Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P01 会場:コンベンションホール 時間:5 月 22 日 13:30-15:00

フィリピン・インドネシアにおける広帯域地震観測網を用いた地震活動モニタリング
Monitoring of seismic activity in Philippine and Indonesia regions

プリード ネルソン [1*], 熊谷 博之 [1], 井上 公 [1], Renato U. Solidum[2], 山品 匡史 [3], Ishmael C. Narag[2], Baby Jane T. Punonbayan[2], Melquiades S. Figueroa II[2], Arnaldo A. Melosantos[2], Suhardjono[4], 前田 裕太 [1]
PULIDO, Nelson[1*], KUMAGAI, Hiroyuki[1], INOUE, Hiroshi[1], Renato U.Solidum[2], YAMASHINA, Tadashi[3], Ishmael C. Narag[2], Baby Jane T. Punonbayan[2], Melquiades S. Figueroa II[2], Arnaldo A. Melosantos[2], Suhardjono[4], MAEDA, Yuta[1]

[1] 防災科学技術研究所, [2] フィリピン火山地震研究所, [3] 国立大学法人高知大学, [4] インドネシア気象気候地球物理庁
[1]National Research Institute for Earth Science and Disaster Prevention, [2]Philippine Institute of Volcanology and Seismology (PHIVOLCS), [3]Kochi Univ., [4]BMKG

In this study we describe the implementation of an automated system for estimations of earthquake source parameters in Philippines and Indonesia using regional broadband seismic waveform data. This system is an updated version of the automated CMT inversion system originally developed for Indonesia (Nakano et al., 2010). The updated system can receive continuously near real-time waveform data at NIED, from 7 broadband stations in the Philippines, operated by PHIVOLCS, as well as 143 broadband stations in Indonesia (122 operated by BMKG and 21 by GFZ). The broadband stations in the Philippines are being deployed within the framework of a five years SATREPS project (2010-2014) entitled,“ Enhancing Earthquake and Volcano Monitoring Capabilities and Promoting Effective Utilization of the Disaster Information in the Philippines ”, managed by NIED. The BMKG stations in Indonesia include 17 stations originally deployed by NIED (JISNET network).

The data acquisition system at NIED is based on the seedlink and SeisComP programs developed by GFZ, which allow us the near real-time collection of data feeds in miniSEED format, from seedlink servers in PHIVOLCS (Philippines) and BMKG (Indonesia). This system receives the data in a ring buffer, and then archives it periodically. After an e-mail alert with event information is received, the automatic centroid moment tensor inversion calculation is performed by SWIFT. Then a manual check of the events is performed in a daily basis. In the SWIFT system the inverse problem is solved in the frequency domain for efficient computation. A double couple focal mechanism is assumed in the inversion to stabilize the solution by using data from a small number of seismic stations (Nakano et al., 2008). The SWIFT system has been updated to be able to process data from miniSEED format, which is a convenient format for data exchange with networks abroad.

As an example of the performance of our system we present results of estimations of source parameters of the February 6, 2012 Negros earthquake in the Philippines and its major aftershocks (NIED, 2012). This shallow thrust earthquake with a moment magnitude (Mw) of 6.7 occurred in the Tanon strait, Central Philippines, in a region where no earthquakes shallower than 50 km and with magnitude (Mw) larger than 5 have occurred in the last 36 years, according to the Global CMT Project catalogue. The SWIFT CMT solutions of the mainshock and its major aftershocks are spread in a region of approximately 70 km along the Tanon strait. These events highlighted the importance of a combined use of stations in Philippines and Indonesia to improve the accuracy of event locations in the SWIFT system.

References

Nakano, M., T. Yamashina, H. Kumagai, H. Inoue, and Sunarjo, 2010. Centroid moment tensor catalogue for Indonesia, Phys. Earth Planet. Inter., 183, 456-467, doi:10.1016/j.pepi.2010.10.010.

Nakano, M., Kumagai, H., Inoue, H., 2008. Waveform inversion in the frequency domain for the simultaneous determination of earthquake source mechanism and moment function. Geophys. J. Int., 173, 1000-1011, doi:10.1111/j.1365- 246X.2008.03783.x.

