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NOCTURNAL SHAPE AND MOTION OVER THE UNITED STATES OF CHARACTERISTIC ISOTHERMS

by E. Gherzi, S.J.

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L'Auteur examine l'allure et l'aspect, à 1h.00, heure normale de l'Est, de deux isothermes, l'une froide et l'autre chaude, sur le territoire des Etats-Unis d'Amérique, durant les quatre saisons de l'année. Il souhaite que dans les Tables officielles de la température diurne on distingue les valeurs de la nuit de celles du jour.

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In a former Note (1) we have expressed our surprise that the temperature at night as being distinct from the temperature during the day-light hours had not been given the attention which, climatologically speaking, it deserves. Human beings, animals and vegetation are greatly affected by the fact that during many hours the solar rays are not reaching the atmosphere in which they live and grow. Botanists know that plants, when kept continuously in the dark, show special biological deportment. The same should apply also to humans and to animals. Those who live in the Great North territories have reported the depressing feeling of being deprived of the regular sunshine of more southern latitudes.

So much so that the climatological maps drawn by means of the 24 hour mean temperature are rather misleading. Such a mean value seems to imply that the solar radiation has been acting continuously over the surface of selected regions. It is impossible to select in a 24 hour mean temperature the part of night hours, although for many months these have been longer than the hours with an overhead sun.

As we have also pointed out in our NOTE quoted above, it would be a tremendous task to table the hourly mean night temperature at every one of the reporting stations scattered all over the United States territory. Besides that,in many of these stations the temperature is probably not read every hour. Furthermore, the official mean temperature published is not the mean value of 24 hour observations a day, but only the mean of the maxima and the minima recorded. We regret that to these two extreme figures no other observations are added as is the practice for instance with the German Weather Bureau.

Owing to the practical impossibility of establishing personnally the tables of all the hourly observations made at night at all the weather stations, taking into account the different duration of dark hours according to the dates and the latitudes, we have chosen to examine the shaping and the movements of chosen isotherms as they were found all over the States at 1h. a.m. Eastern Standard Time. At such an hour all the territory of North America would be without any direct solar radiation; many hours after sunset and many hours before sunrise.

Our purpose would not be to find out the change of temperature from one night to another, but the distribution, from night to night of some chosen isotherms. Of course such a technique cannot be used for forecasting the temperature of the following night. It can only show how much during that lapse of time the location and the aspect of the selected isotherms can change. It could also show why at times the daily minimum was not recorded, as usually it is, just before sunrise, but during the dark hours, even at midnight.

To help understand the course of our technique we had to give up the idea of considering all the isotherms of the weather map, even though only 10°F. apart. That would have meant a bewildering chase. Such an or more complete study would have been quite misleading if all the other meteorological factors (wind, sky, etc.) had not also been considered.

Owing to the kind of documentation at hand we decided to examine only some characteristic isotherms.

The author thought that the analysis of the behaviour of a cold and of a warm isotherm would be sufficient for his purpose.

We considered the 32°F. (or 30°F.) and the 60°F. isotherms for the autumn and the winter seasons; the 40°F. and the 70°F. for spring and 60°F. and 80°F. for summer. These especially selected isotherms would show more spectacularly the extraordinary jumps of temperature which happen overnight. Although such a choice meant a more limited analysis we could nevertheless obtain a better description of the nocturnal temperature vagaries. We reproduce at the end of this article some typical occurrences. (Cf. Figures I - IV)

During autumn and especially in winter the two isotherms (32°F. and 60°F.) enclose the whole of United States. Their northward or southward migrations can be compared to two big atmospheric waves playing up and down over the territory under observation. The geographical location of North America between two oceans should and does affect the general shaping of the isotherms day and night. The powerful polar anticyclones can be pictured as a large atmospheric river flowing southward between two dikes, namely the western and the eastern coasts. Because of the oceanic expanses, existing on both sides of North America, the isotherms are usually curving from south to north towards the polar regions (50°-55° Lat. North).

There is nothing new in this geographical statement. Nonetheless the trend of the two selected isotherms (32°F. and 60°F.) to form a convex picture, even at night, appears to be interesting. Nothing of the sort was found when drawing the same isotherms over continental China (2). There the winter isotherms were most of the time at right angle to the sea coast especially when a powerful Siberian anticyclone, similar to those from Canada, was sweeping southward.

Of course, even in the United States the 24 hour temperature values already mentioned would probably show a similar although misleading pattern. Could we say that the northward curving of the winter isotherms all along the United States coasts is mostly a night condition phenomenon? As a matter of fact the official U.S. temperature map for January (3) shows the isotherms as being parallel to the latitudes and at right angle to the coasts. We can only state that at 1h. a.m. E.S.T., during the three year period examined, the 32°F. and the 60°F. isotherms had always a decided northward curving along the western and eastern coasts.

We have compared the Polar air invasions over U.S. to a powerful atmospheric river flowing between two dikes: the Atlantic and the Pacific borders. We should add that on the western part of the territory under observation the majestic mass of the Rockies acts as a large region of "breakers". As a consequence the trend of the isotherms (and also of the isobars) in the west is most of the time disturbed. In the east such a disturbing factor of the atmospheric flow is seemingly less apparent, notwithstanding the presence of the Appalachian and the New England mountains.

Let us now give a more detailed description of our study.

The 540 weather maps used for the autumn and winter seasons were those from 1956 to 1958 inclusive. To these we added some additional 152 maps for spring and summer 1958. The main synoptic weather conditions were always considered, especially when the change in the trend of the isotherms could be attributed to the atmospheric circulation. Nevertheless it was found that rather oftentimes, for reasons unknown and not necessarily orographic, the migration northward of southward of the 32°F and 60°F isotherms, as well as their ondulations during the night hours, appeared to be without any connection with the cyclonic or anticyclonic aspect of the atmosphere. Happily the temperature values in the official Weather Bureau maps had not been reduced to the sea level. This is done for pressure, causing a quite unrealistic description of the daily atmospheric density over the reporting stations.

