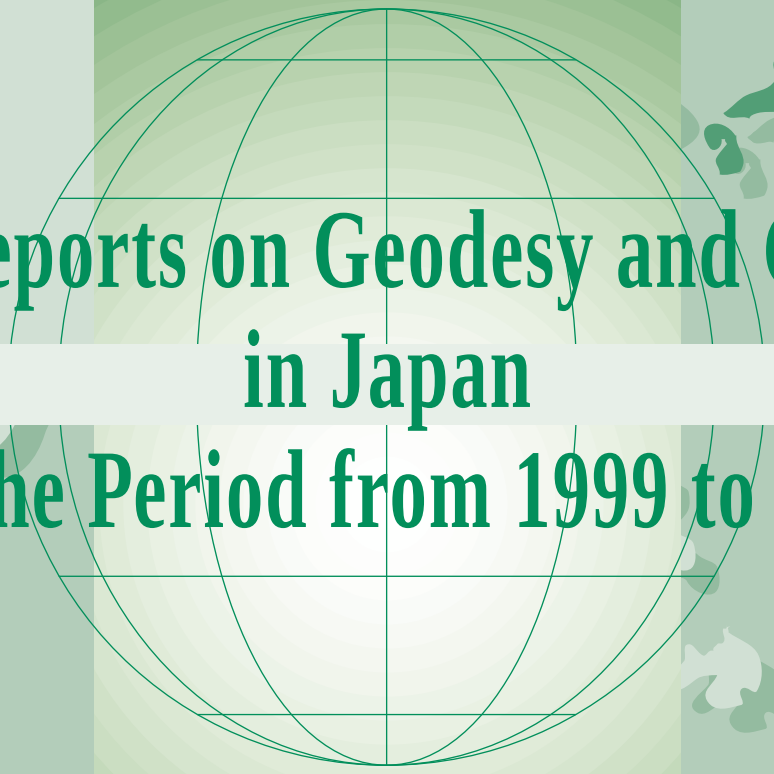
National Report for
INTERNATIONAL UNION
OF
GEODESY AND GEOPHYSICS
(I.U.G.G.)



Activity Reports on Geodesy and Geophysics in Japan for the Period from 1999 to 2002

JULY 2003

JAPAN NATIONAL COMMITTEE
FOR GEODESY AND GEOPHYSICS
SCIENCE COUNCIL OF JAPAN

CONTENTS

FOREWORD

Kojiro IRIKURA
Chair of the Japan National Committee for Geodesy and Geophysics

Japan is one of the first nine member countries of the International Union of Geodesy and Geophysics (IUGG), which was established in 1919 and presently has a membership of 66 countries. The Japan National Committee for Geodesy and Geophysics is set up as one of 180 Liaison Committees under the Science Council of Japan, to deliberate important matters related to Earth sciences and to implement decisions on the international promotion and coordination of scientific research in Geodesy and Geophysics.

The committee consists of 10 members, 2 council members elected from the national associations related to Geophysics and 8 chairs of the national committees. Seven of the 8 national committee chairs are for associations affiliated with IUGG, namely Geodesy (IAG), Seismology and Physics of the Earth's Interior (IASPEI), Volcanology and Chemistry of the Earth's Interior (IAVCEI), Geomagnetism and Aeronomy (IAGA), Meteorology and Atmospheric Sciences (IAMAS), the Physical Sciences and the Ocean (IAPSO), Hydrological Sciences (IAHS), plus the chair of the national committee of Planetary Sciences, which has no corresponding international association.

The committee for the 18th term (2000-2003) of the Scientific Council of Japan has been promoting scientific studies in geophysics and related fields and the applications of our knowledge to social needs, such as environmental preservation and mitigation of natural hazards. These objectives are associated with one of the projects adopted by the 18th Council, "A proposal for Japan's initiative to solve problems of mankind (the Japan Perspective) ", which proposes to find solutions to a variety of issues affecting every part of this planet and the future of mankind.

One of the main activities adopted by the committee for the 18th term is to host the 23rd General assembly of IUGG in Sapporo, Japan. During the last four years (1999-2003), the committee has dedicated efforts for the preparation of this major scientific conference that will be held from June 30 to July 11, 2003.

The main theme of IUGG2003 is the "State of the Planet: Frontiers and Challenges." The Earth, Environmental and Life Sciences have a pivotal role to play in the modern world in an era of unprecedented change, globalization and impact of human activity on the environment. Ever expanding world population, exploitation of natural resources, and human inventiveness in creating new substances and environments have numerous problems. The "State of the Planet" meeting is an initiative designed to enable the international community of geoscientists to have an opportunity to integrate their efforts, through the co-operation of the major international and national organizations of the scientific community. This theme is consistent with the Council's objectives in their action plan for the 18th term.

Membership of Japan National Committee for Geodesy and Geophysics
Science Council of Japan
as on 1 July 2003 (the 18th Term)

Chair	: Prof. Kojiro IRIKURA	(Kyoto University)
Secretary	: Prof. Kimio HANAWA	(Tohoku University)
Members	: Emeritus Prof. Atsuhiro NISHIDA	(Institute of Space and Astronautical Science)
	Prof. Shuzo TAKEMOTO	(Kyoto University)
	Prof. Mitsuhiro MATSU'URA	(University of Tokyo)
	Prof. Toshitsugu FUJII	(University of Tokyo)
	Prof. Yohsuke KAMIDE	(Nagoya University)

Prof. Hideji KIDA	(Kyoto University)
Prof. Michiharu SHIIBA	(Kyoto University)
Prof. Kiyoshi NAKAZAWA	(Tokyo Institute of Technology); until April 2003
Prof. Tetuso YAMAMOTO	(Nagoya University); since May 2003

Activities of the IUGG2003 Local Organizing Committee

Kiyoshi SUYEHIRO
Secretary General of the IUGG2003 Local Organizing Committee

In May 1996, the National Committee for Geodesy and Geophysics (NCGG) of the Science Council of Japan (Chair: Shigewo. ARAMAKI) approved the recommendation from an Ad-hoc Working Group (Chair: Seiya UYEDA) to host the 23rd IUGG General Assembly in Japan. In January 1997, NCGG formed a sub-committee (Chair: Seiya UYEDA) to prepare an invitation for the Assembly to be held in Japan. This sub-committee met 9 times between February 1997 and August 1999. The IUGG Council accepted the formal invitation from NCGG during the 22nd General Assembly in Birmingham during July 1999. In January 2000, representatives from 16 Japanese academic societies for geodesy and geophysics formed the Local Organizing Committee (Chair: Seiya UYEDA) for the next General Assembly (IUGG2003) to be held in Sapporo. In December 2000, the First Circular was printed and distributed. On February 26, the Science Council of Japan recommended co-hosting IUGG2003 to the Government. During July 30-August 2 in 2001, the IUGG Bureau, Executive Committee, and Science Program Committee (Chair: Atsuhiro NISHIDA) met with the Local Organizing Committee in Sapporo. The Science Program Committee met in San Francisco on December 8 and 9 in 2001. The Second Circular was printed and circulated in April 2002. On June 7, 2002, the Cabinet of the Japanese Government approved that IUGG2003 would be co-hosted by the Science Council of Japan and 16 societies for geodesy and geophysics. The Third Circular was printed and distributed in December 2002. A total of 7078 abstracts from 5187 first authors were received by February 2003. The third Science Program Committee meeting was held in Tokyo on March 6 and 7 in 2003 to finalize the program.

23rd IUGG General Assembly in Sapporo

IUGG2003 will be held from June 30 to July 11, 2003 in Sapporo city of Hokkaido prefecture, Japan. Scientific sessions and business meetings will take place in closely located buildings in the downtown area, including the Royton Sapporo, Hokkaido Koseinenkin Kaikan, Sapporo Educational and Cultural Center, and Sapporo Media Park. The Welcome Ceremony will be held at the newly built Sapporo Convention Center on July 2 with the attendance of distinguished guests. With the theme “State of the Planet: Frontiers and Challenges”, the scientific program will consist of 8 Union, 59 Inter-Association, and 109 Association sessions, with 4 Union Lectures to be presented by distinguished scientists.

