Final Report

Collection of Best Practices on the use of geospatial information for disaster risk reduction

UN-GGIM-AP WG2

October 2017

Regional Committee of United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP)

Contents

1. Overview of the Best Practice survey

(1) A Best Practice survey was conducted as a part of UN-GGIM-AP (United Nations Global Geospatial Information Management for Asia and the Pacific) WG2 (Disaster Risk Management, hereinafter WG2) (2015-2018)activities .

(2) NGIAs (National Geospatial Information Authorities) of Member States of UN-GGIM-AP were requested to submit at least one best practice, in conjunction with the questionnaire survey which was simultaneously conducted by WG2. Best Practice cases were invited twice on December 2015 and February 2017 from Member States.

(3) As of October 2017, 18 Best Practice cases have been collected from ten Member States.

2. Key findings of the Best Practice cases

(1) NGIAs in Asia Pacific region have already significantly committed to disaster risk reduction through implementing various kinds of activities.

(2) Kinds of disasters addressed reflect each Member State's circumstances.

(3) Best practices mainly focus on responses during the occurrence of disaster. On the other hand, a few practices focus on before the occurrence of disaster or after the occurrence of disaster.

(4) Geospatial information produced and provided according to each disaster phase is:

1) Before the occurrence of disaster: hazard maps or hazard-related geospatial information provided to stakeholders and citizens to enlighten disaster risk of a particular area. (No.2, 10, 13, 14)

2) During the occurrence of disaster: aerial photos, satellite imagery, UAV images, topographic maps showing damage situation, evacuation sitemap of victimised people, and geodetic data. (No. 1, 3, 4, 6, 7, 8, 9, 11, 12, 16, 17, 18)

3) After the occurrence of disaster: DEM data to consider relocation of victimised people and topographical survey after landslides. (No.5, 15)

(5) Outcomes of the best practice reported are recognized as follows:

1) NGIAs' data were used as a material for decision-making by government organizations and decision makers. (No.1, 2, 3,4, 5, 7, 8, 11, 12, 15, 17, 18)

2) Some cases indicated that data were provided to citizens and residents via the internet to facilitate evacuation activities. (No.6, 9, 14, 16)
3) Promotion of geospatial information application, enlightenment and capacity building of local governments were also reported. (No. 10, 13, 14)
4) A geospatial information catalogue for the provision in case of a disaster to help stakeholder quickly request required information to the NGIA. (No.10)
5) Provision of geospatial platforms (such as geoportal) enabling stakeholder and people to view the situation spatially and to overlay their particular information. (No.14)

(6) The future efforts mentioned are as follows:
1) Use of UAV which enables flexible and quick provision of information during disaster. (No.2, 5, 11, 18)
2) Quick dissemination of geospatial products (No.3, 11)
3) Development of geospatial information about the people vulnerable to disasters. (No.4)
4) Enrichment of data in coordination with other organizations (No. 6, 16)
5) Densification of CORS network (No.12, 17)

3. Conclusion

A variety of examples of Best Practices suggest that the collection be a valuable material for NGIAs in Asia and the Pacific to learn how to take a better action for Disaster Risk Reduction effectively.

4. Summary list of Best Practices introduced

No.	Member state	Disaster Type	Information and Service	Title	Activity Contents	Page
1	Australia: Geoscience Australia(GA)	Overall disaster	Location data	Real Time Crisis Response Mapping for Government Officials	Provided by Geoscience Australia to Government Emergency Crisis Coordination Centre and used by the government as a material for decision-making during disasters .	4
2	Bangladesh: Survey of Bangladesh(SOB)	Typhoon, Cyclone, Earthquake, etc.	Thematic map	Use of Geospatial information for DRR in Asia and the Pacific Region	Provided by Survey of Bangladesh to government organizations, and by integrating and sharing geospatial information in the government, contributed to mitigating disaster risks and saving of resources.	5
3	China: Satellite Surveying and Mapping Application Center (SASMAC)	Earthquake	Geospatial information	Earthquake	Used for emergency response during disasters.	6
4	Fiji: National Disaster Management Office	Typhoon, Flood	Geospatial information		Used for emergency response during disasters.	7
5	Hong Kong Special Administrative Region (HKSAR): Lands Department	Landslide	Location data	Contingency Plan for Natural Disasters	Provided by the system of the website and used to identify the location at the occurrence of landslides and for recovery activities after the occurrence.	8
6	Indonesia: Geospatial Information Agency(BIG)	Volcano	Topographic map	Rapid Mapping of Kelud Mountain	By releasing evacuation routes and distribution of volcanic ash on the topographic map on the Internet, provided the people living around the volcano with a material to make decision for evacuation.	9
7	Japan: Geospatial Information Authority of Japan(GSI)	Flood	Aerial photo, Inundated area map	Floods as a Result of Heavy Rain	Swiftly disclosing the disaster situation that specifies the inundation range on the Internet, contributed to initial restoration operations (placement of police, the numbers of pumper trucks and workers, placement positions and determining work hours). Government and media used the data provided by GSI as trustworthy official information for disaster response and for news coverage.	10
8	Japan: Geospatial Information Authority of Japan(GSI)	Tsunami	Aerial photo, Inundated area map	2011 Great East Japan Earthquake	Immediately after the disaster, GSI created figures to provide related organizations with the general situation of the inundation range, conducted emergency shoots of aerial photograph, and these resources were utilized in a wide range of fields, such as making the base map for disaster recovery planning. All of them are released on the Internet.	12
9	Japan: Geospatial Information Authority of Japan(GSI)	Overall Disaster	Thematic map	Evacuation Center Map for 2016 Kumamoto Earthquake Response	Creating Evacuation Center Map enabled on-site disaster response headquarters to understand information on evacuation centers and to support activities like providing supply goods to evacuation centers.	14
10	Japan: Geospatial Information Authority of Japan(GSI)	Overall Disaster	Creation of Disaster Geoinformation Catalog	Creation of Disaster Geoinformation Catalog	The national and local governments referred to the Catalog and understood what type of geospatial information GSI developed and owned. This preparation helped GSI meet their requests rapidly.	16
11	Malaysia: Department of Survey and Mapping Malaysia (DSMM)	Flood	Video by UAV	The Use of Unmanned Aerial Vehicle (UAV) to Monitor the Flood and Its Impact in Malaysia	Used to identify flooded areas and evacuation sites with video and aerial photo captured by UAVs. After the disaster, used to identify facilities for recovery of various infrastructures.	18
12	Malaysia: Department of Survey and Mapping Malaysia (DSMM)	Earthquake	GNSS data	Earthquake Struck Ranau in Sabah, Malaysia	By analyzing GNSS data before and after earthquakes and releasing them on the early warning system of earthquake, contributed to the citizen for an early planning.	19
13	Philippines: National Mapping and Resource Information Authority (NAMRIA)	Hydromet* and Seismic**	Hazard map	Multi-Hazard Mapping of 28 Priority Provinces and the Greater Metro Manila Area	By providing local government organizations with hazard maps on the Internet, used as a material for decision-making of the area at the time of disasters.	20
14	Philippines: National Mapping and Resource Information Authority (NAMRIA)	Hydromet and Seismic	Hazard map	The Philippine Geoportal	By providing hazard maps on the Internet, contributed to the citizen in visually identifying risk areas.	21
15	Philippines: National Mapping and Resource Information Authority (NAMRIA)	Typhoon	Digital topographic map data, Ortho image	Recovery and Rehabilitation after Typhoon Haiyan	Used by the government to determine the status of disaster-affected areas and to identify safe and risk zones.	22
16	Philippines: National Mapping and Resource Information Authority (NAMRIA)	Typhoon	Hazard map	Mapping of Track of Typhoon Lawin (International Name: Haima) and Affected Areas and Population	The track of the typhoon was visualized by obtaining information from meteorological and statistical organizations and creating and releasing a map layout which showed the track. Through this effort, residents in the area at high risk for the typhoon were able to prepare.	23
17	Philippines: National Mapping and Resource Information Authority (NAMRIA)	Earthquake	GNSS data	Philippine Active Geodetic Network (PageNet) – Surigao Earthquake	GNSS enabled to acquire data of crustal displacement before and after the earthquake. Collaboration of observation system with other organization was achieved by continuous observation.	25
18	Sri Lanka: Survey Department	Tsunami	Digital topographic map data		Expressing disaster-prone areas on the topographic map can make swift relief operations.	29

