

国際的な防災・減災にむけた大学の役割：東北大学災害科学 国際研究所の発足と活動

Universities' role towards international DRR: actions of IRIDeS, Tohoku University

Sharing the experiences and lessons of the 2011 Tohoku earthquake

International Research Institute of
Disaster Science(IRIDeS),
TOHOKU University

F.Imamura, Director of IRIDeS
Prof. Tsunami Eng. At Sendai city

A new building in 2014
One of investment for future risk

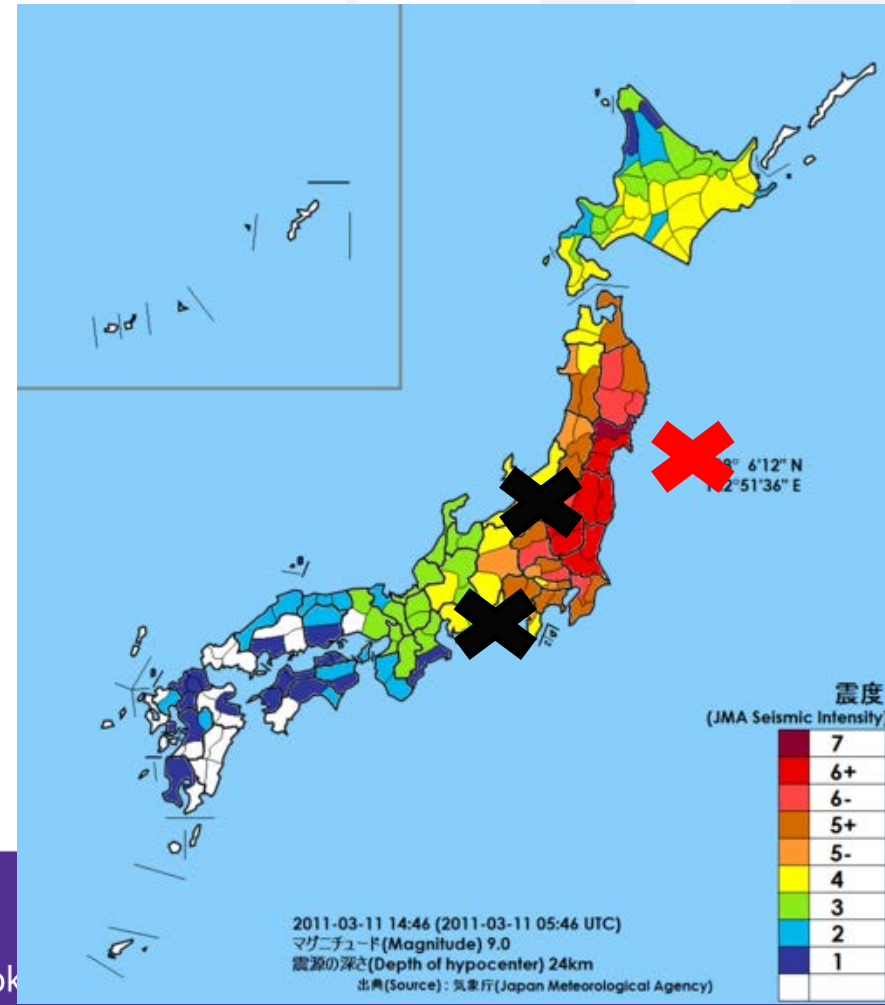


Unfolding the 3.11 event:

Triple Tragedy and Damages

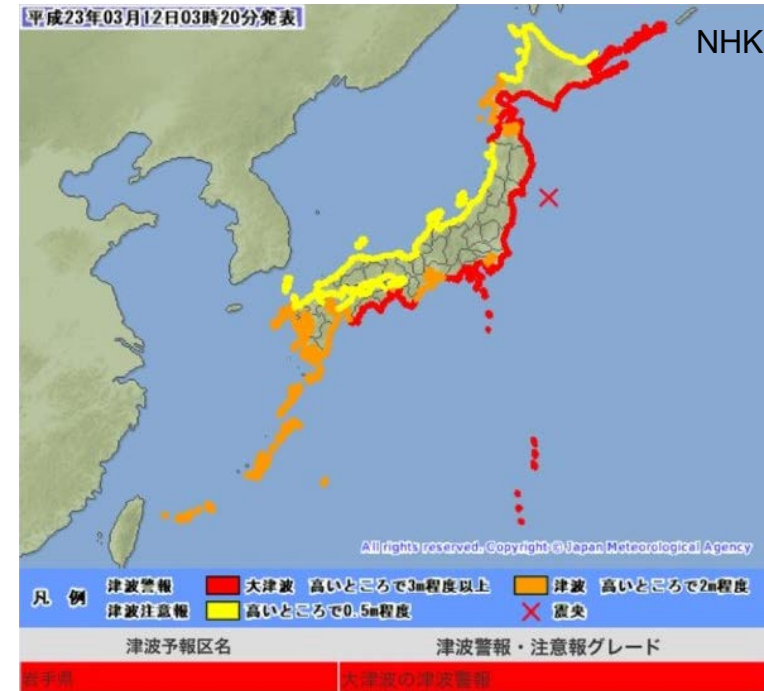
- **Triple Disasters: ONE – The Earthquake**

- Time: March 11, 2011, 2:46pm
- Scale: Mw 9.0
(4th largest in the world since 1900 (USGS))
- In 5 days: 2 additional Mw 5+ earthquakes (black X)
- In a month: 400 + aftershocks continues



• Triple Disasters: TWO – Tsunamis

- Tsunami evacuation order and warning, immediately after – all around coastal Japan
- Time reaching the coast: less than 20-30 min
- 7 tsunamis in the first 6 hrs after the shock, continue for 2 days



- According to the information:
 - Highest wave recorded: 9.3m
 - Highest run up-height : 35 m
 - Farthest inland reached: 8km

Other damages

- Inundated area: 560km²
- Liquefaction
- Fire

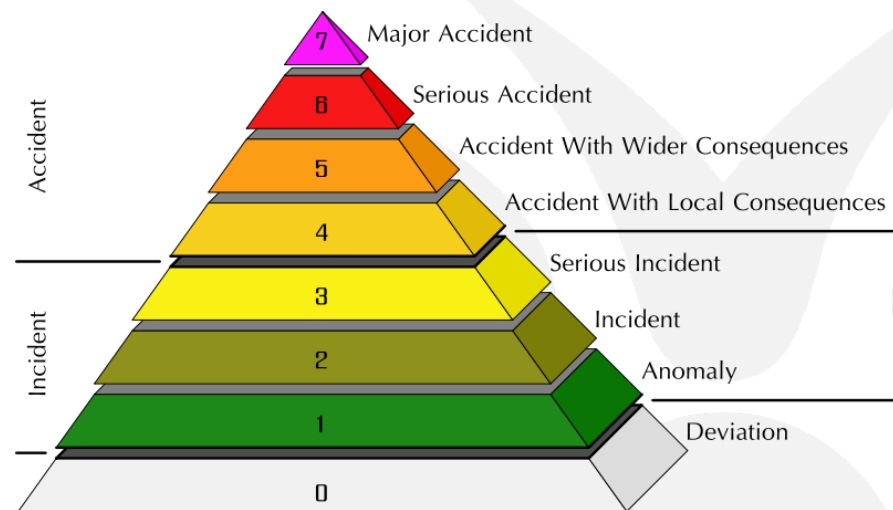




- Triple Disasters:

