Brief report of the 2016 Kumamoto Earthquake in JAPAN

IAEG Japan National Group (Japan Society of Engineering Geology)

The 2016 Kumamoto Earthquake occurred on April 14 2016 with following several major earthquakes in the middle area of Kyushu Island, southwest of Japan. Earthquakes exceeding JMA Seismic Intensity 6 lower occurred 7 times in three days since April 14. Maximum magnitude was 7.3. JSEG has organized an investigation team just after the Kumamoto earthquake.

Figure 1 shows the general view of Japan. The Japanese Archipelago is comprised of five island arcs as shown in the figure. The Philippine Sea Plate has been moving to NW direction 4 cm/yr. on average and subducting in the Nankai Trough. On the other hand, the Pacific Plate has been moving to WNW direction 9 cm/yr. on average and subducting in the Japan Trench and the Izu-Ogasawara Trench. Moreover, the Izu-Ogasawara Island Arc have collided with Honshu Arcs and intruded to north direction.

These continuing movements on the subduction zones at the boundary of the plates are the main causes of large earthquakes and tsunamis. And many active faults are distributed in the island arcs.

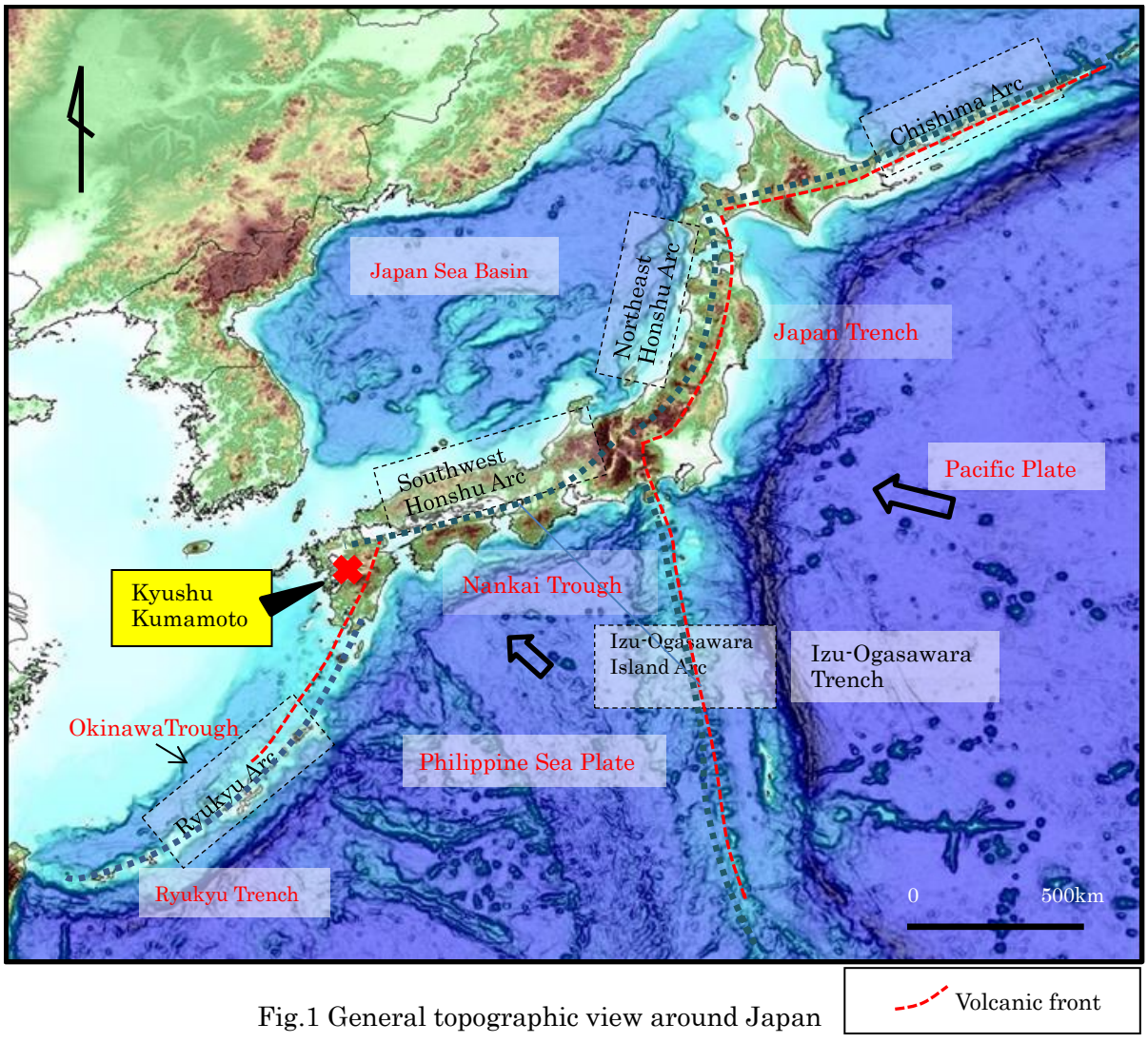


Fig.1 General topographic view around Japan

The Okinawa Trough which locates north of Ryukyu Arc has been expanding to south direction. The Beppu-Shimabara rift zone in the Middle Kyushu is considered to be part of this Okinawa Trough zone. Therefore tensional stress of north to south direction is dominant in the middle to south Kyushu area. (Fig.2 and Fig.3)

