

# *Why IRIDeS takes an multidisciplinary approach to large scale disasters?*

なぜ学際連携で巨大災害の研究をするのか？  
東北大学災害科学国際研究所の特徴

Makoto OKUMURA

奥村 誠

Deputy Director,  
IRIDeS, Tohoku Univ.

東北大学  
災害科学国際研究所副所長



## 国立大学の3つの災害関係研究所

Disaster Disaster Institute settled in Major National University

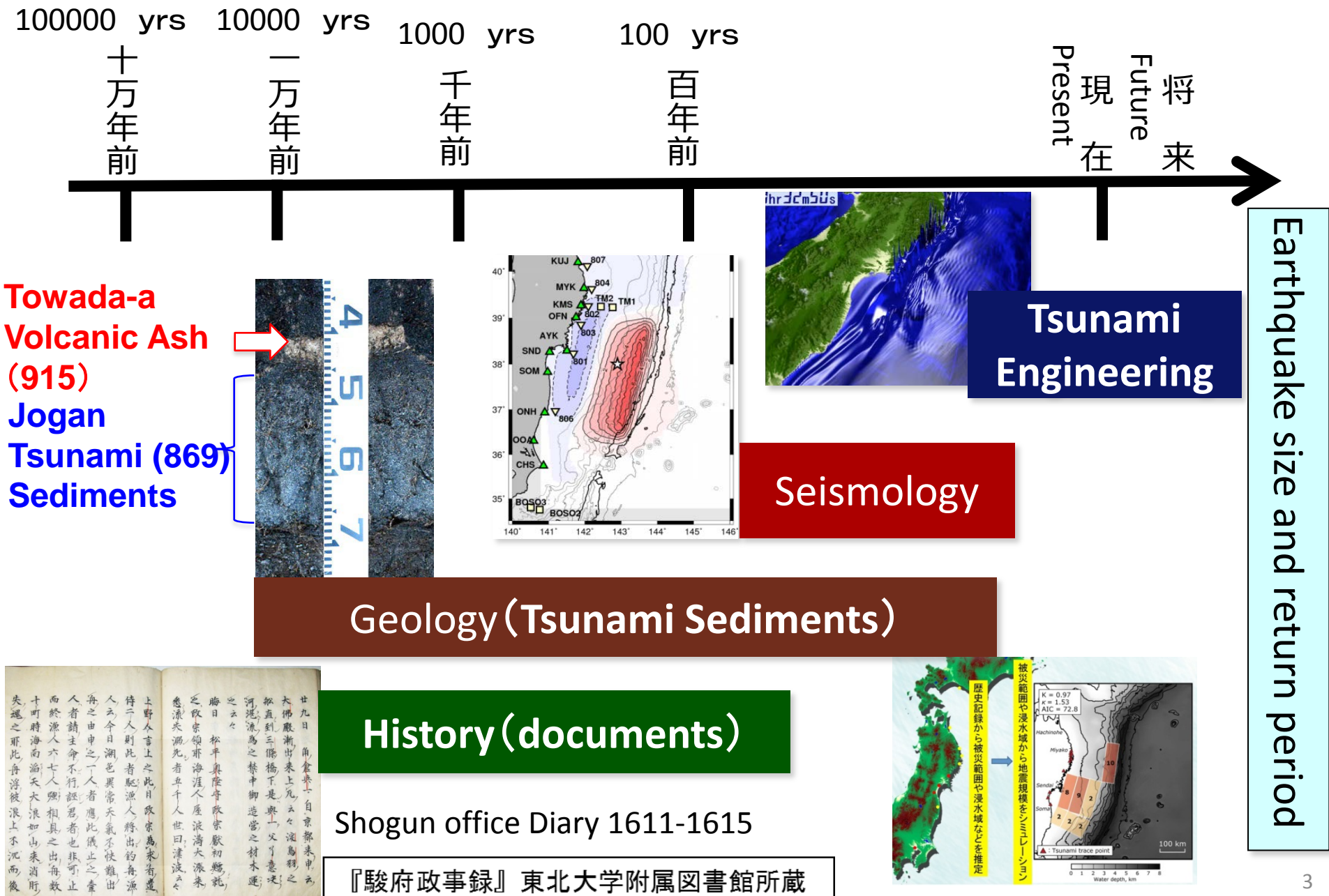
1923  
Great Kanto Earthquake  
関東大震災 → The University of Tokyo  
Earthquake Research Institute  
(1925-) 東大地震研

