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A LIST OF SEISMOLOGIC STATIONS OF THE WORLD

Compiled under the auspices of the
Section of Seismology of the American Geophysical Union
with the cooperation and assistance of the Research Information Service
National Research Council, United States of America

By Harry O. Wood
Secretary, American Geophysical Union

INTRODUCTION

Because of inquiries and recognition of the need for a revised list of the seismologic stations of the world, the present compilation was undertaken, under the auspices of the Section of Seismology of the American Geophysical Union and with the cooperation of the Research Information Service of the National Research Council of the United States of America.

Under date of March 20, 1920, the following questionnaire, accompanied by the following explanatory letter asking the cooperation of seismologists in the assembly of the necessary data, was sent to every address where a seismograph was known or thought to have been installed or projected (except in a very few cases where former stations were definitely known to have been discontinued). In assembling the list of addresses to which the inquiry was sent the compiler received substantial assistance from Professor H. F. Reid, Professor W. J. Humphreys, and Rev. F. A. Tondorf, S.J., to whom thanks and acknowledgments are tendered.

NATIONAL RESEARCH COUNCIL OF THE UNITED STATES OF AMERICA

RESEARCH INFORMATION SERVICE

DATA FOR LIST OF SEISMOLOGIC STATIONS

Please send information concerning seismologic stations to the Secretary of the American Geophysical Union, Research Information Service, National Research Council, Washington, D. C., U. S. A.

STATION
- Name ----------
- Location, with Lat. and Long. ----------
- Altitude above sea ----------
- Lithologic foundation ----------
- Date of inauguration ----------
- *Postal address* ----------

DIRECTOR
- Title ----------
- Name ----------
- Term of office, if limited ----------
- Postal address ----------

SUPPORTING INSTITUTION (university, observatory, or bureau of government)
- Name ----------
- Title of chief officer ----------
- Name ----------
- Term of office, if limited ----------
- Postal address ----------

EQUIPMENT—Seismometers, etc., give *types, components,* and *constants* of each

TIME-SERVICE—Give equipment, chronographic system employed, and the *accuracy obtained.*

AUXILIARY APPARATUS—Describe briefly, but give sufficient details.

A new list of seismological stations throughout the world is now an urgent need. No general list has been published since the outbreak of the world war in 1914.

Since then international seismological service has been interrupted, certain domestic services have been disrupted, and sweeping changes in personnel have occurred. Also some new stations have been established, and changes in equipment have been made.

The need for a new list is emphasized by requests for information received recently by the Secretary of the American Geophysical Union, which is the American "National Committee" of the International Geodetic and Geophysical Union established in affiliation with the International Research Council at the international scientific conference held at Brussels in July, 1919.

It therefore seems a fitting task for the Section on Seismology of the American Geophysical Union to initiate inquiries and to undertake the preparation of such a list. In this the Section seeks to cooperate with and to avail itself of the assistance of the Research Information Service established by the National Research Council of the United States to serve as a general bureau of information for scientific and industrial research.

The Research Information Service has many functions to perform, among them the maintenance of catalogs of information affecting progress in research. A list of the seismological stations of the world giving the location and usual constants of the station and its equipment, its personnel, and its institutional foundation is an especially appropriate body of information for this Service to maintain in its files.

Therefore the officers of the American Geophysical Union and its Section of Seismology, and of the Research Information Service, earnestly request that the information indicated on the enclosed questionnaire be sent at your early convenience to the Research Information Service, National Research Council, Washington, D. C., U. S. A.

The value of a list of seismological stations will depend upon its completeness and accuracy. It should be assembled and prepared for publication at an early date.

Assuring you of our great appreciation of your prompt and hearty cooperation in this inquiry,

Yours very truly,
(*Signed*) ROBERT M. YERKES

Robert M. Yerkes, Chairman, Research Information Service
William Bowie, Chairman, American Geophysical Union
Harry Fielding Reid, Chairman, Section of Seismology
Harry O. Wood, Secretary, American Geophysical Union

A second letter was mailed in November, 1920, to those stations which had failed to reply to the first. On the whole the response to this inquiry has been very gratifying indeed, although to date no replies have been received from many of the stations addressed. There are several reasons which may account for this. A considerable number of letters of both mailings have been returned undelivered by the postal services, either because the stations had been discontinued or had never been established, or because of the disorganized status of postal communication in or with certain countries; and perhaps in some instances because of uncertain or inadequate address. It is probable, too, that a small percentage of the letters of both mailings neither reached their destinations nor were returned undelivered. It seems certain, also, that some of the letters were properly delivered but that, for one reason or another, no reply has been received in return. It is known that some early replies went astray. However, except for a neglect to answer on the part of some stations, doubtless due to oversight in most cases, the inquiry has met with cordial support, and many appreciative letters have been received containing suggestions for improvement which are incorporated in a second inquiry which is initiated here with the publication of this list. The publication of a revised list as early as is practicable is intended.

In only two or three cases has the information requested been definitely refused. Each refusal was a consequence of the nationality of the Director of the station. In two cases the refusal was based on the fact that the nation of the writer was not admitted to the International Research Council with which the National

Research Council of the United States is affiliated. In these cases the information desired had to be supplied, so far as possible, from other sources.

Replies have been received covering approximately two hundred and twenty-five stations now in operation and several other projected stations or former stations temporarily discontinued, somewhat less than two hundred and fifty in all. In many cases the data returned are not as complete or specific as is to be desired. It is hoped that the second inquiry, here initiated, will remedy these defects. In the case of these stations, however, the data printed may be considered up to date and authentic, errors of publication excepted.

More than one hundred stations marked in this list with an asterisk (*) are described on the basis of older data, since no replies have been received from these places. For almost all of these the data for the descriptions have been furnished from his own files by Professor Harry Fielding Reid of the Johns Hopkins University, Chairman of the Section of Seismology of the American Geophysical Union. Additional information has been contributed by Professor J. B. Woodworth of Harvard University, and by the Rev. F. A. Tondorf, S.J., of Georgetown University, and in isolated instances by several others.

Beyond mere mention, or simply an address, no information has been obtained regarding stations supposed to be maintained at Dawson, Yukon District, Canada; Frameries, Belgium; Universidad Nacional de Habana, Havana, Cuba; Idria, Jugoslavia; Kinda, Katanga, Belgian Congo; Monteleone-Calabro, Italy; San José, Costa Rica; Collége du Sacré Coeur, Smyrna, Asia Minor; and Szeged, Hungary.

Mexico

The Servicio Seismológico Nacional de Mexico of the Instituto Geológico y del Servicio Seismológico is under the direction of Ing. Leopoldo Salazar Salinas, Director; Ing. Heriberto Camacho, Jefe de la Sección de Seismología; and Manuel Muñez Lumbier, Inspector del Servicio Seismológico.

The operation of seismologic stations at Guadalajara, and at Monterrey will be renewed in a short time. Later, stations will be installed at Morelia, Colina, and Salina Cruz.

Roumania

For the time being the stations in Roumania, and the territory annexed as a result of the war, are out of commission because of the war and the disturbed conditions which have followed it. This service is to be re-established as promptly as circumstances will allow.

At the present time there still exists some uncertainty concerning the stable political boundaries of some of the states which have arisen out of the re-adjustments resulting from the war. At the date of writing Harpoot, Armenia, remains in Turkish territory; and in what was formerly Russian territory in the Caucasus region the stations at Achalkalaki, Batum, Boržom, and Tiflis are now within the boundaries of the republic of Georgia, and those at Baku, Balakhany, and Šemakha are in the republic of Azerbaijan.

In the list the stations have been arranged in the alphabetical order of the places where they are located. A few cross-references have been inserted to facilitate the use of the list.

In preparing the information for printing it was found advisable to depart from the form of the questionnaire sent out, and to state the data in simple English phrases.

Every reasonable effort has been made to minimize error. Nevertheless, under all the circumstances, in dealing with over two hundred responses written, in many cases with the pen, in several different languages with somewhat different notation and symbols and filled out with different degrees of completeness,—together with more than one hundred descriptions based on data several years old in most instances—it is obvious that the list must contain many errors, and that it is sadly incomplete. This practically necessitates the publication of a revised and corrected list at an early date. This revised list should also be improved in accordance with requests and suggestions received. To facilitate this a second, modified form of questionnaire has been prepared. A copy of this is enclosed with each copy of the list.

It is requested that, upon receipt of the list and the accompanying questionnaire, in all cases where it is necessary or desirable to communicate information in addition to or in correction of that published, these revised questionnaires be filled out as completely and precisely as possible and returned at an early time to the designated address.

All into whose hands this list comes are earnestly requested to bring to our attention any errors or omissions of any kind affecting it. Suggestions will be welcomed. These should be submitted by letter at an early date. The whole seismologic fraternity is urged to cooperate in making the revised edition complete and accurate.

The compiler wishes here to express his sincere appreciation of the cordial reception which has been accorded to this effort, and to tender his thanks to all who have so generously assisted in the assembly and preparation of the materials of this list. To Professor Reid, Chairman of the Section of Seismology of the American Geophysical Union, whose contribution to the work has been coordinate with his own, the compiler wishes especially to make grateful acknowledgment.

14 April, 1921.
National Research Council,
Washington, D. C.

AACHEN, GERMANY

Erdbebenstation der Technischen Hochschule Aachen, inaugurated in 1908.

Prof. Dr. P. Wilski, Director.

Markscheide-Institut.

Postal address: Erdbebenstation der Technischen Hochschule, Aachen, Deutschland.

$\varphi = 50°46'49.25''$ N., $\lambda = 6°29'05.7''$ E., h = 179 m.

Lithologic foundation: firm sandstone.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.

Constants:		V	T_o	ϵ	r/T_o^2
	N,	215	12.0^s	5.5	0.0010
	E,	200	12.6	7.0	0.0013

Wiechert horizontal pendulum, phot. registr., mass 80 kg., three comp. N, E and Z.

Constants:		V	T_o	ϵ	r/T_o^2
	N,	105	15.6^s	4.8	0.0002
	E,	105	16.4	5.0	0.0002
	Z,	69	4.5	3.7	0.05

Time service: time is kept and marked by excellent contact clocks (Riefler, and Strasser und Rohde). Time comparisons made by tele-

graphic signals from the Hamburg Astronomical Observatory. Time determinations are accurate to ±0.1 sec.

ABISKO, SWEDEN

Abisko Geofysiska Observatorium, seismologic service inaugurated December 1, 1912.
Dr. Bruno Rolf, Director (since May, 1915).
Bror Hedemo, Observer.
Komitén för den Naturvetenskapliga Stationen i Vassijaure.

Postal address: Abisko Geofysiska Observatorium, Abisko, Sweden, or Meteorological Bureau, Stockholm 2, Sweden.

$\varphi = 68°20.5'$ N., $\lambda = 18°49.3'$ E., h = 385 m.

Lithologic foundation: concrete block on very hard morainic material, a layer 5 m. thick, on slate or schist (Abisko schist).

Equipment: Wiechert inverted pendulum, mass 130 kg., N comp.
Constants: V = 80, $T_o = 9$ sec., $\epsilon = 5$, 10 mm. = 1 minute.
(Installed at Vassijaure in October, 1906, and transferred thence to Abisko in June, 1915.)
Galitzin horizontal pendulum, galvanometric-photographic registr., mass 7.5 kg., two comp. N and E.
Constants: V = 1,100, A = 1.274 m., T = 11.9 sec., μ^2 = ca. +0.06, 24 mm. = 1 minute.

Time service: contact pendulum clock re-set, or freshly started, once each week by telegraphic signal from Stockholm; time comparisons daily by radiotelegraphic signals from Nauen, and, in winter, from the Eiffel tower; accuracy 1 sec. or better.

*ACCRA, GOLD COAST, AFRICA

Seismologic Station[1], inaugurated in 1912 (?).
Comm. Brit. Ass. Adv. Sci.
$\varphi = 5°32'$ N., $\lambda = 0°12'$ W.
Equipment: Milne seismograph, E comp.

[1]Our information leaves a doubt as to whether this station has ever been in operation.

*ACHALKALAKI, CAUCASUS, RUSSIA

Seismologic Station, of the second class, of the Russian Service.
$\varphi = 41°25'$ N., $\lambda = 43°29'09''$ E.
Equipment: Bosch-Omori horizontal pendulum, two comp.

*ADVENT BAY (EBELTOFTHAFEN ?), SPITZBERGEN[1]

Seismological Station, functioned from October 27, 1911, to June 18, 1912.

Dr. G. Rempp, Director.

$\varphi = 78°13'$ N., $\lambda = 15°36'$ E.

Equipment: Mainka horizontal pendulum, N comp.

Constants: V = ca. 80, T_o = ca. 6 sec.

[1]Cf. Beit. z. Geophysik, XIII, Kl. Mitth. 100-120.

AGRAM, see ZAGREB

*AIGION, GREECE

Seismologic Station.

φ = ca. 38°14′ N., λ = ca. 22°00′ E.

Equipment: Agamennone seismograph.

AKITA, JAPAN

Meteorological Observatory, seismologic service inaugurated in July, 1914.

K. Funayama, Director.

Supported by the local prefecture.

Postal address: Akita Meteorological Observatory, Akita, Japan.

$\varphi = 39°41'$ N., $\lambda = 140°06'$ E., h = 60 m.

Lithologic foundation: soft river-side ground.

Equipment: Imamura horizontal pendulum seismograph, two comp. N and E.

Constants: N, V = 2, T_o = 8 sec.; E, V = 2, T_o = 9 sec.

Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: N, V = 50, T_o = 4 sec.; E, V = 50, T_o = 4 sec.

Time service: time comparisons obtained daily by radio-telegraphic signals from the Tokyo Astronomical Observatory.

ALGER-BOUZARÉAH, ALGERIA

Observatoire d'Alger-Bouzaréah, seismologic service inaugurated in 1911.

Prof. F. Gonnessiat, Director.

Observatoire de l'Université.

Postal address: Station sismique, Observatoire d'Alger-Bouzaréah, Algérie.

$\varphi = 36°48'$ N., $\lambda = 3°02'$ E., h = 332 m.

Lithologic foundation: crystalline schists and metamorphic limestones, density 2.8 to 3.0, (Archæan massif).

Equipment: Bosch-Mainka seismograph, mass 400 kg., two comp.

Time service: time is determined by the observatory by meridian transit observations.

ALICANTE, SPAIN

Estación Sismológica de Alicante, inaugurated in July, 1914.
D. Juan Garcia de Lomas, Ingeniero Geógrafo, Director.
Instituto Geográfico y Estadístico.

Postal address: Ingeniero Jefe de la Estación Sismológica de Alicante, España.

$\varphi = 38°20'44''$ N., $\lambda = 0°28'58.5''$ W., h = 35 m.

Lithologic foundation: marls (Lower Cretaceous).

Equipment:	and	Constants:	Mass	V	T_o	r/T_o^2	m. per hour
Bosch-Omori seismograph,	N	comp.	25 kg.	21	17.0	0.006	0.9
Bosch-Omori "	E	"	25 "	21	16.0	0.010	0.9
Vicentini "	N	"	100 "	68	2.4	0.008	0.6
" "	E	"	100 "	68	2.4	0.008	0.6
" "	Z	"	50 "	110	0.8	0.020	0.6

Time service: time is kept and minute time marks are made electromagnetically by a Bosch contact clock compared by radiotelegraphic signals from the Eiffel tower.

ALMERIA, SPAIN

Estación Sismológica de Almería, inaugurated July 1, 1911.
D. Eduardo Torallas Tondo, Ingeniero Geógrafo, Director.
Instituto Geográfico y Estadístico.

Postal address: Estación Sismológica de Almería, España.

$\varphi = 36°49'36''$ N., $\lambda = 1°13'19.9''$ E., h = 65 m.

Lithologic foundation: calcareous rock.

Equipment:	and	constants:	Mass	V	T_o
Bosch-Omori seismograph,	*N*	*comp.*	*25 kg.*	*15.2*	*13.3*
" "	E	"	25 "	14.2	13.8
Vicentini "	N	"	100 "	83	2.44
" "	E	"	100 "	85	2.44
" "	Z	"	50 "	120	0.82

An Agamennone seismoscope.

Time service: time comparisons by radiotelegraphic signals from the Eiffel tower.

AMBULONG, TANAUAN, (BATANGAS) PHILIPPINE ISLANDS

Seismologic Station, inaugurated in July, 1912.
Gregorio Peralta, Observer.
Weather Bureau, Philippine Islands.

Postal address: Seismologic Station, Ambulong, Tanauan, Batangas, P. I., or Manila Observatory, Manila, P. I.

$\varphi = 14°07'$ N., $\lambda = 121°04'$ E., h = 10.5 m.

Lithologic foundation: water-laid tuff, agglomerate, etc.

Equipment: Vicentini system, Padova type. Agamennone strong-motion seismograph.

Time service: time comparisons by daily telegraphic signals, no chronograph.

ANDALGALA, ARGENTINA

Seismologic Station, inaugurated in August, 1916 (1910).
Dr. Max Schmidt, Observer.

Oficina Meteorológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi = 27°35'41''$ S., $\lambda = 66°19'$ W., h = 1072.43 m.

Lithologic foundation: volcanic, (granitic).

Equipment: Milne seismograph, two comp. N and E.
Constants: $T_o = 17$ sec.; N, 1 mm. displacement $= 0.59''$,
E, 1 mm. " $= 0.51''$.

Time service: light eclipsed once each hour; marks checked four or five times a day with a chronometer compared once or twice a week by telegraphic signals sent to local post-office. "Accuracy not very great." Sun dial, with graphic correction curve, reading approximately to 1 to 5 seconds.

ANN ARBOR, MICHIGAN

Astronomical Observatory, seismologic service inaugurated in 1909.
Prof. William J. Hussey, Director.
University of Michigan.

Postal address: Seismological Station, Astronomical Observatory, University of Michigan, Ann Arbor, Michigan.

$\varphi = 42°16'48.7''$ N., $\lambda = 83°34'36.4''$ W., h = ca. 282 m.

Lithologic foundation: glacial drift.

Equipment:

Bosch-Omori seismograph, mass 100 kg., two comp.

Wiechert inverted pendulum, mass 100 kg., two comp.

" vertical-motion seismograph.

Time service: time is kept by a sidereal clock; time comparisons are made by meridian circle observations; time is obtained from the clock by a chronograph.

AOMORI, JAPAN

Meteorological Observatory, seismologic service inaugurated in November, 1912.

S. Kimura, Director.

Supported by the local prefecture.

Postal address: Aomori Meteorological Observatory, Aomori, Japan.

$\varphi = 40°50'$ N., $\lambda = 140°45'$ E., h = 3.3 m.

Lithologic foundation: sandy ground.

Equipment: Imamura horizontal pendulum seismograph, two comp. N and E.

Constants: N, V = 2, $T_o = 6.4$ sec.; E, V = 2, $T_o = 5.8$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

APIA, SAMOA

Samoa Observatory, seismologic service inaugurated in December, 1902.

Mr. C. J. Westland, Director.

Government of New Zealand.

Postal address: Samoa Observatory, Apia, Samoa.

$\varphi = 13°48'26''$ S., $\lambda = 171°45'$ W., h = 2 m.

Lithologic foundation: coral sand and gravel about 50 m. thick, resting on volcanic rock.

Equipment:

Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E, with mech. and phot. registr.

Constants: $V_{mech.} = 130$, $V_{opt.} = 1{,}500$, $T_o = 9$ sec., $\epsilon = 4$ to 5.

Wiechert vertical-motion seismograph, mech. registr.

Constants: V = 50, $T_o = 3$ to 4 sec., $\epsilon = 3$.

Horizontal pendulum, opt. registr.

Constants: V = up to 1,000, $T_o = 3$ to 4 sec., ϵ = variable as required.

Time service: time is kept by a Riefler clock provided with mercury-compensated pendulum; time comparisons are made to an accuracy of 0.1 sec. by meridian circle observations; time is marked electromagnetically by a contact pendulum clock; readings of the seismograms are made to an accuracy of 1 sec.

AREQUIPA, PERU

Harvard College Observatory Station, maintains only simple seismoscopes which record the time and horizontal components of (local?) earthquakes, writing on smoked glass. These have been maintained for more than twenty years.

ASAHIGAWA, JAPAN

Meteorological Observatory, seismologic service inaugurated in July, 1919.

Z. Yamada, Director.

Supported by the Hokkaido government.

Postal address: Asahigawa Meteorological Observatory, Asahigawa, Hokkaido, Japan.

$\varphi = 43°47'$ N., $\lambda = 142°22'$ E., $h = 111.3$ m.

Lithologic foundation: rather hard alluvial soil.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: N, $V = 30$, $T_o = 6.8$ sec.; E, $V = 30$, $T_o = 7.2$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

*ISLAND OF ASCENSION

Seismologic Station, inaugurated in November, 1910.

Eastern, Eastern Extension, and Pacific Telegraph Co.

$\varphi = 7°57'$ S., $\lambda = 14°21'$ W.

Equipment: Milne seismograph, E comp.

*ASMARA, ERITREA, AFRICA

Stazione Sismica d'Asmara, inaugurated in 1913.

Direzione di Colonizzazione.

Postal address: Stazione Sismica d'Asmara, Asmara, Eritrea, E. Africa.

$\varphi = 15°20'10''$ N., $\lambda = 38°56'$ E., $h = 2{,}350$ m.

Lithologic foundation: crystalline schist.

Equipment: Agamennone horizontal pendulum, mass 50 kg., two horizontal comp.
Constants: $V=30$, $T_o=8$ to 9 sec.

Time service: a slit in the roof of a room allows the sun to send a narrow band of light on the floor. The time of passage of this band across a meridian line drawn on the floor gives local apparent noon. This is then corrected to mean time and to Greenwich time.

ATHENS, GREECE

Observatoire Nationale d'Athènes, seismologic service inaugurated in June, 1899.
Prof. Dèmétrius Eginitis, Director of the Observatory.
Université Nationale d'Athènes, Gouvernement Hellenique.

Postal address: Station sismologique, Observatoire Nationale d'Athènes, Grèce.

$\varphi=37°58'20''$ N., $\lambda=23°43'00''$ E., $h=95$ m.

Lithologic foundation: limestone.

Equipment:
(Since June, 1899) Agamennone seismograph, mass 200 kg., two comp. NW and NE, length of pendulum = 7.25 m.
(Since Nov., 1910) Mainka bifilar pendulum, mass 136 kg., two comp. N and E.
Constants: $V=60$ to 100, $T_o=5.5$. to 6.0 sec., $\epsilon=4$ to 5, $r/T_o^2=0.006$ to 0.010.

Time service: time is kept with high precision; time comparisons are made by meridian circle observations.

BAGNÈRES DE BIGORRE, see PIC DU MIDI

BAGUIO (BENGUET), PHILIPPINE ISLANDS

Mirador Observatory, seismologic service inaugurated in 1909.
José de Jesús, Observer.
Weather Bureau, Philippine Islands.

Postal address: Mirador Observatory, Baguio, Benguet, P. I., or Manila Observatory, Manila, P. I.

$\varphi=16°25'$ N., $\lambda=120°36'$ E., $h=1{,}512$ m.

Lithologic foundation: sedimentary rock, (Tertiary).

Equipment: Vicentini system, Manila type. Omori system, Manila type.

Time service: time is kept by a chronometer compared daily by telegrahic signals; no chronograph.

*BAKU, CAUCASUS, RUSSIA

Nobel Seismologic Station, inaugurated in 1903. A station of the first class of the Russian Service.

Nobel Bros.

Postal address: Nobel Seismologic Station, Baku, Caucasus, Russia.

$\varphi = 40°23'$ N., $\lambda = 49°54'$E.

Lithologic foundation: isolated piers on limestone (Pliocene) in a specially built cellar.

Equipment: Zöllner Repsold seismographs, two comp.

*BALAKHANY, CAUCASUS, RUSSIA

Nobel Seismologic Station, inaugurated in 1903.

Nobel Bros.

Postal address: Nobel Seismologic Station, Balakhany, Caucasus, Russia.

$\varphi = 40°27'$ N., $\lambda = 49°56'49''$ E.

Lithologic foundation: isolated piers on limestone (Pliocene) in a specially built cellar.

Equipment: Galitzin seismographs, two horizontal comp.

BALBOA HEIGHTS, CANAL ZONE.

Seismologic Station, inaugurated October 1, 1914. (Previously at Ancon, inaugurated there in December, 1908.)

R. Z. Kirkpatrick, Chief Hydrographer, in charge.

The Panama Canal.

Postal address: Seismologic Station, Balboa Heights, Canal Zone.

$\varphi = 8°57'39''$ N., $\lambda = 79°33'29''$ W., h = ca. 36 m.

Lithologic foundation: basalt.

Equipment: Bosch-Omori seismograph, mass 25 kg., two comp. N and E. Constants: $V = 10$, $T_o = 20$ sec.

Bosch-Omori seismograph, mass 100 kg., two comp. N and E. Constants: $V = 35$, $T_o = 20$ sec.

Time service: time is kept to an accuracy within one or two sec. by an electric clock corrected hourly; minute time marks made electromagnetically by contact clock.

BALTIMORE, MARYLAND

Johns Hopkins University.

This station was suspended in 1915 on removal of the Johns Hopkins University to its new site.

BARCELONA, see FABRA

*BATUM, CAUCASUS, RUSSIA

Seismologic Station.

$\varphi = 41°40'$ N., $\lambda = 41°38'35''$ E.

Equipment: Bosch-Omori horizontal pendulum, two comp.

BEIRUT, SYRIA

American University Observatory, seismologic service inaugurated about 1902.

Prof. J. A. Brown, Director.

American University of Beirut.

Postal address: Observatory, American University, Beirut, Syria.

$\varphi = 33°54'$ N., $\lambda = 35°28'$ E., h = ca. 30.5 m.

Lithologic foundation: fossiliferous limestone (Upper Cretaceous).

Equipment: Milne seismograph, E comp., $T_c = 15$ sec.

Time service: of the University Observatory; astronomical clocks compared weekly by transit observations; time comparisons by radio-telegraphic signals from the Eiffel tower will be resumed.

*BEIRUT, SYRIA

Observatoire de Ksara, seismologic service inaugurated in 1911.

Rev. B. Berloty, S. J., Director.

International Seismological Association.

Postal address: Observatoire de Ksara, Saad-Naïl near Beirut, Syria.

$\varphi = 33°49'$ N., $\lambda = 35°53'$ (?) or $37°22'15''$ (?) E, h = 918.5 m.

Lithologic foundation: concrete piers, free from the floor, on solid rock.

Equipment: Mainka horizontal pendulum, two comp.

Time service: time is kept and time marks are made by an excellent clock; time comparisons are made by meridian transit observations.

BELGRADE, SERBIA

Observatoire Séismologique à Tasmïadan-Belgrad, inaugurated August 1, 1909. Operation suspended from October 1, 1915, to July 1, 1920, on account of war.

Prof. Yèlénko Mihaïlovitch, Director.
Institut Géologique de l'Université de Belgrad.

Postal address: Section Séismologique Tasmaïdan-Belgrad, Serbie.

$\varphi = 44°49'17.2''$ N., $\lambda = 20°27'19.7''$ E., h = 128.658 m.

Lithologic foundation: limestone.

Equipment: and constants:				V	T_o	ϵ	r/T_o^2
Wiechert, mass	200 kg.,	NE	comp.,	200	8.2 sec.,	6	0.004
" "	200	NW	"	200	8.2 "	6	0.004
" "	360	N	"	123	5.6 "	1.06	0.022
" "	360	E	"	164	6.0 "	1.16	0.016
Belar, "	20	Z	"	20	0.6 "	1.07	0.350
Conrad, "	40	N	"	80	6.0 "	4	0.005

Agamennone seismoscope.

Time service: time is kept by a Riefler pendulum clock, Graham escapement; and by an electric clock of L. Leroy et Cie.

*BENEVENTO, ITALY

Osservatorio Meteorologico e Geodinamico, seismologic service inaugurated in 1908 (?).
Ufficio Centrale di Meteorologia e di Geodinmica.

Postal address: Osservatorio Meteorologico e Geodinamico, Benevento, Italia.

$\varphi = 41°07'$ N., $\lambda = 14°48'$ E., h = 160 m.

Equipment: Brassart seismometrograph, mass 20 kg., three comp., recording with ink continuously. Brassart seismometrograph which records occasionally with a very open time scale.

Time service: time is controlled by the local telegraph station.

BERGEN, NORWAY

Jordskjalvsstation, inaugurated in 1905.
Prof. Dr. Carl Fred Kolderup, Director.
Bergen Museum.

Postal address: Jordskjalvsstationen, Bergen, Norway.

$\varphi = 60°23'45''$ N., $\lambda = 5°18'18''$ E., h = 20 m.

Lithologic foundation: gneiss.

Equipment: Wiechert inverted pendulum, two comp. N and E. Bosch-Omori seismograph, two comp., N and E.

Time service: time is kept and minute time marks are made electromagnetically by a contact pendulum clock compared twice a week by telegraph with the time of the Astronomical Observatory in Kristiania.

Publication: in Bergen Museum Aarbuk.

BERKELEY, CALIFORNIA

Seismologic Station, inaugurated October 30, 1910. (Earlier service with earlier equipment from 1885.)

Lewis A. Bond, in charge.

Department of Geology, University of California.

Postal address: Seismographic Station, University of California, Berkeley, California.

$\varphi = 37°52'15.9''$ N., $\lambda = 122°15'36.6''$ W., h = 85.4 m.

Lithologic foundation: concrete piers, free from floor, on indurated sandstone (Franciscan).

Equipment: and constants:			V	T_o	ϵ
Bosch-Omori seismograph, mass 100 kg.,	N	comp.	80	15	8
" " " 100	E	"	80	15	8
Wiechert " " 80	Z	"	80	6	8
Omori tromometer	N	"	60	2	....
" "	E	"	60	2.5	....
Marvin strong-motion seismograph,	N	"	5.1	6.5	1.4
" " "	E	"	5.8	6.5	1.3

Galitzin prisms, for acceleration, two sets N and E.