*Hydromet: flood, storm surge, rain-induced landslide, **Seismic: ground rupture, ground shaking, tsunami, earthquake-induced landslide, liquefaction

5. Best Practice cases

No.1

Country	Australia
Organization	Geoscience Australia(GA)
Title	Real Time Crisis Response Mapping for Government Officials
Outline of the subject natural disaster	Spatially enabling federal government to enhance decision making.
Response	Geoscience Australia is supporting the Attorney-General's Department's - Australian Government Crisis Coordination Centre - establish a spatial mapping capability as part of its crisis centre. Geoscience Australia also integrates fundamental and synthesised spatial data with statistical information for a given area of interest to estimate exposure. This information is provided in report form on request to the Australian Government Crisis Coordination Centre.
Effect	The collaboration between GA and AGD is supporting the ability of executive decision makers in government to make informed decisions on the coordination of the Australian Government's response to domestic disaster events, using location based data.
Future	Continuous development and improvement of the capability supporting a joint mission across agencies.

No.2

Country	Bangladesh
Organization	Survey of Bangladesh(SOB)
Title	Use of Geospatial information for DRR in Asia and the Pacific region
Outline of the subject natural disaster	Floods, Storm surge, Drought, Tornedo, Landslide and Cyclone are the main disaster. Beside these, country is in the risk of Earthquake and Sea Level Rise.
Response	Survey of Bangladesh is preparing thematic maps for the whole Bangladesh. Thematic maps will help the country to prepare an integrated, comprehensive and coordinated plan which is already underway.
Effect	By supplying geospatial information to the relevant agencies, the Government will be able to mitigate the natural disaster and can save our valuable resources.
Future	Our organization is planning to use UAV for capturing aerial photographs and making available live high resolution satellite images just after the disaster to prepare an integrated, comprehensive and coordinated post disaster plan.

No.3

Country	China
Organization	Satellite Surveying and Mapping Application Center (SASMAC)
Title	Earthquake
Outline of the subject natural disaster	In China, earthquakes happen quite often, In almost all earthquakes, SBSM provides the maps after earthquakes including previous, in situ, and after maps
Response	The response of emergency mechanism of government
Effect	good
Future	Accelerate the speed of response including all kinds of disasters such as storm, flooding. etc

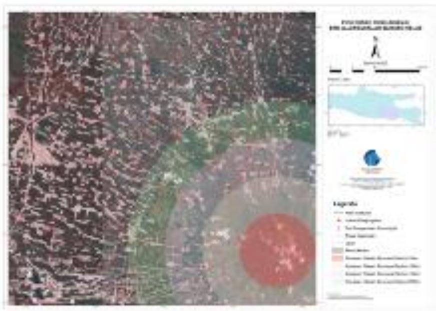
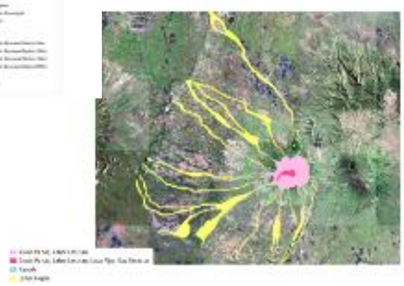
No.4

Country	Fiji
Organization	National Disaster Management Office
Title	
Outline of the subject natural disaster	Tropical Cyclone, Flooding
Response	The information provided by geospatial information assists in the coordination our response.
Effect	It really assists in the effectiveness and efficiency of response efforts.
Future	• Improve geospatial information • Mapping of people with disability

No.5

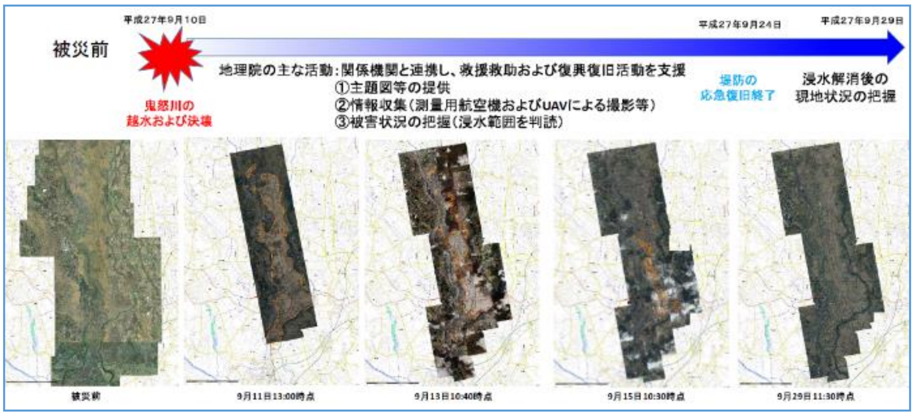
Country	Hong Kong Special Administrative Region (HKSAR)
Organization	Lands Department
Title	Contingency Plan for Natural Disasters
Outline of the subject natural disaster	A landslip is occurred affecting life and property.
Response	Lands Department (LandsD) is responsible for emergency and urgent repair works to landslips occurring on registered man-made slopes maintained by LandsD and to landslips that occur on man-made slopes on unleased and unallocated Government land not maintained by other departments and affecting life and property. LandsD works in conjunction with the Civil Engineering and Development Department (CEDD) in determining maintenance responsibilities of registered man-made slopes. The maintenance responsibilities of slopes having been determined are contained in the Slope Maintenance Responsibility Information System (SMRIS) and publicized on the LandsD's website (http://www.slope.landsd.gov.hk/smris/) and on CEDD's Slope Information System (SIS) accessible from http://hkss.cedd.gov.hk. LandsD will assist as necessary in emergency situations. The Survey and Mapping Office (SMO) of LandsD is responsible for providing existing maps, plans and aerial photos of the scene in conjunction with Government Flying Services (GFS) in an emergency situation. The SMO will also conduct topographical surveys after the disaster if necessary.
Effect	Location and maintenance responsibility of the landslip are identified in the first instance. Geospatial information of the disaster scene is captured for investigation and restoration purposes.
Future	UAV will be deployed as a part of the emergency survey operation in future disaster incidents.

No.6

Country	**Indonesia**
Organization	Geospatial Information Agency(BIG)
Title	Rapid Mapping of Kelud Mountain
Outline of the subject natural disaster	On February 13, 2014 mount Kelud erupted. The Centre of Thematic Mapping and Integration of Geospatial Information Agency (BIG) has conducted rapid mapping and analysis of Mount Kelud.
Response	BIG, together with some institutions and local governments, have provided the Disaster Susceptibility Map of Mount Kelud, Evacuation Sites and Routes, and Ash Distribution of Mount Kelud. EVACUATION SITES AND ROUTES  DISASTER SUSCEPTIBILITY MAP OF MOUNT KELUD  ASH DISTRIBUTION OF MOUNT KELUD 
Effect	The above products have been published on internet so that many people in Blitar and Kediri Regencies could be saved.
Future	Many additional important information from ministries, local governments, and private sectors could be enriched the above maps.

