EO Contribution to Recovery Activities

- A case study on the experience of the Great East Japan Earthquake -

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Purpose of the presentation

- To share the experience of the recovery process among CEOS partners to find the best approach on the use of EO for recovery activities

- To find the best EO contribution to recovery activities through the experience of the Great East Japan Earthquake

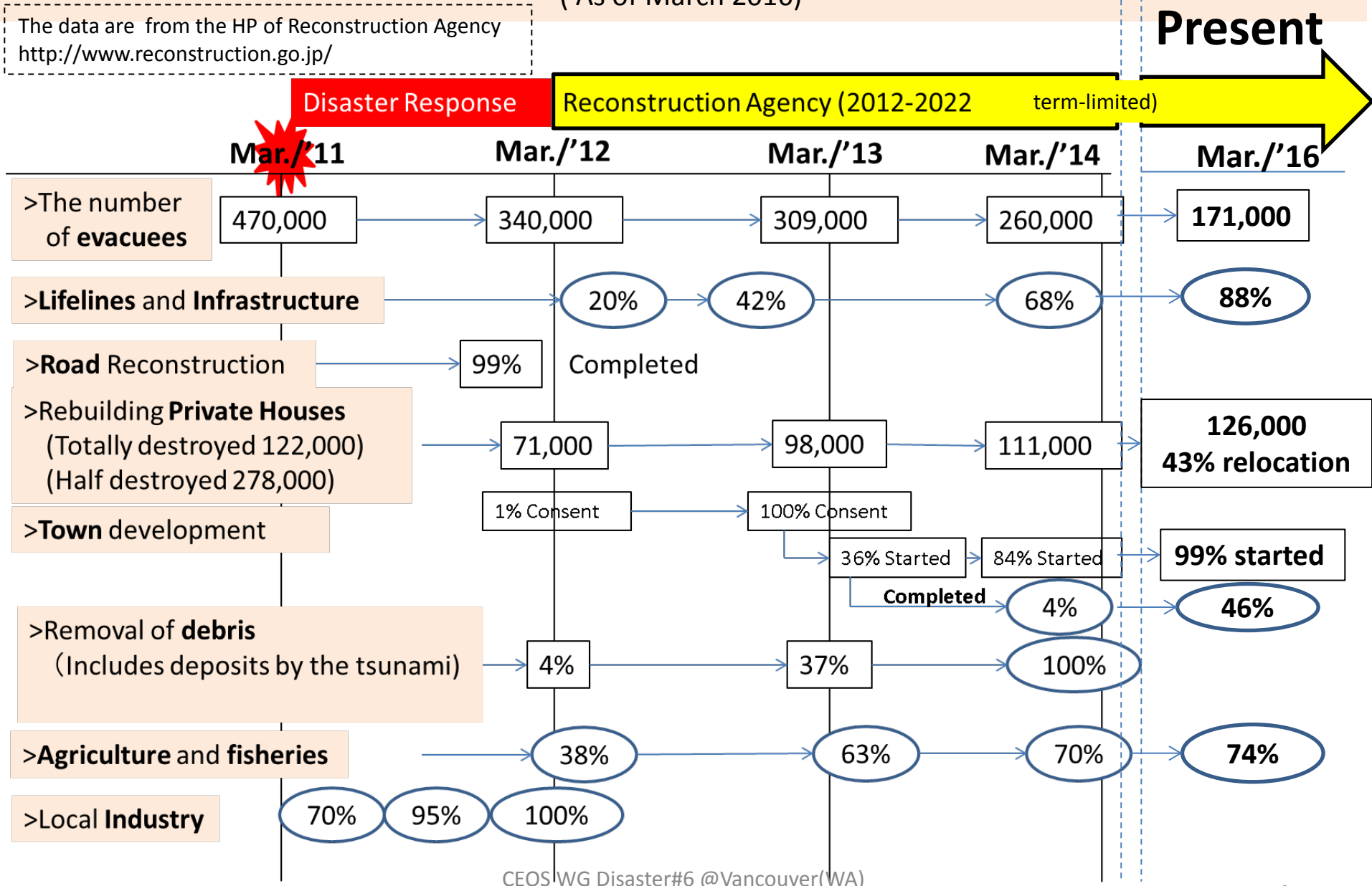
The Great East Japan Earthquake (2011)

