INTERNATIONAL TSUNAMI INFORMATION CENTER

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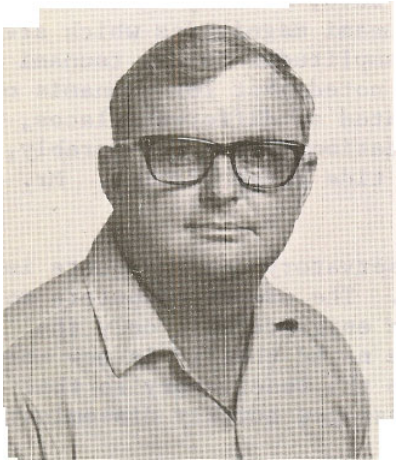


Gaylord R. Mi11ez
1931-1976

Dr. Gaylord Miller, Director of NOAA's Joint Tsunami Research Effort at the University of Hawaii and renowned tsunami research scientist, died on December 6th. In spite of recurrence of illness, Dr. Miller continued in active charge of his responsibilities until the very last.

During the past year he participated in the ITSU meetings in Lima as one of the U.S. representatives, headed the U.S. team in joint US-USSR tsunami research and deep sea instrumentation projects in the Sea of Okhotsk and at Sakhalin, and as vice-chairman of the IUGG Tsunami Committee he took one of the 1eading roles in organizing the Tsunami meetings to be held at Ensenada, Baja California, in March 1977.

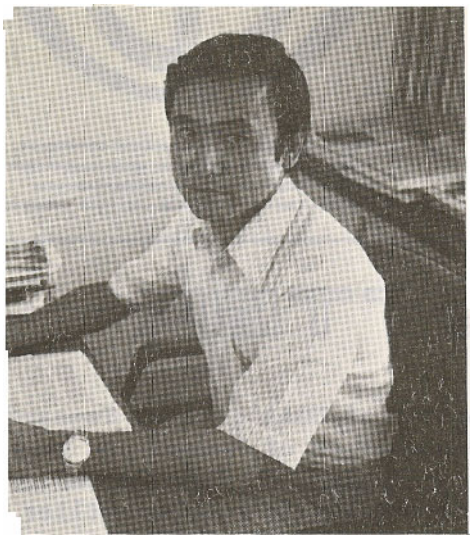
Dr. Miller was born in Santa Monica, California, in 1931. He graduated from Pomona College, and received his Ph.D. from Scripps Institute of Oceanography in 1964.

In 1965 he was appointed Director of JTRE. One of his primary concerns was the internationalization of the Tsunami Warning System, and the deve1opment of an, international exchange program of scientists working in tsunami research.

In January 1972, while retaining his JTRE responsibilities, he was appointed Director of the International Tsunami Information Center. During his year in this role he reactivated the ITIC Newsletter, and encouraged greater international participation.

In October 1976 Dr. Miller received the U.S. Department of Commerce Gold Medal, the highest award of the Department, in recognition of his outstanding leadership in the establishment of the Joint Tsunami Research Effort and the Tsunami Warning Service. The citation accompanying the award recognized him as one of the world's foremost, authorities on tsunamis. He has been at the forefront in international co-operat1ve programs with the Soviet Union and Japan and in the utilization of deep sea instrumentation to measure tsunami characteristics and ocean bottom seismic activity. Dr. Miller also has been active in educating the public in the hazards of these destructive waves, and the strategies for avoiding their effects.

Japanese Seismologist Visits ITIC



Mr. Masahiro Kishio recently departed Honolulu after spending a very productiye 6 week working visit at ITIC. Mr. Kishio, visiting ITIC under the support of the UNESCO-Intergovernmental Oceanographic Commission's visiting scientist program to ITIC, as a seismologist for the Japan Meteorological Agency, Tokyo, Japan.

While at ITIC, Mr. Kishio examined marigraphic files of tsunamis .recorded at various islands in the Central Pacific. Using the amplitudes of the initial wave motion of the tsunami as recorded at these islands, he made estimates of tsunami magnitudes. His estimates, obtained from the island data, correspond closely to Imamura's and others' tsunami magnitudes which are determined from maximum amplitudes of the tsunami near its generation. He also noted that for tsunamis of the same magnitude generated at different places, in general, the heights of the tsunami distant island stations vary considerably, depending on the tsunami source and the location of the tide gauge station. Mr. Kishio will continue this study in Japan.