NIED, 2012. Off Negros Island, Philippines, February 6, 2012, 03:49 (UTC) (Mw 6.7),
http://www.isn.bosai.go.jp/events/20120206034919/index.html (in Japanese).

キーワード: フィリピン・インドネシア, 地震活動, 広帯域地震観測網, 2012 年 2 月 6 日フィリピン・ネグロス島沖の地震, モニタリング, ＣＭＴ

Keywords: Philippines, Indonesia, Seismic activity, Broadband seismic network, 2012/2/6 Off Negros Island, Philippines earthquake, Monitoring, CMT

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P02 会場:コンベンションホール 時間:5 月 22 日 13:30-15:00

Free mode excitation of the Pacific Basin during the 2011 large Tohoku tsunami
Free mode excitation of the Pacific Basin during the 2011 large Tohoku tsunami

Mohammad Heidarzadeh[1*], Kenji Satake[2]
HEIDARZADEH, Mohammad[1*], SATAKE, Kenji[2]

[1]Faculty of Civil and Environmental Engineering, Tarbiat Modares University, [2]Earthquake Research Institute (ERI), University of Tokyo
[1]Faculty of Civil and Environmental Engineering, Tarbiat Modares University, [2]Earthquake Research Institute (ERI), University of Tokyo

Several studies showed that the March 2011 large tsunami offshore northeastern Japan caused long oscillations in the Pacific Basin persisting almost 4-5 days. Analysis of tide gauge records of this tsunami revealed that relatively high-energy waves caused by this tsunami persisted at least 3 days in the Pacific Basin. Therefore, speculations were made in the tsunami community attributing these long energetic oscillations to free-mode excitation of the Pacific Basin. Free mode excitation is the main source of long oscillations and sloshing inside closed or semi-closed basins which results in long-duration and energetic waves in the basins. This is typical of harbors and lakes. However, when the source is large like the one for the March 2011 Japan tsunami, free-mode excitation may occur in large basin like the Pacific Basin. It is clear that a basin as big as the Pacific one can have several eigen modes and that a particular tsunami source can excite one or some of the free modes.

To examine this hypothesis, here first we apply a numerical algorithm to estimate the free modes of the Pacific Basin. This algorithm is based on numerical modeling of tsunami and spectral analysis of the wave time-series recorded at different locations. We then study the spectral characteristics of the selected tide gauge records of the March 11, 2011 Tohoku tsunami to examine if some of the free modes of the basin are present in the tide gauge records or not. Comparative study is performed to determine the contribution of the free mode excitation of the basin to the total energy of the March 2011 tsunami.

キーワード: March 2011 Tohoku earthquake, Pacific Basin, Free mode, Spectral analysis, Sloshing, numerical modeling
Keywords: March 2011 Tohoku earthquake, Pacific Basin, Free mode, Spectral analysis, Sloshing, numerical modeling

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P03 会場:コンベンションホール 時間:5 月 22 日 13:30-15:00

インドネシア・シナブン火山の噴火シナリオ
Eruption Scenario of Sinabung volcano, North Sumatra, Indonesia

吉本 充宏 [1*], 中田 節也 [2], 外西 奈津美 [2], 井口 正人 [3], 大倉 敬宏 [4]
YOSHIMOTO, Mitsuhiro[1*], NAKADA, Setsuya[2], HOKANISHI, Natsumi[2], IGUCHI, Masato[3], OHKURA, Takahiro[4]

[1] 北海道大学理学研究院, [2] 東京大学地震研究所, [3] 京都大学防災研究所火山活動研究センター, [4] 京都大学大学院理学研究科附属地球熱学研究施設火山研究センター
[1]Faculty of Science, Hokkaido University, [2]Earthquake Research Institute, University of Tokyo, [3]Sakurajima Volcano Research Center, Disaster Prevention Research Institute, Kyoto University, [4]Institute for Geothermal Sciences, Graduate School of Science, Kyoto University

Sinabung Volcano is an andesitic stratovolcano located 40 km northwest of Lake Toba, North Sumatra The edifice consists mainly of multiple thick lava flows, lava domes and block-and-ash flow and associated surge deposits. The latest spine is located at the southern end of one of the summit craters trending in N-S. The youngest block-and-ash flow and associated surge deposits derived from the spine distributed at the southeastern flank are considered to be emplaced at ca. 1.1 ka, based on the radiocarbon ages of charcoals in the deposits. The flow deposits reached about 5 km southeast of the vent. Historical eruptions have not been reported prior to the phreatic eruptions during August-September 2010. The latest eruption caused panic among the people living around the volcano.

