Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SCG56-01 Room:103 Time:May 27 09:10-09:25

Four cases of interference by electric power industry in earthquake risk evaluation

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A fair procedure is a key for reliable risk evaluation of earthquakes and tsunamis to judge safety of design and operation of nuclear power plants (NPP). However, we have found, since 1997, 4 cases of unfair interference by an electric power industry in earthquake risk evaluation by governmental institutes or academic societies.

1. Interference in a guideline for tsunami disaster mitigation formulated by the Japanese Government (1997)

Ministries in charge of tsunami disaster mitigation formulated a guideline for tsunami disaster mitigation (the guideline) in 1997. It is stated in the guideline that tsunami assumed in the disaster mitigation planning should be made by taking into account not only a maximum experienced tsunami, but also a maximum tsunami supposed by latest seismological studies. Based on the guideline, the maximum tsunami is estimated to be 8.6m at the Fukushima Diichi NPP, which are much greater than 3.5 m assumed by the Tokyo Electric Power Company (TEPCO). The Federation of Electric Power Companies of Japan (FEPC) tried to put pressure via the Agency of Natural Resources and Energy to the secretariat in charge of the guideline to modify the description on the maximum tsunami and stop the public announcement of the maximum tsunami to avoid ”a social disorder.”

2. Manipulation to reduce a safety factor for NPPs and ignore tsunami earthquakes from maximum tsunami estimation (2002)

In designing NPPs in 1990s and before, only maximum experienced tsunamis were taken into account. There was almost no margin of safety in NPPs to account for uncertainty in the tsunami estimation. To authorize the tsunami risk evaluation policy by the FEPC, the FEPC set up the Tsunami Evaluation subcommittee in the Japan Society of Civil Engineering in 1999. In 2002 the subcommittee published the Tsunami Assessment Method for Nuclear Power Plants in Japan, in which tsunami earthquakes are ignored and the safety factor is not introduced. More than a half of the subcommittee is from the nuclear power industry that covered all the expense of the subcommittee.

3. Interference in revision of the Regulatory Guide for Reviewing Seismic Design for Nuclear Power Facilities (Regulatory Guide) (2001-2006)

The Nuclear Safety Commission revised the Regulatory Guide in 2006. During the revision process, the FEPC supported specific committee members to speak for the nuclear power industry. An example is a manipulation on an evaluation period of active faults. There was an argument that it should be substantially extended to, e.g., 130,000 years. It is written in documents of the FEPC that ”We will ask the cooperative members to propose an alternative proposal, as a counter to the proposal of 130,000 years. The alternative one should be operationally realistic, feasible, and less influential to present power plants.”

4. Interference in the long-term evaluation of seismic activity (2011)

The Headquarters for Earthquake Research Promotion (HERP) had revised the long-term evaluation of seismic activity in the Japan Trench since 2009. The HERP showed the revised evaluation to the power industry before public announcement on March 3, 2011. The TEPCO requested the HERP to modify the revised evaluation so that repeating occurrence of the Jogan earthquakes is uncertain. The secretariat of the HERP met the request without consultation with committee members.

The risk evaluation process should be more transparent to get rid of the interference by the industry. Conflict of interest should also be clarified. When the TEPCO has a meeting with seismologists relevant to regulation of the NPPs, ”technical instruction fee”has been paid for a long time. While the fund donation and cooperative research with the industry have been disclosed, more items such as payments for technical instruction, lecture, meal, travel are also to be disclosed. The transparency is necessary for Earth scientists to be trusted by society.

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SCG56-02 Room:103 Time:May 27 09:25-09:40

Seismological problems in the NRA's permission for the Sendai NPS: Effects of great interplate and intraslab earthquakes

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On September 10, 2014, the NRA (Nuclear Regulation Authority, Japan) granted permission for change in reactor installation of Sendai NPS (Nuclear Power Station) Units 1 and 2 as applied by Kyusyu Electric Power Co., Inc. This was a regulatory step to grant permission for the basic design of nuclear reactors and related facilities applied from the operator. The applied design and safety features of Sendai NPS Units 1 and 2 were deemed to meet the NRA's new regulatory requirements.