1950  
Typhoon Jane  
ジェーン台風 → Kyoto University  
Disaster Prevention Research  
Institute (1951-) 京大防災研

2011  
GEJE and Tsunami  
東日本大震災 → Tohoku University International  
Research Institute of Disaster  
Science (2012-) 東北大災害研

Establishment of a new research institute prepared for disasters of low frequency and high consequences (LFHCD). 低頻度巨大災害への備え

# (1) Expand our time scope to obtain LFHCD samples



## (2) Expand our Spatial scope to obtain LFHCD samples

Department Level Academic Exchange Agreements with Foreign Institutions

Deutsches Zentrum für Luft- und Raumfahrt

Faculty of Mathematics and Natural Sciences, Syiah Kuala University

The Edwin O. Reischauer Institute of Japanese Studies at Harvard University

University of the Philippines Manila

Institute of Geological and Nuclear Sciences Limited (GNS Science)

Angeles University Foundation

Center for Weather Climate and Disaster Research, National Taiwan University Taiwan

Project NOAH, Department of Science and Technology, the Cabinet

United Nations Development Programme (UNDP)

Germany Jul. 17, 2012

Indonesia Jun. 1, 2014

USA Jun. 13, 2014

Philippines Jun. 20, 2014

New Zea. Sep. 1, 2014

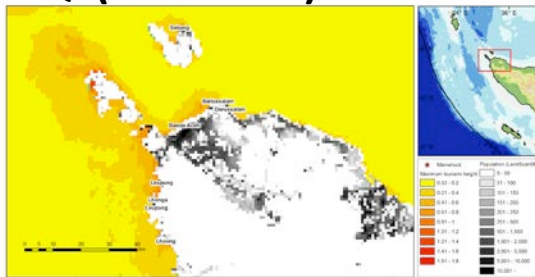
Philippines Nov. 3, 2014

Taiwan Mar. 17, 2015

Philippines Mar. 18, 2015

USA Aug. 4, 2015

### 2012.4 North Sumatra. EQ. (Indonesia)

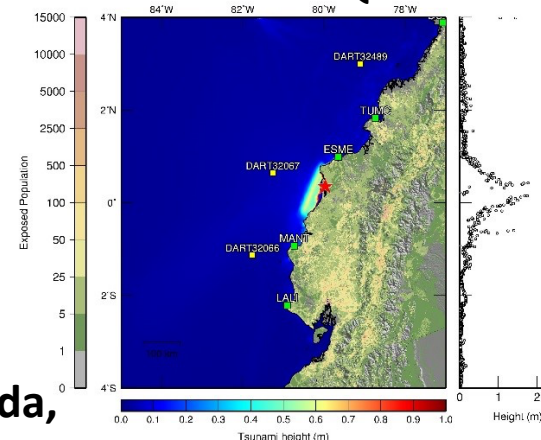