One of the plausible scenarios for future eruption may be proposed based on the eruption history and the chemical characteristics of the volcano. The geology of this volcano shows dome-forming lava extrusion or lava flowing, being associated with pyroclastic flows (block-and-ash flows or surges) and a debris avalanche, the latter which were generated from partial failure of the lava domes/flows or the upper part of the volcanic edifice. On the contrary, ashfall deposits suggesting relatively large explosive eruptions such as plinian- to subplinian-types were not found, implying no occurrence of large explosive explosions in this volcano throughout its history. Therefore, a dome-forming eruption or lava flowing near the summit is highly possible as a future eruption. During dome growth, partial collapse of the lava dome will generate pyroclastic flows (block-and-ash flows and surges). If a large lava dome grows at the summit crater, the most serious scenario will be a failure of the old and weak volcanic edifice due to the load of the dome. Relatively large-scale collapse of the volcanic edifice may generate a lateral blast preceding the pyroclastic avalanche, such as observed in the 1997 event at Soufriere Hills volcano, Montserrat, where the crater wall on which the growing lava dome overrode collapsed together with a part of the overlying dome. In this scenario significant earthquakes and the flank deformation would be expected several days or weeks before the failure as observed in Montserrat. If magma is less viscous due to low SiO2 content or higher temperature driven by a high effusion rate, lava will flow down on the flank from the summit crater, being associated with minor pyroclastic flows from the flow front. Evolution of scenarios may be tracked and judged by continuous monitoring of volcanic earthquakes and ground deformation.

キーワード: インドネシア, シナブン火山, 噴火シナリオ, ブロックアンドアッシュフロー堆積物, 溶岩ドーム
Keywords: Indonesia, Sinabung volcano, Eruption Scenario, block-and-ash flow, Lava dome

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P04 会場:コンベンションホール 時間:5月22日 13:30-15:00

GPS連続観測によるグントール、シナブン、メラピ火山の活動評価
Evaluation of activity of Guntur, Sinabung and Merapi volcanoes, in Indonesia based on continuous GPS observations

大倉 敬宏[1*], 井口 正人[2], Muhamad HENDRASTO[3], Umar ROSADI[3]
OHKURA, Takahiro[1*], IGUCHI, Masato[2], Muhamad HENDRASTO[3], Umar ROSADI[3]

[1]京都大学 火山研究センター, [2]京都大学 防災研究所, [3]CVGHM, ESDM,Indonesia
[1]AVL, Faculty of Science, Kyoto Univ., [2]DPRI,Kyoto Univ., [3]CVGHM, ESDM,Indonesia

Indonesia has 127 active volcanoes along its archipelago and the volcanoes have experienced tremendous disasters in the past with variety of eruption styles and appearance of volcanic disaster. Therefore, prediction of volcanic eruption and mitigation of volcanic hazards are urgently required. However, many active volcanoes are equipped with only one seismic station. For the mid- and long- term prediction and evaluation of post-eruptive activity, continuous observations of ground deformations are necessary. Therefore, we have installed GPS stations in Guntur, Sinabung and Merapi volcanoes, by a project "Multi-disciplinary Hazard Reduction from Earthquakes and Volcanoes in Indonesia" under the Science and Technology Research Partnership for Sustainable Development (SATREPS) started in 2009.

Guntur volcano complex is located 35 km SE of Bandung, West Java. The volcano was quite active, repeating volcanic explosions and effusion of lava flows in 18th and 19th centuries. Although Guntur volcano has been dormant in eruptive activity since 1847, seismicity s is active and this volcano is regarded as one of the high-risk volcanoes due to the dense population SE of the volcano. For the mid- and long-term prediction, continuous observations of ground deformation are necessary.