According to the new regulatory requirements, the "standard seismic motion" (earthquake ground motion that rarely occurs, but may possibly occur in service period of the facilities and have a significant effect on the facility) used for the seismic design of facilities shall be formulated as the "earthquake ground motion formulated with a hypocenter specified for each site" and the "seismic motion formulated without a hypocenter."

The "earthquake ground motion formulated with a hypocenter specified for each site" shall be formulated by selecting multiple earthquakes that are predicted to have a significant effect on the site ("earthquakes for investigation") as to inland crustal earthquakes, interplate earthquakes and oceanic intraplate earthquakes, and by implementing the evaluation of ground motions for each selected earthquake for investigation.

Kyusyu Electric Power, however, by referring to the catalog of past destructive earthquakes in and around Kyushu, considered that even the largest interplate and intraplate earthquakes did not affect so much the Sendai NPS site and that earthquakes for investigation did not need to be selected for interplate and intraplate events.

NRA overlooked this judgment without question and accepted the standard seismic motion, Ss-1 (PGA 540 gals), formulated based merely on inland crustal earthquakes.

But, the judgment by Kyushu Electric Power using the past earthquake catalog only is very insufficient. Possible and probable interplate and intraplate earthquakes including the anticipated great Nankai trough earthquake and large intraslab earthquakes in southern Kyushu are inferred to have considerable effects on Sendai NPS. Therefore, these events shall be selected as earthquakes for investigation in order to formulate a proper standard seismic motion.

Keywords: Sendai nuclear power station, Nuclear Regulation Authority, permission for change in reactor installation, standard seismic motion, anticipated great Nankai trough earthquake, large intraslab earthquakes

Japan Geoscience Union Meeting 2015
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SCG56-03 Room:103 Time:May 27 09:40-09:55

Scientific issues in the ban injunction to the Oi nuclear power plant

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The issues of science and technology in the verdict can be summarized as follows: (1) The cliff edge (if ground motion is beyond this, the plant will lose overall safety) was determined to be 1,260 gal in the stress test. It is impossible to assume no chance of ground motion larger than the cliff edge based on a sound scientific basis. (2) The design basis (if ground motion is beyond this, S-class structures will lose functional safety) was determined to be 700 gal in the stress test. Ground motion between 700 and 1260 gal can possibly occur, but any measure may not be applied at the worst because of difficulties in event grasp, multiple case, training, and so on. (3) The seismic safety regulation does not require structures and facilities of B or C class to keep functional safety under the design basis ground motion. Therefore, even in a case of ground motion smaller than 700 gal, external electricity and main water supply, which are not ranked at S class, have danger to lose functional safety. (4) Because a pool of nuclear waste does not have such a firm confining structure as a pressure vessel for a reactor, it has danger to emit radioactive substances.

Among the above, (1) and (2) are emergencies at the worst, so that science cannot deny the occurrence and also cannot prove their certain occurrence in the future. On the other hand, (3) and (4) can be thought to have sure danger. When we consider only (3) because of the lack of concreteness in (4), we find it quite probable for ground motion smaller than 700 gal to occur and for external electricity to be damaged. In addition, we recall that damage to external electricity was one of causes of the Fukushima Daiichi accident, and therefore it can be scientifically correct to assume the Oi nuclear power plant to have danger to suffer an accident. Furthermore, this point in the verdict suggests the Nuclear Regulation Authority's decision of keeping external electricity at B class to be wrong, though two independent routes have been required after the Fukushima Daiichi accident.

Keywords: Fukui district court, Oi nuclear power plant, ban injunction, issue of science and technology

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SCG56-04 Room:103 Time:May 27 09:55-10:10

A guide to JAEE report and its supplement on road map for seismic safety research of nuclear power plants

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A report and its supplement by Japan Association for Earthquake Engineering (JAEE) are introduced for information sharing between researchers of earth science and engineering.