THREE – Nuclear Power Plant Failure

- One of the worst nuclear incident, triggered by the earthquake and tsunami
- Temporarily assessed as level 7 on INES
- Emergency state is still on-going



March 11, 2011 disaster and IRIDeS

- March 11, 2011 disaster
 - Worst disaster in history from triple tragedy
 - JPY 16.9 trillion (\$210 billion)
 - e.g. JPY 6.5 trillion(\$81 billion) for Hurricane Katrina
 - Uncovered limitations of modern science and technology
 - Large-scale disaster impacts can't be prevented
 - Need longer time horizons for better understanding; importance of referencing ancient documents and geological evidence
 - Holistic approach is needed to respond to mega-scale disasters
 - Need wider spatial horizons for getting enough cases and experiences : International cooperative research

IRIDeS: A new institution in a disaster stricken area

- Principle:

- Promote world's leading research on natural disasters through:

- learning from the Tohoku earthquake and tsunami;
- contributing to the regional recovery; and
- set an international paradigm on disaster management studies



Hazard and Risk
Evaluation Research
Division

Human and Social
Response Research
Division

Regional and Urban
Reconstruction
Research Division

Disaster Science
Division

Disaster Medical
Science Division

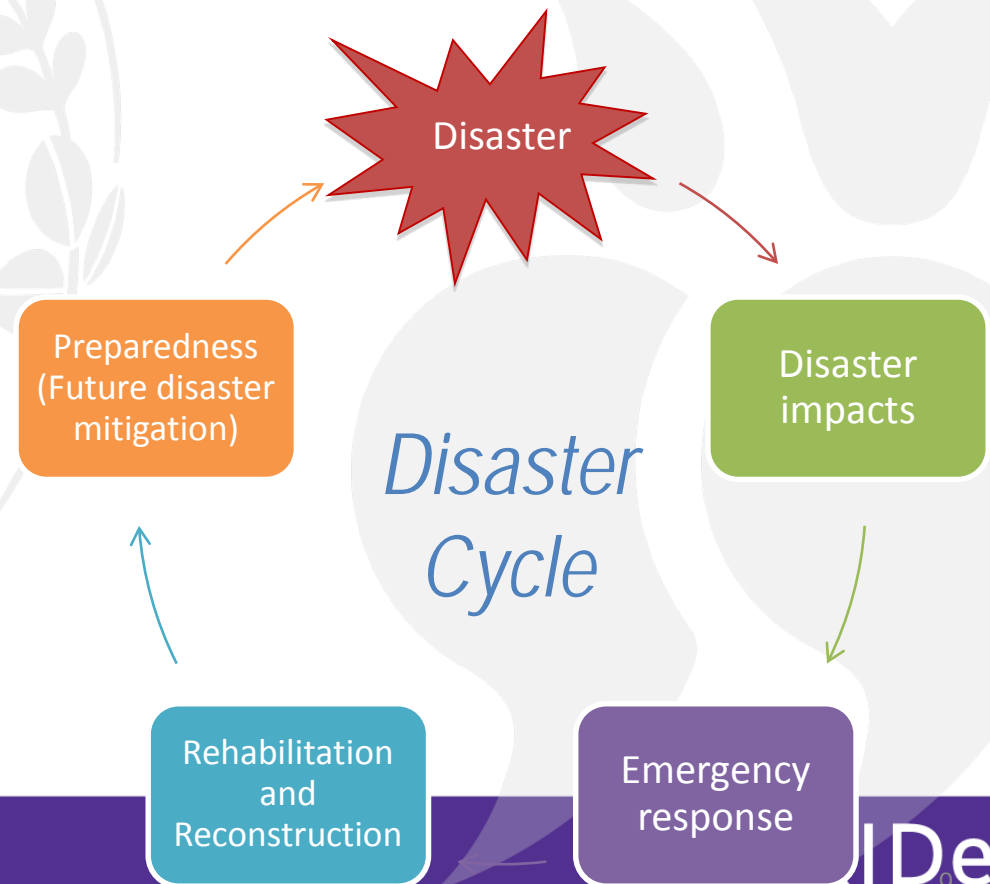
Disaster Information
Management and Public
Collaboration Division

Endowed Research
Division

- **Mission**

- **Establish “practical” disaster management studies**

- Identify and theorize disaster-related phenomenon in each stage of disaster cycle
- Establish an area of disaster management study that supports building societies more resilient to disasters
- Internationally-driven research/ educational activities



Disaster Management Cycle in Four Phases

•Activities to develop knowledge and capacities by governments, professional response and recovery organizations, communities and individuals to effectively manage emergencies and achieve transitions from response to sustained recovery :
Disaster preparedness organization
Emergency response plans, Exercises
Training, and Education, Warning systems, Disaster Science and Risk Assessment

Preparedness

• Activities during a disaster:
Monitoring, Early warning & evacuation, Search and rescue, Medical and public health care physically and mentally, Provide shelters, distribution of relief items

Response

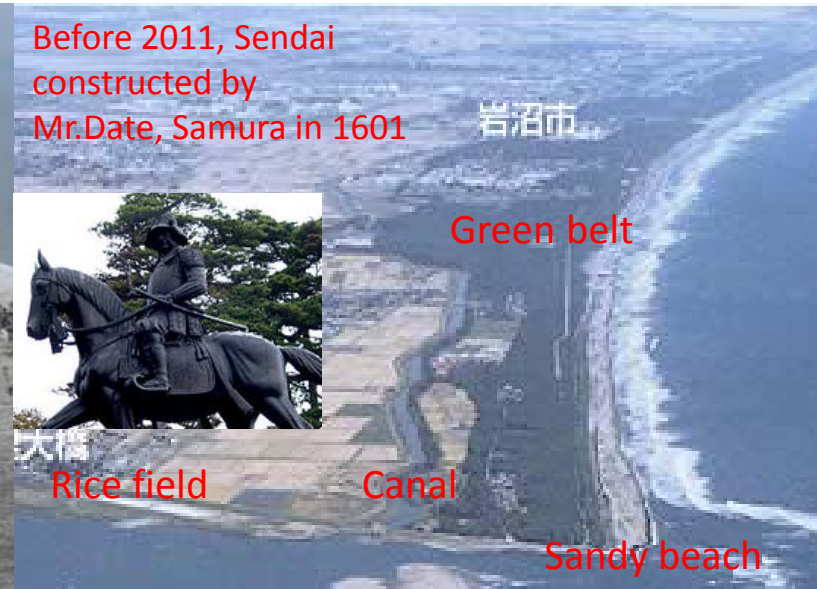
•Activities that reduce the effects of disasters:
Investment of Infrastructure, Building codes and zoning, increase health resilience, Retrofitting, Land use planning, Public awareness, BCP & BCM, Archive

