SIP(Cross-ministerial Strategic Innovation Promotion Program)

“Enhancement of Societal Resiliency against Natural Disasters”

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SIP: Enhancement of societal resiliency against natural disasters

0. Background

Three Major Disasters in 20th Century

■ 1923 Kanto Earthquake（Fire）
Death toll: 105,000; Collapse & Fire: 320,000; Economic Loss: 45 million yen (one-third of then GDP)

■ 1995 Kobe（Strong Shaking）
Death toll: 6,434; Collapse & Fire: 100,000; Economic Loss: 10 trillion yen

■ 2011 Tohoku Earthquake（Tsunami）
Death toll: 18,524; Collapse: 120,000; Economic Loss: 16 - 25 trillion yen

Expected Nankai-Trough Earthquake & Metropolitan near-field earthquake

■ Expected Huge Nankai-Trough Earthquake（M9）（Shaking, Tsunami, and Fire）
Death toll: 323,000; Collapse & Fire: 2,400,000; Economic Loss: 220 trillion yen
Note that appropriated measures shall reduce death toll to 20% and direct loss to 50%.

■ Expected Metropolitan Near-Field Earthquake (M7)
Death toll: 23,000; Collapse & Fire: 610,000; Economic Loss: 95 trillion yen

Expected Tokyo Metropolis Flood and Inundation

■ Expected Tone-River Flood
Death toll: 26,000; Number suffered from flood: 2,300,000; Number isolated: 1,100,000

*「内閣府防災情報のページ」http://www.bousai.go.jp/fusuigai/index.html

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1. Objective

- To better protect our society against natural disasters such as large earthquakes and tsunamis, heavy rain and tornadoes, among others, focused are on the development of system to share disaster-related information in the real-time and between the public and private sectors, as well as the strengthening of capabilities to prevent the damage and enhance the post-disaster response.

2. Goal

- Develop a mechanism named “Resilience Information System” to share disaster-related information in the real-time and between the public and private sectors and to estimate the damage immediately after the disaster.
- Contribute to more prompt and efficient post-disaster rescues and responses such as evacuation, emergent repair, etc. to be implemented by a variety of disaster-response agencies.

Program Details & Schedule

Budget for program	**\2.33billion (for FY2016)**
Duration of program	**Five years (planned)**
Program management agency	**Japan Science and Technology Agency (JST)**

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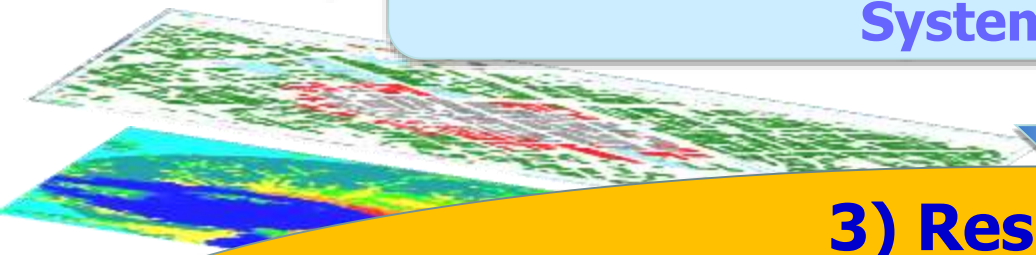
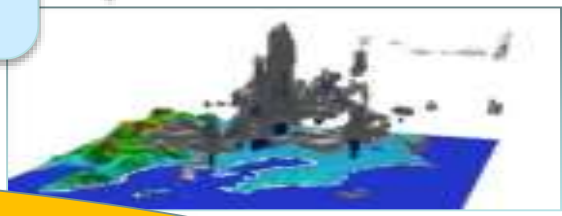
3. Target Areas

1) Prediction:
More accurate understanding and estimate of natural hazards using most advanced "prediction" technologies

2) Prevention:
Optimized strengthening of urban buildings and infrastructural systems

Sharing of Disaster-Related Information
(Development of Resilience Information System)