JAEE published a report on road map for seismic safety research of nuclear power plants in 2011 by a research committee on seismic safety of nuclear power plants. The committee originally planned to complete the report in March 2011. However, the report was finally published in October 2011 with newly proposed supplement considering severe casualty of the Fukushima Daiichi Nuclear Power Station due to the 2011 off the Pacific coast of Tohoku earthquake.

The report is useful to know design concept of engineering and to recognize strenuous demands on nuclear politics for the earth science researches.

Keywords: Nuclear Power Plant, seismic safety, Japan Association for Earthquake Engineering, road map

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SCG56-05 Room:103 Time:May 27 10:10-10:40

The role by earth scientists in problems about nuclear power plants

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One of the causes of the severe accidents of Fukushima nuclear power plants during the Great Tohoku Earthquake of 2011 is that the tsunami hight to design the nuclear power plants was fixed by earth scientists and engineers in spite of their knowledge on tsunami was very limited. The same problem exists in how to fix the ground motion level to ensure safety of nuclear power plants, because knowledge on ground motions for future earthquakes is very limited. In the circumstances, the ground motion level must be fixed by taking into account not only the limited scientific knowledge but also social factors, such as, risk of human life and environment, and so on. The role by earth scientists is not to fix the ground motion level but to provide the society with scientific knowledge and to empower the society so that the society may fix it through discussions among people with various opinions.

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SCG56-06 Room:103 Time:May 27 10:40-10:45

Discussion

KAWAKATSU, Hitoshi[1*] ; KANESHIMA, Satoshi[2] ; SUETSUGU, Daisuke[3] ; HASHIMOTO, Manabu[4]

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To ensure the safety of nuclear power plants in an earthquake/volcano prone country like Japan, understanding of earthquakes and volcanic eruptions phenomenon, and predictions of disaster based on it are essential. But the understanding is very limited, and thus predictions of disaster have huge uncertainties. We discuss how this situation should be considered, dealt with and communicated among earth scientists, related engineers, policy-makers and the society.

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SCG56-07 Room:103 Time:May 27 11:00-11:15

Insufficient guideline and reviews on the volcanic risks to the Japanese nuclear power stations

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The 2011 East Japan earthquake and tsunami disaster caused the severe accident of the Fukushima Daiichi Nuclear Power Station (NPS) and the trust in national nuclear power management was completely lost. The Japanese government newly established the Nuclear Regulation Authority (NRA) in September 2012 and started to make the New Regulatory Requirements for light-water NPSs (NRR). After nine-months discussion by the working team, the NRR was fixed in July 2013.

The NRR includes a new guideline for considering risks of volcanic eruptions (Volcanic effects Assessment Guide: VAG), which did not exist before the 2011 disaster. However, the VAG shows no quantitative criteria to prohibit construction of NPS and thus enables arbitrary interpretation. The VAG also includes unrealistically optimistic views on both long-term and short-term predictions of volcanic eruptions. The VAG does not show any attention to large uncertainty in long-term estimate of large-scale eruptions. Moreover, the VAG explicitly supposes that large-scale eruptions of caldera volcanoes can be predicted several years before the eruption by monitoring.

In spite of opposition from many volcanologists, the VAG has been adopted for the conformity review of each NPS since July 2013 and the Sendai NPS was first authorized to satisfy the NRR in September 2014 under the condition that the volcanic activities of nearby calderas are always monitored. Although the Sendai NPS, located on the south Kyushu Island, is surrounded by at least 5 caldera volcanoes and was overlain by two large-scale pyroclastic flows for the past 120,000 years, there is no official damage estimate of nuclear disasters, which can be triggered by large-scale eruption of the caldera volcanoes.