### 2013.1 Jakarta Floods



### 2013.11 Typhoon Yolanda, Haiyan (Philippines)

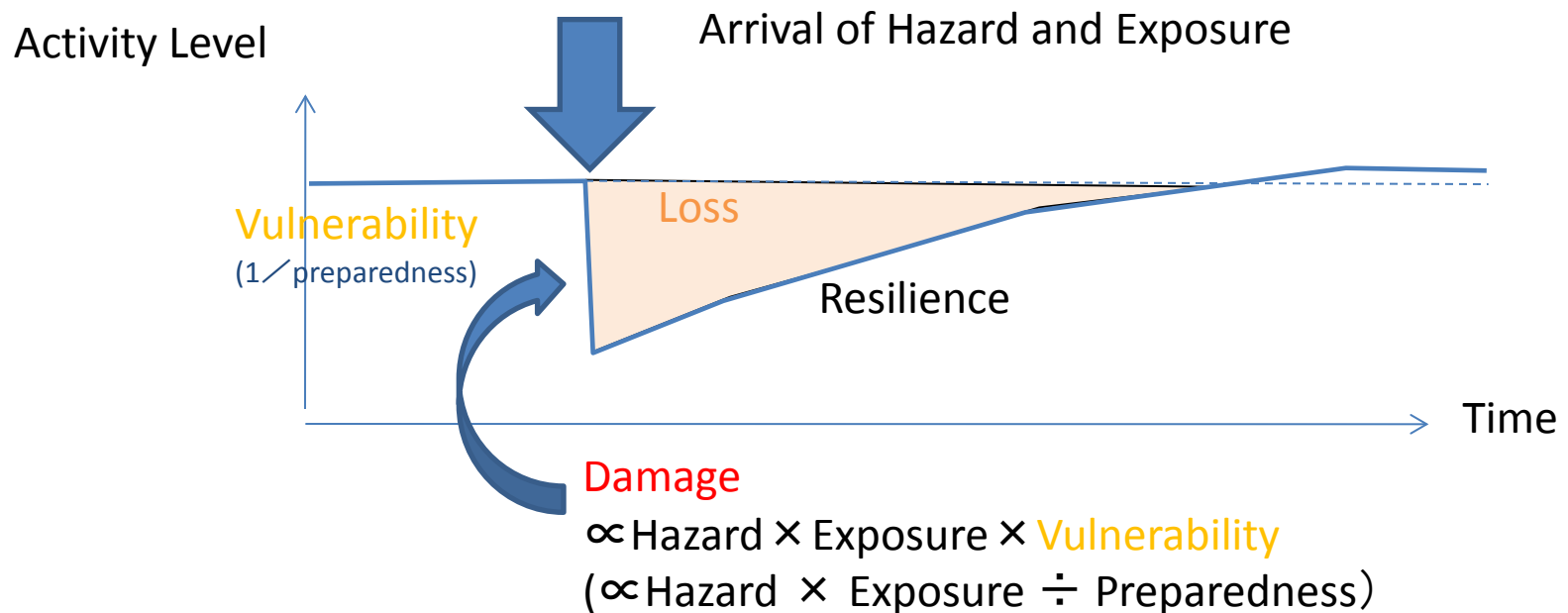
### 2016.4.16 Ecuador EQ.



### 2015.4.25 Nepal EQ. (Nepal)

# Towards Risk Management for LFHC Disasters

- Hazard                      Strength of natural event
- Exposure                  Inhabitants, industries, facilities
- Vulnerability              weakness of human-social system
- Resilience                Speed of bouncing back



# Adaptation Strategies

- We cannot control the Natural Hazards
- 

- Decrease the vulnerability (prevention)

- Building Facilities physically stronger

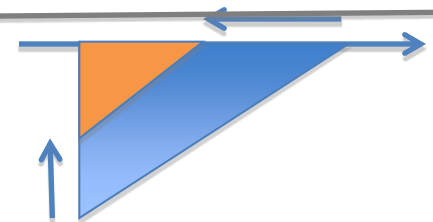
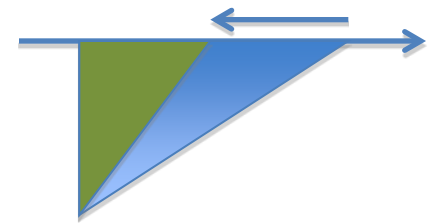
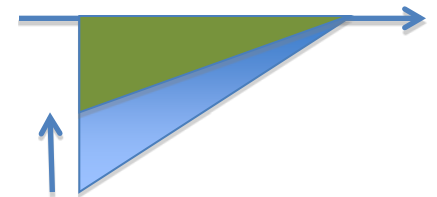
- Decrease the exposure (aversion)

- Land-use control
  - Temporal pre-disaster evacuation
- 

- Increase the resilience (mitigation)

- Back-up, storage, Response
  - Insurance, special finance
  - Business Continuity Plan (BCP)
- 

Combinations





# Need of Multi(inter)disciplinary Approach

- Decrease the vulnerability (prevention)

- Building Facilities physically stronger

Natural Science,  
Engineering

- Decrease the exposure (aversion)

- Land-use control
- Temporal evacuation

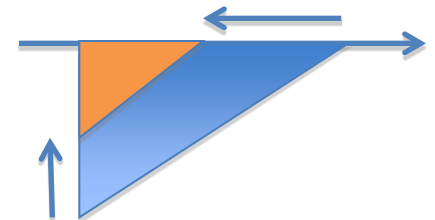
Social Science,  
Behavior Science  
Urban Planning

