

**Sixth Plenary Meeting of UN-GGIM-AP**

**Special Session on  
Geospatial Information for Disaster Response**

**-Case Study on 2016 Kumamoto Earthquake-**

**Part 2  
Outset of the 2016 Kumamoto Earthquake**

**4:45pm-5:30pm, 17<sup>th</sup> October 2017**



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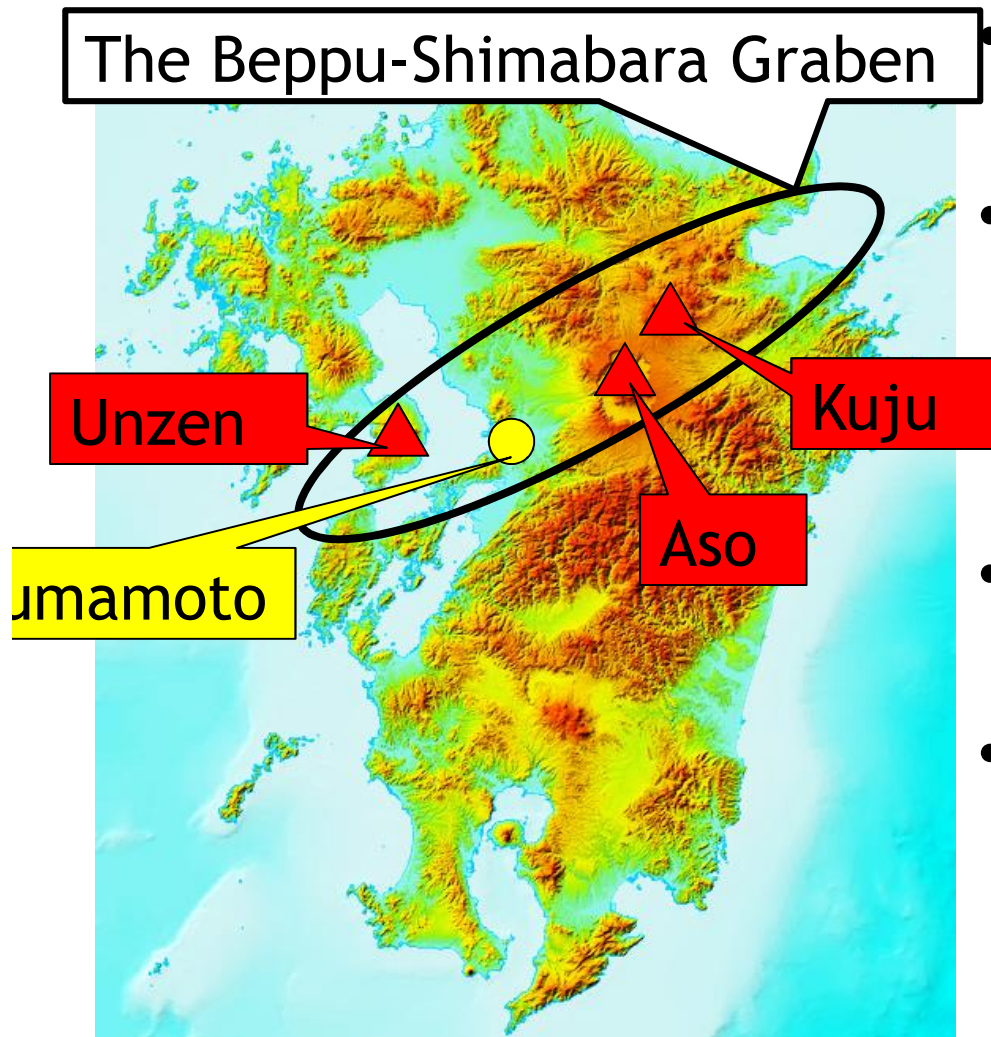
# Geography of Kumamoto Prefecture



- In Kyushu island
- 900km WSW of Tokyo
- 120km S of Fukuoka
- Population: 1.76 mil.
- Area: 7,400 sq. km
- Capital: Kumamoto city



# The Beppu-Shimabara Graben



- Tectonic zone: length 200km, width 20-30km
- Pulling Kyushu island apart, north and south
- Right-slip and normal faults develop in the zone
- Volcanoes develop: Kuju, Aso and Unzen
- Thick layer of volcanic deposit, topographically high despite the sinking structure



