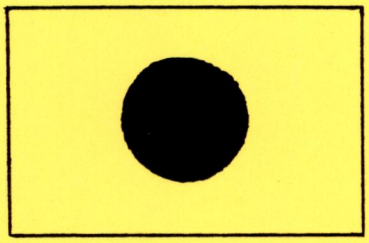
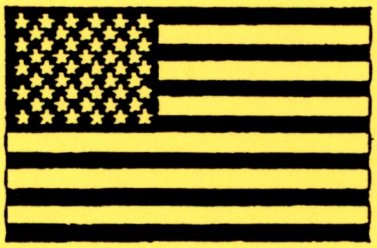
Swanson (147)

Japan - United States
Science and Technology Agreement

PROCEEDINGS OF THE THIRD WORKSHOP FOR NATURAL DISASTER REDUCTION





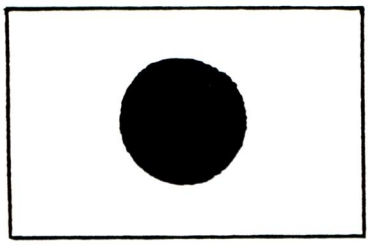
Corvallis, Oregon, U.S.A.

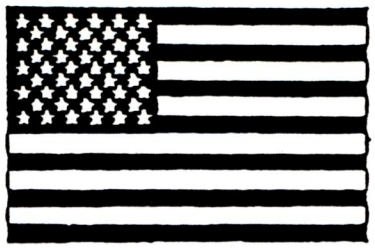
8 - 10 September 1992

Compilers F. Swanson, J. Wickham, K. Park

Japan - United States
Science and Technology Agreement

PROCEEDINGS OF THE THIRD WORKSHOP FOR NATURAL DISASTER REDUCTION





Corvallis, Oregon, U.S.A.

8 - 10 September 1992

IN REMEMBRANCE

On behalf of the Japanese delegation for the Third Workshop on Natural Disaster Reduction in the US-Japan Science and Technology Agreement, I wish to express our deepest sympathy and condolences for the death of Dr. Richard Janda, USGS Cascades Volcano Observatory, who had made great effort and contributed to promote cooperative research activities between the two countries in the aspect of volcanic disaster reduction.

He will be sadly missed by all of us. His memory and his wonderful accomplishments, however, will remain with us.

7 September 1992

/s/Shigetsugu Uehara
Shigetsugu Uehara

CONTENTS

PROCEEDINGS OF THE THIRD WORKSHOP FOR NATURAL DISASTER REDUCTION

EXECUTIVE SUMMARY

INTRODUCTION

The Third Japan-United States Workshop for Natural Disaster Reduction was held in Corvallis, Oregon, United States of America, September 8-10, 1992. The workshop was the third held in accordance with the Japan-United States Science and Technology (JUST) Agreement of 1988 and as part of the International Decade for Natural Disaster Reduction (IDNDR) activities of Japan and the United States (U.S.). Thirteen Japanese and thirty-nine U.S. scientists from universities and government agencies participated in the third workshop. In addition, the countries of Australia, China, Columbia, and Mexico were represented. The workshop was jointly sponsored by the U.S. Forest Service, U.S. Geological Survey, and the U.S. National Oceanic and Atmospheric Administration.

The format of the workshop consisted of fourteen invited talks followed by working group discussions. The talks and discussions were held at the U.S. Forest Service Pacific Northwest Research Station, Forestry Sciences Laboratory, on the campus of Oregon State University in Corvallis, Oregon. In addition, the workshop was preceded and followed by one-day field trips to the U.S. Forest Service, Mount Saint Helens National Volcanic Monument, Washington, and the U.S. Forest Service, H. J. Andrews Experimental Forest, near Blue River, Oregon, respectively. The field trips allowed close-up inspection of the effects of volcanic eruptions including debris avalanche, laher (debris flow), and pyroclastic surge (blast) at Mt. St. Helens and landslide-debris flow research and monitoring, ecological effects of landslides, and effects of storm events and forestry management practices on landslide occurrence at the H.J. Andrews Experimental Forest. Of special interest to the workshop participants were visits to a sediment retention structure on the North Fork of the Toutle River (Mt. St. Helens), the inspection of blast and debris avalanche effects (Mt. St. Helens), the inspection of the USGS-Forest Service debris-flow flume for controlled experiment debris-flows (H.J. Andrews Experimental Forest), and the effects of forestry management practices on landslide occurrence (H.J. Andrews Experimental Forest).

OBJECTIVE

The objective of the Third Workshop was to develop bilateral Japan - U.S. projects, both within and across disciplines, for natural disaster reduction which can be implemented during the remainder of the decade of the IDNDR. Special emphasis was placed on developing joint projects in hazard mapping and data base development. Working groups deliberated in five subject areas of severe storms, earthquakes, volcanoes, landslides, and small-scale hazards mapping. Each working group developed a progress report outlining its respective past achievements, present goals, and future plans, and -- in accordance with the objective of the workshop --joint project proposals. A total of 40 joint project proposals was developed by the working groups.

GREETINGS AND KEYNOTE ADDRESSES

The first day proceedings opened with welcoming remarks from Drs. Edward Wolfe (U.S. Geological Survey) and Frederick Swanson (U.S. Forest Service). Following introductions of all the participants, a welcome by the Japanese delegation was given by Dr. Shigetsugu Uehara of the National Research Institute for Earth Science and Disaster Prevention. The U.S. keynote address was delivered by Professor Dennis Mileti of Colorado State University. Professor Mileti spoke of the progress made since Dr. Gilbert White summarized what was then known about the field of natural hazards in the United States some 20 years ago and the recent Estes Park, Colorado, Workshop on Natural Hazard Reduction. The main theme of his talk was the emerging new perspective on natural hazards--sustainable development. This new perspective focuses on four areas: (1) population growth and distribution, (2) social and political systems, (3) the global natural environment, and (4) new technology and its societal effects. The Japanese keynote address was given by Professor Hiromu Okada of Hokkaido University. Professor Okada reviewed the great natural disasters of Japan during the Twentieth Century, spoke on the development of Japanese natural disaster science, and discussed recent Japanese disaster mitigation and reduction techniques. Examples included evacuation towers, permeable dams, mud-flow detection systems, and the relocation of buildings in populated high-risk areas.

HAZARD-MAPPING SYMPOSIUM

The remainder of the first day was devoted to a hazard-mapping symposium. Eight lectures were given focusing on various aspects of natural hazard mapping.

1. Volcano Hazard Mapping - Dr. William Scott (U.S. Geological Survey) discussed volcano hazard zonation mapping with emphasis on Mt. Hood, Oregon. He pointed out the potential of a Mt. Hood eruption to seriously affect the large population which inhabits the Portland, Oregon, metropolitan area. The water supply for the City of Portland is especially vulnerable.

2. Natural Disaster Hazard Mapping in Japan - Dr. Yohta Kumaki (Geographical Survey Institute) spoke on natural hazard mapping in Japan. Dr. Kumaki reviewed the history of Japanese hazard mapping and exhibited a number of different types of hazard maps. The types of hazard maps presented included locations of actual disasters, property, and disaster potential (assessment) maps. The high degree of development in hazard mapping in Japan was noteworthy, especially maps designed for use by the public.

3. Earthquake Hazard and Risk Mapping - Dr. Kaye Shedlock (U.S. Geological Survey) discussed earthquake hazard and risk mapping in the U.S. Two types of earthquake mapping techniques were reviewed, probabilistic and deterministic scenarios. These maps are produced at national, regional, and local scales and estimate the probability of a ground motion parameter exceeding specified levels for specified exposure times. Traditional seismicity maps were also reviewed as were the physical characteristics used in their development.

4. Landslide Hazards Mapping - Dr. Edwin Harp (U.S. Geological Survey) reviewed the evolution of landslide mapping over the last 20 years. Maps from the early to mid-1970s tended to inventory-type showing landslide location based on

interpretation of aerial photographs. Throughout the 1970s landslide mapping became more process-oriented, incorporating statistical and geological factors. The County of San Mateo, California, U.S.A., is the only U.S. governing body to incorporate landslide hazard mapping in local zoning laws and building codes. From the mid-1980s landslide mapping has extensively utilized statistical techniques to become more probabilistic and predictive.

5. New Technology for Observing and Forecasting Weather - Mr. Edward Gross (U.S. National Oceanic and Atmospheric Administration, National Weather Service) described the U.S. Weather Service Modernization Program. Key technologies in the program include doppler radar, an automated surface weather observing system, a wind profiler network, a next generation weather satellite network, and an interactive forecaster workstation. The completed modernization of the U.S. weather forecast system will greatly improve observation, forecast, warning, and dissemination capabilities.

A briefing on the U.S. government activities related to International Decade for Natural Disaster Reduction, "Reducing the Impacts of Natural Hazards: A Strategy for the Nation" was made to the workshop participants along with an overview of U.S. implementation planning in this area.

6. Small-Scale Hazard Mapping in Southeast Asia - Dr. Maurice Terman (U.S. Geological Survey) reviewed the state of hazard mapping in Southeast Asia. The Circum-Pacific Map Project, which published a Pacific Basin map of natural hazards in April of 1991, is a contribution to the IDNDR. This new map includes new entries on ice extent, ship superstructure icing, wave height, tropical storm tracks, and tornado frequency, in addition to the listing of earthquake epicenters, volcanic centers, fault lines, active plate boundaries, and tsunami sites. Mapping activities of the Australians and Chinese were noted. The East Asia Map Project will map natural hazards in the area through the 1990s.

7. Applications of Dendrochronology to Hazard Assessment - Dr. David Yamaguchi (University of Colorado) focused on the application of dendrochrology in hazard assessment. Volcanic tephra reduces annual tree-ring growth and is reflected in reduced ring width. Dendrochronology can also be used to date earthquakes where coastal forests have dropped below low-tide level. Dendrochronology often provides more accurate dating of geological events than other dating methods.

8. Space Technology for Disaster Mitigation - Dr. Louis Walter (U.S. National Aeronautics and Space Administration) discussed the role of space remote sensing in hazard mapping. Space technology has historically been used to study climate change. However, its use in disaster mitigation shows great potential. Possible new areas for space remote sensing include floodplain mapping and landslide assessment. Both Japan and the U.S. have strong technological capabilities in space remote sensing and they should continue to actively cooperate in this endeavor.

JOINT DATABASES ON NATURAL HAZARDS: CONCEPTS AND DISCUSSION

The morning session of the second day was devoted to the discussion of Japan-U.S. joint database development. Dr. Paul Kilho Park (U.S National Oceanic and Atmospheric Administration) noted that the Second Japan-U.S.

Workshop did not produce an agreement on joint database development, even though the JUST Agreement calls for this activity to be addressed.

Japan - Professor Yoshiaki Kawata (Disaster Prevention Research Institute, Kyoto University) reviewed the Japanese activities related to natural disaster database development and information management. Japan has currently established disaster data centers at six universities. Two Japanese groups that are leaders in data base development for natural disasters are the Japanese Group for the Study of Natural Disaster Science and the Japanese Society of Natural Disaster Science.

United States - Dr. Lawrence Enomoto (U.S. National Oceanic and Atmospheric Administration - National Environmental Satellite, Data, and Information Service) reviewed the U.S. data management programs. Data holdings are under the U.S. Decade for Natural Disaster Reduction, the U.S. Global Change Research Program, the World Data Centers, the United Nations, and most of them are accessible through the International Directory Network of the Intergovernmental ad hoc Committee on Earth Observations Satellites. Many of these database holdings are applicable to natural disaster mitigation.

REVIEWS OF RECENT DISASTERS AND RESPONSES

Four recent natural disasters were reviewed during the early afternoon session of the second day. These included Typhoon Mireille, the eruptions of Mt. Pinatubo and Mt. Spurr, and Hurricane Andrew.

Typhoon Mireille - Dr. Koji Kuroiwa (Japan Meteorological Agency) discussed the devastating hit of Typhoon Mireille on Japan in September 1991. Typhoon Mireille was the most devastating typhoon to hit Japan in the last 20 years. The record-breaking winds and swift speed caused heavy damage to widely scattered socio-economic sectors in Japan, especially in agriculture and forestry. Sixty-two people were killed and two-thousand, eight hundred sixty-two injured. The attitudes and behavioral responses of those in the path of the storm were summarized.

Mount Pinatubo - Dr. Thomas Pierson (U.S. Geological Survey) opened the review of Mt. Pinatubo, Philippines, with a discussion of the physics and behavior of lahars, which are volcanic debris flows--slurries of sediment and water. Lahars, repeatedly formed as heavy rains mobilize loose fragmental volcanic debris deposited on the slopes of Pinatubo in the 1991 eruption, are progressively burying villages and farmland on the lowlands surrounding the volcano.

The post-eruption behavior and continuing effects of the Mt. Pinatubo eruption were reviewed by Dr. Christopher Newhall (U.S. Geological Survey). It was noted that the lava dome of Mt. Pinatubo is still growing and the volcano continues to yield debris flows. The eruption of Mt. Pinatubo (greater than Mt. St. Helens) has highlighted some important lessons. The first is that the enormous scale of Pinatubo events has greatly increased the size and magnitude of human suffering, property loss, and environmental effects. Second, persistent effects of the eruption may last for decades after the initial event. This makes it extremely difficult for relief agencies to effectively respond to the disaster. Third, socio-political issues may block or hamper effective mitigation measures. These

three lessons mean that property and human losses will continue in the aftermath of the Mt. Pinatubo eruption.

Mt. Spurr - Dr. Steven McNutt (University of Alaska) reviewed the recent eruption of Mt. Spurr, Alaska, which last erupted in 1953. Seismographs were first installed on Mt. Spurr in 1981 with the Alaska Volcano Observatory in Fairbanks (a U.S. Geological Survey-University of Alaska-State of Alaska cooperative venture) currently maintaining 9 seismograph stations. A Volcano Warning Code was used to warn the residents of Fairbanks of the pending eruption. NOAA Weather Radar surveillance and Federal Aviation Administration pilot reports of ash events were used to help forecast the eruption.

Hurricane Andrew -- Edward Gross (U.S. National Oceanic and Atmospheric Administration, National Weather Service) gave a preliminary assessment on the meteorology and forecasting of Hurricane Andrew which struck south Florida and southwestern Louisiana in early September 1992. Although the National Hurricane Center in Coral Gables, Florida, was directly in the path of Hurricane Andrew and was temporarily knocked out of service, the tracking and forecasting of Andrew was effectively continued. Doppler radar surveillance of the hurricane was from Melbourne, Florida, some 300 kilometers to the north of Miami, was utilized for the first time in tracking a hurricane.

WORKING GROUP, INTERGROUP DISCUSSIONS AND WORKING GROUP REPORTS

The remainder of the second day and the morning of the third day were devoted to work group deliberations on Japan-U.S. joint project proposals. The working groups were encouraged to confer with one another to develop cross-discipline, joint project proposals. On the afternoon of the third day a plenary session was held and each working group reported to the full workshop.

For the Earthquake Working Group, Dr. William Prescott (U.S. Geological Survey) reported on the group's topics of discussion. These included super-deep drilling for earthquake research between Japan and the U.S. and Germany; cooperative projects on piston coring and radon; exchange of strong motion data; proposal for Japan-U.S. symposia on earthquakes; and the status of earthquake prediction in the two countries. The lack of participation of seismologists in the JUST workshop meetings thus far has been somewhat detrimental to the earthquake deliberations. In the future, discipline-specific meetings would be more productive than multidisciplinary joint meetings.

For the Landslides Working Group, Dr. Masaki Tominaga (Japanese National Research Institute for Earth Science and Disaster Prevention) summarized past Japanese - U.S. cooperative research and outlined Japanese institutions that are involved in landslide research, including publication of the proceedings from a symposium on the exchange program held in Tsukuba, Japan, in October 1992. For the U.S., Dr. Edwin Harp (U.S. Geological Survey) reviewed six joint project proposals developed by the Landslides Working Group: (1) global change-induced landslides; (2) sediment routing in gravel-bed rivers; (3) experimental debris-flow studies; (4) woody debris-flow dynamics; (5) hydro-geomorphic processes in forested slopes; and (6) remote sensing of soil-water distribution. To ensure Japanese and U.S. scientists have access to each other's research literature, an effort should be made to translate journal articles into each other's respective languages. This suggestion initiated a

discussion of current programs devoted to translating foreign scientific literature. A motion was made to seek a mechanism to facilitate translation of scientific literature pertinent to natural disaster research.