- Increase the resilience (mitigation)

- Back-up, storage, Response
- Insurance, special finance
- Business Continuation Planning (BCP)

Social Science,  
Economics  
Medical Science

Combinations



# Interdisciplinary approach to reduce total loss from a large-scale disaster 巨大災害の長期的影響を小さくする学際的アプローチ

Activity Level  
社会経済活動  
の水準

Arrival of Hazard and Exposure  
ハザードの襲来と暴露

直接被害  
Impact

Loss損失

Resilience  
回復力:レジリエンス

Time  
時間

Damage, Impact  
 $\propto \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}$   
直接被害  $\propto$  ハザード  $\times$  暴露  $\times$  脆弱性

**Prevention: 防災**  
Decrease Vulnerability  
Building Facilities  
physically stronger

**Aversion: 回避**  
Decrease Exposure  
Land-use control  
Quick evacuation

**Mitigation: 減災**  
Increase Resilience  
Back-up, storage,  
Response, Insurance

自然科学・工学  
Natural Science,  
Engineering

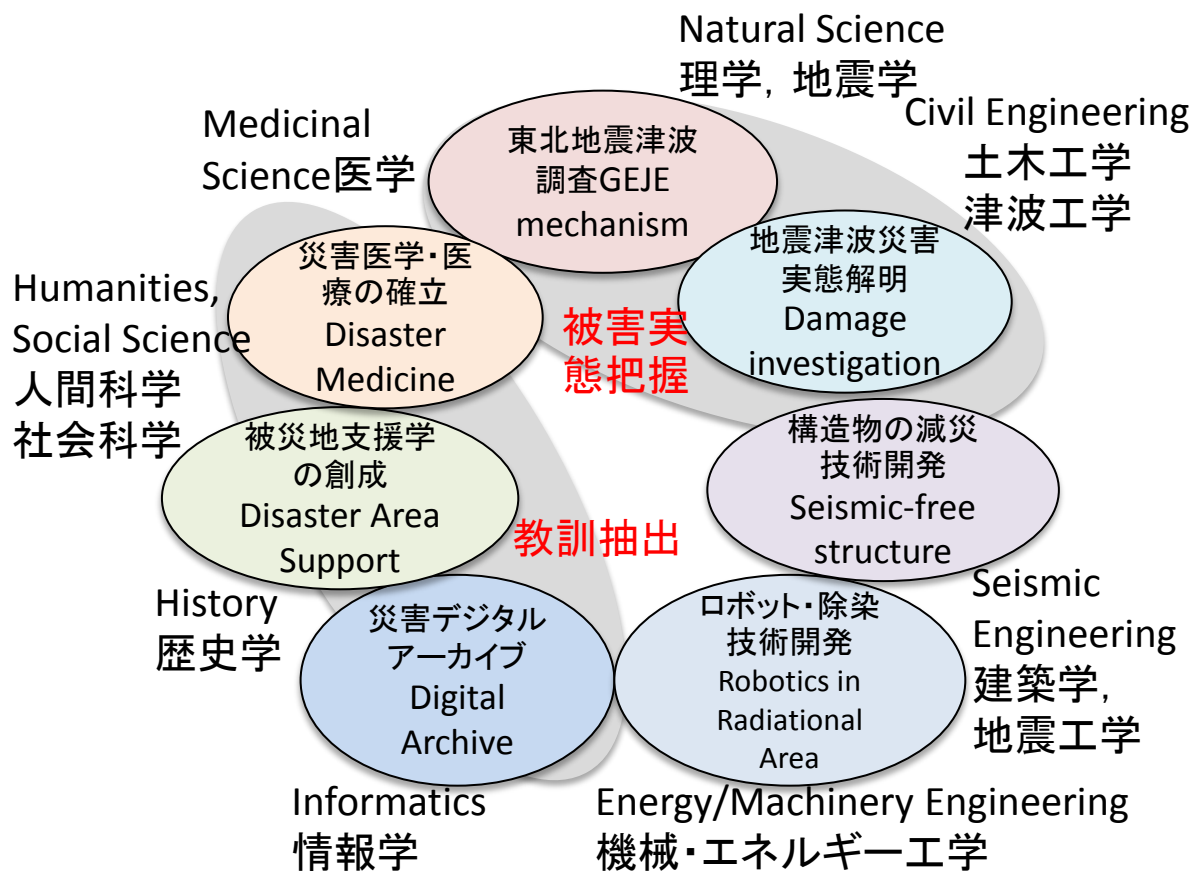
行動科学、都市計画  
Social Science, Behavior  
Science, Urban Planning