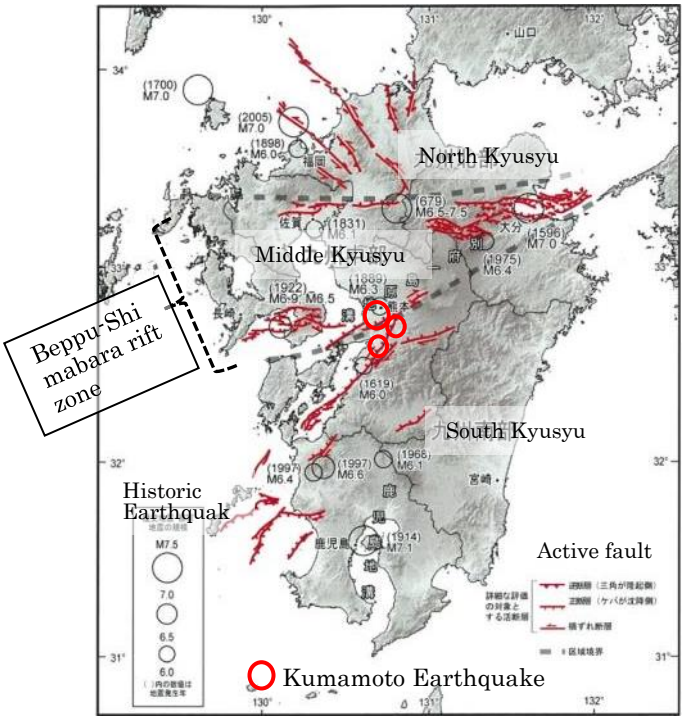


Fig.2 Active faults and historic Earthquakes in Kyushu
Fig.2, 3 The Headquarters for Earthquake research Promotion, report in 2013
http://www.jishin.go.jp/

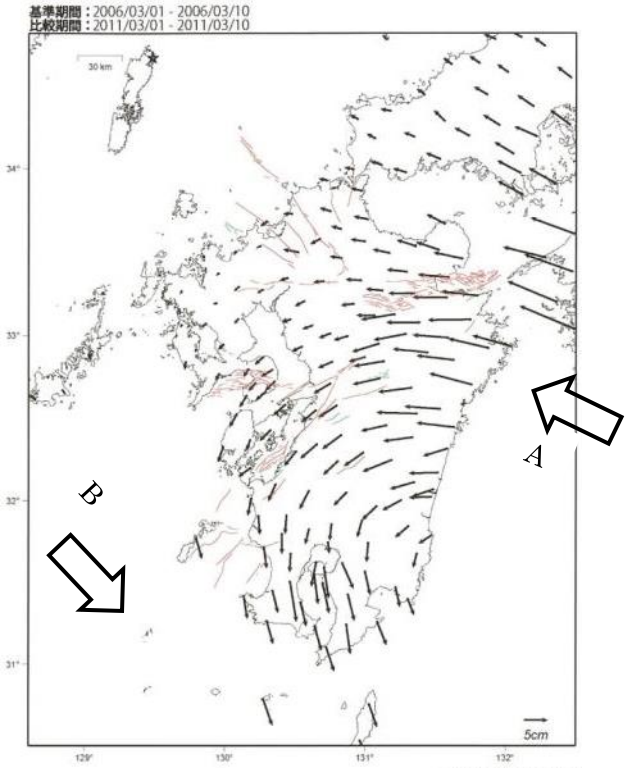


Fig.3 Average speed vector of displacement in the 5 years since March 2006
A:Compressive stress caused by Philippine Plate
B: Expanding of Okinawa Trough

The epicenters of the Kumamoto earthquake and aftershocks since April 14 are distributed SW-NE direction along the southern edge of the Beppu-Shimabara rift zone. (Fig.4) It was reported that the type and the focal depth of main earthquakes were lateral slip type faults and about 10 km respectively.