No.7

<table>
<tr><th>Country</th><th>Japan</th></tr>
<tr><td>Organization</td><td>Geospatial Information Authority of Japan (GSI)</td></tr>
<tr><td>Title</td><td>Floods as a Result of　Heavy Rain</td></tr>
<tr><td>Outline of the subject natural disaster</td><td>Due to the heavy rainfall from September 9 to 11 in 2015, the collapsing of levees, overtopping and leakage, inundation and the fracturing/breaking of levee slopes occurred in over 80 rivers. Immense damage was brought about as a result of this, including the loss of lives, injuries, and many incidents of houses being swept away and above the floor level inundation.</td></tr>
<tr><td>Response</td><td>Relief work and restoration activities were enforced in cooperation with related organizations after overtopping and damage occurred at the rivers. Specifically, aerial photos after the disaster were photographed, and photos before and after the disaster were provided to the government and disaster-stricken municipalities, while information was provided extensively to the nation on our homepage.
By measuring the inundated area using photographic interpretations, the disaster effects and restoration situation after the disaster were monitored. Measurements of the inundated areas were updated daily and reported to the government until the inundated areas became small enough that drainage pump cars were no longer required.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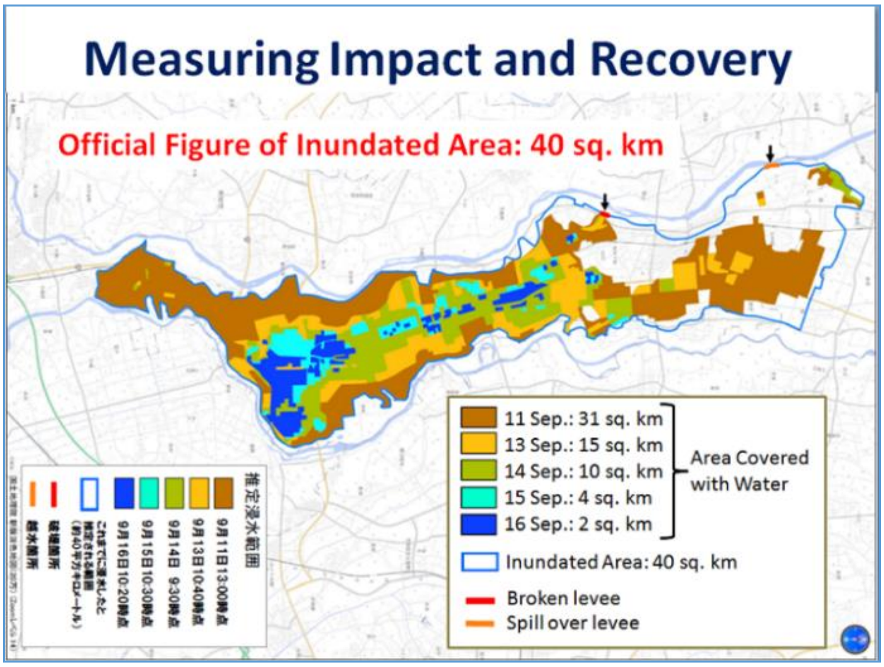
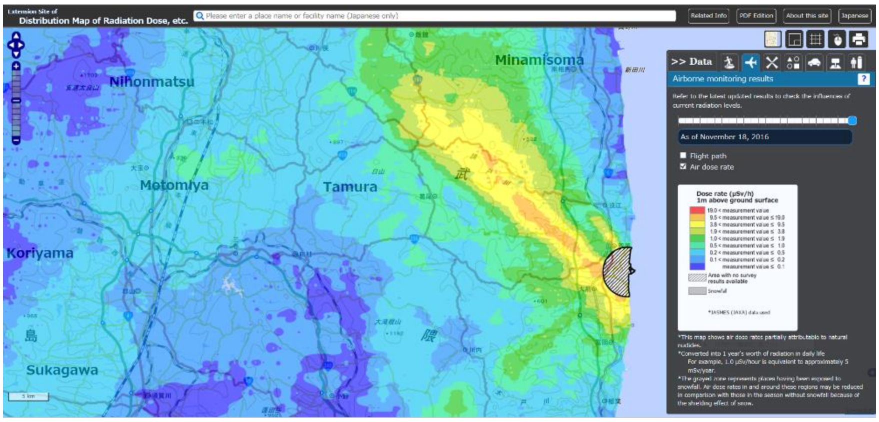
<tr><td></td><td>
</td></tr>
<tr><td>Effect</td><td>Swiftly disclosing the disaster situation that specifies the inundation range, contributed to initial restoration operations (placement of police, the numbers of pumper trucks and workers, placement positions and determining work hours).
As well, the government and media utilized the data provided by GSI as trustworthy official information in their disaster response and news coverage, reaffirming the significance of GSI.</td></tr>
<tr><td>Future</td><td>It was possible to provide timely information to the government, as the government’s needs were understood through frequent interactions with various government posts on a regular basis. In other words, it is important that the required needs for policy making are grasped.
Furthermore, disaster simulations (hazard maps) of these rivers where levees broke had been released to the public until now. However, because a sense of danger was not clearly communicated to residents, it may also be believed that it didn’t lead to their swift evacuations. It is important to also raise the awareness of residents towards disaster prevention.</td></tr>
</table>

No.8

Country	Japan
Organization	Geospatial Information Authority of Japan (GSI)
Title	2011 Great East Japan Earthquake
Outline of the subject natural disaster	The Great East Japan Earthquake that occurred at 14:46 on March 11 2011 with the largest Mw (moment magnitude) of 9.0 ever recorded in Japan, caused strong earthquake motions with an intensity over lower 6 on the Japanese scale of 7 in a wide area spanning eight prefectures from Iwate Prefecture to Chiba Prefecture, and triggered a powerful tsunami over 10-meters in height that hit the Pacific side of Japan's Tohoku region, destroying an area of 561km2 with its massive force, followed by an accident at the Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Plant and resulting massive evacuation efforts, making it the most massive and multiple catastrophe our nation has ever experienced.
Response	Immediately after the disaster, Geospatial Information Authority of Japan created figures of the general situation of the inundation range, conducted emergency shoots of aerial photograph to provide to related organizations, and these resources were utilized in a wide range of fields. Specifically, figures of the general situation of the tsunami inundation and aerial photos were used for the creation of radiation dosimetry maps, the issuing duties of disaster victim certificates, and explanatory manuals for volunteer activities etc. Apart from these, the disaster recovery plan base map, provided by Geospatial Information Authority of Japan, was also utilized.  [Radiation dosimetry map (estimate)]

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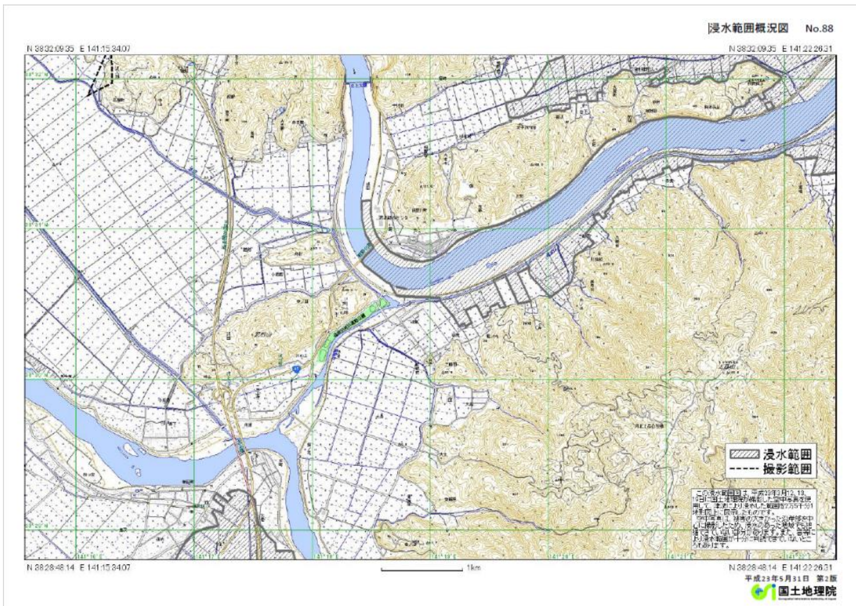
<td>