Mitigation

•Crisis management, Disaster medicine, Public health, Activities following a disaster: Recovery of infrastructure, Temporary housing, reconstruction of buildings and schools, Revival of local economy

Recovery

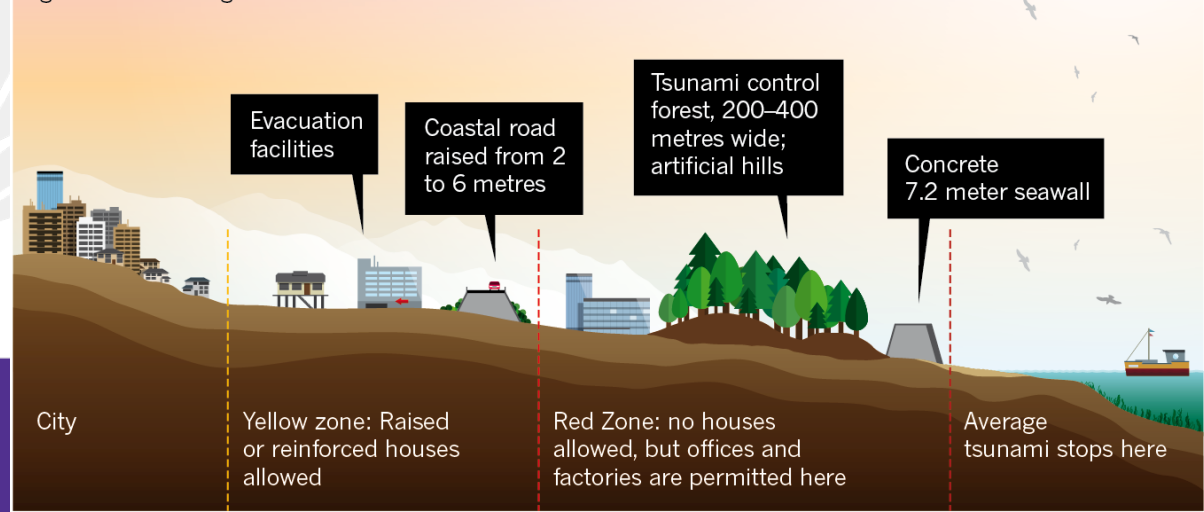
Protections in Multi-layers and Plan for Tsunami Resilient city in Sendai



Only two shrines out of 100 with 1,000 years history were damaged in the affected area

PLAN FOR A TSUNAMI-RESISTANT CITY

Sendai is considering refashioning its coastal area. A raised seawall would block typical tsunamis and an elevated coastal road would protect against giant ones. Zoning restrictions would lower the number of fatalities.



TOHOKU

Cyranoski (Nature, Vo.483, 2011)

Regional Rebuilding Efforts Underway

Collective household relocation



24 municipalities

245 districts

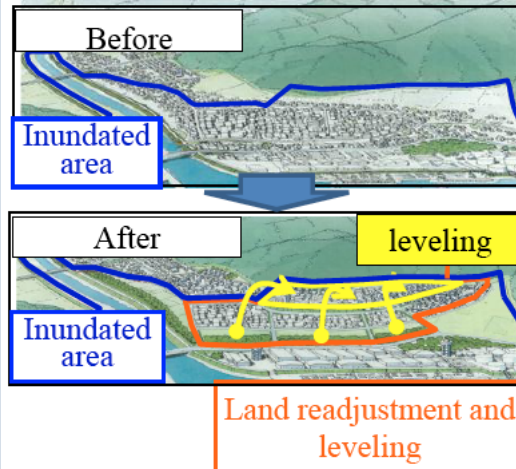
3 municipalities

3 districts

Chuetsu Earthquake
(project term: 2 years)

Great East Japan
Earthquake

Land readjustment



Unprecedented scale of devastation results in a massive amount of projects

20 municipalities

5 municipalities

58 districts

20 districts

Great Hanshin-Awaji
Earthquake (average
project term: 8 years)

Great East Japan
Earthquake

Public housing development

[Soma City, Fukushima Prefecture]
Construction: Feb. 2012 to Aug. 2012
Structure: Wooden flat compound for 12 houses



26,000
houses

Over
20,000
houses

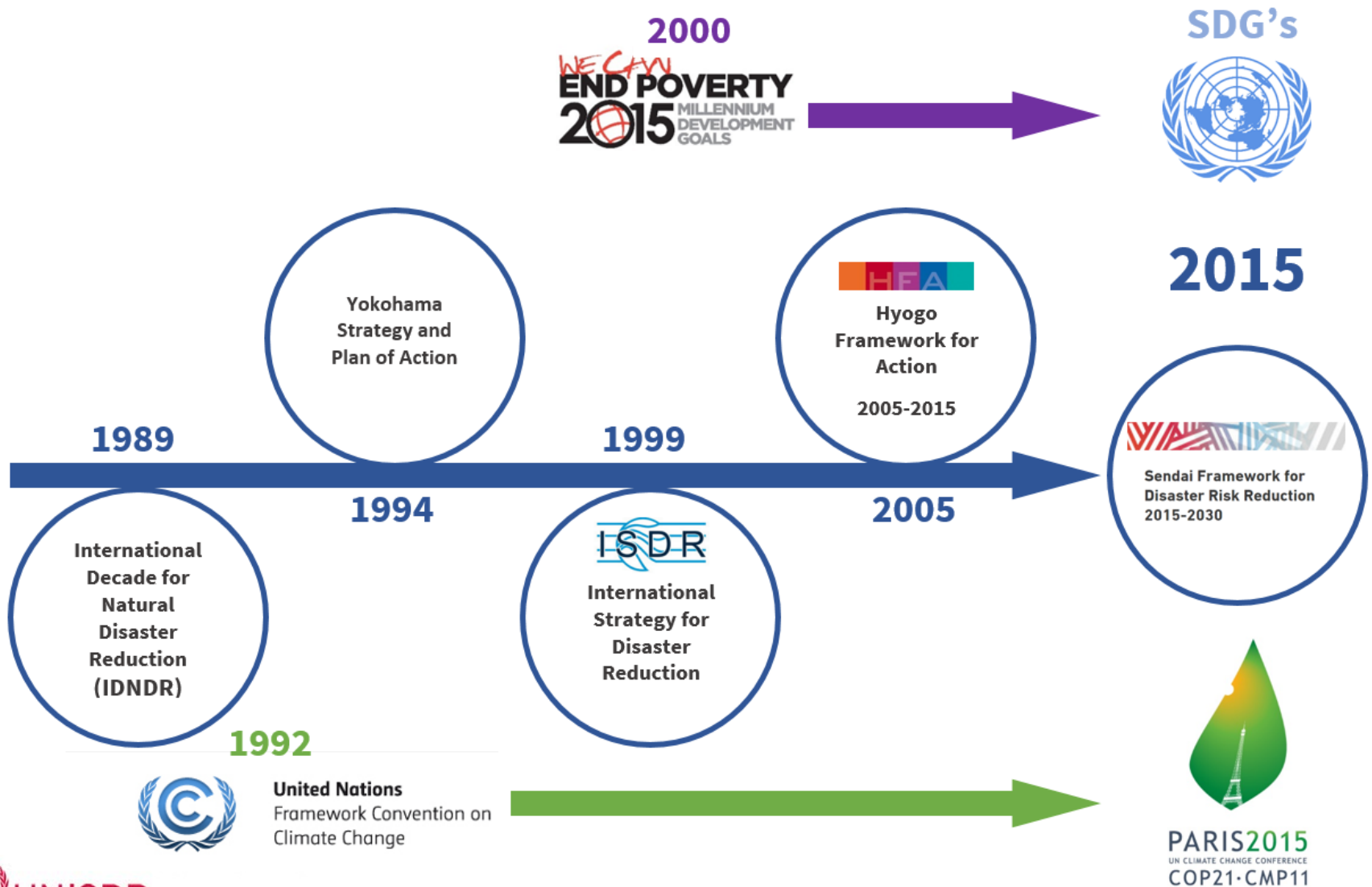
Great Hanshin-Awaji
Earthquake (project
term: 6 years)