I. Activity Report of the National Committee for Geodesy

Shuzo TAKEMOTO
Chair of the National Committee for Geodesy

During the period 1999-2002, several major international symposia related to geodesy were held in Japan, e.g. the 1999 Global Positioning System (GPS) International Workshop (GPS'99) at Tsukuba, the 14th International Symposium on Earth Tides (EST2000) at Mizusawa in 2000, and the 2002 International Very Long Baseline Interferometry (VLBI) Service General Meeting (IVS2002) at Tsukuba. These conferences were attended by many researchers both from Japan and overseas, and papers presented there are summarized in special issues of journals [1, 2]. The National Committee for Geodesy, Science Council of Japan sent official delegates to general meetings of the International Association of Geodesy (IAG), held in Birmingham in 1999 and in Budapest in 2001. In addition to international activities, the Geodetic Society of Japan (GSJ) has two general meetings every year and a tutorial school for young geodesists every summer. GSJ awards an eminent young geodesist with the Tsuboi Prize once a year, and during 1999-2002 these awards were given to Yuki Kuroishi (Geographical Survey Inst., GSI), Masato Furuya (Earthquake Res. Inst.), Mikio Tobita (Geographical Survey Inst.) and Xu Peiliang (Disaster Prevention Res. Inst., Kyoto University). The Group Tsuboi Prize started in 2001, and has been given to the BAYTAP-G development group, represented by Dr. Yoshiaki Tamura, National Astr. Obs. (NAO), and the VLBI research and development group of the Communications Research Laboratory (CRL), represented by Dr. T. Kondo.

There was a major change in geodetic activities because of a new law about the Japanese coordinate system which is to be compatible with the World Geodetic System. In April 2002, the Japanese Geodetic Datum 2000, based on space geodetic data replaced the conventional Tokyo Datum.

Several new facilities were established in this period; the number of receiving stations of the nationwide continuous GPS network, GEONET, run by GSI, exceeded one thousand in 2002 and attained the original goal of a nationwide dense deployment. An independent GPS network has also been run by the Japan Coast Guard (JCG). GEONET data became available to researchers on line at the GSI web page (www.gsi.go.jp). The Keystone stations of CRL, a space geodetic network composed of four stations in the Tokyo metropolitan area equipped with VLBI, SLR and GPS, ceased observations in 2001. This network produced valuable data of crustal deformation since 1993 and provided ideal situations for inter-technique collocation studies. NAO built a new VLBI network VERA (VLBI Exploration of Radio Astrometry), composed of four domestic 20 m radio telescopes. This network is dedicated to radio astrometry using differential VLBI (ΔVLBI) techniques. It will be also used as the ground stations to track the SELENE (Selenological and Engineering Explorer) lunar orbiter with ΔVLBI.

Apart from such government-lead activities, university researchers have been performing field observations of crustal deformation with extra-dense campaign type deployment of GPS stations. Areas studied in such activities include the Median Tectonic Line, the focal region of the 2000 Tottori earthquake, the areas of the Izu and Tokai region where a sequence of volcanic eruptions, dyke intrusions and a 'silent' earthquake has been continuing since 2000, and those around major active faults e.g. the Atotsugawa Fault, the Hanaore Fault, etc. Continuous observations by the worldwide-deployed superconducting gravimeters (SG) have been performed under international cooperation of the Global Geodynamics Project (GGP), in which Japanese participants maintain SG's at Canberra (Australia), Svalvard (Norway), Syowa (Antarctica), Bandung (Indonesia), in addition to domestic points. Absolute gravimeters (AG) have been used to calibrate such SG's, and have been deployed in the field to detect subtle gravity changes associated with earthquakes and volcanic eruptions.

Research and development studies of seafloor positioning using GPS/acoustic techniques have been actively performed by university groups and JCG. A new project has been launched in 2002 by a multi-agency group in order to realize a new-generation satellite gravity mission based on low-low satellite-to-satellite laser interferometry. Development of on-board instruments for the coming lunar exploration mission SELENE, such as laser altimeter, a relay satellite to enable direct measurement of the lunar farside

gravity fields by high-low satellite-to-satellite tracking, on-board radio transmitter for earth-based **Δ** VLBI tracking, has been done mainly by NAO, with expectation of the launch of SELENE in the summer of 2005.

Events that occurred in Japan during 1999-2002 contributed a great deal to our knowledge on various crustal deformation phenomena. These include the 1996/2002 'silent' earthquakes near the Boso Peninsula, the summer 2000 sequence in the Izu-Tokai region (eruption of the Miyake Island, intrusion of the submarine dyke connecting Miyake and the Kozu Islands, followed by the Tokai 'silent' earthquake, that is still continuing to the present), the 2000 Tottori earthquake and its small afterslip, and the 2001 Geiyo earthquake. Secular crustal movement studies in the Japanese Islands have revealed the existence of a zone of concentrated strain running from Niigata to Kobe. Secular vertical crustal movements have become accurate enough to be used for inversion studies of interplate coupling at subduction zones together with interseismic horizontal crustal movements. Seasonal components often found in GPS time series have been studied, and were found to be driven largely by seasonally changing surface loads, such as snow.

References

[1] Earth, Planets and Space, Application of GPS and other Space Geodetic Techniques to Earth Sciences, Vol. 52, No. 10 and 11, 2000.
[2] Journal of Geodetic Society of Japan, ETS2000 Special Issue, Vol.47, No.1, 2001.

II. Activity Report of the National Committee for Seismology and Physics of the Earth's Interior

Mitsuhiro MATSU'URA
Chair of the National Committee for Seismology and Physics of the Earth's Interior

In the last four years (1999-2002) there have been major changes in organization and significant progress in seismology and the physics of the Earth's interior in Japan.

1. Changes in Organization

In November 2000 Mitsuhiro Matsu'ura was elected as chair of the National Committee for Seismology, Science Council of Japan (SCJ), replacing the former chair, Kunihiko Shimazaki. SCJ decided on a reorganization of the National Committees related to geodesy and geophysics in 2003.

The Seismological Society of Japan (SSJ) was reorganized from a voluntary academic society to an incorporated association in December 2000, with the purpose of promoting public information and education, as well as scientific research in seismology. One example of such activities is the International Children's Earthquake and Volcano Summit held at Izu-Oshima volcano in July 2001. Another example is a series of public seminars on current topics in seismology held at the annual SSJ meetings. In April 2002 Masakazu Ohtake was elected as president of SSJ, taking over from the former president, Kojiro Irikura.

The Geological Survey of Japan (GSJ) was reorganized as a part of an independent administrative organization, the National Institute of Advanced Industrial Science and Technology (AIST), in April 2001. The new GSJ includes five geoscientific research units: Research Center for Deep Geological Environment, Active Fault Research Center, Institutes of Geosciences, Institute for Geo-Resources and Environment, and Institute for Marine Resources and Environment. GSJ/AIST is now conducting several international collaborative projects with China, Taiwan, France, Turkey, U.S.A., and Canada. The collaborative projects include active fault and paleo-liquefaction studies using Geoslicer, faulting process of the Nojima fault, and hydrological and geochemical research for earthquake prediction.

The National Research Institute for Earth Science and Disaster Prevention (NIED) was reorganized from a national institute to an independent administrative institution in April 2001. Researches related to IASPEI are carried out in the Solid Earth Science Group and the National Information Center for Earthquakes and Disasters. The International Institute of Seismology and Earthquake Engineering (IISEE), which is a division of the Building Research Institute, was also reorganized from a national institute to an independent administrative institution in April 2001.

The Institute for Frontier Research on Earth Evolution (IFREE) was established in January 2002 in the Japan Marine Science and Technology Center (JAMSTEC). Ikuo Kushiro is the Director-in-General of IFREE. IFREE is a project-oriented institute, which aims at a unified understanding of the dynamics and evolution of the solid Earth during the past 200 million years. IFREE has four research programs (Mantle core dynamics, Geochemical evolution, Plate dynamics, and Paleoenvironment) and one center for data and sample analysis. In March 2002, the Earth Simulator Center (ESC) was also established in the Yokohama Institute for Earth Sciences of JAMSTEC. Tetsuya Sato is the Director-in-General of ESC. The main purpose of ESC is to promote large-scale numerical simulation studies of ocean-atmosphere dynamics and solid Earth dynamics, with the fastest and most powerful computer system in the world, the Earth Simulator.