Mt. Sinabung is an andesitic stratovolcano (2460-m-high) located 40 km northwest of Lake Toba, North Sumatra. Historical eruptions have not been reported prior to the phreatic eruptions during August-September 2010. Although the eruptive activity declined after September, seismicity on and around the volcano was still high .

An explosive eruption occurred on October 26, 2010 at Merapi volcano in Central Java and the eruptive activity was followed by continuous occurrence of pyroclastic flow from the summit crater during the period from November 3- 5.

Four stations were installed around Gntur volcano in October 2009, Merapi volcano in December 2010 and Sinabung volcano in February 2011, where three stations are located on the volcano edifice and one at a base station at the foot of the each volcano. GPS stations on the edifice are connected to the base station via WLAN. We applied a PPP (precise point positioning) using GPS analysis software, GIPSY-OASIS II Ver.6.1 to the data of Guntur and Merapi volcanoes. In the analysis, JPL precise ephemeris is used, and dairy coordinates are calculated in the frame of ITRF2008. From the obtained coordinates, we can calculate baseline among stations. The GPS data at Sinabung volcano is being analyzed automatically using Leica GNSS Spider software.

As a result in Guntur volcano, inflation was detected 5 months prior to seismic crisis in September 2011, suggesting intrusion of magma beneath the volcano at that time. Also, inflation was detected in Merapi volocano, suggesting restart of magma accumulation just after the huge eruption in 2010. And almost no deformation has been detected in Sinabung volcano suggesting little possibility of imminent magmatic eruption.

Keywords: GPS, ground deformation, volcanic activity, Indonesia

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P05　会場:コンベンションホール　時間:5月22日 13:30-15:00

地形からみた２０１１年のタイの洪水
Land form and flooding of central plain of Thailand in 2011

春山 成子[1*]
HARUYAMA, Shigeko[1*]

[1] 三重大学
[1]Mie university

タイ中央平原水害地形分類図で示した自然堤防，後背湿地などの微地形要素を 2011 年洪水とを対照したところ洪水氾濫状況と微地形との対応関係が認められた．後背湿地では洪水冠水期間が長く，自然堤防では冠水しても後背湿地と比べ冠水期間は短い．タイ中央平原西部のメクロン川・クラシオ川扇状地は冠水せず，扇状地末端からチャオプラヤ川・スパンブリ川に沿う後背湿地が洪水氾濫地域となった．1980 年代後半から 30 年が経過してタイ中央平原南部は，かってはバンコク首都圏を取り巻くように拡がっていた農業地域の面積が減少し宅地や工場敷地面積が増加している．このため、被害地域が広域にわたった．

キーワード: タイ中央平原, 洪水, 地形, リモートセンシング
Keywords: central plain of Thailand, flooding, landform, rimote sensing

HDS06-P06 会場:コンベンションホール 時間:5 月 22 日 13:30-15:00

The detection of seismo-ionospheric phenomena: approaches and problems
The detection of seismo-ionospheric phenomena: approaches and problems

Irk Shagimuratov[1*], Iurii Cherniak[1], Irina Zakharenkova[1], Nadezhda Tepenitsyna[1], Galina Yakimova[1]
SHAGIMURATOV, Irk[1*], Iurii Cherniak[1], Irina Zakharenkova[1], Nadezhda Tepenitsyna[1], Galina Yakimova[1]

[1]West Department of IZMIRAN, Kaliningrad, Russia
[1]West Department of IZMIRAN, Kaliningrad, Russia

During several decades the effects related with seismic activity were extensively studied. The nonregular ionospheric variations, associated with pre- and co-seismic activity, were investigated by various radiophysical and in-situ measurements over different seismo-active regions. Nowadays one of the most effective tools for diagnostic of seismo-ionospheric phenomenon in a global scale is the method based on analysis of TEC variations obtained from global navigation systems signals (GPS/GLONASS). The influence on the ionosphere from ground is frequently weaker in compare with effects of solar or geomagnetic origin. By this reason it is very actual the problem of detection of seismo-ionospheric anomalies on the background of strong regular and quasi-regular variation of space weather parameters.