Great East Japan
Earthquake

8 DeS

International Research Institute
of Disaster Science

25 years of international commitment to disaster risk reduction



The 3rd UN world conference for Disaster Risk Reduction at Sendai on 14-18 March 2015

UN Main conf

Official visit

Public forum & exhibition

Welcome reception

- ・会 場: (仮称)国際センター周辺地区コンベンション施設、仙台国際センター
- ・主 催: 国連 (UNISDR (国連国際防災戦略事務局))
- ・規 模: 国連全加盟国 (193カ国)、国際機関、NGO等から首脳・閣僚級を含む5,000人以上の参加を想定 => **187カ国, 6000名以上**

Sendai, Miyagi,
Iwate,
Fukushim
a, Tohoku

- ・会 場: 仙台市内及び宮城県内市町村・東北被災四県内の複数会場
- ・主 催: 仙台市及び青森・岩手・宮城・福島各県等 (仙台市は諸団体等連携した事業も展開)
- ・規 模: **延べ4万人以上の参加を想定 => 延べ15万人に**

- ・主催: 仙台市、被災四県等 (政府主催レセプションも別途開催予定)

分科会 (地域・テーマ別会合)、草案委員会

全体会議 (政府間会合) ※閣僚級

成果

「兵庫行動枠組」の後継枠組となる次代の世界の防災戦略

Process of reconstruction

Study tours

総合フォーラム

- ・仙台市主催 (又は政府と共催)
- ・東日本大震災の経験・教訓や東北の復興を発信
- ・本体会議参加者 (各国代表や国際NGO) や国民が広く参加
- ・会場: 東北大学川内萩ホール

一般事業

○シンポジウム・セミナー

- ・仙台市が全体の企画運営
- ・被災各自治体、省庁、大学、NPO・NGO、企業などが参加
- ・仙台市民会館、県民会館等の東北の複数会場で開催

○展示会

- ・防災・復興展: 仙台市等主催。せんだいメディアテーク、勾当台公園を会場に各国、国際機関、被災自治体、諸団体等が防災や復興について展示
- ・防災産業展: 夢メッセみやぎを会場に防災産業見本市等を実施

歓迎レセプション

エクスカージョン

同伴者プログラム

市民交流事業

<http://www.bosai-sendai.jp/article/?start=2>

Third UN World Conference
on Disaster Risk Reduction



WCDRR



2015.3.15 (SUN) Admission Free

Tohoku University Symposium

Our Message to the future

~ Lessons learned from the Great East Japan Earthquake ~

Date 10:30am-5:00pm (Scheduled Time)

Venue Convention Hall, Tokyo Electron Hall Miyagi

PROGRAM Language: Japanese (English simultaneous interpretation provided) *The schedule is subject to change.

10:30am~ Leading the reconstruction of the Tohoku region and the revitalization of Japan

○Panel Discussion

1 "The 2011 Tohoku Earthquake Disaster and its mitigation"

Coordinator Fumihiko Imamura Director of International Research Institute of Disaster Science (IRIDeS), Tohoku University

2 "Innovation and Reconstruction of Industry and Community"

Coordinator Yutaka Nakai Professor of Graduate School of Agricultural Science, Tohoku University

3 "Restoration and Renovation of Medical Care"

Coordinator Kazuhiko Igarashi Professor of Graduate School of Medicine, Tohoku University

2:00pm~ Lessons learned from the Great East Japan Earthquake

○Lecture

"New role of the Tsunami Engineering on the basis of the lesson by the 2011 Tohoku earthquake disaster"
Fumihiko Imamura Director of International Research Institute of Disaster Science (IRIDeS), Tohoku University

"Towards earthquake forecasting - Hints provided by the 2011 Tohoku Earthquake"

Ryota Hino Professor of International Research Institute of Disaster Science (IRIDeS), Tohoku University

"Building a platform for future regional medicine, training future specialists of regional care"

Tadashi Ishii Tohoku University Hospital



**SENDAI
FRAMEWORK**

**Scope and
Purpose**

1 Global
Outcome

1 Goal

7 Global Targets

13 Guiding Principles

4
Priorities
for Action

at **4** Levels
Local, National, Regional and Global

**Role of
Stakeholders**

**International Cooperation
and Global Partnerships**

Reduce

Mortality/ global population

2020-2030 Average << 2005-2015 Average

Affected people/ global population

2020-2030 Average << 2005-2015 Average

Economic loss/ global GDP

2030 Ratio << 2015 Ratio

Damage to critical infrastructure & disruption of basic services

2030 Values << 2015 Values

Increase

Countries with national & local DRR strategies

2020 Value >> 2015 Value

International cooperation

to developing countries

2030 Value >> 2015 Value

Availability and access to multi-hazard early warning systems & disaster risk information and assessments

2030 Values >> 2015 Values

Future Actions after the UN WCDRR(1)