At the beginning of october the 32°F isotherm shows up in the north of the United States in restricted and isolated localities. It comes then gradually southward. The 60°F. isotherm covers the south coast of the States and is, so to say, hooked up to the Gulf of California in the west and to the northern section of Florida in the east. As autumn proceeds and winter gets in, the cold isotherm pulsates continuously southward, while the warm isotherm moves up and down over the south coast and the Gulf of Mexico.

Toward the end of winter the 32°F isotherm recedes northward while the 60°F. isotherm remains more or less over the same southern localities.

All that is already well known to climatologists and there is nothing to discuss.

The details which might not have been reported are the following.

At the hour selected, namely
tion and the trend of the two quoted isotherms show from night to night quite striking evolutions.

At times a narrow and prolonged cold tongue has invaded southward or northward the place where, on the preceding night, the run of the same isotherm was quite smooth. The same remark applies to the warmer isotherm. These elongated penetrations are most of the time independent of the fronts marked on the official map. They are like temperature pulsations and they show up over and across quite different orographic situations. The skies are then shown to be either blue or cloudy and the wind moderate; so much at least at the time chosen for our analysis, when darkness covers all U.S.

Often, while the northern isotherm has moved southward, the warm isotherm remains steady in the south. The contrary happens also. The 60°F. isotherm invades the southern states while the 32°F. isotherm does not budge. Of course from time to time such a migration northward of the warmer isotherm precedes the appearance in the west of a cold front moving ENEward. But such is not the usual happening. Without any front at all, from one night to the other the isotherms have both moved northward or southward. Moreover that happens even in the body of a powerful polar anticyclone which had invaded the central region of the United States.

As we have already reported, the presence of the Rockies, causes often, but not always, an irregular waving of the cold isotherm. On the eastern side of the continent such an irregular shaping of the same cold isotherm is rather exceptional and is present only when an extratropical cyclone is crossing the Great Lakes district.

At that time the 32°F. isotherm backs along the eastern coast anywhere from 40 to 55 of latitude north, owing to the arrival of the warm sector of the storm.

When the northern isotherm has remained stationary, while the southern one has moved northward, a steep temperature gradient develops. Nevertheless the following night the gradient has become again normal. The warm isotherm has receded over the southern coast of U.S. and no cyclonic center is indicated by the official weather map.

When a large polar anticyclone has spread all over the central territory of the United States as far south as 30 degrees of latitude north, the two isotherms are often parallel to the isobars in the central portion of the High cell, but they run at right angle to these on both west and east sides.

The sporadic cold tongues which we have already mentioned dissolve in less than 24 hours since they are not found again on the map of the following night. Those who remain longer do not extend night to nigt nor do they precede any global invasion of polar air. They look at times like those protuberances of an incipient tornado hanging down from a cloud and being rapidly sucke up again into the cloud's body.

The warm tongues form rather often in the central regions and from night to night are found to have gradually moved eastward to the eastern coast, before disappearing from the weather map.

The cold tongue is also at times the forerunner of a cold front, but it will not follow its travel and will remain stationary several hundred of miles behind in the west. This is probably due to the fact that the temperature of the front will gradually increase, owing to ground friction. Contrary way the warm isobar, when it circumscribes the warm sector of the atmospheric disturbance as a long and narrow tongue, will follow the displacement of the cyclonic center as far as the eastern coast. It will then rapidly retreat southward over the usual latitudes, when the cyclonic center will have reached the Atlantic Ocean.

It is a remarkable fact that in autumn and winter these cold or warm tongues, found one night and lost the following day, are almost always single, forming anywhere over the United States. Although they appear to be a transient phenomenon similar to a passing wave quickly dissolved, they nevertheless cause a great change of the local temperature; such a change is completely obscured by the usual 24 hour mean figure; a mean temperature which takes into account only the maxima and the minima of the month and not all the 24 hourly values.

It is also clear that the parallel run of the isotherms with the isobars of an anticyclone is not correlated with the pressure value of the isobars. With very high pressure figures of the isobars the night trend of 32°F. and 60°F. has been found to have been everywhere at right angle to these. So at least according to the 1h. a.m. E.S.T. weather maps.

Very often the cold or the warm isotherm, which at 1h. a.m. E.S.T. of one night was quite flat, was found 24 hours later greatly undulating. These undulations which usually expand to five or ten degrees in latitude, on both sides, are sometimes

quite distinctly limited to one section only of the whole isotherm. The following night the waves had migrated eastward and dissipated in loco. Of course all around the Rockies the shaping of the 32°F. isotherm is frequently bewildering and we would compare its loops to the whirls produced on the ocean waves by coastal breakers. Nevertheless, over flat country, these temperature undulations show, at times, as almost sinusoidal waves, as if the isotherms were compressed from west to east.

There is also a very long periodical motion which from one night to another night brings northward the western portion of the isotherm and southward the eastern end. The opposite is also apparent: southern migration of the western portion and northward advance of the eastern segment. Such a pendular displacement is mostly noticeable in the warm isotherm. As a rule its ends reach, on the western side, the Gulf of California and, on the eastern, the north of the Florida peninsula, nevertheless often this isotherm moves southward away from the Gulf of California and while its central portion has receded over the Gulf of Mexico, its eastern end shifts northward of Florida.

The analysis of the isotherms drawn between 32°F. and 60°F. is a very difficult task. The author feels that the two isotherms he has chosen for this study can be considered as two barriers enclosing a kind of boiling atmospheric cauldron.

Probably the great difference in temperature of the 32°F. and the 60°F. isotherms helps to characterize their aspect from night to night.

We will give now some measurements of the cold and the warm tongues and of the advances and retreats of the two selected isotherms.