3) Response:
Sharing of disaster-related information, development of "Resilience Information System" by use of most advanced Information and Communication Technology and use of network for most effective disaster response activities

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4. Program Overview (1)

	1) Prediction	2) Prevention	3) Response
EQs and Tsunamis	① Tsunamis Prediction Technology 【NIED/Nagoya-U/PARI/ Tohoku-U/JAMSTEC】	③ Anti-liquefaction Technology 【PARI/PWRI/NRIFD】	④ Resilience Information System 【NIED/Tokyo-Tech/ NARO /HITACH】 ⑤ Real-time Disaster and Damage Prediction and Confirmation 【NIED/JAXA/NICT/RIKEN/NILIM/ Nigata-U】 ⑥ Secure Distribution of Disaster Information in Emergency 【NICT/NTT data/NTT docomo/ NTT/Tohoku-U/U-Aizu】 ⑦ Implementation and Enhancement of Disaster Response Measures by Local and Private Sectors 【Nagoya-U/Kogakuin-U/Kyoto-U/ Nigata-U/Setsunan-U/ Tokyo-Tech】
Heavy Rain and Tornados	② Heavy Rain and Tornadoes Prediction Technology 【NICT/TOSHIBA/JWA/ RTRI/NIED/NILIM/ Osaka-U/Saitama-U】		

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4. Program Overview (2): Special Features of SIP

What makes SIP different from numerous other government-sponsored research

"Common Voice" rather than a collection of individual projects

Clear, quantitative outcomes and direct contributions to urgent societal needs

Cross-ministerial cooperation and sharing information among ministries

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4. Program Overview (3) : Collaboration among Ministries

Prediction

① **Tsunami**

MEXT, MILT

② **Heavy Rain and tornados**

MIC, MEXT, MILT

Prevention

③ **Anti-Liquefaction Measures**

MILT, MIC, FDMA

④ **Information Sharing Using ICT and Collective Use**

MEXT, MILT, MHLW, MAFF

Response

⑤ **Real-time Disaster and Damage Prediction and Confirmation**

MEXT, MILT

⑥ **Secure Distribution of Disaster Information in Emergency**

MIC, FDMA

⑦ **Implementation and Enhancement of Disaster Response Measures by Local and Private Sectors**

Universities

総務省 (MIC: Ministry of Internal Affairs and Communications)
文部科学省 (MEXT: Ministry of Education, Culture, Sports, Science/Technology)
厚生労働省 (MHLW: Ministry of Health, Labour and Welfare)
農林水産省 (MAFF: Ministry of Agriculture, Forestry and Fisheries)
国土交通省 (MLIT: Ministry of Land, Infrastructure, Transport and Tourism)
消防庁 （FDAM: Fire Defense Agency）

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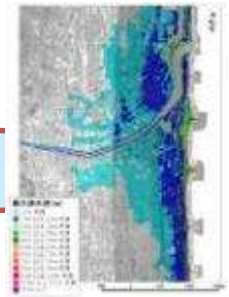
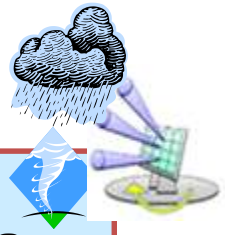
4. Program Overview (4) :Tangible Benefits Expected

Prediction



① **Tsunami**

Estimation of inundation in three minutes



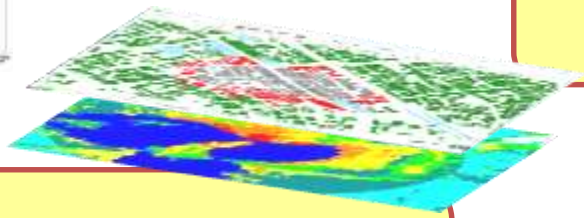
② **Heavy Rain and tornados**

One-hour prior estimation for flood

Prevention

③ **Anti-Liquefaction Measures**

Diagnosis and retrofit during operation



④ **Information Sharing Using ICT and Collective Use**

Connection among ministry information systems

Response

⑤ **Real-time Disaster and Damage Prediction and Confirmation**

Location and severity estimation in 30 seconds

⑥ **Secure Distribution of Disaster Information in Emergency**

Disaster alarms using fire alarm systems

⑦ **Implementation and Enhancement of Disaster Response Measures by Local and Private Sectors**