1. The M9.0 earthquake attacked at 70km east off the coast of Sendai, at 14:46 JST on March 11, 2011. The maximum seismic intensity was 7 and it was the largest earthquake ever recorded in Japan. About 30 minutes after the earthquake, very high tsunami, more than 10m in some areas, attacked the cities and towns along the east coast of Tohoku district.
2. By the earthquake and the tsunami,15,883 people died, 6,144 injured, 2,676 were missing (as of 12 Sep. 2012) and 470,000 people evacuated.
3. More than one million buildings were damaged (129,225 units totally collapsed, 254,204 half collapsed and 691,766 partially damaged).
4. The Fukushima Daiichi nuclear power plant lost its control and the residents within 20km radius of the power plant evacuated.
5. WB estimated the economic cost damage to be US$235billion, making it the costliest natural disaster in world history.
6. Some cities lost most of their people, facilities and houses as well as local governance functions
7. About one year after the disaster, Government of Japan established “Reconstruction Agency” as a “control tower” to accelerate recovery activity expects to complete reconstruction in no more than 10 years.
8. As of March 2016, 5 years from the disaster, reconstruction is still under way.

Recovery and Reconstruction Progress after the Disaster

(As of March 2016)

The data are from the HP of Reconstruction Agency
http://www.reconstruction.go.jp/



Catastrophe of the Cities by the Great East Japan Earthquake

Some cities and towns lost almost of the lives, buildings and facilities in their areas as well as their governance functions.

City	Population (as of 2011)	Number of houses	Number of Killed+ missing	Number of Destroyed Houses	Killed/City population	Destroyed/ houses in the city	Survival of City Governance
Rikuzentakata	**23,300**	7767	446	3341	**8.3%**	**43%**	**NO**
Yamada-cho	**18,617**	6596	815	3184	**4.4%**	**48.3%**	**NO**
Sendai	**1,045,986**	464640	730	82560	**0.1%**	**17.8%**	**Yes**
Ishinomaki	**160,826**	57796	3892	24019	**2.4%**	**41.6%**	**NO**
Kesen-numa	**73,489**	25399	1404	10941	**1.9%**	**43.1%**	**NO**
Higashi-matsushima	**42,903**	13984	1138	10903	**2.7%**	**78%**	**NO**
Onagawa-town	**10,051**	4441	980	3934	**9.8%**	**89.2%**	**NO**
Minamisanriku	**17,429**	5288	902	3299	**5.2%**	**62.4%**	**NO**

