Japan Geoscience Union Meeting 2013
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アジア太平洋地域大規模地震・火山噴火リスク対策（G-EVER）コンソーシアム: 新たなる防災減災活動
G-EVER Consortium: the new earthquake and volcanic hazards mitigation activities

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2011年1月の新燃岳噴火，同3月の東北地方太平洋沖地震など，我が国では火山，地震活動が連続して発生し，一旦大規模な火山噴火，地震・津波が発生すれば社会に甚大な影響を与えることが明らかとなった．アジア太平洋地域の地震及び火山災害軽減，リスク対策は，現在各国でさまざまな活動が行われているが，各研究機関，関連組織の協力体制の確立，防災関連情報の共有化等が必要とされてきている．産総研地質調査総合センターは，アジア太平洋地域の地震・火山防災，リスク対策を議論するため，2012年2月22-24日，第1回アジア太平洋大規模地震・火山噴火リスク対策ワークショップ（G-EVER1）を開催した．アジア太平洋諸国を中心に，12カ国，56の機関から152名が集まった．3日目に行われた討論会では，今後のG-EVERの活動について活発に議論され，下記の10項目がG-EVER1 Accord (協定) として採択された．(1) アジア太平洋地域の協調，自然災害軽減のためコンソーシアムを設立，(2) 災害時に役立つ各種災害情報の整備，共有，(3) G-EVER Hubサイトの構築，(4) データ交換，共有，分析のための国際標準化の推進，(5) 既存のV-Hub, IRDR, GEM, GVM，WOVOdat等の各種プロジェクトとの連携，(6) ”borderless world of science ”を推進，世界基準ハザードマップの作成，(7) 研究者，ポスドク，学生等相互交流の推進，(8) 各種ワーキンググループの設立，個別のテーマ毎に横断的な活動を推進，(9) 各種アウトリーチ活動の積極的な推進，(10) 2年毎にG-EVER国際会議を開催．以上のG-EVER1協定の理念に基づき，G-EVERコンソーシアムが設立され，各種の活動を開始している．また，G-EVER活動を円滑に進めるため，2012年11月より産総研所内にG-EVER推進チームが発足した． 推進チームでは，(1) ワーキンググループの設置， (2) 各種情報共有のためのG-EVER Hubサイトの構築（http://g-ever.org），(3) 標準化の推進，技術移転を目的としたワークショップ・講習会を開催，(4) G-EVERシンポジウム，国際会議の開催，(5) 普及活動の推進，(6) 国際機関との連携等を進めていく予定である．2013年3月11日には，産総研において，第1回G-EVER国際シンポジウムを開催した．また，2013年10月19-20日に，仙台において，第2回G-EVER国際シンポジウムの開催を予定している．現在，(1) 巨大地震のリスク評価WG, (2) 巨大噴火のリスク評価WG, (3) 次世代型火山災害予測システムWG, (4) 活断層カタログWG, (5) アジア太平洋地域地震火山ハザードマッププロジェクトの4つのワーキンググループと1つの国際プロジェクトが進行中である．

アジア太平洋地域地震火山ハザードマッププロジェクトでは，各種のアジア太平洋地域の地震及び火山データベースと連動した，地震及び火山災害情報，リスク情報をインターネット上で検索表示できるシステムを構築する計画である．過去の地震や火山噴火の規模，災害の規模ごとに地図上に表示する機能に加えて，地震，津波災害の分布，降下テフラ，火砕流堆積物等の火山噴出物の分布等を表示する機能など，災害履歴や災害予測情報の比較検討が容易にできるシステムを開発する．また，本システムは，GEM（Global Earthquake Model）による地盤情報等を考慮した地震災害評価システム，GVM（Global Volcano Model），スミソニアン火山DB, 日本第四紀火山DBを取り込んだ最新の次世代型地震火山ハザードマップシステムとする予定である．本プロジェクトは，アジア地域の地質調査機関によるCCOP(東東南アジア地球科学計画調整委員会) 加盟国や，アメリカ，カナダ，中南米，ロシア，オーストラリア，ニュージーランド等の環太平洋の国々と協力の上，進めていく計画である．

キーワード: アジア太平洋, 地震, 火山, リスク, G-EVER, 防災
Keywords: Asia-Pacific, earthquake, volcano, risk, G-EVER, hazard mitigation

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東アジア地震データベース　その２
Seismological database in eastern Asia (part 2)