Preparation of Evacuation drills in various regions

Prediction/Forecast of Heavy Rain using MP-PAWR

Current Status

Capturing Rainfall Distribution (Every five minutes, quantitative, and every 30 seconds, qualitative)

Prospective in 3 Years

Capturing Spatial Distribution of Rainfall Distribution (Every 30 seconds, quantitative)

Advancement of Prediction (Qualitative to Quantitative)

MP Rader

Short-time Quantitative measurement

Water Vapor → Cumulonimbuses

Use of various radars

- Doppler Rader
- MP Rader
- Cloud Rader
- Passive Rader

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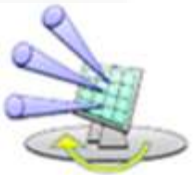
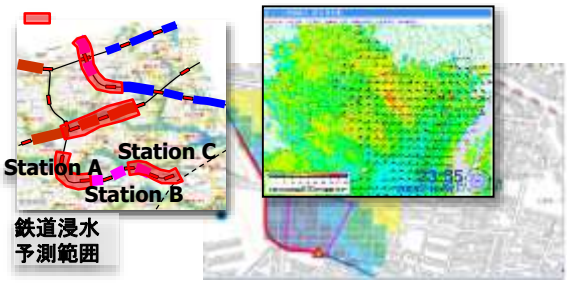


MP-PAWR

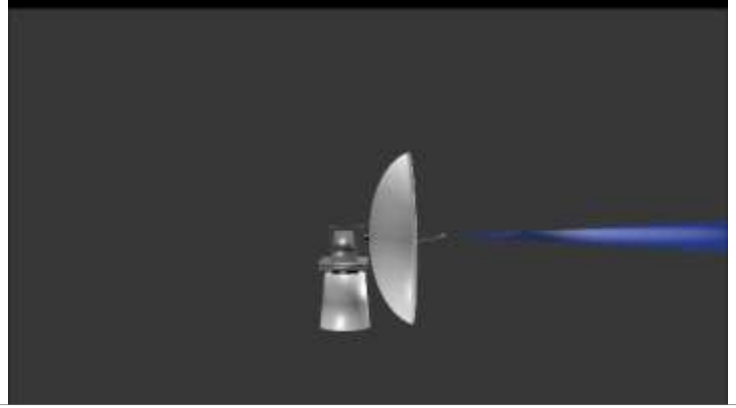
Disaster Responses

- Flood Control
- Railway Management
- Data Sharing
- Local Government Response



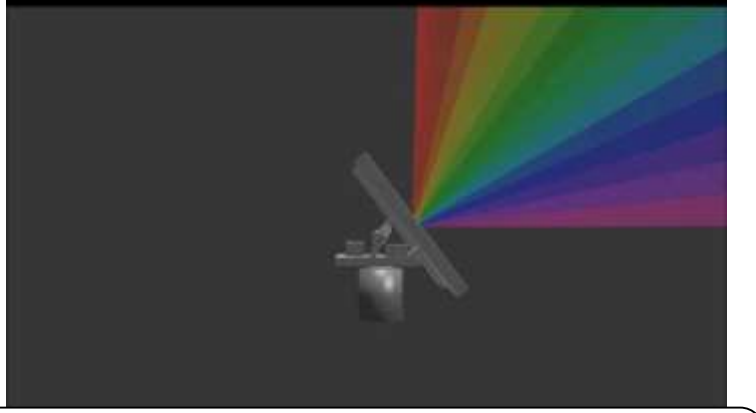
Development of Multi Parameter Phased Array Weather Radar (MP-PAWR) for Forecasting Heavy Rain