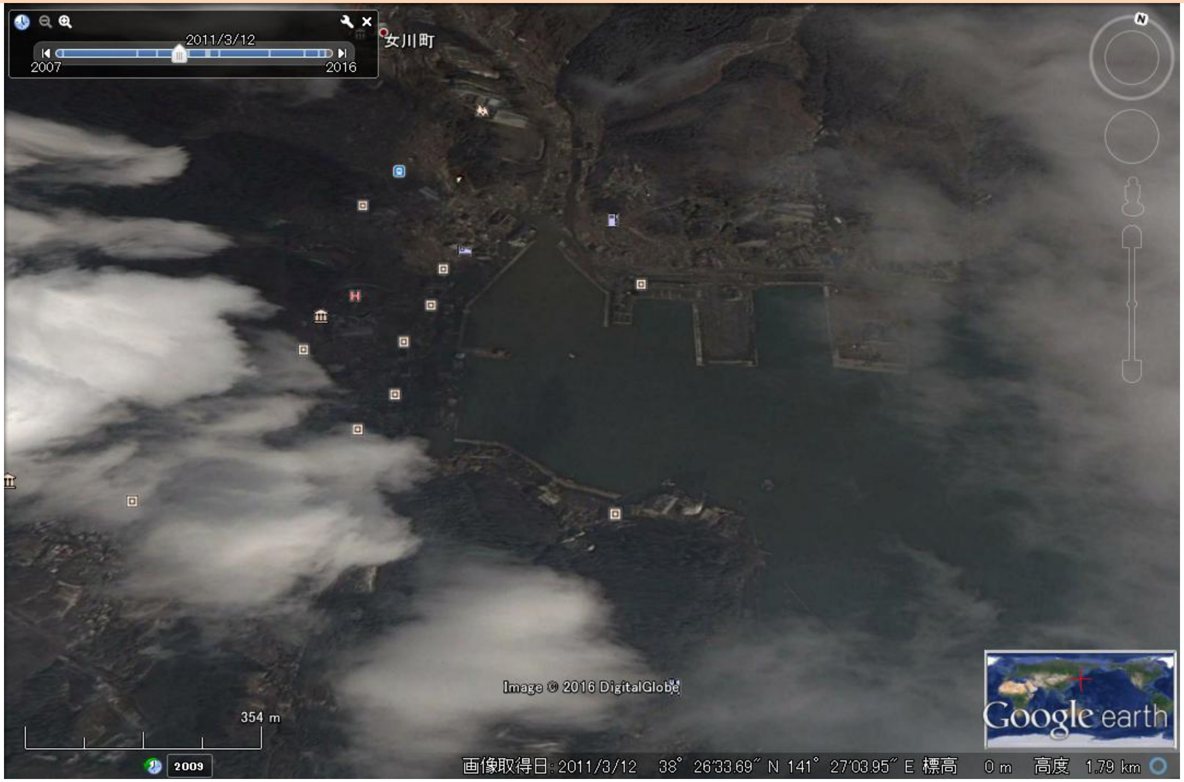
[Onagawa-town] March/2010 Before Disaster

Population ----- 10,051 (as of 2010)
Number of houses ------ 4441 units
Total town area ----- 65.8km^2
Residential area ------ 3.6km^2

[Onagawa-town] March/11/2011 Tsunami Attacked

Earthquake	Tsunami attack	
March/11, **14:46**	March/11, **15:35**	The maximum tsunami height 14.8m The maximum tsunami run-up height 34.7m

[Onagawa-town] March/12/2011 Catastrophe



March/12/2011 Google earth
©Digital Globe

Missing and Killed :
980 (9.8% of population)

Number of destroyed houses :
3934 units
(89.7% of total houses)

Inundated area :
3.2km^2
(87.7% of residence area)

川町内の家屋の被害状況（清水町）

津波で高台の墓地まで流されたJR石巻線の車両（JR女川駅付近）

[Onagawa-town] April/06/2011 Temporary houses for evacuees

April/06/2011 Google earth
©Digital Globe

Temporary houses for evacuees had been constructed from April to July 2011 on top of the hills.
There still left a lot of debris in the devastated area.