At the University of Tokyo, the Department of Earth and Planetary Science was formed in April 2000 by the merger of four departments related to earth and planetary sciences. The aim of the new department is to construct a center of excellence for education and research in earth and planetary sciences in Japan. The department is divided into five major groups: Ocean and Atmospheric Science group, Space and Planetary Science group, Earth and Planetary System Science group, Solid Earth Science group, and Geosphere and Biosphere Science group. Three subgroups (earthquake physics, structure of the Earth's

interior, and dynamics of the Earth's interior) in the Solid Earth Science group and one subgroup (analysis of the earth and planetary system) in the Earth and Planetary System Science group cover the research fields related to IASPEI.

The Shimabara Earthquake and Volcano Observatory of Kyushu University was reorganized to form the Institute of Seismology and Volcanology in April 2000, in order to promote basic research for the prediction of earthquake occurrences and volcanic eruptions as the regional research center in the Kyushu district.

The Geodesy Council, under the Ministry of Education, Culture, Sports, Science and Technology (MEXT), reviewed the national project of earthquake prediction during the past 30 years in 1997, and summarized their results and recommendations in a report entitled "Promotion of the New Program of Observation and Research for Earthquake Prediction" in 1998. With this official recommendation, a new 5-year national program for earthquake prediction research started in 1999. The new program emphasized the importance of a quantitative understanding of the entire process of earthquake generation cycles. At the same time, in order to manage and promote the earthquake prediction research in universities, the Coordinating Committee of Earthquake Prediction Research Promotion was established under the renewed Earthquake Prediction Research Council in the Earthquake Research Institute (ERI), University of Tokyo.

2. Scientific Progress

2.1 Construction of the Fundamental Observation Network

After the 1995 Hyogoken-Nanbu (Kobe) earthquake the Headquarters for Earthquake Research Promotion was established in the Prime Minister's Office. The Headquarters decided to construct nationwide high-density seismic networks, called the "Fundamental Observation Network". Also, they decided to expand a pre-existing GPS network (GRAPES) to a high-density GPS network (GEONET). As of March 2003, the Fundamental Observation Network consists of Hi-net (high-sensitivity seismographs; 740 borehole stations), F-net (full-range seismographs; 71 vault stations), K-net (strong-motion seismographs; 1024 surface stations) and KiK-net (strong-motion seismographs; 740 sets of surface and borehole stations). NIED serves as the data center for these seismic networks. Now, unifying Hi-net data, university's network data and JMA network data, the Japan Meteorological Agency (JMA) locates the hypocenters of more than 100,000 earthquakes (M>1.5) in and around Japan every year. Using Hi-net data, JMA and NIED discovered the belt of deep low-frequency tremors in southwest Japan over a length of 600 km. These events are located at the depth of about 30 km and aligned with the iso-depth contour of the subducted Philippine Sea slab. The Geographical Survey Institute (GSI) operates the nationwide high-density GPS network (GEONET) with about 1000 continuous stations, and data from GEONET are now widely used for studying secular, seismic and transient crustal deformation. For example, GSI detected significant crustal deformation associated with the 2000 seismic swarm in the Izu Islands, the 2000 Western Tottori Earthquake (M6.6) and the 2001-2003 Tokai silent slip event by analyzing GEONET data. The Tokai silent event has continued for more than two years and its total moment reached M6.8 at the end of 2002. EDM measurements by the Nagoya University group and leveling surveys by GSI for the past 25 years suggest that similar events have repeatedly occurred in this region.

2.2 Highlights of Current Research

We briefly summarize highlights of current research in seismology and the physics of the Earth's interior.

(1) Usu volcano, Hokkaido, erupted on 31 of March 2000. The Institute of Seismology and Volcanology (ISV), Hokkaido University, succeeded in predicting this eruption by observing 4-days forerunning swarm and crustal deformation. The precise processes of dome forming after the big eruption were revealed by the extensive seismic and geodetic observations conducted by universities and governmental organizations.

(2) Miyake volcano, Izu Islands (south of Tokyo), erupted at the end of June 2000. ERI conducted extensive observational studies in cooperation with other universities and governmental organizations (GSI, GSJ, JMA, etc.). The most energetic seismic swarm ever recorded in Japan was observed during June-August 2000, with 7,000 small events (M > 3) and 5 large events (M > 6). The swarm was accompanied by several steam and debris eruptions of Miyake volcano. Dense GPS array measurements and gravity surveys revealed that the inflated magma escaped to the west of Miyake Island with strong seismic swarm activity.

(3) On October 6, 2000 a M7.3 earthquake struck the western Tottori area. The Disaster Prevention Research Institute (DPRI), Kyoto University, conducted an integrated research effort on this earthquake, including aftershock observations, seismic profiling, GPS observations and MT observations, in cooperation with other universities. Also, a detailed fault model from the analysis of strong motion data and geodetic data, and the source effects on near-source strong motions were quantitatively evaluated. Significant conclusions are that the main rupture region and the hypocenters of preceding medium-sized events are clearly separated from each other, and deep low-frequency earthquakes occurred beneath the main rupture region.
(4) In the Tokai region, a locked zone of the hypothetical M8 Tokai earthquake was identified from microearthquake data (NIED and JMA) and GPS data (GSI). In this area, a prominent seismic quiescence is observed over the last several years and the spatial pattern of seismic activity indicates a stress concentration on the asperities in the locked zone.
(5) The Tohoku University group detected M4.8±0.1 earthquakes occurring regularly at the same location of the plate boundary off Kamaishi, northeast Japan. They succeeded in predicting the next event in this earthquake sequence, with the hypothesis that the sequence is ascribed to repeating ruptures of one asperity, with a diameter of about 1 km, surrounded by areas of stable sliding. Waveform inversion results show that the rupture areas of the last two events are almost the same, supporting the hypothesis of persistent asperities.
(6) From the precise studies of natural fault structures and deformation along with fluid-flow laboratory experiments, the Kyoto University group demonstrated that thermal pressurization could give an answer to the Dc (slip weakening distance) paradox.
(7) The group at DPRI, Kyoto University produced detailed subsurface structures and earthquake histories of active faults in and around Kobe, Osaka and Kyoto, and made precise assessments of strong ground motions in the region.
(8) The ERI controlled seismology group conducted a series of extensive reflection and refraction surveys in the northern part of Japan in cooperating with other universities, and revealed detailed velocity profiles across northeastern Honshu and Hokkaido.
(9) From ocean bottom pressure monitoring for 14 months across the spreading center of the southern East Pacific Rise, a joint research group of Tohoku University and Tokyo University detected thermal contraction of the crust in the spreading center in the inter-eruption period. They also detected a pressure increase following the 1997-98 El Nino, which corresponds to a large change in the J2 term of the Earth's gravity field.
(10) The Institute for Study of the Earth's Interior (ISEI), Okayama University, succeeded in elevating the maximum attainable pressure of the multi-anvil large volume press (Kawai-type apparatus) to 50 GPa (previous limit was 27 GPa) by utilizing sintered diamond anvils. This technical innovation brought significant progress in both quenching experiments and in situ X-ray observations at Spring 8. Melting relations of peridotite and CI-chondritic mantle material were determined up to 35 GPa, and chemical differentiation in a deep magma ocean was examined for various bulk mantle models. In situ X-ray investigations of iron up to 44 GPa and 2100 K confirmed the absence of the beta phase proposed as the fifth iron polymorph. Precise determination of phase boundaries of the olivine-modified spinel-spinel-post spinel transformations in the system Mg2SiO4-Fe2SiO4 have been made by means of in situ X-ray diffraction.