[Figure of the general situation of the inundation range]</td>
</tr>
<tr>
<td>Effect</td>
<td>Various resources to serve restoration/recovery were created and provided using the map provided by Geospatial Information Authority of Japan as its base. For example, in areas where massive emigration was conducted, the time and cost spent on the move was significantly reduced using the results of the cadastral survey results.</td>
</tr>
<tr>
<td>Future</td>
<td>Though most of the three months after the disaster was spent for grasping the damage situation, because the information gets complicated, the swift disclosure of “trustworthy maps” issued by the nation is indispensable for grasping damage situations towards their recovery. In the future, Geospatial Information Authority of Japan will continue to seriously maintain and provide geospatial information for restoration/recovery, and promote the utilization of information, while understanding the needs of each field.</td>
</tr>
</table>

No.9

Country	Japan
Organization	Geospatial Information Authority of Japan（GSI）
Title	Evacuation Center Map for 2016 Kumamoto Earthquake Response
Outline of the subject natural disaster	A Mw 6.2 earthquake occurred in Kumamoto district in southern Japan on April 14, 2016 at 21:26 (pre-shock). Subsequently, a Mw 7.0 earthquake occurred on April 16 (main shock) at 1:25. These earthquakes are referred to as “The 2016 Kumamoto Earthquake.” The earthquake left 98 people dead, 830 severely injured and 1,491 slightly injured, as well as 8,198 buildings totally collapsed, 29,761 half-collapsed and 138,102 partially damaged. The earthquake hit Kumamoto city with the population of 730 thousand and its suburban municipalities, causing 180 thousand people to be evacuated at peak period.
Response	・Affected people who took precautions against possible aftershocks and people whose houses were totally collapsed took shelter in evacuation centers. As a result, the number of evacuees far exceeded the capacity of evacuation centers. Additionally, some evacuation centers themselves were too damaged to use. Because of these, many people had to stay and sleep outside or in their own car. ・On April 17, the following day of the main shock, evacuees' living conditions became worse and their fatigue peaked due to rain and disruption of relief goods supply. However, the on-site disaster response headquarters, set up by the national government, did not have enough information about the location of the evacuation centers and the number of evacuees, which made the relief goods supply extremely difficult. ・Thus, the next day, on April 18, head of the on-site disaster response headquarters directed Geospatial Information Authority of Japan (GSI) to create a distribution map which showed the locations of the evacuation centers. In response, GSI mobilized disaster response staff, organized and compiled on-site information and existing materials, and created Evacuation Center Map (Figure 1). On April 20, GSI completed and provided the first map for the on-site disaster response headquarters.
Effects	Evacuation Center Map significantly contributed to the on-site disaster response headquarters for accessing evacuation centers and for assisting in relief supply. Since evacuation centers were re-organized and closed according to the change of number of evacuees, GSI had updated the map once a week for four months since the earthquake, until August 2016. The map played an important role in the operation and environmental management of the evacuation centers.
Future	The Basic Act on Disaster Control Measures of Japan (revised in 2013) stipulates that mayors of municipalities designate the emergency evacuation areas*1 and evacuation centers *2. Public facilities such as schools are often designated as such evacuation facilities. Since designation of the facilities is subject to change as appropriate, their location information needs to be updated on a regular basis. GSI prepared the location information of emergency evacuation areas by establishing a framework of cooperation with Cabinet Office and Fire and Disaster Management Agency, as well as collaborating with prefectures, municipalities and the like. The location information of emergency evacuation areas became publicly available on GSI web map in February 2017, and GSI will continue to update the information (Figure 2).

*1 Emergency evacuation area: A place to evacuate residents and other people at immediate risk caused by tsunami, flood or other disasters, in order to secure safety of their lives

*2 Evacuation center: Facilities to accommodate residents and other people who have escaped from disaster up until there is no further disaster risk, or to temporally accommodate those who cannot return home due to disaster.

Figure 1:Evacuation Center Map(east of kumamoto city) provided by GSI and utilized by on-site disaster response headquaters

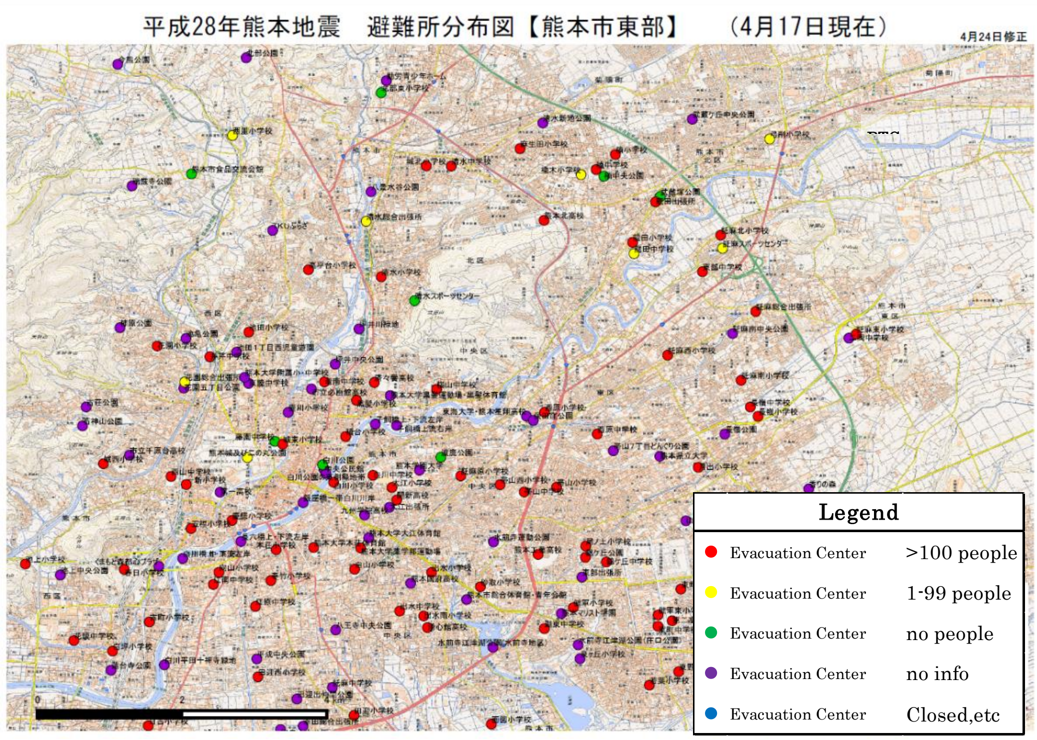
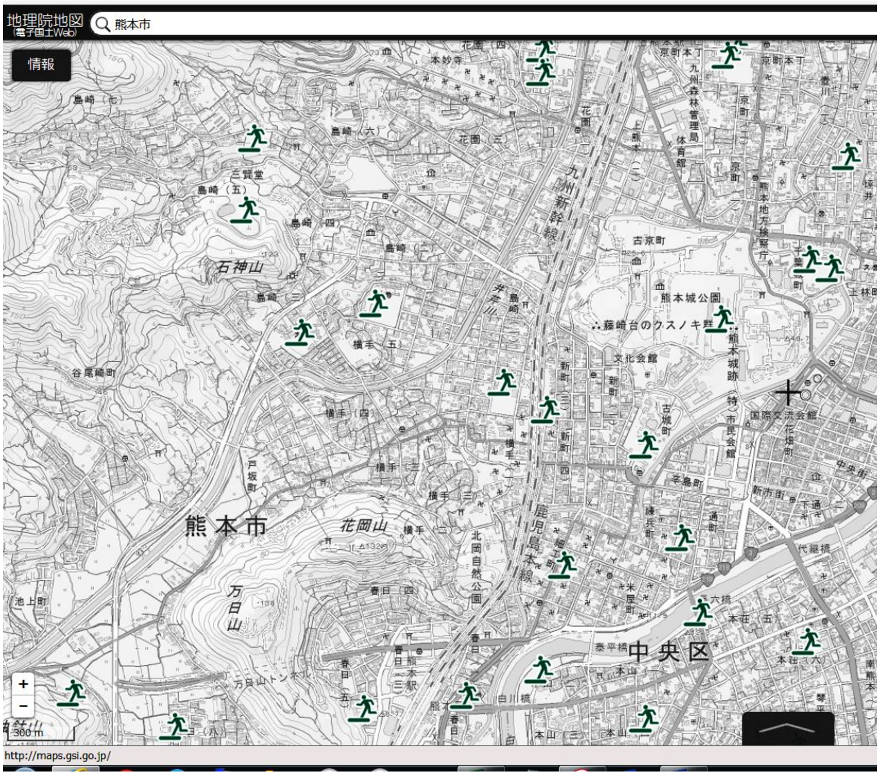