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Earthquake catalogs were compiled and summarized by Ishikawa(2002) in China, Korea and Japan. The calendar was uniformed in Gregorian and the origin time of earthquakes was Universal time. For the next step, worldwide data were used for checking. Engdahl & Villasenor(2002) compiled the global earthquake catalog in 20c. Their result was very useful for many researchers, but the locations of some hypocenters were not suitable. There were large differences of the hypocenter locations from those of JMA. For example, the hypocenter of the 1952 Tokachi-0ki earthquakes was at Hidaka region by them, but actually it was located in the Pacific Ocean. The 1948 Fukui earthquake was located in the Japan Sea and some events in the Japan Sea were much deeper than in their catalog (Ishikawa,2012). Most of parameters of these events were referred from other papers. The parameters in old catalogs were not accurate, so if possible, the parameters had better be re-determined by using original reports. Ishikawa and Lin(2012) presented that the hypocenters by JMA in Taiwan from 1922 to 1944 were much better than others, as JMA re-determined hypocenters there using old reported data.

Next, the earthquake data in Vietnam and Philippine were added. The earthquake catalog by Cao(2012) was inputted in Vietnam. It includes earthquakes from AD 114. The earthquake catalog by PHIVOLCS was used in Philippine and it was from AD 1897.

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キーワード: 東アジア, 地震カタログ, データベース, ベトナム, フィリピン
Keywords: East Asia, earthquake catalog, database, Vietnam, Philippine

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G-EVER活動におけるアジア太平洋地域の活断層カタログの作成
Construction of the active fault catalog of the Asia-Pacific Region in G-EVER project

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国際的な活断層のカタログを構築するにあたっては，まず対象とする活断層の定義を明確にすることが重要である．G-EVERでは，活断層の定義を検討し，既往の論文等で報告されているアジア・太平洋地域に分布する活断層を，定義に照らし合わせてカタログ化していく作業グループを立ち上げることを計画している．

G-EVERでは各国の地震危険度に関する情報を共通の手法で評価し，市民や企業が海外安全情報の一つとして活用できるような情報を提供することを目標としている．世界各国の地震危険度を共通の手法で評価し，比較するためには，地震の震源となる断層を共通の基準において選定することが必要である．現在，日本や米国，ニュージーランドなどで地震の震源となりうる活断層のデータベースが公開されているが，それぞれにおいて活断層の定義，特に過去の活動時期に基づく認定基準は統一されていない．例えば，USGUが公開している「第四紀断層・褶曲データベース」では，第四紀のすべての時期における活動の証拠を有する断層情報を網羅しており，利用者が対象とする活動時期を選んで活断層を検索することが可能である．その時代区分は，第四紀以降，第四紀中期以降，第四紀後期以降，完新世以降，有史時代以降となっている．ニュージーランドのGNSが公開している活断層データベースでは，第四紀後期以降に活動した断層が掲載されている．産総研が公開している日本の活断層データベースでは，高位段丘のみが変位基準となっている断層も含まれていることから，第四紀中期以降に活動した証拠がある断層が活断層として取り上げられていると解釈される．

G-EVERの作業グループでは，活断層であると判断する活動時期の定義を明確にしたうえで，その条件を満たす断層のみを取り上げたカタログを作成していく．一方で，GEMの研究プロジェクトである「Faulted Earth」で世界の活断層データベースの作製が進行している．G-EVERの作業グループの成果がGEMのプロジェクトに反映されるように，相互に連携を取りながら作業を進めていく予定である．

キーワード: 活断層, カタログ, アジア太平洋地域, G-EVER, GEM
Keywords: active fault, catalog, Asia-Pacific Region, G-EVER project, Global Earthquake Model

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巨大地震による産業被害リスク評価法の検討
Comprehensive assessment for seismic risk in industry

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A research project to develop simultaneous risk assessment simulation tool based on the disaster researches of the 2011 Tohoku-Oki Earthquake was initiated to formulate measures for huge seismic risks. Another aim of this project is to control low probability - high consequence disaster causing huge social and economic damages. The proposed new risk assessment simulation tool includes diverse effects of primary disaster of earthquake or tsunami and secondary damages of industrial plants and atomic power plants or supply chains of various products including function of production and transportation. In this study, we focus on the industrial damage in Japan including secondary damage to the supply chains which might be caused by anticipated huge earthquakes such as the Tokai, Tonankai and Nankai Earthquakes.

The boundary and procedures of a comprehensive risk assessment was set as below.

- Considering building and factory damages in each company as seismic direct damage
- The direct damage to production loss in each industry in the considered region
- Production loss ratio represents reduction ratio of industrial production index
- The effect of secondary damage in each industry in each region is simulated by using a computable general equilibrium (CGE) model

Based on these procedures, we are now carrying out our research according to the steps below.