2.3 Major Research Projects

The following research projects conducted during this period also made great contributions to the progress in seismology and the physics of the Earth's interior.
(1) The Solid Earth Simulator project started in 1998 as a 5-year national project to develop a multi-scale/multi-physics parallel computing software system for simulating solid Earth dynamics. The Solid Earth Simulator was designed as a composite of three sub-systems, corresponding to long-term global simulation of core-mantle dynamics, intermediate-term regional simulation of crustal activity, and short-term local simulation of earthquake generation and strong motion. The core-mantle dynamics group has developed 3-D computer simulation models for understanding the dynamic processes of three coupled convective systems in the fluid outer core, the sub-solidus mantle and the outermost solid shell. The crustal activity group has developed a realistic computer simulation model for the entire process of earthquake generation cycles in and around Japan. The earthquake rupture-strong motion group has developed computer simulation models for dynamic rupture on an interacting complex fault system and propagation of seismic waves in a realistic 3-D heterogeneous medium. These simulation models with different

algorithms are connected with each other through a simulation platform on the Earth Simulator. Such a comprehensive simulation system will provide the predictive capacity of evolution and dynamics of the complex solid Earth system.
(2) Kyushu University conducted the Japan-Korea joint research project “Mantle diapir beneath the marginal sea between Korean Peninsula and Kyushu Island” supported by the Japan Society for the Promotion of Science (JSPS) and the Korea Science and Engineering Foundation (KOSEF) from 1999 to 2001.
(3) The OBS group at ISV, Hokkaido University, carried out international ocean bottom seismic observations, off North Island of New Zealand in 2001, Marmara Sea of Turkey in 2001, and Arctic Sea in 2002, supported by JSPS.
(4) From 1997 to 2002, ERI served as the center for the Ocean Hemisphere project (OHP), a 6-year national project of solid Earth science. Through this project the Ocean Hemisphere network was constructed in the Western Pacific, consisting of 10 broadband seismographic stations on land, three ocean bottom borehole seismographic stations, and 10 geomagnetic stations on land. All data from this network are accessible through the Ocean Hemisphere data center in ERI. The OHP seismology group discovered the presence of the Earth’s background free oscillation by analyzing the OHP superconducting gravimeter data. From careful analyses and theoretical studies they concluded that the background free oscillation is excited by atmospheric disturbances. By this study it has been quantitatively shown that the solid Earth and the atmosphere are mechanically coupled.
(5) Since 1999 a 5-year national project “Comprehensive Research for Seismic and Aseismic Slip Processes on Active Faults in the Lower Crust” has been conducted by a cooperative research group of universities and governmental organizations to clarify the structure and dynamic processes of deeper parts of active faults. This project consists of closely integrated research programs such as field observations, laboratory experiments and numerical modeling and simulation.
(6) A 5-year project for Earthquake Disaster Mitigation in Urban Areas started in 2002. One of the core programs of this project is imaging active faults beneath urban areas and predicting strong ground motion from these faults. As a center of cooperative work for national universities, DPRI plays a leading role in this project, especially in seismic profiling, construction of fault models and prediction of strong ground motion in the Kinki area.

2.4 International Symposia and Workshops

Finally, we list the related international symposia and workshops held in Japan during this period; International Workshop on Solid Earth Simulation (January 2000 at Tokyo), The 2nd ACES Workshop (October 2000 at Tokyo & Hakone), International Workshop on the Quantitative Prediction of Strong-Motion and Physics of Earthquake Sources (October 2000 at Tsukuba), OHP/ION Joint International Symposium (January 2001 at Lake Yamanaka), The 4th International Joint-Institutions Symposium: Transport of Materials in the Dynamic Earth (October 2001 at Kurayoshi), International Workshop on Physics of Active Faults (February 2002 at Tsukuba), JUDGE Project Workshop of ICDP (November 2002 at Chiba).

III. Activity Report of National Committee for Volcanology and Chemistry of the Earth's Interior

Toshitsugu FUJII
Chair of the National Committee for Volcanology and Chemistry of Earth's Interior

Hiroshi SHIMIZU
Secretary General of the National Committee for Volcanology and Chemistry of Earth's Interior

There has been significant volcanic activity and progress in volcanology in the last four years (1999-2002).

1. Eruptive Events

During the period of 1999-2002, volcanic eruptions occurred at Usu, Miyakejima, Sakurajima, Suwanosejima, Hokkaido-Komagadake, Iwojima and Izu-Torishima volcanoes in Japan. Among these, the eruptions of Usu and Miyakejima were large in scale and caused serious disasters.

Phreatomagmatic eruptions took place about 4 km northwest of the summit of Usu volcano in March 2000 and a cryptodome was formed at the western foot of the volcano during this eruptive activity. Subsequent eruptive activity and deformation gradually declined but small phreatic explosions continued until September 2001. The onset of the eruption was successfully predicted, based on the detection of seismic activity and ground deformation, and people living near the volcano were required to evacuate before the eruption.

Vigorous eruptions of basaltic magma took place at Miyakejima in July and August 2000, which were associated with subsidence of the summit area. The mode of eruptive activity was unusual for this volcano. Emissions of huge amounts sulfur dioxide began at the end of August 2000, when the lateral migration of magma outside of this volcanic island came to an end. This magma migration generated the summit subsidence and strong seismic activity. Direct degassing of deep-seated magma continued for a few years. All the residents of Miyakejima have been evacuated since September 2000.

High levels of activity without eruptions were observed at several volcanoes. Strong seismicity and inflation began at Iwate volcano in March 1998. The seismicity gradually declined but continued for the period 1999-2002. Fumarolic activity in the western area of Iwate volcano gradually became active since March 1999 and has been continuing. Earthquake swarms accompanied by crustal deformations occurred near Nii-jima and Kozu-jima volcano in 2000, at Hakone volcano in 2001, and at Hachijojima volcano in 2002. Seismicity consisting of deep low frequency earthquakes beneath Fuji volcano occurred from October 2000 to May 2001.

2. Volcanological Studies

Various techniques based on geophysics, geochemistry, and geology have been applied to clarify the nature of the volcanic activity in Japan.

Dense seismic networks, consisting of broadband and short-period seismometers and high resolution data acquisition systems, enable us to determine precise locations of volcano-tectonic, long-period, very long-period, and tremor events, and to clarify magma transport systems at Usu, Towada, Iwate, Bandai, Miyakejima, Unzen, Kuju, Aso, Satsuma-Iwojima and Kuchierabujima volcanoes. GPS and tilt measurement networks around Usu, Iwate, Miyakejima, Kozujima, and Kuju volcanoes, Izu islands and Hachobaru geothermal area are utilized for determining the locations and amounts of dike intrusions. Synthetic Aperature Radar (SAR) was used for measuring topographic changes associated with the 2000 caldera formation of Miyakejima volcano and volcanic inflation of Iwate volcano. Absolute and relative gravitational observations succeeded in detecting a caldera formation process associated with the 2000 activity of Miyakejima. Electric and magnetic observations were utilized for detecting temporal and spatial changes of shallow volcanic systems at active volcanoes in Japan.

Volcanic gas emissions have been measured at various volcanoes in order to monitor volcanic activity. Soil CO_2 degassing from the summit area of Usu volcano increased before and significantly decreased after the 2000 eruption. For the case of the 2000 Miyakejima eruption, SO_2 flux as high as 230 ktons/day was observed using a correlcation spectrometer (COSPEC), and a model of convective transport of magma was proposed to explain the continuously high observations of SO_2 flux. Intensive geochemical and geophysical studies have been done at Satsuma-Iwojima volcano, which is continuously degassing high temperature volcanic gas, and the results are published in a special issue of Earth, Planets, and Space (Vol.54, No.3) in 2002.

Petrographical research successfully detected the important materials of the phreatomagmatic explosions in the 2000 Usu eruption and the 2000 Miyakejima eruption.

Geological studies of Quaternary volcanoes in Japan, including historical eruptions, were reported for Hokkaido-Komagatake, Usu, Iwate, Bandai, Izu-Oshima, Miyakejima, Fuji, Unzen and other volcanoes. On the basis of these studies, geologic maps have been published for 6 volcanoes and hazard maps have been prepared for 10 volcanoes during the period of 1999-2002.