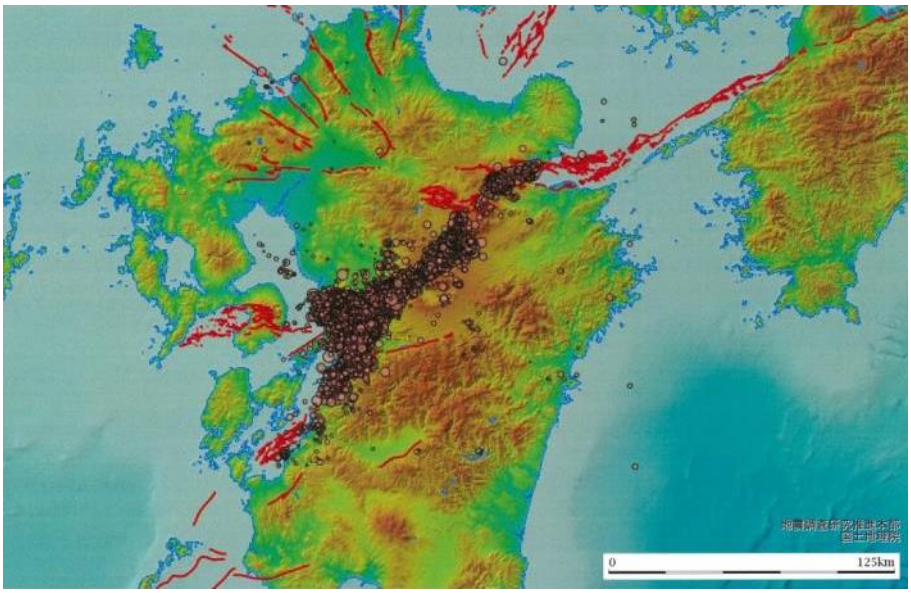
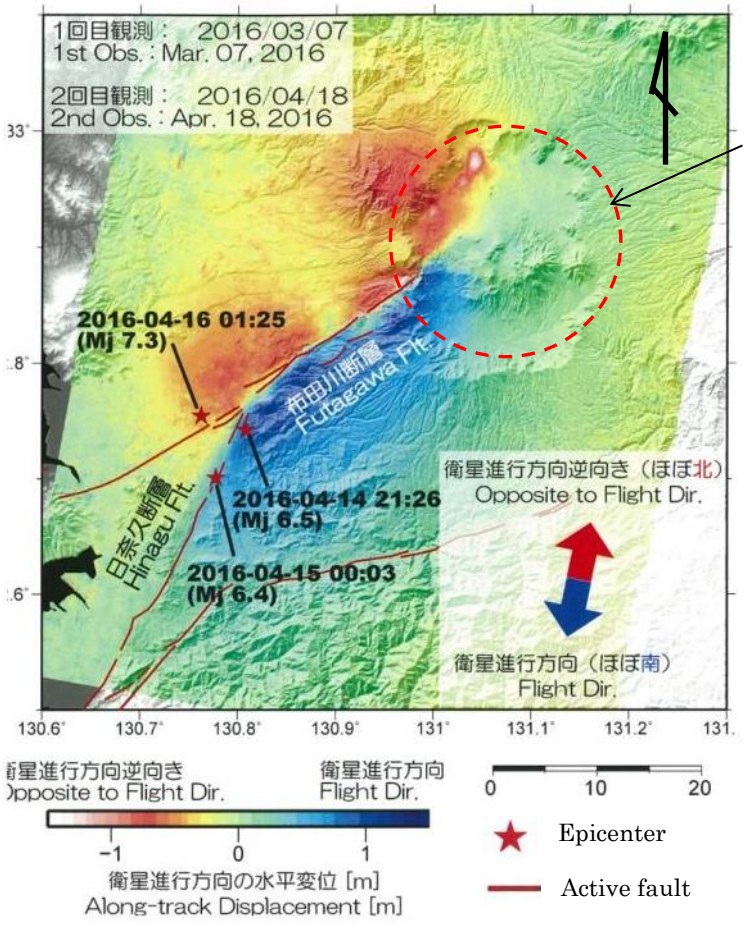


Fig.4
Distribution of the epicenters since April 14 2016
(At May 10, 14:46)

National Research Institute for Earth Science and Disaster Resilience (NIED)
Disaster Information Laboratory
http://www.bosai.go.jp/

There are two right lateral active faults, Hinagu fault and Futagawa fault near Kumamoto City. According to the analysis of the surface movement by MAI (Multiple Aperture Interferometry), right slip movement along these faults are clearly shown. (Fig.5) And surface faults along Futagawa Fault with right lateral slip displacement of maximum 2 m were observed. (Fig.6)