Mr. Kishio also had the opportunity to tour Honolulu Observatory and was quite impressed with the automation that was taking place there. The use of computers to generate tsunami alert messages and determine earthquake epicenters is only the first step in automating the Tsunami Warning System. He noted that it is now more important than ever to speed earthquake and tide data to the Observatory so that data computation can be rapidly completed and warning messages quickly disseminated.

Seismic Seiches

(This article is reprinted from the U.S. Geological Survey's" Earthquake Information Bulletin)

Seismic seiches are standing waves setup on rivers, reservoirs, ponds, and lakes when seismic waves from an earthquake pass through the area. They are in direct contrast to tsunamis which are giant sea waves created by the sudden uplift of the sea floor.

The term seismic seiche was first coined by Anders Kvale in 1955 to describe oscillation of lake levels in Norway and England caused by the Assam earthquake of August, 1950. But this was not the first time that seismic seiches had been observed. The first published mention was after the great earthquake of November 1755 at Lisbon, Portugal. An article in Scot's Magazine in 1755 described seiches in Scotland in Loch Lomond, Loch Long, Loch Katrine and Loch Ness. They were also seen in English harbors and ponds and were originally described in the Proceedings of the Royal Society in 1755.

Earthquake effects recorded by surface-water gages were first notices by A.M. Piper of the U.S. Geological Survey (U.S.G.S.). He reported that two of six gages on the

Mokelumne River in California showed a slight fluctuation caused by the December 20, 1932 earthquake at Lodi, California. Since then many seiches resulting from earthquakes have been recorded. Kvale made a detailed study of 29 seiches recorded in fiords and lakes in Norway and four seiches on reservoirs in England, all caused by the 1950 Assam earthquake. Frank Stermitz, a USGS scientist, reported readings from 54 stream gages that recorded seiches caused by the Hebgen Lake, Mont., earthquake of 17 August, 1959. These were in Montana, Wyoming, Idaho, and Alberta, Canada -- the most distant seiche being 545 kilometres from the epicenter.

Seismic waves from the Alaska earthquake of 28 March, 1964 were so powerful that they caused water bodies to oscillate at many places in North America. Seiches were recorded at hundreds of surface-water gaging stations -- although they had rarely been reported following previous earthquakes. Indeed, four seiches were observed in Australia.

Some of the 1964 seiches were very large. Waves as high as 1.8 metres were reported on the Gulf Coast -- probably because they were generated in resonance with the seismic surface waves.

Arthur McGarr and Robert C. Vorhis studied the continental distribution of seiches produced by the Alaska earthquake. They divided the seiches into two groups -- those that occurred in Alaska itself and those that occurred outside the State.

The Alaska seiches were not wholly seismic, but were caused by landslides, submarine slides, tsunamis, and tilting -- as well as by seismic surface waves. It was therefore difficult to isolate a particular mechanism for seiches produced within this epicentral region. At teleseismic distances, greater than 1000 kilometers from the epicenter, inelastic effects are unimportant and seiches are generated solely by seismic surface waves.

After the 1964 Alaska earthquake, the southeastern part of the United States had by far the greatest density of seiches. Other high density areas included north and central New Mexico, eastern Kansas, and the region at the southern tip of Lake Michigan. The areas west of the Rockies, the Middle Atlantic States and New England experienced few or no seiches.

The 1964 distribution does not have any obvious dependence on distance or azimuth from the epicenter. But it does seem to have definite regional patterns, which reflect the influence of major geologic features:

- The density of seiches is roughly proportional to the thickness of surface sediments, for example, in the Mississippi Delta region.

- Thrust faults apparently provide a favorable environment for seiche generation. The relationship is especially clear in Georgia, near the Brevard thrust zone, in the Ouachita Mountains, and also in the Valley and Ridge province of Tennessee and Alabama.

- Seiche locations were also controlled by structural uplifts and basins -- such as the Williston and Michigan basins.

Because of the interesting results from this first really detailed analysis of seismic seiches resulting from a major earthquake, McGarr and Vorhis recommended in their

report that a network of water-level recorders be maintained throughout the United States. Such a network might be valuable in predicting from seiche data, where local amplification of surface waves, and thus an increased likelihood of damage to buildings by surface seismic waves, might be expected.

NEWS EVENTS

Earthquake Reports

During this last quarter of 1976, there was moderate earthquake activity in the Pacific as well as in other parts of the world.

Only one major earthquake occurred in the Pacific during the month of October. A remote portion of the island of New Guinea was rocked by a magnitude 6.8 earthquake on October 29. The epicenter of this earthquake was located well inland, and Honolulu Observatory determined there was no danger of a tsunami. Reports from the Center for Short Lived Phenomena listed a number of deaths from this earthquake in the remote epicentral area. An earthquake earlier this year in the same area killed over 5000 people.