Source mechanisms of long period seismic events and explosion earthquakes observed at Usu, Iwate, Aso, Sakurajima, Kusatsu-Shirane and Asama volcanoes were investigated through waveform analyses, and source processes were discussed in relation to the movement of magma or hydrothermal fluid beneath the volcanoes. Field explosion experiments, laboratory experiments and numerical simulations were conducted to understand the dynamics of volcanic eruptions.

Three-dimensional seismic structures of volcanoes were revealed by tomography methods at Aso, Kuju, Usu, Izu-Ooshima, Kirishima, Iwate, Unzen and other volcanoes. Temporal changes of seismic structure were studied around Iwate volcano using artificial seismic sources. The electric resistivity structure was also investigated for Usu, Aso, Miyakejima and other volcanoes. Electric self-potential measurements were conducted at Sakurajima and Aso volcanoes to detect hydrothermal systems.

Hydrothermal systems and water chemistry and isotope compositions were studied at several crater lakes and many hot springs. The geochemistry and explorations of geothermal and hydrothermal systems were also studied in various regions, including ocean bottoms.

Magmatism beneath the Japan arc were studied based on the results of numerical simulations seismic structures and/or geologic data. Many studies on noble gas chemistry and isotope compositions in lavas or xenolithes were carried out to understand volcanism, and systems of magma and the mantle. There were various types of studies on the dynamics of magma from petrological points of view, such as, melt migration within dikes, crystallization and cooling history of magma, solidification of lava domes and formation of layered structure of gabbro and peridotite. A series of analogue experiments on crystallization of magma within meltable material (a binary eutectic system) was carried out in order to discuss evolution of a magma chamber within the crust.

3. National Project for Prediction of Volcanic Eruptions

The sixth 5-year plan of the National Project for Prediction of Volcanic Eruptions was proposed by the Geodetic Council of the Ministry of Education, Science and Culture in 1998 after reviewing the achievement of the project since 1974. The proposal of the plan consists of three parts: (1) Reinforcement of volcano monitoring and observational research at volcanoes, (2) Promotion of basic research for higher-grade predictions of volcanic eruptions and (3) Strengthening of the scheme for the prediction of volcanic eruptions.

Under the project, universities carried out the Comprehensive Joint Volcano Observations at Iwate, Satsuma-Iwojima and Kuchinoerabujima, Unzen and Fuji volcanoes, and evaluated current activity and eruption potential for these volcanoes. Furthermore, universities and institutions have done preliminary and collaborative observations at Iwate, Usu and Miyakejima volcanoes, which have had volcanic crises. The Joint Experiment on Subsurface Structure of Volcanoes including seismic sounding was conducted at

Izu-Oshima, Iwate, Usu and Hokkaido-Komagatake volcanoes in the last four years. The experiment has provided information on the detailed shallow (less than 3 km) structure of volcanoes, and greatly improved the determination of locations of volcanic earthquakes at those volcanoes.

At Fuji volcano, seismic activity of deep low-frequency earthquakes increased in fall of 2000, and the Subdivision on Geodesy and Geophysics, Council for Science and Technology reported on a proposal about the reinforcement of monitoring and research at Mt. Fuji (2001). According to the proposal, a collaborative 3 year study involving different institutions, including social sciences, was initiated in 2001.

The Japan Meteorological Agency (JMA) established four regional centers for volcano monitoring and volcanic information in 2002, by restructuring volcano sections at meteorological observatories and weather stations, in order to improve the ability to monitor and evaluate volcanic activity.

The Geodetic Council was restructured into the Subdivision on Geodesy and Geophysics, Council for Science and Technology in 2000. The sixth 5-year plan was reviewed by the subdivision in 2002 and evaluated by experts in the fields of volcanology, seismology, social science, and civil engineering. In the summer of 2003, the recommendation for the seventh 5-year plan (2004-2008) will be proposed from the subdivision.

4. International Activities

The Disaster Prevention Research Institute (DPRI), Kyoto University carried out a survey and observations at Indonesian volcanoes, in cooperation with the Volcanological Survey of Indonesia (reorganized to the Directorate of Volcanology and Geological Hazard Mitigation in 2002). This cooperative study revealed seisimic activity and focal mechanisms of volcanic earthquakes at Guntur, Merapi and other active volcanoes in Indonesia.

Tohoku University carried out investigation at Nyiragongo and Nyamuragira volcanoes in the Virunga volcanic group in the central part of the western rift of the East African Rift System, in cooperation with the Centre de Rechereche en Sciences Naturelles (CRSN), the Rep. Dem. Congo. In the 2002 eruption of Volcano Nyiragongo, CRSN succeeded in the prediction of the eruption. The cooperative observations after the eruption between CRSN and Tohoku University revealed that the horizontal and vertical variations along all baselines for about one year from April 2002 to March 2003 were within the accuracy of the sensors, suggesting that, even though new lava lake activity already re-appeared in the crater, there have been neither significant magma supply or drain-back, nor a magma intrusion into the volcanic region.

In order to understand the nature of Hawaiian volcanism, a 5 year Japan -US Joint Research Program was carried out in the summers of 1998, 1999, 2001 and 2002, using research vessels (Yokosuka and Kairei) and manned and unmanned submersibles (Shinkai-6500 and ROV-Kaiko) of the Japan Marine Science and Technology Center (JAMSTEC). Altogether 20 scientists from the Japanese side, consisting of JAMSTEC, Geological Survey of Japan and 7 universities (Titech., Tokyo Univ., Hokkaido Univ., Shizuoka Univ., Osaka Univ., Shimane Univ., and Kumamoto Univ.) collaborated with 15 US scientists from the USGS, University of Hawaii, Rice Univ., Bishop Museum and MBARI. The joint research has created good quality bathymetric maps around Hawaii, clarified the geologic construction of the deep southern flank of Kilauea volcano, and most importantly has conducted the first systematic study to reconstruct giant landslides on the northeast of Oahu island. These research results have been published as a collection of papers in the AGU Geophysical Monograph vol. 128, Hawaiian Volcanoes: Deep underwater perspectives, in Feb. 2002.

The Unzen Scientific Drilling Project (USDP) is a six-year international project started in 1999, co-sponsored by the Japanese Government and the International Continental Scientific Drilling Project (ICDP). More than 25 research institutes from Japan, USA, Germany, UK and Taiwan joined this project. In the first three years (Phase I), three drillings and associated geological, geophysical and geochemical studies were done to reveal the eruptive history and internal structure of Unzen volcano, along with constructing the strategy of the conduit drilling planned for the Phase II. The conduit drilling, started in January 2003 and ending in 2004, is to understand the eruption mechanism of the volcano.

The Japan Meteorological Agency (JMA) established the Volcanic Ash Advisory Center (VAAC) in

the Tokyo Aviation Weather Service Center in April 1997. This is one of nine VAAC's in the world and has been issuing Volcanic Ash Advisories (VAAs) in the area of responsibility.

IV. Activity Report of the National Committee for Geomagnetism and Aeronomy

Yohsuke KAMIDE
Chair of the National Committee for Geomagnetism and Aeronomy

Hisashi UTADA
Secretary General of the National Committee for Geomagnetism and Aeronomy

We report on IAGA-related activity in Japan over the period of 1999-2003, in terms of two areas: Solar-Terrestrial research and Solid Earth research. The following is an outline of what has been accomplished over the last four years in each of the two areas:

1. Solar-terrestrial research

Scientists in this field have become increasingly reliant on detailed satellite and ground-based observations, as well as sophisticated computer simulations combined with realistic boundary conditions resulting from these detailed observations. This is based on the common view that processes occurring in the solar-terrestrial nonlinear system are known to be much more complicated than what the average picture of the system has been describing. It is also the case that solar-terrestrial physics is internationally oriented, such that most, if not all, studies in this area represent international joint projects. This means that it is extremely difficult these days to identify only the contributions the Japanese community has made.