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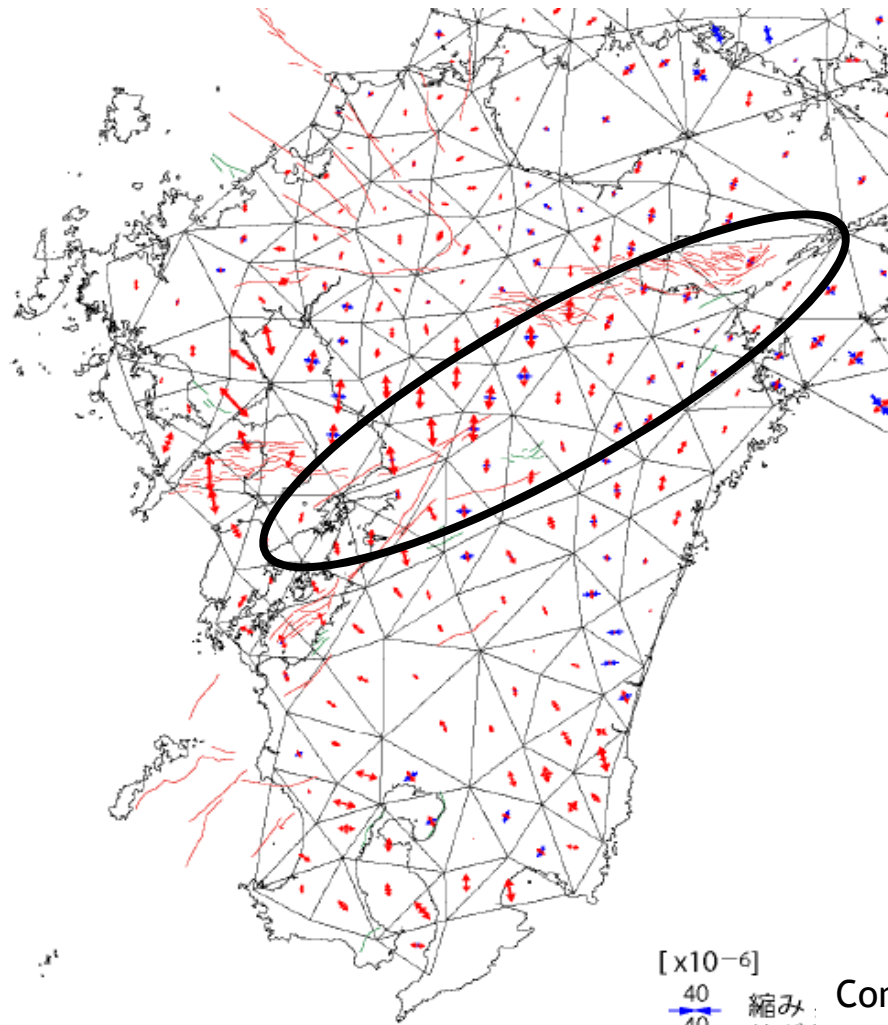
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# The separating Kyushu



- Horizontal strain distribution map
- Based on geodetic Survey 1883-1994
- Extension Axes (Red Arrows) dominate around the Beppu-Shimabara Graben
- Northern and Southern parts of Kyushu are pulled apart

[ $\times 10^{-6}$ ]

40 縮み  
40 伸び

Contraction  
Extension

Principal Axes of Strain

Ref. The Headquarters For Earthquake Research

Promotion [http://www.jishin.go.jp/main/chousa/13feb\\_chi\\_kyushu/k\\_honbun.pdf](http://www.jishin.go.jp/main/chousa/13feb_chi_kyushu/k_honbun.pdf)



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**You are now in Kumamoto  
The time is supposed to be  
9:25pm, 14 April 2016 (Thursday)**