Keywords: nuclear power station, volcanic risk assessment, guideline, conformity review, Sendai NPS, insufficient evaluation

Japan Geoscience Union Meeting 2015
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SCG56-08 Room:103 Time:May 27 11:15-11:45

A suggestion on prediction of very large eruptions and volcano monitoring from the Volcanological Society of Japan

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1. Background

Some of members of the Volcanological Society of Japan (VSJ) have been involved directly or indirectly in disaster measures of national and local governments, evaluation of volcanic activity and nuclear energy as a matter of duty or experts. Related to the 2009 L'Aquila Earthquake in Italy, scientists including a volcanologist involved in a national committee were indicted for the responsibility of victims due to their misjudgment. This event urged scientists to reconsider how scientists should have to do with society and administrative problems. In Japan, the Cabinet Office, Government of Japan (CAO) issued "A suggestion on the disaster measures for large volcanic eruption" in May 2013. In June 2013, the Nuclear Regulation Authority (NRA) issued "Guide on the evaluation of influence/impact of volcanoes on nuclear power plants" . The guide demands enterprises of nuclear power generation to do volcano monitoring and to get advices of volcanologists in evaluation of volcanic activity: whether very large eruption, which may impact on nuclear power plants, occurs or not. To exchange information and opinion on problems of nuclear power plants and very large eruptions, VSJ set up the committee on problems related to nuclear energy. The committee summarized results of discussion as "A suggestion on prediction of very large eruptions and volcano monitoring" and presented it at the general meeting of VSJ in November 2014. The suggestion is placed in Home Page of VSJ to let members of VSJ know it and to inform of society of the suggestion of VSJ.

2. Main issues of discussion and suggestion

The committee discussed problems related to very large eruptions and nuclear energy, those are, the guide of NRA, the suggestion of CAO, eruption alert operated by Japan Meteorological Agency (JMA), and opinion and information from the members of committee.

The Guide of NRA supposes that signs of very large eruption is detectable by volcano monitoring and necessary operation on atomic reactors is completed before eruption. This is opposed to the suggestion of CAO: the research on the prediction of very large eruptions and disaster measures has not initiated. In addition, the guide had made without discussion with CAO and JMA. Problems related very large eruptions including nuclear energy should be discussed at some meetings in which the government offices participate. The results of discussion are expected to be reflected to the safety measures of nuclear power plants and so on.

Volcanologists should explain the present status on the prediction of eruptions by volcano monitoring including possibility, limitation and uncertainty to the publics and the government offices concerned.

Research on prediction of very large eruptions and disaster measures is an important subject of VSJ and Japan, and should be promoted. The results should be applied to eruption alert level by JMA and the guide on nuclear power plants.

Keywords: very large eruption, nuclear power plant

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SCG56-P01 Room:Convention Hall Time:May 27 18:15-19:30

Nuclear power plant and pinpoint earthquake prediction

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[1]none

1.Preface

Seasonality of the earthquake is reported, but even modern science is considered to be the mystery that cannot be settled. It is a fact December has many giant earthquakes of the Nankai trough, and not to be up from March to July. It is said, it ”is scientific basics I hypothesize based on a fact, and to inspect the hypothesis”. In other words, it means that a hypothesis is wrong if there is contradiction in an inspection process.

Plate tectonics theory is still a hypothesis. Because it contradicts it in a fact of the seasonality of the earthquake, this hypothesis gets a wrong this hypothesis. However, it thinks whether it is forgotten that a hypothesis is a hypothesis that a hypothesis is not going to be changed.

As a result of returning to scientific basics, and having studied the driving force except the mantle convection, I find a method to foresee an earthquake at the same time to solve this contradiction and have already announced it in Japan Seismological Society of Japan and JPGU. Unfortunately foretelling an earthquake itself has not been yet received including this method by the earthquake learned society. Therefore, the security of the nuclear power plant is lectured on based on a wrong hypothesis on the premise that earthquake prediction is not possible, besides.

However, there is already this earthquake prediction in the level that there are many results and can predict. The security of the nuclear power plant should be discussed based on it. I explain method of scientific earthquake prediction below.

2. Method of scientific earthquake prediction

As a result of having analyzed many major earthquakes, the strong wind of the downward air current when time and the low pressure which became the extratropical cyclone developed collided in the earth crust, and it was estimated by a typhoon when I had a major earthquake at a collision spot several months later. I can watch the strong wind of this downward air current as a dry slot (domain without the cloud) in a satellite image. And it was estimated that the tip (or the origin) became the epicenter. Width of the tip of the dry slot shows the rough size of the focal region (cf. Fig. 1). In other words, I show the rough volume of earthquake. When there is a remarkable dry slot, more than M 6.5, it is estimated that it is less than M 6.5 when there is not a remarkable dry slot. Certainty is high as a big earthquake. Outbreak time of the earthquakes is three months later on the average seven months later after one week.