The Philippine Island of Mindanao was again rocked by another moderate size earthquake of magnitude 6.8 on November 7. The earthquake took place in the Philippine Sea, approximately fifty kilometers off northeastern Mindanao. The magnitude of this earthquake was not large enough to generate a Pacific-wide tsunami.

A series of large earthquakes affected the eastern part of Turkey on November 24. The main shock, of magnitude 7.5, occurred at 1222 UTC, followed by two aftershocks of magnitude 6 and 6.2, at 1230 UTC and 1236 UTC, respectively. Initial reports listed numerous casualties with many reports from remote villages still outstanding.

A moderate earthquake of magnitude 6.3 struck the northern California area, west of Crescent City, on November 26. Honolulu Observatory reported the magnitude was not sufficient to generate a Pacific-wide tsunami. The Crescent City marigram has been checked by the U.S. National Ocean Survey and no unusual wave activity was recorded.

The last earthquake of the month occurred in northern Chile on November 30. This magnitude 7.0 earthquake prompted Honolulu Observatory to query tidal stations at La Punta, Peru, and Arica and Antofagasta, Chile, as a precautionary measure. Negative wave reports were received at Honolulu Observatory from these stations.

Kovachi Volcano Erupts

It was mistakenly reported in the last ITIC Newsletter that a volcano was erupting in the Coral Sea between Australia and New Caledonia. Mr. R.J.S. Cooke, Senior Government Volcanologist of Papua New Guinea, has kindly brought this error to the editor's attention. According to Mr. Cooke, the volcano in question is Kovachi, a submarine volcano off New Georgia in the Solomon Islands, at about 8°59'South, 175°59'East.

The National Science Event Bulletin, of SEAN, reported in its November issue that the cone height of the volcano is now 15-20 meters above sea level. Additionally, numerous earth tremors have affected Vakambo Island, near New Georgia, which could possibly be associated with Kovachi epicenters. These earth tremors have not been of tsunamigenic magnitudes.

UNESCO - IOC - ITSU

ITIC - ITSU Meeting

A meeting that will guide future activities of the International Tsunami Information Center took place in Washington D.C. on November 18 and 19, when Dr. George Pararas-Carayannis, Director of ITIC and Mr. G. C. Dohler, Chairman of ITSU met to complete a final draft of "The Mandate and Functions of ITIC." This draft was called for in one of the resolutions from the fifth meeting of ITSU, the International Coordination Group for the Tsunami Warning System in the Pacific, held in Lima, Peru, in February 1976. The draft has now been sent to the Secretary of IOC, for submission to and review by all Member States of ITSU. It is hoped to present the Mandate and Functions to the next IOC Executive Council meeting if possible, or to the 10th Session of the Assembly as stated in Resolution EC-VII.13.

Two proposals being submitted by ITIC to the United Nations Environment Programme for support were reviewed, namely; the Tsunami Preparedness Project for the South and West Pacific, and the Pilot Computer Study on Tsunami Hazard Evaluation.

ITSU programs and priorities were reviewed, and the selection of a new candidate for the post of the Associate Directorship and the funding required for that purpose were considered to have the highest priority.

The establishment of a group of experts was discussed to look into the utilization and subsequent application of satellite facilities for an overall TSUNAMI Warning System in the Pacific. ITSU will place great emphasis upon the preparation of educational material in line with the Resolution adopted at the Lima meeting.

Mr. Dohler pointed out that he requested, by letter to the Secretary of IOC to finalize the place and dates for the next ITSU meeting and it is understood that this will be done soon and all Member States will be informed accordingly.

Mr. Bertrand Thompson, National Contact for the United States, hosted this Washington meeting and he as well as Dr. Glenn Flittner and Mr. Mark Speath have taken part in the discussions.

REPORTS FROM INTERNATIONAL TSUNAMI INFORMATION CENTER - HONOLULU

Tsunami Reports

More than 50 replies have been received to date to the query sent with the September issue of the ITIC Newsletter, and regarding the format of data required for research

and requesting to be placed on the mailing list for the forthcoming series, "Tsunami Reports." Generally the responses have offered concurrence in the proposal regarding digitization of tsunami marigrams. However, specific needs have been expressed by several research scientists.