Time service: time is kept and hour and minute time marks are made electromagnetically by an excellent break-circuit marine chronometer compared at least twice a week by direct electric connection with the Riefler sidereal clock of the Students' Observatory: the probable error of the clock is less than 1 sec.

Measurements, etc., published in semi-annual bulletin, Univ. Calif. Publ.

BESANÇON, FRANCE

Observatoire Nationale de Besançon, seismologic service inaugurated in January, 1910.

Prof. A. Lebeuf, Director of the Observatory.

Université de Besançon.

Postal address: Director, Observatoire de Besançon, Besançon, France.

$\varphi = 47°14'59''$ N., $\lambda = 5°59'15''$ E., h = 311 m.

Lithologic foundation: thin argillaceous strata resting on marls and limestone.

Equipment:

Mainka bifilar pendulum, mass 130 kg., constants not specified,

Kilian-Paulin seismograph,

Seismic alarm, and a seismoscope.

Time service: hour and minute time marks are made electromagnetically by a contact clock which is compared with the time service of the astronomical observatory.

*BIBERACH, GERMANY

Seismologic Station[1], inaugurated in 1905.

Postal address: Seismologic Station, Biberach, Württemberg, Deutschland.

$\varphi = 48°05'03''$ N., $\lambda = 9°47'37''$ E., h = 50 m.

Lithologic foundation: alluvium (Tertiary).

Equipment: Tesdorpf horizontal pendulum, mass 34 kg., two comp.

[1]A sub-station of Hohenheim.

BIDSTON-BIRKENHEAD, see LIVERPOOL

BLACKBURN, ENGLAND

Stonyhurst College Observatory, seismologic service inaugurated July 1, 1909.

Rev. A. L. Cortie, S. J., Director.
Stonyhurst College.

Postal address: Stonyhurst College Observatory, Blackburn, England.

$\varphi = 53°50.7'$ N., $\lambda = 2°28.2'$ W., h = ca. 112.6 m.

Lithologic foundation: stone piers on grit (Millstone) overlying limestones and shales (Carboniferous).

Equipment: Milne seismograph, E comp.

Time service: Light eclipsed once each hour; marks checked once a day with a chronometer; time comparisons made by astronomical observations, and by radiotelegraphic signals from the Eiffel tower. Time marks accurate to one second; readings of seismogram accurate to five seconds.

*BOCHUM, WESTFALEN, GERMANY

Erdbebenstation, inaugurated in 1907.

Postal address: Erdbebenstation der Westfälischen Bergewerkschaftkasse, Bochum, Westfälen, Deutschland.

$\varphi = 51°29'36''$ N., $\lambda = 7°13'58''$ E., h = 118 m.

Lithologic foundation: alluvium (8 m.) on calcareous marl on "carboniferous" (70 m.): piers in a special building constructed for the purpose.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. Wiechert inverted pendulum, mass 200 kg., two comp. Wiechert vertical-motion seismograph, mass 1,300 kg. A Wiechert transportable short-period horizontal-and-vertical-motion seismograph for rapid earth vibration.

Time service: time marks are made by a pendulum clock checked daily with an excellent marine chronometer compared weekly with the standard clock of the Geophysikalisches Institut in Göttingen.

BOMBAY, see COLABA

BOM SUCCESSO, MINAS-GERAES, BRAZIL

A Wiechert seismograph, mass 120 kg., is installed here, but as yet there is no time service.

*BORŽOM, CAUCASUS, RUSSIA

Seismologic Station, a station of the second class of the Russian service.

$\varphi = 41°51'$ N., $\lambda = 43°23'$ E.

Equipment: Bosch-Omori horizontal pendulum, two comp.

*BRESLAU-KRIETERN, SILESIA, GERMANY

Seismologic Station, inaugurated in 1907.
Dr. von dem Borne, Director.

Postal address: Seismologic Station, Breslau-Krietern, Schlesien-Deutschland.

$\varphi = 51°04'27''$ N., $\lambda = 16°59'58''$ E., h = 125 m.

Lithologic foundation: diluvium.

Equipment: Wiechert inverted pendulum, mass 1,200 kg., two comp. Wiechert vertical-motion seismograph, mass 1,400 kg.

BRUXELLES, see UCCLE

BUCHAREST, ROUMANIA

Seismologic Station, inaugurated in 1902.
Prof. E. Otetelisanu, Director.

Institutul Meteorologic Central al României,

Ministerul Agriculturei si Domeniilor.

Postal address: Institutul Meteorologic al României, Bucureşti, România.

$\varphi = 46°31'$ N., $\lambda = 26°06'$ E., h = 82 m.

Lithologic foundation: slate.

Equipment: Bosch horizontal pendulum, mass 10 kg., two comp. Galitzin aperiodic seismometer, photo-gavanometric registration, electromagnetic damping, two comp.

Seismoscopes of Tacchini, Brassart, Agamennone, and Guzzanti types.

Time service: not stated.

BUDAPEST, HUNGARY

Seismological Observatory of the University, inaugurated March 11, 1902; with present equipment January 1, 1906.

Prof. Dr. Rado Kövesligethy, Director.

Geological Institute, Ministry of Culture and Public Instruction.

Postal address: Seismological Observatory of the University, Múzeum Körút 6–8, Budapest, Ungarn.

$\varphi = 47°29'29''$ N., $\lambda = 19°03'55''$ E., h = 110 m.

Lithologic foundation: stone pier on concrete block extending down to water level in sand and alluvium (over Tertiary).

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.

		V	T_o	ϵ	r/T_o^2
Constants:	N,	168	6.3	4.06	0.008
	E,	182	7.2	2.75	0.007

Galitzin horizontal pendulum (second-order station type) mech. registr., two comp. N and E.

Time service: time is kept to an accuracy of 1 sec. by a pendulum clock checked by means of a chronometer with the time service of the Cosmographical Institute of the University.

A Bureau of Seismological Calculations is maintained for theoretical and practical investigations in seismological matters.

Formerly stations at Fiume, Kalocsa, Kolozsvár, Ógyalla, Szeged, Temesvár, and Ungvár were dependent on Budapest as central station.

BUTUAN (AGUSAN), PHILIPPINE ISLANDS

Meteorological Station, seismologic service inaugurated in May, 1915. Generoso Copin, Observer.

Weather Bureau, Philippine Islands.

Postal address: The Meteorological Station, Butuan, Agusan, P. I., or Manila Observatory, Manila, P. I.

$\varphi = 8°56'$ N., $\lambda = 125°32'$ E., $h = 2$ m.

Lithologic foundation: alluvial.

Equipment: Wiechert inverted pendulum, mass 180 kg.

Time service: time comparisons daily by telegraphic signals; no chronograph.

CADIZ, see SAN FERNANDO

*CAGGIANO, ITALY

R. Osservatorio Meteorico Geodinamico Agrario.

Postal address: Caggiano, Salernitano, Italia.

$\varphi = 40°33'57''$ N., $\lambda = 15°30'$ (or $12°28'59''$?) E., $h = 831$ (or ca. 820 ?) m.

Lithologic foundation: limestone.

Equipment: Agamennone seismometrograph, mass 200 kg., two comp., registering with ink.

Constants: $V = 12.5$, $T_o = 6$ sec.

Brassart seismometrograph, three comp., open time scale.

Seismoscopes.

Time service: time is determined to 6 seconds by meridian observations on the sun.

CAIRO, see HELWAN

CALCUTTA, INDIA

Alipore Observatory, seismologic service inaugurated in March, 1915. Dr. Edward Philip Harrison, Meteorologist, Director.

India Meteorological Department.

Postal address: Alipore Observatory, Calcutta, India.

$\varphi = 22°32'$ N., $\lambda = 88°20'$ E., $h = 6.4$ m.

Lithologic foundation: alluvial.

Equipment: Omori-Ewing horizontal pendulum, mass 50 kg., two comp. N and E.

Constants: N, V=29, T_o=18 sec.: E, V=29, T_o=30 sec.

Time service: a clock of known rate and error marks time by electric contact at the beginning and end of the trace; correct to 0.1 minute: minute marks are made electromagnetically by a second clock.

Publication: The data are published along with those of the Bombay, Kodaikanal and Simla Observatories in the India Monthly Weather Review. They are also sent to the British Association Seismological Committee.

CAMBRIDGE, MASSACHUSETTS

Harvard Seismographic Station, inaugurated in April, 1908.
Prof. J. B. Woodworth, in charge.
Department of Geology and Geography, Harvard University.

Postal address: Seismographic Station, Harvard Geological Museum, Oxford Street, Cambridge, Massachusetts.

φ=42°22′36″ N., λ=71°06′59″ W., h=5.367 m.

Lithologic foundation: glacial sands and clays over shales (paleozoic).

Equipment: Bosch–Omori seismograph, mass 100 kg., two comp. N and E. (Actually N3°E and E3°S).

Constants:	V	T_o	ϵ	
N,	50	25	1.5	15 mm.=60 sec.
E,	80	23	1.5	

Time service: time is kept and hour and minute time marks are made electromagnetically by a contact clock compared, with an accuracy of 0.3 sec., with the time service of the Harvard Astronomical Observatory. Seismograms are read to the nearest second.

CAPANNOLI VAL d'ERA (PROVINCIA PISA), ITALY

Osservatorio Geodinamico e Stazione Termo-Udometrica "Baldini," seismologic service inaugurated in October, 1909.
Domenico Baldini, Director.

Postal address: Capannoli Val d'Era (Provincia Pisa), Italia.

φ=43°34′40″ N., λ=10°40′30″ E., h=57.31 m.

Lithologic foundation: blue marl and tufa.

Equipment: Alfani tromograph, mass 50 kg., N comp.
Constants: V=ca. 40, T_o=18.1 sec., 100 cm.=ca. 1 hour.
Vicentini seismograph, mass 115 kg., two comp. N and E.

Constants:	V	T_o	cm. per hour
N,	60	2.2 sec.	ca. 84,
E,	60		ca. 84.

Both components are damped with oil.

Time service: time is kept and hour and minute time marks are made electromagnetically by a contact astronomical clock; time comparisons are made by radiotelegraphic signals from the Eiffel tower. Rate of clock not over ± 1 sec. in 24 hours.

Auxiliary seismologic apparatus:

"Ortosismoscopio," mass 10 kg., $T_o = 1.2$ sec., with an electric contact seismoscopic clock.

Vicentini seismoscope, continuous registration, mass 10 kg., $T_o = 1.2$ sec., $V = 20$, 45 cm. = 1 hour.

Vicentini horizontal pendulum seismoscope, continuous registration, mass 10 kg., $V = 15$, $T_o = 4.4$ sec., 103 cm. = 1 hour.

Agamennone "double effect" seismoscope, with electric contact.

CAPE OF GOOD HOPE, SOUTH AFRICA

Seismologic Station, inaugurated in 1899.

S. S. Hough, H. M. Astronomer at the Cape.

Royal Observatory, Cape of Good Hope.

Postal address: Royal Observatory, Cape of Good Hope, S. A.

$\varphi = 33°56'03.5''$ S., $\lambda = 18°28'41.4''$ E., h = ca. 13 m.

Lithologic foundation: slate (Malmesbury). [Argillaceous schist and quartzite]?

Equipment: Milne-Shaw seismograph, to be installed in place of older Milne instrument.

Time service: not specified, presumably of precise character.

*CAPE VERDE ISLANDS

Seismologic Station, inaugurated in 1911.

$\varphi = 16°30'$ N., $\lambda = 24°00'$ W.,

Equipment: Milne seismograph, E. Comp.

CARDIFF, WALES

Cardiff City Observatory, seismologic service inaugurated December 20, 1909.

Edward Walford, Medical Officer of Health, in charge.
Cardiff Corporation.

Postal address: (of Observatory) Penylan Hill, Cardiff, Glaur.
(of Director) City Hall, Cardiff, Wales.

$\varphi = 51°30'$ N., $\lambda = 3°10'$ W., h = ca. 61.9 m.

Lithologic foundation: concrete pier, free of floor, on Old Red Sandstone and Silurian formations.

Equipment: Milne seismograph, E comp.

Time service: light eclipsed every hour by an electromagnet controlled by a watch "kept at Greenwich Mean Time."

CARLOFORTE (SARDINIA), ITALY

Regia Stazione Astronomica di Carloforte, seismologic service inaugurated in 1899.
Dr. Giulio Bemporad, Director.
Regia Commissione Geodetica Italiana.

Postal address: Carloforte (Sardegna), Italia.

$\varphi = 39°08'09''$ N., $\lambda = 8°18'43.5''$ E., h = 18 m.

Lithologic foundation: trachyte.

Equipment: Vicentini microseismograph, mass 100 kg., two comp. V = 50, $T_o = 2.3$ sec., 60 cm. = 1 hour.

Time service: electromagnetic time marking; time accurate, determined by astronomical observations; service of the International Latitude Observatory.

CARTUJA (GRANADA), SPAIN

Estación Sismológica de Cartuja (Granada), inaugurated January 1, 1903.
Father Emm. Ma. S-Navarro Neumann, S.J., Director.
Colegio-Noviciado de la Compañía de Jesús—Granada.

Postal address: Cartuja (Granada), España. Apartado No. *32.*

$\varphi = 37°10'43''$ N., $\lambda = 3°35'52''$ E., h = 770 m.

Lithologic foundation: limestone (Miocene, Tortonian).

Equipment: "Cartuja" bifilar horizontal pendulum, mass 340 kg., two comp. N and E.
Constants: V = 60, $T_o = 10$ sec., ϵ = ca. 4.
"Cartuja" vertical-pendulum horizontal-motion seismograph, mass 280 kg., E comp.

Constants: V = 350, T_o = 2 sec., no damping.

Time service: time is kept and marked by a Bosch contact chronometer (clock); time comparisons are obtained from the Astronomical-Observatory of Cartuja where time is determined by meridian circle observations. Seismograms are read to an accuracy of 1 sec.

Auxiliary apparatus comprises small registering instruments designed by the Director of the Station to record artificial disturbances.

CASAMICCIOLA, GRANDE SENTINELLA, ISCHIA, ITALY

R. Osservatorio Geodinamico Casamicciola, seismologic service inaugurated October 1, 1891.
Dr. Giulio Grablovitz, Director of the Observatory.
R. Ufficio Centrale di Meteorologia e Geodinamica in Roma.

Postal address: R. Osservatorio Geodinamico, Ischia (Napoli), Italia.

$\varphi = 40°44'45.4''$ N., $\lambda = 13°54'13.9''$ E., h = 122.78 m.

Lithologic foundation: argillaceous tuff.

uipment: Seismograph, Cecchi type, two comp. N and E., "occasional" registration on smoked paper; V = 1 to 3.
Brassart seismograph, mass 20 kg., continuous registr., 100 mm. = 1 hour.
" " "occasional" registr.
Agamennone tromometer, phot. registr.
Horizontal pendulums, oriented hexagonally.
Fixed horizontal pendulums.
Portable horizontal pendulums, mass 3 to 12 kg., V = 8 to 15.
Water levels.
Spirit level.
"Vasca sismica."
"The long spiral."

Time service: time is kept by high grade clocks and chronometers; time comparisons are made by astronomical observations.

CATANIA (SICILY), ITALY

R. Osservatorio Geodinamico, seismologic service inaugurated in May, 1891. (An earlier installation was inaugurated in the University in 1880.)
Prof. Gaetano Platania, Director.
Ministero di Agricoltora.

Postal address: R. Osservatorio Geodinamico, Catania (Sicilia), Italia.

$\varphi = 37°30'13''$ N., $\lambda = 15°05'15''$ E., h = 45 m.

Lithologic foundation: lava and sandstone (Quaternary).

Equipment: and constants:		mass	length	1 hour	V	T_o
Vicentini microseismograph,	N,	100 kg.	1.50 m.	60 cm.	60	2.4 sec.
" "	E,	100	1.50	60	60	2.4
" "	Z,	45	1.50	60	90	0.82
Cancani seismometrograph	NE,	300	25.30	60	12	10.0
" "	NW	300	25.30	60	12	10.0

No damping. Several devices no longer in use.

Time service: time is kept by a marine chronometer compared daily with the time service of the Royal Astrophysical Observatory of Catania.

CATANIA, see also MINEO

CERNAUȚI, ROUMANIA

Seismologic Station.

Prof. N. Steliami, Director.
Universitatea din Cernauți.

Postal address: Institutul de *Fizică Cosmică al Universitatei*, Cernauți, România.

$\varphi = 48°17'$ N., $\lambda = 25°56'$ E., $h = 225$ m.

Lithologic foundation:

Equipment: Mainka bifilar horizontal pendulum, two comp.

Time service: not stated.

CHACARITA, ARGENTINA

Observatorio Meteorológico, seismologic service inaugurated in January, 1908.

Observer subject to change.
Oficina Meterológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi = 34°35'15''$ S., $\lambda = 58°28'15''$ W., $h = 25$ m.

Lithologic foundation: alluvial.

Equipment: Bosch-Omori seismograph, two comp. N and E.
Constants: $V = 10$, $T_o = 20$ sec.

Time service: *minute time marks* checked by chronometer compared daily by radiotelegraphic signals from Navy Department. "Time very accurate."

CHALCIS, GREECE

This station has been discontinued.

*CHAPELTON, JAMAICA

Seismologic Station, inaugurated in 1910.

J. F. Brennan, Government Meteorologist, proprietor.
Sub-station of the Kingston Station.

Postal address: Mr. J. F. Brennan, Kingston, Jamaica.

Equipment: Ewing duplex seismograph, mass ca. 13.6 kg. V = 10.

CHELTENHAM, MARYLAND

Cheltenham Magnetic Observatory, seismologic service inaugurated in November, 1904.

Magnetic observer, in charge: George Hartnell, present incumbent.
United States Coast and Geodetic Survey.

Postal address: Cheltenham Magnetic Observatory, Cheltenham, Maryland: or Division of Terrestrial Magnetism, U. S. C. and G. S., Washington, D. C.

$\varphi = 38°44'$ N., $\lambda = 76°50.5'$ W., h = ca. 72 m.

Lithologic foundation: concrete piers on sand and gravel, 1 to 2 m. thick, over fine sand and clay.

Equipment: Bosch-Omori seismograph, mass 10 kg., two comp.
Constants: V = 10, $T_o = 15$ sec.

Time service: two box chronometers; corrections and rates determined by time signals by wireless daily. The time of starting and stopping the record is noted by a chronometer. The seismograph clock, which makes a mark each minute (1 minute = 15 mm.) on the smoked paper, is not of a high grade and the rate is somewhat irregular so that the times of the minute marks in the middle of a sheet may at times be in error by a considerable amount, but comparison with the earthquake reports from Washington, D. C., in general show differences less than 10 sec.

CHIAVARI (GENOA), ITALY

Osservatorio meteorologico e sismico, inaugurated July 3, 1909.

Prof. C. Andrea Bianchi, Director.
Seminario Vescovile.

Postal address: Osservatorio meteorologico e sismico, Chiavari (Genova) Italia.

$\varphi = 44°18'55''$ N., $\lambda = 5°39'45''$ E, h = 3 m.

Lithologic foundation: alluvial, delta deposits.

Equipment: and constants: Stiattesi horizontal pendulum seismograph, locally modified, mass 250 kg., two comp.

N 35° E, V = 35, T_o = 11 sec., 180 cm. = 1 hour,
S 55° E, V = 46, T_o = 12.8 " 180 " = 1 "

Alfani tromometrograph (horizontal pendulum), mass 120 kg., one comp.

S 55° E, V = 25. T_o = 12 sec., 105 cm. = 1 hour.

Agamennone seismometrograph (horizontal pendulum), mass 50 kg., two comp. N and E;

N, V = 24, T_o = 4 sec., 150 cm. = 1 hour,
E, V = 24, T_o = 4 " 150 " = 1 "

Seismometrograph (ordinary, or vertical, pendulum), mass 600 kg.,
V = 6, T_o = 2.6 sec., 100 cm. = 1 hour.
Certain auxiliary apparatus of secondary importance.

Time service: hour and minute time marks are made electromagnetically by a contact chronometer; time comparisons are made by radiotelegraphic signals from the Effel tower, and also by meridian circle observations.

CHICAGO, ILLINOIS

U. S. Meteorological Observatory, seismologic service inaugurated in March, 1918.

Henry J. Cox, Meteorologist, in charge.

University of Chicago.

U. S. Weather Bureau.

Postal address: Rosenwald Hall, University of Chicago, 58th St. and Ellis Ave., Chicago, Illinois; or U. S. Weather Bureau, Washington, D. C.

$\varphi = 41°47'$ N., $\lambda = 87°37'$ W., h = 180.1 m.

Lithologic foundation: concrete pier, through loose material to bed rock.

Equipment: Milne-Shaw seismograph, two comp. N and E.

Constants:	V	T_o	ϵ
N,	150	8 sec.	20
E,	150	12 "	20

Time service: minute time marks are made by means of an electromagnetic shutter operated by a Howard observatory contact clock checked weekly with the time service of the local office of the Hydrographic Office of the U. S. Navy; time-marking considered accurate to 1 to 2 sec.

CHOSHI, JAPAN

Meteorological Observatory, seismologic service inaugurated in September, 1909.

S. Omura, Director.

Supported by Chiba prefecture.

Postal address: Choshi Meteorological Observatory, Choshi, Chiba-ken, Japan.

$\varphi = 35°44'$ N., $\lambda = 140°51'$ E., $h = 18.2$ m.

Lithologic foundation: loam (Tertiary).

Equipment: and constants:		V	T_o
Omori horizontal pendulum tromometer,	N comp.,	120	18.0 sec.
" " " "	E "	30	29.3 "
" vertical-motion tromometer,	Z "	20	11.0 "
" horizontal pendulum tremor recorder,	N "	100	4.9 "
" " " " "	E "	100	4.9 "
" strong motion seismograph,	N "	1	8.0 "
" " " "	E "	1	8.0 "
" " " "	Z "	2	8.0 "

Time service: time marks made by a contact chronometer; time comparisons daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*CHRISTCHURCH, NEW ZEALAND

Magnetic Observatory, seismologic service inaugurated in November, 1901.

Postal address: Magnetic Observatory, Christchurch, New Zealand.

$\varphi = 43°31'50''$ S., $\lambda = 172°37'18''$ E.,

Lithologic foundation: concrete and brick pier on alluvial fan.

Equipment: Milne seismograph, E. comp.

CHUR, SWITZERLAND

Erdbeben-Station, inaugurated in January, 1916.

Prof. Alfred Kreis, Director.

Kantonschule, Chur.

Postal address: Erdbeben-Station, Kantonschule, Chur, Schwyz.

$\varphi = 46°50'55''$ N., $\lambda = 9°32'20''$ E., $h = 630$ m.

Lithologic foundation: exposed rock (Bündner schiefer).

Equipment: Bosch horizontal pendulum, mass 100 kg., E comp.
Constants: $V=96$, $T_o=?$, 1.5 cm. = 1 minute.

Time service: time is kept and minute time marks are made by a contact pendulum clock checked twice a week by the telephonic signals of the Swiss telephone system based on radiotelegraphic signals from the Eiffel tower; accuracy ca. 0.2 sec.

CIENFUEGOS, CUBA

The station at one time projected here has never been established.

CIPOLETTI, ARGENTINA

Observatorio Cipoletti, seismologic service inaugurated in July, 1917.

Observer subject to change.
Oficina Meteorológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi=38°56'03''$ S., $\lambda=68°08'$ W., $h=267$ m.

Lithologic foundation: alluvial.

Equipment: Milne seismograph, one comp.
Constants: $T_o=18.5$ sec., 1 mm. displacement $=0.41''$. 60 mm. = 1 hour.

Time service: light eclipsed once each hour; marks checked four or five times a day with a chronometer compared once or twice a week by telegraphic signals sent to local post-office. "Accuracy not very great" Sun dial, with graphic correction curve, reading approximately to 1 to 5 seconds.

CLAUSTHAL, see KLAUSTHAL

CLERMONT-FERRAND, FRANCE

Station Sismologique de l'Observatoire de Clermont-Ferrand, inaugurated in 1909.
Prof. E. Mathias, Director.

Postal address: Observatoire, Côte de Landois par Clermont-Ferrand (Puy-de-Dôme), France.

$\varphi=45°46'28''$ N., $\lambda=2°58'01''$ E., $h=400$ m.

Lithologic foundation: basalt (Quaternary).

Equipment: Bosch-Mainka bifilar pendulum, mass 130 kg., two comp. N and E.

Constants:	L	V	ϵ	r	
N,	20,490	82.5	3.23	1.41	12 mm. = 1 min.
E,	20,130	84.9	3.28	1.52	

Time service: time is kept and minute and ten-minute time marks are made electromagnetically by an excellent contact clock (Hasler and Escher) compared daily by radiotelegraphic signals; seismograms are read to the nearest second. A marine chronometer is also used for time keeping.

CLEVELAND, OHIO

Meteorological and Seismological Observatory, seismologic service inaugurated in 1905.

Rev. Frederick L. Odenbach, S.J., Director.
St. Ignatius College.

Postal address: Meteorological and Seismological Observatory, St. Ignatius College, Cleveland, Ohio.

$\varphi = 41°29'08''$ N., $\lambda = 81°42'29''$ W., h = 206 m.

Lithologic foundation: glacial drift over shale (Cuyahoga).

Equipment: Wiechert inverted pendulum, mass 80 kg., $T_o = 7$ sec. Hengler horizontal seismograph, mass 80 kg., V = 400, $T_o = 7$ sec. Vertical pendulum seismograph, mass ca. 895 kg., V = 20, $T_o = 1\frac{1}{6}$ sec. (The Wiechert seismograph is stated to be air-damped but the ratio of dumping is not given.)

Time service: time comparisons are obtained by means of radiotelegraphic signals from Paris, and from Arlington.

CLUJ, ROUMANIA

Seismologic Station.
Prof. G. Volsân, Director.
Universitatea din Cluj.

Postal address: Institutul Geografic al Universitatea din Cluj, România

$\varphi = 46°45'$ N., $\lambda = 23°39'$ E., h = 363 m.

Lithologic foundation:

Equipment: Mainka bifilar horizontal pendulum, mass 210 kg., two comp.

Time service: not stated.

COCOS ISLANDS, see KEELING ISLANDS

COIMBRA, PORTUGAL

Observatorio Meteorológico de Coimbra, seismologic service inaugurated in 1903.

Prof. Dr. Anselmo Ferraz de Carvalho, Director of the Observatory. Universidad de Coimbra.

Postal address: Observatorio Meteorológico, Coimbra (Cumeada), Portugal.

$\varphi = 40°12'25''$ N., $\lambda = 8°25'30''$ W., h = 140 m.

Lithologic foundation: sandstone (Triassic).

Equipment: Milne seismograph, E comp.
Constants: $T_o = 22$ to 24 sec., 1 mm. displacement = 0.20 to 0.30″.
Also, since 1915, Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.
Constants: $T_o = 12$ to 14 sec., $\epsilon = 4$ to 6, $r/T_o^2 = 0.01$ to 0.005.

Time service: time is kept and hour and minute marks are made electromagnetically by a contact clock (Wiechert); time comparisons are made by meridian transit observations; time is kept to an accuracy of ca. 0.1 sec. There are also astronomical clocks.

COLABA (BOMBAY), INDIA

Government Observatory, seismologic service inaugurated in November, 1907.

T. K. Chinmayanandam, Director, of Bombay and Alibag Observatories. India Meteorological Department.

Postal address: Government Observatory, Colaba, Bombay, India.

$\varphi = 18°53'36''$ N., $\lambda = 72°48'56''$ E., h = 11 m.

Lithologic foundation: trap.

Equipment: Omori-Ewing horizontal pendulum, E comp.
Constants: V = 20 (20 to 40), $T_o = 32$ sec. (ordinarily).
Colaba seismograph, two comp. N and E.

Time service: minute time marks are made electromagnetically by a standard contact clock.

Data published in India Monthly Weather Review; also sent to the Brit. Ass. Seis. Committee.

COLOMBO, CEYLON

Colombo Observatory, seismologic service inaugurated July 3, 1909. (Instrument previously in operation in Technical Schools, Colombo, Maradana, from 1899.)

A. J. Bamford, Superintendent, Observatory.
Survey Department, Ceylon Government.

Postal address: Colombo Observatory, Bullers' Road, Colombo, Ceylon.

$\varphi = 6°54'18''$ N., $\lambda = 79°52'18''$ E., h = 7.3 m.

Lithologic foundation: pier built up from stratum of compact sand, practically a sandstone, through alluvial soil and sand.

Equipment: Milne seismograph, E comp.
Constants: $T_o = 16$ sec., 1 mm. displacement = 0.5 to 0.6″.

Time service: time is kept by sidereal and mean-time clocks compared by transit observations. The accuracy of the time keeping is greater than the practicable reading of the seismogram (1 mm. = 1 minute).

*CONSTANTINOPLE, ZONE OF THE STRAITS

(Formerly) Observatoire Impériale Météorologique, seismologic service inaugurated in 1895.

COPIAPÓ, CHILE

Estación sismolójica de Copiapó, inaugurated September 14, 1908.
Prof. Luis Sierra Vera, Jefe.

Universidad de Chile.

Servicio Sismolójico de Chile.

Postal address: Jefe Oficina Sismolójica, Copiapó, Atacama, Chile.

$\varphi = 27°21'$ S., $\lambda = 70°21'$ W., h = 370 m.

Lithologic foundation: concrete pier, built up from rock, through alluvium.

Equipment: Wiechert inverted pendulum.

Time service: time is kept by a watch chronometer (un reloj cronómetro).

CRACOW, POLAND

Astronomical Observatory of the Jagellon University, seismologic service inaugurated in November, 1903.
Prof. Thaddaeus Banachiewicz, Director.

Postal address: Astronomical Observatory Cracow Poland.

$\varphi = 50°03.9'$ N., $\lambda = 19°57'12''$ E., h = 205.5 m.

Lithologic foundation: *pillar on cement on alluvial ground.*

Equipment: Bosch horizontal pendulum, mass 10 kg., two comp. NW and NE.
Constants: NW comp. out of order temporarily owing to the war.
NE comp., V = 10, $T_o = 0.43$ min.

Time service: minute marks made electromagnetically by a pendulum clock of the observatory; accuracy ca. 2 sec.