1.1. Space Physics

A major advance has been made in the studies of acceleration of particles in solar flares, solar wind-magnetosphere coupling, magnetospheric convection, magnetosphere-ionosphere coupling, ionosphere-thermosphere coupling, auroral processes, and geomagnetic storms and substorms. In particular, the physics of magnetic reconnection, the nature of current sheets in the magnetotail, and high-energy particles in the inner magnetosphere are some of the main subjects in which major findings were accomplished in the Japanese community. It is now realized that in the solar wind-magnetosphere-ionosphere interactive system, the concept of multi-scale interactions is extremely important as a basic process in the plasmas that characterize this unique system.

1.2. Upper Atmospheric Physics

The part of the Earth's atmosphere IAGA deals with overlaps with the lower thermosphere and the ionosphere and bounded by the lower atmosphere, in which meteorology dominates. Not only the Earth's atmosphere, but also planetary atmospheres arebecoming a target of our study. It is also essential to couple with environmental sciences, such as showing the importance of the sensitivity of the so-called middle atmosphere and the mesosphere and lower thermosphere (MLT). It is in this region of the upper atmosphere where the effects of both gravity waves and solar activity play roles of nearly the same magnitude. It has been more fully realized that ground phenomena, such as volcanoes, clouds, and thunders, influence greatly the structure of the upper atmosphere.

2. Solid Earth research

In a number of research subjects in solid Earth science, significant contributions by Japanese IAGA-related scientists have been made over this period. It will be noteworthy that interaction and integration with other research fields, such as seismology, geodesy, oceanography, and geology, are becoming more important in the studies of solid Earth.

2.1. The Earth's and Planets' interior

Simulation studies of the MHD dynamo were made by several research groups. Significant progress in this field is expected in the near future by the use of an extensive computer system, called The Earth Simulator. The Ocean Hemisphere Network Project (1997-2002) installed 10 permanent geomagnetic observatories, including one ocean bottom station, in the Pacific region. A network of voltage measurements using "retired" submarine cables was established in the Pacific region, as a US-Japan collaboration program. This network has been and will be utilized to study the Earth's mantle structure and

the core dynamics. In a regional geomagnetic study, a project begun in 2000 to create a model of the geomagnetic reference field suitable for the region in and around Japan, will be completed in 2003. Magnetotelluric surveys resolved the resistivity distribution of seismogenic zones and contributed to understand the earthquake generation process. Miyakejima volcano (about 200 km south of Tokyo) erupted in 2000. Magnetic, electrical and electromagnetic investigations were made to reveal the physical process of the eruption. The RIKEN Frontier Project (1997-2001) installed various types of sensors to detect possible electromagnetic variations prior to earthquakes. As for study of the Moon and Mars, NOZOMI was launched in 1998 and will arrive in an orbit around the Mars in 2004. SELEN will also be launched in 2004 for surveying the Moon.

2.2. Time evolution of the geomagnetic field

A large number of measurements of the paleomagnetic intensity and direction were made both with marine sediments and sedimentary and volcanic rocks, are accumulating in the paleomagnetic database. Some attempts have been made to understand the geomagnetic field in the Archaean era. Geomagnetic variations were obtained by paleomagnetic measurements of Archaean rocks in South Africa, Australia, and Canada. Paleomagnetic methods were applied to environmental investigations as well. Studies of deep marine sediments evidently showed apparent high correlation between paleo-secular variations and paleo-climate changes over time scales of 10^4 - 10^5 years. Deep-towed magnetic surveys of the deep seafloor revealed geomagnetic variations with high spatial resolution, greatly contributing to tectonic investigations.

V. Activity Report of the National Committee for Meteorology and Atmospheric Sciences

Hideji KIDA
Chair of the National Committee for Meteorology and Atmospheric Sciences

Takashi YAMANOUCHI
Secretary General of the National Committee for Meteorology and Atmospheric Sciences

In Japan, the main body for research activity in the fields of meteorology and atmospheric sciences is the Meteorological Society of Japan, which was founded in 1882. The membership of the Meteorological Society of Japan is about 4000. The current nine members of the eighteenth National Committee for Meteorology and Atmospheric Sciences are all appointed by the executive committee of the Meteorological Society of Japan, for the term of three years. The affiliations of these members are from a variety of universities, research institutes, and the Japan Meteorological Agency.

1. General Research Activities

The Meteorological Society of Japan has several research sub-committees for scientific problems, such as meso-scale meteorology, air-sea interaction, ozone, polar region meteorology, IGBP/GAIM-related research in Japan, non-hydrostatic modeling, satellite observations, and weather forecasting. These sub-committees have their own purposes and organize the activities in the related research fields.

The society holds two general meetings, usually in May and October for 3 or 4 days with an average number of about 500 participants. We, the National Committee, had nine meetings during the period from October 2000 through May 2003, to discuss the research projects and present and future activities of our community. We also held several symposia on various themes important to us in Japan and are currently preparing a report of these meetings and symposia.

2. Recent Research Highlights

For the recent years, some research highlights are listed below:
The international WCRP project of the GEWEX/GAME was conducted during 1998 to 2002 to study the regional climates, water cycles and energy balance mainly over East Asia and Siberia. Many Japanese researchers participated and played important roles in this research. The exchange of the scientific information was carried out very well, and motivates future cooperating research in the Asia.

Many Japanese scientists, interested in the stratospheric impact on climate change, contributed to the WCRP/SPARC project for research of stratospheric dynamics, chemistry and climate. The interaction of the stratosphere and troposphere was investigated from both the dynamical processes of vertical propagation of planetary waves and zonal modes, and from the air exchange through the tropopause in the tropical region.

One of the main highlights in the Japanese community of atmospheric sciences is the Earth Simulator, presently the largest super computers , which began in early 2002. One purpose of this machine is to study the future climate of the world which is affected by warming due to increasing carbon dioxide. This simulator is able to compute comprehensive climate models about 1000 times faster than usual super computers, and will be a powerful tool for simulation research.

The development of the GPS meteorology in Japan is remarkable both in observation and analysis methods to research the global and local distributions of atmospheric important elements such as water vapor contents and temperatures, and to use for the initial conditions of numerical weather predictions.

3. Other Topics

At this year's spring general meeting of the Meteorological Society of Japan, the first formal exchange of information was made by representatives on behalf of Japanese , Chinese, and Korean academic societies in meteorology and atmospheric sciences. We expect that this regional exchange of information will gradually develop into better scientific and human relationships among these countries.

VI. Activity Report of the National Committee for Hydrological Sciences

Michiharu SHIIBA
Chair of the National Committee for Hydrological Sciences

The Japan National Committee for Hydrological Sciences, the Science Council of Japan is one of seven national committees of the corresponding associations of the International Union of Geodesy and Geophysics. Its roles are to plan future hydrological researches, to coordinate academic bodies related to inland water, and to act as the National Committee for IAHS.

The hydrological societies in Japan now consist of 15 independent societies: the Japanese Society of Limnology, the Japanese Association of Groundwater Hydrology, the Japanese Society of Snow and Ice, the Balneological Society of Japan, the Geochemical Society of Japan, the Japan Society of Civil Engineers, the Japanese Forestry Society, Japan Society of Hydrology and Water Resources, the Japanese Association of Hydrological Sciences, the Erosion Control Engineering Society of Japan, the Society of Agricultural Meteorology of Japan, the Japanese Society of Irrigation, Drainage, and Reclamation Engineering, the Geothermal Research Society of Japan, Japanese Geomorphological Union, and Japanese Society of Physical Hydrology. The current nine members of the National committee are selected from the first nine societies. The chairman of the National Committee acts as the national representative for IAHS and the members act as national correspondents of the international Commissions and Committees of IAHS.

Since there is no unified organization for hydrological sciences in Japan, the National Committee functions as a focus for collecting and distributing information concerning hydrological sciences. For the IAHS 2003 symposium, which will be held in Sapporo with the IUGG 2003 General Assembly, the National Committee proposed a theme “Global Change, Risk Assessment, and Water Management” and created a working committee for preparing the IUGG/IAHS 2003. In an IUGG 2003 Exhibition, the National Committee will display panels and booklets that show research activities of hydrological societies in Japan.

