The Japanese Coordinating Committee for Prediction of Volcanic Eruptions and its Contribution to Volcanic Disaster Mitigation

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1. Introduction

The Coordinating Committee for Prediction of Volcanic Eruptions (CCPVE) was established in 1974 when the National Plan for the Prediction of Volcanic Eruption was formulated. It is a private advisory organ of the Director General of the Meteorological Agency and has ambiguous responsibility and authority; nevertheless, it has been playing a major role in predicting volcanic eruptions in Japan. To discuss the contributions of the Committee to the mitigation of volcanic disasters we need to look back on the history of the National Plan for the Prediction of Volcanic Eruption.

2. Actions taken to formulate the Volcanic Eruption Prediction Plan

The history of studies of the observation of volcanic activities in Japan can be traced back to 1911, when Fusakichi Omori monitored earthquakes in a volcano observatory established on Asamayama by the Imperial Earthquake Investigation Committee and Nagano Weather Station. Systematic studies on volcanoes by university researchers started in 1928, when Kenzo Sassa of the Faculty of Science at Kyoto Imperial University investigated the relationship between volcanic tremor and eruption at an Aso Volcanological Laboratory affiliated with the Faculty.

In 1933, Takeshi Minakami started geophysical observations at Yunodaira Observatory, which was the predecessor of the Asamayama Volcano Observatory of the Earthquake Research Institute of the University of Tokyo. His studies of the relationship between earthquakes and eruption led the world’s volcanic observation research. Showashinzan of Usuzan erupted from 1943 to 1945. During the eruption, Minakami et al. of the Earthquake Research Institute of the University of Tokyo, by monitoring earthquakes and conducting leveling at the slope of the mountain, observed the process of the formation of a new volcano caused by dacite magma intrusion. The studies formed the foundations of volcanic activity observational studies in Japan, which were developed on the basis of physical monitoring by university researchers. These studies were quite different from observational studies in other countries, such as those by the US Geological Survey, which is part of the Department of the Interior, or by national volcanic observatories in Italy at, for example the Vesuvius Observatory, which involve physical and chemical observations and geological surveys.

Volcano observation requires physical observations of various kinds over a long period of time, and universities have established observatories for volcano studies. Before the formulation of the National Plan for the Prediction of Volcanic Eruption, the University of Tokyo established the Izu-Oshima Geo-electromagnetic Observatory (1959) and Kirishimayama Volcano Observatory (1964); the Disaster Prevention Research Institute of Kyoto University constructed Sakurajima Volcano Observatory (1960); and the Faculty of Science of Kyushu University established Shimabara Institute of Volcanology and Balmeology (1962), which was reorganized into Shimabara Volcano Observatory in 1971.

In 1963, a Priority Research Areas system was established for Grants-in-Aid for Scientific Research, and “disaster science” was included in four of the priority areas. In 1965, the Volcanic Eruption Prediction Team was established as an organization for the study of disaster science. The group consisted of 6 research groups from 5 universities and conducted intense observations of earthquake activity on Fujisan. This joint observation led to the nationwide organization of studies to predict eruptions. Observation studies progressed mainly at university observatories at Asamayama, Sakurajima, and Asosan, where volcanoes had been active, enabling eruptions to be predicted with relatively high accuracy. Activity at Minamidake on Sakurajima, which had been active since 1955, intensified still further after an explosive eruption on 2 October 1972, leading researchers to suggest that the eruptions could become large-scale and lateral, as had occurred in the Taisho and Showa eruptions.

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3. Start of the National Plan for the Prediction of Volcanic Eruption

Against this background, Takeshi Nagata, the then president of the Geodesy Council of the Ministry of Education, proposed that earthquake prediction researchers assimilate research into volcanic eruption prediction so as to promote such prediction. This was because the Second National Plan for Earthquake Prediction had finished in fiscal year 1973, and the next plan was scheduled to start. However, the consent of the earthquake prediction study group could not be obtained, and it was decided that the new plan would start independently of any Earthquake Prediction Plan. In June 1973, a proposal entitled “Promotion of Volcanic Eruption Prediction Studies” was formulated by the Geodesy Council and put forward to the relevant ministers. In the face of active volcanic activity at Sakurajima, the Act on Special Measures for Active Volcanoes was enacted on 24 July of the same year.