Among these are requests for microfilm storage of marigrams, a complete catalog of tsunamis in the Pacific, reference data on normal tide levels at each station, and a suggestion that the period of record collected should be extended to include the period from 25 hours before the arrival of the initial wave, to 25 hours after the sea ceases to show measurable disturbance.

Further response is invited, and readers may send requests or comments to Tsunami Reports, ITIC, P.O. Box 3830, Honolulu, Hawaii 96812.

EDITORIALS AND LETTERS

In Remembrance

On December 6, 1976, my friend, Dr. Gaylord Miller, passed away after a long and courageous fight for his life with cancer. This was a great loss to the international oceanographic community in which Gaylord had been one of its outstanding leaders. During his life, Gaylord's talent and creativity served as a source of inspiration among his many friends and colleagues. His many accomplishments need not be mentioned. They are part of the public record. It is regrettable that such a creative mind did not have the opportunity to continue its contribution to science and society.

But more than for his scientific accomplishments and contributions, Gaylord will be missed as a friend. His warm and kind personality will be remembered always by his many friends and colleagues in Hawaii and all over the world, who were fortunate enough to know him better and to work with him.

May his family find comfort in the knowledge that their great grief and feelings of loss are deeply shared by all of their friends.

George Pararas-Carayannis
Director, ITIC

The Need for Good Tsunami Measurements

The April 1, 1946 tsunami from the Aleutians struck Hawaii without warning, leaving behind widespread devastation and 150 persons dead. It was a major disaster with good photogenic and human interest possibilities which were fully exploited by the news media. The tsunami rousted Francis P. Shepard of the Scripps Institution of Oceanography from his cottage at Kamuela Bay, Oahu where he was writing his book on submarine geology. The notes for the book and the cottage itself were lost in the tsunami, but it could not have happened to a more appropriate man. Shepard, Gordon A. Macdonald of the U.S. Geological Survey, and Doak C. Cox of the Hawaiian Sugar

Planters Association realized that this was a pretty unique event, and if there were to be anything to learn scientifically from it then quantitative data would be needed. They surveyed, with level and rod, all of the islands for wave heights. The data were examined for patterns of inundation as related to offshore bathymetry and direction of arrival of the waves. Their report, "The Tsunami of April 1, 1946" which is Vol. 5, No. 6 (1950) of the Bulletin of the Scripps Institution of Oceanography is one of the finest qualitative and quantitative descriptions to date of a tsunami. More than that, their work started a tradition of careful quantitative measurement that has served Hawaii and the tsunami profession well. Doak Cox, still at the Hawaiian Sugar Planters Association, mounted surveys of the 1952, 1957, and 1960 tsunamis. Later as Director of the Joint Tsunami Research Effort, NOAA he directed a survey of the 1964 tsunami. This data base has been used over the years for numerous practical decisions about building, or not building, in flood areas. Now it is the basis for the flood hazard maps required by the Flood Insurance Act of 1968, amended in 1973. The wave measurements from 1946, 1960, and 1964 were used to calibrate the Hilo Harbor hydraulic model. The data have been used for other scientific studies of patterns of wave heights around islands and will certainly be used in the future for tsunami studies. The point of this editorial is that there is no substitute for good quantitative measurements. They must be made in the immediate aftermath of the tsunami, and they should be good. You can't anticipate all of the ways in which these numbers will be used!

Harold G. Loomis

Editorial Note

The Director and staff of ITIC would like to have this Newsletter provide a broader communication service in the world tsunami community. We are prepared to provide one or two pages per issue for editorial comment and Letters to the Editor, and we invite each of you as a reader to submit your thoughts for consideration and possible publication.

Comments may relate to any aspects of tsunamis, tsunami service, or to the Newsletter itself.

TSUNAMI WARNING SYSTEM IN THE PACIFIC

Guam and Truk Tsunami Warning System

The tide station at Apra Harbor, Guam, was destroyed during the super typhoon PAMELA on 21 May 1976. The Truk island tide gauge station recently experienced malfunction. The Pacific Tide Party of NOAA acted promptly to repair these gauges, which in addition to serving the needs of the Pacific Tsunami Warning System, they provide base tidal data for the National Ocean Survey. Lt. Dick Moore of NOAA's Pacific Tide Party made these repairs.

During the first quarter 1977, the Pacific Tide Party plans to visit the remaining domestic and some foreign stations of the Pacific Tsunami Warning System. This annual visit allows for routine maintenance of the gauges and visitation with the tide and tsunami observers.