CUYABÁ, MATTO GROSSO, BRAZIL

A Bosch-Omori seismograph, mass 20 kg., is to be installed in the Lyceo Salesiano.

CZERNOWITZ, see CERNAUŢI

DAIREN, CHINA (JAPAN)

Meteorological Observatory, seismologic service inaugurated in January, 1918.

S. Migunuchi, Director.

Supported by the Kwanto government.

Postal address: Meteorological Observatory of the Government of Kwanto, Dairen, Kwanto-shu, China.

$\varphi = 38°54'$ N., $\lambda = 121°36'$ E., h = 96.8 m.

Lithologic foundation: quartzite.

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.

Constants:

	V	T_o
N,	20	24 sec.
E,	20	25 "
E,	120	25 "

Time service: time comparisons are obtained by astronomical observations.

*DARMSTADT, HESSE, GERMANY

Seismologic Station, inaugurated in 1909 (?).

Prof. Dr. C. Zeissig, Director.

Physikalische Institut der Technischen Hochschule.

Postal address: *Physikalische Institut der Technischen Hochschule,* Darmstadt, Hessen, Deutschland.

$\varphi = 49°53'$ N., $\lambda = 8°40'$ E., h = 146 m.

Lithologic foundation: thin concrete floor directly on the earth surface.

Equipment: Wiechert inverted pendulum, mass 200 kg.

Time service: time is kept and time marks are made by a good clock compared every week with the time service at the Astronomical Observatory at Königstuhl-Heidelberg.

*DAVOS, SWITZERLAND

Seismologic Station.
Prof. Dr. E. Dietz, Director.

Postal address: Seismologic Station, Davos, Schwyz.

$\varphi = 46°48'$ N., $\lambda = 9°49'$ E.,

Equipment: Bosch-Omori horizontal pendulum, two comp.

DE BILT, NETHERLANDS

Royal Netherlands *Meteorological Institute, Section V, Terrestrial* Magnetism and Seismology, seismologic service inaugurated in 1908.
Dr. C. van Dijk, Adjunct Director.

Postal address: Royal Netherlands Meteorological Institute, De Bilt, Netherlands.

$\varphi = 52°06'$ N., $\lambda = 5°11'$ E., h = 3 m.

Lithologic foundation: sand (diluvium).

Equipment: Galitzin seismometers, galvanometric photo. registr., magnetic damping, two comp. N and E.
Constants: A = ca. 138 cm. (before July, 1918, ca. 135 cm.), T = ca. 25 sec., k = ca. 11 (before July, 1918, ca. 17), $\mu^2 = 0$.
Galitzin vertical-motion seismometer, galvanometric photo. registr., to be installed.
Wiechert inverted pendulum, mass 200 kg., two comp. N and E.
Constants: $V_N = 170$, $V_E = 200$, $T_o = 5$ sec., $\epsilon = 4$.
Bosch horizontal pendulum, mass 25 kg., two comp. N and E.
Constants: $V = 20$, $T_o = 18$ sec., $\epsilon = 4$.

Time service: time is kept and minute time marks are made electromagnetically by a contact clock (van Huffel); time comparisons made daily, to an accuracy of ca. 0.25 sec., by means of radiotelegraphic signals from the Eiffel tower.

Publication: *Further details will be found in Koninklijk Nederlandsch* Meteorologisch Institut, No. 108. Also in Seismische Registrierungen in De Bilt.

DEHRA DUN, INDIA

Seismologic Station, inaugurated in July, 1912.

Dr. J. de Graaff Hunter, Mathematical Adviser to the Survey of India, in charge.
Trigonometrical Survey Office.

Postal address: Seismologic Station, Dehra Dun, U. P., India.

$\varphi = 30°19'29''$ N., $\lambda = 78°03'15''$ E., h = ca. 682.8 m.

Lithologic foundation: alluvium.

Equipment: Omori horizontal pendulum, E comp.

Time service: time is kept and minute time marks are made electromagnetically by a contact clock. Time keeping is as accurate as the reading of the seismograms can be.

DENVER, COLORADO

Sacred Heart College Seismological Station, inaugurated in September, 1909.

Rev. Armand W. Forstall, S.J., Director.

Postal address: Seismological Station, Sacred Heart College, Alcott Station, Denver, Colorado.

$\varphi = 39°40'36''$ N., $\lambda = 104°56'54''$ W., h = 1655 m.

Lithologic foundation: conglomerate (Denver Basin).

Equipment: Wiechert inverted pendulum, mass 80 kg.,

Time service: time is kept and hour and minute time marks are made by a contact clock (Wiechert) corrected occasionally by transit observations.

*DERBENT, CAUCASUS, RUSSIA

Seismologic Station.

Observatoire physique de Tiflis.

$\varphi = 42°04'$ N., $\lambda = 48°18'$ E.

Equipment: Bosch-Omori horizontal pendulum, two comp.

DISKO ISLAND, GREENLAND

Seismic Observatory[1], inaugurated in 1907.

Morten T. Porsild, M.Sc., Owner.

Privately maintained.

Postal address: Seismic Observatory, Disko Island, Greenland, via Copenhagen, Denmark.

$\varphi = 69°14'48''$ N., $\lambda = 53°33'24''$ W[2]., h = ca. 15 m.

Lithologic foundation: gneissic rock.

Equipment: Bosch-Omori horizontal pendulum, mass 100 kg., two comp., $T_o = 20$ to 30 sec.

[1]This station is not at present in operation.

[2]The longitude given is probably some 28 sec. too far east, but its error is not yet accurately known.

Time service: time is kept by a chronometer and by a Wiechert contact clock compared occasionally by sextant or theodolite observations. Accuracy of time comparisons from 5 to 0.5 sec.

DOMODOSSOLA, ITALY

Osservatorio Meteorologico Rosmini, seismologic service inaugurated in 1905.

Prof. Cav. Don Francesco Pinauda, Director.

Postal address: Osservatorio Meteorologico Rosmini, Domodossola, presso Novara, Piemonte, Italia.

$\varphi = 46°07'$ N., $\lambda = 8°18'$ E., $h = 280$ m.

Lithologic foundation: alluvium.

Equipment: Omori-Alfani tromometrograph, mass 400 kg., two comp. N 15° E and E 15° S.

Constants: $V = 40$, $T_o = 10$ sec. (20 sec.)[1], 1 m. = 1 hour.

Several auxiliary seismoscopic devices.

Time service: time is kept by a mean-time, and by a sidereal, chronometer; time comparisons are made by means of meridian transit observations.

[1]Complete period.

DORPAT, or JURJEW, RUSSIA

This station was discontinued in 1915, and its apparatus was sent to Tomsk, Siberia.

*DURLACH i. BR., GERMANY

Seismologic Station, inaugurated in 1905.

Prof. Dr. F. M. Haid, Director.

Naturwissenschaftliche Verein in Karlsruhe.

Postal address: Seismologic Station, Durlach i. Br., Deutschland.

$\varphi = 48°59'46''$ N., $\lambda = 8°28'55''$ E.

Lithologic foundation: sandstone in a tunnel in the Turmberg.

Equipment: Hecker horizontal pendulum, phot. registr., two comp.

Time service: time is supplied by a clock with a Riefler pendulum.

DYCE, ABERDEENSHIRE, SCOTLAND

Seismologic Station, inaugurated in 1914.

Mr. James Edward Crombie, Owner.

Privately maintained.

Postal address: Mr. James E. Crombie, Parkhill House, Dyce, Aberdeenshire, Scotland.

$\varphi = 57°13'$ N., $\lambda = 2°10'$ W., h = ca. 53.3 m.

Lithologic foundation: gravel.

Equipment: Mainka horizontal seismograph, mass 450 kg., two comp. N and E.
Constants: V = 150, $T_o = 10$ sec.
A Milne-Shaw seismograph is in course of installation.

Time service: time is kept and marked by a Bosch observatory clock; time comparisons are made by radiotelegraphic signals from the Eiffel tower.

EBELTOFTHAFEN, see ADVENT BAY (?)

EDINBURGH, SCOTLAND

Royal Observatory.
Prof. R. A. Sampson, Astronomer Royal for Scotland.

Postal address: Royal Observatory, Edinburgh, Scotland.

$\varphi = 55°55'30''$ N., $\lambda = 3°11'03''$ W., h = ca. 132.3 m.

Lithologic foundation: andesitic lava (Devonian).

Equipment: not stated (Milne seismograph?).

Time service: of the Royal Observatory, accurate within a fraction of 1 sec.

EGER (BOHEMIA), CZECHOSLOVAKIA

Erdbebenwarte Eger, inaugurated in November, 1908.
Dr. Georg Irgung, in charge.
Stadtsgemeinde Eger.

Postal address: Erdbebenwarte, Eger, Czechoslovakia.

$\varphi = 50°04'46''$ N., $\lambda = 12°22'34''$ E., h = 430 m.

Lithologic foundation: sand and clay (Tertiary) about 20 m. in thickness, on phyllite.

Equipment: Horizontal pendulum, opt. registr., magnetic damping.
Constants: V = ca. 100, $T_o = 20$ sec.
Mainka bifilar pendulum, one comp. only N.

Time service: clock with nickel-steel pendulum, accuracy ± 2 sec.

*EKATERINBURG, RUSSIA

Seismologic Station, inaugurated October 14, 1913.

$\varphi = 56°49'38.29''$ N., $\lambda = 60°38'18.5''$ E., h = 275 m.

Lithologic foundation: granite.

Equipment: Galitzin seismographs, three comp.

ESKDALEMUIR, LANGHOLM, SCOTLAND

Eskdalemuir Observatory, seismologic service inaugurated in 1908.
Dr. A. Chrichton Mitchell, Superintendent.
Meteorological Office, Department of Civil Aviation, Air Ministry.

Postal address: Eskdalemuir Observatory, Langholm, Scotland.

$\varphi = 55°18'19''$ N., $\lambda = 3°12'19.7''$ W., h = 242 m.

Lithologic foundation: stratified rock (Silurian) traversed by dikes.

Equipment: Galitzin seismometer, photo. galvanometric registr., three comp.

Constants:	T	T_1	μ^2	2Ak	l
N,	24.7 sec.	23.1 sec.	+0.032	88,200	118 mm.
E,	24.8 "	23.9 "	−0.015	86,800	118 "
Z,	13.05 "	10.7 "	+0.50	43,500	359 "

Omori seismograph, now out of use.

Time service: time is kept and minute time marks are made by a "Webster" contact clock; a time signal is received from Greenwich each day; seismometric readings are determined to the nearest second.

ETNA, see CATANIA

EWA, see HONOLULU

FABRA, BARCELONA, SPAIN

Estación sismica del Observatorio Fabra, inaugurated in March, 1914.
Prof. Dr. Eduardo Fontseré[1], Director.
Real Academia de Ciencias y Artes, Barcelona.

Postal address: Dr. E. Fontseré, Real Academia de Ciencias y Artes, Barcelona, España.

$\varphi = 41°25'06''$ N., $\lambda = 2°08'$ E., h = 405 m.

Lithologic foundation: slates (Paleozoic).

Equipment:
Mainka bifilar pendulum, mass 141.2 kg., N comp., mass 144.1 kg., E comp.

[1]Auxiliary personnel: D. Gabriel Campo Cunchillos
D. Manuel Alvarez Castrillón.

Constants:	V	T_o	ϵ	r/T_o^2
N,	78	9.1	3.5	0.015
E,	65	8.6	4.5	0.013

Vicentini microseismograph, mass 56 kg., Z comp.
Constants: $V=125$, $T_o=0.9$ sec.
Vicentini microseismograph, mass 106 kg., two horizontal comp.
Constants not given.

Time service: time is kept "exact to the second" and minute time marks are made electromagnetically by a modified Wiechert contact clock compared daily by radiotelegraphic signals from the Eiffel tower; also by means of meridian circle observations.

*FANNING ISLAND

Seismologic Station.

Postal address: Pacific Cable Co., Fanning Island.

$\varphi=4°00'$ N., $\lambda=159°40'$ W.

Equipment: Milne seismograph, one comp. E.

The island is a coral atoll, 30 miles in circumference, no point of which is more than ca. 305 m. from the sea, nor more than ca. 3 m. above sea level.

FELDBERG, see KÖNIGSTEIN

*FIUME, FIUME FREE STATE

Seismologic Observatory, inaugurated in 1903.

$\varphi=45°19'56''$ N., $\lambda=14°25'40''$ E., $h=20$ m.

Lithologic foundation: folded limestones (Cretaceous).

Equipment: Vicentini seismograph, two horizontal comp.

*FLORENCE, ITALY

Osservatorio Geodinamico del Collegio "alla Querce."

Postal address: Collegio "alla Querce," Firenze, Italia.

$\varphi=43°47'18''$ N., $\lambda=11°16'42''$ E., h = ca. 80 m.

Lithologic foundation: alluvium (Quaternary).

Equipment: Stiattesi horizontal pendulum, mass 250 kg., two comp.
Constants: $V=25$, $T_o=18$ sec.
Nelzi vertical pendulum, mass 50 kg., three comp., recording photographically when started by a seismoscope.
Constants: $V=10$, $T_o=2$ sec.

Time service: the clock is checked by the midday cannon, fired on signal from the R. Osservatorio Meteorico del Museo.

*FLORENCE, ITALY

Osservatorio Ximeniano.
Rev. G. Alfani, Director.
Scuole Pie.

Postal address: Osservatorio Ximeniano, Firenze, Italia.

$\varphi = 43°46'40''$ N., $\lambda = 11°15'23.7''$ E., h = ca. 75 m.

Lithologic foundation: alluvium.

Equipment: Stiattesi horizontal pendulum, mass 500 kg., two comp. N and E.
Constants: V = 50, $T_o = 20$ sec.
Omori tromometer, mass 250 kg., two comp. NW and NE.
Constants: V = 40, $T_o = 18$ sec.
Vicentini microseismograph, mass 450 kg., two comp. N and E.
Constants: V = 100, $T_o = 2.6$ sec.
Vicentini microseismograph, mass 50 kg., Z comp.
Constants: V = 130, $T_o = 1.2$ sec.

QUARTO-CASTELLO, FLORENCE, ITALY

Osservatorio Astrofisico di Quarto, seismologic service inaugurated in 1895.

Prof. Raffaello Stiattesi, Director of the Observatory.

Postal address: Osservatorio di Quarto-Castello, Firenze, Italia.

$\varphi = 43°49'11.39''$ N., $\lambda = 11°13'11''$ E., h = 119.71 m.

Lithologic foundation: compact limestone (Upper Eocene).

Equipment: Vicentini horizontal microseismograph, mass 500 kg.
Constants: length = 9.28 m., V = 80, $T_o = 4.6$ sec., 1.8 m. = 1 hour.
Vicentini vertical microseismograph, mass 50 kg.
Constants: V = 130, $T_o = 1.6$ sec., 1.8 m. = 1 hour.
Stiattesi horizontal pendulum, mass 500 kg., two comp. N and E.
Constants: N, V = 50, $T_o = 21.4$ sec.: E, V = 50, $T_o = 17.4$ sec.
Various subordinate instruments and seismic alarms.

Time service: time comparisons by radiotelegraphic signals received by way of the R. Osservatorio Astronomico di Arcetri; also by meridian passage observations.

*FOGGIA, ITALY

Specola Meteorologica "P. F. Denza."

Postal address: Specola Meteorologica, Foggia, Puglie, Italia.

$\varphi = 41°27'$ N., $\lambda = 15°31'$ E., h = 80 m.

Equipment: Stiattesi horizontal pendulum, mass 500 kg., two comp. Constants: V = 50, $T_o = 17.5$ sec., 180 cm. = 1 hour.
Agamennone seismoscope.

Time service: time comparisons made with clock at railway station.

FORDHAM, see NEW YORK

*FORT DE FRANCE, MARTINIQUE

Observatoire du Morne-des-Cadets, seismologic service inaugurated about 1902.

Postal address: Observatoire du Morne-des-Cadets, Fort de France, Martinique.

$\varphi = 14°44'09''$ N., $\lambda = 63°29'$ or $61°09'11''$ (?) W., h = 510 m.

Lithologic foundation: tuff over andesite.

Equipment: Bosch-Omori horizontal pendulum, mass 12.5 kg., two comp. Cecchi seismograph.

*FREIBURG i. BR., GERMANY

Seismologic Station, inaugurated in 1905.
Prof. Dr. F. M. Haid, Director.
Naturwissenschaftliche Verein in Karlsruhe.

Postal address: Seismologic Station, Freiburg i. Br., Deutschland.

$\varphi = 47°59'46.4''$ N., $\lambda = 7°51'34.8''$ E., h = 279 m.

Lithologic foundation: gneiss.

Equipment: Hecker horizontal pendulum, phot. registr., two comp.

Mounted in a tunnel in the Schlossberg especially to study bradyseismic movements.

FUKUOKA, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1907.
T. Ikegami, Director.
Supported by the local prefecture.

Postal address: Fukuoka Meteorological Observatory, Fukuoka, Japan.

$\varphi = 33°34.8'$ N., $\lambda = 130°25.4'$ E., $h = 4.3$ m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.
Constants: N, $V = 120$, $T_o = 18$ sec.; E, $V = 20$, $T_o = 26$ sec.

Time service: time marks are made by a contact chronometer; time comparisons are obtained by radio-telephone from the Tokyo Astronomical Observatory.

*GENOA, ITALY

R. Instituto Idrografico.

Postal address: R. Instituto Idrografico, Genova, Italia.

$\varphi = 44°25'$ N., $\lambda = 80°55'$ E., $h =$ ca. 100 m.

Equipment: Vicentini microseismograph, mass 100 kg., two horizontal comp.
Constants: $V = 80$, $T_o = 2.4$ sec., 60 cm. = 1 hour.
Vicentini microseismograph, mass 50 kg., Z comp.
Constants: $V = 100$, $T_o = 0.9$ sec., 60 cm. = 1 hour.

Time service: time is determined accurately by a good meridian transit.

GIFU, JAPAN

Meteorological Observatory, seismologic service inaugurated in February, 1910.
Y. Tanaka, Director.
Supported by the local prefecture.

Postal address: Gifu Meteorological Observatory, Gifu, Japan.

$\varphi = 35°24'$ N., $\lambda = 136°46'$ E., $h = 12.8$ m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, $V = 50$, $T_o = 4.0$ sec.; E, $V = 50$, $T_o = 3.4$ sec.

Time service: time comparisons obtained daily by radio-telegraphic signals from the Tokyo Astronomical Observatory.

*GÖTTINGEN, GERMANY

Seismische Station.
Prof. Dr. E. Wiechert, Director.
Geophysikalisches Institut der Universität.

Postal address: Seismische Station, Geophysikalisches Institut der Universität, Göttingen, Deutschland.

$\varphi = 51°33'$ N., $\lambda = 9°58'$ E., h = 270 m.

Lithologic foundation: limestone.

Equipment: Wiechert inverted pendulum, mass 17,000 kg., N comp.
Constants: V = 2,100, $T_o = 1.5$ sec., $\epsilon = 8.0$, r = 0.3 mm.
Wiechert inverted pendulum, mass 1,200 kg., two comp. N and E.

Constants:	V	T_o	ϵ	r
N,	152	14	3.9	1.5
E,	172	12.6	3.4	0.9

Wiechert vertical-motion seismograph, mass 1,300 kg., Z comp.
Constants: V = 170, $T_o = 4.8$ sec., $\epsilon = 2.8$, r = 0.1 mm.

Time service: nothing on record, presumably excellent.

*GRAZ, AUSTRIA

Seismologic Station, inaugurated in 1906.
Physikalisches Institut der Universität Graz.

Postal address: Seismologic Station, Physikalisches Institut der Universität, Graz, Österreich.

$\varphi = 47°05'$ N., $\lambda = 15°27'$ E., h = ca. 375 m.

Lithologic foundation: isolated concrete pillar, 2.5 m. long, in a cellar on shale (Lower Miocene).

Equipment: Wiechert inverted pendulum, mass 1,000 kg.

Time service: time is kept by a Riefler clock; time comparisons every two weeks suffice.

GUAM, GUAM (MARIANNE ISLANDS)

Seismologic Station, inaugurated in 1914.
W. W. Rowley, in charge, under the control of the Governor of Guam.
Weather Bureau, Philippine Islands.

Postal address: Seismologic Station, U. S. Naval Station, Guam, Guam, or Manila Observatory, Manila, P. I.

$\varphi = 13°20'$ N., $\lambda = 144°45'$ E., h = 3 m.

$13°28'20.3''$ $144°44'55.9''$ 5 m. (conflicting reports).

Lithologic foundation: concrete, on coral.

Equipment: Wiechert inverted pendulum, mass 180 kg.

Time service: time is marked by a contact clock checked by a chronometer; time comparisons are made by radiotelegraphic signals from Pearl Harbor.

GUATEMALA CITY, GUATEMALA

Georgetown University Co-operative Station, seismologic service inaugurated in March, 1921.
Claudio Urrutia, Director.

Supported by the Government of Guatemala.

Postal address: Señor Claudio Urrutia, Guatemala City, Guatemala, C. A.

Equipment: Wiechert inverted pendulum, mass 80 kg.

Time service: time determinations are made by transit observations.

GUILFORD, ENGLAND

This station is discontinued.

HAKODATE, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1914.
T. Kajinuma, Director.

Supported by the Hokkaido government.

Postal address: Hakodate Meteorological Observatory, Hakodate, Japan.

$\varphi = 41°46'$ N., $\lambda = 140°44'$ E., $h = 2.6$ m.

Lithologic foundation: new made ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, $V = 10$, $T_o = 6.0$ sec.; E, $V = 10$, $T_o = 7.3$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

HALIFAX, NOVA SCOTIA

Seismologic Station, inaugurated in 1915.
Prof. H. L. Bronson, in charge.

Dalhousie University and The Dominion Observatory.

Postal address: Seismologic Station, Dalhousie University, Halifax, Nova Scotia, or Dominion Observatory, Ottawa, Canada.

$\varphi = 44°38'$ N., $\lambda = 63°36'$ W., $h =$ ca. 46.5 m.

Lithologic foundation: carbonaceous slate (Pre-Cambrian).

Equipment: Mainka bifilar pendulum, mass 139.3 kg., two comp. N and E.
Constants: $T_o = 10$ sec., $\epsilon = 5$ to 7 according to adjustment.

Time service: time marks are checked each hour on the record by Western Union telegraph signal; correct within 1 to 2 sec.

HAMADA, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1916.
K. Kambara, Director.
Supported by the Shimane prefecture.

Postal address: Hamada Meteorological Observatory, Hamada, Shimane-ken, Japan.

$\varphi = 34°54'$ N., $\lambda = 132°04'$ E., $h = 18$ m.

Lithologic foundation: rock (rocky hill).

Equipment: Omori horizontal pendulum tromometer, E comp.
Constants: $V = 50$, $T_c = 20$ sec.

Time service: time corrections by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

HAMAMATSU, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1913.
Y. Nagashima, Director.
Supported by the local prefecture.

Postal address: Hamamatsu Meteorological Observatory, Hamamatsu, Japan.

$\varphi = 34°43'$ N., $\lambda = 137°43'$ E., $h = 26.3$ m.

Lithologic foundation: soft soil.

Equipment: Imamura horizontal pendulum tremor recorder, two comp. N and E.
Constants: $V = 15$, $T_o = 10$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

HAMBURG, GERMANY

Hauptstation für Erdbebenforschung, inaugurated in July, 1898.
Prof. Dr. Richard Schütt, Director.

Dr. Ernst Tams, Privatdozent, Scientific Associate.
Physikalisches Staatslaboratorium der Hamburgischen Universität.

Postal address: (of station) Hamburg 36, Jungiusstrasse 9. (of Director) Prof. Dr. R. Schütt, Hamburg 24, Papenhuderstrasse 8, Deutschland.

$\varphi = 53°33'34''$ N., $\lambda = 9°58'52''$ E., h = 17 m.

Lithologic foundation: large re-inforced concrete block, in a specially constructed building, on marl or boulder clay (geschiebemergel).

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.
Constants: V = ca. 200, T_o = ca. 10 sec.
Wiechert vertical-motion seismograph, mass 1,250 kg., Z comp.
Constants: V = ca. 200, T_o = ca. 5 sec.
Rebeur-Hecker horizontal pendulum, phot. registr., two comp. N and E.
Constants: V = 32, T_o = 17 to 18 sec.

Time service: time is kept and compared and time marks are made by excellent Riefler astronomical clocks and a Lenzkirscher clock; also daily time comparisons are made, by means of a Hipp chronograph, with the time of the Hamburg Astronomical Observatory. Accuracy attained within at least 0.2 sec.

*HARPOOT, ARMENIA

Seismologic Observatory, inaugurated in 1906.
Euphrates College.

Postal address: Seismologic Observatory, Euphrates College, Harpoot, Armenia.

$\varphi = 38°43'$ N., $\lambda = 39°16'$ E., h = 1,310 m.

Lithologic foundation: volcanic rock.

Equipment: Marvin seismograph, mass 900 kg.,
Constants: V = 100, 86 cm. = 1 hour.

HAVANA, CUBA

Estación Seismológica del Observatorio del Colegio de Belén[1], inaugurated February 3, 1907.
Lorenzo Gangoiti, S.J., Director of the Observatory.

Postal address: Observatorio del Colegio de Belén, Habana, Cuba.

$\varphi = 23°06'21''$ N., $\lambda = 82°21'09''$ W., h = 35 m.

Lithologic foundation: limestone.

[1]The operation of this station is temporarily suspended.

Equipment: Bosch-Omori horizontal pendulum, mass 25 kg., two comp. N and E.

Constants: V = 10 to 20, 15 mm. = 1 minute.

Time service: time is kept and hour and minute time marks are made by an excellent pendulum clock (Dent); time comparisons made with the time sent out from Washington.

HAZELMERE, ENGLAND

No station.

HEIDELBERG (BADEN), GERMANY

Erdbebenwarte der Landes-Sternwarte auf d. Koenigstuhl bei Heidelberg (Baden), inaugurated in 1904.

Dr. Max Wolf, Director der Landes-Sternwarte.

Supported by the State of Baden.

Postal address: Landes-Sternwarte, Koenigstuhl, Heidelberg (Baden), Deutschland.

$\varphi = 49°23'55.7''$ N., $\lambda = 8°43'15''$ E., h = 558 m.

Lithologic foundation: sandstone (Trias, buntsandstein).

Equipment: (Wiechert) astatic pendulum, mass 2,100 kg., two comp. N and E.

Constants: V = 140, $T_o = 12$ sec., $\epsilon = 2.3$, r = 0.8 mm.

Bosch pendulum, two components
Ehlert pendulum, phot. registr. } not now in use.

Time service: time is kept and time marks are made electromagnetically by a clock; time comparisons are obtained from the time service of the observatory. The accuracy of readings is ± 0.5 sec.

HELIGOLAND, GERMANY

Seismologic Station of the Biological Station of the State of Heligoland, inaugurated in 1907.

Prof. Dr. Heinke, Director of the Biological Station.

Geophysikalisches Institut der Universität, Göttingen.

Postal address: Seismologic Station, Helgoland, Deutschland.

$\varphi = 54°10'46''$ N., $\lambda = 7°52'58''$ E., h = 30 m.

Lithologic foundation: (instruments to be re-mounted on) sandstone.

Equipment: Wiechert inverted pendulum, temporarily out of use.

Time service: time comparisons (will be made) by radiotelegraphic signals.

HELWAN, EGYPT

Helwan Observatory, seismologic service inaugurated January 1, 1904.
K. Knox-Shaw, Director of the Observatory.
Physical Department, Public Works Ministry, Egypt.

Postal address: Observatory, Helwan, Egypt.

$\varphi = 29°51'34''$ N., $\lambda = 31°20'30''$ E., h = 116 m.

Lithologic foundation: limestone.

Equipment[1]: Milne seismograph, two comp. N and E, 25 cm. = 1 hour.

Time service: time is kept and the light is eclipsed every hour by the mean time clock of the Observatory. (The Observatory conducts the time service of Egypt.) The time marks are accurate to 0.5 sec.

[1] A Milne-Shaw seismograph is to be installed.

HIKONE, JAPAN

Meteorological Observatory, seismologic service inaugurated in March, 1909.
S. Maeda, Director.
Supported by the local prefecture.

Postal address: Hikone Meteorological Observatory, Hikone, Japan.

$\varphi = 35°16'$ N., $\lambda = 136°15'$ E., h = 87.3 m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, V = 50, $T_o = 2.0$ sec.; E, V = 50, $T_o = 2.8$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

HIROSHIMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in May, 1915.
K. Nakamura, Director.
Supported by the local prefecture.

Postal address: Hiroshima Meteorological Observatory, Hiroshima, Japan.

$\varphi = 34°23'$ N., $\lambda = 132°27'$ E., h = 1.7 m.

Lithologic foundation: sandy soil.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, V = 20, T_o = 7.5 sec.; E, not stated (the same?).

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

HOF (BAVARIA), GERMANY

Erdbeben-Station, inaugurated October 1, 1903.
Fr. Adami, Oberstudienrat, in charge.
Nordoberfränkischer Verein für Natur-, Geschicts-, und Landeskunde.

Postal address: Erdbeben-Station, Hof (Bayern), Deutschland.

$\varphi = 50°19.6'$ N., $\lambda = 11°55.4'$ E., h = 510 m.

Lithologic foundation: diabase.

Equipment: (Wiechert) horizontal and vertical seismographs.
Constants: V = 80 (can be changed to 240).
Time service: not stated.

*HOHENHEIM, GERMANY

Kgl. Württembergische Meteorologische Station, seismologic service inaugurated in 1893, re-installed in 1905.
Prof. Dr. K. Mack, Director.
Kgl. Landwirtschaftliche Hochschule.

Postal address: Kgl. Württembergische Meteorologische Station, Hohenheim, bei Stuttgart, Württemberg, Deutschland.

$\varphi = 48°43'$ N., $\lambda = 9°13'$ E., h = 392 m.

Lithologic foundation: alluvium on sandstone.

Equipment: Bosch-Omori horizontal pendulum, two comp.
Schmidt trifilar gravimeter.