In the following, recent international activities held in Japan are introduced. The research project, IAHS Decade of Prediction of Ungaged Basins (PUBs), is partly promoted by influential Japanese hydrologists, such as Prof. Takeuchi, the current IAHS president. The preparatory workshop on the IAHS Initiative for the Prediction in Ungaged Basins was held in March 2002 in Kofu, Japan, and also a PUB Session was held in the World Water Forum in Kyoto, 2003. The workshop “Towards a Science Programme for Prediction in Ungaged Basins” will be held in the IUGG/IAHS 2003 in Sapporo. The First International Conference on Hydrology and Water Resources in the Asia Pacific Region was held in Kyoto, Japan. This conference was the first event organized by the Asia Pacific Association of Hydrology and Water Resources (APHW) that was established in 2002. The National Committee also will promote and contribute to these international research activities.

VII. Activity Report of the National Committee for the Physical Sciences of the Ocean

Kimio HANAWA
Chair of the National Committee for the Physical Sciences of the Ocean

The former, 17th Term, National Committee for the Physical Sciences of the Ocean, Science Council of Japan ended in September 2000, and the present, 18th Term, committee begun its activity in October 2000. See the members of the National Committee for the Physical Sciences listed at the end of this report.

In this report, recent progress in physical oceanography is briefly reviewed in several fields. Please refer to more detailed descriptions made in "Report of Oceanographic Studies in Japan for the period from 1995 to 1998" presented at the IUGG XXIII Assembly by the committee.

1. Research on the Kuroshio

Since the Kuroshio plays an important role in global climate changes and impacts on the local Japanese coastal areas, the Kuroshio is the main target of numerous Japanese oceanographers. As one of subprojects of CREST (Core Research for Evolution Science and Technology) promoted by the JST (Japan Science and Technology Corporation), the "Kuroshio Fluctuation Prediction Experiment" has been active from 1998 to 2002. Along the TOPEX/POSEIDON track, off Cape Ashizuri (ASUKA Line), extensive hydrographic observations were made and dense moorings were deployed, to estimate the Kuroshio volume transport. Combining these datasets, the precise transport has been estimated, which showed small seasonal changes and large interannual variations. Many researchers have paid their attention to the Kuroshio path variations. First, using the data from ferry-installed ADCP, XBT and satellite altimeter, the existence of many mesoscale eddies has been pointed out. Further, the eddy-Kuroshio interaction process south of Japan has also been investigated and it has been found that eddies largely influence the Kuroshio path variations (so-called small meanders). Numerical experiments have also done to show this kind of fluctuations of the Kuroshio path. As a whole, it can be said that a new paradigm for the occurrence of the Kuroshio small meanders has been raised.

2. Hydrographic Research on Three-dimensional Oceanic Structure and Circulation

Intensive hydrographic surveys have also been conducted during last decades. As Japanese contributions to WOCE (World Ocean Circulation Experiment), WHP (WOCE Hydrographic Programme) observations, such as P1, P2, P8, P9, P16 and P17, were made in SAGE (Subarctic Gyre Experiment) from 1998 to 2002 funded by the former STA (Science Technology Agency) and the present MEXT (Ministry of Education, Culture, Sports, Science and Technology). Many surface and subsurface water masses, such NPSTMW (North Pacific Subtropical Mode Water), NPCMW (Central Mode Water), NPIW (Intermediate Water), and Tropical Water, have been analyzed to show their formation processes, advection/movement, and distributions. Especially, NPIW was the main focus of the SAGE project. A new type of climatology called the North Pacific HydroBase has been prepared and used by many oceanographers. The Japanese community has participated in the International Argo project under the "Millennium Project" promoted by the Japanese government (2000-2004). To the present (March 2003), a total of 150 Argo floats have been deployed in the Pacific, Indian and Southern Oceans.

3. Large-scale Air-sea Interaction

Japanese researchers have conducted many research projects in the field of large-scale air-sea interactions, such as ENSO (El Nino-Southern Oscillation) and decadal/interdecadal variability, including PDO (Pacific Decadal Oscillation), AO (Arctic Oscillation), and IOD (Indian Ocean Dipole) phenomena. Diagnosis analyses to the observational data and numerical experiments at various levels of models have been made to clarify their mechanisms. The Japanese CLIVAR (Climate Variability and Predictability Study) project has not started. Recently, the proposal of the CLIVAR-related Japanese project entitled "North Pacific and Climate -Clarification of Interdecadal Variability and Its Mechanism-" has been sent to MEXT.

4. Research on Marginal seas

Research on marginal seas have markedly progressed during the last decade. Two international cooperative studies have been conducted: CREAMS-I and II (Circulation of Research of East Asian Marginal Seas, 1993-1997, 1998-2002) for the Japan sSa and East China Sea, and the Joint Japanese-Russian-U.S. Study of the Sea of Okhotsk (1998-2001) sponsored by CREST/JST. In both international projects, many facilities have been utilized, such as moored-ADCP, PALACE floats, and IES, to capture the oceanic structures and circulations, and their temporal variabilities. Diagnostic analyses are now undergoing, but many new oceanic features have already been discovered. Numerical models appropriate to the marginal seas have also developed to reconstruct the findings from observations and to clarify their mechanisms.

5. Numerical Studies on Open Ocean Circulation

Following the development of high-speed computers, modeling studies on the ocean general circulation with associated physical process have accelerated in quality and quantity, in particular simulations. Dynamic ocean models are used not only in the stand-alone simulations, but also in the complex modeling, such as ocean-atmosphere coupling models, and geochemical and ecosystem models. Several institutions have also developed ocean data assimilation models. All of the assimilation studies in Japan contribute to GODAE (Global Ocean Data Assimilation Experiment).

6. Satellite Oceanography

Many researchers have engaged in development of algorithms and validations for the data from satellite sensors, such as altimeter, scatterometer, AVHRR, and CZCS , to obtain more accurate physical parameters such as SST, SSW and SSH. Further, various products have been provided and widely used in the community. Among them, a surface heat and momentum flux data set called J-OFURO (Japanese Ocean Flux data sets with Use of remote sensing Observations) has been released.

7. Cooperative Studies with Asian Countries

The JSPS (Japan Society for Promoting Sciences) Multilateral Cooperative Research Program-Coastal Oceanography started in 2001 and will continue until 2010. The participating countries for this project are Japan, Philippines, Vietnam, Thailand, Malaysia and Indonesia. This program consists of four core projects. Under this program, many symposiums and workshops have been held, and cooperative studies have been promoted and enhanced.

Committee members of the 17th term and 18th term of the Science Council of Japan

I. Membership of the 17th Term (from October 1997 to September 2000) as on 1 July 1999

Chair: Prof. Shiro Imawaki (Kyushu University)

Secretary: Prof. Kimio Hanawa (Tohoku University)

Members: Prof. Nobuhiko Handa (Aichi Prefectural University), Prof. Norihisa Imasato (Aichi Prefectural University), Dr. Hideo Nishida (Maritime Safety Agency), Prof. Yoshiyuki Nozaki (University of Tokyo), Prof. Nobuo Suginohara, (University of Tokyo), Prof. Kensuke Takeuchi (Hokkaido University), Prof. Kensaku Tamaki (University of Tokyo), Emeritus Prof. Yoshiaki Toba (Tohoku University), Dr. Takeshi Uji, Japan Meteorological Agency

II. Membership of the 18th Term (from October 2000 to September 2003) as on 1 July 2003

Chair: Prof. Kimio Hanawa (Tohoku University)

Secretary: Prof. Masaki Kawabe (University of Tokyo)

Members: Prof. Toshiyuki Awaji (Kyoto University), Prof. Toshitaka Gamo (Hokkaido University), Prof. Toshiyuki Hibiya (University of Tokyo), Prof. Shiro Imawaki (Kyushu University), Prof. Haruo Ishii (Japan Coast Guard Academy), Dr. Keisuke Mizuno (National research Institute for Far Seas Fisheries), Dr. Masaro Saiki (Japan Meteorological Agency), Dr. Kensuke Takeuchi (Earth Observation Frontier System for Global Change), Dr. Takatoshi Takizawa (Japan Marine Science and Technology Center), Prof. Eiichi Tokuyama (University of Tokyo)

VIII. Activity Report of the National Committee for Planetary Science

Tetsuo YAMAMOTO
Chair of the National Committee for Planetary Science

The National Committee for Planetary Science was newly established in February 1997 under the Japan National Committee for Geodesy and Geophysics, the Science Council of Japan. The Committee began its activity in October 1997, the beginning of the 17th term. The members of the Committee of the 17th and 18th terms are listed below.