The geographical length of those tongues is usually of the order of five to even twenty five degrees in latitude and five degrees in longitude. They are also often bent either northwestward or northeastward over the territory. We have already stated that we failed to find in the synoptic air mass distribution the reason of their appearance and rapid disappearance. The more so that the location of these warm and cold tongues is not restricted to the same regions of the United States. Nevertheless we agree that the observation of the weather conditions at one single hour from night to night cannot help to state that these cold or warm tongues had not formed during the daylight hours before night sets in all over North America.

We measured also the geographical displacement of the two isotherms when they had moved in their full length. Such a simultaneous and global travel of the 32°F. and the 60°F. isotherms checked at 1h. a.m. E.S.T., from night to night, was found to be usually connected with the atmospheric synoptic situation. That should be expected. As a matter of fact some of these great polar air anticyclones of winter months rush the 32°F. isotherm across 20 or more degrees of latitude in 24 hours. Once the high cell has become stationary the advance of the 32°F. isotherm stops. That does not happen with the 60°F. isotherm. After it has at first migrated northward to meet the incoming high center, it reverses its course and bulges southward over the Gulf of Mexico, still remaining tied up to the Gulf of California and to the northern section of Florida. When the anticyclone has started subsiding, the 60°F. isotherm moves up again northward and the 32°F. isotherm as well.

During these rapid and powerful invasions of polar air the extent of the territory overrun by the high cell has a rather limited influence on the value of the temperature of the onrushing air. The air remains just as cold during the day as during the night. All this is well known since long to meteorologists.

For the study of the weather maps in spring we have chosen the 40°F. and the 70°F. isotherms. Their run during that season is more irregular than that of the winter isotherms. A plausible and detailed analysis of their behaviour is an impossible task. Of course cold and warm tongues are present at 1h. a.m. E.S.T. as during winter. They are even more spread out and somewhat more penetrating over the territory. Such a complex aspect of the isotherms and of their undulations is probably due to the numerous extratropical cyclones which form over the southwestern states or which advance SEward from Canada only to back ENEward. On these occasions the synoptic aspect of the weather map becomes very confused and any amount of active or stationary fronts are in evidence. Nevertheless, as that happened during autumn and winter, the cold and warm tongues develop and disappear in a rather short lapse of time. At times, two tongues are formed in the same isotherm, a fact which we did not notice during autumn or winter months.

Isotherms differing only by 10 degrees F. are rarely parallel. The northern isotherm of 40°F. is as a rule more uniform in its shape and less undulated than the 70°F. isotherm which often reaches the central States in its migration northward. In spring the irregular run of the isotherms is generally

more accentuated close to the easte

The 40°F. isotherm does not show over the western and the eastern coastal borders the run parallel to the ocean coast, which was so frequent in winter. The influence of the near-by oceans is seemingly not as strong as one had expected.

For the summer weather maps we have chosen the 60°F. and the 80°F. isotherms. During this season until the end of September the aspect of these isotherms is, as in spring, very difficult to disentangle. Since extratropical depressions are not very numerous we had to look for some other atmospheric conditions which would explain the erratic shaping and the motions of the isotherms selected. These irregularities might be attributed to the shorter dark hours. The action of the solar radiation, just as well as in late spring, could still be felt even when night has set in. Moreover, thunderstorms are very frequent even late after sunset and heavy rain showers happen when an exceptionally early hurricane has landed over the continent or when it is passing not far from the coasts. The cool and warm tongues are frequently quite irregular in shape and of a longer duration than those of winter.

The few fronts existing over the United States in summer are mostly stationary and badly defined. Nevertheless even during this season the isotherms undergo night to night quite extraordinary changes in their location and movement. We give a few cases below (Figure I-IV).

A last remark concerns the parallel trend of the isotherms along the ocean borders. While in China during summer this parallel aspect of the coastal isotherms is very apparent, in the United States things are not so evident. We fail to find the reason of that, the more so because in both regions there is a warm sea current flowing off the coast; the Kuroshiwo in the Far East and the Gulf Stream in the Atlantic ocean. And let us repeat that in winter things are also reversed: in North America the isotherms curve northward along the western and eastern coast while in China they run at right angle to the sea shore and are parallel all way down the map to the isobars.

We have now to see if in this long list of remarks there are some interesting items not yet explicitely reported by climatologists? If such were not the case, our study could provide a new confirmation of statements already at hand. Nevertheless we doubt that any nocturnal temperature inquiry has yet been published along the lines we have followed.

The author realizes that his research has, all in all, been rather limited. Moreover, it could perhaps be pointed out that what we have found in the behaviour of two isotherms from night to night is equally found in the daylight hours weather maps. Since we have not been able to consult daily isotherms we cannot answer to these remarks. We are nevertheless not aware of any official daily temperature map printed only with the daylight hours figures and available to the public. Let us remember that the official daily mean temperature published is the mean of the maximum and the minimum of that day. A temperature map drawn by means of these values cannot be opposed to the technique we have followed.

All in all, the facts reported in the preceding pages concerning the trend and the shaping of some characteristic isotherms appear to provide a substantiated confirmation of the importance of tabulating night temperature as distinct from daylight temperature. And we would stress the fact that during several seasons the hours without direct solar radiation are more numerous than the sunlit ones.

Although every one knows that the temperature at night is usually colder than during the day, our analysis has apparently added something more factual to the above trite statement.

When we ventured to say that these cold and warm tongues were rather short lived, it was because we were able to consider only intervals of time of 24 hours. The author is prone to admit that probably these tongues had had a much shorter life and that in a few hours they could have formed and dissolved. Did they appear during the day hours preceding sunset? We do not know, since daylight temperature maps were not at hand. Nevertheless we feel that if these tongues had developed during sunlit hours they should have disappeared at dusk when the temperature tends to equalize particularly when no polar air invasion is on its warpath.

So much so that the existence at night of these warm and cold intrusions is a real climatological item to be considered when describing the climate of a region.

The fact that the two characteristic isotherms considered during the different seasons move at times jointly from north to south or from south to north and that often only one is shifting while the other remains stationary, or that they have an opposite migration, should interest the climatologist. The more so because these displacements happen also when the weather map does not show any atmospheric cyclonic activity.