Parabollic Radar



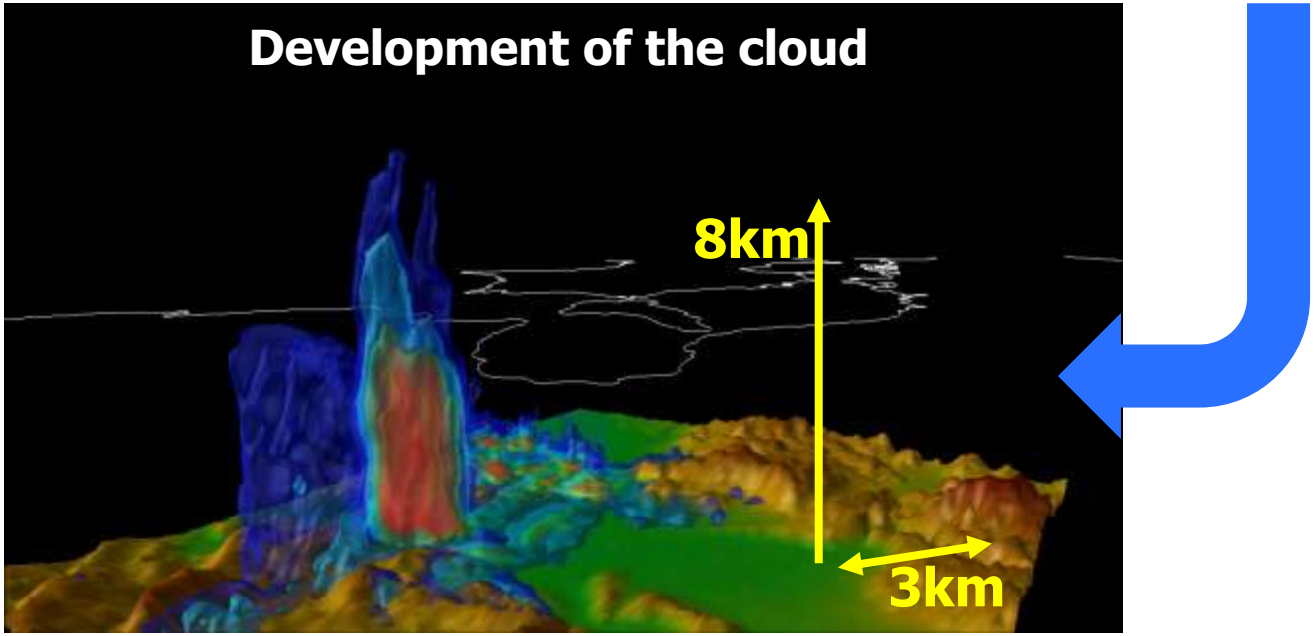
3D Recording by Multiple Round of Gyration → Five Minutes

Phased Array Radar



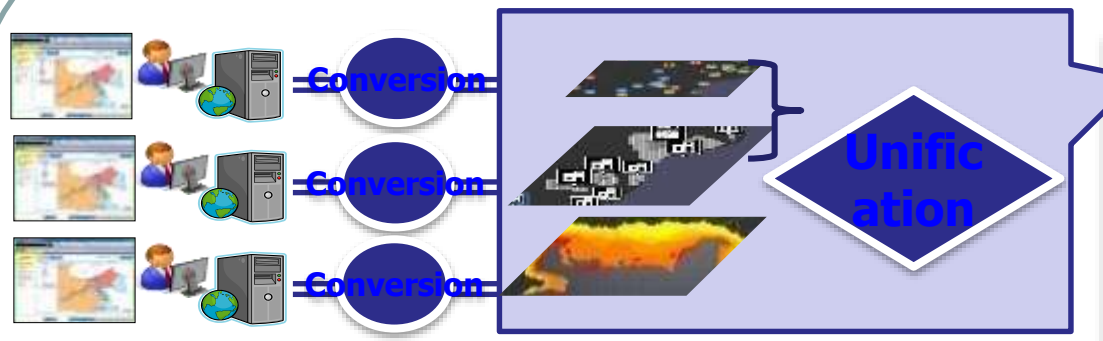
3D Recording by a Round of Gyration → 30 seconds