- Preparing the fragility curve of each industry
- Mapping the plants of each industry
- Recreating the damages using CGE model, by regions and industries, on information obtained from the experiences of the Tohoku Earthquake

The industry-specific fragility curve was created based on the damage studies (Naraoka et.al. 2012) and questionnaire for the past earthquakes. Reduction of industrial production index was resulted from many causes such as reduction of production, disruption of transportation, power failure, lack of water supply and shortage of employee. At the early stage of this study, we only consider reduction ratio in each industry, which is accumulated from regional statistics, such as a regional industrial statistics, a census of commerce of Japan and so on. Disruption of transportation, power failure, lack of water supply and shortage of employee will be taken into account in our future study.

キーワード: 巨大地震, 産業被害, リスク評価, フラジリティー曲線, サプライチェーン, 2011年東北地方太平洋沖地震
Keywords: gigantic earthquake, industrial damage, risk assessment, fragility curve, supply chain, the 2011 Tohoku-oki earthquake

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台湾における水文学的・地球化学的手法による地震予測のための共同研究
Hydrological and geochemical cooperative research for earthquake forecasting in Taiwan

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Active Fault and Earthquake Research Center, Geological Survey of Japan, AIST has been carrying out the cooperative research entitled ”Hydrological and geochemical research for earthquake prediction in Taiwan” with Disaster Prevention Research Center, National Cheng-Kung University, Taiwan since 2002. We made much contribution to clarifying the mechanism of groundwater changes and their recoveries related to the 1999 Chichi earthquake, constructing a groundwater observation network composed of 16 wells in Taiwan and understanding the earthquake-related groundwater changes observed by the new groundwater observation network through this cooperative research. We also investigates seismotectonics in and around Taiwan. In Taiwan seismicity is more active and crustal deformation is more rapid than in Japan. Therefore observation and analysis of groundwater changes related to earthquake and crustal deformation in Taiwan will enable us to make rapid progress in hydrological and geochemical research for earthquake forecasting. This cooperative research will also give important information for evaluation of long-term groundwater changes in tectonically active areas like Japan and Taiwan.

キーワード: 台湾, 地下水, 地震予知, 地殻変動, 地球化学, 地震動
Keywords: Taiwan, Groundwater, Earthquake prediction, Crustal deformation, Geochemistry, Ground shaking

HDS07-06 会場:101B 時間:5 月 23 日 17:30-17:45

Tracing the sources of marine tephra layers in the Philippine marginal basins

Tracing the sources of marine tephra layers in the Philippine marginal basins

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Piston coring in the Sibuyan and Bohol seas in the Philippines recovered several marine tephra layers that may provide an archive of explosive eruptions and magmatic activities from the nearby Bicol volcanic arc. The glass fragments in these ash layers exhibit bubble-wall-type morphology typical of co-ignimbrite ash deposits, suggesting that they are primary distal deposits of explosive eruptions on land. In-situ geochemical microanalyses of the glass fragments reveal that they have compositions that form tight clusters in major element data plots, supporting their primary depositional origin. The ash layers appear to have a bimodal distribution in terms of major element geochemistry: one group having andesitic to dacitic composition (55-64 weight percent SiO2) and the other one having rhyolitic composition (69-78 weight percent SiO2). Small variation in major element composition is also observed within each group, especially the high-silica one. The bimodal grouping in terms of major elements is also supported by distinct trace element compositions of glass fragments in representative ash layers.

The andesitic to dacitic ash layers have compositional resemblance to the chemistry of the scoria fragments from fall and pyroclastic flow deposits from Mayon volcano, suggesting it as a possible source. There are several candidates for the sources of the rhyolitic ash layers, although most have strong geochemical affinity with the flow and fall deposits around the Irosin volcano. Iriga and Iraya volcanoes could be the other sources of some ash layers in the Bohol Sea. The persistence of rhyolitic ash layers in the cores suggests that they could be correlatable to the newly identified widespread tephra marker in the Bicol arc (Mirabueno et al., Quat. Intl. 2011). However, more detailed and extensive tephrochronological work is needed to establish the chronology and frequency of explosive eruption events from these volcanoes in order to assist disaster prevention planning from explosive volcanic eruptions in the future.

キーワード: Philippine volcanoes, tephrochronology, Bicol arc, Mayon Volcano, Iriga Volcano, Irosin tephra marker
Keywords: Philippine volcanoes, tephrochronology, Bicol arc, Mayon Volcano, Iriga Volcano, Irosin tephra marker

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Hazard mitigation of a caldera-forming eruption: From past experience in Indonesia to modern society

Hazard mitigation of a caldera-forming eruption: From past experience in Indonesia to modern society

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A caldera-forming eruption, erupted volume˜ 10-1000 km3, causes huge direct damages caused by widespread pyroclastic flow, ash fall, and tsunami, and global impacts such as climate change. The recovering time is more than 10 years for climate, food, human health, and 100-1000 years for land use. Japanese have forgotten such a caldera-forming eruption, because the last one occurred 7,000 years ago. Indonesia was suffered twice for the last 200 years, and three times within 1,000 years. We must learn valuable experiences from Indonesia.