For the Volcano Working Group, Dr. Christopher Newhall (U.S. Geological Survey) used the past two JUST workshops as a basis for discussion. Outlined were joint project proposals addressing the subjects of degassing, domes and pyroclastic flows, rapid snowmelt, low-frequency earthquakes, characterizing eruptions in progress, improved communication skills, and assistance in developing countries. A planned future JUST Volcanic Disaster Prevention Panel meeting would provide a forum for addressing these issues. The main focus would be on risk-mapping using GIS technology. The training of natural disaster scientists in improving communication skills would also be emphasized. Professor Hiromu Okada (Hokkaido University) offered some thoughts on future meetings. The consensus was that an interdisciplinary approach would be better than continued planning workshops that are primarily within disciplines.

For the Severe Storms Working Group, Mr. Edward Gross (U.S. National Oceanic and Atmospheric Administration) reviewed the recommendations from the second JUST Workshop as well as the current joint proposals. In addition to research on typhoons, research in heavy rainfall, floods, hydrology, and disaster awareness and preparedness were recommended. Remote sensing for disaster mitigation is emphasized as will be improved communication skills.

For the Small-Scale Hazards Mapping Working Group, Dr. Maurice Terman (U.S. Geological Survey) reported on the benefits of producing a natural hazards map of eastern Asia with a focus on geological hazards. The recent publication of the "Geological Hazards Map of Japan" will provide guidance for an eastern Asia hazards map. Future southeastern Asia hazards mapping should incorporate meteorological hazards as well as risk estimates. Professor Russell Blong (Macquarie University, Australia) spoke on the needs for future small-scale mapping endeavors. Special emphasis should be placed on mapping less developed countries and the development of hazard potential and vulnerability (i.e., risk) maps.

In addition to the working groups, two interdisciplinary fields were represented at the Third JUST Workshop. Dr. Louis Walter (U.S. National Aeronautics and Space Administration) reported on satellite remote sensing of natural disasters. Four areas of research were emphasized: (1) requirements of satellite systems for disaster mitigation; (2) observational bases for flood forecasting; (3) hazard mapping using advanced remote sensing systems; and (4) remote-sensing database development.

Dr. Josephine Malilay (U.S. Public Health Service, Centers for Disease Control and Prevention) reported on the public health aspects of natural disasters. Dr. Malilay outlined the Centers for Disease Control's role in disaster response and reviewed the work being done in the field of disaster epidemiology. Public health is an issue that is paramount in all natural disasters. Four joint project were proposed in the field of disaster medicine: (1) development of joint database for public health and medical natural disaster topics; (2) cooperative public health and disaster medicine research; (3) effects of shelters in severe storms and outcomes of injury; and (4) casualty estimation models and hazard mapping. In addition, the public health field encourages a

workshop for scientists on natural hazards communication. A greater emphasis should be placed on the subject of disaster medicine at future workshops.

CONCLUSION

The interval between the Second and Third Workshops has seen some of the most devastating natural disasters in recent history. In spite of these events much progress has been made in the field of natural disaster reduction and mitigation. New forecasting technologies and increased sociopolitical awareness have helped save human life although much needs to be done, especially in respect to property loss and damage control. The focus of a fourth Japan-U.S. conference will be in the area of remote sensing, a technique that offers potentially significant applications to detecting, forecasting, and mitigating natural disasters.

Small-Scale Hazards Mapping Working Group Report
3rd JUST Workshop

Participants: Blong, Enomoto, Kinugasa (Japan Chair), Kumaki, Pinero, Terman (U.S. Chair).

A consensus was quickly reached on the benefits of producing a natural hazards map of eastern Asia. It was agreed the first effort should focus only on geological hazards, following the general guidance established by the recent publication of a Geological Hazards Map of Japan at a scale of 1:3,000,000 by the Geological Survey of Japan (GSJ). Subsequently, a second effort by different agencies might focus on meteorological hazards. In addition to the proposed inventory maps, the importance was recognized of later efforts to be directed to producing successive maps of hazard potential, vulnerability, and risks.

It was proposed that the geological hazards map would be compiled on the East Asia Geographic Map, an 8-sheet series at a scale of 1:2,500,000 that is being completed by the U.S. Geological Survey (USGS). The coordinators would create a Working Group on Hazards Mapping (WGHM) that would be made up of compilers nominated by each participating country; the maps cover Australia, Brunei, Burma, Cambodia, China, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hong Kong, Indonesia, Korea, Laos, Malaysia, Papua New Guinea, Philippines, Russia, Singapore, Solomon Islands, Taiwan, Thailand, and Vietnam. These compilers will be recruited through Consultative Committee for Off-shore Petroleum (CCOP) or other appropriate contracts, and the WGHM will be chaired by Japan with technical support from the USGS. The USGS also will take initial responsibility for bringing together all available digital databases relevant to geological hazards.

The first meeting of WGHM will be at the International Review on Natural Hazards to be held in Japan next year, at which time a final legend and a completion schedule will be established; the target date for printing will be July 1996, just before the next International Geological Congress in Beijing. The project will endeavor to coordinate all other pertinent international projects to the fullest extent possible. When compilation is complete and approved by WGHM, Japan will coordinate the final cartography and printing. The project will be a major international contribution to IDNDR.

Earthquake Working Group Report
3rd JUST Workshop

Participants: Hamada, Hasegawa, Prescott (U.S. Chair), Shedlock, Wakita (Japan Chair); Harp, Hill part-time participants.

The Earthquake Working Group met and continued discussions begun at the first two workshops. Topics of discussion at this third meeting included:

1. Status of super deep drilling for earthquake research in the two countries. Japan is planning a deep drillhole into an active onland subduction fault. Japan will hold a workshop on the topic in January 1993.

   The U.S., Germany, and Japan are forming a consortium to drill a deep hole into an active fault zone using technology developed for the German deep drilling program.

2. Two cooperative projects that are already planned were discussed: Shimizaki and Thatcher - Piston Coring, and Wakita and King - Radon.

3. We endorsed a proposal from the landslide panel to facilitate the exchange of strong motion data.

4. We developed a new proposal for a series of Japan-U.S. symposia on earthquakes. A description of the first symposium is attached.

5. We discussed the status of earthquake prediction efforts in the two countries. There have been considerable discussions recently about the direction of the Japanese Earthquake Prediction Program. In the United States, the National Earthquake Hazard Reduction Program has been facing severe funding difficulties. We compared and contrasted the state of earthquake research in the two countries.

The earthquake group also discussed how the earthquake groups should function in the future and whether we should continue with these JUST workshops. It was our unanimous opinion that we should not continue with the meetings in their present format. We proposed to replace them with the symposia mentioned in item 4. above. It is our plan that the present earthquake working group would act as a steering committee for these symposia. The steering committee would hold its meetings at the time of the annual symposium. At this annual meeting we would discuss progress in joint activities and make plans for the next annual symposium.

Severe Storms Working Group Report
3rd JUST Workshop

Participants: Gross (U.S. Chair), Kuroiwa, Hagemeyer, Hituma, Malilay, Park, Ookura, Sasaki, Uehara (Japan Chair), Walter, Weiher

During the past 2 years, the scope of our working group has expanded from projects related only to the typhoon problem to those encompassing severe local storms including heavy rainfall, floods, hydrological aspects as well as disaster awareness and preparedness related to severe storms.

Recommendations made at the second workshop and those made at this third workshop will continue to improve our joint cooperative activities. Work continues on technical information and data exchange, numerical modeling efforts, forecast experiments, and basic research. Recommended projects from this third workshop expand the focus on areas related to a variety of hydrological aspects including the development of new methods for the measurement of heavy rainfall. The working group has also defined a joint project for the use and characterization of future satellite systems for disaster mitigation.

We will continue to work on projects related to the prediction of severe local storms, hydrological model development as well as cooperation in the area of disaster awareness and the public use and reaction to warnings. A particular focus will be a comparison of the public reaction to Typhoon Mireille (19) and Hurricane Andrew and the exchange of ideas on the development of a standard wind-damage scale for the Pacific Rim.

The continued success of our cooperative efforts should be valuable in helping to reduce the impacts of natural hazards caused by severe storms.

Landslide Working Group Report
3rd JUST Workshop

Participants: Harp (U.S. Chair), Tominaga (Japan Chair), Iverson, Sidle, Swanson

The landslide working group of the 3rd annual JUST meeting in Corvallis, Oregon, convened to discuss the status of the Working Group's plan drafted at the previous year's meeting in Karuizawa, Japan, and to implement many of these goals as cooperative proposals and work plans. In general we affirmed the goals and proposed research topics outlined in the Karuizawa report and proceeded to identify projects for near-term implementation. We reviewed a list of ten proposals, and made recommendations as to the feasibility, timeliness, and impact. We also produced additional proposals and presented a suggestion regarding translation of journal articles into Japanese and English to facilitate increased awareness of current research that is reported in journals not generally translated.

Volcano Working Group Report
3rd JUST Workshop

Participants: Frenzen, Heiken, Ida, McNutt, Miller, Newhall (U.S. Chair); Okada (Japan Chair), Riehle, Scott, Sheridan, Symonds, Tanaka, Tilling, Waitt, Wakita, Wolfe

The JUST interim working group for volcanic disaster prevention reports the following progress and plans:

Volcanologists from both countries have participated actively in three plenary, multidisciplinary sessions--in Punalu'u, Hawaii; Karuizawa, Nagano Prefecture; and Corvallis, Oregon. During these three sessions, we defined a set of relatively broad projects on topics of strong mutual interest. A revised list (next item) includes topical research projects, projects that combine research with a demonstrated application to hazard mitigation at selected volcanoes, and a project that is intended to improve volcanologists' ability to communicate information about volcanic hazards effectively, leading to disaster-preventing actions by decision-makers and those at risk.

Currently proposed projects are:

Low-frequency volcanic earthquakes and tremor
Magma degassing and its application to eruption forecasting
Dome growth and dome collapse: prediction and hazards
Rapid snowmelt during volcanic eruptions
Volcanic unrest at Iwo-Jima Caldera

Development and application of new methodologies for volcanic hazard mapping (including use of numerical models of volcanic processes)
Characterization of eruptions in progress (remote methods, when visual observation is not possible)

Joint U.S.-Japan volcanological assistance in developing countries
Workshop(s) on communication of hazards information to the public

Most of the projects are generic and not limited to any specific volcano. However as much as possible, these joint projects will be undertaken at Decade Volcanoes of the U.S. (Mt. Rainier, Mauna Loa), Japan (Unzen and Sakurajima), and third countries upon invitation (possibilities include Merapi in Indonesia, Taal in the Philippines, Santiaguito in Guatemala, and others). Work at Iwo-Jima would also contribute to the projects on low-frequency earthquakes and degassing.

Work on activities suggested during the first two meetings of this working group has proceeded slowly, principally for lack of scientists' time and funding. Crises at Unzen and Pinatubo volcanoes, as well as several other volcanoes in Japan and Alaska, have forced postponement of some planned work.

Time and funding notwithstanding, a few useful exchanges have taken place, in spirit though not formally as part of the JUST exchange. At least three U.S. scientists have visited Unzen during its current crisis (not including a large group which visited Unzen on a recent International Geological Congress field

trip). Japanese scientists have worked recently at Crater Lake, and U.S. and Japanese scientists met together at Mt. Pinatubo, Philippines. U.S. and Japanese volcanologists have also worked together on problems of detecting and tracking volcanic ash clouds, and a Japanese scientist will soon spend several months in the U.S. examining the philosophy and procedures of USGS hazards warnings.

In order to move projects ahead more quickly, the working group in Corvallis narrowed its list of proposed projects, and designated both products and project leaders for each. We expect that this step will encourage individuals to plan the details of their individual projects, and to submit proposals to their respective sources of funding without waiting for an overall funding proposal to be put together.

Owing to the work of this interim working groups, the new JUST Panel on Volcanic Disaster Mitigation can begin its work with a minimum of further planning, and use its time instead for substantive technical discussions and joint field work. The U.S. side of the Volcano Panel will shortly propose that the first formal meeting of the Panel be held in March 1993, at Menlo Park, California, and that the session be devoted primarily to a question of great interest to both sides, "How can we predict the time and hazards of dome collapse?" Other topics will be considered in relation to this overall theme.

The working group on volcanic hazards recognizes the value of interdisciplinary discussions that reach across hazard boundaries. The group believes that such discussions would be more productive if focused on difficult problems in disaster prevention that require ideas from all disciplines, rather than on planning of projects that are primarily within disciplines. For example, the training workshop proposed by volcanologists for volcanologists, to learn new tools with which they communicate hazards information to the public, could be broadened to include all hazards. Surely, we volcanologists have much to learn from other natural and social scientists, and from discussions with civil defense and community leaders, from both countries.

Such plenary, multi-hazard, problem-oriented sessions could be held every third or fourth year, alternating with discipline-specific field work and discussions such as those planned for the Volcano Panel. In the context of the JUST, such sessions should include insightful, comparative discussions that draw lessons from both countries. We support the idea of a plenary session to be held in 1995, leaving time in the interim for the Volcano Panel to begin several of its discipline-specific projects.

Technical Agreement List

LIST OF PROJECTS:

	PROJECT TITLE	CONTACTS
A.	**Remote Sensing**	
A1.	Database of research on remote sensing for disaster mitigation	Kishi, Uehara, Walter
A2.	Use and definition of requirements for future satellite systems for disaster mitigation	Kishi, Uehara, Walter
A3.	Hazard mapping using advanced remote sensing systems	Kishi, Uehara, Walter
A4.	Remote sensing of soil water distribution and implication of change of soil water distribution in ecosystem and occurrence of natural disaster.	Tominaga, Swanson
B.	**Joint Database**	
B1.	Joint geological hazards database for east Asia	Kawata, Enomoto, Shedlock
B2.	Development of joint disaster database for public health and medical topical areas	Kawata, Noji
C.	**Social-Economic Aspects**	
C1.	Public risk perception, mitigation, and preparedness	Hirose, Mileti
C2.	Evaluation of the public use and reaction to warnings	Hitsuma, Kuroiwa, Gross
C3.	Workshop for scientists on natural hazards communication	Okada, Pierson
D.	**Human Health**	
D1.	Cooperative public health and disaster medicine research on the health and medical consequences of specific disaster events	Watoh, Uehara, Noji, Malilay

D2. Efficacy of shelters in severe storms and outcomes of injury	Murakami, Kaji, Malilay
D3. Casualty estimation models and hazard mapping	Shiono, Murakami, Ohta, Noji
D4. Development of rapid health needs assessement methods following occurrence of a disaster	Uehara, Watoh, Noji
E. Hazards Mapping	
E1. East Asia Geological Hazards Map	Kinugasa, Terman
F. Earthquake-Tsunami	
F1. Japan-U.S. Symposia on Earthquake Hazard Reduction	Hamada, Hasegawa, Wakita, Prescott, Shedlock
F2. Earthquake recurrence: study in shallow water areas	Shimazaki, Thatcher
F3. Geochemical observation for earthquake prediction	Wakita, King
F4. Tsunami inundation modeling exchange	Shuto, Hagemeyer
G. Severe Storms-Floods	
G1. Hydrologic Disaster Research	Mitsuta, Tsuchiya, Ikabuchi, Nakakita, Yamashita, Sasaki, Vieux, Lamb, Alberty, Yeh
G2. Expansion of data sources for tropical cyclones using GMS	Hagemeyer
G3. Exchange of the best track data of tropical cyclones in the western North Pacific	Kuroiwa, Lander
G4. Observational study on heavy rain and flood forecasting	Takeda, Sasaki
H. Landslides	
H1. Global change induced variation in landslide hazard	Nakamura, Swanson, Lienkaemper

H2. Experimental studies of debris flows using the large flume at Andrews Forest, Oregon	Iverson, LaHusen
H3. Dynamics and effects of woody debris transport and deposition by debris flows and floods	Ishikawa, Yajima, Kusano, Grant, Swanson
H4. Snow avalanche management, landslide prediction and control	Uehara, Swanson
H5. Hydrogeomorphic processes and analyses in forested hillslopes	Inoue, Sidle
H6. Relation between strong-motion shaking parameters and distribution of seismically induced landslides	Kobayashi, Harp
H7. Sediment routing in gravel-bed rivers	Ikeda, Lisle

I. Snow Hazards

I1. Release prediction and impact force of dry snow avalanches	Nakamura, Yamada, Noguchi, Ikarashi, Iwanami, Abe, Abromeit, Tremper, Ream, Ferguson, Decker
I2. Snow hydrology and hazards--detection with remote sensing and relationship to global circulation and climate change	Nakamura, Kimura, Decker, Brown
I3. Snow physics: relationship between metamorphism and micrograins of snow	Sato, Kimura, Brown, Adams

J. Volcanic Hazards

J1. Volcanic earthquakes and tremors as precursors of volcanic eruptions	Ida, McNutt
J2. Domes and generation of Merapi-style pyroclastic flows	Ui, Fink
J3. Volcanic hazard and risk mapping	Aramaki, Sheridan
J4. Unrest at Iwo-Jima Caldera	Kumagai, Newhall
J5. Volcanically induced melting of snow and ice	Walder

J6.	Characterizing eruptions in progress	Ishihara, Rose
J7.	Volcanic gases--sampling and use in eruption forecasting	Kazahaya, Symonds
J8.	Coordinated Japan-U.S. assistance to developing countries	Kamo, Miller

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

A1. Project title: Data base of research on remote sensing for disaster mitigation

Contacts: S. Kishi, S. Uehara, National Research Institute for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 JAPAN.
Phone 81 298-51-1611; FAX 81 298-51-1622.
Louis Walter, National Aeronautics and Space Administration, Code 620, Goddard Space Flight Center, Greenbelt, MD 20771, USA.
Phone 301 286-2538; FAX 301 286-3884.