The preceding First National Plan for Earthquake Prediction was centered on “studies” of earthquake prediction, but the word “study” was omitted from the Second Plan in response to social demand for practical earthquake prediction. In response to this, the succeeding “National Plan for the Prediction of Volcanic Eruption” ruled out the word “study” from its title.

On the basis of the proposal of the Geodesy Council, the Plan for the Prediction of Volcanic Eruption was implemented in 1974 as a national project. The First Plan aimed to construct monitoring systems appropriate to the characteristics of each volcano and collect the necessary monitoring data for volcano studies and eruption prediction. Therefore, the mainstays included increasing and strengthening volcano monitoring systems, constructing observatories, organizing mobile observation teams, promoting research to develop prediction methods, establishing a coordinating committee, and developing human resources.

On the basis of the plan, the CCPVE was established as a private advisory organ of the Director General of the Meteorological Agency, with its head office in the Meteorological Agency. Members of the Committee included not only university professors and other people of learning and experience but also executive officers of the Ministry of Education, National Land Agency, Science and Technology Agency, and other relevant authorities. This situation was quite different from that of the preceding Coordination Committee for Earthquake Prediction, because administrative power was judged necessary to ensure fast mobilization and judgments during volcanic eruptions. Since it was first established, the main objective of the Committee has been disaster prevention. Takeshi Nagata, the then president of the Geodesy Council, became the first president of the Committee.

4. The National Plan for the Prediction of Volcanic Eruption and volcano observatories

In 1974, when the First Plan started, volcanoes on Izu-Oshima and Sakurajima had become active and were intensively observed by mobile observation teams from universities. Initially, construction of observatories was not included in the Plan, but the Geodesy Council revised the First Plan soon after its formulation and decided to include construction of a new university-owned observatory on Usuzan in the proposal. This was because there was no university-owned volcano observatory in Hokkaido (although there are many active volcanoes in the prefecture) and Usuzan was thought to erupt soon: it had erupted at intervals of about 30 years and more than 30 years had passed since its eruption in 1943. At that time, on Usuzan there was only one set of seismometers, which belonged to the Meteorological Agency. The fact that Toyako Onsen resort was located near the volcanic crater aroused social interest and propelled the revision. It was also decided that an annual and systematic practice of intensive and comprehensive volcano observation would be included in the revised plan. The Geodesy Council produced a summary document called “Partial Revision of the National Plan for the Prediction of Volcanic Eruption” and sent the proposal and request to the relevant ministries and agencies.

In 1977, the construction of an observatory by Hokkaido University on Usuzan was approved, but before the observatory started operating a large number of earthquakes that could be felt, and had hypocenters near Usuzan, occurred on 6 August. At 7:50 on 7 August, the Meteorological Agency dispatched Special Notice No. 6 on volcanic activity to warn people of the eruption. Immediately after the announcement, at 9:21, the volcano issued ash plume from the southeastern slope of Kousu on the top of Usuzan; the ash plume reached an elevation of 1,200 m.

Backed by the start of the National Plan for the Prediction of Volcanic Eruption, the Meteorological Agency renewed and modernized observation devices and systems at those of the 16 observatories considered most important. In 1977, it constructed a constant observation station on Kusatsu-Shiranesan as its 17th observatory.

The Second Plan, which started in 1979, aimed to strengthen observational studies toward practical implementation and took a step forward from the First Plan’s central objective of observation system construction. To achieve the Plan’s goals, the volcanoes
to be monitored were classified into 1) particularly active ones (Usuzan, Asamayama, Izu-Oshima, Asosan, Kirishimayama, and Sakurajima) and 2) others. Besides upgrading of the observation system, the priority items chosen were construction of systems for predicting eruption, basic studies for understanding volcanic phenomena, and development of methods for predicting eruption. There were university observatories on active volcanoes (i.e. those in the first category). The numbers of earthquake observation stations were increased around these observatories so as to cover large areas, and telemetric systems for intensive recording of various data were introduced. Hokkaido University’s volcano observatory on Usuzan was chosen to monitor also Tarumaesan, Tokachidake, and Hokkaido-Komagatake, and observation stations were constructed in these areas.