[Evaluation of potentiality for a caldera-forming eruption] We proposed an evolutional model to a caldera-forming eruption in Indonesia. The long-term evolution into caldera-forming eruption was studied by Toshida et al. (2012). This study can identify volcanoes evolving into caldera formation from those without caldera formation. The volcanoes became quiet with a few explosive eruptions during the last 10,000-5,000 years before the first caldera formation (Takada et al, 2012). Some volcano caused caldera-formation multiply. Furukawa et al. (2012) studied multiple cycle of caldera formation in Bali. According to the model, the candidate evolving into a caldera-forming eruption is a dormant volcano after large stratocone building. We must, however, distinguish a target volcano accumulating magma from that terminating its activity. Moreover, some volcanoes are decreasing in potentiality of eruption by continuous degassing.

[Precursor events] During the last a few months, we may have caught geologically the short-term process as the progressive activity to the climax eruption in cases of Tambora 1815 eruption and Krakatau 1883 eruption (Takada, 2010; Takada et al., 2012). If a volcano comes into the stage just before the climax at the present time, we can catch unusual geophysical signs from various monitoring system. However, the problem is to evaluate or predict when the volcano reaches a climax condition, and how much the volcano erupts. The evacuation plan depends on them.

[Linkage of disaster in the short-term (<10 years)] A caldera-forming eruption can cause wide range linkages of disaster globally, such as the secondary, and the thirdly ones as well as the direct damage. (1) The population on the earth increased abruptly. For example, the modern population in Sumbawa is 0.9 million, compared with 0.1 million when Tambora 1815 eruption. The other areas in Asian country are the same case as those above. (2) Recently human being develops its society with high technology, compared with the age of the caldera-forming eruptions in the 19th century. The lager the eruptive volume becomes, the wider the linkage is spread to cause traffic damage, energy plant damage, and various shortage, such as food, water, medicine, which connect each other. For example, the damage of traffic system in an island country will close from outside rescue. Volcanic ash fall close airports. Tsunami cause various coastal damage including ports or harbors. (3) Climate change will cause a possibility for plague (epidemic). Aftermath of Tambora 1815 eruption caused “ The year without a summer ” (Stommel and Stommel,1983).

[Long-term damage (> 10 years)] The damage in the area near the volcano that caused a caldera-forming eruption continues long-time. Accumulation of volcanic ash will cause lahar, close drainage (sewer) in a city, and ash pollution. Thick pyroclastic flow deposits remain long time without erosion, and prevent from agriculture. For example, the case of Tambora 1815 eruption, 200 years ago, and that of Rinjani 13th Century, 700 years ago are presented.

キーワード: カルデラ噴火, 巨大災害軽減, インドネシア, タンボラ, リンジャニ, クラカタウ
Keywords: Caldera-froming eruption, Hazard mitigation, Indonesia, Tambora, Rinjani, Krakatau

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Earthquake Hazard Map of Papua, Indonesia

Earthquake Hazard Map of Papua, Indonesia

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Indonesia occupies a very active tectonic zone as the world's three major tectonic plates collides each other. This tectonic condition makes Indonesia an area of pronounced tectonic activity that is very prone to earthquakes. The northern part of Papua Island has experienced destructive earthquakes in the past and prone to earthquake in the future. Several destructive earthquakes occured in the region during the last decade such as Nabire (2004) and Serui (2010) has caused casualties, destruction and damage to infrastructures and buildings. Therefore, the availability of earthquake hazard map of Papua is needed, since the earthquake mitigation effort is more emphasized on pre-disaster phase.

The hazard map is created using PSHA (Probability Seismic Hazard Assessment) method and developed using EQRM (Earthquake Risk Model) computer program. This method requires inputs of earthquake sources (active fault, subduction zone and diffuse earthquake), site classes, return period and GMPE (Ground Motion Prediction Equation) for each earthquake zone should be preconcerted. As for Papua hazard map the earthquake source zone is classified into 19 zones for both active faults and subduction and 9 zones for diffuse earthquakes.

The result is PSHA map for 0.2 second spectral acceleration. The map represents the 10% probability of exceedance in 50 years (475 years return period). The Papua seismic hazard map was created based on the estimated intensity, which obtained by converting the acceleration level on 0.2 second RSA (Response Spectral Acceleration). The hazard levels are divided into four classifications, they are very low (MMI < V), low (VII > MMI ? V), moderate (VIII > MMI ? VII), and high (MMI ? VIII) respectively.

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