Development of the cloud



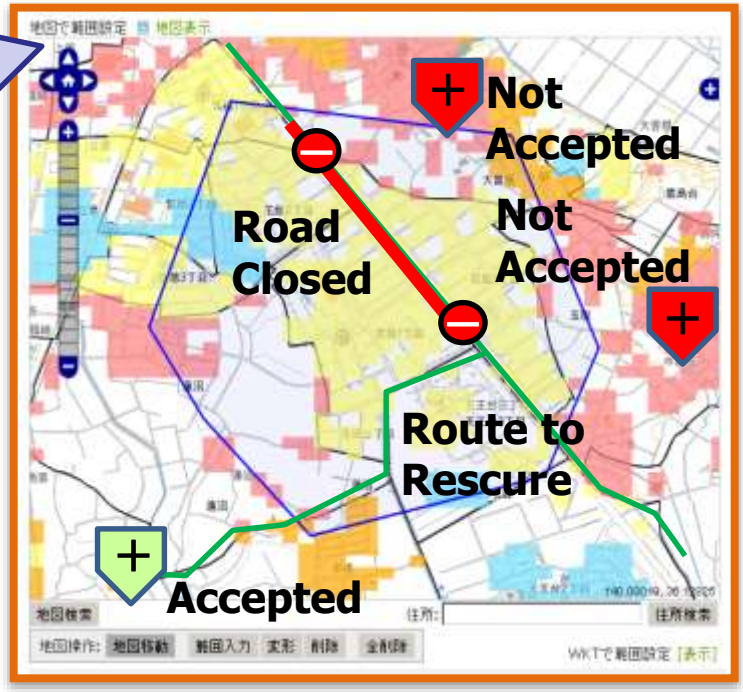
Development of Resilience Information System

Collection, Synthesis, Interpretation, Processing, Translation, Transformation, Sharing, and Dissemination of Disaster-Related Data and Information → among Governmental Agencies, Local Municipalities, Public Agencies, Private Firms, and Groups and Individuals ← Consideration into Hierarchy, Privacy, and Priority



Disaster Related Data and Information Collected by Respective Agencies

* Road Damage and Closure (MLIT)
* Road Regulations (Local Municipalities)
* Refugee Centers (MHLW)
* etc.



Processed Data Map

Real Time Damage Evaluation and Confirmation

Current Status

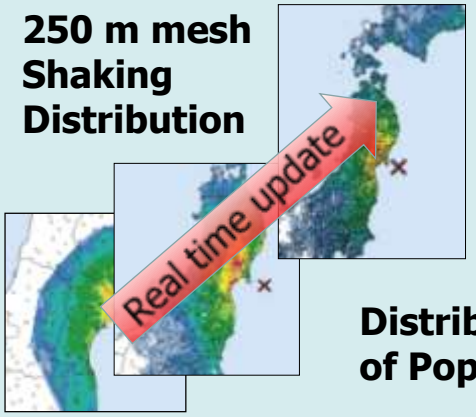
Map of shaking Intensity (1 km mesh) and approximate building damage distribution in a few minutes

Prospective in 3 Years

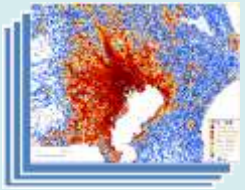
Map of building damage and human casualties (50 or 250 m mesh) in a few minutes