Since the initiation of the Second Plan, the Ministry of International Trade and Industry’s Geological Survey of Japan has participated in the Plan and joined CCPVYE to work together with the universities, the Meteorological Agency, the Geographical Survey Institute (now the Geospatial Information Authority of Japan), the National Research Center for Disaster Prevention (now the National Research Institute for Earth Science and Disaster Prevention), and the Hydrographic Department of the Marine Safety Agency to prepare annual volcanic geology maps, which are needed for understanding the history of volcanic activity.

Two volcanoes erupted as if in anticipation of the start of the Second Plan. One was Asosan, which erupted from June 1979 over a period of 6 months. Because the study team at the Aso Volcanological Laboratory, Faculty of Science, Kyoto University, predicted activation of the volcano and a resultant increase in the frequency of volcanic earthquakes and tremors, the local weather bureau dispatched frequent volcanic activity notices, and municipal governments ordered evacuation of the area 1 km from the crater. However, the Crater East Side Ropeway Station was left out of the order even though it was located no farther than 1 km from the crater, and some tourists at the station were killed or injured. The other volcano was Ontakesan, which unexpectedly erupted at its summit on 28 October 1979. At the time, it was believed that Ontakesan had erupted for the first time since the dawn of history. The volcano was located in the area to be covered by Nagoya University, which was not yet participating in the Plan, and had therefore not been observed. With the revision in circumstances, Nagoya University joined the Plan and started monitoring Ontakesan, but this did not occur until the time of the Fourth Plan.

During the period of the Second Plan, the Faculty of Science and Technology of Hirosaki University asked the Ministry of Education for permission and funds to construct a new observatory on Iwakisan to monitor its volcanic activity, and construction was approved in 1981. The Faculty of Science of Tokyo Institute of Technology started geochemical observations of Kusatsu-Shiranesan which at the time was becoming active.

In the Third Plan, which aimed to strengthen and enhance the observational studies based on the characteristics of volcanoes and promote basic studies of the eruption mechanisms of volcanoes, Japanese active volcanoes were classified into 1) 12 particularly active ones that needed to be intensively observed (Tokachidake, Tarumaesan, Usuzan, Hokkaido-Komagatake, Kusatsu-Shiranesan, Asamayama, Izu-Oshima, Miyakejima, Asosan, Unzendake, Kirishimayama, and Sakurajima); 2) active volcanoes and those with the potential to erupt (Fujisan and 22 other volcanoes and submarine volcanoes); and 3) others.

Construction of a system for promoting comprehensive observation of Izu Oshima was advised. On the basis of this advice, in 1985 the Earthquake Research Institute of the University of Tokyo integrated its geomagnetic observatory and tsunami observatory on Izu-Oshima into Izu-Oshima Volcano Observatory. To strengthen observations of Unzendake, which had been newly selected for intensive monitoring, in 1984 the existing Shimabara Volcano Observatory of the Faculty of Sciences, Kyushu University, was enlarged and reorganized into Shimabara Earthquake and Volcano Observatory, with an increase in staff and upgrading of the facility.

With the aim of strengthening observations of those volcanoes scattered in the Tohoku Area that had the potential to erupt, such as Iwatesan, Azumayama, Chokaisan, and Akita-Yakeyama, in 1987 a division in charge of volcano studies was added to the Observation Center for Earthquake Prediction of the Faculty of Science, Tohoku University, and the facility was reorganized into the Observation Center for Prediction of Earthquakes and Volcanic Eruptions.

In July 1989, during the Fourth Plan, a submarine volcano erupted off the coast of the city of Ito and the Teishi submarine knoll was formed. Against this background, the Izu-Tobu Volcanic Group was added to the group of particularly active volcanoes to be intensively monitored (Group 1), increasing the number of such volcanoes from 12 to 13. Introduction of basic studies, such as high-pressure experiments, alongside observation studies was also stressed. In response to this, a division of volcanic studies was added to the earthquake prediction observation facility of Nagoya University, which joined
the National Plan for the Prediction of Volcanic Eruption. The facility was reorganized into the Research Center for Seismology and Volcanology. The Nansei-Toko Observatory for Earthquakes and Volcanoes of the Faculty of Science, Kagoshima University, also joined the Plan.