[Onagawa-town] At Present

Resilient Town Development

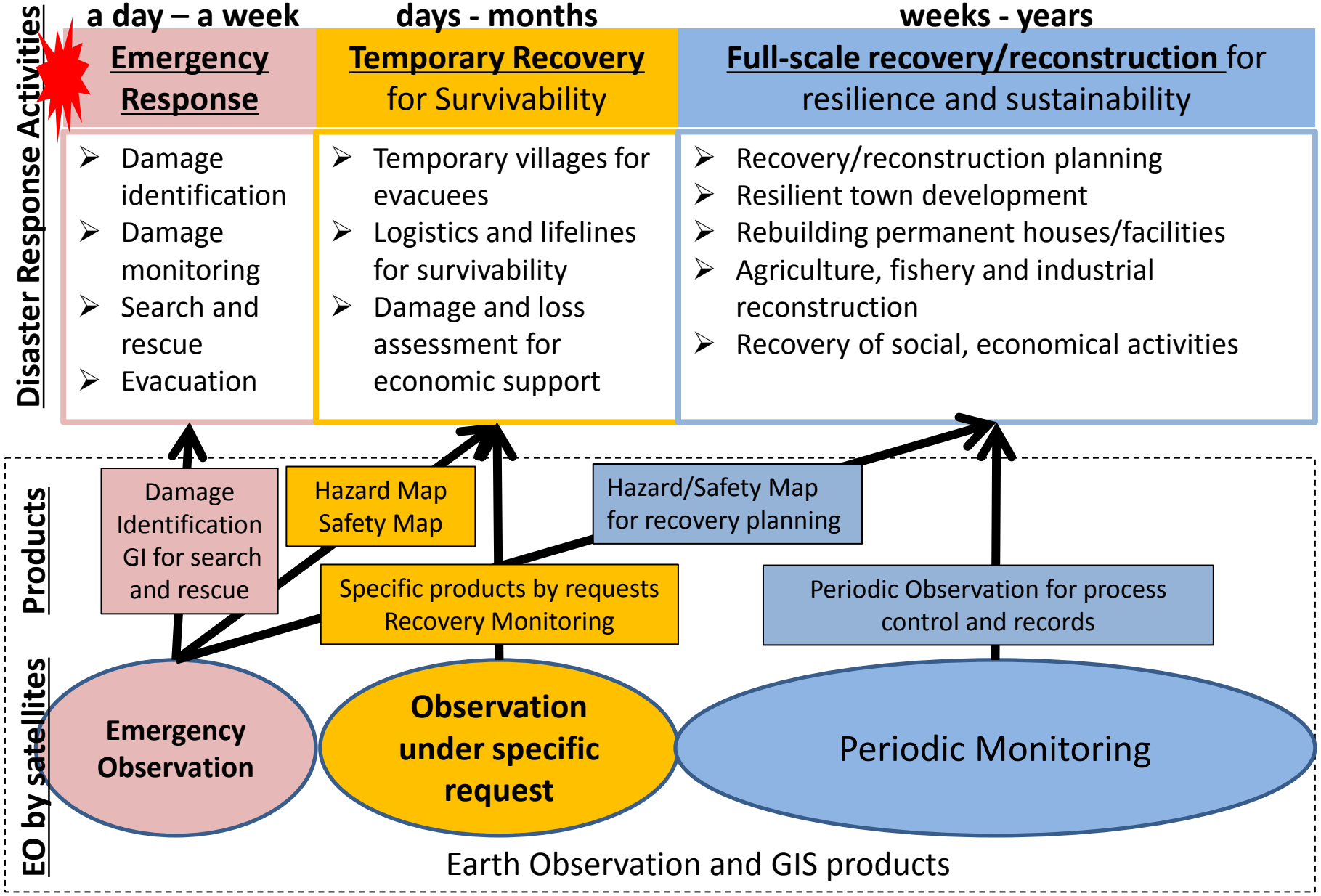
June/01/2015 Google earth
©Digital Globe

Under construction toward town development.

Onagawa-town Reconstruction Plan

‘11-’12 : Recovery Phase
‘13-’15 : Infrastructure development phase
‘16-’18 : Full-scale reconstruction phase