Figure 2: Emergency evacuation area provided in web map (Kumamoto city and its vicinity)



Emergency evacuation area

No.10

Country	Japan
Organization	Geospatial Information Authority of Japan（GSI）
Title	Creation of Disaster Geoinformation Catalog
Outline of the response to natural disaster	Geospatial Information Authority of Japan (GSI) compiles and provides a catalog of disaster geoinformation, including type of geospatial information as well as timing of provision and data format, featured as "Disaster Geoinformation Catalog." This catalog aims at facilitating national and Local governments effectively utilizing disaster geoinformation provided by GSI.
Response	Japan experienced various natural disasters such as earthquakes, volcanic eruptions and floods. During these disasters, the national and local governments referred to the Catalog and requested GSI to provide geospatial information according to their particular needs for disaster response.
Effects	The national and local governments referred to the Catalog and understood what type of geospatial information GSI developed and owned. This preparation helped GSI meet their requests rapidly.
Future	Since the geospatial information developed and owned by GSI are expected to become more varied and wide-ranging, GSI intends to update the Catalog regularly and provide it for the related organizations.

Disaster Geoinformation Catalog (excerpt)

[関係機関限り]

(Available Disaster Geoinformation to be provided by GSI at disaster occasions)

災害時に国土地理院が提供する地理空間情報

(Disaster Geoinformation Catalog)

防災カタログ

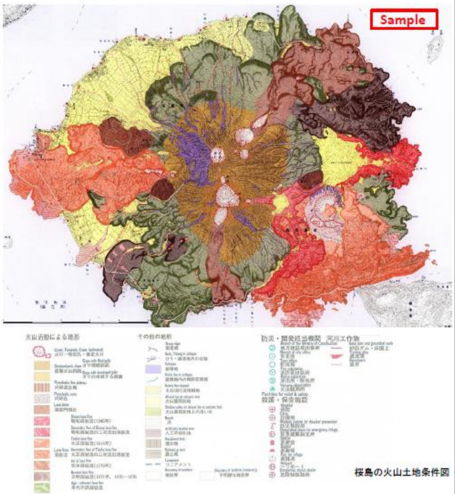
(As of 1.March 2016)

平成28年3月1日作成

国土地理院 Geospatial Information Authority of Japan

Cover Page

No. 5 火山土地条件図



火山土地条件図とは、火口分布や過去の噴出物の分布等の火山活動による地形のほか、防災関連施設などが記載された地図です。
過去の噴火と比較した災害対応をする際に有効な情報です。

注)現時点の整備状況は地理院地図からご確認ください。

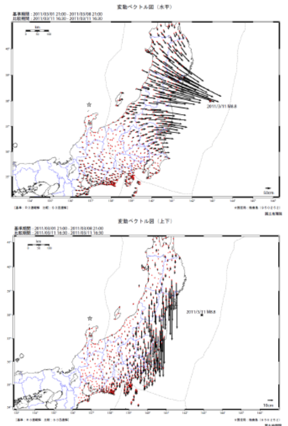
提供できる時期と形式	
時　期	噴火発生後、24時間以内
データ形式	PDF及びGeoTIFF
提供・公表形態	メール提供、国土地理院HP、関係機関向けwebサイト

問い合わせ先:企画部防災推進室　E-mail:gsi-bousai@ml.mlit.go.jp

Catalogue No. 5　国土地理院 Geospatial Information Authority of Japan

No.5 Volcanic land condition map

No. 12 変動ベクトル図(地震による変動があった場合提供)



※3月11日(発生当日)　地震調査研究推進本部地震調査委員会提出資料

変動ベクトル図は、電子基準点で観測されたデータを解析し、震源域周辺の地震による地殻変動を矢印で表示した図です。
水平成分及び上下成分の2種類を速報値として提供します。この情報は、地震規模や断層モデル等の地震現象の解明、広域な地盤沈下の把握、高潮・津波等に対する注意喚起等の防災情報として活用されます。
※地震による被災状況等により、電子基準点の復旧・データの回収が必要となることがありますが、その場合、早期に復旧、データ回収・再解析を行い、迅速に情報を提供します。

提供できる時期と形式	
時　期	発災後(地震)5時間後
データ形式	PDF
提供・公表形態	メール提供、国土地理院HP、関係機関向けwebサイト

問い合わせ先:企画部防災推進室　E-mail:gsi-bousai@ml.mlit.go.jp

Catalogue No.12　国土地理院 Geospatial Information Authority of Japan

No.12 Crustal displacement map

No. 16 無人航空機(UAV)

平成27年9月関東・東北豪雨に伴う鬼怒川破堤地点周辺

平成27年9月関東・東北豪雨に伴う西仁連川破堤地点周辺

国土地理院ランドバード班は、立入困難な被災地域を無人航空機(UAV)を用いて、現地の状況を撮影いたします。

撮影された映像は現地の状況を俯瞰的に把握できるので、迅速な状況把握に役立ち、人命救助や道路啓開等の初動活動に利用できます。

提供できる時期と形式	
時　期	撮影後、活動拠点に到着してから6～12時間程度
データ形式	静止画:JPG 動画:WMV
提供・公表形態	メール提供、国土地理院HP

問い合わせ先:企画部防災推進室　E-mail:gsi-bousai@ml.mlit.go.jp

Catalogue No. 16　国土地理院 Geospatial Information Authority of Japan

No.16 Unmanned aerial vehicle

No.11

Country	Malaysia
Organization	Department of Survey and Mapping Malaysia (DSMM)
Title	The Use of Unmanned Aerial Vehicle (UAV) to Monitor the Flood and Its Impact in Malaysia
Outline of the subject natural disaster	Floods are the major natural disaster threat facing Malaysia. The 2014-year end downpour and floods has been the worst ever in the country's history, affecting more than half a million people. Damage to infrastructure alone was estimated RM2.851 billion. Areas that have never experienced floods before were also inundated and floodwater rose at an unprecedented level.
Response	The video and aerial photo captured using UAV have been used to provide information about the areas that were susceptible to the floods and locations where people can be evacuated to. The data have been used for making post flood damage assessments and identifying the facilities need to be repaired urgently such as roads, bridges, water treatment plant, etc.
Effect	The process to search and rescue flood victims were expedited by using the UAV data. Besides that the refurbishment and reconstruction of damaged facilities were expedited to ease the transportation links in moving people and goods to the affected area. The use of UAV also has saved the operational cost due to its flexibility and cheap flying operation with less constraint on time and human resources.
Future	To provide UAV data during and after disaster for relief and recovery purposes particularly on the remote area. Efficient dissemination of information

No.12

Country	Malaysia
Organization	Department of Survey and Mapping Malaysia (DSMM)
Title	Earthquake Struck Ranau in Sabah, Malaysia
Outline of the subject natural disaster	A magnitude 5.9 earthquake struck near Mount Kinabalu killing 18 and stranding more than a hundred people on the peak. The quake damaged roads and buildings, including schools and a hospital on Sabah's west coast. Geospatial information also plays a big role to monitor the crustal and surface motion by using Continuously Operating Reference Station (CORS) data.
Response	The earthquake that occurred in Ranau on 5th June 2015 which is near to Mount Kinabalu had caused massive landslides around the mountain and nearby area as well. The data before and after earthquake from CORS stations (MyRTKnet) and 11 GNSS monuments were analysed and has indicated the surface motion on the area is between 36 to 53 cm. The output reflected the benefit to monitor the progress of motion so that the early warning for earthquake can be disseminated to alert the surrounding people.
Effect	The data from CORS stations (MyRTKnet) and 11 GNSS monuments has contributed significant information for an early warning system for earthquake in order to expedite the necessary evacuation of people from the hazard area. Also important in the following cases: • Overall picture and extent of damage caused • Indication of ground displacement • Planning and distribution of aids
Future	To densify the CORS stations (MyRTKnet) throughout the country