Another peculiar and puzzling event is that both, the advance and the retreat of the isotherms in 24 hours, is generally found to be of the order of 10 to 20 degrees of latitude. Besides that when these displacements can be attributed to an advancing cyclone or anticyclone, their extent has no real correlation with the pressure values of the atmospheric high cell. The isotherms do not keep pace with the isobars. Of course that can be attributed to the orographic conditions and we would agree that many times such has been the case.

Up to now we have considered these temperature events as surface phenomena. Are we right? Should we not examine also the upper air conditions at that 1h. a.m. E.S.T.? The author agrees that such would have been a more complete technique. It should have been very interesting to find out how thick were these cold or warm intrusions shown on the surface map.

Unhappily only monthly rawinsonde data were at hand. We regret this lack of a daily documentation because we are convinced that at night the thermodynamic conditions of the lower troposphere are different from those recorded during daylight hours. Meteorologists are not yet as well provided with continuous atmospheric soundings as are those interested in the ionospheric research. These physicists know very well that important changes happen during the night in the ionized layers. A similar phenomenon is surely happening also in the lower atmosphere at that time of the day with regard to the humidity and to the temperature.

We would regret that meteorologists, in their forecast of extratropical and tropical cyclones, seem to neglect the influence of the nocturnal conditions on the troubled atmosphere. When we were in charge of the National China Weather Service we found that meteorological observations made at night had some special utility for forecasting the motion and also the intensification of a near-by typhoon.

The well assessed existence at night of restricted and elongated cold and warm tongues in the temperature maps brings us to formulate a tentative explanation of their appearance. We anticipate that the following lines could very well be found objectionable. Nevertheless the facts quoted are real. And meteorologists in North America can check them all.

It is a well sustantiated fact that foreigners in Canada, during the winter polar air invasions, feel at times suddenly out of sorts.. only to find themselves again in good shape some twenty or more minutes later. They are not sick people, but their body has had to react suddenly to an unexpected temperature and humidity change. We made checks by means of temperature and humidity recordings and noticed that at times, during these cold waves periods, although the temperature had remained stationary the relative humidity had jumped from an 85% and even a 95% value down to 30%. Moreover during a same day or night for an equal increase or decrease of the temperature the value of the simultaneous increase or decrease of the relative humidity was found quite variable. There was not the expected intensity correlation. And these singularities can last one or several hours. It is such a break in the normal behaviour of the two meteorological factors, temperature and relative humidity which we have noticed that will modify the human metabolism. The fact that, although usually the relative humidity decreases when the temperature rises, the opposite happens in such a way that the absolute humidity instead of remaining constant decreases or increases is adversely felt by the human body and rapid changes of temperature of the order of 10° and 40° F. in a few hours happen not only in frontal conditions but also during the polar air conditions.

These well established facts, which probably happen also elsewhere, we quite agree, seem to show that the polar air from Canada is not as thermodynamically homogeneous as the pressure maps would show. There are in the invading polar air flow, floating we would say, "atmospheric icebergs, cold and warm pools". They are imbedded in the body of the advancing anticyclone and make themselves felt by humans as they pass overhead or on the surface. Nothing of the sort was ever noticed by ourselves during the 35 years of weather service in the Far East at the time of Siberian air invasions, on the surface or in the upper air (aeroplanes reports). The powerful atmospheric flow had been so to say homogenized owing to the fact it had not passed, as in Canada, over lakes or prairies.

Can we find in these irregular and relatively short lived variations of the temperature and of the relative humidity the

influence on the surface and in the lower troposphere of these colder or warmer sections of the moving anticyclone? Such a consideration might help, we think, to explain the appearance and disappearance on the weather maps of those cold and warm tongues which we have discussed. The more so that as the author has repeatedly stated they cannot be attributed to orographic nor to cyclonic conditions. The biological importance of these vagaries of the temperature and of the humidity has already been reported in many studies by well known meteorologists (4). As we said, we do not know if these sudden and short lived phenomena happen only or mostly at night. As a matter of fact even during daylight hours they have been experimented by humans. Could we advance that during the night hours they are more pronounced since at that time no overhead solar radiation could anymore tend to dissipate them?

As a conclusion of this rather limited research, we would again stress the importance for climatological studies of giving more consideration to the nocturnal temperature. Altogether, we have to admit the basic knowledge of this meteorological factor at night is badly known. Although one could by personal work find at the central weather stations all the hourly temperature figures, it would be very helpful to research people to find in the official tables not only the mean of the maximum and the minimum but also, at least under the heading of first class observatories, the detailed 24 hours temperature observations. Many industrial and agricultural concerns do want such a kind of hourly reports.

In order to show how the usual temperature maps can be confusing we will consider the mean temperature map for November 1963 (5). There is shown a cold tongue all over the Appalachian mountains. The temperature value is 40°F. calculated by means of the maxima and the minima. A very wrong impression could be given by the fact that such a presentation shows that during the whole month the mean temperature over that region has been that of 40°F. The 1h. a.m. E.S.T. maps show that during November 1963 many depressions passed over those mountains and, at least at that hour, the temperature varied from 20° to 60° F. Colder than 40° and warmer than 40° F.tongues had succeeded each other. Such a 40°F. restricted intrusion shown by the quoted map did not persist during the whole month.

Far from us to think that the meteorologists do not realize how the mean monthly values can be misleading. Since very long that is common knowledge. Nor do we think that these official monthly data have no utility. That would be a sheer nonsense. But it remains that a table giving the monthly mean temperature for the daylight hours and another one for those of the night wou[ld] be a better climatological presentation.

Of course that would require a change in the practice of calculating the mean daily temperature. The maximum and the minimum values are usually both obtained under the influence of the solar radiation; they are recorded just before sunrise and in the noon hours. The long night hours are completely out of the picture. In many countries outside North America, durin[g] the dark hours the temperature can be and is greatly colder tha[n] when the sun is above the horizon. Every one can guess how un-realistic would be in these regions a mean daily temperature ob-tained only with the maxima and the minima values.