Tsunami Detection (Najita)

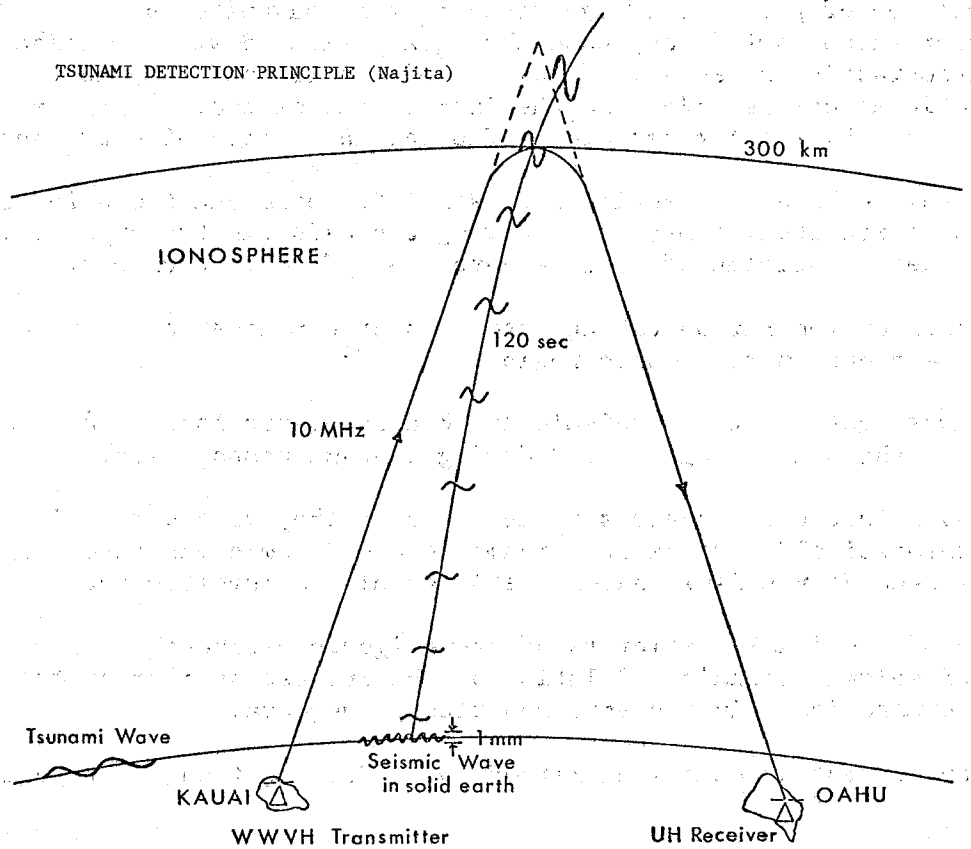
Researchers at the University of Hawaii have been developing techniques whereby the probability of a tsunami can be determined by detecting the very long-period Rayleigh waves arriving at the Hawaiian Islands from distant points of origin in the Pacific. One of the objectives of the project, funded by the National Science Foundation (NSF), is to experimentally link their system to the existing Pacific Tsunami Warning System (PTWS) to provide long-period Rayleigh wave information.

Shortly following the occurrence of the May 16, 1968 earthquake in Tokachi-Oki, Japan, the HF Doppler system operated by the Radioscience Laboratory of the University of Hawaii, detected fairly rapid oscillatory changes in the radio reflection heights in the ionosphere. These oscillations are explained in terms of upward propagating atmospheric acoustic waves generated at the surface of the earth near the sub-ionospheric point by the vertical ground movement during the passage of the Rayleigh waves from the earthquake. Similar observations were also recorded for the Kurile Island earthquake of August 11, 1969 and the Kamchatka Island earthquake of November 23, 1969.

The University of Hawaii investigators, Drs. Paul C. Yuen, Kazutoshi Najita, Augustine S. Furumoto, and Gaylord Miller have found that a very sensitive radio technique, which measures the dynamic variation in the upper atmosphere, can be used to detect and record the ionospheric changes caused by the vertical motions of the Rayleigh waves at ground level. The waves that can best be recorded are in the 50 to 200 second period waves which lie in the inversely dispersive region of the oceanic Rayleigh wave group velocity curve.

These precursor waves which spread outward from the epicenter along the surface of the earth, also couple to the air atmospheric waves which propagate upward to extreme high altitudes. Because of the exponential decrease in air density with height, the amplitude of the upward-traveling atmospheric wave increases from a very small amplitude on the surface of the earth to a very large amplitude at ionospheric heights. Radio signals transmitted upward from the ground are altered by the motion of the atmospheric wave in proportion to the amplitude and form of the wave. After reflection from the ionosphere, the disturbed radio signals are detected by sensitive receiving equipment and processed to produce a record which is a faithful reproduction of the Rayleigh wave. By analyzing its fine structure from the ionospheric record and tracing the Rayleigh wave back to the earthquake epicenter to determine the characteristics of the source, the probability that the earthquake generated a tsunami could be deduced.