17th term (October 1997 to September 2000):

Chair:	Prof. Kiyoshi Nakazawa (Tokyo Institute of Technology)
Members:	Prof. Hitoshi Mizutani (ISAS)
	Prof. Masao Kitamura (Kyoto University)

18th term (October 2000 to September 2003):

Chair:	Prof. Kiyoshi Nakazawa (Tokyo Institute of Technology); until April 2003
	Prof. Tetsuo Yamamoto (Nagoya University); since May 2003
Members:	Prof. Yoshimori Honkura (Tokyo Institute of Technology)
	Prof. Akira Tsuchiyama (Osaka University)

To support the activity of the Committee, several planetary scientists participated in the Committee as the observers in addition to the members listed above, because of the wide extent of planetary science and the limited number of the official Committee members. There are no international counterparts of the Committee.

Significant progress has been made in the following fields: (1) Explorations of the solar system bodies, (2) Study of Antarctic meteorites and of the extraterrestrial materials, (3) Progress in the observational and theoretical studies of the formation of extra-planetary systems. Also described is the effort of formation of the basis for promotion of the study of young planetary scientists.

1. Explorations of the solar system bodies

The major objectives of the Japanese solar system explorations are a) to explore primitive bodies of the solar system, b) to explore the internal structure of the Moon and planets, and c) to explore the atmospheric and magnetospheric environment of the planets. All of these explorations are directed toward better understanding of the origin and evolution of the solar system.

The current planetary exploration programs are PLANET-B (NOZOMI), MUSES-C (HAYABUSA), LUNAR-A, and SELENE missions, most of which are carried out by ISAS (Institute of Space and Astronautical Sciences) in collaborations with scientists from many universities and other institutes in Japan, as well as those abroad. The SELENE mission is a joint project of ISAS and NASDA (National Space Development Agency) in which many planetary scientists from universities and institutes in Japan participate.

The PLANET-B (NOZOMI) mission aims to study the Martian atmosphere and magnetosphere, including its dusty environment. Nozomi, a spacecraft for the PLANET-B mission, launched in July 1998 by an M-V rocket developed by ISAS, is now in cruise phase toward the Mars and will be inserted into a Mars orbit in January 2004. During the cruise phase, the Nozomi discovered existence of the inflow of the interstellar gas into our solar system.

The MUSES-C (HAYABUSA) is an engineering demonstration mission to test key technologies required for future planetary missions such as an electric propulsion system, an optical navigation system, a sample collection device and others. The MUSES-C target is the near-Earth asteroid, 1998SF36 and it

will become the first mission to return the asteroid sample to the Earth. It also makes observations of the asteroidal surface by visual, infrared, and X-ray wavelengths. The spacecraft was launched in May 2003 by an M-V rocket, will arrive at the asteroid in June 2005, and return to the Earth in June 2007.

The LUNAR-A is the first mission to explore the internal structure of the Moon by newly developed penetrators, and will be launched in August to September 2004. Two penetrators will be deployed on the lunar surface and the instruments on board the penetrators will carry out lunar seismology experiment and heat flow experiment, both of which provide us with important data of deep structure and composition of the lunar interior.

The SELENE is an ISAS-NASDA joint mission for lunar surface observation and global mapping. It will be launched in 2005 by an H-IIA rocket. The SELENE mission consists of a main orbiter satellite and two sub-satellites carrying out global mapping of the lunar surface. The 14 science instruments will be on board for global mapping of elemental abundance, mineral composition, topography, geological structure, gravity fields, magnetic fields, plasma environment, and others. The mission will provide the most comprehensive data sets on the lunar surface. In addition to these missions, the PLANET-C and Bepi Colombo missions are being developed by ISAS. The PLANET-C is a Venus Climate Orbiter exploring Venusian atmospheric dynamics by using various remote sensing techniques. The Bepi Colombo mission is a Mercury Exploration mission which is a joint project of ESA (European Space Agency) and ISAS. ISAS is responsible to construct an MMO (Mercury Magnetospheric Orbiter) and aims to clarify the magnetospheric environment around Mercury and the origin of the magnetic dipole of this small enigmatic planet.

2. Study of the Antarctic meteorites and of the extraterrestrial materials

Since 1969, the Japanese Antarctic Research Expeditions have searched for meteorites in the Yamato Mountains, the Belgica Mountains, and the Soer Rondane Mountains, Antarctica, and found about 16,000 meteorites up to now. The meteorites collected are classified and the results are published as the Meteorite Newsletter and as photo catalogues. More than 1,200 research proposals from Japanese and foreign scientists have been received and evaluated in the Committee on Antarctic Meteorite Research, which meets twice a year. After approval by the committee, the samples are allocated to scientists for planetary science research. The Antarctic Meteorite Symposium is held annually at NIPR (National Institute of Polar Research) and provides a forum for Japanese and foreign scientists to present the most recent research results on planetary materials. Manuscripts resulting from these presentations are published in the Proceedings of the Symposium on Antarctic Meteorite. The Antarctic Meteorite Research Center in NIPR also maintains an active research program that has produced numerous scientific publications in international journals.

In recent years, several special sessions were organized in the Symposium on the consortium studies of lunar and Martian meteorites retrieved from Antarctica. New data from other Antarctic meteorites, non-Antarctic meteorites and planetary research were also presented there.

3. Progress in the observational and theoretical studies of the formation of extra-planetary systems.

There have been many discoveries of extra-planetary systems, that is, planetary systems around stars other than the Sun, within the last ten years. Many of those planetary systems are extraordinary ones, compared to our solar system. Their extraordinary natures have brought about a challenge to the theoreticians who established a standard model (Kyoto model) of formation of the solar system. They are finding that some of the extraordinary nature of those planetary systems are also explained within a theoretical framework of the Kyoto model, but there remain aspects that cannot be explained by the standard model. The theoretical study is actively being pursued by the groups of the Tokyo Institute of Technology and University of Tokyo. The effort of detecting terrestrial planets around stars other than the Sun is actively being made in collaborations with observational astronomers using a large Subaru telescope built in Hawaii by NAO (National Astronomical Observatory) and the space infrared observations being planned in collaborations of astrophysicists in ISAS, NAO and universities and other institutes in Japan.

Progress has also been made in the observational study of the deep solar system bodies, called the Edgeworth-Kuiper belt objects, and other small bodies in the solar system, as well as in the study of the dynamical and physical evolution by the NAO group.

Recent progress in other fields of planetary science in Japan can be found in the Proceeding of the ISAS Moon and Planetary Symposium published annually by ISAS, the Proceedings of the Symposium on Antarctic Meteorite Research published annually by NIPR, the Proceeding of the Annual Meeting of the Japanese Society for Planetary Sciences (JSPS) published by JSPS, and other Proceedings of the various workshops in many fields of planetary science in Japan.

Planetary science is a young field compared to other fields of geophysics and the number of young scientists in planetary science is increasing. But the supporting systems and resources for young planetary scientists have been limited under the traditional geophysical and geological educational and research organizations. One of the resources is the grant-in-aid for scientific research from the Japan Society for the Promotion of Science. The problem is that there is no planetary science discipline to which the planetary scientists in Japan can make grant applications. As a result, they have to apply to the traditional disciplines where their activity in planetary science is not necessarily properly evaluated. The present Committee carried out a study on the present status of the applications of the planetary scientists to the grant-in-aid program of the Japan Society for the Promotion of Science, in collaboration with the Japanese Society for Planetary Sciences. We hope that the result of the study will be used to improve the research environment for young planetary scientists in Japan.