Contribution of EO to Recovery Activities



Summary and Conclusions

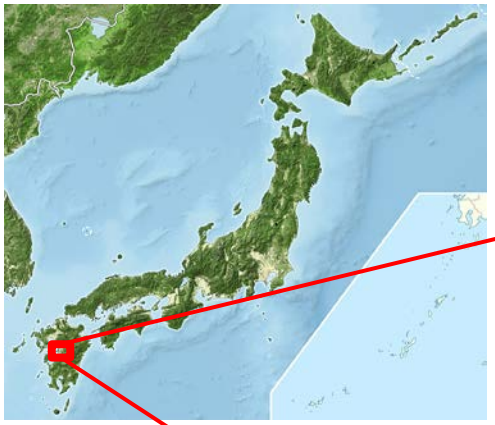
1. Japan's progress in recovery from the Great East Japan Earthquake was summarized.
2. Recovery of Onagawa-town, which had been devastated and wiped out all the life foundation by the disaster, is now in progress toward a resilient town against disaster.
3. From the experience of the Japanese recovery progress, recovery phase can be categorized "temporary recovery" and "full-scale recovery (reconstruction)" phase.
4. Temporary recovery" phase requires geographic information to find safe and easy accessible/supportable location at its early stage.
5. "Full-scale recovery" phase requires geographic information to develop "recovery plan" as well as the periodic observation for process control and the records of the progress.
6. **"Recovery plan" with the goal and the milestones of the recovery/reconstruction process is important to identify "recovery " .**
7. Both emergency EO and recovery monitoring are important to contribute to the recovery activities.

ALOS-2 OBSERVATION, 2016 KUMAMOTO EARTHQUAKE

“2016 Kumamoto Earthquake” in Japan

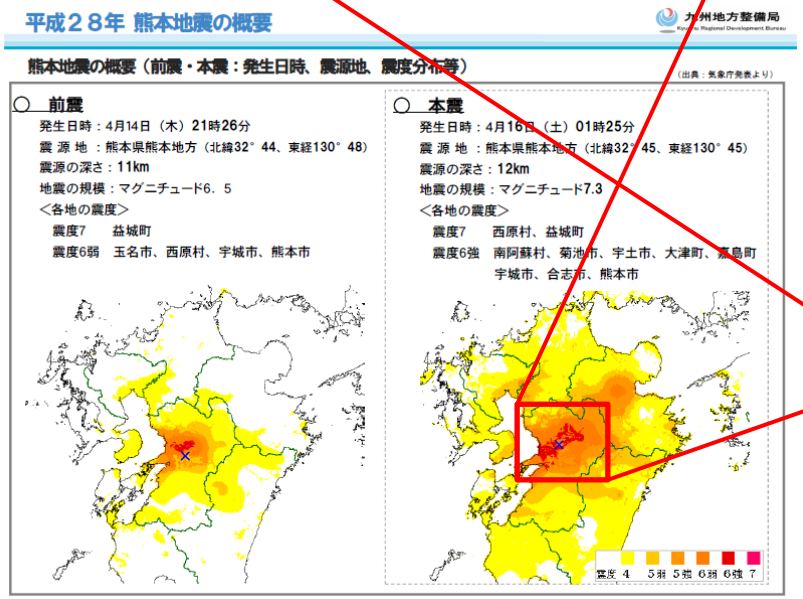
- April 14, 2016, 21:26 The Foreshock attacked Kumamoto prefecture. Mw=6.3, maximum seismic intensity=7 was almost the same scale as that of the Hanshin Awaji Great Earthquake in 1995.
- April 16,2016, 01:25 The main shock attacked Kumamoto Prefecture. Mw=7.3, max. seismic intensity=7 was greater than the foreshock. It killed more than 20 people and damaged more than 40,000 houses.
- More than 130 landslides were observed by aircrafts/satellites earth observation.