We add a last remark. The fact that we have not consid-ered for instance the radiation of the ground and its correlation with the water vapor and the wind at 1h. a.m. E.S.T. does not invalidate the descriptive statements of our research.

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ACKNOWLEDGMENT

We express here our sincere gratitude to Rev. W. Hébert S.J. who took on himself the tedious and painstaking task of drawing the isotherms of more than 1000 weather maps.

REFERENCES

(1) GHERZI, Ernest, S.J. A short note on the temperature at night. Bulletin de Géophysique. No 14, p.59. Collège Jean-de-Brébeuf, Montréal. 1963

(2) GHERZI, Ernest, S.J. Climatological Atlas of East Asia (in folio: 75 maps). Observatoire de ZiKaWei, Shan-ghai. 1944.

(3) Climate of the United States. Climate and Man. Yearbook of Agriculture. 1941.

(4) Dritte Medezin-meteorologische Arbeits-Tagung in Ham-burg. von 13. bis 15 Juni 1957.

Medezin-meteorologische Hefte. Nr. 13 (1958)

Annalen der Meteorologie. Hamburg.

(5) Climatological data. National Summary. November 1963. U.S. Department of Commerce, p. 566.

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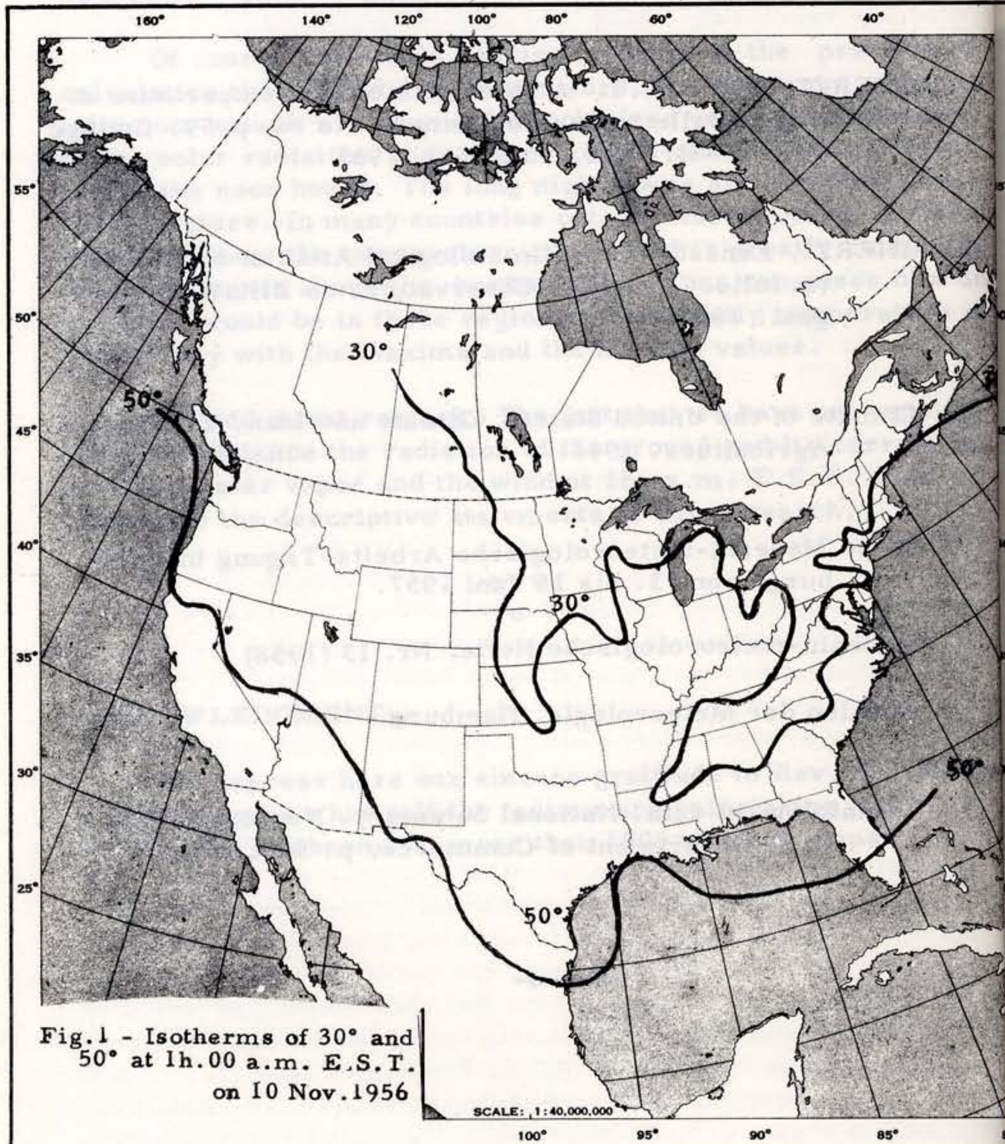