For analysis of seismo-ionospheric effects the traditional approach consists in statistical processing of long-term datasets, calculation of non-disturbed averaged diurnal variation of TEC, estimation of differences and anomaly recognizing. Many scientists studied seismo-ionospheric phenomena have reported about different precursors appearance for the same earthquakes.

Results of analysis of possible ionospheric anomalies associated with earthquakes of 2007-2011 was indicated that estimation of differences, obtained by traditional techniques can led to anomalies during seismo-quite periods, but strongly correlated with variations of solar ionizing radiation. Also similar effects can be caused by superimposing effects of waves in the ionosphere (planetary 2-3 day period waves, terminator waves, Poincare waves, etc).

In this work we analyze the influence of different factors (separate and superimposed) on the reliability of detection seismo-ionospheric anomalies. It was considered the specific temporal intervals used for background calculation and revealed most optimal variants. It is proposed several approaches in order to take into account the space weather factors and ionospheric waves during process of seismo-ionospheric phenomenon recognizing.

The research leading to these results has received funding from the European Union Sevenths Framework Program (FP7/20017-2013) under grant agreement N. 263502 - PRE-EARTHQUAKES project.

キーワード: ionosphere, GPS, seismo-ionospheric effects, space weather
Keywords: ionosphere, GPS, seismo-ionospheric effects, space weather

Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HDS06-P07 会場:コンベンションホール 時間:5 月 22 日 13:30-15:00

Use of multi-instrumental radiophysical measurements to study seismo-ionospheric effects

Use of multi-instrumental radiophysical measurements to study seismo-ionospheric effects

Iurii Cherniak[1*], Irina Zakharenkova[1], Irk Shagimuratov[1], Olga Suslova[2]
CHERNIAK, Iurii[1*], ZAKHARENKOVA, Irina[1], SHAGIMURATOV, Irk[1], Olga Suslova[2]

[1]West Department of IZMIRAN, Kaliningrad, Russia, [2]I. Kant Baltic Federal University, Kaliningrad, Russia
[1]West Department of IZMIRAN, Kaliningrad, Russia, [2]I. Kant Baltic Federal University, Kaliningrad, Russia

Though lithosphere-atmosphere-ionosphere coupling has been intensively discussed for several decades, it does not mean that the ionospheric morphology above seismically active regions is investigated sufficiently well. Investigation of seismo-ionospheric phenomena is a rather complicated task which consists of the identification and localization of weak anomaly pattern at the background of ionospheric changes under various space weather conditions. Analysis of the previous works on lithosphere-ionosphere interactions confirmed the necessity to use simultaneous observations form several independent diagnostics tools in order to raise the reliability of the observed seismo-ionospheric effects. For the given research we propose to use integrated processing of the ionospheric data from different sources: total electron content (TEC) data obtained on the basis of regular GPS observations of IGS stations located in Japan region, ionospheric E and F2 layers peak parameters, derived from data of Japan ionosonde network and electron density profiles, obtained by FORMOSAT-3/COSMIC radio occultation measurements. It allows us to estimate the contribution of different parts of the ionosphere into the GPS TEC values and to reveal the ionospheric regions that are affected to a greater extent by the possible influence from below. There is also estimated the cross-correlation between spaced measurements and data obtained by different techniques. The proposed approach was applied to the case-study of Japan earthquake occurred on May 7, 2008 with magnitude of 6.9. The obtained results and further testing of the method are discussed in the report.

We acknowledge the University Corporation for Atmospheric Research (UCAR) for providing the COSMIC data, IGS community for GPS permanent data and WDC for Ionosphere, Tokyo, National Institute of Information and Communications Technology (NICT) for ionosonde data. This work was supported by Russian Federation President grant MK-2058.2011.5.

キーワード: ionosphere, seismo-ionospheric phenomena, TEC, ionosonde, radio occultation
Keywords: ionosphere, seismo-ionospheric phenomena, TEC, ionosonde, radio occultation