Shaking Prediction

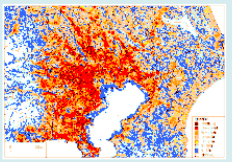
250 m mesh Shaking Distribution



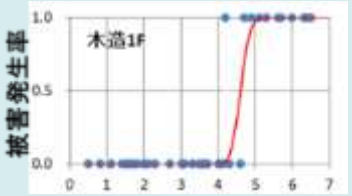
Soil and Ground Data

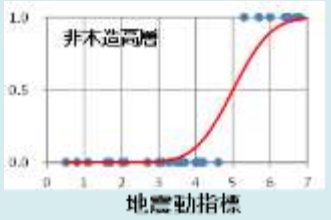


Distribution of Population

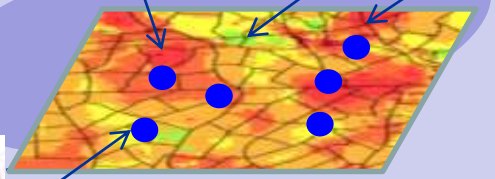


Fragility Functions for Building Damage



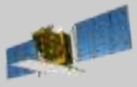


Damage Prediction

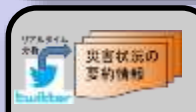


Confirmation

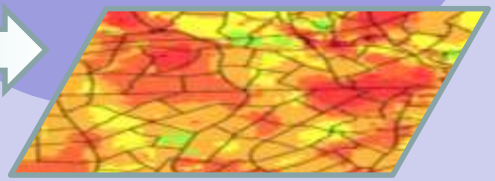
Data from Agencies