HOKOTO (PESCADORES), FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1897.
Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 23°32'$ N., $\lambda = 119°33'$ E., h = 11 m.

Lithologic foundation: basaltic.

Equipment: Gray-Milne seismograph; also since June, 1902, Omori horizontal pendulum tromometer, mass 6 kg., E comp.

Constants: $V=6$, $T_o=12$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

HONOLULU (EWA), T. H.

Honolulu Magnetic Observatory, seismologic service inaugurated in April, 1903.

Magnetic observer, in charge, subject to change; H. E. McComb, present incumbent.

U. S. Coast and Geodetic Survey.

Postal address: (of observatory) Ewa, Oahu, T. H.; also, U. S. Coast and Geodetic Survey, Washington, D. C.

$\varphi=21°19'12''$ N., $\lambda=188°03'48''$ W., $h=15$ m.

Lithologic foundation: coral, on basalt.

Equipment: Milne seismograph, mass 0.255 kg., E comp. (Loaned by the Earthquake Investigation Committee of the *British Association for* the Advancement of Science).

Constants: $V=6$, $T_o=18$ sec., 1 mm. displacement $=0.4''$.

This instrument is soon to be replaced by a Milne-Shaw seismograph, two comp.

Time service: Time is determined by solar observations 3 or 4 times a month and carried by two box chronometers. The seismograph clock is compared daily with one of the chronometers. The minute hand of the clock marks the seismogram every hour by cutting off the light near the edge of the paper. The space between hour marks is about 60 mm. The daily rate of the clock is satisfactory but there is some irregularity in the motion of the paper.

HONOLULU, T. H.

Seismologic Station, inaugurated in 1921.

Dr. Arnold Romberg, Professor of Physics, in charge.

University of Hawaii.

Postal address: Dr. Arnold Romberg, University of Hawaii, Honolulu, T. H.

$\varphi=21°\ 18'$ N., $\lambda=157°\ 49.3'$ W., $h=$ ca. 19.8 m.

Lithologic foundation: alluvium, on basalt, near middle of valley about 1.6 km. wide.

Equipment: Romberg horizontal pendulum, mass ca. 31.75 kg., two comp. N and E, phot. registr., with viscous coupling to eliminate effects of slow tilting.

Constants: $V=50$, $T_o=60$ sec., $\epsilon=5:1$ (oil damping); no pivots.

Time service: time is kept and marked by a clock with a wooden pendulum; time comparisons are made by radiotelegraphic signals sent out daily from Pearl Harbor, error ca. one second.

INNSBRUCK, AUSTRIA

Institut für Kosmische Physik, seismologic service inaugurated December 15, 1913.

Prof. Dr. Albert Defaut, Director.

Universität Innsbruck, Austria.

Postal address: Institut für Kosmische Physik, Innsbruch, Schöpfste 41, Österreich.

$\varphi=47°16'$ N., $\lambda=11°24'$ E., $h=580$ m.

Lithologic foundation: river alluvium.

Equipment: Mainka horizontal pendulum, mass 135 kg., two comp. NE and NW.

Constants: $V=$ ca. 100, $T_o=10$ to 12 sec., $\epsilon=4$ to 5, $r/T_o^2=0.007$ to 0.01.

Time service: time is kept and marked with high accuracy, error less than one second.

*IRKUTSK, SIBERIA, RUSSIA

Meteorological and Magnetic Observatory, seismologic service inaugurated in December, 1901.

Postal address: Meteorological and Magnetic Observatory, Irkutsk, Siberia, Russia.

$\varphi=52°16'17.5''$ N., $\lambda=104°18'33''$ E., $h=470$ m.

Lithologic foundation: instruments housed in a specially constructed building on hard clay (Jurassic).

Equipment: Milne seismograph, E comp. Zöllner-Repsold seismograph, mass 50 kg., two horizontal comp., 18 cm. = 1 hour. Bosch-Omori horizontal pendulum, two comp.

Time service: the Observatory is also an astronomical observatory.

IRKUTSK, see also KABANSK

IROSIN (SORSOGON), PHILIPPINE ISLANDS

Seismologic Station, inaugurated in May, 1919.

Eliseo Villalón, Observer.

Weather Bureau, Philippine Islands.

Postal address: The Observer at Irosin, Sorsogon, P. I., or Manila Observatory, Manila, P. I.

$\varphi = 12°43'$ N., $\lambda = 124°02'$ E., h = 29 m.

Lithologic foundation: basalt and andesite.

Equipment: Vicentini system, Manila type.

Time service: time comparisons daily by telegraphic signals; no chronograph.

ISHIGAKIJIMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1915.

T. Iwasaki, Director.

Supported by the Central Meteorological Observatory.

Postal address: Ishigakijima Meteorological Observatory, Okinawa-ken, Japan.

$\varphi = 24°20'$ N., $\lambda = 124°10'$ E., h = 5.5 m.

Lithologic foundation: coral reef.

Equipment: C. M. O. horizontal pendulum tremor recorder, two comp. N and E.

Constants: N, V = 20, $T_o = 7$ sec.; E, V = 20, $T_o = 6$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

ITHACA, NEW YORK

Seismograph Station.

Department of Geology, Cornell University.

Postal address: Seismograph Station, Department of Geology, Cornell University, Ithaca, New York.

$\varphi = 42°26'58''$ N., $\lambda = 76°29'09''$ W., h = 242.6 m.

Lithologic foundation: not stated.

Equipment: Bosch-Omori horizontal pendulum, mass 25 kg., two comp. N and E.

Constants:

	V	T_o	ϵ
N,	13	24	4
E,	12	21	4

Time service: time is kept and marked by a contact clock compared with a clock kept in the Astronomical Department, College of Civil Engineering. Recent service not accurate.

JENA, GERMANY

"Zentralstelle für Erdbebenforschung. Die Zentralstelle für Erdbebenforschung wurde im Jahre 1898 in Strassburg begründet. 1919 wurde sie nach Jena verlegt und übernahm die seismische Station Jena."

Prof. Dr. Oskar Hecker, Director.

Reichsministerium des Innern.

Postal address: Zentralstelle für Erdbebenforschung, Schillergäszchen 2, Jena, Deutschland.

$\varphi = 50°55'36''$ N., $\lambda = 11°35'03''$ E., $h = 154.2$ m.

Lithologic foundation: limestone.

Equipment: Wiechert inverted pendulum, mass 1,200 kg., V = 200.
Straübel vertical seismograph, V = 2,000.
"Die Station wird wahrscheinlich in Kürze erheblich vergrössert werden."

Time service: daily radiotelegraphic time signals received; clock correction known with an accuracy of ca. 0.2 sec.

JINSEN, KOREA, JAPAN

Meteorological Observatory, seismologic service inaugurated January 1, 1915.

T. Hirata (or Dr. I. Goto), Director.

Supported by the Choshen (Korea) Government General.

Postal address: Meteorological Observatory of the Government General of Choshen, Jinsen, Choshen (Chemulpo), Korea.

$\varphi = 37°29'$ N., $\lambda = 126°37'$ E., $h = 69$ m.

Lithologic foundation: granite.

Equipment: Omori horizontal pendulum tromometer, mass 50 kg., two comp. N and E.

Constants:

	V	T_o
N,	20	30 sec.
N,	150	12 "
E,	150	28 "

Time service: minute time marks made by a contact chronometer; time comparisons obtained by transit observations twice a week.

JOHANNESBURG, SOUTH AFRICA

Union Observatory, seismologic service inaugurated in July, 1910.

H. E. Wood, Chief Assistant, in charge.

Union of South Africa.

Postal address: Union Observatory, Johannesburg, South Africa.

$\varphi = 26°11'$ S., $\lambda = 28°04'$ E., h = ca. 1806 m.

Lithologic foundation: quartzite.

Equipment: Wiechert inverted pendulum, mass 200 kg., two comp. N and E.
Wiechert vertical-motion seismograph, mass 160 kg.

Time service: minute marks are made by an auxiliary contact clock, compared with the time service of the Observatory. Records can be read to about 0.05 minute.

*JUGENHEIM, HESSE, GERMANY

Seismologic Station, inaugurated in 1908.
Prof. Dr. C. Zeissig, Director.
Grossh. Technische Hochschule, Darmstadt.

Postal address: Grossh. Technische Hochschule, Darmstadt, Hessen, Deutschland.

$\varphi = 49°45'30''$ N., $\lambda = 8°39'$ E., h = 125 m.

Lithologic foundation: solid concrete base on gravel.

Equipment: Wiechert inverted seismograph, mass 1,200 kg., two comp. recording with ink on white paper.

Time service: time is kept by a standard clock with a Riefler pendulum; time comparisons are made frequently by telephonic signals from the Astronomical Observatory at Königstuhl-Heidelberg; time is marked by a clock checked frequently with the standard clock.

JURJEW, see DORPAT

*KABANSK, near IRKUTSK, SIBERIA, RUSSIA

Seismologic Station, a station of the second class of the Russian service.

$\varphi = 53°03'$ N., $\lambda = 106°37'$ E.,

Equipment: Galitzin horizontal pendulum, mech. registr., two comp. Galitzin vertical-motion seismograph, mech. registr.

KAGOSHIMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in July, 1915.
N. Maeda, Director.
Supported by the local prefecture.

Postal address: Kagoshima Meteorological Observatory, Kagoshima, Japan.

$\varphi = 31°34'$ N., $\lambda = 130°33'$ E., h = 4.2 m.

Lithologic foundation: soft ground, volcanic ash.

Equipment: and constants:		V	T_o
Omori horizontal pendulum tremor recorder,	N comp.	50	3.6 sec.
" " " " "	E "	50	3.8 "
Imamura seismograph,	N "	2	8.0 "
" "	E "	2	
" "	Z "	2	3.0 "

Time service: Time comparisons are obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*KALAMATA, GREECE

Seismologic Observatory.
Prof. D. Eginitis, Director.
Observatoire Nationale d'Athénes.

$\varphi = 37°02'$ N., $\lambda = 22°15'$ E., h = 32 m.

Equipment: Agamennone seismograph, registering with ink.

KALOCSA, HUNGARY

Haynald Observatorium, seismologic service inaugurated in 1909.
Dr. Theodore Angehrn, S.J., Director.

Postal address: Haynald Observatorium, Kalocsa, Hungary.

$\varphi = 46°31'42''$ N., $\lambda = 18°58'55''$ E., h = 110 m.

Lithologic foundation: heaped up earth.

Equipment: Wiechert inverted pendulum, mass 200 kg., at present out of use.

Time service: time is kept and minute time marks are made electromagnetically by a contact clock (Cook) with a mercury-compensation pendulum; time comparisons are made by astronomical observations.

KANAYAMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in September, 1917.
R. Sano, Director.
Privately supported.

Postal address: Kanayama Meteorological Observatory, Kanayama, Miyagi-ken, Japan.

$\varphi = 37°53'$ N., $\lambda = 140°46'$ E., h = 22.5 m.

Lithologic foundation: rocky ground.

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.

Constants: N, $V=50$, $T_o=16$ sec.; E, $V=20$, $T_o=10$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical observatory.

KANAZAWA, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1908.

Y. Kaneda, Director.

Supported by the Ishikawa prefecture.

Postal address: Kanazawa Meteorological Observatory, Kanazawa, Ishikawa-ken, Japan.

$\varphi=36°32'$ N., $\lambda=136°39'$ E., $h=27$ m.

Lithologic foundation: hard gravel.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: $V=30$, $T_o=3.4$ sec.

Time service: time corrections by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

KARENKO, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1911.

Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi=23°59'$ N., $\lambda=121°37'$ E., $h=19.2$ m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; Imamura small horizontal pendulum seismometer, two components; also, since January, 1914, Omori horizontal pendulum tromometer, mass 13.5 kg., two comp. N and E.

Constants: $V=35$, $T_o=4$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

*KAŠGAR (CHINESE TURKESTAN), RUSSIA

Seismologic Station, a station of the second class of the Russian service.

$\varphi = 39°27'$ N., $\lambda = 70°01.5'$ E.

Equipment: Galitzin horizontal pendulum, mech. registr., two comp. Galitzin vertical-motion seismograph, mech. registr.

(COCOS) KEELING ISLANDS

The Milne seismograph formerly maintained at this station was destroyed by the German cruiser "Emden" on November 9, 1914, and has not been replaced.

Postal address: Superintendent, Eastern ExtensionTelegraph Company, Cocos Island, via Singapore.

$\varphi = 12°12'$ S., $\lambda = 96°54'$ E.

KEW, see RICHMOND

KINGSTON, JAMAICA

Private seismologic station inaugurated in 1907.
J. F. Brennan, Government Meteorologist, Proprietor.

Postal address: J. F. Brennan, Esq., Kingston, Jamaica.

$\varphi = 17°57'41''$ N., $\lambda = 76°47'40''$ W., h = (a) ca. 1.5 m.
(b) ca. 30.2 m.

Lithologic foundation: alluvium.

Equipment: Seismograph of Gray-Milne type.
Duplex pendulum seismograph.
Horizontal pendulum seismograph, local construction, two comp. N and E.
Constants: V = 1 $^5/_{18}$, $T_o = 24$ sec., 1 mm. displacement = 1″, 1¼ inches = 1 hour.

Time service: time is kept by a pendulum clock of good rate. Time comparisons are made by sextant observations about once a fortnight.

*KLAUSTHAL, GERMANY

Seismologic Station, inaugurated in 1908.
Prussian Ministry of Education.

Postal address: Seismologic Station, Klausthal, Harz, Deutschland.

$\varphi = 51°48'30''$ N., $\lambda = 10°20'30''$ E.

Lithologic foundation: solid rock, in the abandoned tunnel of a mine at a depth of 600 m. below the surface.

Equipment: horizontal pendulum, mass 100 kg.

Time service: time is transmitted by telephone from Göttingen.

KOBE, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1904 (1910).

Y. Horiginti, Director.

Supported by the local prefecture.

Postal address: Kobe Meteorological Observatory, Kobe, Japan.

$\varphi = 34°41'10''$ N., $\lambda = 135°10'51''$ E., $h = 58.2$ m.

Lithologic foundation: loam (diluvial series).

Equipment: Omori horizontal pendulum seismograph, two comp. N and E

Constants:	mass	V	T_o
N,	18.5 kg.	20	19 sec.
E,	17.5 "		

Time service: time marks made by a contact chronometer compared daily with the time ball of the Kobe Harbor Office; also time comparisons by direct telegraphic communication with the Tokyo Astronomical Observatory.

KODAIKANAL, S. INDIA

Seismologic Station, inaugurated January 12, 1900.

J. Evershed, Director of the Observatory.

Kodaikanal Observatory, Meteorological Department, Government of India.

Postal address: Kodaikanal Observatory, Kodaikanal, South India.

$\varphi = 10°13'50''$ N., $\lambda = 77°28'00''$ E., $h = 2343$ m.

Lithologic foundation: charnockite rock.

Equipment: Milne seismograph, E comp.

Constants: $V = 9.76$, $E = 1$.

Time service: Time is marked by the hourly eclipse of light by a watch compared daily with the standard observatory clock; time comparisons daily to within 0.1 sec. by signal from the Madras Observatory. Clock error is never greater than ± 2 sec. Hour time marks are also made by an electromagnet in circuit with the standard clock. On the seismogram time can be read to within ± 5 sec.

Publication: Data are published in the India Monthly Weather Review; also sent to the Brit. Ass. Seismological Committee.

*KOLOZSVAR, HUNGARY

Seismologic Observatory, inaugurated in 1912 (?).

Postal address: Seismologic Observatory, Kolozsvar, Hungary.

$\varphi = 46°41'16''$ N., $\lambda = 23°32'$ E., h = 340 m.

Equipment: Mainka horizontal pendulum, mass 210 kg., two comp.

*KÖNIGSBERG, PRUSSIA, GERMANY

Hauptstation für Erdbebenforschung[1], inaugurated in 1911.
Prof. Dr. A. Tornquist, Director.
Geologisches Institut.

Postal address: Hauptstation für Erdbebenforschung, Lange Reihe 4, Königsberg, Preussen, Deutschland.

$\varphi = 54°50'$ N., $\lambda = 20°30'$ E.

Lithologic foundation: heavy concrete base, in a specially constructed building, on sand and loam resting on rock (Cretaceous).

Equipment: Wiechert inverted pendulum, mass 1,000 kg., Wiechert vertical-motion seismograph.

Time service: the clock is checked by telephone from the Astronomical Observatory at Königsberg.

[1] 15 km. north of Königsberg.

*KÖNIGSTEIN i. T., GERMANY

Taunus Observatorium bei Königstein i. T.
Dr. F. Linke, Director.
Meteorologisch-Physikalisches Institut des Physikalisches Vereins, Frankfurt a. M.

Postal address: Taunus Observatorium, Königstein i. T., Deutschland.

$\varphi = 50°13'$ N., $\lambda = 8°27'$ E., h = 827 m.

Lithologic foundation: quartzite.

Equipment: Galitzin horizontal seismograph. Mainka horizontal seismograph, mass 450 kg. Wiechert vertical-motion seismograph, mass 80 kg.

KOSHUN, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1897.
Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 22°00'$ N., $\lambda = 120°44'$ E., h = 23.3 m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; also since October, 1907, Omori horizontal pendulum tromometer, mass 6 kg., E comp.
Constants: $V = 10$, $T_o = 20$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

*KRAKOW, POLAND

Astronomical Observatory.
Prof. Dr. M. P. Rudski, Director.
University.

Postal address: Astronomical Observatory, University, Krakow, Poland.

$\varphi = 50°03'05.9''$ N., $\lambda = 19°57'04.5''$ E., h = ca. 205 m.

Lithologic foundation: compact sandy clay and alluvium.

Equipment: Bosch-Omori horizontal pendulum, mass 10 kg., two comp.

*KRASNOJARSK, SIBERIA, RUSSIA

Seismologic Station.

$\varphi = 56°01'$ N., $\lambda = 92°52'$ E.

Equipment: Bosch-Omori horizontal pendulum, two comp.

*KRASNOVODSK, SIBERIA, RUSSIA

Seismologic Station.

$\varphi = 39°59'$ N., $\lambda = 53°03'$ E.

KREMSMÜNSTER, AUSTRIA

This station has been discontinued.

Oberosterreich Sternwarte Kremsmünster.

$\varphi = 48°03.4'$ N., $\lambda = 14°07.9'$ E.

*KREMSMÜNSTER, AUSTRIA

Observatoire des Benedictines.[1]

Postal address: Observatoire des Benedictines, Kremsmünster, Österreich.

$\varphi = 48°03'$ N., $\lambda = 14°08'$ E., h = 380 m.

[1] Service discontinued.

Lithologic foundation: ca. 20 m. of glacial till over stratified rock (Tertiary).

Equipment: Rebeur-Ehlert horizontal pendulum, three horizontal components.

KUMAMOTO, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1918.
S. Kuriyama, Director.
Supported by the local prefecture.

Postal address: Kumamoto Meteorological Observatory, Kumamoto, Japan.

$\varphi = 32°49'$ N., $\lambda = 130°42'$ E., $h = 37.9$ m.

Lithologic foundation: rock.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, $V = 50$, $T_o = 3.6$ sec.; E, $V = 50$, $T_o = 3.8$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

KYOTO, JAPAN

Kamigamo Geophysical Observatory[1], seismologic service inaugurated in 1908.
Prof. Toshi Shida, Director.
Imperial University of Kyoto.

Postal address: Geophysical Institute, Imperial University of Kyoto, Kyoto, Japan.

$\varphi = 35°03'33''$ N., $\lambda = 135°46'$ E., $h = 175$ m.

Lithologic foundation: rock (Paleozoic).

Equipment: Wiechert inverted pendulum, mass 1000 kg., two comp. N and E.
Constants: $V = 200$, $T_o = 12$ sec., $\epsilon = 3$.
Wiechert vertical-motion seismograph, mass 1,300 kg., Z comp.
Constants: $V = 160$, $T_o = 5$ sec., $\epsilon = 3$.
Rebeur-Paschwitz horizontal pendulum, for measuring earth body tides.
Omori horizontal pendulum, two comp. N and E: $V = 20$, $T_o = 15$ sec.

[1] The Imperial University of Kyoto maintains also a second order seismological station at Uji, ca. 20 km. south of the University. The data of this station were not given.

In preparation—
A 20-ton (20,000 kg.?) hofizontal seismograph to have V = 2,000.
Long-period horizontal pendulums.

Time service: hour and minute time marks are made by a pendulum clock compared daily by telephone with the Riefler standard clock of the Astronomical Observatory; time is accurate within one second.

KYOTO, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1916.
M. Tozima, Director.
Supported by the local prefecture.

Postal address: Kyoto Meteorological Observatory, Kyoto, Japan.

$\varphi = 35°01'$ N., $\lambda = 135°44'$ E., h = 41.5 m.

Lithologic foundation: sandy clay.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: N, V = 50, $T_o = 4.5$ sec.; E, V = 50, $T_o = 4.0$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

*LAIBACH, JUGOSLAVIA

Seismologic Station, inaugurated in 1897.
Prof. Dr. A. Belar, Director.
Technical High School.

Postal address: Seismologic Station, Laibach, Jugoslavia.

$\varphi = 46°03'$ N., $\lambda = 14°31'$ E., h = 296 m.

Lithologic foundation: alluvium.

Equipment: Galitzin aperiodic horizontal pendulum; Vicentini seismograph, two comp.; Grablovitz-Belar horizontal pendulum, two comp.; Rebeur-Ehlert seismograph, three comp.; horizontal pendulum, phot. registr.

LA PAZ, BOLIVIA

Estacion sismológica San Calixto, inaugurated in 1913.
Prof. P. M. Descotes, S.J., Director.
Colegio de San Calixto.

Postal address: Estacion Sismológica San Calixto, La Paz, Bolivia.

$\varphi = 16°29'43''$ S., $\lambda = 68°09'10''$ W., h = 3658 m.

Lithologic foundation: old alluvium.

Equipment: and constants:			Mass	V	T_o
Bifilar horizontal pendulum,	N	comp.	2,000 kg.	180	14.0 sec.
" " "	E	"	500 "	80	18.0 "
" " "	E	"	100 "	25	20.0 "
Vertical (simple) "	N and E	comp.	1,500 "	1,100	2.4 "

Time service: time is kept and time comparisons are made with the accuracy of the Astronomical Observatory service.

LA QUIACA, ARGENTINA

Observatorio La Quiaca, seismologic service inaugurated in July, 1917. Observer subject to change,

Oficina Meteorológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi = 22°08'$ S., $\lambda = 65°43'$ W., h = 3462 m.

Lithologic foundation: volcanic.

Equipment: Milne seismograph, two comp. N and E.
Constants: $T_o = 16$ sec.; N, 1 mm. displacement = 0.54″,
E, 1 " " = 0.36″.

Time service: light eclipsed once each hour; marks checked four or five times a day with a chronometer; time comparisons made occasionally by astronomical observations. Sun dial, with graphic correction curve, reading approximately to 1 to 5 seconds.

LA VALETTA, see MALTA

LAWRENCE, KANSAS

Seismographic Station, inaugurated earlier than 1910. Regular service from April 30, 1915.
Prof. Winthrop P. Haynes, in charge.

Department of Geology, University of Kansas.

Postal address: Seismographic Station, University of Kansas, Lawrence, Kansas.

$\varphi = 38°57'30''$ N., $\lambda = 95°14'58''$ W., h = 301.1 m.

Lithologic foundation: limestone.

Equipment: Wiechert inverted pendulum, two comp. N and E.
Constants: N, V = 205; E, V = 177; both, $T_o = 3.4$ sec., $\epsilon = 4$.

Time service: time is kept and hour and minute time marks are made electromagnetically by a contact pendulum clock compared daily by radiotelegraphic signals from Arlington.

LECCE, see TARANTO

*LEIPZIG, GERMANY

Erdbebenwarte der Universität, inaugurated in 1902.

Postal address: Erdbebenwarte, Universität, Leipzig, Deutschland.

$\varphi = 51°20'06''$ N., $\lambda = 12°23'30''$ E., h = 119 m.

Lithologic foundation: gravels (Pliocene).

Equipment: Wiechert inverted pendulum, mass 1,000 kg.

LE MANS (SARTHE), FRANCE

Seismologic Station, inaugurated in March, 1912.
Albert Jagot, in charge.

Privately inaugurated and conveyed to the city.

Postal address: Station sismologique, Beauverger 36, Le Mans, France.
$\varphi = 48°00'17''$ N., $\lambda = 0°12'30.6''$ E., h = 77 m.
Lithologic foundation: clay.
Equipment: horizontal pendulum, Mainka type, mass 300 kg., two comp. N and E.
Constants: N, V = 43, $T_o = 7$ sec.; E, V = 48, $T_o = 9$ sec.; 6 mm. = 1 min.
Records changed weekly.

Time service: time is kept and minute time marks are made by an accurate contact clock compared daily by radiotelegraphic signals from the Eiffel tower.

LILLE, FRANCE

Seismologic Station.
Prof. Chas. Barrois, Director.
University of Lille.

The station is temporarily disorganized as a consequence of the war. It is now in course of reorganization.

*LIMA, PERU

Observatorio Seismografico de la Sociedad Geografica de Lima.
H. Hope-Jones, Director.

Postal address: Observatorio Seismografico, Sociedad Geografica de Lima, Lima, Peru.

$\varphi = 12°03'05.8''$ S., $\lambda = 77°00'50''$ W., h = 154 (or 122?) m.

Lithologic foundation: differently given in available records as "gravel and conglomerate on andesite" and "alluvium on basement of diorite and metamorphic rocks": the seismograph is mounted on a pier of stone and cement which goes 10 feet into the ground.

Equipment: Milne seismograph, E comp.

LISBON, PORTUGAL

Seismologic Station, inaugurated in January, 1918.
General João Maria de Almeida Lima, Director.
Observatory "Infante D. Luis."

Postal address: Observatory "Infante D. Luis," Lisbon, Portugal.

$\varphi = 38°43'13''$ N., $\lambda = 9°08'20.5''$ E., h = 78 m.

Lithologic foundation: marls.

Equipment: Wiechert inverted pendulum, mass 1,000 kg.
Constants: L = 36 m., I = 8,571, V = 238, $T_0 = 12$ sec., $\epsilon = 7.8$, r = 0.75.
Wiechert vertical-motion seismograph, mass 1,300 kg., not yet in use.
Mainka horizontal seismograph.
Agamennone seismograph.

Time service: time comparisons by telephone from the Astronomical Observatory of Lisbon.

LIVERPOOL (BIDSTON-BIRKENHEAD), ENGLAND

Liverpool Observatory, seismologic service inaugurated in 1898.
William E. Plummer, Director.
Mersey Docks and Harbour Board.

Postal address: Liverpool Observatory, Bidston-Birkenhead, England.

$\varphi = 53°24'04.8''$ N., $\lambda = 3°04'19.5''$ W., h = ca. 56 m.

Lithologic foundation: sandstone (Kuyper).

Equipment: Milne seismograph, N comp.
Milne-Shaw seismograph, N comp., constants not stated.

Time service: time is kept by a clock electrically controlled (by a master-clock?); time comparisons are made by radiotelegraphic signals.

LIVORNO, ITALY

Osservatorio sismico, inaugurated in June, 1914.
Prof. Giuseppe Schiavazhi, Director.

Postal address: Osservatorio Sismico, Livorno, Italia.

$\varphi = 43°31'38.26''$ N., $\lambda = 10°18'23.89''$ E., h = sea level.

Lithologic foundation: sandy rock.

Equipment: Stiattesi, Vicentini, and Schiavazhi seismographs.

Time service: mean time chronometer.

LWÓW (LEMBERG), POLAND

Seismologic Station, inaugurated in June, 1899.

Prof. Dr. L. Grabowski, Director.

Technical High School.

Postal address: Observatory of the Technical High School, Lwów (Lemberg), Poland.

$\varphi = 49°50'11''$ N., $\lambda = 24°01'$ E., $h = 312$ m.

Lithologic foundation: 5 m. sand and sandstone (diluvial and Tertiary) resting on compact marl (Cretaceous).

Equipment: Bosch-Omori horizontal pendulum, two comp. N and E.

Constants: $V = $ ca. 10, $T_o = 30$ sec., $\epsilon_N = $ ca. 5. $\epsilon_E = $ ca. 3.

Time service: minute time marks are made electromagnetically by a contact pendulum clock checked twice a week with the standard clock of the Observatory; time comparisons are made by meridian transit observations very accurately (average probable error ca. 0.05 sec.); the time of a sharply marked disturbance on the seismogram can be determined with an accuracy of about 1 sec.

MADRAS, see KODAIKANAL

MAEBASHI, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1912.

K. Akaii, Director.

Supported by the local prefecture.

Postal address: Maebashi Meteorological Observatory, Maebashi, Japan.

$\varphi = 36°24'$ N., $\lambda = 139°04'$ E., $h = 111.7$ m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: $V = 100$, $T_o = 4.1$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

*MAHE, SEYCHELLES

Seismologic Station, inaugurated in 1911.

Eastern, Eastern Extension and Pacific Telegraph Co.

Postal address: Seismologic Station, Mahe, Seychelles.

$\varphi = 4°05'$ S., $\lambda = 55°05'$ E.,

Equipment: Milne seismograph, E comp.

*MAKEJEVKA, RUSSIA

Seismologic Station, a station of the first class of the Russian Service. The Society of Mine Industries of South Russia.

Postal address: Seismologic Station, Makejevka, Russia.

$\varphi = 48°02'$ N., $\lambda = 37°59'$ E.

Equipment: Galitzin seismographs.

The instruments are mounted in a specially constructed building.

MALABAR, NETHERLANDS EAST INDIES

Seismologic Station.
$\varphi = 7°13'$ S., $\lambda = 107°37'$ E.,

Equipment: Wiechert inverted pendulum, mass 100 kg., two comp. N and E.

MALAGA, SPAIN

Estación Sismológica de Málaga.
D. José Rodríguez de Córdoba, Ingeniero Geógrafo, Director.
Instituto Geográfico y Estadístico.

Postal address: Ingeniero Jefe de la Estación Sismológica de Málaga, España.