Outline of proposal:

Objective: To assemble and make available a database on research, programs, and results which relate to the use of satellite remote sensing for disaster mitigation.

Approach: Issues and Background:

- Both the cost and potential benefits of satellite remote sensing systems are very high. Particularly in disaster mitigation, such systems have demonstrated considerable capability, although operational availability and utilization of these data have not yet become a reality.
- Perhaps the major reason for the slow operational development of this capability is the high degree of disaggregation of the remote sensing community in the area of disaster mitigation (compared, for example, with those engaged in exploration geology).
- A natural result of this situation is that, although there have been many technical accomplishments in the field, there has been no common forum (either through journals or meetings) where the results in this field can be displayed, evaluated, disseminated, or extended.
- In addition, the diffusion of the community makes it extremely difficult to assess accomplishments and status or to appropriately staff projects through which the benefits of remote sensing for disaster mitigation can be developed, tested, and realized.
- To remedy this situation, the creation of a database of researchers, programs, and accomplishments in the field of remote sensing for disaster mitigation applications is proposed.

Funding:

Japanese side: S. Kishi; NIED, JMA, National Space Development Agency, Remote Sensing Technology Center (Japan).
U.S. side: NASA, NSF, NOAA, USGS, US Forest Service.

Status: Planning of database; identification of sources: 1992-1993; assembling data for Japan and U.S.: 1993-1994; extension to other countries: 1994-1995.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

A2. Project title: Use and definition of requirements for future satellite systems for disaster mitigation.

Contacts: S. Kishi, S. Uehara, National Research Institute for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 JAPAN.
Phone 81 298-51-1611; FAX 81 298-51-1622.
Louis Walter, National Aeronautics and Space Administration, Code 620, Goddard Space Flight Center, Greenbelt, MD 20771, USA.
Phone 301 286-2538; FAX 301 286-3884.

Outline of proposal:

Objective: To investigate satellite system concepts and requirements which will be able to observe and predict operationally dynamic phenomena which result in natural disasters.

Issue:

- Planned satellites such as ADEOS and the EOS series will have significant capabilities for disaster mitigation research and applications.
- Although these systems are designed for global change research studies, they provide excellent opportunities to test and define capabilities and requirements for future operational satellite systems.

Approach: Review current capabilities: 1992-1993;
assess capabilities of planned satellites for observing dynamic phenomena: 1992-1993;
identify additional capability requirements: 1993-1994;
define multi-satellite system for operation use: 1994-1995.

Funding:

Japanese side: S. Kishi; NIED, JMA, GSI, NASDA, RESTEC.
U.S. side: L. Walter; NOAA, NASA, USGS.

Status: Proposal development.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

A3. Project title: **Hazard mapping using advanced remote sensing systems.**

Contacts: S. Kishi, S. Uehara, National Research Institute for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 JAPAN.
Phone 81-298-51-1611; FAX 81-298-51-1622.
Louis Walter, National Aeronautics and Space Administration, Code 620, Goddard Space Flight Center, Greenbelt, MD 20771, USA.
Phone 301 286-2538; FAX 301 286-3884.

Outline of proposal:

Objective: Test the utility of high resolution synthetic aperture radar (SAR) imagery, in conjunction with other space imagery and ground data and using geographic information systems, to effectively map flood, landslide, and other hazard vulnerability.

Issue:

Hazard vulnerability mapping is perhaps one of the most appropriate uses of satellite remote sensing in hazard mitigation. The Japanese Earth Resources Satellite (JERS-1) which was recently launched carries a synthetic aperture radar system (SAR) which yields imagery at high (180 meter) spatial resolution. This imagery can provide a new dimension in land use and land cover mapping and the potential for global mapping of flood and landslide hazard vulnerability.

Background:

- Vulnerability mapping forms the basis for effective disaster mitigation but appropriate land use and land cover data are lacking in many parts of the world and are extremely difficult and expensive to acquire.
- Visible and infra-red satellite remote sensing imagery have proven effective in mapping vulnerability for several types of hazards including flooding and landslides but, recently, high resolution data from a completely different portion of the electromagnetic spectrum have become available through the SAR on JERS-1. These data should add an additional dimension to the construction of such vulnerability maps.
- Vulnerability maps will be constructed using JERS-1 SAR data and appropriate satellite visible and IR data and ground data in regions where conventional vulnerability maps are already available. These two types of maps will be compared for accuracy and completeness.

Approach: Setting up joint team: 1992-1993; selection of test areas in Japan and the U.S. - 1993;
JERS-1 and ancillary data acquisition: 1992-1994;
construction of vulnerability maps: 1993-1994;
evaluation of accuracy and completeness: 1994;
demonstration in uncharted areas in developing countries: 1994-1996.

Funding:

Japanese side: S. Kishi; NIED, NASDA, RESTEC, GSI (Geographical Survey Institute).
U.S. side: L. Walter; NASA, NOAA, USGS, FEMA, DOE, USDA.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

A4. Project title: Remote sensing of soil water distribution and implication of change of soil water distribution in ecosystem and occurrence of natural disaster.

Contacts: Masaki Tominaga, National Research Institute for Earth Science and Disaster Prevention, Science & Technology Agency.
Phone 0298-51-1611; FAX 0298-51-1622.
Fred Swanson, USDA, Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.
Phone 503 750-7355; FAX 503 750-7329.

Outline of proposal:

Objective: Development of a global observation system of soil water distribution including theory, methodology, and data analysis. Investigation of mechanisms of change of soil water distribution and its effect on ecosystem and occurrence of natural disaster.

Approach: Theoretical development, development of methodology and production of prototype of remote sensing system based on each institute's experience of soil water study. Investigation of relationship between soil water change and change of ecosystem and occurrence of natural hazard.

Exchange scientists of both institutes.

Funding:

Japanese side: National Research Institute for Earth Science and Disaster Prevention
U.S. side: USDA, Forest Service, Pacific Northwest Research Station; and USDA, Forest Service, Redwood Sciences Laboratory, Arcata, CA.

Status: This project should be done under the current project of "Snow Avalanche Management, Landslide Prediction and Control."

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

B1. Project title: **Joint Geological Hazards Database for East Asia**

Contacts: (Initial) Yoshiaki Kawata, Disaster Prevention Research Institute, Kyoto University, Gokasho, Uji, Kyoto 611 Japan. Ministry of Education.
Phone 81-774-31-8294; FAX 81-774-31-4115.
(Initial) Lawrence Enomoto, U.S. Dept. of Commerce NOAA, NESDIS, International Affairs, FB4, Room 0110, Washington, D.C., USA. Phone 301 763-4586; FAX 301 736-5828.
Kaye Shedlock, Denver Federal Center, U.S. Geological Survey, PO Box 25046 (M.S. 966), Denver CO 80225, USA.
Phone 303 273-8579; FAX 303 273-8600.

Outline of proposal:

Objective:

To develop a joint database of geological hazards for East Asia.

Identify all automated databases in U.S. and Japan containing geological hazards data sets for the East Asian region. Integrate these datasets into a combined database; determine common data exchange and directory interchange formats, keywords, and query languages; establish connections or media for exchange; use database to support the hazard mapping project; demonstrate access to joint database.

Approach: GIS-based digital data management.

Funding:

Japanese side: MITI.

U.S. side: Member agencies of CEES Subcommittee on Natural Disaster Reduction.

Status: New project.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

B2. Project title: **Development of joint disaster database for public health and medical topical areas**

Contacts: Yoshiaka Kawata, Disaster Prevention Research Institute, Kyoto University; Gokasho, Uji, Kyoto, 611 Japan.
Phone 81-774-31-8294; FAX 81-774-31-4115.
Eric Noji, MD, MPH; Josephine Malilay, Ph.D., Disaster Assessment and Epidemiology Section, U.S. Centers for Disease Control and Prevention.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective: To compile existing databases at national, regional, and international levels in order to establish an information system for documenting disaster-specific mortality and morbidity.

Details: A number of databases that are specific for disaster-related mortality and morbidity exist in Japan, the United States, and elsewhere in the world. Knowledge of and access to these databases will enable researchers to share information for preparedness planning and response to specific disaster events. Examples of databases to date include the following:

1. CDC-American Red Cross disaster database for deaths and injuries from natural disaster in the U.S.
2. Office of Foreign Disaster Assistance disaster database.
3. Disaster mortality database for Japan - Prof. Suminae Murakami.
4. Historical disaster database for Japan, China, Bangladesh - Prof. Yoshiaki Kawata.

Funding:

Japanese side: Kyoto University.
U.S. side: CDC.

Status: Proposed.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

C1. Project title: **Public risk perception, mitigation, and preparedness**

Contacts: H. Hirose plus colleagues, College of Arts and Sciences, Tokyo Woman's Christian University, 2-6-1 Zenpukuji, Suginami-ku, Tokyo 167 Japan.
Phone 81-3-3395-1211; FAX 81-3-3399-9745.
Dennis Mileti plus colleagues, Dept. of Sociology, Colorado State University, Fort Collins, CO 80523.
Phone 303 491-7347 or 5951; FAX 303 491-2191.

Outline of proposal:

Objective: Cross-cultural comparison for earthquakes and hurricanes (see proposal from 2nd JUST workshop for details).

Approach: (See proposal from 2nd JUST workshop for details.)

Funding: Original budget was approximately $90 K per side a year.

Status: Proposal pending.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

C2. **Project title: Evaluation of the public use and reaction to warnings.**

Contacts: Michio Hitsuma; Koji Kuroiwa; Japan Meteorological Agency,
Forecast Division.
Phone 03-3212-8341, ext 3137; FAX 03-3211-4923
Edward Gross, National Weather Service Headquarters, NOAA.
Phone 301 731-0258; FAX 301 713-0662.

Outline of proposal:

Objective/Approach:

(1) Evaluate and compare public reaction to Typhoon Mireille and Hurricane Andrew.

(2) Exchange information on warning systems, thresholds, and levels of warnings, and valid times. Exchange ideas on the development of a wind-damage scale for the tropical Pacific similar to the Saffir-Simpson scale. This would require involvement of structural engineers and others. Compare data on the impact of strong wind incidents from Typhoon Mireille and Hurricane Andrew and resulting property damage.

(3) A comparison of data and information will be exchanged.

Funding:

Japanese side: None required.

U.S. side: None required.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

C3. Project title: Workshop for scientists on natural hazards communication.

Contacts: Hiromu Okada, Faculty of Science, Hokkaido University, 59 Soubetsu Onsen, Soubetsu-cho, Hokkaido 052-01 Japan.
Phone 81-1427-5-3746; FAX 81-1427-5-3705.
Tom Pierson, Cascades Volcano Observatory, U.S. Geological Survey, 5400 MacArthur Blvd., Vancouver, WA 98661 USA.
Phone 206 696-7693. FAX 206 696-7866.
Dennis Mileti, Professor of Sociology, Colorado State University, Fort Colllins, CO 80523.
Phone 303 491-7343; FAX 303 491-2191.

Outline of proposal:

Objective: To organize and hold a workshop to teach working scientists how to effectively communicate hazards information and warnings to public officials, the media, and the general public.

Approach: Taking advantage of recent sociological research on perception of natural hazards and associated risk and response to natural disasters, the workshop, will engage qualified sociologists, specialists, media representatives, emergency-response officials, and land-use planning officials to lecture and lead workshop sessions on how scientists can more effectively translate and transmit scientific information on natural hazards to the end users of that information. Lecturers will come from the U.S., Japan, and possibly other countries in order to explore cultural differences in perception of risk, credibility of scientists, willingness to heed warnings, etc. Each attendee will come away with an improved understanding of how hazards information can best be presented to different user groups, whether during a disaster response or during quiet times, in order to save more lives and better mitigate disasters.

Funding:

Japanese side: STA (being sought), NHK.
U.S. side: Possible funding sources will be explored with FEMA, NSF, Society of Technical Communicators.

Status: New project.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

D1. Project title: Cooperative public health and disaster medicine research on the health and medical consequences of specific disaster events.

Contacts: Yukihiro Watoh, Dept. of Anesthesiology, Tottori Medical School.
Phone 0859-33-1111; FAX 0859-34-8088.
Naruo Uehara, Dept. of International Cooperation, National Medical Center.
Phone 03-5273-6828; FAX 03-3205-7860.
Eric Noji, MD, MPH; Josephine Malilay, PhD, Disaster Assessment and Epidemiology Section, U.S. Centers for Disease Control and Prevention.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective: To assess the health and medical consequences of specific disasters (e.g., eruption of Mt. Unzen, Hurricane Andrew, earthquake events, etc.) on the affected population and on the existing health infrastructure in the disaster zone through the use of epidemiologic applications.

Approach: The present knowledge base of the effects of disasters on populations requires the addition of new information with each disaster event. For instance, we know that respiratory illnesses may result from volcanic eruptions in which ashfall is a problem. While short-term effects may be evidenced, long-term health and medical effects such as the development of new cases of specific respiratory diseases in special subgroups of the affected population have yet to be fully investigated. Secondary effects of disasters also require study. For instance, roof-related trauma due to cleanup activities occurred after the 1992 eruption of Cerro Negro in Nicaragua. Proper health and safety directives following volcanic eruptions with heavy ashfall have yet to be determined.

Funding:

Japanese side:
U.S. side: CDC.

Status: Proposed.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

D2. Project title: Efficacy of shelters in severe storms and outcomes of injury.

Contacts: Suminao Murakami, Dept. of Architecture, Yokohama National University; Hideki Kaji, Institute of Socioeconomic Planning, University of Tsukuba.
Phone 81-45-335-1451; FAX 81-45-338-1016.
Josephine Malilay, PhD, Disaster Assessment and Epidemiology Section, U.S. Centers for Disease Control and Prevention.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective: To assess the efficacy of shelter types in severe storms such as typhoons in relation to behavioral patterns and outcomes of injury among shelter occupants.