A recording of the precursor Rayleigh wave made by seismographs at the ground surface would be the best for the purpose of tsunami warning. However, seismographs designed to record the long-period Rayleigh waves are either unstable and/or couple to both the horizontal and vertical components of motion. In effect the ionospheric record is another seismogram with needed filtering and amplifying processes provided by nature.



NATIONAL AND AREA REPORTS

The Second USA-USSR Meeting of Experts on Integration of Tsunami Warning Systems, 22-26 September 1976

ITIC has recently received the Record of Discussion of this meeting, held in Novosibirsk, USSR, and reported briefly in the September ITIC Newsletter. It contains several items of significance to long range improvement of warning systems, and protection of the Pacific community from tsunamis.

A new program to measure open ocean tsunamis and sea bottom seismicity is planned for 1977. Observations will begin in April 1977 with near-shore measurements in the vicinity of Hokkaido and Shikotan Islands. Free-drop and cable-operated equipment will be used to set in place instruments for measuring bottom seismicity, hydrostatic pressure, and current velocity. This work is planned as a long duration program.

Concurrently or consecutively, a 70-day open-ocean cruise is planned to commence August 1, 1977, with the 1000 ton displacement Soviet vessel Valerian Uryvaev.

On this expedition, research will be conducted in the southern Kuril Trench and northern Honshu Trench, a region of high seismicity, with USA, USSR, and Japanese instruments being deployed.

The program will be of particular significance if a tsunami should occur during the periods of observation, but in any case the data collected will contribute substantially to oceanographic and seismic knowledge of the region. Beyond this the furthering of international co-operation and the improvement of deep-ocean tsunami and seismic technology can both have a far reaching influence on Pacific-wide protection.

Scientists at this bilaterial meeting made specific recommendations for the direction of future tsunami research, aimed at improving the existing tsunami warning systems, and developing new principles of a quick detection of local tsunamis.

a) Study of tsunami generation taking into account nonlinear effects and varying depth of the ocean in the source region.

b) Further investigation of the seismic and hydroacoustic fore-runners of tsunamis generated in the source regions and during tsunami propagation.

c) Tsunami waves induce secondary seismic waves as they propagate. It is possible, at least theoretically, to deduce kinematic and dynamic parameters of tsunamis from these secondary seismic waves. This should be investigated.

d) Estimation of the focal parameters of tsunamigenic earthquakes from distant recordings of seismic signals. Solution of the inverse problem of the source parameters determination using seismic and tide gauge data.

e) Further development of numerical methods of modelling tsunami propagation and run-up.

f) Further investigation of the relationship between parameters of the seismic source and tsunami waves with the purpose of finding some features of tsunamigenity.

g) Development of a reliable statistical model of the seismic process in the Pacific active belt for classifying zones of the belt with a similar source mechanism.

h) Theoretical and experimental investigations of the background oscillations of the sea level in the tsunami frequency band.

i) Investigation of long ocean waves generated by moving atmospheric disturbances.

Reprint on Earthquake Prediction in U.S.

Earthquake Prediction: The Art Is Still on Shaky Ground -- H. Dale Langford

(This article originally appeared in the National Academy of Sciences' News Report. The editor has kindly granted permission to reprint it here.)

Desirable as it may be now for the saving of lives and property, reliable prediction of the time, magnitude, and location of earthquakes is probably 10 years into the future even for well-instrumented areas, a panel of the National Research Council

found in assessing the present state of earthquake prediction. "The apparent public impression that routine prediction of earthquakes is imminent is not warranted by the present level of scientific understanding," the panel said.

Present understanding is that various observable changes in ground behavior do foretell some earthquakes. Although the causes of these phenomena are unclear, and particular phenomena may not occur in all cases, the panel found evidence that these natural signs have enabled the successful prediction of at least some small earthquakes. Large earthquakes may pose more difficult problems of prediction for several reasons, including their relative infrequency. Because fewer have been studied, the generality of prediction techniques is not established. Nevertheless:

"... The Panel unanimously believes that reliable earthquake prediction is an achievable goal. We will probably predict an earthquake of at least magnitude 5 in California within the next five years in a scientifically sound way and with a sufficiently small space and time uncertainty to allow public acceptance and effective response. A program of routine announcement of reliable predictions may be 10 or more years away ...." Development of such a program, the panel said, depends to a great extent on the effort now directed toward that end.