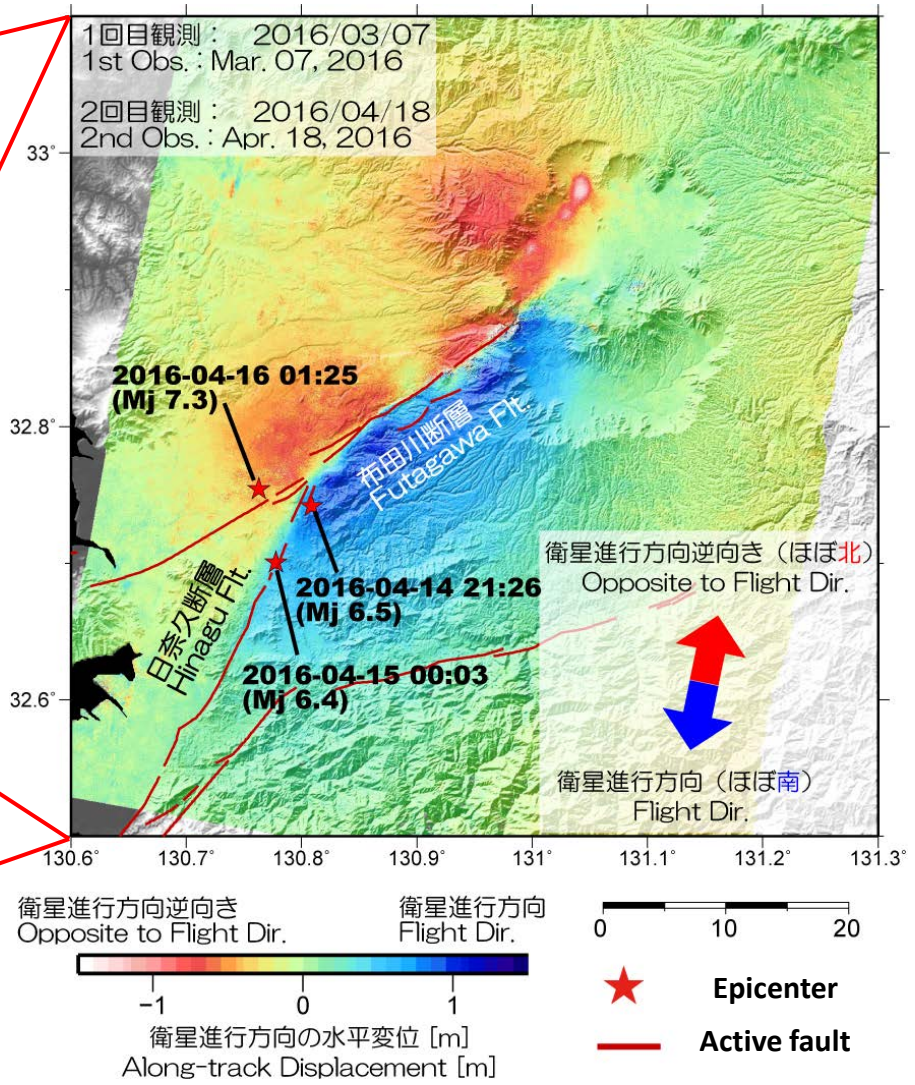
“2016 Kumamoto Earthquake” in Japan



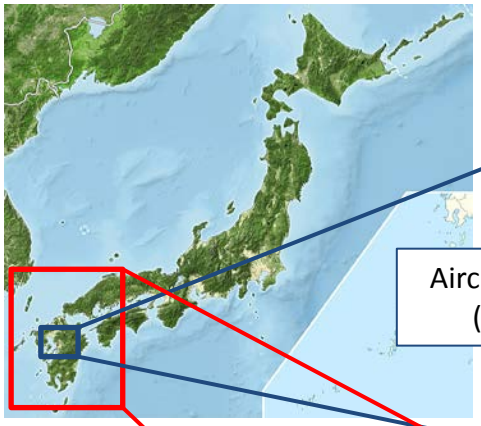
Kumamoto Prefecture in Kyushu

InSAR Analysis using ALOS-2/PALSAR-2 EO data identified two active faults as causes of the earthquakes in Kumamoto Prefecture.