Approach: Considerable attention, particularly by the United Nations Disaster Relief Organization (UNDRO), has focused on typhoon-resistant dwellings throughout developing countries in Asia and the Pacific. Special typhoon-resistant structures for one-family occupancy have been developed and installed by UNDRO in some areas of the Philippines. The use of such dwellings by the occupants, their integration in regional development planning and acceptance by the community, and injury and other health outcomes given the occurrence of a typhoon would provide information on the efficacy of such dwellings from structural and land use, and public health perspectives. The information could set precedence for the development of similar structures in other cyclone-ravaged countries such as Bangladesh.

Funding:

Japanese side:
U.S. side:

Status: Proposed.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

D3. Project title: Casualty estimation models and hazard mapping

Contacts: Keishi Shiono, Dept. of Civil Engineering, Tokyo Metropolitan University.
Hitomi Murakami, Dept. of Architectual Engineering, Hokkaido University, Sapporo.
Yutaka Ohta, Earthquake Research Institute, Tokyo University.

Eric Noji, MD, MPH; Disaster Assessment and Epidemiology Section, U.S. Centers for Disease Control and Prevention.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective: To incorporate analyses of injury patterns from past earthquakes in casualty estimation models that will allow prediction of the percentage of deaths and range of injury severity for principal building types and occupancies.

Approach: Although considerable attention has been focused on earthquake loss estimation models, little attention has been devoted to the more specific estimations of earthquake casualties. Integrating casualty prediction models into earthquake vulnerability and loss estimation analyses will lead to 1) development of more realistic earthquake scenarios for pre-earthquake preparedness activities, simulations, and exercises; 2) development of validated indicators for rapid assessment of the health effects of earthquakes and related health needs in order to determine most appropriate medical needs during the critical first few hours after impact; and 3) developing more effective rescue and medical training programs.

Funding:

Japanese side: STA (to be requested)
U.S. side: CDC.

Status: Proposed.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

D4. Project title: **Development of rapid health needs assessment methods following occurrence of a disaster.**

Contacts: Naruo Uehara, Dept. of International Cooperation, National Medical Center, Tokyo.
Yukihiro Watoh, Dept. of Anesthesiology, Tottori Medical School, Yonago, Tollori-ken 683, Japan.
Eric Noji, MD., MPH, Josephine Malilay, PhD, Scott Lillibridge, Lynn Quenemoen, MD, MPH, Disaster Assessment and Epidemiology Section, U.S. Centers for Disease Control and Prevention.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective: To develop methods for rapidly determing health and medical needs during the response phase to a disaster so that appropriate resources can be identified and mobilized into disaster-affected areas.

Approach: Rapid needs assessment methods are a major focus of interest among public health and medical responders worldwide. CDC developed and implemented a rapid needs assessment system in the aftermath of Hurricane Andrew in the states of Florida and Louisiana. The system aided in the establishment of medical and social service units where needed in disaster-stricken areas as identified by the system. The Japanese Medical Team for Disaster Relief (JMTDR) has been active in relief services to disaster-stricken countries. The use and development of these methods assist in the timely and efficient delivery of relief services to victims.

Funding:

Japanese side:
U.S. side: In development

Status:

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

E1. Project title: East Asia Geological Hazards Map (8 sheets, 1:2,500,000 scale)

Initial Contacts: Yoshihiro Kinugasa, Geological Survey of Japan (GSJ)
1-3-1 Higashi, Tsukuba, Ibaraki, 305 Japan.
Phone 81-298-87-3688; FAX 81-298-54-3533
Maurice J. Terman, U.S. Geological Survey (USGS), USGS National Center, MS 917, Reston, VA 22092, USA.
Phone 703 648-6070; FAX 703 648-4227.

Outline of proposal:

Objective: Provide leadership of, and technical support to, an international Working Group on Hazards Mapping (WGHM) that would compile 8 sheets of an East Asia Geological Hazards Map for publication at a scale of 1:2,500,000.

Approach: USGS will provide the scale-stable base geographic maps (with topography and bathymetry, and the available digital databases of relevant geohazards information. GSJ proposes the format of its already published Geological Hazards Map at a 1:3,000,000 scale for Japan. The principal WGHM participants will be solicited through the Permanent Representatives of CCOP in its member nations, including Cambodia, China, Indonesia, Korea, Malaysia, Papua New Guinea, Philippines, Singapore, Thailand, and Vietnam. Additional participants will be solicited through the appropriate contacts in Australia, Brunei, Burma, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Hong Kong, Laos, Russia, Solomon Islands, and Taiwan. The first meeting of WGHM will be at the International Forum on Natural Hazards to be held in Japan in 1993, at which time a final legend and a compilation schedule will be established; the target date for printing will be July 1996. The project will endeavor to coordinate with all other pertinent projects to the fullest extent possible. When compilation is complete and approved by WGHM, Japan will provide the cartography and printing. The project will be a major international contribution to IDNDR.

Funding:

Japanese side: Initial WGHM meeting, coordination of final cartography and printing.
U.S. side: Base map materials, initial digital databases.
Other: Subsequent WGHM meetings and operational expenses to be solicited from possible donors, such as ADB, ADAB, AID, OFDA, ESCAP, JICA, MITI, NSF, STA, UNDP, UNESCO, etc.

Status: Initial action needs to be amplified by communication between coordinators.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

F1. Project title: Japan-U.S. Symposia on Earthquake Hazard Reduction

Contacts: Kazuo Hamada, National Research Institttue for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 Japan.
Phone 81-298-51-1-611; FAX 81-298-51-1622.
Akira Hasegawa, Faculty of Science, Tohoku University, Aoba-ku, Sendai 980 Japan.
Phone 81-22-223-7087; FAX 81-22-264-3292.
Hiroshi Wakita, Faculty of Science, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113 Japan.
Phone 81-3-3812-2111; FAX 81-3-3816-1784.
Will Prescott, Kay Shedlock, National Earthquake Hazard Reduction Program, U.S. Geological Survey, 345 Middlefield Road MS/977, Menlo Park, CA 94025, USA.
Phone 415 327-4860 FAX 415 329-5163.

Outline of proposal:

Objective: To compare earthquake hazard reduction activities in the U.S. and Japan and stimulate cooperative projects.

Approach: We are planning a series of symposia. The symposia will be held annually until the end of the decade. Each will focus on one aspect of earthquake hazard reduction.

The focus of the first symposium will be a comparison of the U.S. and Japanese intensified earthquake prediction experiments. The U.S. is currently reviewing its Parkfield prediction experiment and is completing installation of a second experiment in the San Francisco Bay area. The Japanese are conducting intensified observations in the Tokai and South Kanto areas, and are beginning discussion for the next 5-year earthquake prediction plan.

We anticipate that the first symposium will be held in either the Tokai area or in California. It will probably involve 30 to 40 participants from each side (perhaps 80 total), and it will last 4 to 5 days.

Funding: Unknown.
Japanese side:
U.S. side:

Status: Planning stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

F2. Project title: Earthquake recurrence: study in shallow water areas

Contacts: Kunihiko Shimazaki, Earthquake Research Institute, University of Tokyo, 346-6 Kuromama, Motomachi, Oshima-chou, Tokyo, 100-01, Japan.
FAX 81-4992-2-3768.
Wayne Thatcher, US Geological Survey, 345 Middlefield Road, MS/977, Menlo Park, CA 94025.
Phone 415 329-4810; FAX 415 329-5163.

Outline of proposal:

Objective: Examine active fault zones in shallow water areas.

Approach: In September to October 1992, we plan to carry out the survey on the San Andreas in Tomales and Bodega Bays and on the Hayward fault in San Pablo Bay near San Francisco, CA. The high-resolution seismic profiler and piston corer were sent to U.S. on 10 August 1992. Five Japanese will visit U.S. and work with U.S. researchers. A small fund of the University of Tokyo is used. Future planning will also be made.

Funding:

Japanese side: Earthquake Research Institute, University of Tokyo; Dept. Geography, Hiroshima University; Dept. Geology, Kochi University; etc.
U.S. side: US. Geological Survey, Menlo Park; University of Hawaii; San Francisco State University; etc.

Status: Wayne Thatcher became a new U.S. contact person, succeeding Professor Yeats at Oregon State University. The first planned survey on the San Andreas fault in September 1991 had to be postponed because of too much time taken to get a special export permit for our seismic profiler. We plan the first preliminary survey on the San Andreas in September to October 1992. A newly made piston corer for this survey was tested first in April, and second in June 1992 with success on the second trial.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

F3. **Project title: Geochemical observation for earthquake prediction.**

Contacts: Hiroshi Wakita, Faculty of Science, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113 JAPAN.
Phone 81 3-3812-2111, ext. 4621; FAX 81-3-3816-1784.
Chi-Yu King, U.S. Geological Survey.
Phone 415 329-4838.

Outline of proposal:

Objective: Continuous measurements of the radon concentration in groundwater and of water level have been operated at two sites in Parkfield and one site in San Juan Bautista, California.

Approach: Future Activities: Continue the present observation in Parkfield and San Juan Bautista in order to detect possible precursory changes of earthquakes.

Visit observation sites once a year for maintenance of the instruments and for exchange knowledge.

Funding:

Japanese side: University of Tokyo.
U.S. side: USGS.

Status: In May 1992 a researcher of University of Tokyo visited the observation sites in order to check the operation of the instruments. This was useful to exchange knowledge with the counterpart scientist in the U.S.
In September 1992, the American scientist will visit Japan.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

F4. Project title: Tsunami inundation modeling exchange

Contacts: Nobuo Shuto, Faculty of Engineering, Tohoku University, Aoba, Aramaki, Aoba-ku, Sendai 980, Japan.
Phone 81-22-222-1800; FAX 81-22-268-3689.
Richard H. Hagemeyer, NOAA National Weather Service (NWS).
Phone 808 541-1641; FAX 808 541-1678.

Outline of proposal:

Objective: Establish a process whereby tsunami inundation modeling capability can be transfered to developing countries.

Approach: Establish tsunami inundation modeling center at Tohoku University. Scientist is trained to use the model with standard experiments. Experiment is conducted under close supervision. Other countries participate in a similar way.

Funding:

Japanese side: Tohuku University $77,000; $50,000 requested of STA; $37,000 requested of UNESCO/COC which they cannot fund in 1992-93.
U.S. side: NOAA $75,000.

JAPAN - U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

G1. Project title: Hydrologic Disaster Research

Contacts: Y. Mitsuta, Y. Tsuchiya, S. Ikabuchi, E. Nakakita, T. Yamashita,
Disaster Prevention Research Institute, Kyoto University.
Phone 0774-32-3111; FAX 0774-32-4115.
Y. Sasaki, Baxter Vieux, Peter Lamb, Ron Alberty, Roy Yeh,
International Center for Disaster Research, University of Oklahoma.
Phone 405 325-2989; FAX 405 329-6815.

Outline of proposal:

Objective:

(a) Develop rainfall analysis and prediction algorithms for NEXRAD Doppler Radar data,
(b) develop surface wind analyses and prediction algorithms for NEXRAD Doppler Radar wind data,
(c) further develop typhoon analysis prediction algorithms,
(d) further develop river run-off/flood analysis and prediction model for operational uses, and
(e) further develop GIS (Geological Information System) data algorithm for flood and coastal problems mentioned in (a), (b), (c), (d).

Funding: Proposals in preparation which will be submitted to:

Japanese side: Ministry of Education, Japan Promotion of Science and Technology, and others.

U.S. side: National Science Foundation, FEMA, and others.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

G2. Project title: Expansion of data sources for tropical cyclones using GMS

Contacts: Koji Kuroiwa (tentatively), Japan Meteorological Agency.
Phone 81-3-3212-8341, ext. 3137; FAX 81-3-3211-4923.
Richard H. Hagemeyer, NOAA/NWS Pacific Region, Honolulu, HI.
Phone 808 541-1641; FAX 808 541-1678.

Outline of proposal:

Objective: Increase the availability of meteorological data from the Typhoon Genesis area in Micronesia.

Approach: The NWS is installing 20 automatic weather stations in Micronesia, some of the desirable locations are outside of the GOES footprint. The cooperation would take the form of the U.S. installing the equipment and Japan making regional channels on the GMS available for the collection of the data.

Funding:

Japanese side: Provision of Regional documents on the GMS.
U.S. side: Provide, install, and support the operation of the automatic stations (funded).

Status: This was a proposal of the 2nd workshop and progress has been made. The first station, Pogan in the Maraiana Islands, is operating and four additional stations in Yap State, Federated States of Micronesia, are planned.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

G3. Project title: **Exchange of the best track data of tropical cyclones in the western North Pacific.**

Contacts: Koji Kuroiwa, Forecast Division, Japan Meteorological Agency, 1-3-4 Otemachi, Chiyoda-ku, Tokyo 100 JAPAN.
Phone 81-3-3212-8341, ext. 3137; FAX 81-3-3211-4923.
Mark A. Lander, University of Guam, 790 North Marine Drive (#268), Tumon, Guam 96911.
Phone 671 472-3712; FAX 671 477-6186.

Outline of proposal:

Objective:

a) Mutual understanding of the methodological differences in tropical cyclone analysis between Japan and U.S.

b) Development of more comprehensive understanding of the climatological features of tropical cyclones in the western North Pacific.

Approach: Exchange of best track data with an appropriate format will be first set up on a regular basis. Intercomparison of the data will be then performed in both countries. Cooperative studies will be conducted focusing on the climatological features of tropical cyclones such as spatial distribution of formation, track, and dissipation and their long-term variations.

Funding:

Japanese side: JMA
U.S. side: NOAA.

Status: First exchange of best track data was done in 1991.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

G4. Project title: Observational study on heavy rain and flood forecasting.

Contacts: Atsushi Takeda, National Research Institute for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 JAPAN.
Phone 81 298-51-1611; FAX 81 298-51-1622.
Yoshi Sasaki, George Lynn Cross Research, University of Oklahoma, School of Meteorology, Norman, Oklahoma 73019, USA.
Phone 405 325-2989; FAX 405 329-6815.

Outline of proposal:

Objective: Develop hydrologic disaster prevention schemes using new technologies such as Doppler radar and GIS.

Issue and Background:

- NEXRAD Network Plan is being executed in the U.S.
- In Japan, studies using Doppler radar are being conducted by some institutes and universities such as MRI, NIED, etc., and JMA has AMeDAS Networks which observe various meteorological elements on the ground covering the whole country with 17 km mesh.
- The University of Oklahoma is conducting STORMFEST experimental study in which closely located ground-based, airborne meteorological observations and satellite data are utilized.
- CRSL, MRI, and NIED are planning a joint observation study of rain clouds over the Kanto Plain using airborne Precipitation radar, radar wind profiler, Doppler radars as well as AMeDAS Network observation form 1993.
- TRMM (Tropical Rainfall Measuring Mission) satellite has scheduled its launching in 1997 by the cooperation of Japan and U.S. which is planned for observation of global rainfall amount and distribution between $\pm 37^{\circ}$ in latitude using PR (Precipitation Radar), AMSR (Advanced Microwave Scanning Radiometer) and AVHRR (Advanced Very High Resolution Radiometer).
- Japan has frequently suffered from flood disaster due to heavy rainfalls from frontal activities and typhoons, the U.S. also from hurricanes, thunderstorms, and tornadoes. In many developing countries, disasters induced by severe rains are becoming serious socioeconomic problems.
- The theme will contribute to IDNDR activities, especially useful to natural disaster reduction for developing countries as well as deeply connected with GEWEX/WERP.

Approach: Activities:

- Exchange researchers and information, 1993-2000.
- Scientific panel meeting, 1993, 1996, 1998, 2000.
- Use of new radar observations and development of hydrologic disaster prediction schemes in each country, 1993-1996.
- Joint research in tropical or subtropical zones such as southeast Asia and middle America synchronizing with TRMM observation, 1997-2000.
- Symposium, 1994, 1998, 2001.

Funding:

Japanese side: NIED, MRI, CRL, PWRI, Kyoto University, NASDA.
U.S. side: University of Oklahoma, NSSL, USGS, NOAA, NASA, ICDR, NEXRAD.