In 1990 earthquakes were observed near Tachibana Bay, and in July of the same year earthquakes started to occur directly beneath Unzen-Fugendake. The mobile observation team of the Meteorological Agency started mobile observations, and the Shimabara Earthquake and Volcano Observatory attached to Kyushu University established several temporary observation stations. On 17 November, immediately after a mobile observation team of the universities had established temporary observation stations, phreatic explosions occurred from two of Fugendake’s craters. In April 1991, magmatophreatic explosions became active, and in early May notable expansion of the volcano was observed, suggesting magma intrusion. On 20 May, the top of a lava dome appeared in the Jigokuato Crater, and the dome continued growing following the intrusion of magma. On 25 May, the lava dome collapsed, and the first pyroclastic flow was confirmed to have flowed down the Mizunashigawa River. Many pyroclastic flows followed, reaching farther and farther. On 3 June, 43 persons were killed, including firemen and journalists; the latter were taking videos of pyroclastic flows within the controlled area.

During the 6-year eruption period, Kyushu University’s Shimabara Earthquake and Volcano Observatory served as the base for volcano researchers from all over the nation and provided space for liaison officers from the Self-Defense Forces, police, and other people engaged in disaster prevention. It also played a central role in disaster prevention in the region. The CCPVVE dispatched its deputy president to be stationed at the site for a month in June 1991 to control the observation systems of the various organizations and establish a network among them.

In the Fourth Plan the active volcanoes were reclassified into 1) 13 particularly active volcanoes that needed to be intensively observed; 2) active volcanoes and those with the potential for erupting (Fujisan and 22 other volcanoes and submarine volcanoes); and 3) others. In the Fifth and subsequent Plans the classifications were not revised.

At the end of March 2000, during the period of the Sixth Plan, Usuzan erupted for the second time after the start of the Plan; this put the Plan to the test for its ability to predict eruptions. After observing the occurrence of an earthquake swarm, the research team of the Usu Volcano Observatory suggested to evacuate 16,000 people. People were evacuated following the suggestion, and no one was killed or injured by the eruption. During the eruption, the central members of the research committee for volcanic eruption prediction, which was composed of university researchers and in charge of planning and conducting explorations of the volcano’s structure, stayed by turn in Hokkaido University’s volcano observatory on Usuzan. They maintained observation points, collected observation data, and coordinated and selected the workshifts of personnel, working with the observatory staff.

In June, Miyakejima, which had erupted in 1983, erupted for the second time since the start of the Plan. Initially, the movement of the magma was estimated from the results of tilt and earthquake observations. The submarine eruption on 27 June was correctly predicted, and this was praised as a successful result of the National Plan for the Prediction of Volcanic Eruption. However, in July the difficulty in predicting eruptions was manifested by of the fail to predict the change of the mode of eruption when the explosive eruptions from the summit crater started following the subsidence of the summit. On 29 August, a low-temperature and slow pyroclastic flow occurred, requiring the entire island to be evacuated. Because of subsequent emissions of sulfur dioxide gas, the island had to remain unpopulated over a period of 4 and a half years.

During this period, there were no passenger ships or any other ordinary means of transport to the island. It was therefore difficult for university staff to independently monitor the volcano, and the observation team had to rely on transfers provided by the Meteorological Agency. After the island was evacuated, the commercial power supply was shut down. Not only the university but also national research institutes such as the Geographical Survey Institute and National Research Institute for Earth Science and Disaster Prevention faced temporary data gaps.

From 1992 to 2000, nine former imperial and other national universities were restructured so as to prioritize their graduate schools. The research centers constructed throughout Japan under the National Plan for the Prediction of Volcanic Eruption belonged to undergraduate schools and not the newly intensified graduate schools. Therefore, in and after the Sixth Plan, the observation centers shifted their affiliations to graduate schools, with the exception of the Earthquake Research Institute of the University of Tokyo and the Disaster Prevention Research Institute of Kyoto University, both of which stayed as they were.