No.13

Country	Republic of the Philippines
Organization	National Mapping and Resource Information Authority (NAMRIA)
Title	Multi-Hazard Mapping of 28 Priority Provinces and the Greater Metro Manila Area
Outline of the subject natural disaster	The Philippines is consistently visited by tropical disturbances exposing communities to hydrometeorological hazards such as strong winds, storm surge floods/flashfloods, and rain-induced landslides. The country, being located in the Pacific ring of fire, is likewise exposed to seismological hazards such as ground shaking, ground rupture, earthquake-induced landslide, and liquefaction. Aiming to have a safer and disaster resilient communities, multi-hazard mapping of the 28 high risk provinces was implemented to map out areas exposed to natural hazards. The output of this activity will facilitate evidence-based decision-making by local and national authorities.
Response	The Agency provided base maps, capacitated LGUs on the use of GIS technology, engaged technical staff in the integration of hazard maps for use by the local government units and national government agencies, and participated in the conduct of information and education campaign (IEC) in the communities primarily exposed to hazards.
Effect	1. Raised awareness on the impending hazards confronting the exposed communities in the provinces. 2. Hazard maps are increasingly used in the formulation of land use and physical development plans. 3. Hazard maps used in the formulation of local DRRM plans. 4. Increasing number of LGUs expressing interest in the use of GIS for DRRM
Future	

No.14

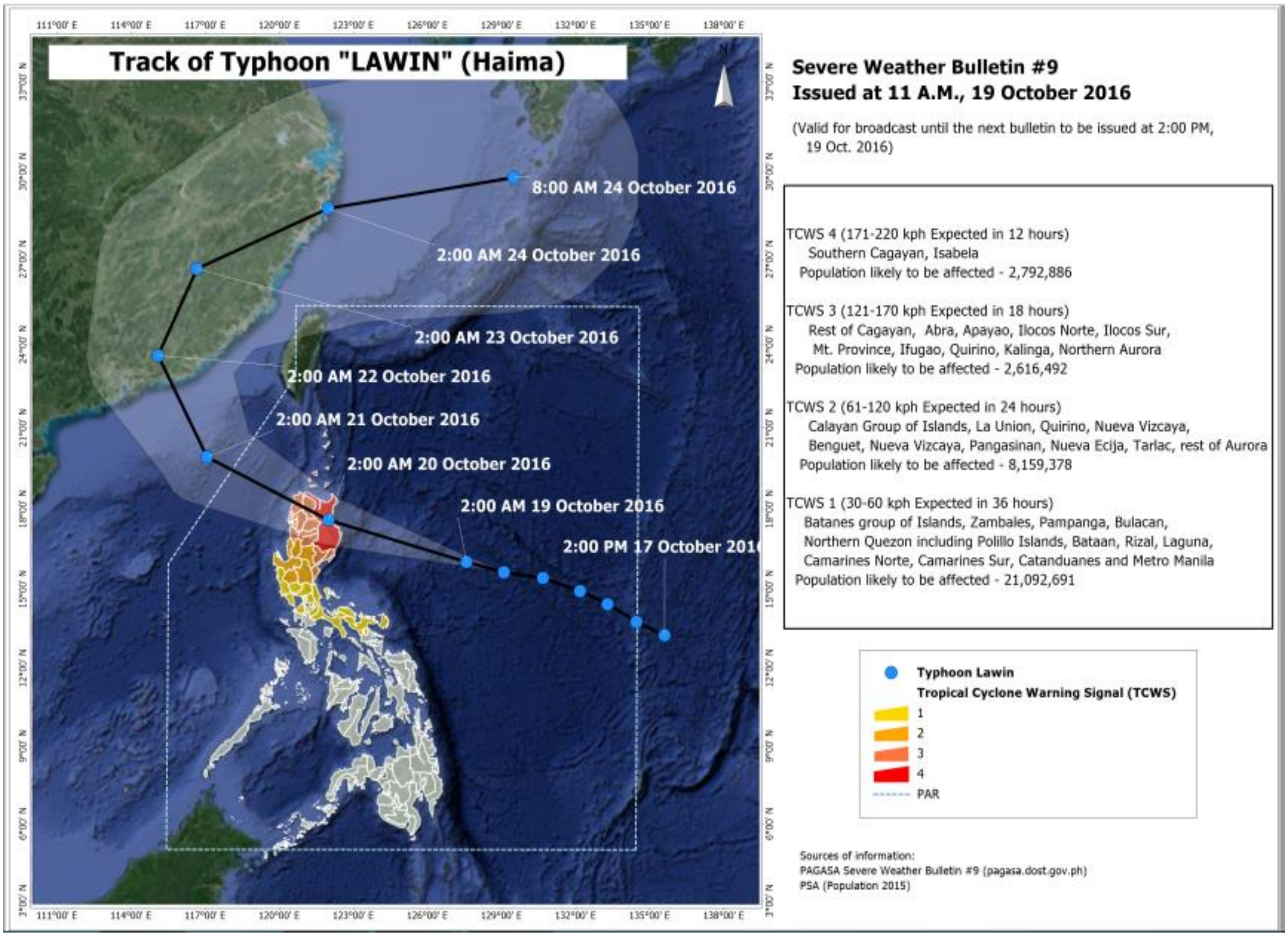
Country	Republic of the Philippines
Organization	National Mapping and Resource Information Authority (NAMRIA)
Title	The Philippine Geoportal
Outline of the subject natural disaster	The Philippine Geoportal is envisioned to provide a comprehensive and consistent geospatial information of the country. It aims to support the geospatial information needs of users in various disciplines by providing access to such information. In the aftermath of Tropical Storm Ketsana (Ondoy) which left Metro Manila and 30% of the provinces in the Philippines under state of calamity, geohazard maps were prepared for the 28 high risk areas in the country. These maps were made accessible to the public through the Philippine Geoportal.
Response	Developed in the Philippine Geoportal is a DRRM application which provides a visual appreciation of the hydrometeorological and seismological hazards in the high risk areas of the country.
Effect	1. Increased awareness of the public on the hazards faced by the community. 2. Hazard maps are increasingly used in the formulation of land use and physical development plans. 3. Hazard maps used in the formulation of local DRRM plans.
Future	

No.15

Country	Republic of the Philippines
Organization	National Mapping and Resource Information Authority (NAMRIA)
Title	Recovery and Rehabilitation after Typhoon Haiyan
Outline of the subject natural disaster	The harrowing impact of typhoon Haiyan left about 4 million people homeless. This prompted the Philippine government to ensure the safety of the affected communities, moving them away from the seashore to more suitable relocation sites. In focusing on the recovery and rehabilitation phase, the immediate objective is to identify areas suitable for relocation of those left homeless by the typhoon.
Response	NAMRIA provided technical assistance with the provision of IfSAR data which includes digital terrain models (DTM), digital surface models (DSM), and orthorectified images used in the identification of suitable relocation sites for the affected communities.
Effect	The government was able to advance and fast track the identification of safe and unsafe zones in the Haiyan-affected areas.
Future	

No.16

Country	Philippines
Organization	National Mapping and Resource Information Authority (NAMRIA)
Title	Mapping of Track of Typhoon Lawin (International Name: Haima) and Affected Areas and Population
Outline of the subject natural disaster	In 19 October 2016, Typhoon Lawin (Haima) classified as extremely dangerous by the state's weather agency affected the provinces in the northern part of the country. As it intensified into a super typhoon, destructive floods and massive landslides were expected to be brought by moderate to heavy rains within its 800-km diameter.
Response	NAMRIA prepared a map layout showing the track of Typhoon Lawin (Haima), the likely affected provinces and population. NAMRIA integrated data from various sources such as Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) and the Philippine Statistics Authority (PSA). The map was made public via NAMRIA's website for download by other DRR agencies, local government units, and other interested parties.
Effects	The public is able to visualize the track of the typhoon and is made aware of the areas and population likely to be affected by it. This increased awareness of the residents in the likely affected areas to prepare for the impending typhoon.
Future	Strengthen coordination with DRR and other agencies providing statistical data relevant to disaster preparedness.