Fig.1 - Isotherms of 30° and 50° at 1h.00 a.m. E.S.T. on 10 Nov.1956

Fig.2 - Isotherms of 30° and 50° at 1h.00 a.m. E.S.T. on 11 Nov.1956

Fig. 3 - Isotherms of 32° and 60° at 1h.00 a.m. E.S.T. on 12 Dec. 1957

Fig. 4 - Isotherms of 32° and 60° at 1h.00 a.m. E.S.T. on 13 Dec. 1957

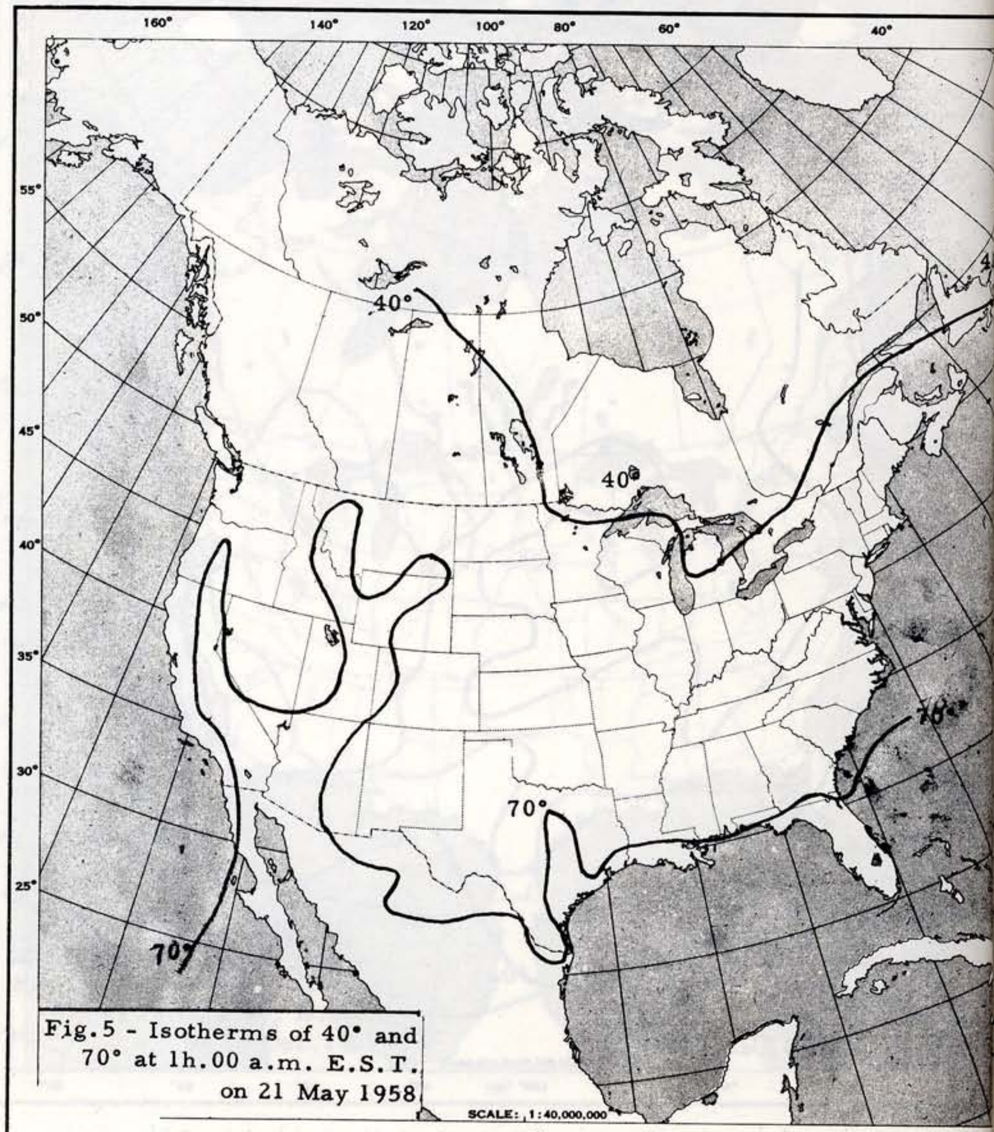


Fig.5 - Isotherms of 40° and 70° at 1h.00 a.m. E.S.T. on 21 May 1958

g.6 - Isotherms of 40° and 70° at 1h.00 a.m. E.S.T. on 22 May 1958

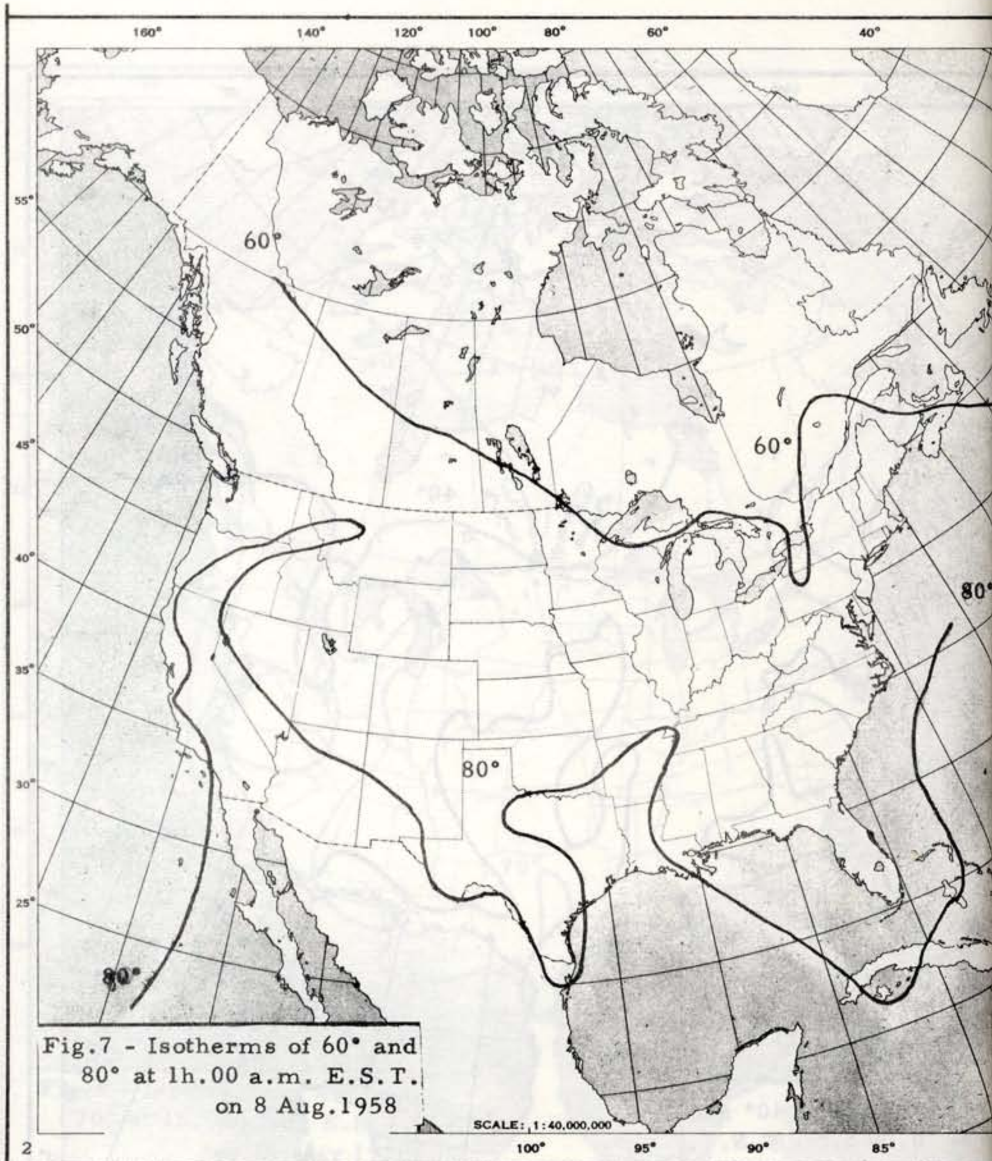


Fig.7 - Isotherms of 60° and 80° at 1h.00 a.m. E.S.T. on 8 Aug.1958

Fig.8 - Isotherms of 60° and 80° at 1h.00 a.m. E.S.T. on 9 Aug. 1958

RADIATION SOLAIRE A MONTREAL

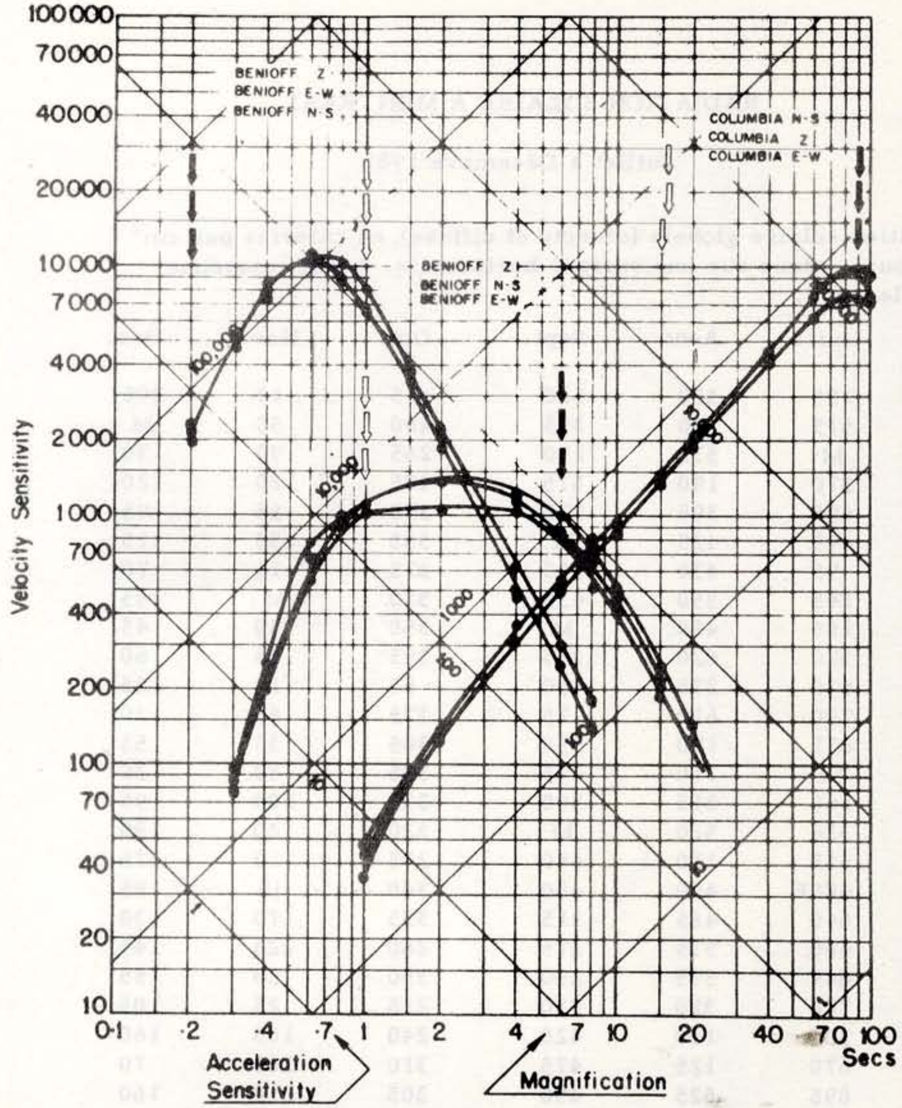
Juillet à Décembre 1963

Radiation solaire globale (directe et diffuse), en calories par cm^2 par jour, reçue sur une surface horizontale. Aussi, moyenne pour le mois.

Date	Juil.	Août	Sept.	Oct.	Nov.	Dec.
1	705	450	510	415	10	200
2	575	330	395	400	50	M
3	M	535	190	265	90	130
4	370	190	575	405	120	120
5	695	395	525	395	55	195
6	495	425	M	355	130	115
7	95	430	535	275	15	70
8	145	550	435	310	M	155
9	185	480	M	350	30	45
10	320	620	385	395	55	60
11	470	275	430	55	10	185
12	720	610	75	375	55	30
13	675	170	550	305	35	155
14	M	110	495	385	40	130
15	160	315	500	335	100	195
16	330	520	M	320	20	180
17	635	110	480	295	10	175
18	480E	400	450	340	15	85
19	640	485	115	335	170	130
20	460	535	275	280	225	145
21	645	595	250	350	20	155
22	700	320	330	215	25	105
23	705	140	425	240	105	160
24	670	125	475	310	165	70
25	695	525	450	305	210	160
26	715	490	330	290	120	110
27	670	605	190	295	120	135
28	685	M	430	275	80	175
29	620	M	55	150	20	130
30	430	M	430	180	25	185
31	670	M		150		M
Moyenne	530	398	381	302	73	134

M: enregistrement manqué.