Status: Planning stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H1. Project title: Global change induced variation in landslide hazard

Contacts: Futoshi Nakamura, Forestry, Hokkaido University, Sapporo.
Phone 11 716 2111, ext. 2529; FAX 11 726 6502.
Fred Swanson and George Lienkaemper, USDA, Forest Service,
Pacific Northwest Research Station, Corvallis, Oregon.
Phone 503 750-7355; FAX 503 750-7329.

Outline of proposal:

Objective: Examine the extent to which landslide hazard varies in time in response to land use, climate change, and atmospheric chemistry change.

Approach: Conduct case studies of the time dynamic of landslide hazard. The first case study considers effects of forest cutting and road construction in Lookout Creek basin (Andrews Experimental Forest), Oregon, USA, showing effects of 40 years of land use on a measure of landslide hazard integrated over the 6400-ha study area (Nakamura, Lienkaemper, and Swanson have conducted this analysis together). Probable future analysis will include effects of climate change on the geographic distribution of the zone of rapid snow melt during warm rain events (the conditions that trigger most landslides in the study area). A second case study may be led by Nakamura examining effects of land use on change in landslide hazard for a study area in Japan. These analyses are conducted using a Geographic Information System.

Funding:

Japanese side: possibly Japan Society for the Promotion of Science
U.S. side: USDA Forest Service

Status: The first case study is nearing completion and a draft manuscript is in preparation.

JAPAN - U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H2. Project title: Experimental studies of debris flows using the large flume at Andrews Forest, Oregon

Contacts: Richard Iverson, Richard LaHusen, U.S. Geological Survey, Cascades Volcano Observatory, 5400 MacArthur Blvd., Vancouver, WA 98660, USA
Phone 206 696-7772; FAX 206-696-7866
NIED (tentative): Ministry of Construction (tentative)

Outline of proposal:

The recently constructed USGS, 80-m long, 2-m wide debris-flow flume provides a facility for potential collaborative research on debris-flow dynamics and hazard mitigation. Elements of the flume design and initial research questions are derived from part collaboration with NIED researchers. Specific problems for collaborative research have not been identified. On-site housing is available for researchers working at the flume, but funding for salaries and materials must be provided by participating organizations. A brief proposal stating scientific objectives and funding plan must be approved by USGS. An appropriate approach would be for a single investigator to participate in experiments over an extended period of time.

Funding:

Japanese side: NIED (tentative): Ministry of Construction (tentative)
U.S. side: U.S. Geological Survey

Status: The flume has been constructed and initial trial experiments are being conducted in 1992.

JAPAN - U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H3. Project title: Dynamics and effects of woody debris transport and deposition by debris flows and floods

Contacts: Yoshiharu Ishikawa, Shigemi Yajima, Shinnichi Kusano, Ministry of Construction, Japan Science and Technology Agency, Public Works Research Institute.
Phone: 81-298-64-2211; FAX 81-298-64-0903
Gordon Grant, Fred Swanson, USDA, Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.
Phone: 503-750-7328; FAX: 503-750-7329

Outline of proposal:

Objective: The destructive potential of both debris flows and floods is often augmented by transport of large woody debris in the moving fluid. Mechanics of woody debris transport are, however, poorly understood.

Approach: This study will focus on the initiation of motion, transport, and deposition of large wood by fluvial and nonfluvial processes. The emphasis will be on wood movement and consequent effects in rivers of sufficient width and energy to transport individual pieces. Hydraulic experiments using the flume facilities at the Public Works Research Institute in Japan will be complemented by field studies in natural rivers in the Pacific Northwest, and typhoon and volcano-impacted rivers in Japan.

Funding: Primary funding is being provided by the Japanese Science and Technology Agency. Salary and other expenses for principal investigators are being provided by:
Japanese side: Public Works Research Institute, Japanese Science and Technology Agency.
U.S. side: USDA, Forest Service, Research

Status: Exchange field visits and experimentation planned for November 1992-March 1993.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H4. Project title: Snow avalanche management, landslide prediction and control

Contacts: Shigetsugu Uehara, National Research Institute for Earth Science and Disaster Prevention, Science & Technology Agency.
Phone 0298-51-1611; FAX 0298-51-1622.
Fred Swanson, USDA, Forest Service, Pacific Northwest Research Station, Corvallis, Oregon.
Phone 503 750-7355; FAX 503 750-7329.

Outline of proposal:

Objective: Foster cooperative studies of hazard reduction related to snow and landslides.

Approach: Report of activities since 1990.

1. Four Japanese scientists and one U.S. scientist conducted cooperative research and field observation on the Release Control and the Protection Method of Surface Dry Snow Avalanches in both countries.
2. George W. Lienkaemper (USFS) stayed at NIED and studied application of GIS to the hazard potential zoning of landslides in Japan (Feasibility Study of the Geographical Information System for analysis of landslide mechanisms).
3. The second joint workshop on Natural Disaster Reduction was held in Karuizawa, Japan. The future cooperation in the following fields was discussed in six subgroups: (a) snow avalanche and landslides, (b) eruption of volcanoes, (c) earthquake, (d) typhoon, (e) sociology and economics, (f) human health.
4. Advanced technical workshop on "Snow avalanche, landslide, debris flow prediction and control" was held in Tsukuba, Japan, after the general workshop mentioned above, sponsored by STA of Japan and IUFRO. Review of the decade's cooperation and introduction of scientists of both countries by presenting individual studies and future cooperation by discussion of attendants were done. Field trip to hazard sites of the related fields were also conducted. Proceedings which contains 60 papers was published by the organizing committee.

Funding:

Japanese side: National Research Institute for Earth Science and Disaster Prevention, Civil Engineering Research Institute, National Research Institute for Agricultural Engineering, Forestry and Forest Products Research Institute, Geological Survey of Japan, Public Works Research Institute, Geographical Survey Institute.
U.S. side: USDA, Forest Service, Forestry Sciences Laboratory, Corvallis, OR; Redwood Sciences Laboratory, Arcata, CA; USDI, Geological Survey, Menlo Park; USDI, David A Johnston Cascades Volcano Observatory, Vancouver, WA; The University of Utah; Montana State University.

Status: Continuing promotion of cooperative studies.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H5. Project title: Hydrogeomorphic processes and analyses in forested hillslopes

Contacts: Takao Inoue, Forestry and Forest Products Research Institute.
Phone 81 298-73-3211 ; FAX
Roy C. Sidle, USDA, Forest Service, Intermountain Research Station.
Phone 801 752-1311.

Outline of proposal:

Objective: Quantify hydrologic and geomorphic factors related to hillslope erosion, emphasizing effects of forest vegetation and management.

Approach: Comprehensive investigations will involve a series of related field, laboratory, and modeling studies to evaluate hydrologic, geomorphic, and biologic processes influencing hillslope erosion. Field studies will focus on pore water fluctuations and pathways of water movement in forested slopes, as well as effects of landslide "infilling" and tree-root systems on slope stability and sediment delivery to headwater streams. Laboratory studies will be conducted in a rainfall simulator to analyze dynamic pore water pressure, influence of soil macropores, and thresholds for erosion under controlled rainfall conditions. The following modeling studies are proposed: (a) numerical analysis of groundwater response in forested hillslopes; (b) regional analysis of rainfall thresholds for landslide initiation; (c) root strength simulations for different species and management scenarios; and (d) incorporation of components into a watershed-scale erosion model using GIS. All models will be verified with results from field studies and will include effects of various forest management strategies and possible long-term climate change.

Cooperative studies will involve both short- and long-term scientific exchanges from both sides. Joint research programs for Japanese and American graduate students at various universities will be arranged. Symposia and workshops designed to disseminate research findings and coordinate research programs will be organized periodically. Technology obtained from these cooperative venues will be jointly applied in developing countries by Japanese and U.S. researchers.

Funding: This proposed research is supported by several previous and ongoing cooperative investigations and scientific exchanges between Japan and U.S.: (1) Dr. R. R. Ziemer, 3 months in Japan (1983),a root strength research; (2) Kazutoki Abe, 1 year in California, U.S. (1988-1989), root strength studies; (3) Dr. R.C. Sidle, 9 months in Japan (1991), STA Fellowship for research on subsurface flow; 2 months in Japan (1992) STA Foreign Specialist Award for research on landslide initiation mechanisms; (4) Wimin Wu, 3 weeks in Japan (1992) to discuss development of a GIS-based landslide model, STA Short-Term Award.
Japanese side: National Research Institute for Earth Science & Disaster Prevention, Public Works Research Institute, Various Universities.
U.S. side: USDA, Forest Service, Research; East-West Center, Hawaii, Various Universities; U.S. Geological Survey.

Status: Continuing.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H6. Project title: Relation between strong-motion shaking parameters and distribution of seismically induced landslides.

Contacts: Dr. Yashimasu Kobayashi, Center for Applied Geophysics, Kyoto University.
Edwin L. Harp, Denver Federal Center, U.S. Geological Survey, P.O. Box 25046 (M.S. 966), Denver, CO 80225 USA. Phone 303 273-8641; FAX 303 273-8600.

Outline of proposal:

Objective: Share strong-motion databases from selected earthquakes in Japan and U.S. triggering large numbers of landslides. Quantify relation between shaking parameters and landslide distribution.

Approach: Arias intensities calculated from strong-motion records written in Japanese and U.S. earthquakes will be correlated with the distribution and limits of seismically induced landslides. Arias intensity and landslide distributions will be compared to derive magnitude-distance-shaking intensity relationships of the form $\log I_h = A\underline{M} + B \log D + C$, where I_h is Arias intensity, $\underline{M}$ is movement magnitude, $\underline{D}$ is fault plane distance to farthest landslide, and A, B, and C are constants determined by statistical regression. A general equation such as the above, derived from numerous earthquake data will allow the prediction of landslide distance limits from future earthquakes of different magnitudes. Comparisons of landslide spatial densities and Arias intensity distribution will allow derivation of equations predicting landslide concentrations of various source distances for future earthquakes. The ability to predict concentrations and limits of landslides for future earthquakes will facilitate planning decisions made by public officials and engineers affecting development of residences, industry, and infrastructure.

Funding: Japanese organizations such as NIED and UJNR may be involved in providing contact personnel for data sharing.
Japanese side: Kyoto University.
U.S. side: USGS.

Status: Preparations have been made in advance of an earthquake which would then lead to field and air photo interpretation of landslide occurrence.

JAPAN - U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

H7. Project title: Sediment routing in gravel-bed rivers

Contacts: Hiroshi Ikeda, Environmental Research Center, University of Tsukuba.
Phone 298-53-2532; FAX 298-53-2530
Thomas E. Lisle, USDA, Forest Service, Pacific Southwest Research Station, Arcata, CA.
Phone 707-822-3691; FAX 707-822-5628.

Outline of proposal:

Objective: To measure routing of an input of sediment down a modeled gravel-bed river.

Approach: We will use the 160-m long flume at Environmental Research Center (ERC) to measure the dispersal and translation of an input of sediment down a modeled gravel-bed channel, which will contain alternate bars. The data will be used to test and calibrate sediment routing models based on dispersion and reservoir theory.

Funding:

Japanese side: University of Tsukuba.
U.S. side: USDA Forest Service

Status: Continuing.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

II. Project title: Release prediction and impact force of dry snow avalanches.

Contacts: T. Nakamura, Y. Yamada, Y. Noguchi; T. Karashi, K. Iwanami; Nagaoko Institute of Snow and Ice Studies, National Institute of Earth Science and Disaster Prevention, Nagaoka, Japan. O. Abe; Shinjo Branch of Snow and Ice Studies, NIED, Shinjo, Japan.
D. Abromeit, B. Tremper, D. Ream; U.S. Forest Service, Salt Lake City; Sue Ferguson, U.S. Forest Service, Seattle; R. Decker, University of Utah, Salt Lake City.
Phone 801 588-5042.

Outline of proposal:

Objective: Increase understanding of snow avalanche release mechanisms and impact forces.

Approach:

- Conduct cooperative programs of field research involving exchanged scientists (a very active exchange program has been underway for years). Using newly developed and old technologies of snow pack characterization.
- Continue field studies of impact forces of dry snow avalanches on a research pylon where load cells are mounted. This facility has been constructed with Japanese funding in a snow avalanche chute at Alta, Utah, where avalanches are artificially released.
- Investigate novel shock energy sources for avalanche release technology in Japan.
- Continue field studies of alpine snowpacks in Japan for the purpose of avalanche hazard forecasting.
- Develop micrographing techniques for snow avalanche weak layers and running surfaces.

Funding:

Japanese side: STA.
U.S. side: U.S. Forest Service

Status: Joint activities continue primarily through funding on the Japanese side.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

I2. Project title: Snow hydrology and hazards--detection with remote sensing and relations to global circulation and climate change

Contacts: Tsutomu Nakamura, Nagaoka Institute of Snow and Ice Studies, National Institute of Earth Science and Disaster Prevention, Nagaoka; Takashi Kimura, Shinjo Branch of Snow and Ice Studies, NIED, Shinjo.
R. Decker, University of Utah, Dept. of Civil Engineering, Salt Lake City, UT; Bob Brown, Montana State University, Dept. of Civil Engineering, Bozeman, MT; USA.

Outline of proposal:

Objective: Improve existing remote sensing techniques to assess snow cover structure and water content. Assess occurrence or extreme snowfall events in relation to global circulation, including ENSO events, and determine the usefulness of seasonal, alpine snowpacks as indicators of climate stability or change.

Approach: Scientific activity:

- Exchange of researchers and information, 1993 to 1997,
- SAR, and passive and active microwave analysis of snowpacks with verification by ground truth survey in each country based on coordinated research, 1993 to 1996.
- Develop a snowpit data collection and archiving standard for ease of handling and transmitting ground truth data on snow cover.
- Comparative study on snowfall conditions corresponding to global atmospheric conditions, especially anomalous ones, 1994 to 1997.
- Evaluation of global hazards induced from anomalous snowfall conditions, 1993 to 1997,
- Symposium, 1997.

Funding:

Japanese side: NIED, STA
U.S. side: To be determined (NASA; NOAA; USGS; Forest Service; University of Alaska).

Status: Proposal being developed.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

I3. Project title: Snow physics: relationship between metamorphism and micrograins of snow.

Contacts: Atsushi Sato, Tadashi Kimura; Shinjo Institute of Snow and Ice Studies, Shinjo Japan.
Robert Brown, College of Graduate Studies, Montana State University, Bozeman, MT 59717.
Phone 406 994-4145; FAX 406 994-4733.
Edward Adams, Civil Engineering Dept., Montana State University, Bozeman, MT 59717.
Phone 406 994-6122; FAX 406 994-6105.

Outline of proposal:

Objective: Increase understanding of snow metamorphism with micrograins and a distribution of micrograins and grain sizes. Studies will be done for a wide variety of conditions to determine how metamorphism is related to global climate change.

Approach:

1. Two American scientists and one Japanese scientist will conduct cooperative research on metamorphism of snow. One scientist will visit the Shinjo Branch to conduct laboratory studies, and one Japanese scientist is planned to visit Montana State University to conduct similar studies.
2. Laboratory studies will be conducted to monitor metamorphism of micrograins. At the Shinto Branch snow with micrograins (10-50 micron diameter) will be made, and the metamorphism will be monitored to measure metamorphism as a function of temperature and temperature gradient.
3. The microstructure of the micrograin snow will be measured with an image analyses system developed at Montana State University. Variations in grain size, intergranular bonding, pore size, specific free surface area, and other variables can be directly measured.
4. A physical model will be developed to predict variation of microstructure of the micrograin snow and also physical properties.
5. Studies will also be conducted on nonhomogeneous snow with strong layering in grain size. Snow with layers that have large differences in grain size (10 microns to 1 mm) will be made and steps 2-4 described above will be repeated for these samples.
6. Test results and modeling results will be used to infer effects of global climate change on metamorphism of mountain snow cover.

Funding:

Japanese side: STA.
U.S. side: To be determined.