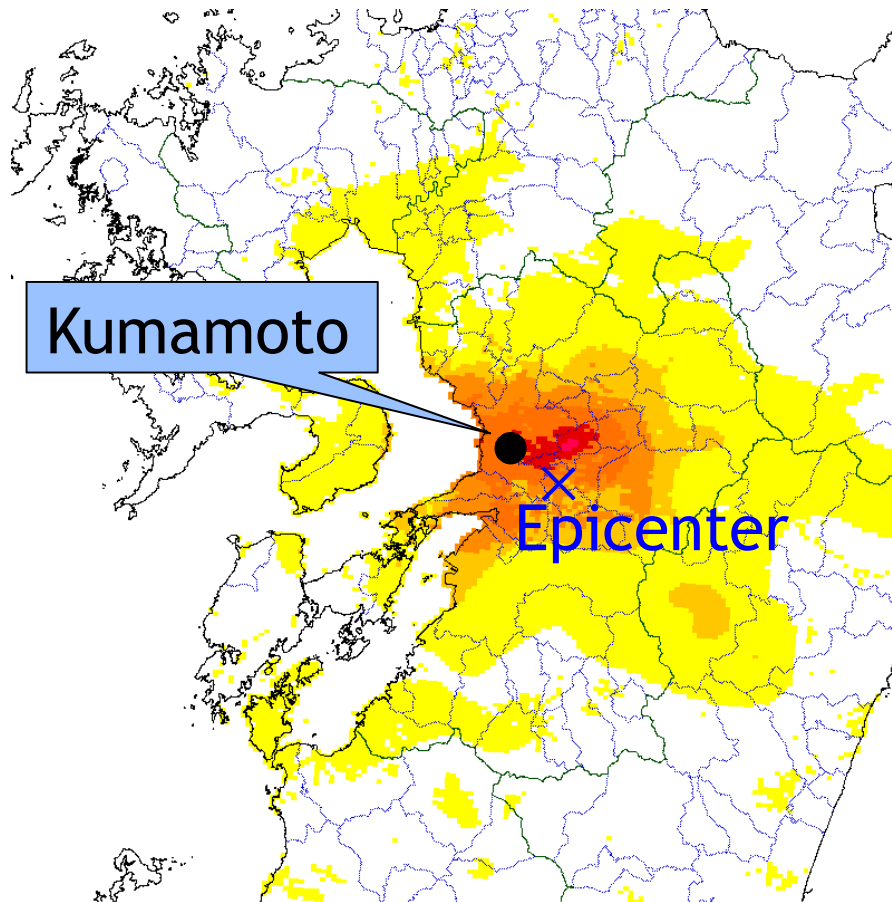
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# The first shock came



Ref. Japan Meteorological Agency

Japanese seismic  
intensity scale



- Occurred 9:26pm, 14 April 2016
- Magnitude (Mj): 6.5
- Focal Depth: 11km
- By the movement of the Hinagu Fault
- Terrible shock felt in large parts of Kumamoto Prefecture
- Scale 7 in Mashiki town



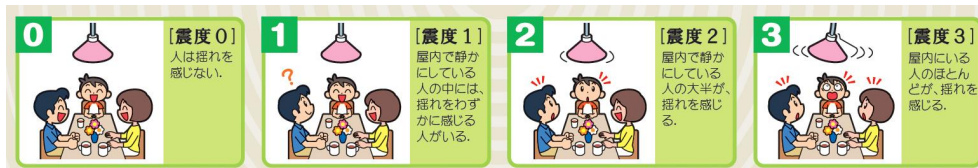
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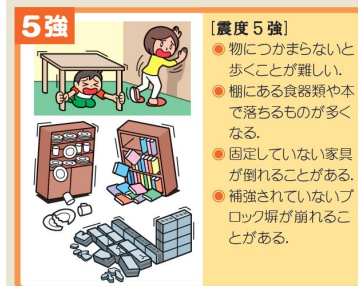
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# Japanese seismic intensity scale



Scale 1,2,3: Mild shake, no damage



Scale 4,5-,5+: Middle shake, small damage may occur



Scale 6-,6+,7: Serious shake, large damage occurs



Ref. Japan Meteorological Agency

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# Earthquake Early Warning (EEW)

- Issues a warning in several to several tens of second before the arrival of large shock
- Operated by Meteorological Agency, broadcast by various kinds of media



Compulsory  
broadcast through  
mobile phones



TV (National Broadcast  
Corporation):  
Earthquake warning  
Screen



Search Engine  
(Yahoo! JAPAN):  
Notice of the  
earthquake



Sound Ref: <http://okoya.seesaa.net/article/164511396.html>  
Ref: Japan Broadcasting Corporation web site

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# Topics for discussion #2

- What kind of initial responses should or could be made by NGIAs immediately after the outset of a disaster?
- For example, how should the employees be informed and summoned to the office, and what kind of responses should they make?
- What kind of decisions should be made by an organization immediately after a disaster?