$\varphi = 36°43'39''$ N., $\lambda = 4°24'40.5''$ W., $h = 60$ m.

Lithologic foundation: quartzose limestone.

Equipment: and constants:		Mass	V	T_o	r/T_o^2	m.per hour
Bosch-Omori seismograph,	N comp.	25 kg.	14	17.0	0.005	0.9
" " "	E "	25 "	15	16.0	0.008	0.9
Vicentini "	N "	100 "	110	2.4	0.010	0.6
" "	E "	100 "	110	2.3	0.010	0.6
" "	Z "	50 "	120	0.9	0.020	0.6

An Agamennone seismoscope.

Time service: time is kept and minute time marks are made electromagnetically by a Bosch contact clock compared by radiotelegraphic signals from the Eiffel tower.

ISLAND OF MALTA

Meteorological Observatory, seismologic service inaugurated May 10, 1906.
Prof. Thomas Agius, Director.
Malta University.

Postal address: Seismological Station, Meteorological Observatory, University, Malta.

$\varphi = 35°52'48''$ N., $\lambda = 14°30'50''$ E., h = ca. 36.9 m.

Lithologic foundation: limestone.

Equipment: Milne seismograph, E comp.

Time service: time marks made by eclipse of light by an excellent clock checked daily by the Admiralty Time-ball.

MAMBAJAO, CAMIGUIN ISLAND, PHILIPPINE ISLANDS

Meteorological Station, seismologic service inaugurated in March, 1917.
Domingo Araw, Observer.
Weather Bureau, Philippine Islands.

Postal address: The Meteorological Station, Mambajao, Misamis, P. I., or Manila Observatory, Manila, P. I.

$\varphi = 9°15'$ N., $\lambda = 124°43'$ E., h = 6.5 m.

Lithologic foundation: extrusive rock.

Equipment: Vicentini system, Manila type.

Time service: time comparisons daily by telegraphic signals; no chronograph.

MANILA, PHILIPPINE ISLANDS

Manila Observatory, seismologic service inaugurated in 1884.
Miguel Saderra Masó, Chief, Seismic and Magnetic Divisions, Weather Bureau, Philippine Islands.
Chief Station of the Philippine Service.

Postal address: Manila Observatory, Philippine Islands.

$\varphi = 14°34'41''$ N., $\lambda = 120°58'33''$ E., h = 3 to 10 m.

Lithologic foundation: alluvial and littoral deposits.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.
Constants: N, $T_o = 6.25$ sec., $\epsilon = 2.906$; E, $T_o = 6.18$ sec., $\epsilon = 2.393$.
Vicentini system, Padova type.
Bertelli tromometer.

Cecchi seismograph.
Gray-Milne seismograph.
Omori system, Manila type.

Time service: time comparisons made daily with the standard clocks o the Observatory in the same building.

*MARITUJ, RUSSIA

Seismologic Station, a station of the second class of the Russian service.

$\varphi = 51°46'$ N., $\lambda = 104°07'$ E.

Equipment: Wiechert inverted pendulum, small model.

MARSEILLES, FRANCE

Observatoire de Marseille, seismologic service inaugurated in 1909.
Prof. Bourget, Director.
Université de Marseille.

Postal address: Observatoire de Marseille, Marseille, France.

$\varphi = 43°18'19''$ N., $\lambda = 5°23'38''$ E., $h = 75$ m.

Lithologic foundation: limestone.

Equipment: *Mainka horizontal pendulum, mass 130 kg., two comp.*

Time service: city circuit of (electric) synchronous clocks correct to 0.2 sec.; time comparisons made by meridian circle observations.

MATSUMOTO, JAPAN

Meteorological Observatory, seismologic service inaugurated in April, 1917.
I. Yanagisawa, Director.
Supported by the local prefecture.

Postal address: Matsumoto Meteorological Observatory, Matsumoto, Japan.

$\varphi = 36°14'$ N., $\lambda = 137°59'$ E., $h = 581$ m.

Lithologic foundation: alluvium (loam).

Equipment: C. M. O. horizontal pendulum tremor recorder, two comp. N and E.
Constants: $V = 20$, $T_o = 10$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

MATSUYAMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1911.

K. Hiroe, Director.

Supported by the local prefecture.

Postal address: Matsuyama Meteorological Observatory, Matsuyama, Japan.

$\varphi = 33°50'$ N., $\lambda = 132°45'$ E., h = 31.4 m.

Lithologic foundation: granitic gravel, soil.

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.

Constants: V = 100, $T_o = 12$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

MAZATLÁN (SINALOA), MEXICO

Estación Seismológica de Mazatlán, a station of the second order.

Pablo Vazquez Schiaffino, Jefe de la Estación.

Servicio Seismológico Nacional de México,
Instituto Geológico Nacional.

Postal address: Instituto Geológico Nacional, 6a del Cipres núm. 176, México, D. F., República Mexicana.

$\varphi = 23°11'17''$ N., $\lambda = 106°23'38''$ W., h = 70 m.

Lithologic foundation: andesitic porphyry.

Equipment: Wiechert inverted pendulum, mass 200 kg., two comp. N and E. Wiechert vertical-motion seismograph, mass 80 kg., Z comp.

Time service: time comparisons by telegraphic signals from Tacubaya.

MELBOURNE, see SOUTH YARRA

MENDOZA, ARGENTINA

Escuela Vitivinícola, seismologic service inaugurated in February, 1916.

Observer subject to change.

Oficina Meteorológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi = 32°53'$ S., $\lambda = 68°49'$ W., h = 755 m.

Lithologic foundation: alluvial.

Equipment: Milne seismograph, N comp.
Constants: $T_o = 14$ sec., 1 mm. displacement $= 0.49''$.

Time service: light eclipsed once each hour; marks checked four or five times a day with a chronometer compared once or twice a week by telegraphic signals sent to the local post-office. "Accuracy not very great."

MERIDA (YUCATAN), MEXICO

Seismologic Station, of the first order.
Rafael Acosta Ocampo, Jefe de la Estación.
Servicio Seismológico Nacional de Mexico,
Instituto Geológico Nacional.

Postal address: Instituto Geológico Nacional, 6a del Cipres núm. 176, México, D. F., República Mexicana.

$\varphi = 20°56'52''$ N., $\lambda = 89°37'$ W., $h = 6.35$ m.

Lithologic foundation: limestone (Quaternary).

Equipment: Wiechert inverted pendulum, mass 1,200 kg., two comp. N and E. Wiechert vertical-motion seismograph, mass 1,300 kg., Z comp.

Time service: time comparisons by telegraphic signals from Tacubaya.

MESSINA, ITALY

Osservatorio Geofisico di Messina, seismologic service inaugurated December 1, 1902 (this observatory continues the work of an older establishment).

Prof. Dr. Comm. G. B. Rizzo, Director.
University.

Postal address: Osservatorio Geofisico di Messina, Italia.

$\varphi = 38°12'$ N., $\lambda = 15°33'$ E., $h = 48.8$ m.

Lithologic foundation: sandstone.

Equipment: Vicentini microseismograph, mass 100 kg., three comp.

Constants:	V	T_o
NE and NW comp.,	100	2.4 sec.
Z "	120	0.9 "

Conrad seismograph, mass 26 kg., one comp NW, $T_o = 1.8$ sec.
Horizontal pendulum seismograph, mass 100 kg., two comp. NE and NW, with electromagnetic damping.

Constants:	V	T_o	ϵ
NE comp.,	50	26 sec.	1.2
NW "	50	25.5 "	1.2

Time service: time is kept by a Cooke sidereal clock and by a Riefler mean time clock; time determinations are made by transit observations.

MEXICO, see TACUBAYA

MILAN, LOMBARDY, ITALY

Seismologic Station, inaugurated in June, 1909.
L. Gabba, Director.
Reale Osservatorio Astronomico di Brera.

Postal address: Reale Osservatorio Astronomico di Brera, Milano, Lombardia, Italia.

$\varphi = 45°27'59.3''$ N., $\lambda = 9°11'29.7''$. E., h = 124 m.

Lithologic foundation: alluvial ground.

Equipment: Agamennone seismograph, mass 210 kg., length 6.59 m., two comp. N and E.
Constants: V = ca. 20, $T_o = 2.6$ sec., ca. 60 cm. = 1 hour.
Galli seismograph.
Cecchi seismic alarm.

Time service: minute time marks are made electromagnetically by a contact clock; accuracy ca. 2 sec.

*MILETO, CATANZARO, ITALY

Osservatorio Sismico "Morabito" nel Seminario.

Postal address: Osservatorio Sismico "Morabito" Mileto, Catanzaro, Italia.

$\varphi = 38°36'14''$ N., $\lambda = 16°03'14''$ E., h = ca. 360 m.

Equipment: Omori seismograph, mass 200 kg.
Constants: V = 25, $T_o = 20$ sec., 100 cm. = 1 hour.

Time service: time is determined by meridian transit observations.

MILWAUKEE, WISCONSIN

Seismologic Station, inaugurated in 1909.
John B. Kremer, in charge, temporarily.
Marquette University.

Postal address: Marquette University, Milwaukee, Wisconsin.

$\varphi = 43°32'$ N., $\lambda = 87°50'40''$ W.,

Lithologic foundation: concrete pier, free of floor, on limestone.

Equipment: Wiechert inverted pendulum, mass 80 kg., not completely installed.

Time service: contact clock (Wiechert).

MINEO (CATANIA), ITALY

Osservatorio Meteorico Geodinamico "Guzzanti," seismologic service inaugurated in 1885.
Prof. Comm. Corrado Guzzanti, Director.
Privately established.

Postal address: Osservatorio Meteorico Geodinamico "Guzzanti," *Mineo (Catania), Italia.*

$\varphi = 37°15'$ N., $\lambda = 14°44'$ E., h = 509.85 m.

Lithologic foundation: (Pliocene).

Equipment: Guzzanti horizontal seismograph, mass 200 kg., two comp., length of pendulum, 2.80 m.
Constants: V = 20, $T_o = 3.0$ sec., 80 cm. = 1 hour.
Agamennone horizontal seismograph, mass 50 kg., two comp.
Constants: V = 30, $T_o = 8$ sec., 1.3 m. = 1 hour.
Brassart seismograph, mass 20 kg., three comp.
Constants: length = 2.35 m., V = 13, $T_o = 2$ min. 33 sec., 0.24 m. = 1 hr.
Several subordinate seismographic devices.

Time service: not stated.

MITO, JAPAN

Meteorological Observatory, seismologic service inaugurated in April, 1905.
H. Uno, Director.
Supported by the local prefecture.

Postal address: Mito Meteorological Observatory, Mito, Japan.

$\varphi = 36°23'$ N., $\lambda = 140°28'$ E., h = 30 m.

Lithologic foundation: hilly ground.

Equipment: *Omori horizontal pendulum tromometer, two comp.* N and E.
Constants: N, V = 20, $T_o = 38.7$ sec.; E, V = 20, $T_o = 29.8$ sec.

Time service: time comparisons daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

MIYAZAKI, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1915.

Y. Satake, Director.

Supported by the local prefecture.

Postal address: Miyazaki Meteorological Observatory, Miyazaki, Japan.

$\varphi = 31°55'$ N., $\lambda = 131°26'$ E., $h = 6.8$ m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: N, $V = 50$, $T_o = 2.8$ sec.; E, $V = 50$, $T_o = 3.0$ sec.

Time service: time comparisons are obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

MIZUSAWA, JAPAN

International Latitude Observatory, seismologic service inaugurated in January, 1911.

A. Kimura, Director.

Postal address: International Latitude Observatory of Mizusawa, Iwate-ken, Japan.

$\varphi = 39°08'03.6''$ N., $\lambda = 141°07'41''$ E., $h = 61.0$ m.

Lithologic foundation: (Quaternary).

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.

Constants: N, $V = 20$, $T_o = 36$ sec.; E, $V = 100$, $T_o = 16$ sec.

Time service: of the International Latitude Observatory; time marks made by a contact chronometer; time comparisons based on astronomical observations.

MOBILE, see SPRING HILL

MONCALIERI, ITALY

Osservatorio sismico, inaugurated in 1905.

Dr. Giovanni Penta, Director.

Real Collegio Carlo Alberto.

Postal address: Osservatorio sismico, Moncalieri, Italia.

$\varphi = 44°59'51.8''$ N., $\lambda = 7°41'43.1''$ E., $h = 238$ m.

Lithologic foundation: alluvial.

Equipment: and constants:	Mass	V	T_o
Stiattesi horizontal pendulum, N comp.	260 kg.	34	19.4 sec.
" " " E "	260 "	34	20.3 "
Vertical (simple) "	650 "	58	3.2 "

100 cm. = 1 hour.
Two small horizontal pendulums with electric contacts to give alarm.

Time service: time is kept and minute time marks are made directly with the writing styles by means of a good contact clock; every day radiotelegraphic signals from the Eiffel tower are marked directly on the records by the styles; the accuracy of reading of the seismograms is ca. 1 sec.

MONTECASSINO (CASERTA), ITALY

Osservatorio Meteorico-Aerologico-Geodinamico, seismologic service inaugurated in 1875.
Dr. Bernardo M. Paoloni, O.S.B., Director.
R. Ufficio Centrale di Meteorologia e Geodinamica, Roma.

Postal address: Osservatorio Meteorico-Acrologico-Geodinamico, Montecassino (Caserta), Italia.

$\varphi = 41°29'26''$ N., $\lambda = 13°49'07''$ E., h = 540 m.

Lithologic foundation: not stated.

Equipment: Cancani seismograph, three comp. Agamennone seismograph, three comp.
Constants: see "La Meteorologia Pratica, No. 1, 1920."
Several subordinate seismographic mechanisms.

Time service: time is kept (and marked?) by marine chronometers compared daily by radiotelegraphic signals from the Eiffel tower.

MONTEVIDEO, URUGUAY

Observatorio Central del Instituto Nacional Físico-Climatológico, seismologic service inaugurated in 1909.
Prof. Luis Morandi, Director.
Dependencia del Ministerio de Industrías.

Postal address: Instituto Nacional Físico-Climatológico, Montevideo-Prado, Uruguay.

$\varphi = 34°51'47.7''$ S., $\lambda = 56°12'05.5''$ W., h = 25 m.

Lithologic foundation: heavy masonry pier, free of floor and 1 m. from walls, on clay.

Equipment: Vicentini microseismograph, mass 65 kg., two comp. N and E. (simple pendulum).
Constants: length of pendulum = 1.6 m., V = 112.
Alfani horizontal seismograph, mass 45 kg., two comp. NE and NW.
Constants: NE, V = 120, T_o = 13.8 sec.; NW, V = 120, T_o = 18.8 sec.

Time service: time is kept and minute time marks are made electromagnetically by a clock having an invar pendulum, compared once a day by means of a signal from the office of the Time Service.

*MOSCOW, RUSSIA

Seismologic Station.
Dr. Ernest Leyst, Director.
Imperial University.

$\varphi = 55°45'$ N., $\lambda = 37°34'$ E.

Lithologic foundation: sand.

Equipment: Bosch-Omori horizontal pendulum, two comp.

MOUNT HAMILTON, CALIFORNIA

Lick Observatory, seismologic service inaugurated in 1887; with present equipment May 23, 1911.
Dr. W. W. Campbell, Director of the Observatory.
Lewis A. Bond (Berkeley), in charge of seismometric measurement.
University of California.

Postal address: Lick Observatory, Mt. Hamilton, California, or Seismographic Station, University of California, Berkeley, Calif.

$\varphi = 37°20'24.5''$ N., $\lambda = 121°38'34''$ W., h = 1281.7 m.

Lithologic foundation: feldspathic sandstone.

Equipment: and constants:		V	T_o	ϵ
Wiechert, mass 80 kg.,	N and E comp.,	100	6	0.25
" " 80 "	Z "	60	3	0.25
Duplex-pendulum seismograph,		5	2.5	
Ewing three-component seismograph,	N "	4	5	
" " " "	E "	4	5	
" " " "	Z "	3	3	

Time service: with the Wiechert seismographs hour and minute time marks are made electromagnetically by a compensated contact clock whose accuracy (=rate) is ca. 0.3 sec. per day compared two or three times a week with the standard clocks of the Observatory which are of a very high order of accuracy.

MUKAIYAMA, JAPAN

Observatory of Mukaiyama, seismologic service inaugurated in 1913.
Prof. Sirota Kusakabé, Director.
Tôhoku Imperial University.

Postal address: Observatory of Mukaiyama, Sendai, Japan.

$\varphi = 38°14'38.8''$ N., $\lambda = 140°51'56.3''$ E., h = 88 m.

Lithologic foundation: loam.

Equipment: Omori horizontal pendulum, N comp., V = 120.
E " V = 20.
Omori vertical-motion seismograph, Z comp., V = 10.
Imamura horizontal seismograph, N comp., V = 2; E comp., V = 2.
Wiechert inverted pendulum, two comp. N and E, V = 100.
Wiechert vertical-motion seismograph, Z comp., V = 280.

Time service: chronometer, error ca. 1 sec., checked by astronomical observations.

MUNICH, GERMANY

Erdbebenwarte München, inaugurated in 1905.
Prof. Dr. C. W. Lutz, Director.
Sternwarte München u. Verwaltung d. wiss. Sammlungen d. Staates.

Postal address: Erdbebenwarte München 27, Sternwarte, Bayern, Deutschland.

$\varphi = 48°08'46''$ N., $\lambda = 11°36'31''$ E., h = 528 m.

Lithologic foundation: glacial detritus.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E. 15 mm. = 1 minute.

Time service: daily chronographic comparisons with the chief clock of the Astronomical Observatory; accuracy ca. 0.1 sec.

NAHA, JAPAN

Meteorological Observatory, seismologic service inaugurated in November, 1912.
T. Tsutsui, Director.
Supported by the Okinawa prefecture.

Postal address: Naha Meteorologial Observatory, Naha, Okinawa-ken, Japan.

$\varphi = 26°13'$ N., $\lambda = 127°41'$ E., h = 8.9 m.

Lithologic foundaton: limestone.

Equipment: Omori horizontal pendulum tromometer, E comp.
Constants: V = 120, T_o = 6 sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

NAGANO, JAPAN

Meteorological Observatory, seismologic service inaugurated in July, 1903.

Z. Nishizawa, Director.

Supported by the local prefecture.

Postal address: Nagano Meteorological Observatory, Nagano, Japan.

$\varphi = 36°40'$ N., $\lambda = 138°12'$ E., h = 418.1 m.

Lithologic foundation: diluvial hill.

Equipment: and constants:		V	T_o
Omori horizontal pendulum tromometer,	E comp.,	15	39.7 sec.
" " " tremor recorder,	N "	100	4.0 "
" " " " "	E "	100	4.0 "

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

NAGASAKI, JAPAN

Meteorological Observatory, seismologic service inaugurated in April, 1913.

Dr. I. Goto, Director.

Supported by the local prefecture.

Postal address: Nagasaki Meteorological Observatory, Nagasaki, Japan.

$\varphi = 32°44'01''$ N., $\lambda = 129°52'37''$ E., h = 130.6 m.

Lithologic foundation: volcanic agglomerate.

Equipment: and constants:		V	T_o
Omori horizontal pendulum tromometer,	N comp.,	20	20 sec.
" " " "	E "	120	20 "
Imamura seismograph,	N "	2.0	7.0 "
" "	E "	2.0	7.0 "
Omori horizontal pendulum seismograph,	N "	5	6 "
" " " "	E "	5	6 "
" " " "	Z "	10	6 "

Time service: time marks are made by a contact chronometer; time comparisons are obtained by telephone from the office of the Nagasaki Time-Ball service.

NAGOYA, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1910.

R. Iguchi, Director.

Supported by the local prefecture.

Postal address: Aishi-ken Meteorological Observatory, Nagoya, Japan.

$\varphi = 35°10'$ N., $\lambda = 136°55'$ E., h = 15.2 m.

Lithologic foundation: concrete pier on soft soil (Quaternary).

Equipment: and constants:

			V	T_o
Omori	horizontal pendulum tromometer,	N comp.,	50	15 sec.
"	" " "	E "	50	15 "
C. M. O.	" " tremor recorder,	N "	25	11 "
" " "	" " " "	E "	25	8 "
Gray-Milne	" "	N "	5	3 "
" "	" "	E "	5	3 "

Time service: time is kept by two chronometers "adjusted" daily; time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*NAPLES, ITALY

Instituto di Fisica Terrestre[1] della R. Università.

Postal address: San Marcellino, Napoli, Italia.

$\varphi = 40°50.8'$ N., $\lambda = 14°15'36''$ E., h = 24.5 m.

[1] Discontinued (?)

VALLE DI POMPEI (NAPLES), ITALY

Osservatorio geodinamico-meteorico Pio X, seismologic service inaugurated 19 May, 1907.

Prof. Giovanni Alfano, Director.

Santuario Valle di Pompei, Napoli.

Postal address: Osservatorio, Valle di Pompei, Napoli, Italia.

$\varphi = 40°44'50''$ N., $\lambda = 14°30'06.9''$ E., h = 12.1 m.

Lithologic foundation: ashes and tuffs of Vesuvius.

Equipment and constants:

	mass	comp.	V	T_o	mm. per sec.
Omori-Alfani tromometrograph..	225 kg.	N	80	10	0.26
" " "	225	E	80	10	0.26
Microsismografo Vesuvio	500	NW	270	2.5	1.50
Navarro-Neumann pendulum	850	E	320	1.9	0.30
Mercalli pendulum.....	500	N	270	2.0	1.80
Grablovitz pendulum	10	N	6	13.0	0.26
" "	10	E	6	20.0	0.26

	mass	comp.	V	T_o	mm. per sec.
Grablovitz vasca	1,000	N	140	1.0	0.73
" "	1,000	E	140	1.0	0.73
Denza macroseismograph	10	N	4	3.0	1.26
" "	10	E	4	3.0	1.26
Alfani Ortosismografo	200	Z	200	1.9	0.26

Time service: time is furnished by a clock with an invar pendulum and by a chronometer; time comparisons are made by telephone with the clocks of the Astronomical Observatory at Naples.

NEUCHATEL, SWITZERLAND

Station sismique, inaugurated in 1911.

Dr. Louis Arnot, Director.

Observatoire de Neuchatel.

Postal address: Station Sismique, Observatoire de Neuchatel, Schwyz.

$\varphi = 46°59'51''$ N., $\lambda = 6°55'48.5''$ E., h = 488 m.

Lithologic foundation: compact rock.

Equipment: Mainka bifilar horizontal pendulum, mass 146 kg., two comp. N and E.

Constants: N, V = 46, $T_o = 7.2$ sec.; E, V = 65, $T_o = 6.1$ sec., 30 mm. = 1 minute.

Time service: time is kept and marked by a contact precision clock; time comparisons are made by meridian circle observations with an accuracy of some hundredths of a sec.

NEW HAVEN, CONNECTICUT

Seismologic Station of Yale University.

Operation temporarily suspended.

NEW ORLEANS, LOUISIANA

Seismologic Station, inaugurated in 1910.

Rev. A. L. Kunkel, S.J., Director.

Nicholas D. Burke Observatory, Loyola University.

Postal address: Seismologic Station, Loyola University, New Orleans, Louisiana.

$\varphi = 29°56'54''$ N., $\lambda = 90°07'12''$ W., h = 2 m.

Lithologic foundation: alluvial.

Equipment: Wiechert inverted pendulum, mass 80 kg., two comp. N and E. Wiechert vertical-motion seismograph, mass 80 kg., Z comp.

Constants: $V = 120$, $\epsilon = 5$.

Time service: astronomical clocks.

FORDHAM, NEW YORK CITY, NEW YORK

Seismologic Station, inaugurated in November, 1910.
Joseph Lynch, S. J., Director.
Fordham University.

Postal address: Seismologic Station, Fordham University, Fordham, New York, New York.

$\varphi = 40°51'47''$ N., $\lambda = 73°53'08''$ W., $h = 23.86$ m.

Lithologic foundation: dolomite (Silurian, Stockbridge).
Equipment: Wiechert inverted pendulum, mass 80 kg., two comp. N and E.
Constants: $V = 80$, $T_o = 7$ sec., $\epsilon = 5$.

Time service: time is kept and hour and minute time marks are made electromagnetically by a Wiechert contact clock; time comparisons are made by radiotelegraphic signals from Arlington.

NEW YORK, NEW YORK

Seismologic Station, inaugurated in June, 1912.
Chester A. Reeds, Observer in Charge, 1921.
New York Academy of Sciences, American Museum of Natural History.

Postal address: American Museum of Natural History, 77th Street and Central Park West, New York, New York.

$\varphi = 40°46'48.06''$ N., $\lambda = 73°58'39.60''$W., $h = 26.206$ m.

Lithologic foundation: mica schist.

Equipment: Mainka horizontal pendulum, mass 450 kg., two comp. N and E.
Constants: N, $V = 95.5$, $T_o = 7.5$ sec.; E, $V = 107$, $T_o = 7.5$ sec., air damping, ratio not stated.

Time service: time comparisons by radiotelegraphic signals from Brooklyn and Arlington; interrupted by the war, soon to be resumed.

*NICOLAJEF, RUSSIA

Observatoire Astronomique Maritime[1], seismologic service inaugurated in 1898.

[1] This station probably was discontinued before the war.

$\varphi = 46°58.4'$ N., $\lambda = 31°58'27''$ E. (or $31°47.25'$?), h = 50 m.

Equipment: von Rebeur-Paschwitz horizontal pendulum.

NIIGATA, JAPAN

Meteorological Observatory, seismologic service inaugurated in August, 1912.

T. Sasaki, Director.

Supported by the local prefecture.

Postal address: Niigata Meteorological Observatory, Niigata, Japan.

$\varphi = 37°55'$ N., $\lambda = 139°03'$ E., h = 24.5 m.

Lithologic foundation: soft sandy hill.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: V = 30, $T_o = 2.7$ sec.

Time service: time corrections obtained daily by radiotelegraphic signals from Tokyo Astronomical Observatory.

NÖRDLINGEN, GERMANY

Erdbebenwarte Nördlingen[1], inaugurated in June, 1911.

Otto Aumüller, Wissenschaftl. Leiter, in charge.

Sternwarte München.

Postal address: Erdbebenwarte Nördlingen, Bayern, Deutschland.

$\varphi = 48°50'55''$ N., $\lambda = 10°29'26''$ E., h = 432 m.

Lithologic foundation: limestone.

Equipment: Mainka bifilar horizontal pendulum, mass 465 kg., E comp. only. 15 mm. = 1 minute.

Time service: time comparisons are made by daily telegraphic signals from the Astronomical Observatory at Munich.

[1] This is a sub-station of the station at Munich.

NORTHFIELD, VERMONT

Local Office, U. S. Weather Bureau, seismologic service inaugurated January 1, 1915.

W. A. Shaw, Meteorologist, in charge.

United States Weather Bureau.

Postal address: Local Office, U. S. Weather Bureau, Northfield, Vermont, or U. S. Weather Bureau, Washington, D. C.

$\varphi = 44°10'$ N., $\lambda = 72°41'$ W., h = 256 m.

BULLETIN
OF THE
NATIONAL RESEARCH COUNCIL
Vol. 2. Part 7 JULY, 1921 Number 15

A LIST OF SEISMOLOGIC STATIONS OF THE WORLD

Compiled under the auspices of the
Section of Seismology of the American Geophysical Union
with the cooperation and assistance of the Research Information Service
National Research Council, United States of America

By Harry O. Wood
Secretary, American Geophysical Union

INTRODUCTION

Because of inquiries and recognition of the need for a revised list of the seismologic stations of the world, the present compilation was undertaken, under the auspices of the Section of Seismology of the American Geophysical Union and with the cooperation of the Research Information Service of the National Research Council of the United States of America.

Under date of March 20, 1920, the following questionnaire, accompanied by the following explanatory letter asking the cooperation of seismologists in the assembly of the necessary data, was sent to every address where a seismograph was known or thought to have been installed or projected (except in a very few cases where former stations were definitely known to have been discontinued). In assembling the list of addresses to which the inquiry was sent the compiler received substantial assistance from Professor H. F. Reid, Professor W. J. Humphreys, and Rev. F. A. Tondorf, S.J., to whom thanks and acknowledgments are tendered.

Lithologic foundation: clay over bed rock.

Equipment: Bosch-Omori horizontal pendulum, mass 25 kg., two comp. N and E, mech. registr.

Constants: N, $V=10$, $T_o=16$ sec.; E, $V=10$, $T_o=15$ sec.

Time service: time is kept and minute time marks are made electromagnetically by a contact clock (Howard) compared daily with the telegraphic time signals of the Western Union service through the local office. The accuracy is dependent only on the time signals.

NUMAZU, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1915.

R. Kanada, Director.

Supported by the local prefecture.

Postal address: Numazu Meteorological Observatory, Numazu, Japan.

$\varphi=36°06'$ N., $\lambda=138°51'$ E., $h=6$ m.

Lithologic foundation: soft soil.

Equipment: C. M. O. horizontal pendulum tremor recorder, two comp. N and E.

Constants: $V=20$, $T_o=5$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

OAXACA, MEXICO

Estación Seismológica de Oaxaca, a station of the second order.

Ignacio Gomez Feria, Jefe de la Estación.

Servicio Seismológico Nacional de México

Instituto Geológico Nacional.

Postal address: Instituto Geológico Nacional, 6a del Cipres núm. 176, México, D. F., República Mexicana.

$\varphi=17°01'$ N., $\lambda=96°47'$ W., $h=1{,}570$ m.

Lithologic foundation: volcanic tuff.

Equipment: Wiechert inverted pendulum, mass 200 kg., two comp. N and E. Wiechert vertical-motion seismograph, mass 80 kg., Z comp.

Time service: time comparisons by telegraphic signals from Tacubaya.

ÓGYALLA, see STARÁ ĎALA

OITA, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1906.

G. Yamagawa, Director.

Supported by the local prefecture.

Postal address: Oita Meteorological Observatory, Oita, Japan.

$\varphi = 33°14'$ N., $\lambda = 131°37'$ E., h = 4.5 m.

Lithologic foundation: soft ground.