In 2004, when the Seventh Plan started, Asamayama began magmatic explosions after a lapse of 21 years. Observation was made mainly by the Earthquake
Research Institute of the University of Tokyo, which has an observatory on Asamayama. The explosion was on a relatively small scale and caused almost no damage to residential districts. Damage to farm products was also relatively small because the eruption occurred from September to November.

5. **Incorporation of national universities and volcano observation**

When the Seventh Plan started in 2004, national universities were incorporated under the Act of General Rules for Incorporated Administrative Agencies. The incorporations ushered in a period in which volcano observation by universities has been difficult. It was decided that Management Expenses Grants would be paid to each university in sums determined on the basis of the expenses paid in the previous fiscal year (2003), thus impeding universities from requesting funds for constructing or renovating volcano observatories and observation points. It has therefore become difficult to renovate observation points, even when they have deteriorated.

The former Geodesy Council was disbanded because of integration of the Ministry of Education and the Science and Technology Agency; the Council became the Subdivision of Geodesy and Geophysics, Council for Science and Technology. In December 2002, the volcano section of the Subdivision summarized a proposal called “Temporary Strategy for Volcanic Observations and Research by universities, etc”. It proposed to choose 16 most active volcanoes out of 34 that had been studied by universities, enhance the observation network infrastructure for those 16 volcanoes via research institutes such as the National Research Institute for Earth Science and Disaster Prevention, share observation data among universities and institutes, and use the data for predicting eruptions.

Although the National Research Institute for Earth Science and Disaster Prevention started to improve and reinforce volcano observation points on the basis of the proposal, budgeting has not been enough, and the initial construction plan has not been completed. However, two observation points on Kirishimayama that had been installed on the basis of the proposal, together with an observation point newly constructed under the Meteorological Agency’s upgrading project associated with 47 volcanoes, were quite useful to monitor a series of eruptions that started as a sub-Plinian eruption on 26 January 2011. These stations played a very important role in helping us to understand the nature of the eruptions. Observational data from the National Research Institute for Earth Science and the Disaster Prevention and Meteorological Agency have been available to the public via the web site of the National Research Institute for Earth Science and Disaster Prevention since 2012.

6. **Integration with the Earthquake Prediction Plan**

The Great Hanshin-Awaji Earthquake occurred during the Seventh National Plan for the Prediction of Earthquake. Therefore, the eighth plan was not drawn up, but a new Observation and Research Plan for Earthquake Prediction was formulated in 1999. The new plan was succeeded thereafter by the “Second Observation and Research Plan for Earthquake Prediction.” On the basis of reviews and outside evaluations of the Second Observation and Research Plan for Earthquake Prediction and the Seventh National Plan for the Prediction of Volcanic Eruption, both Plans were integrated into the “Program of Research and Observation for Earthquake and Volcanic Eruption Prediction” in fiscal year 2009.

In the second year of the integrated plan, a magmatic eruption occurred in Kirishimayama (Shinmoedake) after a lapse of about 300 years. On 26 and 27 January, 2011 a sub-Plinian eruption occurred, spewing out pumice. Subsequent inflow and accumulation of magma in the summit crater, intermittent Vulcanian eruptions occurred. These eruptions, which resulted in over 50 million tonnes of ejecta and lava, were among the largest in recent years, but no explosive eruptions have been observed since 7 September 2011. The observation team could not detect signs of the sub-Plinian eruption but successfully detected premonitory phenomena of the Vulcanian eruptions, such as slope changes and increased tremors, and predicted the eruptions after February 2011. The borehole-type monitoring system of the Meteorological Agency, built in 2010, played an important role in the predictions.

The Volcano Observatory at the Earthquake Research Institute of the University of Tokyo on Kirishimayama had been left unmanned as a result of the government policy of reducing staff numbers to cut costs. Therefore, data were monitored and transmitted to the Research Institute, but the team could not communicate with local government and could not give sufficient advice on disaster prevention.