Map showing the track of Typhoon Lawin and likely affected areas. The map was made available for public download at NAMRIA's website.

No.17

Country	Philippines
Organization	National Mapping and Resource Information Authority (NAMRIA)
Title	Philippine Active Geodetic Network (PageNet) – Surigao Earthquake
Outline of the subject natural disaster	The Province of Surigao del Norte in northeastern Mindanao was struck by a magnitude (M_S) 6.7 earthquake on 10 February 2017. The earthquake was generated by the movement of the Philippine Fault-Surigao segment. The groundshaking was felt at PHIVOLCS Earthquake Intensity Scale (PEIS) VII in Surigao City and San Francisco. Liquefaction and earthquake-induced landslide were documented as well as collapsed bridge, damages to buildings, ports, roads, and bridges. As of 15 February 2017, there were 202 reported injuries and 8 reported casualties.
Response	NAMRIA measured the displacement of PageNet stations as a result of the M6.7 Surigao Earthquake on 10 February 2017. The recent earthquake caused a 2D shift in the coordinates[1] by as much as 12.9 cm in the north-west direction. This displacement (10.1 cm to North, 8.0 cm to West, and 2.8 cm Down) was measured from 9 to 11 February 2017 from the active geodetic station (AGS) PSUR of PageNET, which is located in Surigao City, 14km from the earthquake's epicenter. The next nearest AGS PTGO in Tagoloan, Misamis Oriental, which is 158 km from the epicenter, showed no significant shift in its position. The data from PSUR was processed using Bernese GNSS Software from 01 to 20 February 2017 (10 days before and after the event) using the best available products (e.g. orbits, clocks) from the International GNSS Service (IGS). The displacements measured are not fixed to a stable tectonic plate and are just based solely on the change in position in the ITRF. The reference coordinates of the stations are based on the May 2015 monthly solution from Bernese. Continuous monitoring of the stations is ongoing for post-earthquake events. ______________ Coordinates in the International Terrestrial Reference Frame (ITRF) 2008
Effects	Results of the measurements and continuous monitoring of the stations will be made available to the Philippine Institute of Volcanology and Seismology (PHIVOLCS) in support of the Agency's (PHIVOLCS) assessment and analysis related to the recent seismic activity.
Future	Strengthen partnership with PHIVOLCS and other DRR agencies such as Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) to promote the use of AGS data for seismological, meteorological, and other potential applications.