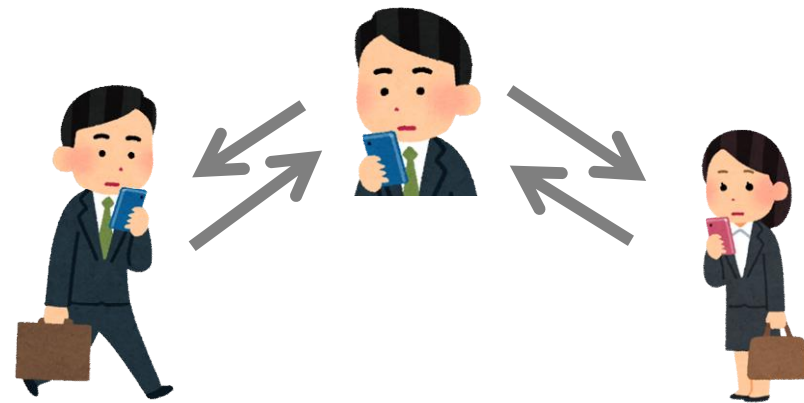
# Starting initial responses

## Safety check of GSI staff and family members



- Answer via mobile phone
- Auto collection of results
- All respondents in Kyushu region were safe

## Staff availability check “Ten-minutes rule”



- GSI-DRM office sends availability check e-mail message
- Senior officials and related staff need to acknowledge the receipt within 10 minutes.



# Starting initial responses

**Teleconference  
(1<sup>st</sup> GSI DMHQ meeting)  
10:15pm 14 April**



**2<sup>nd</sup> Headquarters meeting  
00:30am 15 April**



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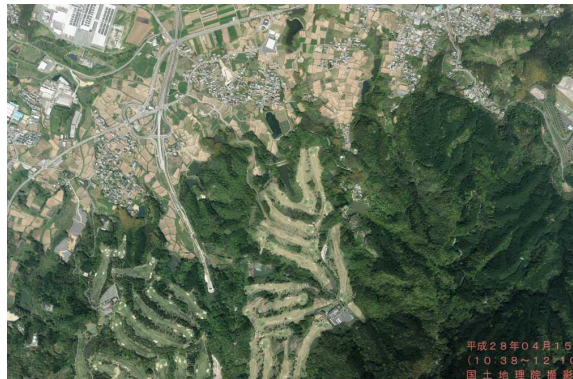
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# Initial response (1) : areal photography

- GSI Aircraft was 1,000km away from Kumamoto, unavailable for immediate response
- Private company aircraft took initial photographs based on the partnership agreement



Vertical Photo  
Coverage



Vertical Photo  
From 10am 15 April



Oblique Photo  
From 7am 15 April



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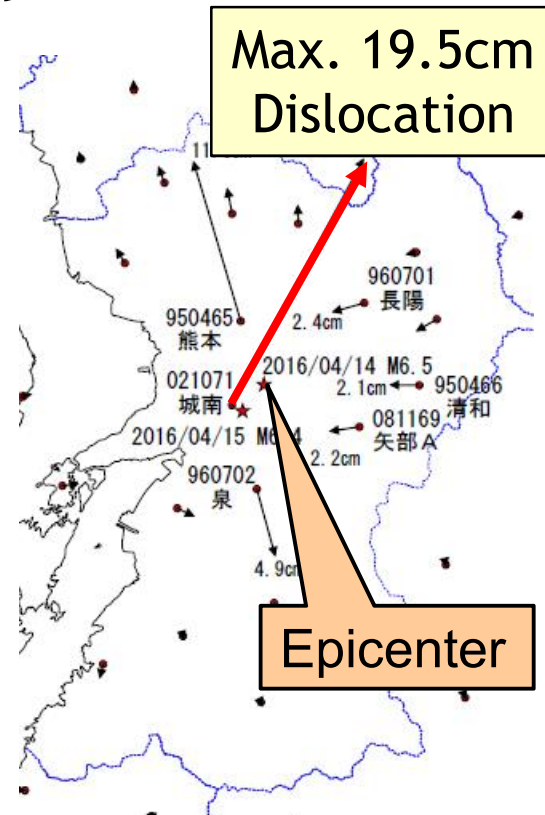