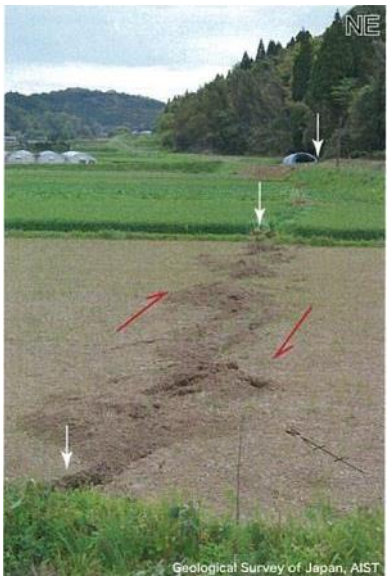


Fig.5 MAI (Multiple Aperture Interferometry) analysis using ALOS-2/PALSAR-2

Geospatial Information Authority of Japan (GSI)
http://www.gsi.go.jp/cais/

Fig. 6 Earthquake surface fault along Futagawa Fault.
→ Right lateral slip movement was observed.

Geological Survey of Japan, The third report of urgent investigation, April 18, 2016
http://www.gsj.jp/hazards/earthquake/kumamoto2016

Futagawa fault continues to the northeast area of the somma and atrio of Volcano Aso. Figure 7 shows a preliminary report of the distribution of landslides and collapses in this area.

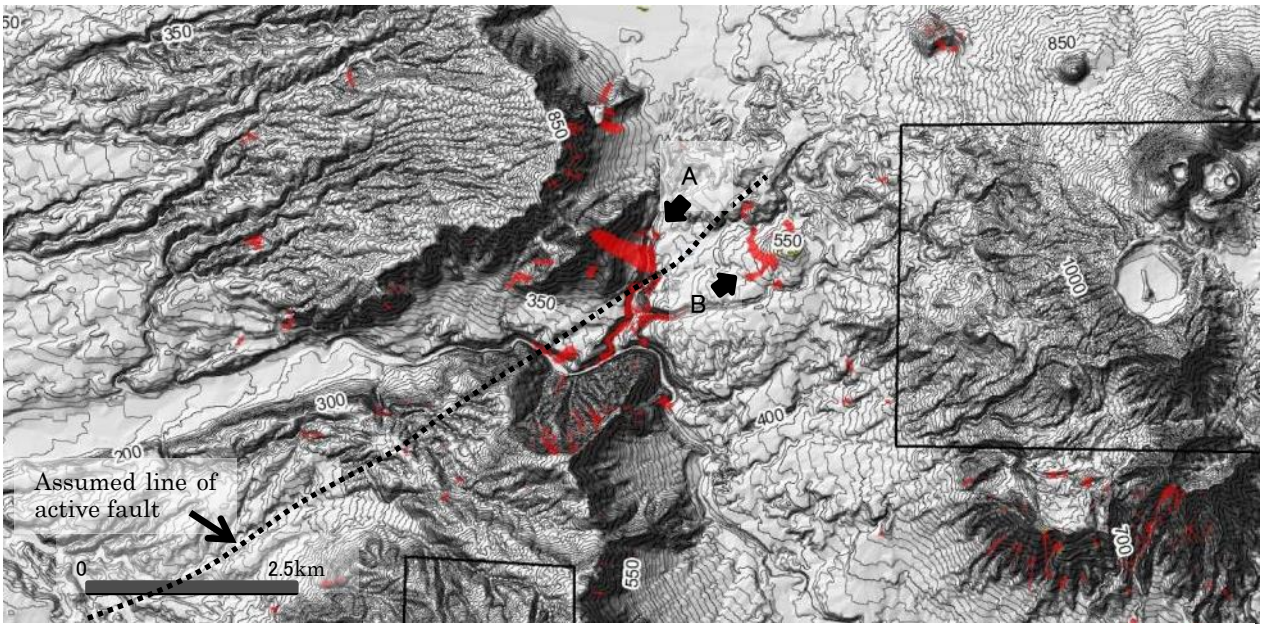


Fig.7 Preliminary analysis of landslides distribution and collapses in the west area of Volcano Aso (Assumed fault line is added.)
Prof. Chigira and Matsushi, Disaster Prevention Research Institute, Kyoto University

Figure 8 is the photo of steep slope collapse of near the somma just north of Futagawa Fault. Landslide on gentle slope shown in Fig.9 would be slipped along very soft and high water content pumice layer of Quaternary tephra.

Fig. 8
Large collapse on the steep slope of near the somma of Volcano Aso
(View from point A in the Fig. 7)

Fig. 9
Landslide flows on gentle slope of the lava dome. Landslide slip would have occurred in the tephra which covered on the lava.(View from point B in the Fig. 7)

Fig.8 and Fig.9 are offered by
KOKUSAI KOGYO CO., LTD
PASCO CORPORATION
http://www.kkc.co.jp