INTERNATIONAL TSUNAMI WARNING SYSTEM

SUMMARY OF ROUND TABLE DISCUSSION
ON AN INTERNATIONAL TSUNAMI WARNING SYSTEM

29 August 1961

Doak C. Cox, Substitute Convener

The following were present at the round table discussion on an international tsunami warning system:

Leslie Bailey	R. E. Houtz	Robert Wiegel
J. W. Brodie	C. W. Shipman	Bernard D. Zetler
Doak C. Cox	Ryutaro Takahasi	Kiyoo Wadati
	Augustine S. Furumoto	

In the absence of the announced convener, Mr. D. C. Cox called the meeting to order at about 20:00.

Mr. Zetler and Mr. Bailey discussed the operation of the United States Seismic Sea Wave Warning System. This system, centered at the Honolulu Magnetic Observatory at Ewa Beach, Oahu, Hawaii, was organized and is operated practically without special funds as an adjunct to the regular seismic and magnetic monitoring work at the Observatory. It relies on ties with seismographic and tide stations, scattered in and around the Pacific, through a communications network, composed of the most nearly fool-proof components available, tested at frequent intervals by dummy messages. Warnings are provided not only to U. S. areas but also foreign areas which supply seismographic information.

Dr. Takahasi suggested that UNESCO might be interested in organizing an international tsunami warning system, and there was a discussion of agencies under UNESCO which conceivably might undertake the job.

Mr. Cox considered that a very considerable degree of local autonomy would have to be preserved in areas like Japan and the Kuriles-Kamchatka because of the stringent limitations on time available for warnings of locally generated tsunamis. He thought that the most desirable form of internationalization would consist of greatly strengthened ties between national warning systems, particularly the U. S., the Japanese, and the Russian systems, but with the possible addition of such other national systems as might be established in the future, and with the provision of warnings to such nations not having internal systems as might desire them. He discussed the tsunami warning system of the Kuriles and Kamchatka as described in recent Russian journals.

Following a discussion of the differences in organization of the various tsunami warning systems, Dr. Wadati described the organization of the Japanese tsunami warning system, a part of the Japan Meteorological Agency. The service of a "meteorological agency" as a general geophysical agency is common practice in Asian countries. In the U. S., however, the Weather Bureau has no responsibilities in the area of seismology or tsunamis.

The talk then turned to communication systems. The advantages of the meteorological communication system of the world were mentioned. The U. S. Coast and Geodetic Survey representatives indicated that the Seismic Sea Wave Warning System has not in general used this system, relying instead on whatever communication links seemed best locally, but they said that consideration of alternate communication systems could be made at any time.

The U. S. Coast Survey representatives asked whether any other data could usefully be provided from the Seismic Sea Wave Warning System to Japan, and indicated that they would like to have sea-level data from one or two key Japanese tide stations fed into the Seismic Sea Wave Warning System. The Tokyo tide station was discussed as a possibility. Dr. Takahasi mentioned the administrative ease with which the Tokyo tide gage could be included. Mr. Zetler indicated that a tsunami travel-time chart would have to be provided for any station, such as Tokyo, that was added. He discussed the kind of chart required -- one having lines of equal travel time necessary for long-wave fronts to arrive at the tide station, rather than one showing equal travel time for long-wave fronts spreading out from a source. Mr. Cox questioned whether the Tokyo station was really a very good one. Telemetry facilities there are excellent because of its

importance as a storm-surge station, but the remoteness of the Tokyo station from the ocean limits its utility for early tsunami warning purposes. Other stations on the east coast of Japan would be superior, and even if communications are not as excellent, they are quite good enough for distance tsunami warnings. Mr. Zetler suggested that direct communications between HMO and the Japanese tide stations selected would have to be set up, but Mr. Cox suggested that communication via the JMA headquarters would be more efficient. There was a lengthy general conversation on the relative advantages of various stations and communications means, with the eventual decision that three Japanese tide stations ought to be added to the Seismic Sea Wave Warning System.

Discussion continued on travel-time charts. Mr. Zetler indicated that the first C. and G. S. charts had been drawn primarily for the purpose of warning Hawaii and were, therefore, restricted to those stations of the Pacific which tsunamis were likely to reach before reaching Hawaii. A more general set of charts is now being prepared. The problems of arranging for the preparation of travel-time charts for tide stations in countries lacking the required technical staff for their preparation were discussed. Inquiries were made as to the possible assistance of the East-West Center at the University of Hawaii. Mr. Cox said this possibility was worth exploring, and, in response to questions, discussed the nature of the East-West Center.

Dr. Brodie then discussed the needs of New Zealand, which can well rely on outlying islands for warnings of the approach of tsunami waves, but would benefit by information on the occurrence and epicentral locations of large earthquakes. New Zealand would appreciate having this information from HMO, but would not like the HMO to take the responsibility of calculating arrival times. It was mentioned that both Fiji and Apia send seismic data to the HMO. Mr. Zetler and Dr. Brodie discussed the kind of message that should, in this case, be sent from HMO, and Mr. Zetler agreed that it would probably be possible for the HMO to undertake to provide such messages. Mr. Zetler asked whether the communication from HMO to New Zealand should be via Nandi or by some other route. This question was not settled. The provision of tide data from New Zealand to the HMO was then discussed, Dr. Brodie indicating that none of the five stations that might contribute data had continuous watch.

Apia now provides seismic information but not necessarily tide information. Mr. Zetler mentioned the fact that Apia was not far from Pago Pago and Suva. Mr. Cox indicated the advantages of the Apia gage in being operated by a geophysical establishment, but said that the gage location could be much improved. The relations between New Zealand at stations operated by it and the Seismic Sea Wave Warning System were left pending formal requests from New Zealand for inclusion in some manner.

The discussion then returned to the construction of travel-time charts. Mr. Zetler discussed the development of the Coast and Geodetic Survey type of travel-time charts, constructed by computing elapsed time along rays initially assumed to be great circles, then corrected for the effects of greater depths on adjacent paths. In an initial study based on the historical tide-gage records of tsunamis at Honolulu and Hilo, the average error in travel time was 2.3%. The major source of error now appears to be the bathymetry. Dr. Takahasi described the Japanese system of drawing refraction diagrams, and discussed the errors indicated by laboratory experiments in using the ordinary long-wave velocity formula close to the source, errors which become insignificant beyond about 15 wave lengths. Mr. Zetler pointed out the errors noted in 1957 arising from considering the source a point at the earthquake epicenter instead of the probably more realistic elongate zone. The calculation by Frank Press of a length of 700 miles for the 1960 Chile fault was recalled.

The discussion then returned to some of the problems of international warnings of tsunamis. The question was raised whether data would be sent from the Russian tsunami warning center for Kamchatka and the Kuriles to the Japanese warning center in case of a Kamchatka tsunami, or whether Japanese data would be sent to Kamchatka in the case of Japanese tsunamis. Such exchanges do not now seem to be formalized. The provision of firm bilateral agreements providing such exchanges between national tsunami warning centers, where these do not exist, seemed to constitute naturally the next and very important step in creating an international warning system. Obviously, however, every tsunami warning service in the Pacific will be vitally concerned with all tsunamis, no matter which tsunami warning center is in a position to report them first.

There followed a discussion of the recommendations regarding tsunamis adopted at the 1960 IUGG meetings in Helsinki, which led to the formulation of resolutions later recommended by the Section of Geophysical Sciences of the Tenth Pacific Science Congress, and finally adopted by the Congress itself.