• Global Centre for Disaster Statistics

- To be established in April 2015 as part of the International Research Institute of Disaster Science (IRIDeS)
- Assemble disaster statistics on damage and loss and archive it
- Analyse the statistics at the IRIDeS
- Modify it so that it can be used for policy making in disaster risk reduction and recovery
- Contributing to the UNISDR for their monitoring progress on the targets and indicators of the new DRR Framework to be adopted at the World Conference on Disaster Risk Reduction in Sendai
- Collaboration: UNISDR, ESCAP, Asian Disaster Reduction Center (ADRC), International Recovery Platform (IRP), JICA, International Center for Water Hazards and Risk Management (ICHAHM), and others



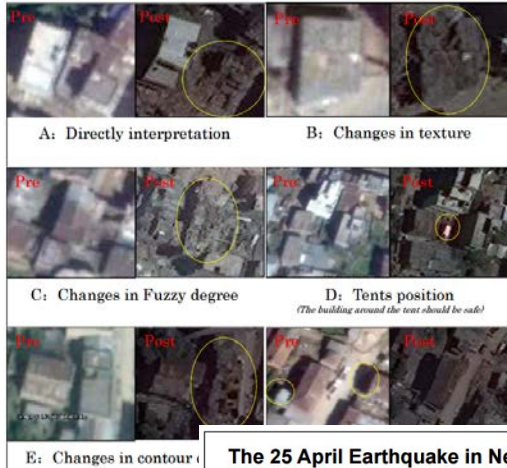
IRIDeS's response to Gorkha Earthquake

1. Early damage assessment

25 April 2015

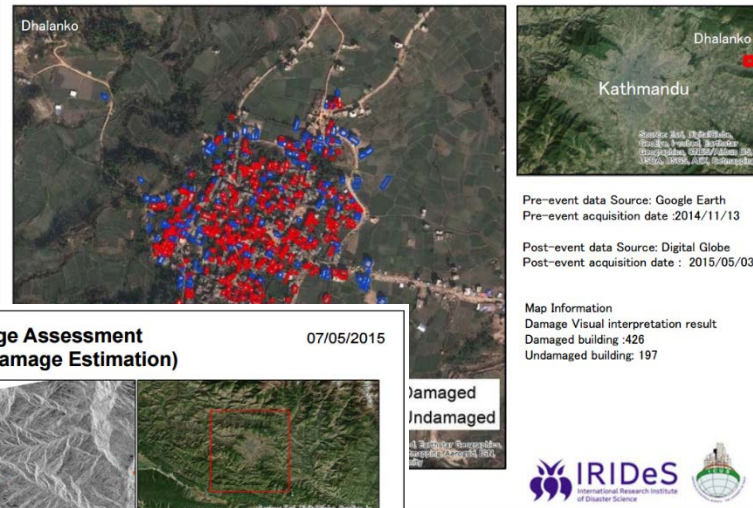
The 25 April Earthquake in Nepal Damage Assessment
Satellite Remote Sensing, Damage Visual interpretation

07/05/2015



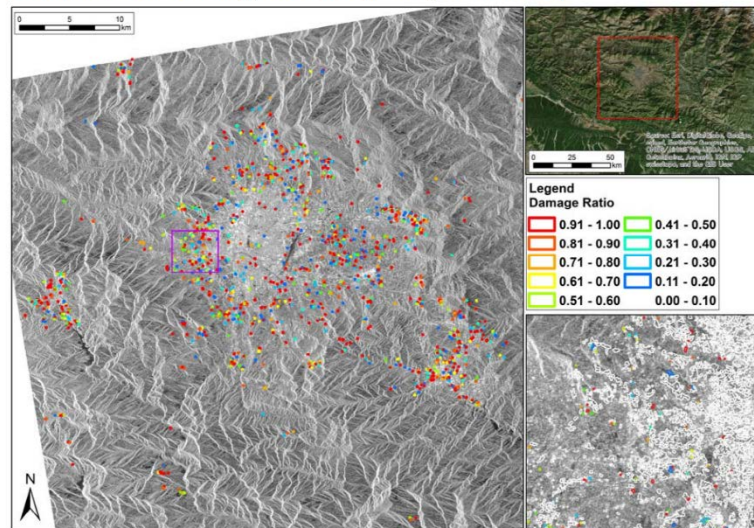
The 25 April Earthquake in Nepal Damage Assessment
Satellite Remote Sensing, Damage Visual interpretation

07/05/2015



The 25 April Earthquake in Nepal Damage Assessment
Satellite Remote Sensing, PALSAR-2 (Damage Estimation)

07/05/2015



- Interpretation of structural damage at an early stage
- Using Satellite Remote Sensing

2. Symposium on Gorkha Earthquake

- May 8, 2015
- Presentations and topics included:
 - The mechanism of this earthquake;
 - Damage situation;
 - Potential of landslides;
 - Building damages;
 - Health and safety issues; and
 - Relief goods distribution



3. Field visit by IRIDeS Director in collaboration with JICA



- May 22, 2015 ~
- Understand and assess situation
- Identify urgent initiatives to carry out

4. Follow up symposium

- May 28, 2015
- Findings from the field reconnaissance

5. Fact finding mission

- Dispatched three times: July, September, and December, 2015
- Team and members

1. Hazard Division

① Jeremy Bricker

2. Medical Division

① **Shinichi Egawa**

② Hiroaki Tomita

③ Toshio Hattori

④ Haorile CHAGAN-YASUTAN

⑤ Hiroyuki Sasaki

⑥ Aya Murakami

3. Social Division

① Aiko Sakurai

② Das Rubel

③ Elizabeth Ann Maly

④ Carine Yi

Collaboration/ Information Sharing

4. Domestic Support

Fumihiko Imamura

Makoto Okumura

Yuichi Ono

Shunichi Koshimura

Kiyoshi Ito

Mitsuo Kaku

Shuji Moriguchi

Tadashi Kawai

Eric Mas

Volker Roeber

Investigation topics

●Hazard

- Landslide and damming of rivers assessment in the mountainous area
- Remote sensing and creation of risk map suitable for future rainfall
- Damage to the water supply and waste water infrastructures

●Medical and public health

- Damages and preparedness of the health facilities. Medical and public health needs assessment
- Establishment of strategies against infectious disease and psychosocial problems