Equipment: and constants:		V	T_o
Omori horizontal pendulum tromometer,	E comp.,	20	25 sec.
" " " tremor recorder,	N "	90	6 "
" vertical-motion tromometer,	Z "	20	10 "
C. M. O. horizontal pendulum tremor recorder,	N "	50	9 "
" " " " " " "	E "	50	9 "

Time service: time marks are made by a contact chronometer; time comparisons are obtained by radiotelephone from the Tokyo Astronomical Observatory.

OSAKA, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1901.

N. Shimono, Director.

Supported by the local prefecture.

Postal address: Osaka Meteorological Observatory, Osaka, Japan.

$\varphi = 34°39'$ N., $\lambda = 135°26'$ E., h = 1.5 m.

Lithologic foundation: soft soil.

Equipment: and constants:		V	T_o
Omori horizontal pendulum tromometer,	N comp.,	120	25 sec.
" " " "	N "	20	30 "
" " " "	E "	20	30 "
" vertical-motion seismograph,	Z "	20	5 "
" horizontal pendulum tremor recorder,	N "	60	5 "
" " " " "	E "	60	5 "
" strong-motion seismograph,	N "	1	5 "
" " " "	E "	1	5 "
" " " "	Z "	2	5 "

Time service: time comparisons by direct telegraphic communication with the Tokyo Astronomical Observatory.

OSORNO, CHILE

Seismologic Station, a station of the second class of the Chilean service.

Postal address: Servicio Sismolójico de Chile, Santiago, Chile.

$\varphi = 40°35'$ S., $\lambda = 73°10'$ W., h = 25 m.

Lithologic foundation: alluvial.

Equipment: Wiechert inverted pendulum, mass 180 kg.

Time service: Time is kept and minute time marks are made by a contact clock compared weekly by telegraphic signals from the central station at Santiago.

ŌTOMARI, JAPAN

Meteorological Observatory, seismologic service inaugurated in January, 1911.

T. Noda, Director.

Supported by the Karafuto government.

Postal address: Karafuto Meteorological Observatory, Ōtomari, Karafuto, Japan.

$\varphi = 46°39'$ N., $\lambda = 142°46'$ E., h = 35.7 m.

Lithologic foundation: tuff (Tertiary).

Equipment: Omori horizontal pendulum tromometer, two comp. N and E.

Constants: N, V = 20, T_o = 28 to 31 sec.; E, V = 60, T_o = 27 to 30 sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

OTTAWA, CANADA

Seismologic Station, inaugurated in 1906.

Ernest A. Hodgson, Seismologist, in charge.

Dominion Observatory, Department of Interior, Government of Canada.

Postal address: Seismologic Station, Dominion Observatory, Ottawa, Canada.

$\varphi = 45°23'38''$ N., $\lambda = 75°42'57''$ W., h = 83 m.

Lithologic foundation: boulder clay over limestone (Cambro-Silurian).

Equipment: Bosch horizontal pendulum, two comp. N and E.

Constants: N, V = 120, T_o = 8.0 sec.; E, V = 120, T_o = 7.1 sec.

Wiechert vertical motion seismograph, Z comp.

Constants: V = 120, T_o = 6.3 sec.

Undagraph, used in the investigation of microseisms (installed at Duncan's Cove, Chebucto Hd., near Halifax).
Deformation Instrument of the International Seismological Ass'n.

Time service: of the Dominion Observatory, minute contacts controlled by the master clock, correct to within half a second.

OXFORD, ENGLAND

Seismologic Station[1], inaugurated in October, 1919.
Prof. Herbert Hall Turner, Director.
Seismological Committee, Brit. Ass. Adv. Sci.

Postal address: Seismologic Station, Oxford University Observatory, Oxford, England.

$\varphi = 51°45'34.2''$ N., $\lambda = 1°15'06''$ W., h = ca. 64 m.

Lithologic foundation: not stated.

Equipment: Milne-Shaw seismograph, E comp.
Constants: V = 260, T_o = 12 sec.

Time service: time comparisons made by radiotelegraphic signals, correct within ±1 sec.

[1] This station replaces that so long maintained on the Isle of Wight by the late John Milne.

*PADUA, ITALY

Instituto Fisico della R. Università.

Postal address: Padova, Italia.

$\varphi = 45°24'02.5''$ N., $\lambda = 11°52'18''$ E., h = ca. 20 m.

Lithologic foundation: alluvium (Recent and Quaternary).

Equipment: Vicentini microseismograph, mass 400 kg., two horizontal comp.
Constants: V = 90 to 110, T_o = 6.7 sec., special aperiodic damping.
Vicentini microseismograph, mass 100 kg.
Constants: two horizontal comp., V = 125 to 140, T_o = 2.3 sec.
one vertical " V = 145 " 165, T_o = 1.2 "

Time service: time comparisons are obtained by electric signals from the neighboring Astronomical Observatory.

*PAISLEY, SCOTLAND

Seismologic Station, inaugurated in 1902.
David Crilley, Esq., Director.
The Coats Observatory.

Postal address: Seismologic Station, The Coats Observatory, Paisley, Scotland.

$\varphi = 55°50'43.8''$ N., $\lambda = 4°25'49.5''$ W., h = ca. 32 m.

Lithologic foundation: boulder clay on limestone or sandstone.

Equipment: Milne seismograph.

*PAMPLEMOUSSES, MAURITIUS

Seismologic Station, inaugurated in September, 1898.
Royal Alfred Observatory.

Postal address: Seismologic Station, Royal Alfred Observatory, Pamplemousses, Mauritius.

$\varphi = 20°05'39''$ S., $\lambda = 57°33'09''$ E., h = ca. 51 m.

Lithologic foundation: heavy concrete pier on soil 1 to 4 m. thick resting on solid basalt.

Equipment: Milne seismograph, two horizontal comp.

Time service: time observations are made daily (presumably by meridian transit).

PARC SAINT MAUR (PARIS), FRANCE

Observatoire du Parc Saint Maur, seismologic service inaugurated in 1908.
M. Ch. Dufour, Meteorologist, in charge of Observatory.
M. Eblé, in charge of seismologic work.
Bureau Centrale Meteorologique de France.

Postal address: Observatoire du Parc Saint Maur, Seine, France.

$\varphi = 48°48.6'$ N., $\lambda = 2°10.9'$ E., h = 50 m.

Lithologic foundation: limestone of the Paris basin.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E. Bosch-Mainka horizontal pendulum, mass 400 kg., two comp. N and E. Galitzin seismograph, photo-galvanometric registration, three comp.

Constants:	V	T_o	ϵ	r
Wiechert, N,	ca. 225	ca. 11.1 sec.	ca. 5.0	ca. 0.7
" E,	" 240	" 11.2 "	" 4.7	" 0.8
Mainka, N,	" 160	" 9.2 "	" 5.5	" 0.7
" E,	" 150	" 8.5 "	" 3.5	" 1.2

Time service: time is kept and minute time marks are made electromagnetically by a compensated contact clock; time comparisons are made daily by radiotelegraphic signals from the Eiffel tower, accurate to 0.5 sec.

PAVIA, ITALY

R. Osservatorio Geodinamico, inaugurated in 1891.
Prof. Dr. Pericle Gomba, Director.
Ufficio Centrale di Meteorologia e Geodinamica, Roma.

Postal address: R. Osservatorio Geodinamico, Pavia, Italia.

$\varphi = 45°11'06''$ N., $\lambda = 9°10'25''$ E., h = 77 m.

Lithologic foundation:

Equipment: Vicentini seismograph. Agamennone seismograph.

Time service: time comparisons by telephone from the Astronomical Observatory at Milan, approx. accuracy 1 sec.

PERTH, AUSTRALIA

The Perth Observatory.
H. B. Curlewis, The Government Astronomer for Western Australia, Director.
The Government of Western Australia.

Postal address: The Observatory, Perth, Western Australia.

$\varphi = 31°57'08.6''$ S., $\lambda = 115°50'26.1''$ E., h = ca. 60 m.

Lithologic foundation: solid sand with limestone beneath.

Equipment: Milne seismograph, N comp.
Constants: 1 mm. displacement = 0.62", 18 inches = 1 hour.

Time service: light eclipsed once each hour by an electromagnetic shutter operated by the Mean Time clock of the Observatory; also, light eclipsed every five minutes by an electromagnetic shutter operated by a secondary clock having a uniform rate: time marks are correct to about 0.2 min.

*PIC DU MIDI (BAGNÈRES DE BIGORRE), HAUTES PYRENEES, FRANCE

Seismologic Station at Bagnères, a sub-station of Observatoire du Pic du Midi, Université de Toulouse.

Postal address: Observatoire du Pic du Midi, Bagnères de Bigorre, Hautes Pyrenees, France.

(The latitude and longitude of the station at Bagnères is not available.) h = 547 m.

$\varphi = 42°56'17''$ N., $\lambda = 0°08'30''$ E., h = 2,859 m. (of Observatory).

Lithologic foundation: at Bagnères, morainic detritus and alluvium: (at the Observatory, crystalline rock).

Equipment: Marchand recording seismograph. Marchand seismoscope.

PILAR (CÓRDOBA), ARGENTINA

Observatorio Magnético, seismologic service inaugurated in January, 1905.

Observer subject to change.

Oficina Meteorológica Argentina.

Postal address: Jefe de la Oficina Meteorológica Argentina, Paseo Colon 974, Buenos Aires, Argentina.

$\varphi = 31°40'13''$ S., $\lambda = 63°53'$ W., $h = 330$ m.

Lithologic foundation: alluvial.

Equipment: Milne seismograph, two comp. N and E.

Constants: $T_o = 17$ sec.; N, 1 mm. displacement $= 0.48''$,
E, 1 " " $= 0.41''$.

Time service: Time marks made every two hours. Chronometer checked daily by telephone with time of Astronomical Observatory. Time is accurate, and seismograms are read to 0.1 minute.

*PJATIGORSK, RUSSIA

Seismologic Station, a station of the second class of the Russian service.

Equipment: Zöllner horizontal pendulums.

PLAUEN-VOGTLAND, GERMANY

Erdbeben-Station, inaugurated August 29, 1905.

Prof. E. Weise, Director.

Hauptstation der Geologischen Landesuntersuchung von Sachsen in Leipzig.

Postal address: Erdbeben-Station, Plauen-Vogtland, Sachsen, Deutschland. Neundorfer Str. 55.

$\varphi = 50°29.9'$ N., $\lambda = 12°09.2'$ E., $h = 380$ m.

Lithologic foundation: brick pier, free from the floor, on breccia (Upper Devonian).

Equipment: Wiechert inverted pendulum, N comp.

Constants: $L = 12.25$ m., $V = 116$, $T_o = 7$ sec., $\epsilon = 1.2$, $r = 2.5$.

Time service: time is kept and time marks are made electromagnetically by a Göttingen pendulum clock compared twice a week by means of the telegraphic time service of the Berlin Astronomical Observatory.

POINT LOMA, CALIFORNIA

Co-operative Meteorological Station of the U. S. Weather Bureau, seismologic service inaugurated in 1906.
Fred J. Dick, Co-operative Observer.
Theosophical University.

Postal address: The Meteorological Station, Theosophical University, Point Loma, California.

$\varphi = 32°43'03''$ N., $\lambda = 117°15'10''$ W., h = 91.4 m.

Lithologic foundation: aeolian hard pan, on sandstone (Jurassic).

Equipment: "Two-horizontal-component astatic arrangement. on lines of a suggestion by C. D. West. (See Milne: *Earthquakes.*) No magnification. Longitudinally each of the heavy weights has no period—each being astatic in that direction. The transverse pendulum-action produces no record on the smoked glass. In addition there is an arrangement for recording any vertical movement of the ground upon the same smoked glass plate."

Time service: approximate to half minute only.

POLA, ITALY

Ufficio Idrografico della R. Marina (Sezione Geofisica), seismologic service inaugurated in April, 1914.
Captain Augusto Spagnoli, Director.

Postal address: Ufficio Idrografico della R. Marina (Sezione Geofisica), Pola, Italia.

$\varphi = 44°51'49''$ N., $\lambda = 13°50'46''$ E., h = 32 m.

Lithologic foundation: limestone.

Equipment: Wiechert astatic pendulum, mass 1,000 kg., two comp. Constants:

	V	T_o	ϵ	r/T_o^2
N,	228	10.8	1.96	0.0161
E,	230	11.0	2.22	0.0157

Time service: time is determined to tenths of seconds.

*PONTA DELGADA, AZORES

Serviçao Meteorologico dos Açores.

Postal address: Ponta Delgada, San Miguel, Açores.

$\varphi = 37°44'$ N., $\lambda = 25°41'$ W., h = 16 m.

Lithologic foundation: basaltic rock.

Equipment: Milne seismograph, E comp.

PORT-AU-PRINCE, HAITI

Observatoire metéorologique, seismologic service inaugurated in May, 1912.

Prof. J. Scherer, Director.

College St. Martial.

Postal address: Observatoire Metéorologique, Port-au-Prince, Haiti.

$\varphi = 18°33'20''$ N., $\lambda = 72°20'15''$ W., h = ca. 25.9 m.

Lithologic foundation: calcareous tufa, beds of shingle, argillaceous marl.

Equipment: Bosch-Omori seismograph, two comp. NE and NW.
Constants: V = 40, T_o = 11 sec., no damping, 13 to 14 mm. = 1 minute.

Time service: time comparisons are made by radiotelegraphic signals, and by means of meridian circle observations.

*PORT OF SPAIN, TRINIDAD

Seismologic Station, inaugurated about 1900.

W. G. Freeman, B.Sc., Director.

St. Clair Experiment Station of the Botanical Gardens.

Postal address: Seismologic Station, St. Clair Experiment Station, Port of Spain, Trinidad, W. Indies.

$\varphi = 10°38'39''$ N., $\lambda = 61°30'39''$ W., h = 20.5 m.

Lithologic foundation: sands and clays.

Equipment: Milne seismograph, E comp.

Time service: based on daily astronomical observations.

*PORTICI, NAPLES, ITALY

Osservatorio Meteorologico e Geodinamico.

Postal address: Portici, presso Napoli, Italia.

$\varphi = 40°48'$ N., $\lambda = 14°20'$ E., h = ca. 80 m.

Equipment: Agamennone seismometrograph, mass 120 kg., two horizontal comp., registering with ink.
Constants: V = 14, T_o = 5.1 s.

Time service: time is checked by the midday cannon at Naples.

PORTO ALEGRE, RIO GRANDE DO SUL, BRAZIL

At the Engineering School there is a Wiechert seismograph, mass 120 kg., not yet in use.

PORTO D'ISCHIA (NAPLES), ITALY

R. Osservatorio Meteorologico e Geodinamico—Porto d'Ischia, seismologic service inaugurated August 17, 1885.
Dr. Giulio Grablovitz, Director.
R. Ufficio Centrale di Meteorologia e Geodinamica in Roma, Ministero por l'Agricoltura.

Postal address: R. Osservatorio Geodinamico, oppure Via Terme 165, Ischia (Napoli), Italia.

$\varphi = 40°44'26.7''$ N., $\lambda = 13°56'35.1''$ E., h = 36.72 m.

Lithologic foundation: ash and tufaceous and trachytic material over trachyte.

Equipment: horizontal pendulum, local model, mass 12 kg.
"Vasca sismica."

Time service: time is kept by high grade clocks and chronometers; time comparisons are made by astronomical observations.

*PORTO MAURIZIO, ITALY

Osservatorio Meteorico e Sismico, seismologic service inaugurated about 1910 (?).

Postal address: Osservatorio Meteorico e Sismico, Porto Maurizio, Italia.

$\varphi = 43°53'$ N., $\lambda = 8°03'$ E., h = ca. 50 m. (ca. 24 cm. ?).

Equipment: Agamennone seismometrograph[1], mass 200 kg., two horizontal comp. registering with ink.
Constants: V = 12, $T_o = 2.5$ sec.
Several seismoscopes.

Time service: time is determined by sextant observations.

[1] Transferred to this station from Turin about 1910.

PORTO RICO, see VIEQUES

*POTSDAM, GERMANY

Seismic Observatory, inaugurated in 1901.
Kgl. Preussisches Geodätisches Institut.

Postal address: Seismic Observatory, Potsdam, Deutschland.

$\varphi = 52°22'51''$ N., $\lambda = 13°03'59''$ E., h = ca. 90 m.

Lithologic foundation: sand.

Equipment: modified Rebeur-Paschwitz horizontal pendulum, mass 70 grams, two horizontal comp.
Constants: V = 36, T_o = 18 sec.
Wiechert inverted pendulum, mass 1,000 kg., two comp.
Constants: V = 133, T_o = 14 sec.
A vertical-motion seismograph.
Rebeur-Hecker horizontal pendulums used for experiments on the rigidity of the earth.

PUEBLA, MEXICO

Estación Seismológica de Puebla, a station of the second order.
Francisco de P. Tenorio, Jefe de la Estación.
Servicio Seismológico Nacional de México,
Instituto Geológico Nacional.

Postal address: Instituto Geológico Nacional, 6a del Cipres núm. 176, México, D. F., República Mexicana.

$\varphi = 19°03'$ N., $\lambda = 98°12'$ W., h = 2,132 m.

Lithologic foundation: basalt.

Equipment: Wiechert seismograph, third-order type, mass 10 kg., two comp. N and E. Milne seismograph, three comp.

Time service: time comparisons by telegraphic signals from Tacubaya.

*PULKOVA, near PETROGRAD, RUSSIA

Central Seismologic Station, the chief station of the Russian service.

Postal address: Central Seismologic Station, Pulkova, near Petrograd, Russia.

$\varphi = 59°46'$ N., $\lambda = 30°19'$ E.,

Lithologic foundation: (piers are in a specially constructed building entirely underground).

Equipment: Galitzin aperiodic seismometer, galvanometric-photographic registration, three comp.: two complete sets, one group adjusted to record stronger, another group adjusted to record weaker teleseismic motion.
Galitzin seismograph, mech. registr., three comp.

Time service: of the Astronomical Observatory.

*PUNTA ARENAS, CHILE

Seismologic Station.

Postal address: Servicio Sismolójico de Chile, Santiago, Chile.

$\varphi = 53°10'$ S., $\lambda = 70°54'$ W.

Lithologic foundation: sand.

Equipment: Wiechert inverted pendulum, mass 180 kg., two comp. N and E.

Time service: time is kept and minute time marks are made by a contact clock compared weekly by telegraphic signals from the central station at Santiago.

PUY DE DÔME, see CLERMONT-FERRAND

QUARTO CASTELLO, see FLORENCE

*QUENAST, BELGIUM

Seismologic Station, inaugurated in 1899.
Société des Carrières de Quenast.

Postal address: Seismologic Station, Quenast, Belgium.

$\varphi = 50°39'45''$ N., $\lambda = 4°10'50''$ E., h = 30 m.

Lithologic foundation: compact porphyry.

Equipment: Rebeur-Ehlert triple horizontal pendulum.

*QUITO, ECUADOR

Observatorio Astronomico y Meteorologico.

Postal address: Quito, Ecuador.

$\varphi = 0°13'51''$ S., $\lambda = 78°32'30''$ W., h = 2,908 m.

Equipment: Bosch seismograph.

*RENO, NEVADA

Seismologic St tion, inaugurated in 1911.
Prof. J. Claude Jones, in charge.
Department of Geology, University of Nevada.

Postal address: Seismologic Station, University of Nevada, Reno, Nevada.

φ = ca. 39°30′ N., λ = ca. 119°50′ W.

Equipment: Ewing Duplex seismograph, V = 4.

*REYKJAVIK, ICELAND

International Station, seismologic service inaugurated in 1909; attached to the Danish School of Navigation of Reykjavik.

Postal address: Seismologic Station, Danish School of Navigation, Reykjavik, Iceland.

$\varphi = 64°08'32''$ N., $\lambda = 21°55'45''$ W.

Lithologic foundation: solid rock.

Equipment: Mainka horizontal pendulum, one comp.

RICHMOND, SURREY, ENGLAND

Kew Observatory, seismologic service inaugurated in March, 1898.
Charles Chree, Assistant Director of Geophysics.
Meteorological Office, Department of Civil Aviation, Air Ministry.

Postal address: Kew Observatory, Richmond, Surrey, England.

$\varphi = 51°28'06''$ N., $\lambda = 0°18'47''$ W., $h = 5$ m.

Lithologic foundation: river gravel resting on chalk.

Equipment: Milne seismograph (old pattern), E comp.
Constants: T_o = ca. 18 sec., 1 mm. displacement = 0.5″, 1 *mm.* = 1 *min.*

Time service: time comparisons are made by signal from Greenwich with an accuracy of ca. 0.25 sec. Seismic times never given to nearer than 0.1 minute, usually to nearest minute.

RIO DE JANEIRO, BRAZIL

Observatorio Nacional[1], seismologic service inaugurated in 1906.
Prof. Dr. Henrique Morize, Director of the Observatory.
Alix Lemos, Assistant in charge of Geophysics.
Ministerio da Agricultura, Industria e Commercio.

Postal address: Observatorio Nacional, Rio de Janeiro, Brazil.

$\varphi = 22°54'23.6''$ N., $\lambda = 43°10'21.15''$ W., $h = 60$ m.

Lithologic foundation: slate or shale.

Equipment: Mainka bifilar horizontal pendulum, mass 400 kg. Mainka bifilar horizontal pendulum, mass 120 kg. Wiechert vertical-motion seismograph. A Milne-Shaw seismograph is to be installed.

Time service: time is kept accurately to 0.1 sec.; time determinations are made by meridian transit observations; seismometric readings are accurate to ca. 1 sec.

[1] Observatory recently removed to new quarters; re-installation not complete.

RIO TINTO MINES, SPAIN

Postal address: Rio Tinto Mines, España.

$\varphi = 37°46'$ N., $\lambda = 6°38'$ W., h = 427 m.

Lithologic foundation: slate (Lower Carboniferous).

Equipment: Milne seismograph, *one comp.* N.
Constants: $T_o = 18$ sec., 1 mm. displacement = 0.5″ approx.

Time service: variations of five minutes not unusual.

ROCCA DI PAPA (ROME), ITALY

R. Osservatorio Geodinamico di Rocca di Papa, seismologic service inaugurated in 1889.
Prof. Dr. Cav. Uff. Giovanni Agamennone, Director.
R. Ufficio Centrale di Meteorologia e Geodinamica, Roma.

Postal address: R. Osservatorio Geodinamico di Rocca di Papa, presso Roma, Italia.

$\varphi = 41°45.5'$ N., $\lambda = 12°43'$ E., h = 760 m.

Lithologic foundation: lava.

Equipment: Agamennone microseismograph, mass 1,800 kg., two horizontal comp.
Constants: V = ca. 400, $T_o = 2.3$ sec., 70 cm. = 1 hour.
Agamennone horizontal pendulum, mass 3,000 kg., N comp.
Constants: V = 110, $T_o = 15$ sec., 96 cm. = 1 hour.
Agamennone universal microseismometrograph, three comp.
Constants: N and E comp., Mass = 400 kg., V = 100, $T_o = 8$ sec.; $\left\{\begin{matrix}96 \text{ cm.} \\ = 1 \text{ hr.}\end{matrix}\right.$
Z " " = 250 " V = 100, $T_o = 4$ " $\left\{\begin{matrix}96 \text{ cm.} \\ = 1 \text{ hr.}\end{matrix}\right.$

Each of the masses can be increased up to 1,000 kg.

Agamennone seismometrograph, mass 200 kg., two comp.
Constants: V = 14, $T_o = 4.3$ sec., 36 cm. = 1 hour, except that for 90 sec. following the beginning of an earthquake the cylinder speeds up and runs at the rate of 20 m. per hour, and then runs at its usual rate.
Brassart seismometrograph, three comp., with sporadic registration following the beginning of an earthquake.

Constants:	Mass	V	T_o
N,	10 kg.	10	4.3 sec.
E,	10 "	10	4.3 "
Z,		10	2.0 "

Runs about 60 cm. at the rate of 30 m. per hour.

Agamennone macroseismograph, three comp., registers after beginning of a shock.
Constants: N and E, Mass 2 kg. V = 1 to 2, $T_o = 4$ sec.;
Z V = 1 " 2, $T_o = 2$ "

Various seismoscopes, three groups of sensitiveness.
All the seismographs are provided with appropriate damping.

Time service: minute, half-hour, and hour time marks made electromagnetically by a contact chronometer (marine type) checked by telephone with R. Specola Astronomica di Roma at the Collegio Romano: accuracy of about 1 sec.

ROME, ITALY

Stazione Sismica Sperimentale al Collegio Romano, inaugurated in August, 1909.
Prof. Commendatore Luigi Palazzo, Director.
Ministero dell' Agricoltura.

Postal address: R. Ufficio Centrale di Meteorologia e Geodinamica, Via Caravita N. 7, Roma, Italia.

$\varphi = 41°54'$ N., $\lambda = 12°29'$ E., h = ca. 30 m.

Lithologic foundation: (Quaternary).

Equipment: Agamennone horizontal pendulum, mass 50 kg.
Constants: $V = 50$, $T_o = 8$ sec., ca. 1.6 m. = 1 hour.

Time service: time is kept and hour and minute time marks are made electromagnetically by a contact marine chronometer compared daily by signals from the R. Osservatorio Astronomico del Collegio Romano; accuracy of seismometric readings about 2 sec.

ROQUETAS, see TORTOSA

SAGA, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1915.
K. Miyazima, Director.
Supported by the local prefecture.

Postal address: Saga Meteorological Observatory, Saga, Japan.

$\varphi = 33°12'$ N., $\lambda = 130°18'$ E., h = 11.5 m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E. $V = 20$.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

ST. BONIFACE, MANITOBA, CANADA

L'Observatoire Sismique, inaugurated January 21, 1910.

Prof. Albert Buron, S.J., in charge.
Collége de St. Boniface.

Postal address: Seismic Observatory, Collége de St. Boniface, Manitoba, Canada.

$\varphi = 49°53'31''$ N., $\lambda = 97°06'39''$ W., h = 230 m.

Lithologic foundation: 18 m. of shale over rock (Ordovician).

Equipment: Wiechert inverted pendulum, mass 80 kg. V = 80.

Time service: time is kept and hour and minute time marks are made electromagnetically by an ordinary contact clock of good rate compared with the time service of the C. P. Ry.

*ISLAND OF ST. HELENA

Seismologic Station, inaugurated in February, 1911.
Eastern, Eastern Extension and Pacific Telegraph Co.

Postal address: Seismologic Station, Island of St. Helena.

$\varphi = 15°55'$ S., $\lambda = 5°44'$ W.

Equipment: Milne seismograph, E comp.

ST. LOUIS, MISSOURI

Earthquake Station, inaugurated January 1, 1910.
Prof. J. B. Goesse, Director.
St. Louis University.

Postal address: Earthquake Station, St. Louis University, Grand and Lindell Boulevard, St. Louis, Missouri.

$\varphi = 38°38'17''$ N., $\lambda = 90°13'58.3''$ W., h = 160.36 m.

Lithologic foundation: ca. 3 m. clay over limestone (Mississippi).

Equipment: Wiechert inverted pendulum, mass 80 kg., two comp. N and E., $T_0 = 7$ sec.

Time service: time kept and marked electromagnetically by a contact clock compared by means of radiotelegraphic signals.

SAKAI, JAPAN

Meteorological Observatory, seismologic service inaugurated in March, 1916.
K. Takakuwa, Director.
Supported by the Tottori prefecture.

Postal address: Sakai Meteorological Observatory, Sakai, Tottori-ken, Japan.

$\varphi = 35°33'$ N., $\lambda = 133°14'$ E., h = 2.1 m.

Lithologic foundation: alluvium.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: $V=20$, $T_o=4$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*SALÒ, near BRESCIA, ITALY

R. Osservatorio Geodinamico.

Postal address: Salò, presso Brescia, Italia.

$\varphi=45°36'27''$ N., $\lambda=10°30'45''$ E., h = ca. 80 m.

Equipment: Agamennone seismometrograph, mass 220 kg., two horizontal comp. registering with ink.
Constants: $V=10$, $T_o=7.8$ sec., 33 cm. = 1 hour.
Agamennone seismoscope.

Time service: time is checked with the time of the telegraph office.

*SALT LAKE CITY, UTAH

Seismologic Station.
Prof. Fred J. Pack, in charge.
University of Utah.

Postal address: Seismologic Station, University of Utah, Salt Lake City, Utah.

$\varphi=$ ca. 40°46′ N., $\lambda=$ ca. 111°50′ W.,

Equipment: Bosch-Omori horizontal pendulum, two comp.

Note: these instruments are installed only a short distance from the great fault at the western base of the Wasatch mountains.

SAN FERNANDO (CADIZ), SPAIN

Seismologic Station, inaugurated in 1898.
Contralmirante Tomás de Azcárate, Director.
Observatorio de Marina de San Fernando.

Postal address: Observatorio de Marina, San Fernando, España.

$\varphi=36°27'42''$ N., $\lambda=6°12'19.5''$ W., h = 28.5 m.

Lithologic foundation: calcareous rock.

Equipment: and constants:		Mass	V	T_o	r/T_o^2
Milne seismograph,	N comp.	1 kg.	7	20 sec.	
" "	E "	1 "	7	17 "	

Equipment: and constants:		Mass	V	T_o	r/T_o^2
"Observatory" seismograph,	E comp.	700 kg.	280	2.1.sec.	0.067
"Observatory" bifilar horiz.	E "	60 "	13	24 "	0.001

Ewing seismograph,

Time service: of the Observatorio de Marina, not minutely specified.

[1] An ordinary vertical, or simple, pendulum.

SAN JOSÉ, CALIFORNIA

Seismologic Station, inaugurated about 1888.

Louis S. Kroeck, Director.

College of the Pacific.

Postal address: Seismologic Station, College of the Pacific, San Jose, California.

$\varphi = 37°20'38.2''$ N., $\lambda = 121°55'03''$ W., h = ca. 9 m.

Lithologic foundation: sedimentary rock.

Equipment: Ewing seismograph.

Time service: not specified.

*SAN LUCA, BOLOGNA, ITALY

Osservatorio Meteorologico e Sismico "Malvasia."