Status: In planning.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J1. Project title: Volcanic earthquakes and tremors as precursors of volcanic eruptions

Contacts: Yoshiaki Ida, Earthquake Research Institute, University of Tokyo.
Phone 81 3-3812-2111 ext. 5765; FAX 81 3-3819-6979
Stephen R. McNutt, Alaska Volcano Observatory, University of Alaska (AVO).
Phone 907 474-7131; FAX 907 474-5618.

Outline of proposal:

Objective: To study the source processes of volcanic earthquakes and tremor, and to find their meaning and statistical significance as precursors of various types of volcanic eruptions.

Approach: The first step will be to collect seismic wave data of volcanic earthquakes and tremor that have been accumulated at several volcanoes in the United States and Japan. The data will be suitably classified and analyzed to derive the information on the sources. The methods of the analysis as well as the theories of the source processes, which have been developed independently in both countries, will also be critically examined. Focusing the study on some specific problems that are of central importance, dense network experiments will be cooperatively conducted at suitable volcanoes.

Product: Pamphlet containing seismograms and brief explanations and interpretations, to be printed in 1994.

Funding:

Japanese side: Ministry of Education, all volcano observatories, JMA.
U.S. side: NSF International Program, AVO existing funds, USGS, University of Washington, University of Alaska.

Status: Underway.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J2. Project title: Domes and generation of Merapi-style pyroclastic flows.

Contacts: T. Ui, Kobe University.
Phone 81 78-881-1212; FAX 81 78-881-7593.
Jon Fink, Dept. of Geology, Arizona State University, Tempe, AZ.
Phone 404 488-7350; FAX 404 488-7335.

Outline of proposal:

Objective:

1. To understand how silicic lava domes develop and later fail, generating pyroclastic flows (Merapi-type).
2. With an understanding of the processes, predict conditions leading to dome-collapse pyroclastic flows.

Approach: The team will synthesize observational data from eruptions of Unzen and Redoubt volcanoes. On the basis of these data, develop numerical models of collapse and subsequent fragmentation of unstable dome segments. Characterization of tephra from the pyroclastic flows will provide additional data for understanding the processes. All of the above data and models should be integrated and interpreted and criteria developed for predicting this type of explosive activity.

Funding:

Japanese side: Kobe University, Director of National Com. of Volcanology.
U.S. side: Arizona State University; Apply to NSF, DOE National Laboratories, USGS.

Status: Planning stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J3. Project title: Volcanic hazard and risk mapping.

Contacts: Shigeo Aramaki, Faculty of Science, Hokkaido University, Kita 10 Nichi8, Kita-ku, Sapporo 060 Japan.
Phone 81-11-716-2111 ; FAX 81-11-746-0394.
Michael F. Sheridan, 415 Fronczak Hall, Geology Dept., University at Buffalo, Buffalo, NY 14260 USA.
Phone 716 645-3100; FAX 716 645-3999.

Outline of proposal:

Objective: Develop a methodology for producing volcanic risk maps integrating data with simulations. The method will use GIS databases and new technology to link geologic hazards with population and cultural data. This project will focus on the four Japan and U.S. decade volcanoes: Moana Loa, Rainier, Unzen, and Sakurajima. Emphasis will be on application of low-level GIS systems emphasizing ease in demonstrations to public officials, decision makers, and the public. The product will be a demonstration of software, and display products using DEM as a base.

Approach:

Funding: Funding will be obtained from national agencies in U.S. and Japan. Cooperation will be sought from other researchers and agencies concerned with this problem. Existing data, DEM, and commercial software will be generally employed.

Japanese side: Hokkaido University.
U.S. side: USGS, NASA, SUNY Buffalo.

Status: Planning stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J4. Project title: Unrest at Iwo-jima Caldera.

Contacts: T. Kumagai, National Research Institute for Earth Science and Disaster Prevention, Tennodai 3-1, Tsukuba, Ibaraki 305 JAPAN.
Phone 81 298-51-1611; FAX 81 298-51-1622.
Chris Newhall, Volcano Hazards and Geothermal Research, U.S. Geological Survey, 905 National Center, Reston, VA 22092 USA.
Phone 703 648-6747; FAX 703 645-6717.

Outline of proposal: Important for understanding caldera unrest (crises) and for predicting future caldera forming eruptions.

Objective: To document and interpret dramatic unrest at Iwo-jima caldera.

Approach: Integrated geologic study and monitoring of Iwo-Jima, the world's best (only?) example of active resurgent doming.

Funding:
Japanese side: NIED plus universities
U.S. side: Smithsonian Institution, universities, USGS.

Status: Early stage of implementation.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J5. Project title: Volcanically induced melting of snow and ice

Contacts: To be determined from Low Temperature Institute, University of Hokkaido, Sapporo.
Joseph Walder, USGS-CVO, 5400 MacArthur Blvd., Vancouver, WA 98661 USA.
Phone 206 696-7671; FAX 206 696-7866.

Outline of proposal:

Objective: The tragedy of Nevado del Ruiz and experience in both the Japan and U.S. show that snow or ice can be melted quietly by pyroclastic flows and related phenomena. The objective is to explore and understand the conditions under which this process occurs so that the consequent lahars can be anticipated and the hazards that they represent mitigated.

Approach: Joint studies in Japan and the U.S. are proposed to investigate the physics of snowmelt lahar generation both experimentally and empirically, to elucidate the processes by which such lahars are generated, and to develop models that can be applied to anticipating the hazards imposed by snowmelt lahars.

Laboratory experiments are to be carried out in both countries. Eruptions on snow- or ice-covered volcanoes in either Japan of Alaska offer the greatest potential for joint field investigations.

Funding:

Japanese side: University of Hokkaido.
U.S. side: USGS.

Status: Planning stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J6. **Project title: Characterizing eruptions in progress.**

Contacts: Kazahiro Ishihara, Sakurajima Volcano Observatory.
Phone 81-0992-93-2058 ; FAX 81-0992-93-4024.
Bill Rose (Chris Newhall), Dept. of Geol. and Geol. Engineering,
Michigan Technology University.
Phone 906 487-2367; FAX 906 487-3371.

Outline of proposal:

Objective: To confirm and characterize eruptions in progress, and especially ash clouds, during all conditions of weather, darkness, and access.

Approach: Apply and exchange information regarding existing methods, and develop new methods for remote, all-weather detection and tracking of ash clouds, pyroclastic flows, lahers and other volcanic phenomena. Also for detection and quantification of explosions.

Products: A compilation of available and promising methods, and preliminary testing of new methods.

Funding: New methods must be tested where explosive eruptions are in progress, e.g., Sakurajima, Unzen, Spurr, etc. Budget must include adequate amounts for equipment and equipment development.
Japanese side: JMA, SVO, UVO, ERI, PWRI, others.
U.S. side: USGS, NOAA, MTU, University of Alaska, others.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J7. Project title: Volcanic gases--sampling and use in eruption forecasting.

Contacts: Kohei Kazahaya, Geological Survey of Japan, 1-1-3 Higashi, Tsukuba, Ibaraki 305 JAPAN.
FAX 81-298-54-3533
Robert Symonds, Cascades Volcano Observatory, U.S. Geological Survey, 5400 MacArthur Blvd., Vancouver, WA 98661 USA.
Phone 206 696-7961; FAX 206 696-7866.

Outline of proposal:

Objective: Evaluate and test multiple methods of sampling volcanic gases to understand their role in forecasting volcanic eruptions.

Approach: Conduct basic research to understand the degassing process. Sampling work would be focused on decade volcanoes (i.e., Sakurajima, Unzen). Other sites of interest at present include Satsuma, Iwo-Jima, or other active volcanoes. We will also evaluate historical data sets on volcanic gases from U.S. and Japanese volcanoes.

Products: Research papers on basic research on volcanic gases and evaluating gas sampling methods in forecasting volcanic eruptions.

Funding: Governmental agencies in the U.S. and Japan.
Japanese side: GSJ, STA, AIST.
U.S. side: NSF, USGS.

Status: Proposal stage.

JAPAN-U.S. SCIENCE AND TECHNOLOGY AGREEMENT OF 1988
NATURAL DISASTER REDUCTION JOINT PROJECT PROPOSAL

J8. Project title: Coordinated Japan-U.S. assistance to developing countries.

Contacts: Kosuke Kamo, Kyoto University, Gokasho, Uji, Kyoto 611 JAPAN.
FAX 81-774-31-4115
Dan Miller, Cascades Volcano Observatory, U.S. Geological Survey, 5400 MacArthur Blvd., Vancouver, WA 98661 USA; Kolho Park, NOAA, VCAT.
Phone 206 696-7885; FAX 206 696-7866.

Outline of proposal:

Objective: Coordinated assistance to developing countries in volcanic hazards mitigation.

Approach: Assist countries before, during, and after volcanic activity by (a) training and assistance in hazard assessment, hazard zonation, volcano monitoring; (b) providing equipment (seismic, deformation, gas, telemetry, computer analysis), (c) providing onsite expertise to assist local scientists during unrest/eruptions.

Both U.S. and Japan must be invited by local officials/scientists through our respective governments.

Funding:

Japanese side: JICA, others.
U.S. side: Cooperative funding efforts by V.H.P., USGS, and USAID OFDA.

APPENDIX

ABSTRACTS OF PRESENTATIONS

Natural-Disaster Hazard Mapping in Japan

Yohta Kumaki, Geographic Department, Geographical Survey Institute, Tsukuba, JAPAN

Japanese Islands are located in a very active tectonic zone, and moreover, heavy rains hit them frequently. Therefore they are subject to natural disasters. To reduce disaster damage, it is important to know what type of disaster occurs and where it takes place as well as to predict when it will occur. Actually a map showing the area which would be affected by the volcanic activity of the Unzen Volcano played an important role for the evacuation of the inhabitants in 1991. This example indicates that place condition data are indispensable for disaster measures. Maps are a very good medium for accurate description and communication.

Many administrative organs, both national and local, and many scientists have been preparing maps which show geographic data relating to disasters. Though these maps vary greatly in content and title, they can be classified into two types: maps which show place properties and maps which guide people or administrative offices. The former can be subdivided into three types:

A. Research maps on actual disaster(s)
B. Place property maps showing natural and/or social conditions such as geology, geomorphology, soil properties, land use, traffic situation, etc.
C. Disaster potential maps

The type-A maps are basic materials for scientific studies. They are very useful in knowing the place properties in an area where a certain type of natural disaster occurs repeatedly, and they provide important data to prepare B-type maps.

The B-type maps can include not only pure geological maps, and pure geomorphological maps, but also applied science maps focused on disasters. They are no more direct predictors than the A-type maps, but specialists can estimate the hazard potential using some suppositions.

The C-type maps show the distribution of disaster potential or probability usually on the basis of B-type maps. Making proper C-type maps is only possible with a good understanding of the relationship between place properties and disaster. From this point of view, disaster sciences should progress further towards the satisfactory results. Estimation of social conditions is the most difficult problem. Accordingly, many C-type maps are based on only physical conditions.

The guidance-type maps show what people or administrative offices should do in case of emergency. The contents of this type of maps should emphasize simple, easy understanding rather than scientifically accurate.

The research maps of the flood disaster by Typhoon Kathryn of 1947 and of Fukui Earthquake damage of 1948 are the first hazard maps after the World War II in Japan.

In the 1950's most Japanese hazard maps were on floods and tidal waves. Maps on tsunami, landslide, snow avalanche and inundation of urban areas increased in the 1960's. In the 1970's, when seismologists gave a warning that there was a high possibility of a large-scale earthquake in Tokai region in the near future, earthquake hazard mapping developed rapidly. The interest in volcanic hazard mapping has risen since the 1980's. During these periods the mapping technique has progressed. Nowadays various methods are used for hazard mapping, such as field survey and measurement, air-photo interpretation, photogrammetry, remote sensing, database processing, statistical analysis, simulation, computer graphics, etc. Recently geographical information systems (GIS) have been popularized, which are utilized for land use planning, disaster measures, management of lifelines, etc.

Japanese administrative organs have not had a tendency that they positively publish their hazard maps, because the maps are not necessarily perfect. Land owners do not want them to publish the maps, for the land price might fall. Recently, however, some organs publish hazard map positively. The Ministry of Construction made public potential inundation area maps in 1991. The National Land Agency of the Prime Minister's Office made a guide to volcanic hazard mapping and recommended local governments to prepare volcanic hazard maps. Some municipal governments have been making hazard maps in co-operation with inhabitants. This type of map show the distribution of dangerous things, hydrants, etc. The inhabitants can realize their circumstances through this activity.

ABSTRACTS OF PRESENTATIONS

Review on the Disaster Caused by Typhoon Mireille (1991)

Koji Kuroiwa, Forecaster, Forecast Division, Forecast Department, Japan Meteorological Agency

Introduction

Typhoon Mireille, the most devastating typhoon to hit Japan in the last 20 years, made its first landfall over Kyushu on 27 September 1991 and another landfall over Hokkaido within the day. The record-breaking strong winds associated with the typhoon caused heavy damage to the widely scattered socio-economic sectors in Japan, particularly in agriculture and forestry with damage of more than 700 billion yen (about $5.5 billion).

Trace of Typhoon Mireille

Mireille originated as a tropical depression over the Marshall Islands on 13 September 1991. It tracked consistently westward for more than a week while steadily intensifying. It reached tropical storm intensity on 16 September and attained typhoon intensity the same day. Turning from its initial westward track to the northwest over the waters east of the Philippines, Mireille reached the peak intensity on 23 September with the central pressure of 925 hPa and maximum sustained winds (10-minute average) of 50 m/s.

Recurvature occurred on 26 September as it moved northward across the Ryukyu Islands. Mireille later accelerated and took a northeastward track to hit Nagasaki Prefecture (western Kyushu) around 0700 UTC on 27 September with the central pressure of 940 hPa, maximum sustained winds of 45 m/s, and radial extent of winds over 15 m/s of 600 km. The typhoon then moved over northern Kyushu and entered in to the Sea of Japan while further accelerating.

The subsequent landfall was made on the west coast of Hokkaido at 2300 UTC the same day (with 955 hPa and 40 m/s), after the rush across the Sea of Okhotsk before it evolved into an extratropical cyclone at 0600 UTC on 28 September over the Kurile Islands.

Mireille was the most intensive since Typhoon Trix (7123) of 1971 as regards the central pressure at the time of landfall; it was the fourth most intense on record since 1951. One of the causal factors allowing Mireille to attack the Japanese Archipelago without notable decay was the anomalously warm sea surface temperatures over the East China Sea in September, which were considered to have contributed to the reintensification of the typhoon prior to the landfall over Kyushu. Furthermore, the swift movement at the speed of nearly 100 km/h across the Sea of Japan landed Mireille on Hokkaido leaving it in typhoon status with the central pressure of 955 hPa and the maximum sustained winds of 40 m/s, and eventually caused widespread disaster.

Socio-economic Impacts

Fire Defense Agency announced on 31 December 1991 that Mireille affected 42 prefectures (out of 47 in total), where 62 people were killed, 2862 others injured, and more than 670,000 houses were damaged including 1,058 destroyed. The number of fatalities was the most severe from a single typhoon in the last 10 years.

Economic damage was also enormous, especially in agriculture and forestry. Numerous forest trees were prostrated in Kyushu, salt damage was serious to fruit trees and paddy rice throughout western Japan, and apple orchards suffered a fatal blow in Aomori Prefecture (northern Honshu). The Ministry of Agriculture, Forestry and Fisheries estimated the total loss at 719 billion yen, inclusive of the loss caused by Typhoon Kinna (9117) and Severe Tropical Storm Luke (9118), both of which also affected Japan in succession during the 2 weeks preceding Mireille's attack in September.

Furthermore, the breakdowns of pylons and power lines caused widespread electricity failure throughout Japan with a total of 7,360,000 households affected, which accounted for 13% of all consumers. Particularly, power facilities polluted by salty winds resulted in another electricity failure in western Japan, forcing power supply to be suspended for days.

Despite its catastrophic intensity, the rainfall amounts brought by the typhoon were relatively small during the assault partly due to its hurried transfer. In contrast, Mireille's strong winds and extended windfields set up new records of the maximum wind speeds at numerous weather stations: daily maximum wind speed (10-minute average) at 5 stations (3.3% of the total stations); daily maximum peak gust at 26 stations (17.3%).