社会科学, 災害医学  
Social Science,  
Economics, Medical Science



# Action-based Disaster Mitigation 実践的防災学創成

## In the first phase of the IRIDeS



既存学問分野の災害研究への応用と融合

Application of Existent Research Disciplines to establish Action-based Disaster Mitigation

# Organization of IRIDeS 研究所の組織: 7部門37分野

## Organization of IRIDeS



# Uniqueness : Multi-interdisciplinary structure

Research area		Tohoku Univ. IRIDeS	Univ. of Tokyo E Institute	Kyoto Univ. D Institute	Niigata Univ. R Institute	Fukushima Univ. S Institute	D Institute (governmental)
Hazard and Risk Evaluation  Disaster Science	Earthquake, Tsunami	Hazard and Risk Assessment  Natural Disaster Science	研究所全体 (4部門, 4研究 センター, 3マネ ジメントセン ター)	地震・火山研究 グループ	環境変動科学 部門  複合災害科学 部門  地域安全科学 部門		地震・火山 研究ユニット 兵庫県耐震工学 研究センター
	Volcanic						
	Wind and Rain			地盤研究 グループ 大気・水研究 グループ			水・土砂防災 研究ユニット
	Snow Storm						雪氷防災 研究センター
Human & Social Response		Human and Social Response		総合防災 研究グループ	地域安全科学 部門	研究所全体 (11研究会)	災害リスク 研究ユニット
Regional & Urban Reconst- ruction	Regional safety	Regional and Urban Reconstruction					
	Radiation Decontamination						
	Robotics						
Medical Relief		Disaster Medical Science			地域安全科学 部門		
Public Cooperation		Information management		総合防災 研究グループ		研究所全体 (11研究会)	災害リスク 研究ユニット
International Collaboration		Yes	Yes	Yes			

\* Multi-interdisciplinary also includes research on different types/areas of hazards, low frequency high risk disasters 11

## People in IRIDeS

38 Professors(permanent), 30 Professors(5 years)  
39 Research assistants, 12 Bureaucratic staff.





## English name

IRIDeS

Iris, Iris laevigata or Japanese Iris : Symbol of hope and nobility

## Logo meaning

It is the deformed image of the Japanese character of disaster (災, wazawai) turned upside down, based on the idea of Japanese saying "Turn your misfortune to good account".

It represents our mission of learning the lessons from the 2011 Tohoku earthquake and tsunami disaster and pursuing effective disaster management to build sustainable and resilient societies. Iris is the symbol of "hope" and "dignity".





## Building of IRIDeS



The new building is located on the west side of the Aobayama campus, in a quiet location enclosed by green trees.

The five story RC building has a seismic isolation system, 72-hour emergency power generation, natural ventilation and light, a balcony preventing direct sunlight. It also has a space for conveying information to visitors, a multi-purpose hall for 150 people, seminar rooms, a lecture room, meeting rooms, a server room, and a library room.

Most of the research labs have glass walls, and each floor also features a common space to enable researchers interactions.



## Impressive Interdisciplinary researches 学際研究の例



- Great East Japan Earthquake Archive Project: Michinoku-Shinrokuden –
- Collaboration among over 120 organizations from industry, government, academia and the private sector.

Documenting images of the earthquake disaster as it happened.