# Initial response (2) : crustal movement

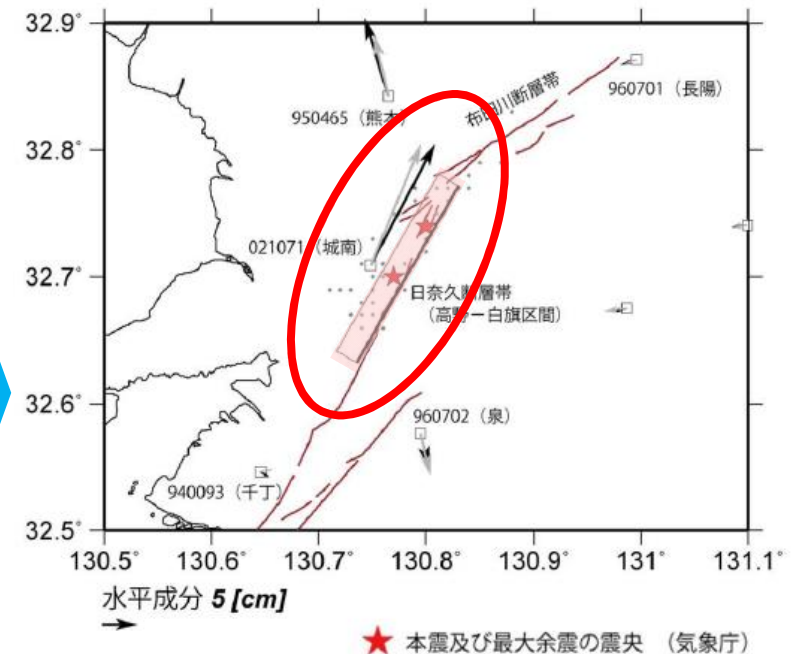
- CORS analysis and fault modelling were conducted



