

## Responses of Kyushu Regional Survey Department to the 2016 Kumamoto Earthquake

### Kyushu Regional Survey Department

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#### Abstract

*The Kyushu Regional Survey Department, in cooperation with the Main Office of Geospatial Information Authority of Japan (GSI), prepared large-format print-outs of various maps and related materials to help understand the onsite topography and assess the damage situation, immediately after the 2016 Kumamoto earthquake occurred, moreover directly handed over such maps and related materials and explained their content to the persons in charge in affected municipal governments including On-site Headquarters for Major Disaster Management established in Kumamoto Prefectural office.*

*Also, the Department examined the requests made with respect to surveys and map availability at the time of delivery. As a result, requests were made for “surveys to consider levee repairs” and “status maps of wide area ground displacement to consider resident evacuation in case of flooding”. The Department started work on these right away in cooperation with the Main Office. This paper reports on such responses.*

#### 1. Main Responses of Kyushu Regional Survey Department

Following the 2016 Kumamoto earthquake (hereinafter referred to as “the Kumamoto earthquake”) which occurred on April 14, the Kyushu Regional Survey Department moved to the highest alert on April 14 at 21:30 JST and established Regional Disaster Countermeasures Office, the Geospatial Information Authority of Japan (hereinafter referred to as “GSI”) in accordance with GSI Disaster Countermeasures Procedures.

Immediately after the earthquake it was impossible to understand the extent of the damaged areas in detail and needs for maps. Thus, the Kyushu Regional Survey Department compiled reduced scale maps for disaster countermeasures to fit in an A0 sheet size for the local government offices in the districts where tremors with seismic intensity over 5 were observed, and made these available to the respective municipal governments. (Fig. 1)

After aerial photos were captured, ortho images were sent to the relevant authorities as DVDs and large size file transfer systems, and large size print-outs were made available to On-site Headquarters for Major Disaster Management (hereinafter referred to as “Disaster Management Headquarters”) and Kyushu Regional Development Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), as well as relevant prefectural and municipal governments.

On April 15, 2 staff were dispatched to carry out inspection of GNSS-based control stations within Kumamoto City and on April 20 one staff member was dispatched to carry out ground laser survey of the Kumamoto Castle. Also, 1 staff member (4 days) was dispatched as supervisor and 8 staff members (39 man days) were dispatched as liaison (contact person for



**Fig. 1** Map for disaster countermeasures as provided to Minamiaso Village office

disaster countermeasures on-site information) to Disaster Management Headquarters.

## 2. Provision of Maps and related materials to Relevant Authorities

The Kyushu Regional Survey Department provided various geospatial information to relevant authorities, including maps for disaster countermeasures, aerial photo data, orthophotographs, Surface Cracks Derived Maps, etc. (Table 1).

**Table 1** Details of geospatial information provision to relevant authorities

Entity	Recipients	Medium	Number of items
Government organizations	5	paper	112
		CD · DVD	11
Prefectural governments	4	paper	128
		CD · DVD	10
Municipal governments	20 cities 18 towns 4 villages	paper	181
		CD · DVD	34
Total	51	paper	421
		CD · DVD	55

Efforts were made as much as possible to explain individually the contents of the maps and related materials to the mayors of the affected municipal governments and TEC-FORCE (Technical Emergency Control Force). At the same time, the staff tried to find out their requests for geospatial information and address them. Such requests included: enlarged photos of certain areas or provision of additional maps to be used for searches(Photo 1).



**Photo 1** Provision of aerial photo data and printed maps to the Disaster Countermeasure Office in Nishihara Village, and explanation of them to the mayor

Immediately after the earthquake occurred, traffic on portions of the express way and railways was suspended and couriers suspended business as well, and as a result staff members were forced to use official business vehicles to deliver the maps and photographs. Thus, information of passable roads was collected from the Kyushu Regional Development Bureau to ensure safety and “Disaster Dispatch” stickers and an extra pass of “emergency vehicle” was made visible on the vehicle for operation. This allowed the staff to travel on roads where traffic of general vehicles was restricted and assisted with efficient disaster response.

As the Kumamoto earthquake affected a wide area, a large number of municipalities suffered damages which meant that a large volume of printing needed to be carried out in a very short time to supply maps for disaster countermeasures and print-outs of aerial photos to each recipient. It was anticipated that there would be demands to provide print-outs of GSI contents to Disaster Management Headquarters. In order to respond to such printing demands in a timely manner, the Kyushu Regional Survey Department installed an additional printer in collaboration with the Main Office, upgrading to a 2-printer system. On April 19, a large-size printer was installed in the Disaster Management Headquarters which made it possible to provide print-outs of required maps and related materials without delay (Photo 2).



**Photo 2** GSI staff carrying in and setting up a large size printer in Disaster Management Headquarters

With respect to provision of maps and related materials to relevant authorities, we chose methods which were thought to be the best to deliver them in the required time frame. For instance, when dispatching location of

TEC-FORCE of Kyushu Regional Development Bureau coincided with the delivery address for the maps, etc., then TEC-FORCE was requested to deliver the maps. When a relevant authority had printing capability, then maps and related materials were sent as electronic files using large size file transfer systems and printing was done at their end. In case of urgent requests, maps and related materials were sent by motorbike messenger.

### 3. Responses in Cooperation with Affected Local Governments, Main Office

Upon visiting Mashiki Town office, the following request was made. The river levees for Akitsu River and Kiyama River which flow through the town subsided during the Kumamoto earthquake. Leveling on the levees was carried out by the town but it is likely that the reference point may have subsided. Fixed height references were needed for inspection of levee maintenance.

After receiving this request, a verification step of the reference benchmarks in Mashiki Town was added to the tasks of the GNSS Emergency Survey Research Group dispatched to the Kumamoto City area to verify the results of SAR interferometry. Verification was carried out by GNSS surveying (Photo 3).

These results were made available to the Mashiki Town office and Kumamoto Prefectural government as well as dispatched liaison of MLIT to Mashiki Town and they were used as height reference for emergency restoration work such as piling up sandbags on levees.

Another request made by Mashiki Town office



**Photo 3** At the request of Mashiki Town office, GSI Emergency Survey and Research Group carried out verification surveys of reference benchmarks

was: As river levees subsided, evacuation planning needs to be reviewed in preparation for the flood season. Also, in order to create a grand design for town reconstruction, it is important to understand the ground displacements by the Kumamoto Earthquake in detail.

After receiving this request, aerial laser surveying was carried out and Elevation Variation Map showing differences between current elevations and past elevations in gradient tint maps were compiled. These maps were provided by the Kyushu Regional Survey Department to Mashiki Town office and the relevant authorities (Photo 4).



**Photo 4** Provision of Elevation Variation maps to Mashiki Town and explanation of them to the mayor of Mashiki Town and liaison of MLIT

### 4. Summary

The Kyushu Regional Survey Department delivered the maps and aerial photos to the relevant authorities by hand and upon receiving numerous demands for maps to be used in searches and restoration work, etc. delivered without delay the geospatial information required based on the collaboration with the Main Office.

As the Kumamoto earthquake caused damages over a wide area, a large volume of large-scale maps needed to be printed out in a very short time. Additional printers were installed, nevertheless, immediately after the earthquake occurred, printing needed to be carried all night long. In these conditions, staff was dispatched from the Main Office and the neighboring Regional Survey Departments which made it possible to continue the printing job.

We believe that the swift response to this natural disaster is due to routine partnership building amongst the relevant authorities. In order to fulfill our duties as a designated local administrative authority, we usually intend to keep striving to build partnerships with other institutions.