The Great East Japan Earthquake occurred on 11 March 2011. The National Program of Research and Observation for Earthquake and Volcanic Eruption Prediction is being partly revised; the revision was completed by the end of 2012. The progress of the present plan, which will end in fiscal year 2013, is to be reviewed in 2012 by an outside third party. On the basis of this outside evaluation the next plan will be drawn up, but its development is difficult to predict because the Council for Science and Technology, in
its Interim Report on the Science and Technology Policy, proposed that earthquake research systems be revised. Because the Plan for the Prediction of Volcanic Eruption has been integrated with that of earthquake prediction, the National Plan for the Prediction of Volcanic Eruption will surely be changed.

7. Coordinating Committee for Prediction of Volcanic Eruptions

7.1 Roles of Coordinating Committee for Prediction of Volcanic Eruptions

As described above, the CCPVE was organized on the basis of the First National Plan for the Prediction of Volcanic Eruption, which started in 1974. The Committee is made up of university scholars, experts from research institutes, and representatives of administrative organizations such as the Ministry of Education, Culture, Sports, Science and Technology and the Cabinet Office in charge of disaster prevention, which are also members of the Volcanic Eruption Prediction Plan. The term of service is 2 years, and the members are commissioned by the Director General of the Meteorological Agency. The members are to:

1. exchange information on the results of studies and work by related institutes and organizations; promote research on volcanic eruption prediction; and develop technologies at each institute;
2. during volcanic eruptions, make comprehensive judgments on the phenomena of eruption and improve the quality of information about the volcano, thus contributing to disaster prevention activities; and
3. comprehensively investigate measures for enhancing systems for studying volcanic eruption prediction and monitoring.

There are three regular meetings in an ordinary year, but the Committee may be urgently summoned during eruptions. Upon predicting a volcanic eruption, CCPVE used to announce collective opinions or the comments made by the Chair, but today its announcements mainly include the results of investigations of a specific volcano and evaluations of the activities of other volcanoes in Japan. The literature references investigated by CCPVE, and the Committee’s proceedings, are published in CCPVE bulletins three times a year. Recently, most of the references have been published almost in real time on the web pages of the Meteorological Agency.

An executive board has been established to discuss the operations of the Committee. There have also been Subcommittees for predicting the activity of specific volcanoes and in specific regions. Working groups have been established to investigate specific topics, such as activity levels and approval of new active volcanoes, but today they serve as investigative commissions. The Usuzan Subcommittee was established during the eruption of Usuzan in 2000, and the Izu Subcommittee was formed during the eruption of Miyakejima. The latter is the only remaining Subcommittee as of 2012.

To support information transmission by the Meteorological Agency, CCPVE working groups have investigated approvals of the classification of volcanoes as active and information about volcanic activity. In 1975, CCPVE published “Nihon Kakkazan Soran” (Complete Guide to Active Volcanoes in Japan) as its first project, which included 77 volcanoes. In 1991, the definition of active volcanoes was revised from “volcanoes with a historical record(s) of eruption” to “volcanoes that have erupted in the past 2000 years,” thus increasing the number of active volcanoes from 77 to 83. In 1996, three volcanoes were newly listed as those with eruption records in the past 2000 years, making the total number 86. In 2003, the definition was revised again into an internationally accepted one of “volcanoes that have erupted in the last ~10,000 years or those in which fumaroles are active.” Using the new definition, the volcanoes in Japan were revised; 108 were acknowledged to be active.

The Assessment and Investigative Commission on Volcanic Activity, which was subsequently established, investigated the long-term activity of volcanoes in Japan and listed 47 volcanoes as those to be intensively monitored for the time being. On the basis of the results, the Meteorological Agency increased the number of volcanoes to be monitored on a 24-h basis from 34 to 47 in 2010, and it constructed and improved observation points. The Commission is also in charge of investigating the basic data for approval of volcanoes as active. In 2011, CCPVE approved more volcanoes as active on the basis of the results of the Commission, and the number of active volcanoes in Japan was increased from 108 to 110.

The Investigative Commission on volcano observation systems is investigating monitoring systems and is exchanging and integrating observational data from the Meteorological Agency and other related organizations. The results of the Commission were used to increase the number of observation points when the Meteorological Agency increased the number of volcanoes to be monitored around the clock. The Investigative Commission on fume research in volcanic areas has been preparing a database on gases.