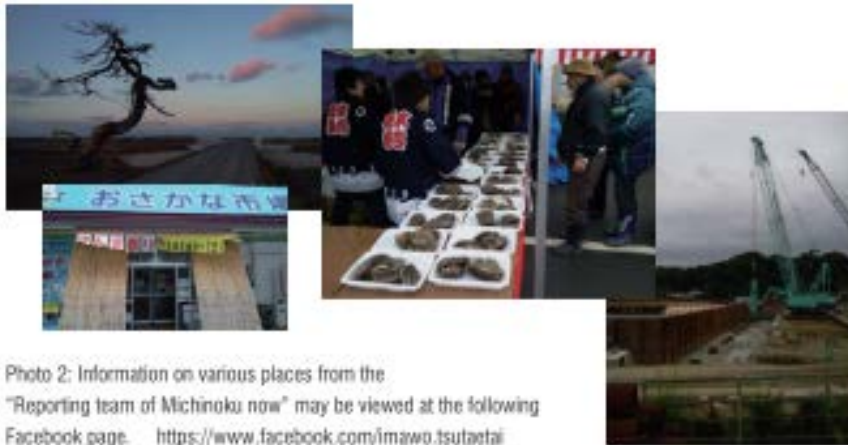


Photo 2: Information on various places from the "Reporting team of Michinoku now" may be viewed at the following Facebook page: <https://www.facebook.com/imawo.tsutaetai>



Kakeagare!  
Japan  
(Get Going!  
Japan)



Elementary school pupils wearing protective hoods rush to the school building of Tamaura Middle School (Tsunami evacuation drill, Iwanuma City, 2012)

***Kakeagare! Japan*** is a project that aims to habitualize evacuation behavior in preparation for a tsunami while tackling regional problems based on the lessons learned from the Great East Japan Earthquake. Tsunami evacuation drill programs are being planned and implemented in collaboration with industry, government and academia, including IRIDeS.

# Impressive Interdisciplinary researches 学際研究の例

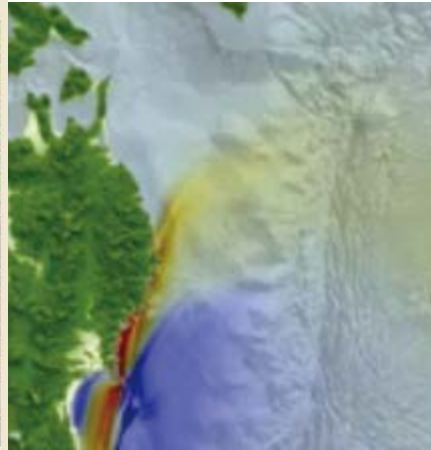
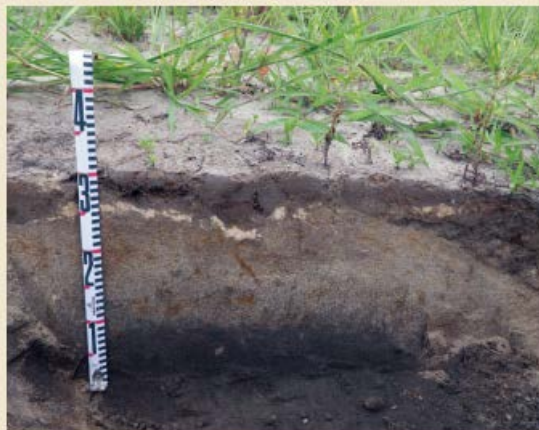
## Keicho period, Oshu Tsunami Project 慶長年間奥州津波研究プロジェクト

● Map of the Iwanuma area in the Edo period



About 400 years ago, “Keicho Period Oshu Earthquake Tsunami” struck the Pacific coast of the Tohoku Region. The accurate picture of the disaster is investigated by a team from the different areas.

● Geological layers on the coast of the Tohoku region



- *Analysis and Observations based on Hyogo Framework for Action (HFA)* - Publication of Preliminary Report outlining problems and calling for discussion.

国連防災世界会議に向けて、議論を加速させるためのHFA分析レポートの作成・発行



## IRIDeS Project Research 特定プロジェクト研究

The IRIDeS promotes publicly-offered project research with collaborating organizations from many countries and with broad areas of specializations. The aims of these research projects are not only to contribute to on-going recovery/reconstruction efforts in the affected areas but also to conduct world-leading research on natural disaster science and disaster mitigation.

1～2年間の研究プロジェクトを公募し、学内の共同研究、国際連携研究、及び被災地・関連他大学との連携研究を推進しています。  
公開報告会を年1回7月に実施しています。

## Meeting opportunities in IRIDeS 公開型の研究会の開催

IRIDeS will hold conferences and meetings on a regular basis, in order to share and disseminate our research progress and outcomes, and to promote research collaboration and integration.