As a consequence, most of the damage can be attributed to the strong winds accompanied by the typhoon. Nearly 80% of the casualties, in fact, were caused by the winds either directly or indirectly, fallen by gusts, hit by blown objects such as roofing tiles, or caught under fallen trees and collapsed houses. The enormous figure of damaged houses (over 670,000) compared with 23,000 of flooded houses, also proves that winds surpassed the rainfalls by far in the impacts of Mireille.

Response

During the Typhoon Mireille's threat from 24 to 28 September 1991, 99 general typhoon bulletins were issued nationwide by the Headquarters of Japan Meteorological Agency (JMA) to alarm the people to the approach of Mireille and its severity, and a total of 236 warnings against storm, storm surge, high waves, heavy rain and flood was issued by the regional meteorological offices in charge.

A verification showed that the operational forecast performance for Mireille was as good as the annual mean of 1991 with the averaged position error of 146 km for 24-hour forecasts (vs. annual mean 163 km) and 344 km for 48-hour forecasts (vs. 333 km). In addition, a series of 24-hour forecasts provided from 1200 UTC on 24 (when Mireille crossed 20°N) to 0600 UTC on 26 September (about 24 hours prior to the landfall), was extremely accurate with the averaged position error of 45 km.

However an inquiry conducted by the National Land Agency to the people in Hiroshima, one of the cities most severely affected, exposed the indifference of the people towards the forthcoming typhoon and its effects. It proved that while most of the people were aware of the approach of Mireille, about 70% did not expect disasters to occur and therefore make any necessary preparation. Furthermore, about 60% neglected the warning about the storm which they knew had been issued.

People's response to the inquiry indicates they believed themselves to be immune from disasters even if they were actually struck by a typhoon. Accordingly, it suggests that a long absence of such a destructive typhoon's visit can mislead the people into false security against typhoon disasters. The impacts of Mireille thus revealed the unpreparedness of the general public against the typhoon and posed the task to be taken towards their proper understanding of the social vulnerability to the violent storms and of the possible disasters.

ABSTRACTS OF PRESENTATIONS

Assessment of Research and Applications on Natural Hazards in the United States

Dennis S. Mileti, Hazards Assessment Laboratory, Colorado State University, Fort Collins, CO, USA

An assessment of knowledge, research and applications needs for natural hazards in the United States has begun. The effort has general goals that include the following. First, we are taking stock of contemporary knowledge in all applicable fields of investigation on natural hazards. Second, we are determining the current state of applications of that knowledge in the nation at relevant levels of human aggregation, for example, in national, state and local governments, households, and in the private sector. Third, we are specifying research and applications priorities given exciting constraints and incentives, for example, economic trends, climate change, political feasibility and so on.

The project has an advisory panel made up of representatives from federal agencies, state and local government, the private sector, disaster response organizations and the academic community. The people working on the assessment include established experts and students. These persons bring knowledge from a variety of subject areas including engineering (structural, nonstructural, soils and wind), the behavioral and social sciences (economics, geography, psychology, political science and sociology), the physical sciences (hydrology, meteorology, seismology, geology and volcanology), and other fields of study such as global climate change, historical property, planning and public health. Team members come from a variety of organization settings throughout the United States.

More specifically, the assessment is: (1) taking a stock of what has been learned in the last 20 years, (2) creating a vision for compiling baseline data and information on applications in the U.S. and other relevant countries, (4) exploring, developing and using a multi-hazards (natural and technological) approach to foster linkages and integration across hazards, (5) defining and networking with constituencies and users to facilitate product use, (6) broadening the visibility of and interest in hazards in the U.S., (7) tracing the application of research findings from the last 20 years to discover factors that produced success, (8) maintaining a national focus with a relevant international component, for example, global linkages and cross-national lesson transfer, and (9) developing and using a broad view of hazards to facilitate applications, productivity, sustainable development and quality of life. We view hazards as an ever-moving target that result from the interaction of factors such as population, social organization and policy, the environment and science and technology.

ABSTRACTS OF PRESENTATIONS

Cooperation in The Use of Space Technology for Disaster Mitigation

Louis S. Walter, Assistant Director for Science, Earth Sciences Directorate, National Aeronautics and Space Administration, Godard Space Flight Center

Both Japan and the United States have humanitarian as well as economic interests in disaster mitigation. Both nations also have strong interests and capabilities in space technology and its development in the service of human needs. The amalgamation of these interests of both nations could form a very potent force in the heightening effort to alleviate the effects of natural hazards.

This convergence is already starting to take place in several ways. The two countries are already cooperating in several satellite missions which will provide research and demonstrations leading to improved capabilities for disaster mitigation. Among these are missions to improve the measurements of rainfall, surface wind velocities and tectonic plate movements.

The Pacific International Space Year Conference brought together many space technological experts from the circum-Pacific region, especially from Japan. The use of space technology in disaster mitigation was an important issue discussed in the panel on Earth Observation and Dynamic Processes.

In late 1990, forty senior representatives of US and Japanese industry, academia and government met to assess the role of cooperation in space and consider new cooperative space activities which would enhance scientific and technical efforts in the Pacific region. First among the four initiatives which they agreed should be pursued was a global environmental and disaster observation satellite system. The initiative addressed an international global environmental satellite system with the capability of providing disaster warning and other services, to be operational in the late 1990's or the early 21st century.

Both the United States and Japan are noted for their strong technological capability in space and cooperative activities which are immediately applicable to disaster mitigation and are already under way. Perhaps the most notable example of this is the Tropical Rainfall Monitoring Mission (TRMM). The objectives of this measurement program are to develop and test a remote sensing capability to quantitatively measure rainfall. This capability has extremely important bearing in providing warnings of floods, droughts and insect infestations. Several crucial instruments are provided by Japan and the mission is being launched by the U.S. Japan will soon be launching the JERS-1 satellite which will have important capabilities for measuring surface wind velocities over the oceans (pertinent to storm surge warnings) and radar mapping of the land surfaces (for landuse mapping). Both nations already cooperate through international agreements with respect to the maintenance of geosynchronous meteorological satellites. Other areas of cooperation include the launch of a U.S. TOMS (Total Ozone Mapping Spectrometer) aboard the Japanese ADEOS mission

and the inclusion of the Japanese ASTER instrument (a multispectral scanner) in the U.S. EOS satellite.

These considerations suggest an important joint effort under the aegis of the S&T Agreement. Under this effort, the two parties would:

- Outline important elements of disaster mitigation which could be assisted through the use of space technology;
- Identify existing space technological capabilities which can be applied to these elements;
- Identify scientific research and/or technological developments which must be addressed in order to enable applications;
- Encourage the implementation of these developments;
- Enlist the aid, support, and active involvement of the disaster management community ("practitioners") in these efforts;
- Define and carry out projects through which these developments can be tested and demonstrated;
- Press for the implementation of the effective, efficient use of appropriate space technology for disaster mitigation.

Several governmental agencies on each side may be identified to make substantive contributions to this effort. On the U.S. side, these would include NASA, the U.S. Geological Survey, NOAA, and the U.S. Department of Agriculture. On the Japanese side, they would include NASDA, Japanese Meteorological Agency and the National Research Institute for Earth Science Research and Disaster Prevention.

ABSTRACTS OF PRESENTATIONS

Earthquake Hazard and Risk Mapping

Kaye M. Shedlock, U.S. Geological Survey, Denver, CO, USA

Earthquake hazard and risk mapping is conducted at national, regional, and local scales using both probabilistic and deterministic methods. Probabilisitic earthquake hazard and risk assessment estimates the probabilities of exceeding specified levels of a chosen ground motion parameter for specified exposure times. Deterministic, or scenario, earthquake hazard and risk assessment estimates catastrophe potential from the largest possible earthquake believed likely to occur within a specified region. All earthquake hazard and risk assessment involves four major steps: 1) determination of seismic sources and source zones, 2) determination of magnitude recurrence relations for each source or zone, 3) estimation of attenuation relationships for the ground motion parameter of interest, and 4) summation of the probabilities (exceedences) from all source zones contributing to a given site. The national earthquake hazard and risk mapping program in the United States produces national maps of peak ground acceleration and velocity with a 90% probability of non-exceedence, for 50 and 250 years, as well as regional 5% damped spectral response acceleration at 0.3s and 1.0s with a 9% probability of non-exceedence for 50 and 250 years.

ABSTRACTS OF PRESENTATIONS

Mapping of Natural Hazards in the Circum-Pacific Region

Maurice J. Terman, U.S. Geological Survey, Reston, Virginia, USA

Since 1974, the Circum-Pacific Map Project (CPMP) has compiled a series of maps of the Circum-Pacific showing a variety of geoscience parameters. Those which constitute perennial hazards have been selectively recompiled on a Pacific Basin Map at a scale of 1:17,000,000, including: (1) earthquake epicenters (<70 km depth, M 5-7.5 for 1974-80, M >7.5 for 1899-1983), (2) volcanic centers (active in past 1,000 or 10,000 years), (3) faults with historic rupture, (4) plate boundaries currently active, and (5) tsunami sites (runup of 2.0 m or more).

New compilations by the National Oceanic and Atmospheric Administration have added a number of seasonal hazards, including: (6) wintertime maximum and summertime minimum ice edges in polar regions; (7) probability for areas of wintertime ship superstructure icing; (8) percent frequency for areas of wintertime wave heights of 6.0 m or more; (9) preferred tracks for tropical storms; (10) percent probability for areas having at least one tropical storm within a given 5-degree square in any given year; and (11) mean tornado frequency by areas with local probability for USA.

This CPMP map and text was published in April 1991 as a contribution to IDNDR.

Also in 1991, the Australians established a Natural Hazards Map Working Group which proposed compiling an IDNDR natural hazards map for the CPMP Southwest Quadrant at a scale of 1:10,000,000, including earthquakes, volcanoes, tsunamis, possibly landslides, cyclones, severe storms, drought, storm surges, floods, and bush fires. The philosophic emphasis will be to portray areas of future hazard potential rather than record past events as on the CPMP Basin Map; legends will be formulated in 1992.

During the late 1980's, USGS volcanologists worked with counterparts in Indonesia to prepare a draft map at a scale of 1:2,000,000 on the Volcano Hazards of the Indonesion region, including location (name and IAVCEI number), danger index, year of latest activity, observational status, ash fall areas, air routes, and population centers; other parameters are being added and the map should be completed at a scale of 1:2,500,000 in 1992.

During the 1990's the East Asia Map project also will work with ESCAP to prepare pilot studies, and possibly full map series, of geoscience hazards at a scale of 1:2,500,000, including at least earthquake hazards, volcanic hazards, and landslide inventories.

ABSTRACTS OF PRESENTATIONS

Mapping of Landslide Hazards-Evolution During the Last Decade

Edwin L. Harp, U.S. Geological Survey, Denver, CO, USA

Prior to the late 1960's, mapped landslide information generally took the form of geologic maps on which landslide location and shape in plan view were portrayed as part of the Quaternary deposits. In most cases, only the largest of such features were recognized and displayed. Only a few types, such as large slumps, block slides, earthflow complexes, and occasionally avalanche deposits, were likely to be shown on a geologic map. In the early 1970's specialized maps showing only landslides or a mixture of landslides and other surficial deposits began to be produced to evaluate the potential for damage to possible future development in large urban areas. Again, the types of landslides portrayed on these maps tended to be the larger, more obvious types of failures. In general, small, fast-moving landslides leaving only shallow deposits, were not recognized or mapped despite their destructive potential.

The first maps to show information other than landslide location combined geology, slope, and spatial frequency of landslides within the various geological units to display susceptibility to landslides. Brabb and others (1972) compiled a map of San Mateo County, California, showing the susceptibility of slopes throughout the country at a scale of 1:62,500, which was subsequently used by the County of San Mateo to develop zoning ordinances to govern future development.

As the mapping of landslide hazards developed and included more types of landslides, the smaller and more rapid types of failures, such as debris flows began to be analyzed and their hazards quantified in map form. Increasingly abstract parameters not directly related to the topography were included in the analyses and hazard depictions. In quantifying debris-flow hazards, rainfall and rainfall intensities were often correlated with failure locations to establish rainfall thresholds for different geology and topography (Cannon and Ellen 1988). The mapping of debris-flow hazard has subsequently progressed to a current state where models for runout distance and probability of source locations have been combined with digital elevation models for automated correlation with slope gradient and cross-slope curvature to establish relative levels of hazard. Ellen and others (1992, in press) have used such a map of the city and county of Honolulu, Hawaii, together with rainfall thresholds to enable the effective planning and emergency response to debris flows.

As an example of the extensive use of statistical techniques, Carrarra and others (1991) have used discriminate analysis to apply to 40 readily obtained geological and geomorphic variables to evaluate landslide risk within the Tescio Basin in Italy. Combined with GIS software, their application allowed them to readily evaluate hazard within the basin with a subset of only 15 variables that could be correlated over a wide area.

Maps of landslides triggered during earthquakes began to be produced as individual studies where sufficient airphoto coverage could be obtained

following an earthquake and where conditions permitted distinction between pre-earthquake and earthquake-induced landslides. Harp and others (1981) constructed a 1:50,000-scale map, covering over 16,000 km^2, of landslides triggered by the 1976 Guatemala earthquake. Subsequent efforts were undertaken to describe slope stability during future earthquakes using parameters related to landslide-triggering mechanisms such as strength properties of materials, slope, existing landslide deposits, design strong-motion records for seismic input, and a dynamic analysis. Wieczorek and others (1985) used this analysis (Newmark 1965) to produce a map of slope stability in future earthquakes in San Mateo County, California, at a scale of 1:62,500.

Probabilistic studies were undertaken to describe the landslide hazard from a future earthquake in terms of probability of exceeding a theoretical threshold of shaking for triggering landslides. Wilson and Keefer (1985) used design strong-motion records, theoretical shaking thresholds, and magnitude-distance data for landslides from historic earthquakes to describe the probabilistic distance thresholds for different types of landslides during a future earthquake in southern California. Present studies continue to use data from recent earthquakes in California and Japan to define statistical limits of different types of landslides in terms of shaking thresholds and to compare these relationships to the theoretical models.

Recent studies of rock-fracture characteristics and distributions of rock falls triggered by the 1980 Mammoth Lakes, California, earthquake have produced criteria to statistically map rock-fall susceptibility of slopes in future earthquakes. These criteria have been applied to slopes in the urban corridor of the Wasatch Front near Salt Lake City, Utah, to highlight slopes of greatest relative hazard to development from seismically induced rock fall.

As populations continue to advance on steeper, more unstable slopes near many metropolitan areas, geologists and engineers will need to use increasingly sophisticated methods of instrumentation, data collection, and analysis of geological, geophysical, and geotechnical parameters that affected the stability of slopes and to devise equally innovative and effective ways to portray the hazards that arise from the juxtaposition of slopes susceptible to failure and the encroachment of urban development.

References Cited

Brabb, E.E., Pampeyan, E.H., and Bonilla, M.G. 1972. Landslide susceptibility in San Mateo County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-360, scale 1:62,500.

Cannon, Susan H., and Ellen, Stephen D. 1988. Rainfall that resulted in abundant debris-flow activity during the storm. In Ellen, Stephen D., and Wieczorek, Gerlad F., eds. Landslides, floods, and marine effects of the storm of January 3-5, 1982, in the San Francisco Bay region, California: U.S. Geological Survey Professional Paper 1434:27-33.

Carrara, A., Cardinali, M., Detti, R., Guzzetti, F., and Reichenbach, P. 1991. GIS techniques and statistical models in evaluating landslide hazard: Earth Surface Processes and Landforms, 16(5):427-445.

Ellen, Stephen D., Mark, Robert K., Cannon, Susan H., and Knifong, Donna L. 1992 (in press). Preliminary map of debris-flow hazard in the Honolulu District of Oahu, Hawaii: U.S. Geological Survey Open File Report. 40 p.