These considerations, among others, led the panel to identify four areas of concern in earthquake prediction that are sufficiently urgent, in the panel's view, to require immediate attention. They are:

- The United States now should initiate a long-term program to develop an operational system of earthquake prediction.

- Progress and needs of the prediction program should be communicated directly to high offices in the Federal Government through an advisory group.

- Formal procedures should be established for evaluating earthquake predictions and advising concerned agencies and groups of their validity.

- Development of a system for earthquake prediction should be coordinated with concurrent efforts to establish a system concerned with social responses to earthquake predictions.

Chaired by Clarence R. Allen, of the California Institute of Technology, the panel conducted a technical evaluation of earthquake prediction, looking primarily at its scientific merit and promise.

Attempts to predict earthquakes follow two main methods. First is the statistical method, which employs analysis of records of the distribution, magnitude, and recurrence of earthquakes. A major limitation of this method is that it can specify the probability of earthquakes only within a relatively broad range of time and locations. Such statements of seismic risk do not permit preparation for specific earthquakes, the panel said, but are valuable in developing design criteria for earthquake-resistant structures in high-risk areas.

The second, the geophysical method, involves looking for earthquake indicators among various changes in geophysical conditions that precede earthquakes. Some of these changes are land uplift and tilt, variations in the concentration of radon in ground water, anomalous magnetic fields and electrical resistivity, changes in the relative

abundance of large and small earthquakes, and variations in the ratio between seismic compressional and shear-wave velocities.

"As yet, only the roughest of linkages exist between the models of precursory phenomena and observations of them in the field. Furthermore, no satisfactory models yet exist for determining the extent to which a given fault will tear, once rupture has been initiated, and hence for estimating the probable magnitude of an earthquake. However, the empirical data suggest that the magnitude of an earthquake may be predetermined by the extent of the physically anomalous zone and the duration of the anomalous episode."

The panel stressed the need in present U.S. earthquake-prediction efforts for improving field projects aimed at detecting and interpreting earthquake precursors. The People's Republic of China, the U.S.S.R., and Japan are several years ahead of the United States in conducting such field observations, the panel said. Field observation in the United States is concentrated in California, and even there some important measurements are not made because of inadequate funding.

Lynn R. Sykes, of Columbia University, who was a member of a U.S. seismology delegation to the People's Republic of China in 1974, prepared as an appendix to the panel report a review of earthquake-prediction research outside the United States. Of the Chinese program, he said:

"The very high level of seismic activity and the relative accessibility of many of the active regions of China to monitoring (the most active zone for earthquakes affecting the United States, by comparison, is located almost entirely offshore, along the Aleutian trench) are two factors that have led to the rapid accumulation of precursory data and can be expected to remain important for prediction of large earthquakes in China in the future. A wide variety of precursory phenomena -- the existence of which have been reported previously in Japan, the U.S.S.R. and the United States -- are being studied in China, largely empirically. Relatively little effort appears to have been made thus far in designing field or laboratory experiments around theories or models, such as the dilatancy/fluid-diffusion hypothesis....

"Particularly at the provincial and county levels, where a great amount of the monitoring and data analysis is now being done, attempts are being made to use a variety of anomalies to predict earthquakes routinely. In addition to the February 4, 1975, earthquake, Chinese scientists claim to have predicted several other earthquakes successfully. They emphasize, however, that they have failed in some other predictions, that they have not estimated the time, place, or size very accurately in still others, and that they have made some predictions that turned out to be false alarms."

Looking to the future of earthquake prediction in the United States, the panel warned of "unavoidable errors and false alarms." "The public must be made aware of this prospect, and the development of any procedure to issue warnings must accommodate it," the panel said. "Even the ultimate system probably will not be infallible."

ABSTRACTS AND RESUMES

Predicting Earthquakes: A Scientific and Technical Evaluation -- with Implications for Society.

Panel on Earthquake Prediction
Committee on Seismology
Assembly of Mathematical and Physical Sciences
National Research Council

(National Academy of Sciences, 1976; 62 pp.; ISBN 0-309-02527-3; $5.25).

A report by the Panel on Earthquake Prediction of the Committee on Seismology, Assembly of Mathematical and Physical Sciences, National Research Council has been completed. Support for the work of the panel was provided by the Advanced Research Projects Agency, National Science Foundation, U.S. Geological Survey, National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, U.S. Nuclear Regulatory Agency, and the U.S. Energy Research and Development Administration.