Satellite image



SNS

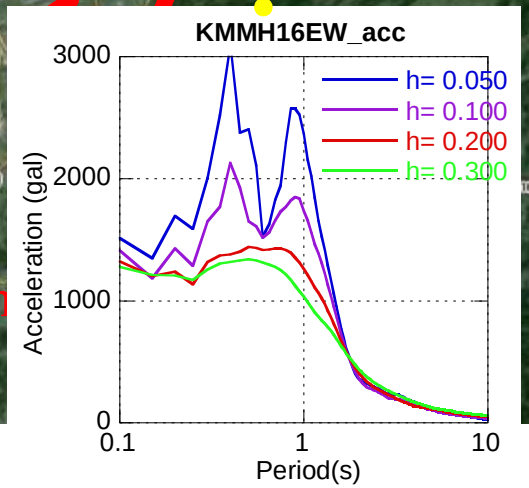


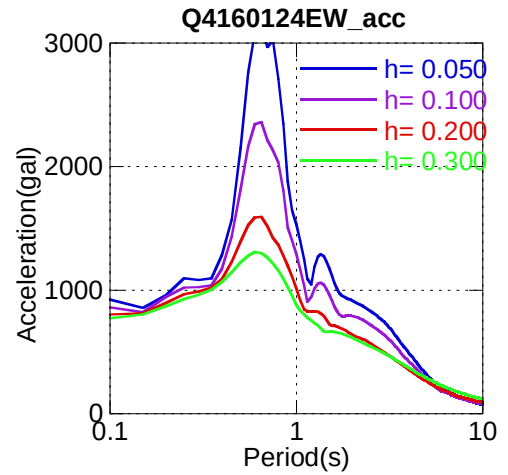
Prediction

2016 Kumamoto Earthquake

City of Kumamoto

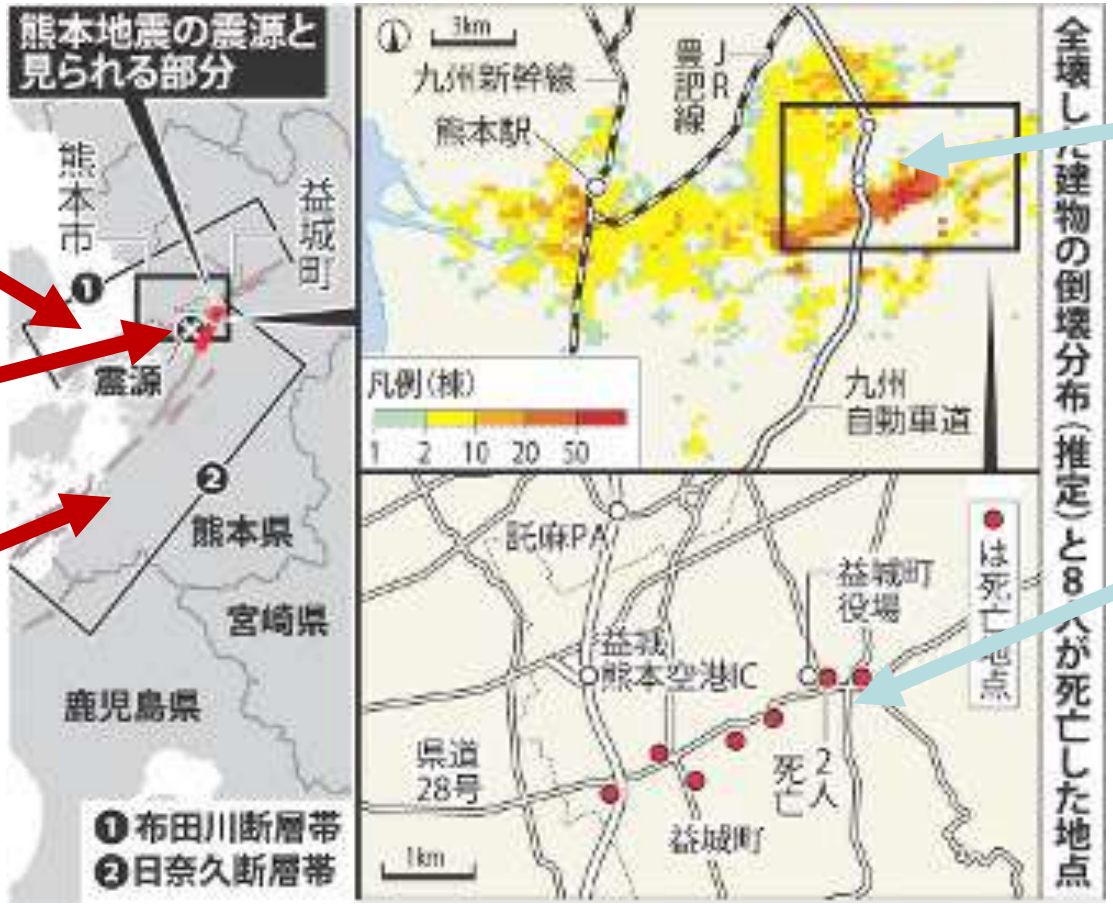
Futagawa Fault





SIP's Trials in 2016 Kumamoto Earthquake

The real-time damage prediction system was able to predict the most severely damaged location in reasonable accuracy within a few minutes, and the information was sent immediately to Central Government and Prefecture of Kumamoto...