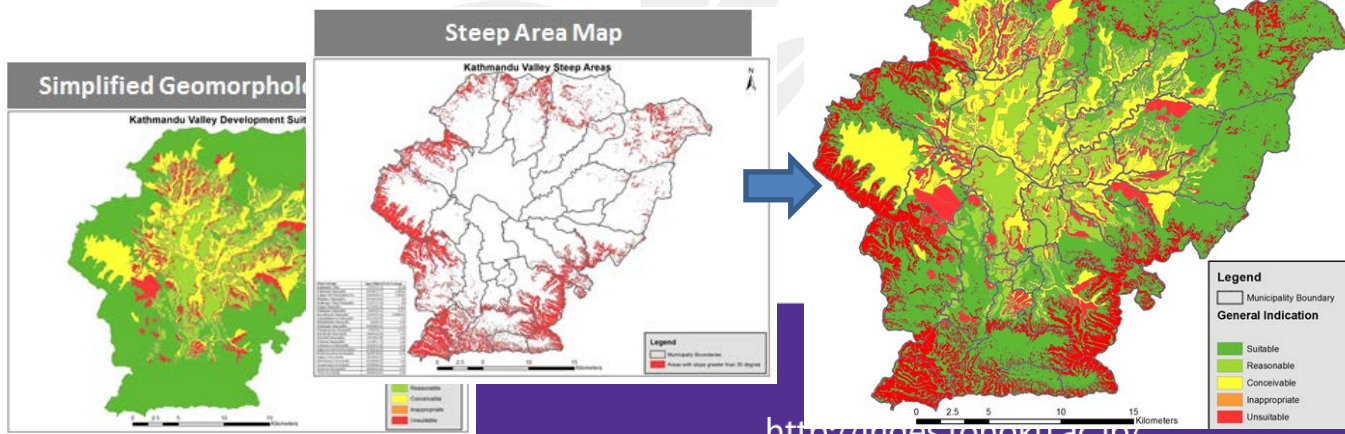
●Society

- Disaster Logistics
- Disaster education, reconstruction and building back better



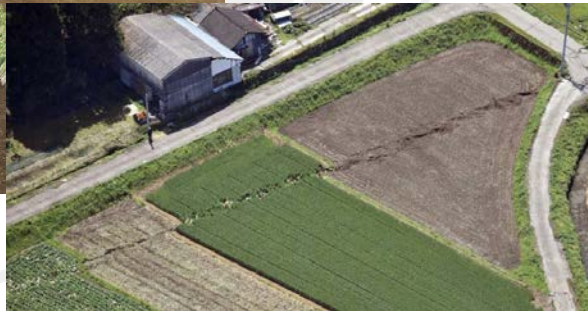
6. Other activities at IRIDeS supporting Nepal

- **Disaster education for disaster affected students: connecting Nepal-Japan**
 - March 24, 2016
 - HABATAKI and Support Our Kids under the program TohokuNepal [Reconstruction Project]
- **Sharing knowledge on Tohoku to Nepalese gov't officials**
 - March 22, 2016
 - Lectures on:
 - Earthquake risk assessment and its use in Miyagi Pref.
 - Land use control and emerging challenges after the GEJE
 - Field Reconnaissance in Sendai plain
- **Participating JICA project**