### IRIDeS Friday forum

A forum of regular presentations and discussions is provided in order to share the information of research activities and collaborations at the IRIDeS. This forum also reports emergency disaster surveys.

金曜フォーラム 研究所内の研究成果を公開型で紹介・議論する催しです。



東北大学

# AREA-UNIT STRUCTURE from 2016

## Blooming a Comprehensive Mitigation System

**Academics  
learn from  
regions**

**【Phase 1】**  
Launching  
IRIDeS to  
enhance  
LFHC-D  
studies  
(2012–2015)

Collect the  
previously  
existent  
research  
areas  
relating  
Disaster  
(Academic-  
seeds  
oriented)

Success of  
UN  
Conference  
of DRR in  
Sendai  
(2015.3)  
and SFA

Compreh  
ensive  
inter-  
national

Outputs of Project  
1 (Facts, ) Lessens,  
from 2011 Disaster

Importance  
of  
consistency  
with local  
cultures  
and  
histories

local-based  
implement

TU Strategy⑤ Various Actions for Revival of the Tohoku Area affected in 2011

**【Phase 2】 (2016–2021)**

Build International Research center for Action-based Disaster Mitigation

**1 applicative research areas**

Comprehensive  
Disaster  
Mitigation System  
Implement  
**【Social】**

Expose outputs  
and outcomes,  
world-wide

Unique local-  
oriented actions

**5 fundamental research areas**

Medical Science and  
system for multi-  
hazard disaster  
**【Health】**

Resilience  
Engineering  
**【Technology】**

Support and  
response  
technologies  
**【Response】**

Disaster  
archive and  
Education  
**【Information】**

Mechanism of  
huge  
earthquake  
and Tsunami  
**【Fields】**

Lessens learned from 2011 Disaster, Multidisciplinary summarize over existent research fields.