Check CORS status  
Data acquisition



Quick Solution  
(Q3 Analysis)  
Horizontal

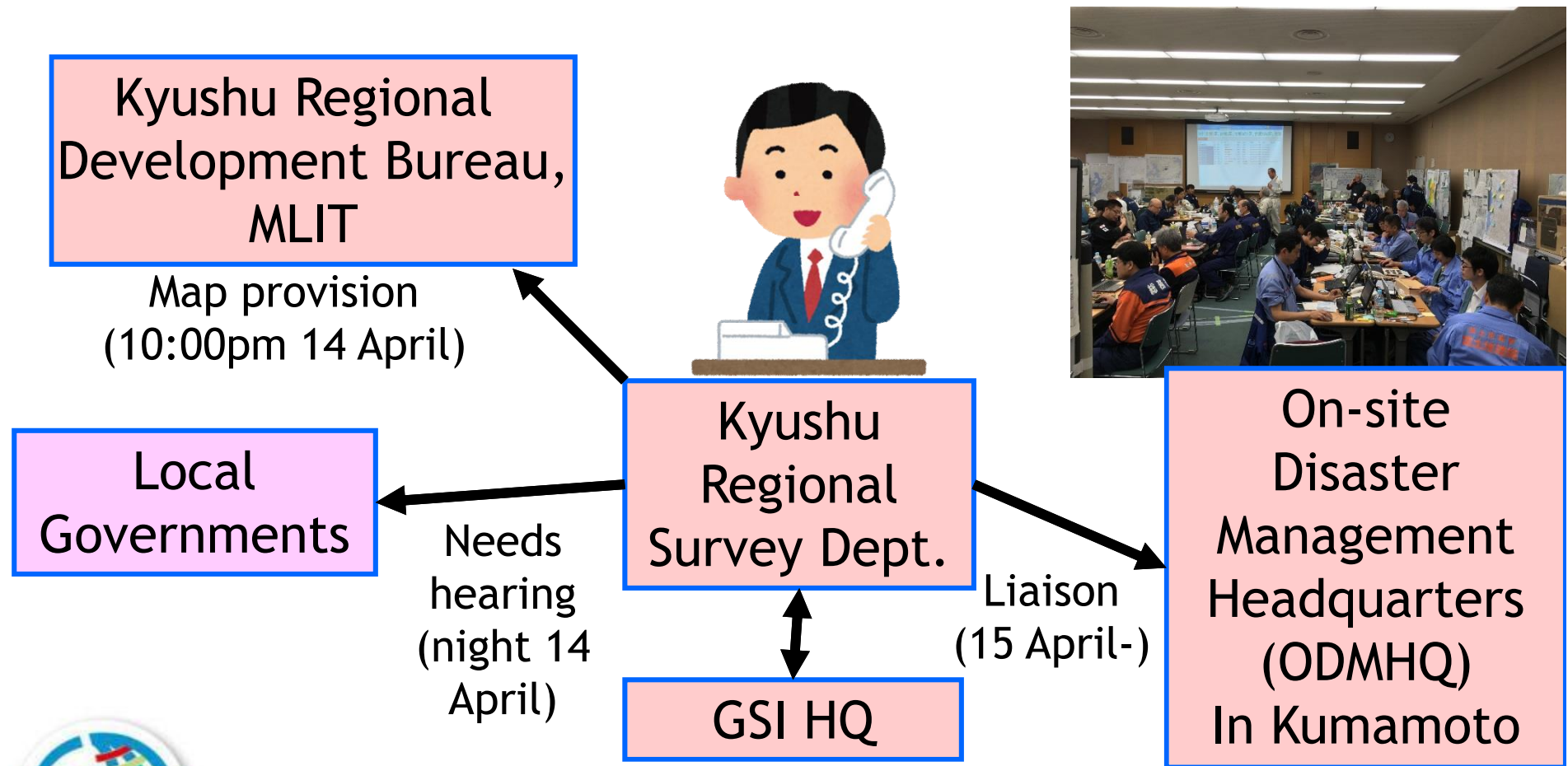


Estimated Fault Model  
(Along Hinagu Fault)  
Max. slip 60cm



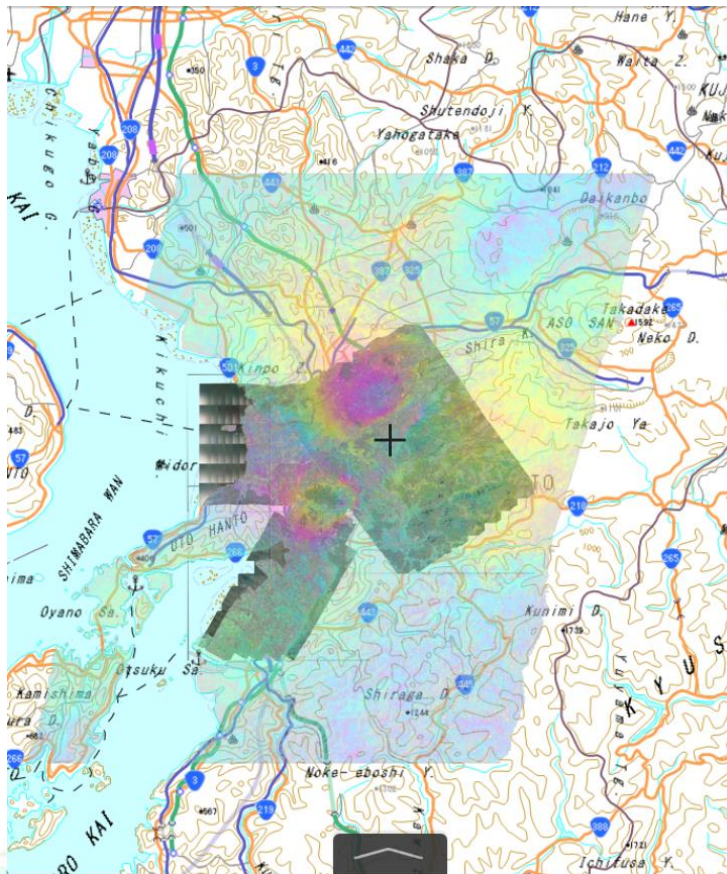
# Initial response (3) : channel establishment

- Quick action of Kyushu Regional Survey Dept.