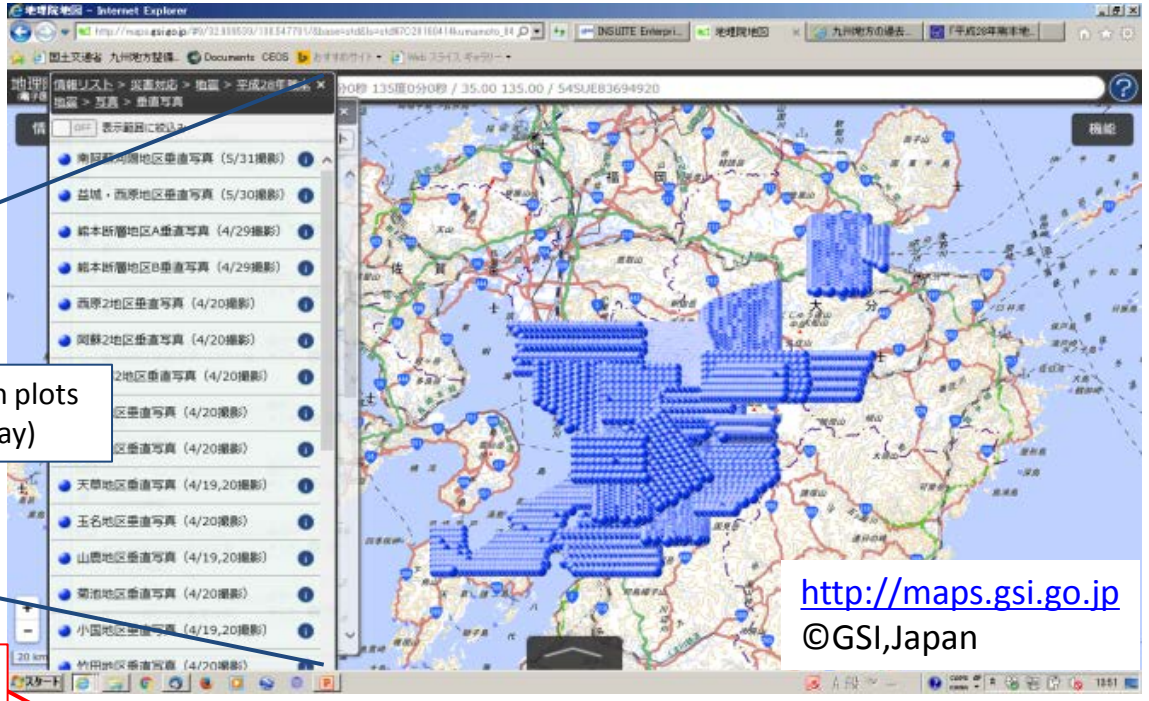




source: http://www.gsi.go.jp/BOUSAI/H27-kumamoto-earthquake-index.html#3



Aircrafts observation plots
(14/April – 31/May)



http://maps.gsi.go.jp
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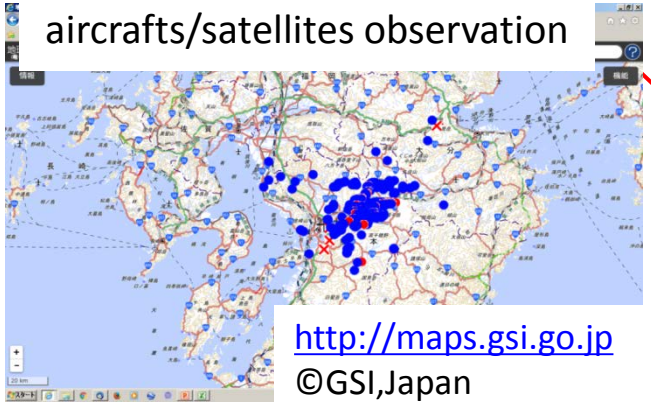
Satellites observed area
(15/April – 20/April)

http://maps.gsi.go.jp

Identified landslides by
aircrafts/satellites observation



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