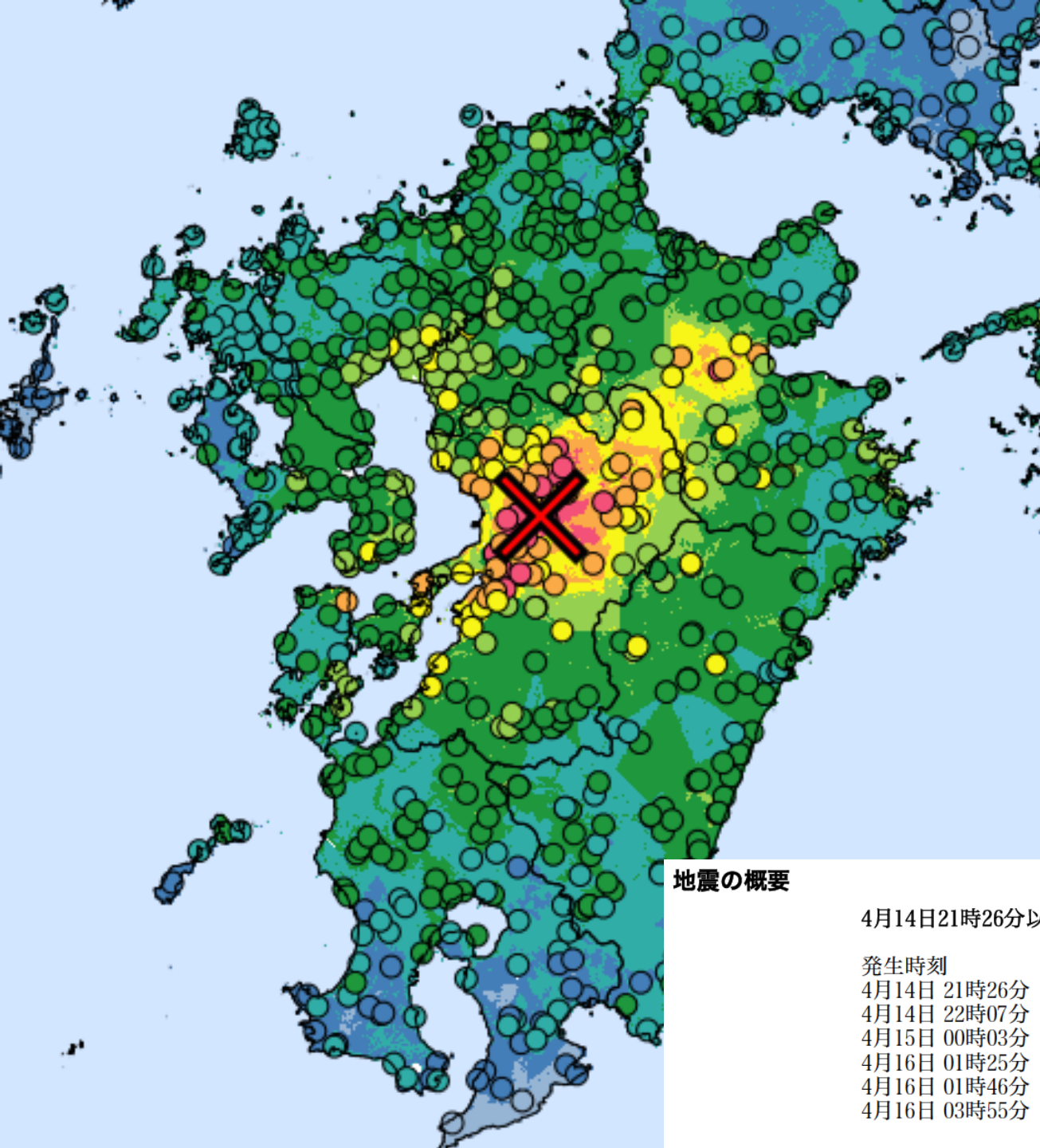


Additional information on action for the 2016 Kumamoto earthquake

IRIDeS role towards international DRR
To support the damaged area





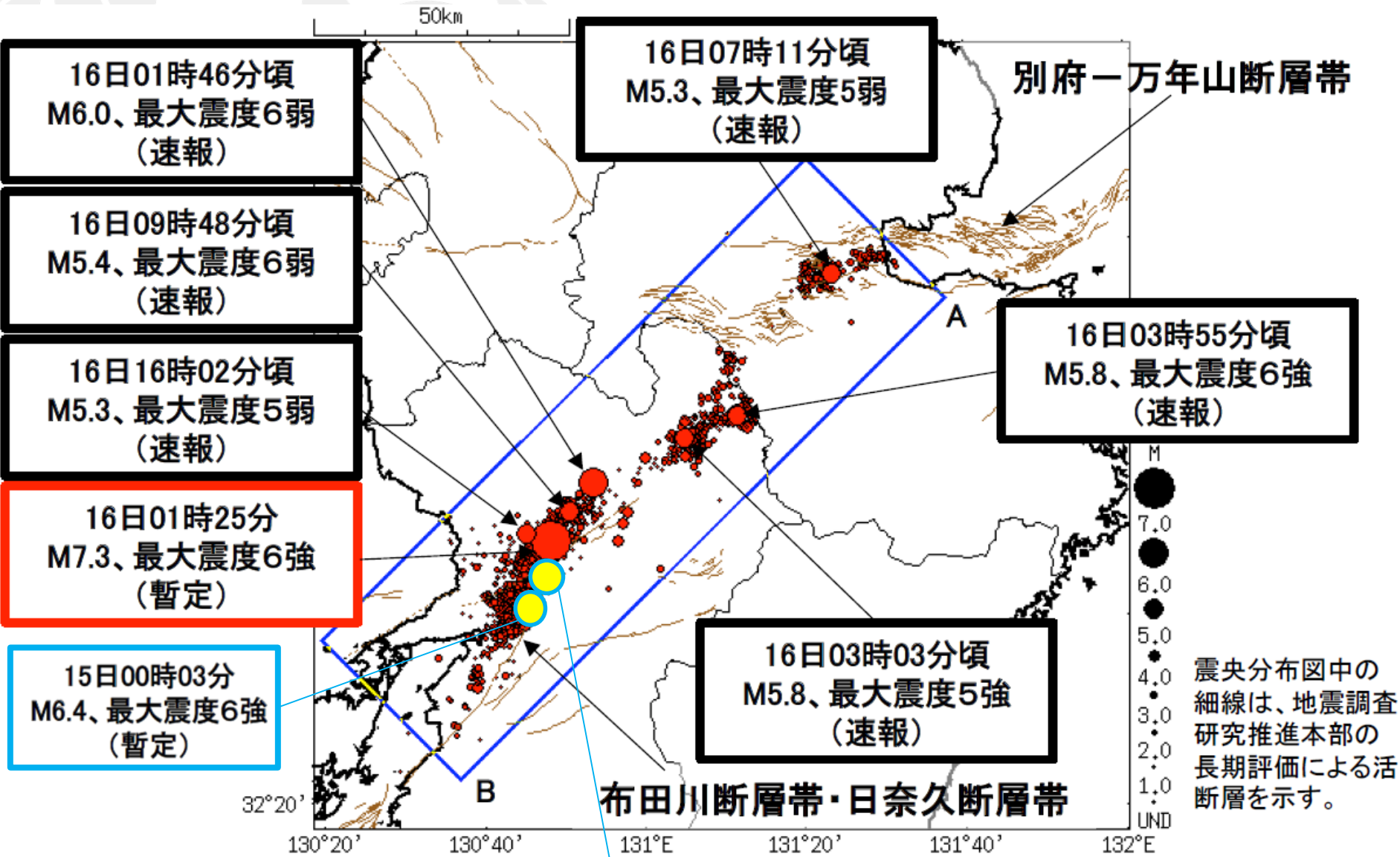


地震の概要

4月14日21時26分以降に発生した震度6弱以上を観測した地震

発生時刻	震央地名	マグニチュード	最大震度
4月14日 21時26分	熊本県熊本地方	6.5	7
4月14日 22時07分	熊本県熊本地方	5.7	6弱
4月15日 00時03分	熊本県熊本地方	6.4	6強
4月16日 01時25分	熊本県熊本地方	7.3	6強
4月16日 01時46分	熊本県熊本地方	6.0	6弱
4月16日 03時55分	熊本県阿蘇地方	5.8	6強

震央分布図



14日21時26分
M6.5、最大震度7
(暫定)

IRIDeS 現在までの対応(1)

- 4月14日および15日
- 21:26 熊本で地震(気象庁速報でM6.4,最大震度7)
- 21:44 佐々木助教からMLへ第一報, EMISは21:34より11府県で警戒運用中
- 22:26 **緊急調査WG情報収集チーム活動開始** 佐藤翔輔助教
チームリーダー
- 22:52 遠田教授NHK等でコメント
- 22:54 **専用HPを立ち上げ**
 - http://irides.tohoku.ac.jp/topics_disaster/2016kumamoto-eq.html
- 23:22 大野准教授から震度に関する情報提供
- 01:18 柴山准教授からライフライン情報
- 9:00 **緊急対応会議(災害調査対応本部設置)**
- 13:00 地震および対応について記者レク
- 夕方 第一チーム(森口准教授, 村尾教授, 柴山准教授)派遣

4.16.2016 Ecuador (M7.8) Earthquake

Updated on 2016/04/20 11:20 (JST)

A magnitude 7.8 earthquake struck the coastal region of Ecuador (South America) on Saturday, April 16, 2016 at 23:58 UTC. This quake was generated by reverse faulting of the Nazca and South American plates. Severe shaking was experienced near the coast, where the state of Manabi experienced heavy damage to buildings. As of April 19, the death toll is 413, in addition to over 2,500 injured, but these numbers are expected to grow as more victims are found.

The shallow fault rupture responsible for this quake occurred slightly inland of the coast. Though this quake does not pose any tsunami danger to Japan, tsunamis were reported along the coasts of Manta and Esmeraldas in Ecuador. As of now, no tsunami-induced damage has been reported.