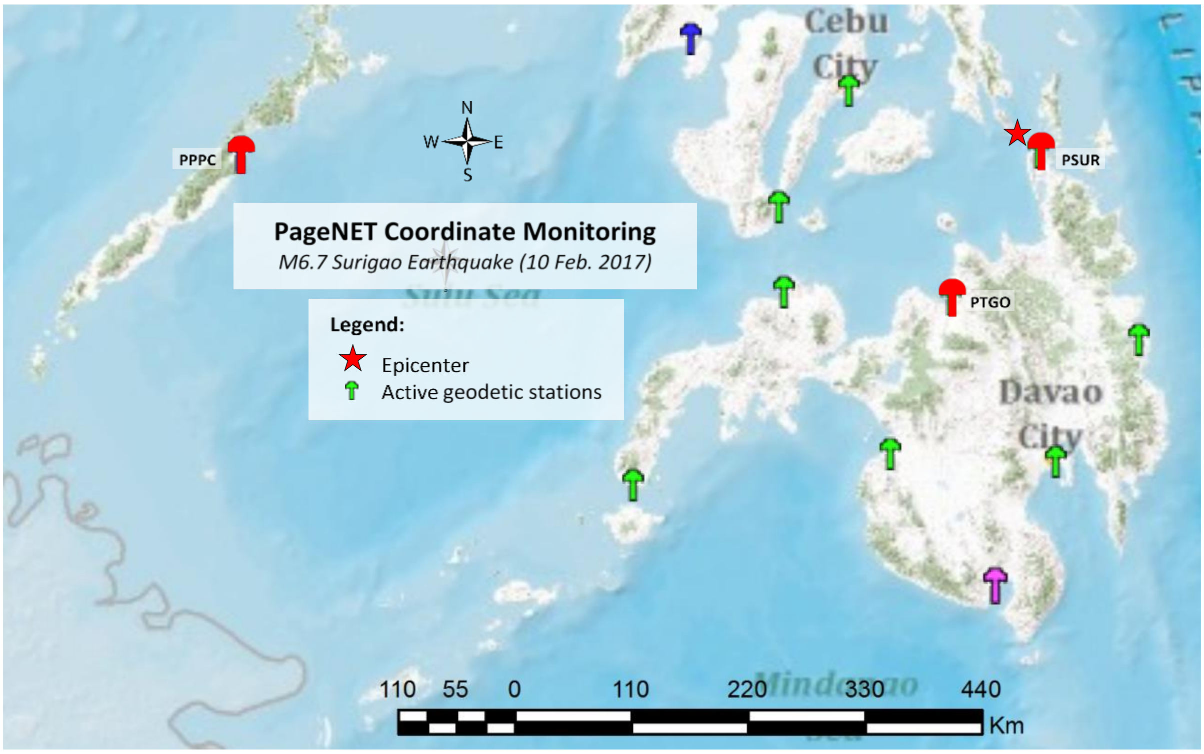


Figure 1. ***PageNET active geodetic stations monitored*** *(in red)*

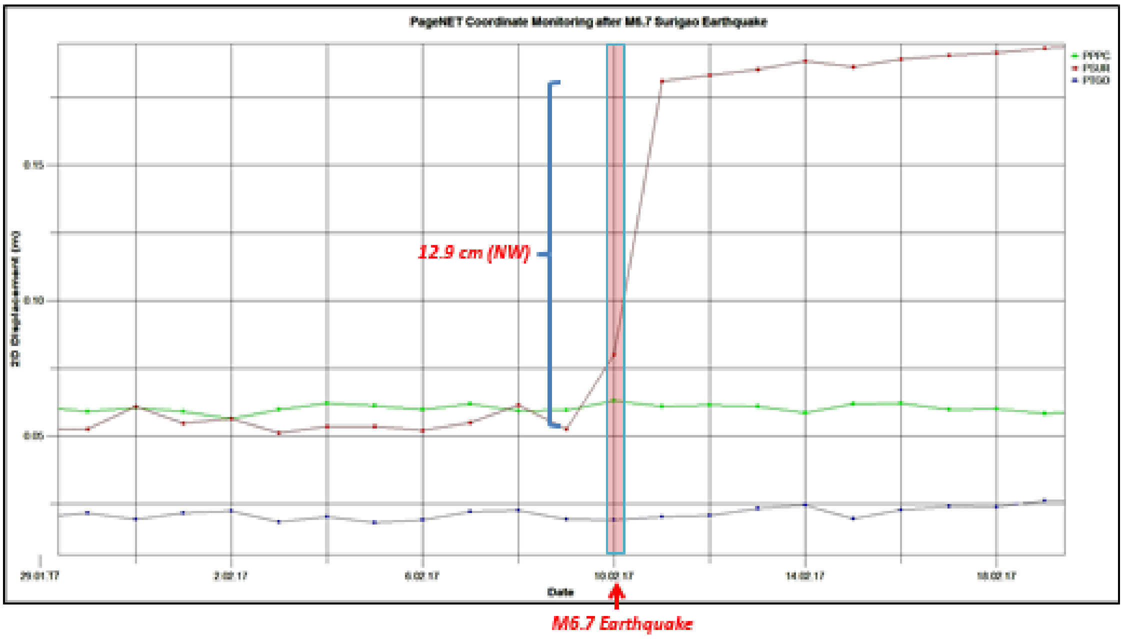


Figure 2. ***2D Displacement*** *(9 to 11 February 2017 = 12.9 cm, north-west)*

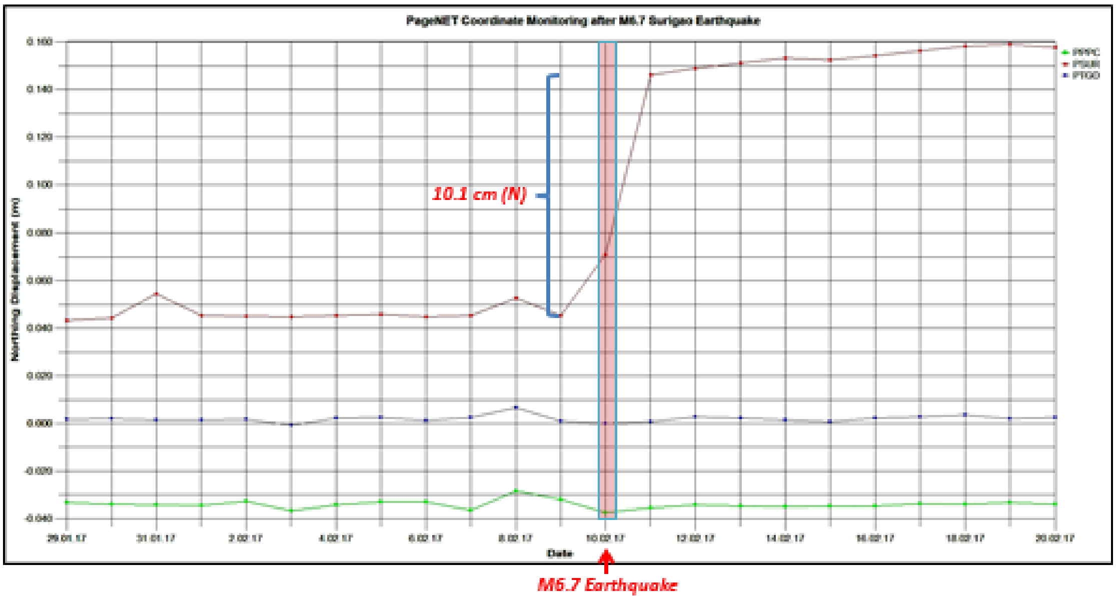


Figure 3. ***Northing Displacement*** *(9 to 11 February 2017 = 10.1 cm, north)*

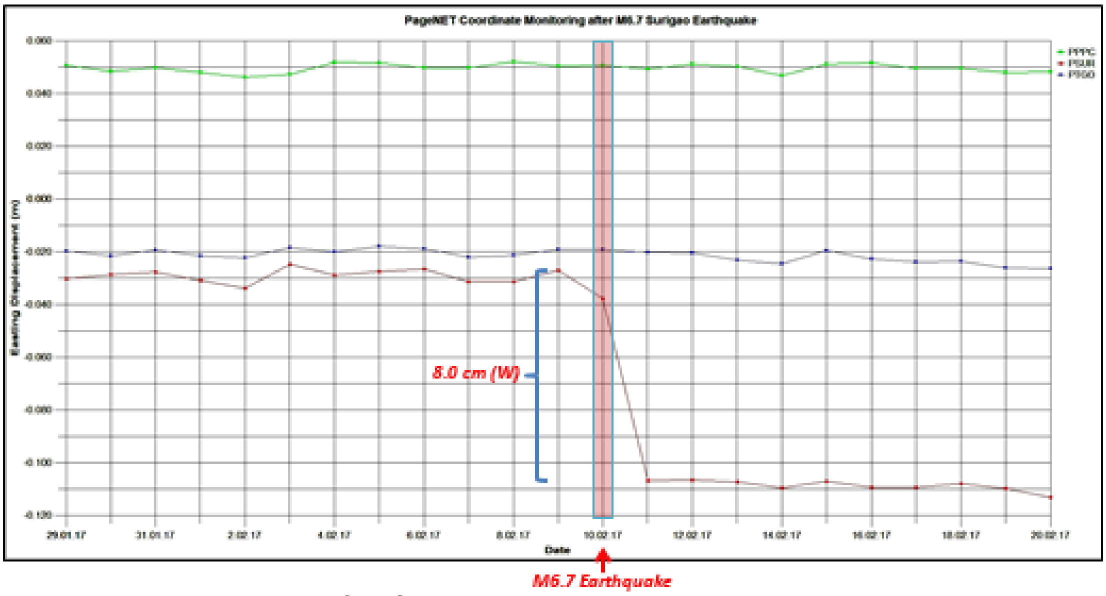


Figure 4. **Easting Displacement** (9 to 11 February 2017 = 8.0cm, west)

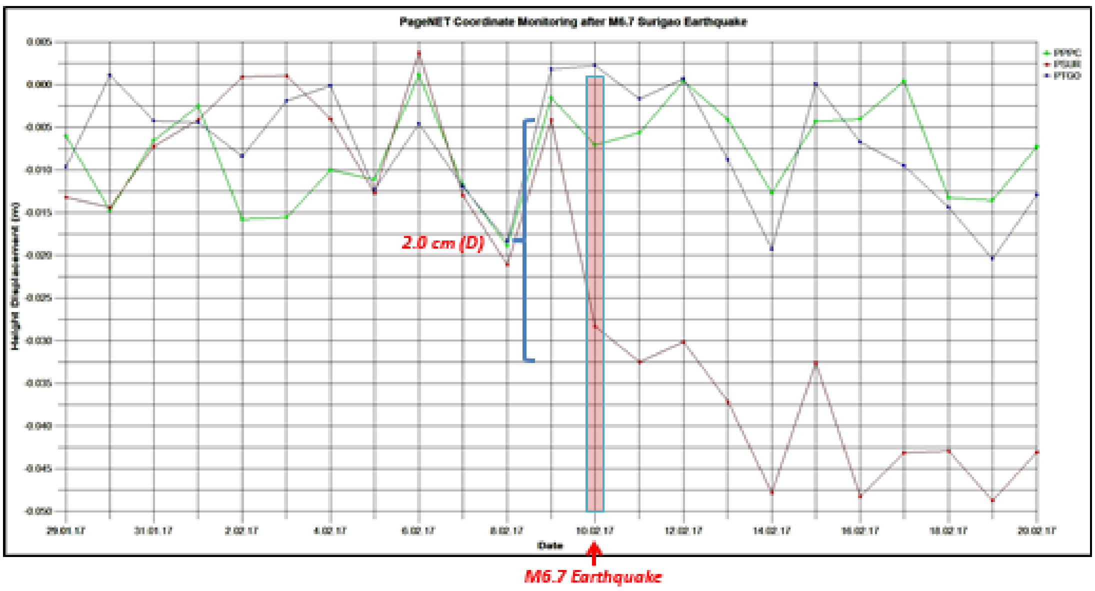


Figure 5. **Height Displacement** (9 to 11 February 2017 = 2.8cm, down)

Notes:

1. *Date format: dd.mm.yy, e.g. 1.02.17 = 1 February 2017*
2. *Each data point corresponds to one daily solution processed from Bernese*
3. *Displacements measured is difference of each daily coordinates from PageNET AGS' reference ITRF2008 coordinates (epoch 15 May 2015). For example, in Figure 3, PSUR Northing has moved ~0.04 m (N) on 29 January 2017 from its 15 May 2015 coordinates.*

No.18

Country	Sri Lanka
Organization	Survey Department
Title	Surveyor General
Outline of the subject natural disaster	Tsunami – 2004 December 26
Response	Providing available digital data / maps and technical support to map the disaster prone areas / damages Identify available resources for relief activities
Effect	Help quick dispatch of support Relief providing activites Locations for relief camps Medical support availability information
Future	Fully pledged database on topographic information / resources available which is shared with stakeholders / allowing them to add / update information Quick mapping with UAV when required Provide accurate digital elevation model