commentary”
in Confucius ed. ”Spring and Autumn”, 480BC

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and empowerment!**

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preparedness for floods