IRIDeS response:

Near-field and far-field tsunami simulations were carried out, indicating up to 1.5 m runup possible along Ecuador's coastline, and no tsunami along Japan's coastline. These simulations results follow:

Near-field Tsunami Simulation - Laboratory of Remote Sensing and Geoinformatics for Disaster Management - IRIDeS (EN)

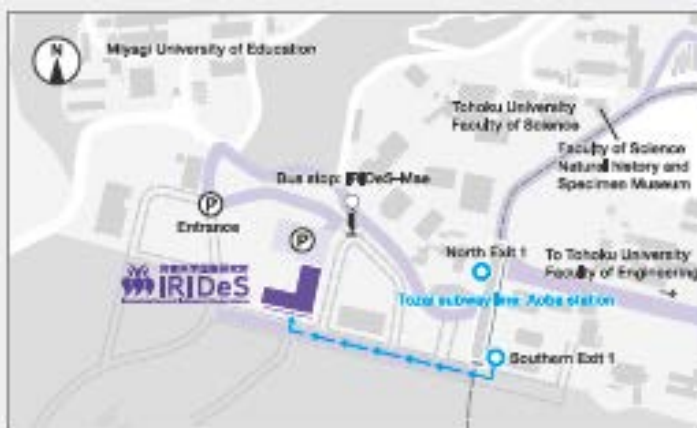
Far-field Tsunami Simulation - Laboratory of Remote Sensing and Geoinformatics for Disaster Management - IRIDeS (EN)



IRIDeS Enters Its Fourth Year



TOHOKU
UNIVERSITY

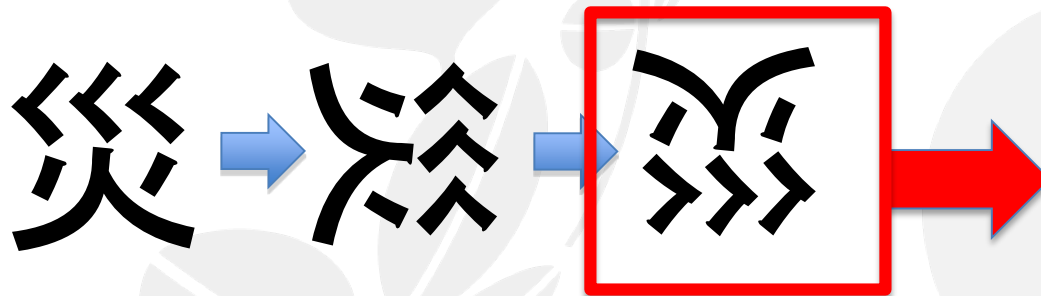


IRIDeS is now more accessible with Tozai Subway Line.

The Sendai Municipal Subway Tozai Line opened in December 2015. The station closest to IRIDeS is "Aobayama Station." Located only about 10 minutes from Sendai Station, it is now more accessible.



- Origin of logo meaning:
 - IRIS (plural)
 - Violet (Color of Iris)
 - (Color of Tohoku Univ.)
 - Nobility and desire
- Second : reversing Chinese Character for disaster



- A proverb: “Disaster turns into blessings”



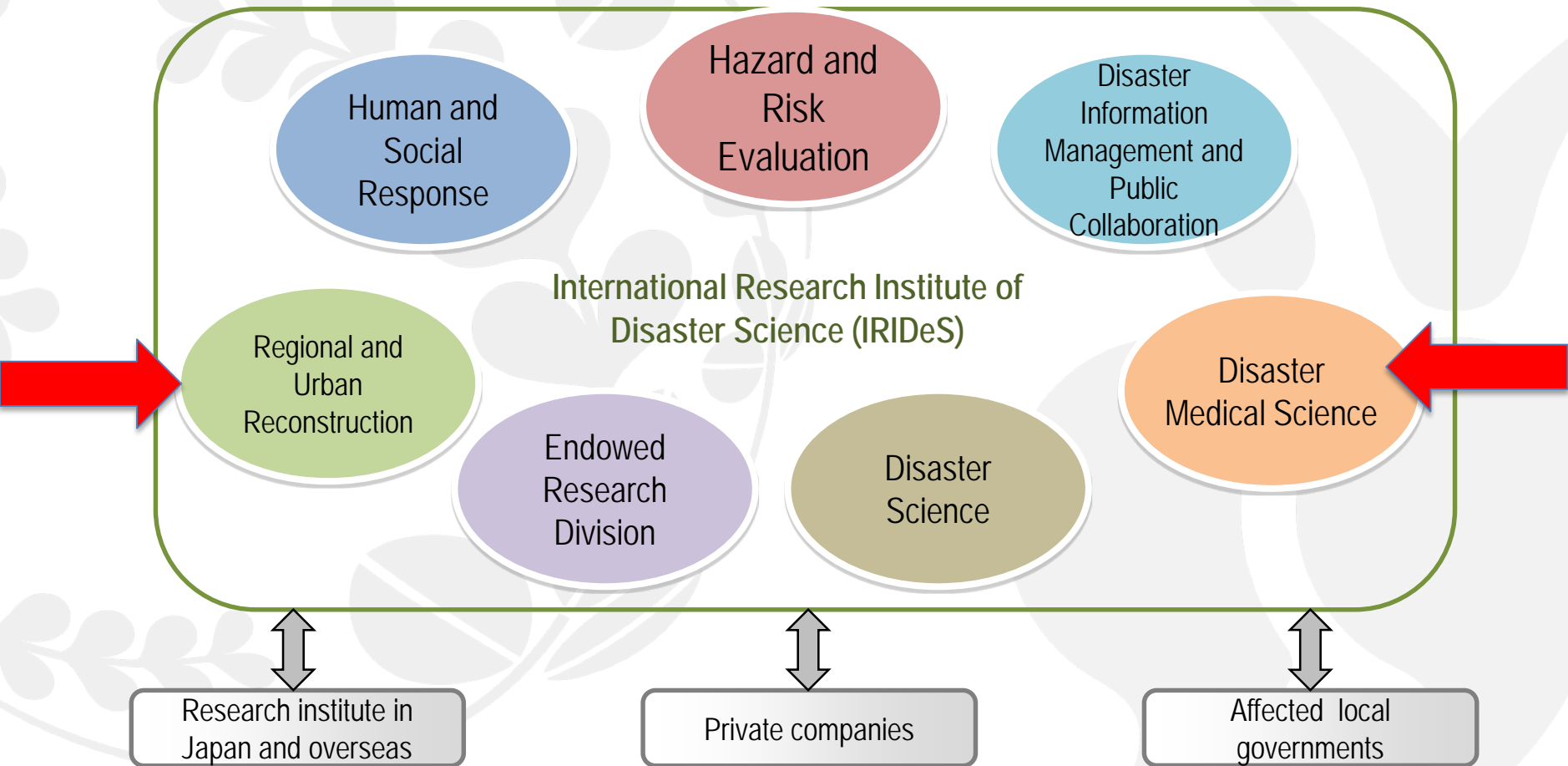
IRIDeS

International Research Institute
of Disaster Science

災害科学国際研究所

- Institutional structure

- 7 divisions, extensive collaboration beyond IRIDeS



Tsunami Disasters

- Huge amount of inundation (561 km²) + destructive wave force
- Direct and in-direct tsunami damages
- Floating of debris, ships, cars, tanks
- Fires by attack of ships, sea water, houses
- Damage on RC building with more than 3 story
- Change of topography and Geometry due to erosion and deposition

Ships and fire at Kesennuma



Destruction on building at Onagawa