Postal address: San Luca Bologna, Italia.

$\varphi = 44°29'$ N., $\lambda = 11°18'$ E., h = ca. 290 m.

Equipment: Stiattesi horizontal pendulums, mass 500 kg., two comp. Constants: V = 80, $T_o = 4.6$ sec., 180 cm. = 1 hour.

Time service: time comparisons are furnished by the Astronomical Observatory of Bologna.

*SAN SALVADOR, CENTRAL AMERICA

Fisica Modela, seismologic service inaugurated in 1916.

Señor Sanz. Gr. Barbarena, Director.

Postal address: Seismologic Station, Fisica Modela, San Salvador, C. A.

$\varphi = 13°43'44''$ N., $\lambda = 89°14'30''$W.,

Equipment: Vicentini microseismographs. Bosch-Omori horizontal pendulums. Agamennone macroseismometrograph.

SANTA CLARA, CALIFORNIA

Seismologic Station, inaugurated in 1909.

Rev. Jerome S. Ricard, S.J., Director.

Observatory, University of Santa Clara.

Postal address: Observatory, University of Santa Clara, Santa Clara, California.

$\varphi = 37°20'45''$ N., $\lambda = 123°15'00''$ W., h = ca. 28 m.

Lithologic foundation: adobe, hardpan, sand, gravel; old sea bottom.

Equipment: Wiechert inverted pendulum, two horiz. comp.
" vertical-motion seismograph, Z comp.
Mass = 80 kg., $\epsilon = 5$.

Time service: time is kept and hour and minute time marks are made electromagnetically by a standard contact clock compared daily by radio-telegraphic and telegraphic signals from the Marc Island Observatory; accurate within 1 to 2 sec.

SANTIAGO, CHILE

Central Seismologic Station, inaugurated June 9, 1908.
Comte F. de Montessus de Ballore, Director.
Servicio Sismolójico de Chile.

Postal address: Servicio Sismolójico de Chile, Santiago, Chile.

(The Cerro Santa Lucia Park Observatory is situated 4 km. east of the old Santiago Astronomical Observatory.)

$\varphi = 33°26'42''$ S., $\lambda = 70°40'$ W., h = 580 m.

Lithologic foundation: trachytic rock.

Equipment: Wiechert inverted pendulum, mass 180 kg., two comp. N and E., with damping.
Wiechert vertical-motion seismograph, mass 100 kg., Z comp., with damping.
Bosch-Omori horizontal pendulum, mass 100 kg., two comp. NW and NE, with air damping. $T_o = 36$ sec.
Stiattesi horizontal pendulum, mass 1,000 kg., two comp. N and E.
De Montessus cardanic pendulum, mass 40 kg., one comp.

Time service: time is kept and minute time marks are made by a contact clock compared daily by a gun-fire signal with the time service of Lo Espejo Astronomical Observatory.

SAPPORO, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1910.
S. Takayura, Director.

Supported by the Hokkaido government.

Postal address: Sapporo Meteorological Observatory, Sapporo, Japan.

$\varphi = 43°04'$ N., $\lambda = 141°21'$ E., h = 15.1 m.

Lithologic foundation: soft sandy soil.

Equipment: Omori horizontal pendulum tromometer, E comp.
Constants: V = 30, $T_o = 19.2$ sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*SARAJEVO, JUGOSLAVIA

Meteorological and Seismological Observatory, seismologic service inaugurated in 1905.

Postal address: Seismological Observatory, Sarajevo, Jugoslavia.

$\varphi = 43°52'08''$ N., $\lambda = 18°25'39''$ E., h = 673 m.

Lithologic foundation: marls and sandstones (Tertiary).

Equipment: Vicentini microseismograph, mass 100 kg., two horizontal comp., 90 cm. = 1 hour.
Wiechert inverted pendulum, mass 200 kg., two comp., 60 cm. = 1 hour.

SASKATOON, SASKATCHEWAN, CANADA

Seismological Station, inaugurated in April, 1915.
Prof. Alexander G. McGougan, Director.
Department of Physics, University of Saskatchewan.

Postal address: Seismologic Station, University of Saskatchewan, Saskatoon, Sask., Canada.

$\varphi = 52°08'$ N., $\lambda = 106°30'$ W., h = ca. 515 m.

Lithologic foundation: clay and sand.

Equipment: Mainka bifilar horizontal pendulum, mass 139.3 kg., two comp. N and E.
Constants: N, $T_o = 9.1$ sec., $\epsilon = 5$; E, $T_o = 9.3$ sec., $\epsilon = 5$.

Time service: time is kept and hour and minute time marks are made electromagnetically by a Bosch contact clock compared monthly by telegraphic signal; probably reliable within 2 sec.

*SEATTLE, WASHINGTON

Seismologic Station, inaugurated in 1906.
Prof. E. J. Saunders, in charge.
Department of Geology, University of Washington.

Postal address: Seismologic Station, University of Washington, Seattle, Washington.

$\varphi = 47°39'06''$ N., $\lambda = 122°18'30''$ W., h = ca. 50 m.

Lithologic foundation: glacial drift.

Equipment: Bosch-Omori seismograph, mass 50 kg.

*ŠEMAKHA, CAUCASUS, RUSSIA

Seismologic Station.

$\varphi = 40°38'$ N., $\lambda = 48°38'$ E.

Equipment: Bosch-Omori horizontal pendulum, two horizontal comp.

SHIONOMISAKI, JAPAN

Meteorological Observatory, seismologic service inaugurated in December, 1912.
K. Yamasawa, Director.
Supported by the Central Meteorological Observatory.

Postal address: Shionomisaki Meteorological Observatory, Shionomisaki, Wakagawa-ken, Japan.

$\varphi = 33°27'$ N., $\lambda = 135°46'$ E., h = 72.9 m.

Lithologic foundation: rock.

Equipment: Omori horizontal pendulum tromometer, N comp.
Constants: V = 120, T_o = 12.5 sec.
Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: V = 60, T_o = 4 sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

SIENA, ITALY

Osservatorio Geodinamico di Siena, seismologic service inaugurated June 1, 1918 (1908?).
P. L. Atto Maccioni, Director.
R. Università.

Postal address: Osservatorio Geodinamico di Siena, R. Università, Italia.

$\varphi = 43°19'$ N., $\lambda = 11°20.5'$ E., h = 348 m.

Lithologic foundation: calcareous tuff.

Equipment: Vicentini microseismograph, mass 200 kg., two comp.
Constants: V = 100, T_o = 3.5 sec., 90 cm. = 1 hour.
Horizontal pendulum tromograph, mass ca. 60 kg., two comp. N and E.
Constants: V = 12, T_o = 12 sec.

Vertical-motion seismograph, mass 15 kg., Z comp.
Constants: $V=10$, $T_o=1$.
Electric and mechanical seismoscopes and a "source indicator," some of which are fitted to register "occasionally."

Time service: time is kept and minute time marks are made by a contact pendulum clock checked every eight days by radiotelegraphic signals.

*SIENA, ITALY

Osservatorio Sismico dell' Osservanza[1], inaugurated in 1908.

Postal address: Siena, Toscana, Italia.

$\varphi=43°19'$ N., $\lambda=11°20.5'$ E., h = ca. 330 m.

Equipment: Agamennone seismometrograph, mass 200 kg., two comp.
Constants: $V=10$, $T_o=3$ sec., 60 cm. = 1 hour.
Stiattesi horizontal pendulum, mass 60 kg.
Constants: $V=6$, $T_o=18$ sec.
Vicentini microseismograph, mass 500 kg., two horizontal comp.
" " Z comp.
Agamennone seismoscope.
Cecchi alarm.

Time service: time is determined by meridian passage of the sun, but the error may amount to one minute.

[1] This station took over the instruments at the observatory at Giaccherino, which was discontinued in 1907.

SIMLA, INDIA

Seismologic Station, inaugurated in June, 1905. Removed to present site October 1, 1917.
Dr. Gilbert Thomas Walker, Director General of Observatories.
India Meteorological Department.

Postal address: Meteorological Office, Simla, India.

$\varphi=31°06'$ N., $\lambda=77°11'$ E., h = 2200 m.

Lithologic foundation: rock (schist and quartzite underlaid by Carboniferous strata).

Equipment: Omori-Ewing horizontal pendulum, mass 50 kg., two comp. N and E.
Constants: $V=14$, $T_o=45$ sec.

Time service: time comparisons by radiotelegraphic signals from Calutta, ordinarily correct to a second.

Publication: Data published in India Monthly Weather Review; also sent to the Seismological Committee of the Brit. Ass. Adv. Sci.

SITKA, ALASKA

Sitka Magnetic Observatory, seismologic service inaugurated in April, 1904.

Magnetic Observer, in charge, Franklin P. Ulrich, present incumbent.

U. S. Coast and Geodetic Survey.

Postal address: Magnetic Observatory, U. S. C. and G. S., Sitka, Alaska, or U. S. Coast and Geodetic Survey, Washington, D. C.

$\varphi = 57°03'$ N., $\lambda = 135°20.1'$ E., $h = 15.2$ m.

Lithologic foundation: concrete piers, through peaty soil, to granitic rock.

Equipment: Bosch-Omori horizontal pendulum, mass 10 kg., two comp. N and E., mech. registr. on smoked paper.

Constants: N, $V = 10$, $T_o = 16$ sec.; E, $V = 10$, $T_o = 18$ sec.

Time service: two box chronometers; corrections and rates determined by means of telegraphic time signals. The time of stopping and starting the record is noted daily by one of the chronometers. The seismograph clock, which makes a mark each minute on the smoked paper (one minute = 15 mm.), is not of a high grade, but when in good adjustment has a fairly uniform rate, so that the time of the minute marks in the middle of a sheet are uncertain by not more than 10 sec., and correspondingly less near the beginning or end.

SOFIA, BULGARIA

Seismologic Station, inaugurated April 16, 1905.

Le Directeur de l'Institut Météorologique de Bulgarie.

Postal address: Institut Météorologique de Bulgarie, Sofia, Bulgarie.

$\varphi = 42°41'40''$ N., $\lambda = 23°19'39''$ E., $h = 540$ m.

Lithologic foundation: thin diluvial gravel.

Equipment: Bosch-Omori horizontal pendulum, mass 10 kg., two comp. N and E.

Horizontal pendulum, mass 25 kg., one comp. N 60° W, $T_o = 13.4$ sec.

Time service: time is determined by the chronodeik of Palisa, with an accuracy of ca. 5 sec.

SOUTH YARRA, VICTORIA, AUSTRALIA

Melbourne Observatory, seismologic service inaugurated in 1900.

Joseph Mason Baldwin, Government Astronomer of Victoria.

Government of Victoria.

Postal address: Melbourne Observatory, South Yarra, Victoria, Australia.

$\varphi = 37°50'$ S., $\lambda = 144°58'$ E., h = ca. 25.9 m.

Lithologic foundation: stratified rock (Pliocene) on older rock.

Equipment: Milne seismograph, early form, E comp.
Constants: $T_c = 18$ sec., 1 mm. displacement = 0.5″, 3 mm. = 1 minute.

Time service: time is kept, and marked by eclipse once each hour, by the Observatory clocks; accurate within 2 seconds.

SPOKANE, WASHINGTON

Seismologic Station, inaugurated in 1909.
A. M. Jung, Seismologic Observer, in charge.
Gonzaga University.

Postal address: Seismologic Station, Gonzaga University, Spokane Washington.

$\varphi = 47°40'04''$ N., $\lambda = 117°25'15''$ W., h = 584.15 m.

Lithologic foundation: concrete base on gravel and sand, lake beds.

Equipment: and constants:		V	T_o	ϵ
Wiechert inverted pendulum, mass 80 kg.,	N comp.,	80	5.9	8
	E "	80	5.1	8

Time service: time is kept and hour and minute time marks are made electromagnetically by a Göttingen clock compared with a Western Union clock regulated by the U. S. Naval Observatory; accuracy ca. 1 sec.

SPRING HILL (MOBILE), ALABAMA

Seismic Observatory, inaugurated in October, 1910.
Prof. Rev. Cyril Ruhlmann, S.J., in charge.
Spring Hill College.

Postal address: Seismic Observatory, Spring Hill College, Spring Hill, Mobile Co., Alabama.

$\varphi = 30°41'44''$ N., $\lambda = 88°08'46''$ W., h = 60 m.

Lithologic foundation: alluvial.

Equipment: Wiechert inverted pendulum, mass 80 kg., two comp.
Constants: undetermined.

Time service: time is kept and minute time marks are made electromagnetically by a contact clock (Wiechert) equipped with a compensating pendulum, compared daily by radiotelegraphic signals from Arlington.

STARÁ ĎALA (formerly ÓGYALLA), CZECHO-SLOVAKIA

Seismologic Station, inaugurated in 1900.
Meteorological and Magnetic Observatory.

Postal address: Seismologic Station, Meteorological and Magnetic Observatory, Stará Ďala, Czecho-Slowakia.

$\varphi = 47°52'$ N., $\lambda = 18°12'$ E., h = 114 m.

Lithologic foundation: sand 400 to 600 m. thick.

Equipment: Mainka bifilar horizontal pendulum, two comp.

Time service: "accuracy 1 sec."

STONYHURST, see BLACKBURN

STRASBOURG, FRANCE

Station Sismologique de l'Institut de Physique du Globe, inaugurated in 1899 and augmented in 1906.
Prof. Edmond Rothé, Director.
Henri Labrouste, Sub-Director.

Postal address: Station Sismologique de l'Institut du Physique de Globe, Rue Flerder 9, Strasbourg, France.

$\varphi = 48°35'05''$ N., $\lambda = 7°45'57''$ E., h = 135 m.

Lithologic foundation: gravel.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., Wiechert vertical-motion seismograph, mass 2,000 kg., Mainka bifilar horizontal pendulum, mass 450 kg., Galitzin aperiodic seismometer, with photo-galvanometric registration.

Time service: time is kept and marked by high grade clocks (Leroy, Riefler, Strasser) and compared by chronographic methods by means of radiotelegraphic signals from the Eiffel tower.

SUBIACO, ITALY

Seismologic Station, established lately, no further information available.

SWARTHMORE, PENNSYLVANIA

Sproul Observatory.
Prof. John A. Miller, Director.
Swarthmore College.

Postal address: Sproul Observatory, Swarthmore, Pennyslvania.

$\varphi = 39°54'23.3''$ N., $\lambda = 75°21'13.4''$ W., h = 59.4 m.

Lithologic foundation:

Equipment: Milne seismograph, E comp.

Time service: time comparisons are obtained by radiotelegraphic signals from Arlington, and also by transit observations; the time marking clock is kept accurate within 1 minute.

SYDNEY, N. S. W., AUSTRALIA

Government Observatory, seismologic service inaugurated in May, 1906, Prof. William Ernest Cooke, Government Astronomer.

Postal address: Government Observatory, Sydney, New South Wales. Australia.

$\varphi = 33°51'41.1''$ S., $\lambda = 151°12'25.1''$ E., h = ca. 42.7 m.

Lithologic foundation: sandstone.

Equipment: Milne seismograph, E comp.
Constants: $T_o = 20$ sec., 1 mm. displacement $= 0.23''$.

Time service: hourly time signals from the mean time clock of Sydney Observatory.

SYDNEY, N. S. W., AUSTRALIA

Riverview College Observatory, seismologic service inaugurated in March, 1909.
Dr. Edward Francis Pigot, Director of the Observatory.

Seismologic work supported in part privately and in part with aid from the Government.

Postal address: Riverview College Observatory, Sydney, New South Wales, Australia.

$\varphi = 33°49'49''$ S., $\lambda = 151°09'30''$ E., h = ca. 41.9 m.

Lithologic foundation: concrete piers, free of floor and soil, on sandstone (Triassic).

Equipment: and constants:			Mass	V	T_o	ϵ	r/T_o^2
Wiechert inverted pendulum,	N	comp.,	1,000 kg.	158	8.4	5.5	0.018
" " "	E	"	1,000 "	171	8.3	4.1	0.02
" vertical-motion pendulum,	Z	"	80 "	83	5.1	5.5	0.05
Mainka horizontal pendulum,	N	"	500 "	113	9.0	3.9	0.02
" " "	E	"	500 "	148	10.2	2.1	0.04

Galitzin aperiodic seismometer, photo-galvanometric registration, three comp., to be installed.

Time service: time is kept and hour and minute time marks are made electromagnetically by a standard observatory mean time clock compared daily with the clock of the Government Astronomical Observatory.

*TACNA, CHILE

Seismologic Station.

Postal address: Servicio Sismolójico de Chile, Santiago, Chile.

$\varphi = 18°01'$ S., $\lambda = 70°18'$ W., h = 560 m.

Lithologic foundation: gravelly alluvium.

Equipment: Wiechert inverted pendulum, mass 180 kg., two comp. N and E.

Time service: time is kept and minute time marks are made by a contact clock compared weekly by telegraphic signals from the central station at Santiago.

TACUBAYA, MEXICO

Estación Seismológica Central, inaugurated September 5, 1910.
Ing. Francisco Patiño Ordáz, Jefe de la Estación Seismológica Central.
Servicio Seismológico Nacional de México,
Instituto Geológico Nacional.

Postal address: 4a de Zaragoza no. 127, Observatorio Astronómico Nacional, Estación Seismológica, Tacubaya, D. F., México, or Instituto Geológico Nacional, 6a del Cipres núm. 176, México, D. F., República Mexicana.

$\varphi = 19°24'18''$ N., $\lambda = 99°11'37''$ W., h = 2,320 m.

Lithologic foundation: volcanic series.

Equipment: and constants:		Mass		V	T_o	ϵ
Wiechert inverted pendulum,	N and E comp.,	17,000	kg.	2,000	1.5	2:5
" " "	N " E "	1,200	"	200	8.0	1:6
" " "	N " E "	200	"	80	5.0	3:5
" " "	N " E "	125	"	40	5.0	3:5
" vertical-motion pendulum,	Z "	1,300	"	160	4.0	3:5
Wiechert vertical-motion pendulum,	Z "	80	"	80	4.0	3:5
Omori horizontal pendulum,	N " E "	10	"			
Bosch-Omori horizontal pendulum,	N " E "	0.2	"			

Wiechert-Mintrop tromometer, phot. registr.
Schmidt trifilar gravimeter, phot. registr.

Time service: time is kept by the mean time clock of the Observatorio Astronómico Nacional within a probable error of 0.2 sec.; time marks are made by contact watches; the error of reading of the seismogram is ca. 0.5 sec.

TADOTSU, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1902.
Y. Katsuno, Director.

Supported by the local prefecture.

Postal address: Tadotsu Meteorological Observatory, Tadotsu, Japan.

$\varphi = 34°17'$ N., $\lambda = 133°46'$ E., h = 4 m.

Lithologic foundation: soft ground, alluvial.

Equipment: Omori horizontal pendulum tromometer, mass 10 kg., two comp. N and E.

Constants: V = 20, $T_o = 22$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

TAICHU, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1897.
Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 24°09'$ N., $\lambda = 120°41'$ E., h = 78.4 m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; also since June, 1902, Omori horizontal pendulum tromometer, mass 6 kg., E comp.
Constants: V = 6, $T_o = 12$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

TAIHOKU, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1896.
Prof. H. Kondo, Director.

Chief Station of the Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 25°02'$ N., $\lambda = 121°31'$ E., h = 9.3 m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; also, since June, 1901, Omori horizontal pendulum tromometer, two comp. N and E.

Constants:	Mass	V	T_o
N,	55 kg.	120	8 sec.
E,	16 "	20	25 "

Time service: time is kept by astronomical clocks (Riefler) and chronometers; time comparisons are made by astronomical observations.

Reports are received from more than 100 rainfall stations regarding "felt" shocks.

TAINAN, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1897.
Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 23°00'$ N., $\lambda = 120°12'$ E., h = 14.3 m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; also since January, 1902, Omori horizontal pendulum tromometer, mass 6 kg., E comp.
Constants: $V = 6$, $T_o = 12$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

TAITO, FORMOSA, JAPAN

Meteorological Observatory, seismologic service inaugurated in 1901.
Meteorological Service of Formosa.

Postal address: Taihoku Meteorological Observatory, Taihoku, Formosa, Japan.

$\varphi = 22°45'$ N., $\lambda = 121°09'$ E., h = 9.9 m.

Lithologic foundation: alluvial.

Equipment: Gray-Milne seismograph; also since December, 1903, Omori horizontal pendulum tromometer, mass 6 kg., E comp.
Constants: $V = 6$, $T_o = 12$ sec.

Time service: telegraphic time signals received from the Taihoku central station.

TAKAYAMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in October, 1915.

R. Wakazaki, Director.

Supported by the local prefecture.

Postal address: Takayama Meteorological Observatory, Takayama, Japan.

$\varphi = 36°09'$ N., $\lambda = 137°16'$ E., h = 560.3 m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.

Constants: V = 50, T_o = 3 sec.

Time service: time comparisons obtained daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

*TANANARIVE, MADAGASCAR

Observatoire des P. P. Jésuites, reconstructed in 1898.

Postal address: Tananarive, Madagascar.

$\varphi = 18°55'02''$ S., $\lambda = 47°31'45''$ E., h = ca. 1,402 m.

Lithologic foundation: red clay and gneiss.

Equipment: Cecchi seismograph.

TARANTO, ITALY

Osservatorio Geodinamico Taranto, seismologic service inaugurated in 1908.

Luigi Ferraiolo, Director.

Postal address: Osservatorio, Taranto, Italia.

$\varphi = 40°28'30''$ N., $\lambda = 17°15'15''$ E., h = 15.85 m.

Lithologic foundation: limy gravel (Upper Pliocene).

Equipment: and constants:	Mass	V	T_o	
Wiechert inverted pendulum,	200 *kg.*	120	8 *sec.*	*60 cm. = 1 hr.*
Vicentini horizontal seismograph,	100 "	100	2.4 "	
" vertical "	50 "	120	0.8 "	
Cartuja horizontal pendulum,	350 "	25	16.0 "	
" vertical "	350 "	250	0.6 "	

Time service: time comparisons by radiotelegraphic signals from Paris.

*TAŠKENT, TURKESTAN, RUSSIA

Seismologic Station, a station of the first class of the Russian service.

Astronomical and Physical Observatory.

Postal address: Seismologic Station, Astronomical and Physical Observatory, Taškent, Turkestan, Russia.

$\varphi = 41°19.5'$ N., $\lambda = 69°17'42''$ E., h = 478 m.

Lithologic foundation: stiff loess. (Mounted in a special building.)

Equipment: Repsold-Zöllner horizontal pendulum, mass 59 grams, two comp.
Constants: V = 60, $T_o = 9$ sec.
Bosch-Omori horizontal pendulum, mass 11 kg., two comp.
Constants: V = 10, $T_o = 12$ sec.
Milne seismograph.

Time service: of the Astronomical Observatory.

TEMESVAR, see TEMIȘOARA

TEMIȘOARA, ROUMANIA

Seismologic Station.
Fundatiunea Konkoly.

Postal address: Fundațiunea Konkoly, Temisoara, România.

$\varphi = 45°46'$ N., $\lambda = 21°14'$ E., h = 103 m.

Lithologic foundation:

Equipment: Konkoly-Vicentini seismograph, mass 180 kg., two comp. N and E.
Konkoly-Vicentini seismograph, mass 60 kg., Z comp.

Time service: not stated.

*TIFLIS, RUSSIA

Seismologic Station, a station of the first class of the Russian service.

Postal address: Seismologic Station, Physical Observatory, Tiflis, Russia.

$\varphi = 41°43'08''$ N., $\lambda = 44°47'51''$ E., h = 409 m.

Lithologic foundation: slaty shales on hard rock.

Equipment: Ehlert triple horizontal pendulum, mass 75 grams. Milne seismograph, mass 0.23 kg., E comp. Four Bosch-Omori horizontal pendulums, mass 10 kg., two sets of two comp. Heavy Zöllner horizontal pendulum, mass 14 kg., two comp. Cancani vertical (simple) pendulum, mass 300 kg., two comp.

TIGAON, AMBOS CAMARINES, PHILIPPINE ISLANDS

Meteorological Station, seismologic service inaugurated in May, 1918.
Fabián Martinez, Observer.

Weather Bureau, Philippine Islands.

Postal address: The Meteorological Station, Tigaon, Ambos Camarines, P. I., or Manila Observatory, Manila, P. I.

$\varphi = 13°36'$ N., $\lambda = 123°28'$ E., h = 35.8 m.

Lithologic foundation: andesite and basalt.

Equipment: Vicentini system, Manila type.

Time service: time comparisons daily by telegraphic signals; no chronograph.

TOKUSHIMA, JAPAN

Meteorological Observatory, seismologic service inaugurated in March, 1913.
G. Jimba, Director.

Supported by the local prefecture.

Postal address: Tokushima Meteorological Observatory, Tokushima, Japan.

$\varphi = 34°04'$ N., $\lambda = 134°33'$ E., h = 2.9 m.

Lithologic foundation: soft ground.

Equipment: Omori horizontal pendulum tremor recorder, two comp. N and E.
Constants: V = 50, $T_o = 2.4$ sec.
Imamura seismograph, two comp. N and E.
Constants: V = 2, $T_o = 4.6$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

TOKYO, JAPAN

Central Meteorological Observatory of Japan, seismologic service inaugurated 1920 (?).
K. Nakamura, Director.

Postal address: Central Meteorological Observatory of Japan, Tokyo, Japan.

$\varphi = 35°41'06''$ N., $\lambda = 139°45'04''$ E., h = 21.3 m.

Lithologic foundation: (Quaternary).

Equipment: Wiechert inverted pendulum, two comp. N and E.
Omori horizontal pendulum.

Constants:	V	T_o	ϵ	r/T_o^2
Wiechert N,	76	3.0 sec.	3.2	0.0001
" E,	80	3.0 "	3.2	0.0001
Omori,	20	16.1		0.017

Time service: not available, presumably excellent.

TOKYO, JAPAN

Seismological Institute, inaugurated in 1880.
Prof. Dr. Fusakichi Omori, Professor of Seismology, Director.
Tokyo Imperial University.

Postal address: Seismological Institute, Tokyo Imperial University, Tokyo, Japan.

$\varphi = 35°42'40''$ N., $\lambda = 139°45'59''$ E., h = 18.9 m.

Lithologic foundation: clay (diluvium).

Equipment:

Omori horizontal pendulum,	N comp.,	V = 120, T_o = 20 sec.
" " "	E "	V = 120, T_o = 20 "
" " "	N "	V = 20, T_o = 40 "
" " "	E "	V = 30, T_o = 40 "
" " "	E "	V = 15, T_o = 60 "
" " "	N "	V = 10, T_o = 30 "
" " "	E "	V = 10, T_o = 30 "
" " "	N "	V = 300, T_o = 8 "
" " "	E "	V = 300, T_o = 8 "
" duplex pendulum, resultant horizontal motion,		V = 20, T_o = 14 "
" vertical motion seismograph,	Z comp.,	V = 20, T_o = 18 "
" " " "	Z "	V = 10, T_o = 22 "

Time service: time marks are made by a contact chronometer checked daily by radiotelegraphic time signals from the Tokyo Astronomical Observatory.

TOLEDO, SPAIN

Estación Sismológica Principal de Toledo.
Vicente Inglada Ors, Ingeniero Geógrafo, Director.
Instituto Geográfico y Estadístico.

Postal address: Ingeniero Jefe de la Estación Sismológica de Toledo, España.

$\varphi = 39°51'25.6''$ N., $\lambda = 4°01'28.5''$ W.. h = 500 m.

Lithologic foundation: gneiss.

Equipment: and constants:			Mass	V	T_o	ϵ	r/T_o^2	m.per hour
Vicentini	seismograph,	N comp.,	100 kg.	112	2.5		0.004	0.6
"	"	E "	100 "	111	2.5		0.004	0.6
"	"	Z "	50 "	250	0.86		0.020	0.6
Agamennone[1]	"	NE "	2,000 "	230	2.5		0.010	0.61
" [1]	"	NW "	2,000 "	230	2.5		0.010	0.61
Bosch-Omori	"	N "	25 "	20	17.0		0.001	0.9
" "	"	E "	25 "	20	17.0		0.001	0.9
Wiechert	"	NE "	1,000 "	190	8.9	5	0.003	0.9
"	"	NW "	1,000 "	225	8.2	5	0.004	0.9
Milne	"	E "		9	15.0			0.255
Rebeur-Ehlert	"	N "	0.2 "	123	7.0	4		0.86
" "	"	E "	0.2 "	122	7.0	4		0.86

Time service: time is kept by a Dent clock compared by radiotelegraphic signals from the Eiffel tower; minute marks are made electromagnetically by several contact clocks as follows,—a Bosch clock for the Bosch-Omori seismographs, a Bosch clock for the Milne and Rebeur-Ehlert seismographs (which register photographically), and a Hipp clock for the Vicentini, Agamennone, and Wiechert instruments; accuracy of time ca. 0.5 sec.

[1] May be adjusted to magnify 1,000 times.

TORONTO, CANADA

Meteorological Office, seismologic service inaugurated in September, 1897. Sir Frederick Stupart, Director, Dominion Meteorological Service.

Department of Marine and Fisheries.

Postal address: Director, Dominion Meteorological Service, Toronto, Canada.

$\varphi = 43°40'00.8''$ N., $\lambda = 79°23'54''$ W., $h =$ ca. 115.5 m.

Lithologic foundation: sand and gravel on boulder clay to a depth of ca. 15 m., then shale over crystalline rock (Laurentian) at a depth of ca. 335.5 m.

Equipment: Milne seismograph,[2] mass 0.23 kg., E comp., no damping. Constants: $T_o = 18$ sec., 1 mm. displacement $= 0.45''$.

Time service: time is kept and marked by a clock whose rate may vary ± 2 sec.; time comparisons are made by meridian transit observations with an accuracy of ± 0.01 sec.

[2] Soon to be superseded by a Milne-Shaw seismograph to register two horizontal comp. N and E.

TORTOSA, SPAIN

Observatorio del Ebro, seismologic service inaugurated in 1905.
Pedro Trullás, in charge.

Observatorio del Ebro.