# Initial response (4) : information provision

## GSI Maps (GSI's webmap platform)



## GSI Twitter



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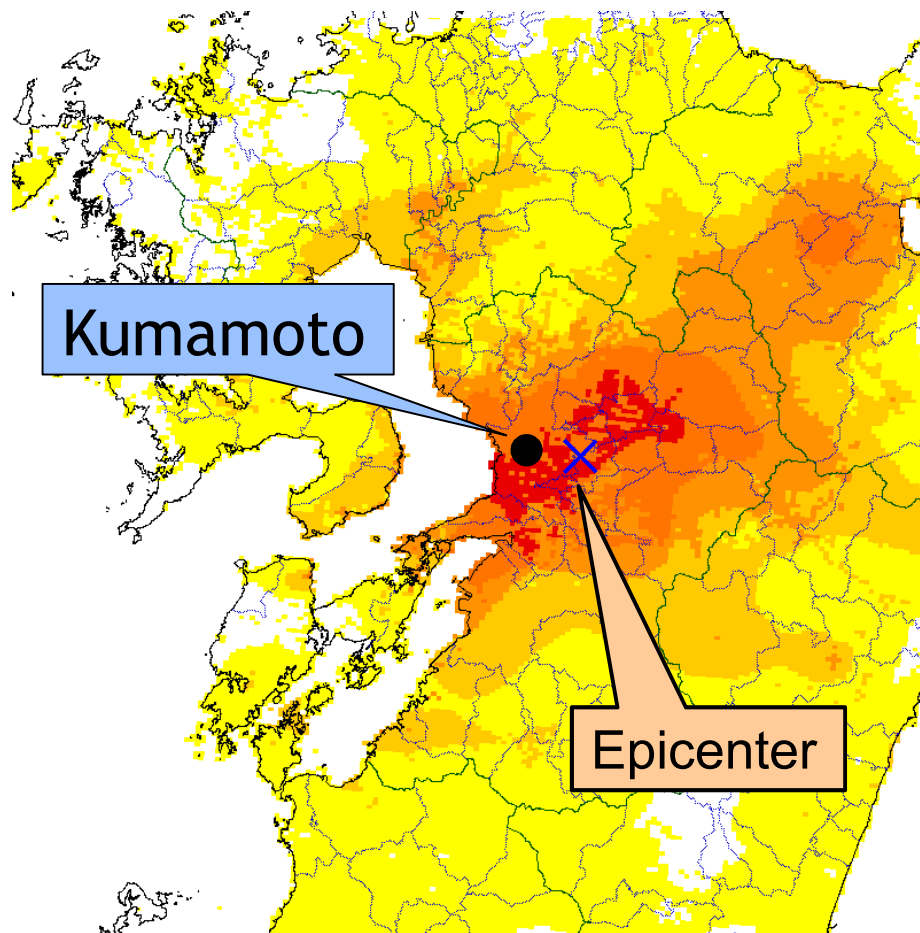
# At the end of 15 April 2016

- 27 hours after the first shock
- GSI had four Headquarters meetings
- Initial Response seemed to have been set on the right path
- Most staff got back home and were about to sleep





# But, the Second Shock Came



Ref. Japan Meteorological Agency  
Japanese seismic  
intensity scale



- Occurred 1:25am, 16 April 2016
- Magnitude (M<sub>j</sub>): 7.3
- Focal depth: 11km
- By the movement of the Hinagu and Futagawa Faults
- Much larger than the first shock
- SI-7: Mashiki town and Nishihara village



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# Re-Starting Initial Responses

Teleconference  
(5<sup>th</sup> GSI HQ meeting)  
2:19am 16 April



6<sup>nd</sup> Headquarters meeting  
6:00am 16 April



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# Renewing Response Strategy

Ordered by Director-General of GSI

- 1) Personnel Assignment
- 2) Information Sharing
- 3) Aerial Photography
- 4) Interpretation of aerial photographs
- 5) CORS data analysis
- 6) Interferometric SAR data analysis
- 7) Shooting videos with drones
- 8) Provision of geospatial information



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**The time is supposed to be at  
7:00am, 16 April 2016 (Saturday)**  
**Re-starting Response, based on the  
renewed strategy**



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