7.2 Contingency plans

In contingencies, the executive board or expanded board may judge an eruption, and sectional meetings and special
CCPVE meetings are to be held when necessary to assess the activity of the volcano. When the eruption is predicted to last for a long time, a comprehensive observation team is to be formed under CCPVE to estimate changes in volcanic activity, establish new observation points, and conduct mobile observations. Because the team may need to enter control areas and other dangerous zones as occasion demands, the Meteorological Agency is to serve as the head office and engage in negotiations with local governments, etc.

The comprehensive observation team is to consist mainly of people from member organizations of the National Plan for the Prediction of Volcanic Eruption but may also include researchers from other institutes when necessary. Approval by the team leader, who is also a member of CCPVE, needs to be obtained for a person to become a member of the team. However, the member’s expenses will not be paid by CCPVE but will need to be covered by the institute to which he or she belongs, and the institute that dispatches the person will also be responsible in the case of accidents, etc. Luckily, no accidents have occurred since the establishment of the National Plan for the Prediction of Volcanic Eruption, mainly because only small-scale eruptions have occurred. However, such a calm period cannot last forever, and urgent improvement measures are needed.

7.3 Problem of the term, “eruption scenarios”

Since 2007, the Meteorological Agency has been in charge of issuing eruption predictions and warnings for Japan’s active volcanoes. At the same time, the Agency has introduced and deployed an eruption alert level system for volcanoes, starting with those that are ready for introduction of the system. To introduce the alert level system for a volcano, a time-sequence diagram of the expected eruption called an eruption scenario should be prepared to help establish judgment standards for deciding on alert levels and clarify when changes in level should be made. Because there are no established methods available today for predicting the scale and modes of eruption, the scenario must be prepared on the basis of a particular recorded past eruption event, assuming that the eruption will progress as in the past, but this can never be taken as the exact future scenario. More than one scenario may be prepared, but not all cases can be assumed. Thus, in a manner of speaking, the scenarios are just for emergency drills.

The Izu Subcommittee of CCPVE prepared an event tree showing the divergences at which decisions were made during an eruption of Izu-Oshima. It was called “the eruption scenario for Izu-Oshima”. The Volcano Group of “the Program of Research and Observation for Earthquake and Volcanic Eruption Prediction”, organized the phenomena involved in the eruption, which occur in time sequence, into an event tree and is developing methods to determine the probability of each divergence. However, it must be noted that the probabilities that are expressed as divergences are only the frequencies observed in the past and may differ from the actual probabilities in the future. Probability prediction of low-frequency events, such as volcanic eruptions, has not been statistically established, so care should be taken not to rely on unreliable numbers.

Another problem is that the event trees are also called “eruption scenarios.” Giving two different concepts (i.e. that of JMA and those of the Izu Subcommittee and the Volcano Group of the Program of Research and Observation for Earthquake and Volcanic Eruption Prediction) the same name may cause confusion in real scenarios of disaster prevention; this issue needs to be resolved urgently.

8. Conclusions

Unlike earthquake prediction, for which there is a government authority called the Headquarters for Earthquake Research Promotion, there is no government body for predicting volcanic eruption. The CCPVE is the sole organization that evaluates volcanic activity and predicts activity progress on the basis of monitored data. The comprehensive observation team is responsible for monitoring and collecting data, which are indispensable for predicting the progress of volcanic activity during eruptions. Although team members may have to expose themselves to danger, their legal security is not covered by CCPVE but must be covered by the institutes to which they belong. This is because the CCPVE is a private advisory organ of the Director General of the Meteorological Agency, which has no legal responsibility or authority over the CCPVE, although it serves as a head office.

In Japan, where volcanic activity could be intensified in the near future, radical strengthening of disaster prevention organizations is essential. Particularly, CCPVE—the organization for assessing volcanic activity—should be an official organization of the government instead of being a private advisory organ of the Director General. A centralized authority such as a Volcano Agency should be ideally created to monitor, assess, and study volcanic activity, but this may be difficult to actualize given the recent trends in administrative reform.

Therefore, headquarters in charge of volcanic eruption research promotion, such as Headquarters for Earthquake Research Promotion, should be immediately established. Under such headquarters, the national government should
be responsible for unifying related ministries and agencies and preventing volcanic disasters.

References