Postal address: Observatorio del Ebro, Tortosa, España.

$\varphi = 40°49'14''$ N., $\lambda = 0°29'38''$ E., h = 39 m.

Lithologic foundation: conglomerate (Miocene).

Equipment: and constants:			Mass	V	T_o
Vertical (simple)	pendulum,	N comp.	300 kg.	200	2.4 sec.
Vicentini	"	E "	100 "	90	2.5 "
"	"	Z "	50 "	150	0.65 "
Mainka horizontal[1]	"	N "	1,500 "	160	15.0 "
" " [1]	"	E "	150 "	50	7.5 "

Time service: time is kept and minute time marks are made electromagnetically by the central Observatory clock.

[1] Modified.

*TOULOUSE[2], FRANCE

Observatoire de l'Université.

Postal address: Toulouse, France.

$\varphi = 43°36'46''$ N., $\lambda = 1°27'44''$ E., h = 194 m.

Lithologic foundation: sandstone and marl (Miocene).

[2] There is now no station at Toulouse.

TRENTA (COSENZA), ITALY

Stazione Sismica "Proviero," inaugurated in February, 1915.
D. Antonio Proviero, Director.

Postal address: Stazione Sismica "Proviero," Trenta (Cosenza), Italia.

$\varphi = 39°16'57.57''$ N., $\lambda = 16°19'21.3''$ E., h = 534.43 m.

Lithologic foundation: friable sedimentary rock, prevailingly calcareous.

Equipment: Agamennone seismometrograph, mass 50 kg., three comp.
Constants: V = 50; T_o (horizontal) = 7 sec., T_o (vertical) = 1.8 sec.
Vertical microseismometrograph, mass 1,000 kg.
Constants: V = 250, T_o = 2.8 sec.

Time service: time is kept (and marked?) by a marine chronometer compared by meridian observations.

TRIESTE, ITALY

R. Instituto Geofisico[1].
Prof. Francisco Vercelli, Director.
Comitato Talassografico Italiano.

Postal address: R. Instituto Geofisico, Passegio S. Andrea 2, Trieste, Italia.

$\varphi = 45°39'$ N., $\lambda = 13°46'$ E., h = 67 m.

Lithologic foundation: calcareous rocks.

Equipment: Wiechert inverted pendulum, mass "*1 ton*" (*1,000 kg.?*), two horiz. comp.
Constants: V = ca. 200, T_o = 12 sec.
Vicentini seismograph, three comp.

Constants:		V	T_o
N comp.,	100 kg.	100	1.6 sec.
E "	100 "	100	1.6 "
Z "	80 "		1.0 "

Time service: not stated.

[1] The seismologic station is to be transferred to another locality in the city. The chronographic system will be changed.

TSINGTAO, CHINA (JAPAN)

The Meteorological Observatory of Tsingtao, seismologic work renewed January 1, 1921, after being interrupted for about six years.
T. Irumata, Director.

Postal address: The Meteorological Observatory of Tsingtao, Tsingtao, China.

$\varphi = 36°04'11''$ N., $\lambda = 120°19'14''$ E., h = 70 m.

Lithologic foundation: igneous rock.

Equipment: Wiechert inverted pendulum, mass 200 kg.

Time service: time comparisons are made by transit observations using a chronograph; accuracy ca. 0.1 sec.

*TSITA, SIBERIA, RUSSIA

Seismologic Station.

$\varphi = 52°01'$ N., $\lambda = 113°30'$ E.

TSU, JAPAN

Meteorological Observatory, seismologic service inaugurated in March, 1917.

S. Yasaki, Director.

Supported by the local prefecture.

Postal address: Tsu Meteorological Observatory, Tsu, Japan.

$\varphi = 34°43'$ N., $\lambda = 136°31'$ E., $h = 3.0$ m.

Lithologic foundation: soft sandy soil.

Equipment: C. M. O. horizontal pendulum tremor recorder, two comp. N and E.
Constants: $V = 20$, $T_o = 10$ sec.

Time service: time comparisons daily by radiotelegraphic signals from the Tokyo Astronomical Observatory.

TSUKUBA-SAN, JAPAN

Meteorological Observatory, seismologic service inaugurated at sub-station (a) in November, 1904; and at sub-station (b) in January, 1902 Z. Sato, Director.

Supported by the Central Meteorological Observatory.

Postal address: Tsukuba-san Meteorological Observatory, Tsukuba-san Ibaraki-ken, Japan.

Sub-station (a), $\varphi = 36°13'$ N., $\lambda = 140°06'$ E., $h = 870$ m.
" " (b), $\varphi = 36°12'$ N., $\lambda = 140°06'$ E., $h = 240$ m.

Lithologic foundation: sub-station (a), diorite.
" " (b), decomposed diorite.

Equipment: at sub-station (a), Omori horizontal pendulum tromometer, two comp. both E.
Constants: E, $V = 7$, $T_o = 13$ sec.; E, $V = 30$, $T_o = 5$ sec.
At sub-station (b), Omori horizontal pendulum tremor recorder, E comp.
Constants: $V = 200$, $T_o = 9$ sec.

Time service. time comparisons obtained daily by radiotelegraphic signals from Tokyo Astronomical Observatory.

TUCSON, ARIZONA

Tucson Magnetic Observatory, seismologic service inaugurated in September, 1910.

Magnetic Observer, in charge; W. H. Cullum, present incumbent.

U. S. Coast and Geodetic Survey.

Postal address: Tucson Magnetic Observatory, R. F. D. No. 2, Tucson. Arizona, or U. S. Coast and Geodetic Survey, Washington. D. C.

$\varphi = 32°14'48''$ N., $\lambda = 110°50'06''$ W., h = 770 m.

Lithologic foundation: concrete piers on sand and loose gravel.

Equipment: Bosch-Omori seismograph, mass 10 kg., two comp. N and E.

Constants: V = 10, $T_{oN} = 18$ sec., $T_{oE} = 17$ sec.

Time service: two box chronometers, corrections and rates determined once a week from telegraphic time signals from Tucson. The times of starting and stopping the record are noted daily by one of the chronometers. The seismograph clock, which makes a mark on the smoked paper each minute (1 minute = 15 mm.) is not of high grade and the daily rate is somewhat irregular so that the times of the minute marks in the middle of the sheet may at times be in error by a considerable amount.

*TURIN, ITALY

Seismologic Station discontinued, and apparatus transferred to Porto Maurizio about 1910.

UCCLE, BELGIUM

Station sismologique, inaugurated in January, 1904.

Professor G. Lecointe, Director of the Observatory.
Observatoire royal de Belgique.

Postal address: Observatoire royal, Uccle, Belgique.

$\varphi = 50°47'55.5''$ N., $\lambda = 4°21'31''$ E., h = 100 m.

Lithologic foundation: limestone (calcaire grossier, Eocene).

Equipment: Galitzin aperiodic seismometer, photo-galvanometric registration, two comp. N and E.

Wiechert inverted pendulum, mass 1,000 kg., two comp.
Wiechert vertical-motion seismograph, mass 1,300 kg.

For constants,—see Annales de l'Observatoire Royale de Belgique, nouvelle série, Physique du globe, tome VI, fasc. II, pp. 163 et seq.

Time service: minute time marks are made electromagnetically by a contact clock which is compared, to an accuracy of ca. 0.1 sec., with the precision clock of the time service of the Observatory. The time marks are made by eclipsing the light beams, or lifting the writing styles.

*UNGVÁR, CZECHOSLOVAKIA

Observatoire sismologique, inaugurated in 1911.
Lycée royale catholique.

Postal address: Observatoire sismologique, Lycée royale catholique, Ungvár, Czechoslovakia.

$\varphi = 48°37'$ N., $\lambda = 22°14'$ E., h = 128 m.

Equipment: Bosch-Omori horizontal pendulum, mass 10 kg., two comp.

UPSALA, SWEDEN

Meteorological Observatory of the University, seismologic service inaugurated in 1904.
Prof. Filip Åkerblom, Director.

Postal address: Meteorological Observatory, Upsala, Sweden.

$\varphi = 59°51'29''$ N., $\lambda = 17°37'37''$ E., h = 14 m.

Lithologic foundation: granite pier resting directly on crystalline rock.

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E.

Constants:	L	J	V	T_o	ϵ	r
N,	23.9	4,510	189	9.8 sec.	3.7	0.5
E,	22.0	4,204	191	9.4 "	3.7	0.6

Time service: minute time marks are made by an interruption in the registration; time is checked at least once a week with a chronometer at the Astronomical Observatory near by.

URBINO, ITALY

Osservatorio Meteorico-Sismico di Urbino, founded in 1853.

Prof. Giovanni Camburini, Director.
Ufficio Centrale di Meteorologia e Geodinamica, Roma.

Postal address: Osservatorio Meteorico-Sismico, Urbino, Italia.

$\varphi = 43°43'$ N., $\lambda = 12°38'$ E., h = 451.5 m.

Lithologic foundation: argillaceous marl.

Equipment: at present this station functions solely as a meteorological station.

Time service: not stated.

VENICE, ITALY

Stazione Sismologica, inaugurated in December, 1904.
Prof. Padre Francisco Saverio Zanon, Director of the Observatory.
Seminario Patriarcale di Venezia.

Postal address: Osservatorio Meteorologico e Geodinamico del Seminario Patriarcale di Venezia, Venezia, Italia.

$\varphi = 45°25'44''$ N., $\lambda = 12°20'15''$ E., h = 1 m.

Lithologic foundation: argillaceous rock.

Equipment: Vicentini microseismograph, three comp.
Constants: (horizontal comps.) Mass = 100 kg., length of pendulum = 1.5 m. V = 120, T_o = 2.4 sec., 5 mm. = 1 minute: (vertical comp.) mass = 50 kg., length of spring = 1.29 m., V = 140, T_o = 0.8 sec., 5 mm. = 1 minute. Agamennone seismoscope.

Time service: time is kept and marked by a good contact clock provided with a mercury-compensated pendulum, compared with good chronometers; accuracy ca. 1 sec.

VERA CRUZ, MEXICO

Estación Seismológica de Veracruz, a station of the second order.
Ing. Rubén Bouchez, Jefe de la Estación.
Servicio Seismológico Nacional de México,
Instituto Geologico Nacional.

Postal address: Instituto Geológico Nacional, 6a del Cipres núm. 176 México, D. F., República Mexicana.

φ = 19°12′ N., λ = 96°07′58″ W., h = 5 m.

Lithologic foundation: basalt.

Equipment: Wiechert inverted pendulum, mass 200 kg., two comp. N and E. Wiechert vertical-motion seismograph, mass 80 kg., Z comp.

Time service: time comparisons by telegraphic signals from Tacubaya.

*VERNYI (WJERNOJE), RUSSIAN TURKESTAN

Seismologic Station, a station of the second class of the Russian service.

φ = 43°17′ N., λ = 76°57′ E.

Equipment: Galitzin seismograph, mech. registr. three comp.

*VERONA, ITALY

Stazione Sismica del R. Instituto Technico, inaugurated in 1906.

Postal address: Verona, Italia.

φ = 45°26′ N., λ = 11°01′ E., h = ca. 60 m.

Lithologic foundation: sandy alluvium.

Equipment: Vicentini microseismograph, mass 150 kg., two horizontal comp.
Constants: V = 65, T_o = 2.4 sec.
Vicentini seismograph, three comp.

Time service: time is checked with the clock of the telegraph office.

VESUVIUS, see NAPLES

VICTORIA. BRITISH COLUMBIA, CANADA

Meteorological Observatory, Gonzales Heights, seismologic service inaugurated (at present site) in April, 1914.
F. Napier Denison, Director.
Dominion Meteorological Service, Department of Marine.

Postal address: Meteorological Observatory, Victoria, B. C., Canada.

$\varphi = 48°24'50''$ N., $\lambda = 123°19'28''$ W., h = ca. 67.6 m.

Lithologic foundation: cement piers, free of the floor, through a "cushion" of sand (18 inches thick) to igneous rock.

Equipment: Milne seismograph, older type, E comp. $T_o = 18$ sec.
Wiechert vertical-motion seismograph, mass 80 kg., $V = 70$, $T_o = 5$ sec.
Milne-Shaw seismographs to be installed (before end of 1920).

Time service: time is determined by astronomical observations and kept to an accuracy of 0.1 sec. Hourly time eclipses are made on the Milne record by a watch, and minute time marks are made electromagnetically on the Wiechert record by a good contact pendulum clock which has a steady rate (1 sec. per day).

*VIENNA, AUSTRIA

Zentralanstalt für Meteorologie und Geodynamik, seismologic service inaugurated in 1905.
Prof. Dr. Exner, Director.

Postal address: Zentralanstalt für Meteorologie und Geodynamik, Wien, Österreich.

$\varphi = 48°14'53''$ N., $\lambda = 16°21'42''$ E., h = ca. 200 m.

Lithologic foundation: concrete piers in a cellar on alluvium.

Equipment: Wiechert inverted pendulum, mass 1,000 kg.
Wiechert vertical-motion seismograph, mass 1,300 kg.
Vicentini seismograph, three comp.

VIEQUES, PORTO RICO

Porto Rico Magnetic Observatory, seismologic service inaugurated in September, 1903.
Magnetic Observer, in charge, W. W. Merrymon, present incumbent.
U. S. Coast and Geodetic Survey.

Postal address: Porto Rico Magnetic Observatory, Vieques, Porto Rico, or U. S. Coast and Geodetic Survey, Washington, D. C.

$\varphi = 18°08'50''$ N., $\lambda = 65°26'50''$ W., $h = 19.08$ m.

Lithologic foundation: granitic rock overlaid with a few feet of heavy clay loam.

Equipment: Bosch-Omori seismograph, mass 10 kg., two comp. N and E.
Constants: $V = 10$, $T_{o_N} = 19$ sec., $T_{o_E} = 17$ sec., 15 mm. = 1 minute.

Time service: two box chronometers, corrections and rates determined by solar observations 3 or 4 times a month. The times of starting and stopping the record are noted daily by one of the chronometers and also the time of a mark made about the middle of a day's record. The seismograph clock, which makes a mark each minute on the smoked paper (1 minute = 15 mm.), is not of high grade, but when in good adjustment has a fairly uniform rate, so that the times of the minute marks are probably uncertain by not more than 5 sec.

*VLADIVOSTOK, RUSSIA

A seismologic station of the first class of the Russian service was projected here.

VOLCANO HOUSE, T. H.

Hawaiian Volcano Observatory, seismologic service inaugurated in August, 1912.
Dr. T. A. Jaggar, Volcanologist, in charge.
U. S. Weather Bureau.

Postal address: Hawaiian Volcano Observatory, Volcano House, T. H. or U. S. Weather Bureau, Washington, D. C.

$\varphi = 19°25'54.2''$ N., $\lambda = 155°15'39.2''$ W., $h = 1214.6$ m.

Lithologic foundation: concrete piers on basalt.

Equipment: Bosch-Omori horizontal pendulums (re-built at the station) both registering on one speeded drum (12 hour record), mass 100 kg., two comp. N and E, adjusted to register local shocks.
Constants: $V = 116$, $T_o = 7$ sec., aperiodic (oil-damping), $r/T_o^2 = 0.03$.
Romberg-Omori horizontal pendulum, optical registration, 24-hour record, viscous (oil) coupling, oil damping, silk-fibre mirror suspension, wire suspension of steady mass, adjusted for teleseismic registration.
Constants: $V = 124$, $T_o = 18.4$ sec., $K_o = 0.45$ (Cf. Bull. Seis. Soc. Am., IX, 4, 136).

A special vertical-component pendulum, optical registration, is set up but not finished.

Time service: time is kept by a chronometer checked occasionally by radiotelegraphic signals at Hilo. Provision is being made for direct receipt of radiotelegraphic signals.

WASHINGTON, D. C.

Georgetown University Seismological Station[1], inaugurated in 1911.
Rev. Francis A. Tondorf, S.J., Chief Seismologist.

Postal address: Georgetown University Seismological Station, W. Washington, D. C.

$\varphi = 38°54'25''$ N., $\lambda = 77°04'24''$ W., $h = 42.4$ m. at substation A, $h = 48.2$ m. at substation B.

Lithologic foundation: decayed diorite.

Equipment: Wiechert inverted pendulum, mass 200 kg., two comp. N and E.
Constants: N, $V = 142$, $T_o = 5.2$ sec.; E, $V = 165$, $T_o = 5.4$ sec.
Wiechert vertical-motion seismograph, mass 80 kg., Z comp.
Constants: Z, $V = 80$, $T_o = 3$ sec.
Bosch-Omori horizontal pendulum, mass 25 kg., two comp. N and E.
Constants: N, $V = 13.5$, $T_o = 8.6$ sec.; E, $V = 13.7$, $T_o = 8.8$ sec.
Bosch horizontal pendulum, mass 0.2 kg., phot. registr., two comp. N and E.
Constants: $V = 133$, $T_o = 5.0$ sec.
Mainka bifilar horizontal pendulum, mass 135 kg., two comp. N and E.
Constants: N, $V = 70$, $T_o = 5.4$ sec.; E, $V = 93$, $T_o = 4.0$ sec.

Time service: time is kept and hour and minute time marks are made electromagnetically by a contact clock; time comparisons are made by communication with the Georgetown Astronomical Observatory, by telegraphic time signals (Western Union service), and by radiotelegraphic signals (Arlington service).

[1] This station also maintains a substation at Guatemala City, Guatemala, with a Wiechert inverted pendulum, mass 80 kg.

WASHINGTON, D. C.

Seismologic Station, U. S. Weather Bureau.
Dr. W. J. Humphreys, Professor of Meteorological Physics, in charge.

Postal address: U. S. Weather Bureau, Washington, D. C.

$\varphi = 38°54'12''$ N., $\lambda = 77°03'03''$ W., $h = 21$ m.

Lithologic foundation: clay (few meters) over granitic rock.

Equipment: Marvin inverted pendulum, two comp. N and E.

Constants: V = 110, T_o = 6.4 sec., 1 mm. = 4 sec.

Time service: time is kept and minute marks are made electromagnetically by the writing styles by a contact clock of special construction compared daily by time signals from the U. S. Naval Observatory.

WELLINGTON, NEW ZEALAND

Hector Observatory, seismologic service inaugurated in 1898.
Dr. Charles Edward Adams, Government Astronomer and Seismologist.
Department of Internal Affairs, New Zealand Government.

Postal address: Government Astronomer, Hector Observatory, Wellington, New Zealand.

φ = 41°17′03.8″ S., λ = 174°46′04″ E., h = ca. 121.9 m.

Lithologic foundation: graywacke and argillite (Trias-Jura).

Equipment: Milne seismograph, mass 0.222 kg., E comp.
Constants: L = 15.6 m., J = 525 m., V = 6.1, T_o = 18 sec., ϵ = 0.14.
A Milne-Shaw pendulum is soon to be installed.
Gray-Ewing duplex pendulum.
Tilt is measured by a sensitive spirit level mounted E–W on the pier, and also by the stride level of the transit instrument.

Time service: time is determined astronomically and comparison signals are put on the seismogram at least five times per day direct from the standard clock. Ordinary time marks are made by eclipse of the light beam once each hour.

WELTEVREDEN, BATAVIA, JAVA

Batavia Observatory, seismologic service inaugurated in June, 1898.

Postal address: Director, Koninklijk Magnetisch en Meteorologisch Observatorium, Weltevreden, Java.

φ = 6°11′00″ S., λ = 106°49′50″ E., h = 8 m.

Lithologic foundation: alluvium (Pleistocene).

Equipment:
Milne seismograph, since June 1, 1898.
Bosch seismograph, two comp. N and E, installed in 1912.
Wiechert inverted pendulum, mass 1,000 kg., two comp. N and E, installed December 6, 1908.

Constants:	V	T_o	ϵ
N,	ca. 193	ca. 8.0s.	ca. 5
E.	ca. 216	ca. 7.6	ca. 5

Time service: time is kept (?) and minute time marks are made electromagnetically by a lifting of the writing styles by a Peyer Favager contact clock, with an accuracy of about 1 sec.; hour time marks are made by the observer on duty by lifting the styles electromagnetically.

WEST BROMWICH, ENGLAND

Private seismologic station, inaugurated in 1908.
J. J. Shaw, proprietor.

Postal address: Birmingham Road, West Bromwich, England.

$\varphi = 52°31'$ N., $\lambda = 1°59'$ W., h = ca. 156 m.

Lithologic foundation:

Equipment: Omori seismograph, mech. registr., two comp. N and E.
Constants: V = 60, $T_o = 12$.
Milne-Shaw instruments frequently running on test.

Time service: an observatory clock, rate about 2 sec. per week, compared daily by radiotelegraphic signals.

The primary objective of this station is construction, testing, and research,—not routine registration.

WINNIPEG, see ST. BONIFACE

WJERNOJE, see VERNYI

*WORCESTER, MASSACHUSETTS

Seismologic Station, inaugurated in 1909.
Rev. William R. Cullen, S.J., Director.
Holy Cross College.

Postal address: Seismologic Station, Holy Cross College, Worcester, Massachusetts.

$\varphi = 42°16'23''$ N., $\lambda = 71°48'27''$ W., h = ca. 203.4 m.

Equipment: Wiechert inverted pendulum, mass 200 kg.

YAGI, JAPAN

Meteorological Observatory, seismologic service inaugurated in June, 1917.
H. Haraoka, Director.
Supported by the local prefecture.

Postal address: Yagi Meteorological Observatory, Yagi, Nara-ken, Japan.

$\varphi = 34°31'$ N., $\lambda = 135°48'$ E., h = 63.3 m.

Lithologic foundation:

Equipment: C. M. O. horizontal pendulum tremor recorder, two comp. N and E.

Constants: $V=30$, $T_o=6$ sec.

Time service: time comparisons by telegraphic signals received through the local post-office from the Tokyo Astronomical Observatory.

YAMAGATA, JAPAN

Meteorological Observatory, seismologic service inaugurated in September, 1913.
M. Morita, Director.

Supported by the local prefecture.

Postal address: Yamagata Meteorological Observatory, Yamagata, Japan.

$\varphi=38°15'$ N., $\lambda=140°21'$ E., $h=150.6$ m.

Lithologic foundation: soft ground.

Equipment: Imamura seismograph, two comp. N and E.
Constants: $V=2$, $T_o=4$.

Time service: time corrections by telegraphic signals received through local post-office from Tokyo Astronomical Observatory.

ZAGREB (AGRAM), JUGOSLAVIA

R. Meteorological and Geodynamical Observatory, seismologic service inaugurated in 1906.
Dr. A. Mohorovičić, Provisory Director.

Postal address: R. Meteorological and Geodynamical Observatory, Zagreb, Jugoslavia.

$\varphi=45°48'55''$ N., $\lambda=15°58'52''$ E., $h=155$ m.

Lithologic foundation: clay (alluvium 40 to 50 m. thick).

Equipment: Wiechert inverted pendulum, mass 1,000 kg., two comp. NW and NE.
Constants: $V=200$, $T_o=9$ to 10 sec., $\epsilon=5$ to 6, $r=0.1$ to 0.2 mm., $r/T_o^2=0.001$ to 0.002, 20 mm. = 1 minute.
Wiechert inverted pendulum, mass 80 kg., two comp. NW and NE.
Constants: $V=20$, $T_o=7$ sec., $\epsilon=5$ to 6, $r=0.1$ mm.

Time service: time is kept to an accuracy of 0.1 to 0.2 sec. by a Riefler clock.

ZANTE, GREECE

Seismologic Station, inaugurated in 1900.
Prof. Dennis Martinengo, Director.
Observatoire National d'Athènes.

Postal address: Station Sismologique, Zante, Grèce.

$\varphi = 37°39'$ N., $\lambda = 18°40'$ E., h = ca. 4 m.

Lithologic foundation: land reclaimed from the sea.

Equipment: Agamennone seismograph, temporarily out of use.

Time service: not stated.

ZI-KA-WEI, SHANGHAI, CHINA

Zi-ka-wei Observatory, seismologic service inaugurated in 1903, and augmented in 1909 and 1913
Louis Froc, S.J., Director.
Jesuit Mission of Nanking.

Postal address: Zi-ka-wei Observatory, via Shanghai, China.

$\varphi = 31°11'32''$ N., $\lambda = 121°25'48''$ E., h = 7 m.

Lithologic foundation: alluvium several meters thick.

Equipment: Omori horizontal pendulum, mass 20 kg., two comp. N and E., 13 mm. = 1 minute. Installed in 1903.
Wiechert inverted pendulum, mass 1,200 kg., two comp. N and E, 15 mm. = 1 minute. Began registration March 31, 1909.
Galitzin aperiodic vertical-motion seismometer, photo-galvanometric registration, 30 mm. = 1 minute. Began registration April 3, 1913.
Constants: (May 3, 1920, presumably of Wiechert apparatus)

	V	T_o	ϵ	r/T_o^2
N,	137	11 sec.	2.8	0.013
E,	131	11 "	3.2	0.011

Time service: the clocks are compared daily with the astronomical clocks (Férron) of the time service of the Observatory.

ZÜRICH, SWITZERLAND

Erdbeben-Warte Zürich, inaugurated in 1911. (Macroscopic observations since 1898.) The special purpose of this station is the registration of local and near earthquakes.
Prof. Dr. Alfred de Quervain, Director.
Dr. A. de Weck, Assistant.
Bureau Météorologique Central Suisse.

Postal address: Schweizerischer Erdbebendienst, Météorolog. Centralanstalt, Zürich, Schweiz.

$\varphi = 47°22'07.2''$ N., $\lambda = 8°34'49.5''$ E., $h = 604.2$ m.

Lithologic foundation: sandstone and marl (Samartien, Miocene).

Equipment: Bosch-Mainka horizontal pendulum, mass 450 kg., two comp. N and E.
Constants: $V = 220$, $T_o = 5$ sec., $\epsilon = 4$.
Wiechert vertical-motion seismograph, mass 80 kg., Z comp.
Constants: $V = 110$, $T_o = 3.2$ sec., $\epsilon = 4$.
Quervain-Piccard transportable seismograph[1], three comp., mass 25 kg.
Constants: $V = 50$, $T_o = 2$ sec.
Quervain-Piccard seismograph for local earthquakes, in construction, mass 20,000 kg., three components.
Constants: $V = 1{,}000$ to $2{,}000$, $T_o =$ ca. 3 sec.

Time service: time is kept by excellent compensated astronomical clocks compared daily by radiotelegraphic signals from the Eiffel tower with an accuracy of about 0.1 sec.; the seismograms are read with an accuracy of about 0.1 sec. for the horizontal motion and of about 0.3 sec. for the vertical motion.

Publication: preliminary measurements of the principal phases are published in the daily Meteorological Bulletin of the Météorolog. Centralanstalt and collected in an annual report sent to all seismologic observatories which desire it.

[1] For the registration of epicentral shocks and jarring due to artificial causes.

*ZURNABAD, RUSSIA

Seismologic Station, a station of the second class of the Russian service.

$\varphi = 40°31'$ N., $\lambda = 46°16'$ E.

It has proved impossible to obtain any information concerning seismologic stations supposed to be maintained at Barrackpur, Bengal, India; Huelva, Spain; Pontevedra, Spain; Rangoon, Burma; Sucre, Bolivia; Taungoo, Burma; and the Island of Teneriffe.

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Krakow (2), Lwów.

CZECHOSLOVAKIA

Eger, Stará Ďala, Ungvár.

AUSTRIA

Graz, Innsbruck, Kremsmünster, Vienna.

HUNGARY

Budapest, Kalocsa, Kolozsvar.

JUGOSLAVIA

Belgrade, Laibach, Sarajevo, Zagreb.
Fiume. Constantinople.

ROUMANIA

Bucharest, Cernauți, Cluj, Tenițoara.

BULGARIA

Sofia.

GREECE

Aigion, Athens, Chalcis, Kalamata, Zante.

RUSSIA

Achalkalaki, Baku, Balakhany, Batum, Borzum, Derbent, Ekaterinburg, Makejevka, Moscow, Nicolajef, Piatigorsk, Pulkova, Šemakha, Tiflis.

MEDITERRANEAN SEA

Malta.

AFRICA

Alger-Bouzaréah (Algiers), Helwan (Egypt), Asmara (Eritrea), Accra (Gold Coast), Johannesburg (Cape of Good Hope).

ASIA

RUSSIA

Irkutsk, Kabansk, Kašgar, Krasnojarsk, Krasnovodsk, Marituj, Taškent, Tsita, Vernyi, Vladivostok, Zurnabad.

ASIA MINOR

Beirut (2), Harpoot.

INDIA

Bombay, Calcutta, Colaba, Colombo, Dehra Dun, Kodai Kanal, Simla.

CHINA

Dairen, Tsingtao, Zi-ka-wei.

JAPAN

Aomori, Asahigawa, Chosi, Fukuoka, Gifu, *Hakodate*, *Hamada*, *Hamamatsu*, Hikone, Hiroshima, Hokoto, Ishigakijima, Jinsen, Kagoshima, Kanayama, Kanazawa, Karenko, Kobe, Koshun, Kumamoto, Kyoto (2). Maebashi, Matsumoto, Matsuyama, Mito, Miyazaki, Mizusawa, Mukaiyama, Naha, Nagano, Nagasaki, Nagoya, Niigata, Numazu, Oita, Osaka, Otomari, Saga, Sakai, Sapporo, Shionomisaki, Tadotsu, Taichu, Taihoku, Tainan, Taito, Takayama, Takushima, Tokyo (2), Tsu, Tsukuba-San, Yagi, Yamagata.

INDIAN OCEAN

Keeling Island, Mahe (Seychelles Isls.), Pamplemousses (Mauritius Isl.), Tananarive (Madagascar).

EAST INDIES

Ambulong, P. I., Baguio, P. I., Butuan, P. I., Irosin, P. I., Mambajao, P. I., Manila, P. I., Tigaon, P. I., Batavia, Java, Malabar, Java.

AUSTRALIA

Perth, South Yarra, Sydney (2).

PACIFIC OCEAN

Guam, Honolulu (2), Volcano House, T. H., Fanning Isl., Apia, Samoa, Wellington, N. Z., Christchurch, N. Z.

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