ANNOUNCEMENTS

IUGG Tsunami Meeting March 23-27, 1976

Further information on the Tsunami Research meeting reported in the September Newsletter, has been received in a letter from Professor S.L. Soloviev, Chairman of the Tsunami Committee of IUGG.

"I wish to bring to your attention that a symposium on tsunami research convened by the Tsunami Committee of the International Union of Geodesy and Geophysics will be held during 23-26 March 1977 in Ensenada, Baja California, Mexico, on the invitation of Dr. S.A. Borrego, General Director, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada, B.C., ave. Gastelum No. 898, Ensenada, Baja California, Mexico. The following four sessions are planned:

1. Seismicity in the Pacific Ocean and tsunami generation processes

2. Tsunami propagation in open ocean

3. Tsunami run-up and destructive effects of the waves

4. Observation means for tsunamis and their concurrent phenomena, tsunami warning system, tsunami zonation.

The previous symposia, in particular, those convened by the Tsunami Committee in Honolulu, USA, 1969 (W.M. Adams, ed., Tsunamis in the Pacific Ocean, East-West Center Press, Honolulu, 1970), in Moscow, USSR, 1971 (S.L. Soloviev, V.M. Kaistrenko, ed., Tsunami, Yuzhno-Sakhalinsk, 1973), in Wellington, New Zealand, 1974 (Proceedings due to be published in 1976), and others were successful and contributed to the development of research on the tsunami problem in many countries. By our joint effort we can make the forthcoming symposium not less interesting and fruitful."

Abstracts of papers offered for presentation should be submitted as soon as possible to:

Dr. S. L. Soloviev
Chairman, IUGG, Tsunami Committee
Sakhalin Complex Scientific Research Institute
Novoalexandrovsk
Sakhalin 694050, USSR

Dr. T. S. Murty
Secretary, IUGG, Tsunami Committee
Marine Environment Data Service
Department of Environment
580 Booth St.
Ottawa, Canada

HONOLULU OBSERVATORY REPORTS

Geophysicist in Charge of the Honolulu Observatory Retires

Mr. Herman J. Wirz, Jr., in charge of programs and operations assigned to the Honolulu Observatory and the Tsunami Warning System is retiring on December 17.

Mr. Wirz's U.S. government career began in March 1961 when he established and subsequently directed the Albuquerque Seismological Center. Following this assignment, he transferred to Seattle, Washington, where he helped establish the New Seismic Sea Wave Warning System (now the Tsunami Warning System) in Alaska and the Northwestern United States. This included construction of two Observatories in Alaska and one in Newport, Washington, and intergrating the various seismic and tide gauge facilities into a system by an elaborate telemetering and communication network. Mr. Wirz then moved to Honolulu where he accepted the position as Geophysicist in Charge of the Honolulu Observatory. In 1970, Mr, Wirz and the observatory staff received a Special Group Achievement Award for superior on-the-job performance. Previous to his U.S. Government service, he worked for 26 continuous years as a geophysicist for Standard Oil Company, New Jersey.

Mr. Wirz was born in Okmulgee, Okla. He attended high school in Beggs, Okla.(1925-29) and Oklahoma University, where he received a degree in civil and geological engineering in 1934. He is married to the former Dorothy G. Armstrong, of Oklahoma City. Mr. Wirz and his wife plan to retire in San Diego, California.

Seismic Summary (October 1, 1976 to Press-time)

Date and Origin Time (UTC)	Epicenter	Magnitude	Region	Comments
Oct 29 0251 UTC	4.2 S 139.8 E	6.8	West Irian, Indonesia	Press Release

Date and Origin Time (UTC)	Epicenter	Magnitude	Region	Comments
Nov 7 1709 UTC	9.1 N 126.4 E	6.8	Mindanao, Philippines	Press Release Three tide stations queried, negative disturbance reported
Nov 18 0324 UTC	9. S 156. E	6.4	Solomon Is.	--
Nov 26 1119 UTC	41.5 N 124.9 W	6.3	Northern Coast of California	Press Release
Nov 30 0040 UTC	21.3 S 66.9 W	7.0	Northern Chile	Press Release Three tide stations queried, negative disturbance reported.

THE STAFF OF

THE INTERNATIONAL TSUNAMI INFORMATION CENTER

WISHES ALL

A HAPPY HOLIDAY SEASON

AND

A PROSPEROUS NEW YEAR