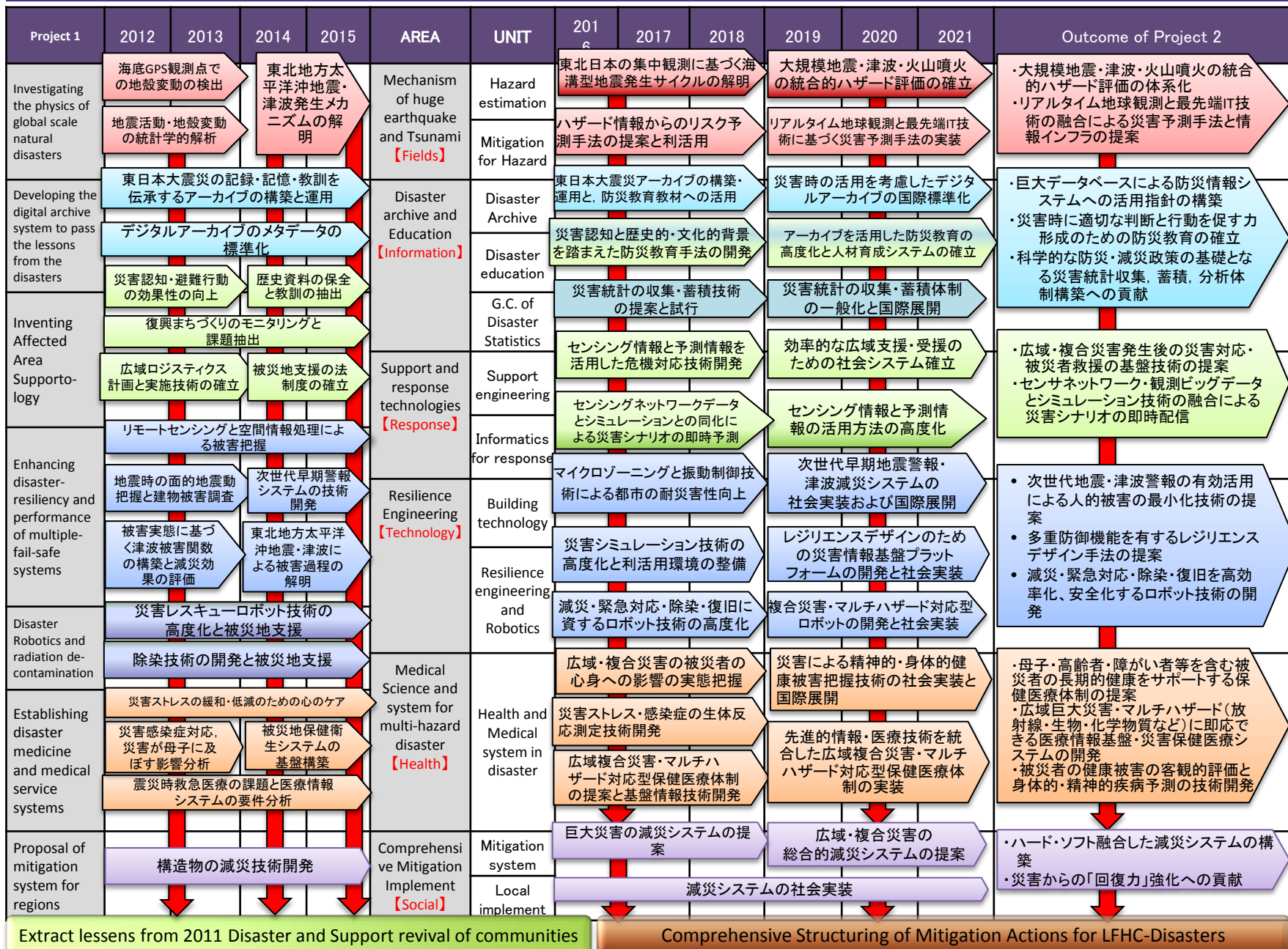
**Academics take action for regions**

Collaborative studies in 12 research units in 6 research areas





# Project 2 (under the AREA-UNIT structure) Timeline



Build up Action-based Disaster Mitigation and extending international applications

- Educational program
  - Establishing a disaster management program for higher education
  - Aims to educate internationally-prominent researchers in disaster management





- Inter-graduate School Doctoral Degree Program on Science of Global Safety (g-Safety)
- 2012-2018 supported by MEXT



- Inter-graduate School Doctoral Degree Program on Science of Global Safety

		Science of Natural Disasters Course	Safety and Security Engineering Course	Human Science Course	Quality Assurance
					Degree Examination
Doctoral Course	Doctoral Training (8 required credits)	Research Work			Proposal Defense
	C-Lab Training (1 required credit)	Specialized Seminar of Science for Natural Disasters	International Training of Action-based Disaster Mitigation	Independent Project Training	
	Multi-disciplinary Lectures	Special Studies of Action-based Disaster Mitigation -- 1 and 2, International Lectures of Action-based Disaster Mitigation (4 mandatory credits of selected subjects including Action-based Disaster Mitigation)			
Master's Course	Master's Training (8 required credits)	Pre-Research (Overview)			QE-II
	C-Lab Training (1 required credit)	Specialized Seminar of Science for Natural Disasters	Safety Engineering Frontier Training	Metrological Behavior Science Research Seminar	QE-I
	Multi-disciplinary Lectures	Action-based Disaster Mitigation (8 required credits of selected subjects including 4 credits of this subjects)			Basis of Practical Science for Disaster Prevention
		Deep Carbon Cycle Theory Natural Disaster Generation Mechanism Sun and Earth Environment Link Theory Biosphere Damage caused by Disasters	Theory of Disaster Prevention Systems Theory of Risk Management Theory of Energy Resource Strategies Theory of Technological Society	Special Studies of Sociology I Special Studies of Social Behavior Science I Theory of Sustainable Society Japanese Social History	
	Specialized Basic Subjects (8 required elective credits)	(2 selected subjects from major course and 1 selected subject from each of the others)			Standpoint of Integrated Science
		Special Studies of Resource Geochemistry Special Studies of Seismology 1 Special Studies of Volcano Physics 1 Special Studies of Marine Physics 1	Science for Seismic Hazard Control Science for Urban Safety Operation and Maintenance Engineering Theory of Environmental Energy	Mathematical Sociometrics Mathematical Socioeconomics Theory of Project Assessment Microeconomic System Methodology	
	Fundamental Subjects (3 required credits)	Philosophy	Sociology	Historical Science	Basis of Human Science

Core Formation of Science for Global Safety

# Thank you!

URLs:

<http://irides.tohoku.ac.jp/eng/index.html>

<http://irides.tohoku.ac.jp/index.html>