3. Reduction of the nuclear power generation risk by the introduction of the pinpoint earthquake prediction

Earthquake vibration, the tsunami beyond the limit damaged a nuclear power plant by the Fukushima first nuclear plant accident, and radioactivity was released outside. Even if it is said that facilities were strengthened as earthquake, tsunami measures, there is uneasiness of the radioactive contamination because I do not know it whether you can tolerate it if you are operating it, and a giant earthquake comes. However, there is not uneasiness of the radioactive contamination if it does not operate. The large reduction of the risk is possible if I stop only an applicable nuclear power plant before major earthquake outbreak by a method to predict an earthquake occurrence place in pinpoint. Of course because it is not yet perfect, the stop that is not necessary is possible as a result mark, but the uneasiness of the radioactive contamination by the re-operation of the nuclear power generation largely disappears.

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Keywords: nuclear power plant, peak gust, earthquake prediction, dry slot, satellite image

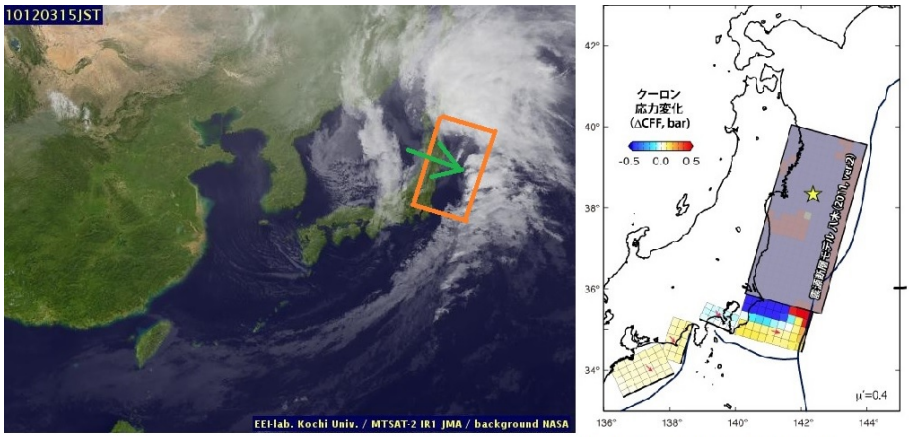

Fig. 1. The satellite image at 15:00 December 3 in 2010 and Focal region in the 2011 Tohoku earthquake

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Uncertainty evaluated from tsunami simulation of Tohoku earthquake around Nuclear Power Stations among Different Tsunami

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After the 2011 Tohoku-Oki Earthquake, evaluating based on tsunami simulation approach becomes very important role for promoting tsunami disaster prevention measures against mega-thrust earthquakes. In considering tsunami disaster prevention measures based on the knowledge from tsunami simulation, it is important to carefully examine what kind of tsunami source model we use. In this presentation, we show the result of tsunami simulation of the 2011 Tohoku-Oki Earthquake around Fukushima Daiichi I Nuclear Power Plant and Fukushima Daini II Nuclear Power Plant in Fukushima Prefecture of Japan by using several tsunami source models, and show how different tsunami response could be in tsunami inundation process. The results show that for incoming tsunami onto inland region there are a fair amount of relative differences in maximum wave height and tsunami wave pressure. This suggests that there could be a false determination of promoting tsunami disaster prevention measures against mega-thrust earthquakes, depending on tsunami source model one choose. On the basis of this topic of tsunami evaluation and its uncertainty, we also suggest our viewpoint on how disaster prevention measure and earth science should be related.