Hinaku Fault

Epicenter

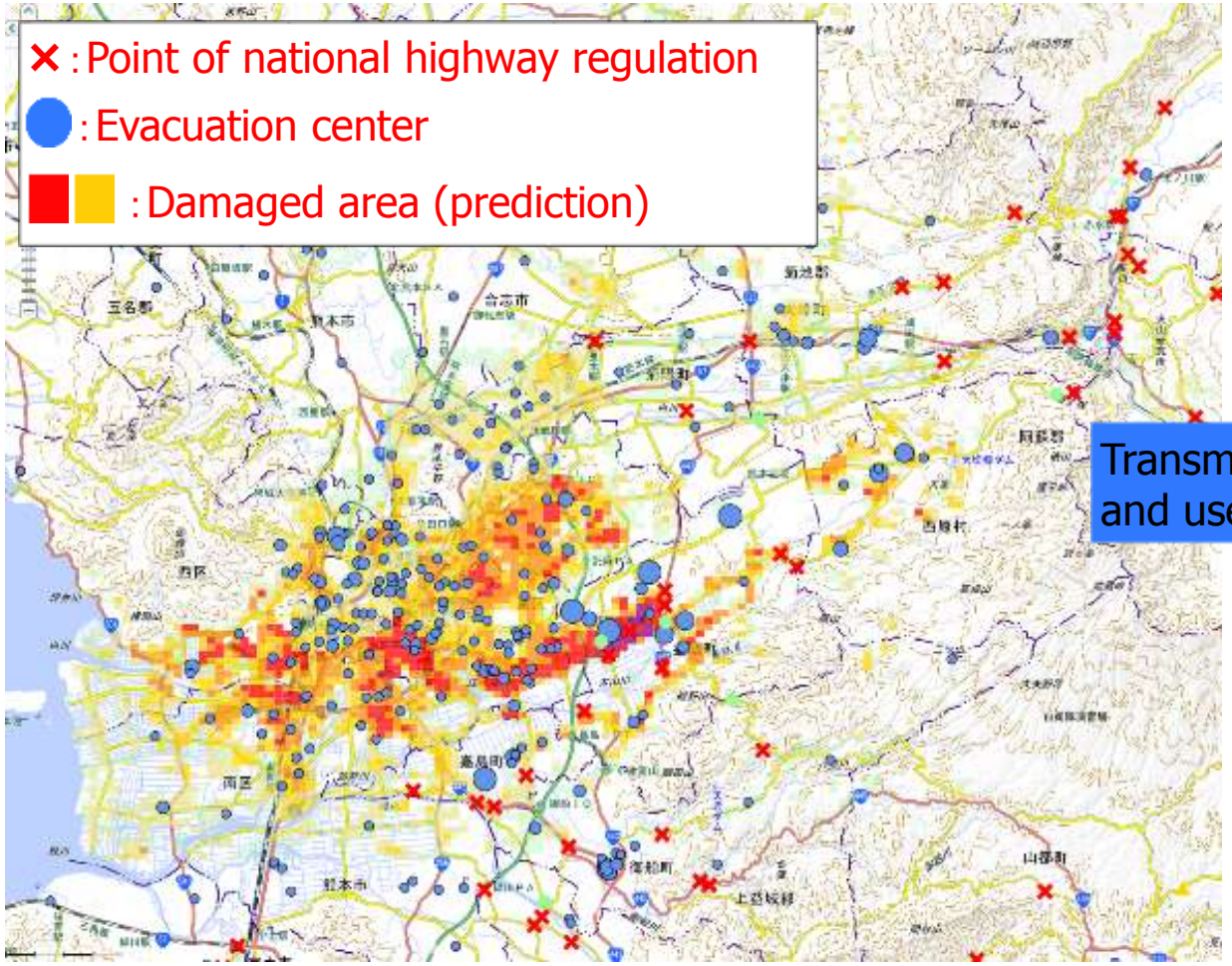
Futagawa Fault

SIP's Predicted Area of Most Intensive Shaking

Human Casualties

SIP's Trials in 2016 Kumamoto Earthquake

Information of evacuation center, damaged area and national highway regulation was gathered on one map. This map was utilized in extraction of support area for livelihood of disaster victims and examination of the route to area requiring assistance in Kumamoto.



Transmission and use

Governmental Disaster Management HQ

Local Disaster Mangement HQ (Kumamoto Prefecture)

Public Agencies

SIP: Structure of R&D Promotion

CSTI

Governing Board

Prof. Masayoshi Nakashima
Kyoto University

SIP: Enhancement of societal resiliency against natural disasters

PD (Program Director)

Sub-Program Directors
(Sub-PD: five experts)
Coordinator for Strategy Planning (two experts)

Promoting Committee
PD（chairman）、Sub-PD、Coordinator、
Related Ministries（Cabinet Secretariat (IT strategy/ National resilience) Cabinet Office(Disaster management/ STI), MIC, FDMA, MEXT, MHLW, MLIT,MAFF,METI) / JST

JST
（Management Agency）

Advisory Committee

Prediction Sub-PD

Prevention Sub-PD

Response Sub-PD

①Tsunami SC*

②Heavy Rain SC

③ Anti-liquefaction SC

④ Resilience Info. System SC

⑤ Real-time Damage Prediction SC

⑥ Distribution of Information SC

⑦ Implementation SC

*SC: Steering Committee

Local Governments/ Private companies/Local communities etc.

SIP-related Information Site

Cabinet Office (内閣府)
http://www8.cao.go.jp/cstp/english/index.html

Japan Science and Technology (科学技術振興機構)
http://www.jst.go.jp/EN/index.html

National Research Institute for Earth Science and Disaster Resilience (防災科学技術研究所)
http://www.bosai.go.jp/e/

National Institute of Information and Communication Technology (情報通信研究機構)
https://www.nict.go.jp/en/index.html

Thank you very much
for your kind attention!

http://www8.cao.go.jp/cstp/english/index.html