Harp, Edwin, L. Wilson, Raymond C., and Wieczorek, Gerald F. 1981. Landslides from the February 4, 1976, Guatemala earthquake: U.S. Geological Survey Professional Paper 1204-A. 35 p.

Newmark, N.M. 1965. Effects of earthquakes on dams and embankments. Geotechnique 15(2):139-160.

Wilson, R.C., and Keefer, D.K. 1985. Predicting areal limits of earthquake-induced landsliding. In: Ziony, J.E., ed., Evaluating earthquake hazards on the Los Angeles region--An earth-science perspective. U.S. Geological Survey Professional Paper 1360: 316-345.

Wieczorek, Gerald F., Wilson, Raymond C., and Harp, Edwin L. 1985. Map showing slope stability during earthquakes in San Mateo County, California. U.S. Geological Survey Miscellaneous Investigations Studies Map MI-1257-E.

ABSTRACTS OF PRESENTATIONS

Volcano Hazard Mapping--An Example from Mount Hood, Oregon

William E. Scott, David A. Johnston Cascades Volcano Observatory, U.S. Geological Survey, Vancouver, WA USA

Over the past 30 years, more than 50 maps have been produced worldwide that portray volcano hazards information. Most have focused on an individual volcano or single sector of a volcano, but others have covered larger regions. All such maps delimit zones of hazard for various types of event and some show relative degree of hazards. Hazard-zonation maps are intended to be employed in long-term land-use decisions and in siting of major engineering works, as well as for volcano-crisis response, in which land-access and evacuation issues are of critical importance. The past behavior of a volcano, typically the historical record for highly active volcanos and combined historical and Holocene records for less active volcanos, has traditionally provided the basis for forecasting future behavior and for identifying potentially hazardous areas. Some workers have also taken into account the possibility of events occurring that are unprecedented at a subject volcano, but that have occurred at similar types of volcanos in the region or elsewhere. Computer-assisted models of various types of flowage events are being developed to help identify hazardous areas, but at present, such models suffer from our poor understanding of the physical processes of lava, pyroclastic, and debris flows.

In 1980, D. R. Crandell of the U.S. Geological Survey prepared a volcano-hazard zonation map of Mount Hood, which will be used to demonstrate the techniques and rationale that are widely used in making such maps. Current research at Mount Hood by our Survey team is aimed at better understanding the evolution of the volcano and the detailed history of the recent eruptive periods, as well as providing an updated hazard assessment and detailed hazard zonation of distal valleys. In contrast to many Cascade volcanos that are isolated from population centers and major transportation routes, the flanks of Mount Hood and nearby valleys are the site of numerous small communities, resorts, and important highways.

Mount Hood has had three periods or eruptive activity during the past 15,000 yr. All have been dominated by lava-dome extrusion and pyroclastic flows and surges related to explosive or mass-wasting destruction of domes. Melting of snow and ice on the slopes of the volcano by hot pyroclastic debris has generated voluminous debris flows and floods. The steep, locally hydrothermally altered, upper flanks of the volcano have shed numerous debris avalanches. Tephra-fall deposits derived from probably minor explosive eruptions and from ash clouds of pyroclastic flows have largely been restricted to within 30 km of the volcano. Hazard zonation for future eruptions takes into account (1) the areas affected by these past events, (2) the ongoing aggradation of valleys during an eruptive period as dome growth and destruction proceeds and sediment chokes drainage basins, (3) changes in vent position, and (4) the possibility of events occurring of an unprecedented type or magnitude.

ABSTRACTS OF PRESENTATIONS

Reducing the Impacts of Natural Hazards: A Strategy for the Nation Implementation Plan for Assessing and Managing the Risks from Natural Hazards

Edward M. Gross, National Oceanic and Atmospheric Administration/National Weather Service

On July 8, 1992, the President of the United States Science Advisor released a report entitled "Reducing the Impacts of Natural Hazards: A Strategy for the Nation." Thirteen Federal agencies, each conducting various research, response, and recovery programs to address natural hazards are now coordinating the efforts around a common goal: to provide the scientific and technological bases and services to reduce fatalities, human suffering, environmental damage and economic losses caused by natural disasters.

The report outlines the details of the Federal Strategy and the projects that support it. The basic strategy calls for agencies to integrate existing programs with innovative, interagency, multidisciplinary, international approaches to disaster reduction. The release of the report ended the conceptual phase of our program. Now implementation planning begins.

During the 1990's as part of the International Decade for Natural Disaster Reduction (IDNDR), 30,000 local jurisdictions throughout the United States will have an opportunity to develop and implement a program and projects for assessing and managing their risks from floods, severe storms, landslides, wildfires, earthquakes, tsunamis, volcanic eruptions and droughts. Projects will be created from existing programs and implemented by a network of cooperating public and private sector organizations in each of 10 Federal regions of the Nation. The Federal science and disaster reduction agencies will have the important role of promoting linkages and coordination among these networks. The four primary areas of activity will include (1) prediction and warning systems, (2) assessment of risk, (3) reduction of community vulnerability, and (4) monitoring and information systems to monitor the natural hazards, learn from past disaster studies, and transfer technology.

ABSTRACTS OF PRESENTATIONS

New Technology for Observing and Forecasting Weather - Application to Hazard Warning

Edward M. Gross, National Oceanic and Atmospheric Administration/National Weather Service

The completed modernization of the United States weather system promises to greatly improve forecast and warning capabilities of the National Weather Service (NWS). Based on new technology and a greater emphasis on training and education in the sciences of meteorology and hydrology, the program is designed to provide more timely and precise severe weather and flood warning and forecasts for the Nation -- a move that will save lives and help minimize property damage.

The United States has the greatest variety of severe weather of any country in the world. In an average year, weather-related events claim the lives of several hundred Americans and damage runs in the billions of dollars.

Current obsolete technologies, however, have hindered the rapid observation, analysis and communication of information on fast-breaking smaller scale events that produce severe thunderstorms, tornadoes and flash floods. With outdated technology, too often warnings are issued only after the storm or flood has developed.

Major advances in radar, (doppler radar, mode WSR-88D) satellites (dual coverage) information processing and communications systems (advanced workstations) automated remote sensors, (Automated Surface Observing System and Profiler network) and superspeed computers are the tools of tomorrows warnings and forecasts. By the end of the decade, the NWS will operate one of the most advanced weather and flood warning and forecast systems in the world. When the new technology is in place, our citizens will receive:

- Better warnings and forecasts of hurricanes and winter storms.
- Earlier, more reliable and site specific warning of flash floods, the number-one cause of weather deaths.
- As much as thirty minute warnings of thunderstorms and tornadoes.
- Few false alarms of severe weather, resulting in heightened public confidence in the NWS weather warning services.
- Improved long-range forecasts, out to ten days.

As will be seen, the application of new observing and forecasting technology in the United States will have a major application to hazard warning.

PARTICIPANTS
Third Japan-U.S. Workshop on Natural Disaster Reduction
Corvallis, Oregon, U.S.A.
8-10 September 1992

Russell Blong
Macquarie University
School of Earth Sciences
North Ryde 2109
NSW AUSTRALIA
Tel: 61-2-805-8397
Fax: 61-2-805-8428

Cesar Carvajal
Ingeominas Observatory
Volcanology of Colombia
Avenida 12 de Octubre No. 15-47
Manizales-Caldas COLOMBIA
Tel: 57-68-843004/005
Fax: 57-68-826735

Jin Fan Duan
Department of Geosciences
Oregon State Univesity
Corvallis, OR 97331 USA
[Visiting Scientist, Chinese
Academy of Sciences, Chengdu, CHINA]
Tel: (503)750-7332
Fax: (503)750-7329

Lawrence Enomoto
U.S. Dept. of Commerce NOAA
NESDIS, International Affairs
FB4, Room 0110
Suitland and Silver Hill Rds.
Washington, D.C. 20233, USA
Tel: (301)736-4586
Fax: (301)736-5828

Shou Shan Fan
Office of Hydropower Licensing
Federal Energy Regulatory Commission
825 N. Captial Street Room 1144
Washington, D.C. 20426 USA
Tel: (202)219-2703
Fax: (202)219-0205

Peter Frenzen
Mount St. Helens National Volcanic Monument
42218 NE Yale Bridge Road
Amboy, WA 98601 USA
Tel: (206)247-5473
Fax: (206)247-5470

Gordon Grant
Forest Service
3200 SW Jefferson Way
Corvallis, OR 97331 USA
Tel: (503)750-7328
Fax: (503)750-7329

Edward Gross
Ch. Constituent Affairs, NWS, NOAA
1325 East-West Highway Rm. #18462
Silver Springs, MD 20910 USA
Tel: (301)713-0258
Fax: (301)713-0662

Richard Hagemeyer
National Weather Service
P.O. Box 50027
Honolulu, HI 96850 USA
Tel: (808)541-1641
Fax: (808)541-1678

Kazuo Hamada
National Research Institute for Earth Science
and Disaster Prevention
Tennodai 3-1, Tsukuba
Ibaraki 305 JAPAN
Tel: 81-298-51-1611
Fax: 81-298-51-1622

Edwin Harp
Denver Federal Center
U.S. Geological Survey
P.O. Box 25046 (M.S. 966)
Denver, CO 80225 USA
Tel: (303)273-8641
Fax: (303)273-8600

Akira Hasegawa
Faculty of Science, Tohoku Univ.
Aoba, Aramaki, Aoba-ku
Sendai 980 JAPAN
Tel: 81-22-223-7087
Fax: 81-22-264-3292

Grant Heiken
Los Alamos National Laboratory
EES-1, MS D462
Los Alamos, NM 98545 USA
Tel: (505)667-8477
Fax: (505)665-3286

James Hill
Department of Energy
EH-33 GTN
Washington, D.C. 20585 USA
Tel: (301)903-4508
Fax: (301)903-4725

Michio Hituma
Forecast Division
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo 100 JAPAN
Tel: 81-3-3212-8341 ext.3137
Fax: 81-3-3211-4923

Yoshiaki Ida
Earthquake Research Institute
University of Tokyo
7-3-1 Yayoi, Bunkyo-ku
Tokyo 113 JAPAN
Tel: 81-3-3812-2111
Fax: 81-3-3816-1784

Dick Iverson
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd
Vancouver, WA 98661 USA
Tel: (206)696-7772
Fax: (206)696-7866

Chris Jonientz-Trisler
Federal Emergency Management Agency
130-228th Street, SW
Bothell, WA 98021-9796 USA
Tel: (206)487-4645
Fax: (206)487-4613

Yoshiaki Kawata
Disaster Prevention Research Institute
Kyoto University
Gokasho, Uji
Kyoto 611 JAPAN
Tel: 81-774-31-8294
Fax: 81-774-31-4115

Yoshihiro Kinugasa
Geological Survey of Japan
1-3-1 Higashi, Tsukuba
Ibaraki 305 JAPAN
Tel: 81-298-87-3688
Fax: 81-298-54-3533

Yohta Kumaki
Geographic Department
Geographical Survey Institute
Kitazato 1, Tsukuba
Ibaraki 305 JAPAN
Tel: 81-298-64-111 ext.631
Fax: 81-298-64-1804

Koji Kuroiwa
Forecast Division
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku
Tokyo 100 JAPAN
Tel: 81-3-3212-8341 ext 3137
Fax: 81-3-3211-4923

George Lienkaemper
Forest Service
3200 SW Jefferson Way
Corvallis, OR 97331 USA
Tel: (503)750-7343
Fax: (503)750-7329

Peter Lipman
Branch of Igneous and Geothermal Processes
U.S. Geological Survey
345 Middlefield Road, MS-910
Menlo Park, CA 94025 USA
Tel: (415)329-5228
Fax: (415)329-5203

Josephine Malilay
Centers for Disease Control & Prevention
HHS/U.S. Public Health Service
4770 Buford Highway, NE
Atlanta, GA 30341-3724 USA
Tel: (404)488-7350
Fax: (404)488-7335

Stephen McNutt
Geophysical Institute
University of Alaska
Fairbanks, AK 99775 USA
Tel: (907)474-7131
Fax: (907_474-7290

Dennis Mileti
Department of Sociology
Colorado State University
Fort Collins, CO 80523 USA
Tel: (303)491-7347
Fax: (303)491-2191

Daniel Miller
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd
Vancouver, WA 98661 USA
Tel: (206)696-7885
Fax: (206)696-7866

Chris Newhall
Volcano Hazards and Geothermal Research
U.S. Geological Survey
905 National Center
Reston, VA 22092 USA
Tel: (703)648-6747
Fax: (703)648-6717

Hiromu Okada
Faculty of Science
Hokkaido University
59 Soubetsu Onsen, Soubetsu-cho
Hokkaido 052-01 JAPAN
Tel: 81-1427-5-3746
Fax: 81-1427-5-3705

Hiroshi Ookura
National Research Institute for Earth Science
and Disaster Prevention
Tennodai 3-1, Tsukuba
Ibaraki 305 JAPAN
Tel: 81-298-51-1611
Fax: 81-298-51-1622

Paul Kilho Park
Office of the Chief Scientist, NOAA
1825 Connecticut Ave. NW Rm. #625
Washington, D.C. 20235 USA
Tel: (202)606-4360
Fax: (202)606-4355

Tom Pierson
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd.
Vancouver, WA 98661 USA
Tel: (206)696-7693
Fax: (206)696-7866

Berta Elena Sosa Piñero
Direccion General de Proteccion Civil
Direccion de Coordinacion Regional
Abraham Gonzalez No. 48 2 Piso
Col. Juarez MEXICO, D.F. 06699
Tel: 7-52-705-43-80
Fax: 7-52-705-55-37

William Prescott
National Earthquake Hazard Reduction Program
U.S. Geological Survey
345 Middlefield Road MS/977
Menlo, Park, CA 94025 USA
Tel: (415)327-4860
Fax: (415)329-5163

Jim Riehle
U.S. Geological Survey, MS 905
Sunrise Valley Dr.
Reston, VA 22092 USA
Tel: (703)648-6709
Fax: (703)648-6717

Yoshi K. Sasaki
George Lynn Cross Research Professor
University of Oklahoma
School of Meteorology
Norman, OK 73019 USA
Tel: (405)325-2989
Fax: (405)329-6815

William Scott
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd.
Vancouver, WA 98661 USA
Tel: (206)696-7909
Fax: (206)696-7866

Kaye Shedlock
Denver Federal Center
U.S. Geological Survey
P.O. Box 25046 (M.S. 966)
Denver, CO 80225 USA
Tel: (303)273-8579
Fax: (303)273-8600

Michael Sheridan
Geology Department
University at Buffalo
Buffalo, NY 14260 USA
Tel: (716)645-6100
Fax: (716)645-3999

pg. 83
missing

Shigetsugu Uehara
National Research Institute for Earth Science
and Disaster Prevention
Tennodai 3-1, Tsukuba
Ibaraki 305 JAPAN
Tel: 81-298-51-1611
Fax: 81-298-51-1622

Richard Waitt
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd
Vancouver, WA 98661 USA
Tel: (206)696-7558
Fax: (206)696-7866

Hiroshi Wakita
Faculty of Science
University of Tokyo
7-3-1 Hongo,Bunkyo-ku
Tokyo 113 JAPAN
Tel: 81-3-3812-2111
Fax: 81-3-3816-1784

Louis Walter
National Aeronautics and Space Administration
Code 620
Goddard Space Flight Center
Greenbelt, MD 20771 USA
Tel: (301)286-2538
Fax: (301)286-3884

Rodney Weiher
Economics Group Chief
Office of the Chief Scientist, NOAA
1825 Connecticut Ave. Suite 625
Washington, D.C. 20235 USA
Tel: (202)606-4360
Fax: (202)606-4355

John Wickham
Office of the Chief Scientist, NOAA
1825 Connecticut Ave. NW Rm. #625
Washington, D.C. 20235 USA
Tel: (202)606-4364
Fax: (202)606-4355

Edward Wolfe
Cascades Volcano Observatory
U.S. Geological Survey
5400 MacArthur Blvd.
Vancouver, WA 98661 USA
Tel: (206)696-7806
Fax: (206)696-7866