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Keywords: Tohoku-Oki Earthquake, Tsunami wave force, Fukushima Nuclear, 1F, 1F 2F

Japan Geoscience Union Meeting 2015
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SCG56-P03 Room:Convention Hall Time:May 27 18:15-19:30

Strong ground motions around the Fukushima Daiichi Nuclear Power Plant and the SPGA model

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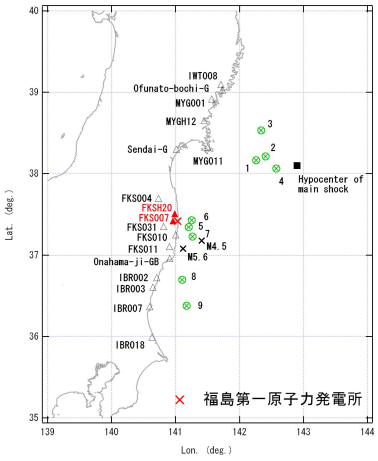
After the severe accident at the Fukushima Daiichi Nuclear Power Plant, it is significantly important to investigate how strong ground motions were generated around the power plant. In this study, the SPGA model (Nozu, 2012; Nozu et al., 2012) was used to explain strong ground motions in the area. According to the results, the strong ground motions around the nuclear power plant were far from a so called 'worst case scenario'. The most prominent SPGA for the 2011 Tohoku earthquake was SPGA4, which was located away from the coast and it was at least 150km off Sendai City. The SPGAs off Fukushima Prefecture were closer to the coast but they were relatively weak and hence did not cause catastrophic ground motions in that area. Such a configuration of the SPGAs was nothing more than a 'manna from heaven', because, there is no necessity for this configuration from the view point of modern seismology. In the assessment of such important facilities as the nuclear power plants, a true 'worst case scenario' should be considered, where a strong SPGA is close to the nuclear power plant.

Acknowledgement: Strong motion data used in this study were kindly provided by the NIED.

Keywords: nuclear power plant, strong ground motion, SPGA



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Review of studies on estimates of the maximum magnitude of earthquakes

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The estimate of the maximum magnitude of earthquakes that occur in a specified seismic region is critically important from the viewpoints of disposal of radioactive waste. Recently I studied literatures on estimates of the largest magnitude of earthquake and consider that its brief summary may contribute to the discussion of this session.

In Japan, this kind of researches has been done mainly from the viewpoints of geomorphology and geology such as Kakimi et al. (2003). However, there are a wide variety of studies with different approaches from geomorphology and geology. In this review, I introduce some of them.

In fact, many studies have been conducted since at least 1980s in the world mainly base on engineering demands (probably construction of nuclear power plants). According the Wheeler (2009), more than 10 approaches have been proposed, but they have merits and demerits. They are categorized into (1) use of the maximum magnitude of earthquake previously observed, (2) statistical method such as estimate using seismicity or extrapolation of G-R law, (3) estimate based on tectonics, (4) estimate based on physical principles, and (5) estimate based on coda Q of Lg wave. Statistical studies are predominant recently. McCaffrey (2008) estimated maximum magnitude of subduction zone earthquakes assuming whole segment of a specified subduction zone ruptures simultaneously. His estimate for the Japan trench was Mw 9.0. Studies by Kagan, Jackson and Bird, and Zöller et al. fit tapered or truncated G-R law to seismic catalog. Both groups concluded that corner magnitude or truncate magnitude should be Mw 9 - 10. All of them insisted that the length of data is critical for good estimate and longer datasets may give larger maximum magnitude.

According to the above studies, we are forced to conclude that there is no scientific validity on the estimate of maximum magnitude in the earthquake science community. Therefore we should sincerely discuss what and how to disseminate this difficulty to society under the pressure of demand of the maximum magnitude of earthquake.

Keywords: maximum sized earthquake, tetonics, Gutenberg-Richter’s law, seismotectonic province

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Seismology, volcanology as ”academic clinical”

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In an earthquake/volcano prone country like Japan, the role of related sciences, such as seismology and volcanology, might be different from that of other countries where related sciences are mainly driven by curiosity. Such intellectual activities might be called ”academic clinical”, a term borrowed from medical science. I hope to discuss the role of Earth sciences as ”academic clinical” in the problems related to the nuclear power plant in Japan.

Keywords: seismology, volcanology, academic clinical