STATION : MONTREAL



ϕ = 45°30'09"N λ = 73°37'23"W Altitude 112M

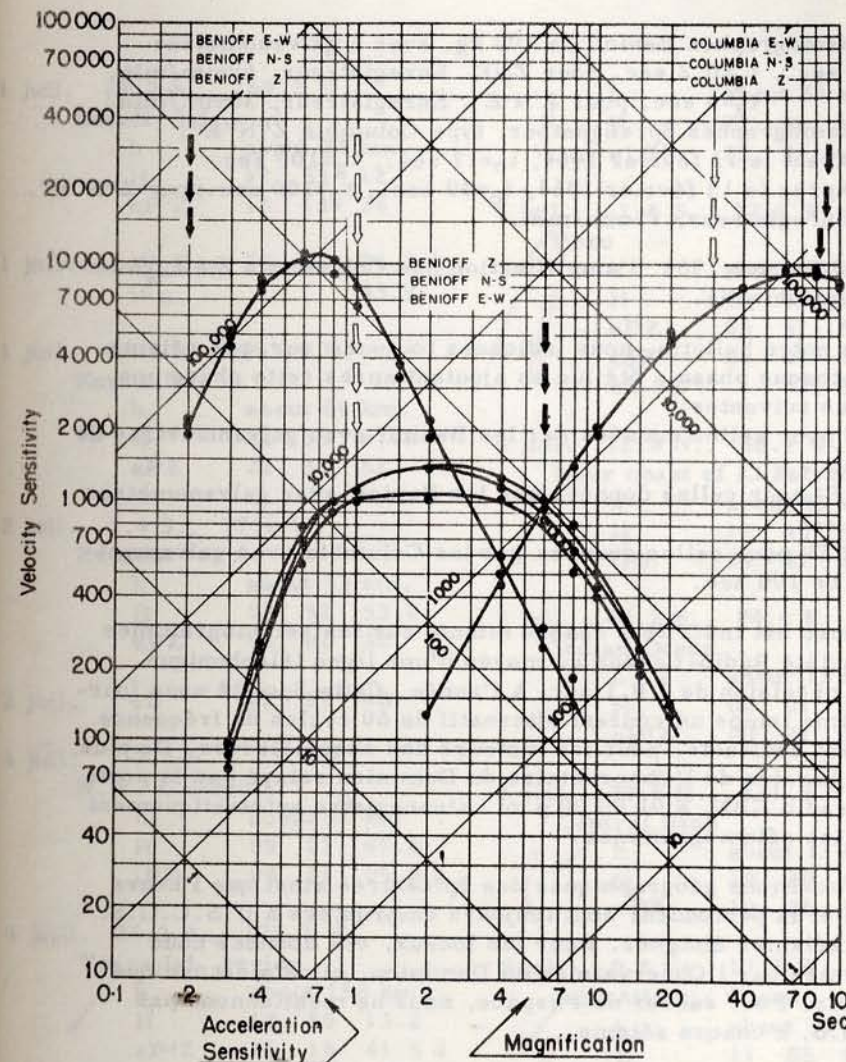
Foundation : Ordovician Limestone (Trenton)

T_s ⇑ T_g ⬆

Date of Calibration: March - April 1962

BENIOFF'S		BENIOFF'S		COLUMBIA'S	
S.P. -Z.	Apr. 4	I.P. -Z.	Apr. 4	L.P. -Z.	Mar.
S.P.H. -N.S.	Apr. 4	I.P.H. -N.S.	Apr. 4	L.P.H. -N.S.	Mar.
S.P.H. -E.W.	Apr. 5	I.P.H. -E.W.	Apr. 5	L.P.H. -E.W.	Mar.

STATION : MONTREAL



ϕ = 45°30'09"N λ = 73°37'23"W Altitude 112M

Foundation : Ordovician Limestone (Trenton)

T_s ⇑ T_g ⬆

Date of Calibration: April - 1962
Feb. - 1964

BENIOFF'S		BENIOFF'S		COLUMBIA'S	
S.P. - Z	Apr. 4	I.P. - Z	Apr. 4	L.P. - Z.	Feb.
S.P.H. - N.S.	Apr. 4	I.P.H. - N.S.	Apr. 4	L.P.H. - N.S.	Feb.
S.P.H. - E.W.	Apr. 5	I.P.H. - E.W.	Apr. 5	L.P.H. - E.W.	Feb.

INSTRUMENTS DE LA STATION

3 séismographes Benioff de 100 kg. avec 6 galvanomètres.
t_o=1 sec., t_g=0.2 sec. pour ZNE. Enregistreur, 60mm/min.
t_g=6 sec. pour Z'N'E'. Enregistreur, 30mm/min.
3 séismographes Sprengnether, type Columbia Z"N"E".
Avant le 13 février 1964, t_o=17 sec., t_g=100 sec.
Après le 13 février 1964, t_o=30 sec., t_g=100 sec.pour Z"N"E".
Enregistreur, 15mm/min.

Le 13 février 1964, l'amplification des Columbia a été augmentée. Cf. graphiques.

Dans notre bulletin, nous indiquons toujours sur quel séismogramme chaque phase a été lue en ajoutant après cette phase une des lettres suivantes:

ZNE pour celles données par les Benioff avec galvanomètres de 02.sec.

Z'N'E' pour celles données par les Benioff avec galvanomètres de 6 sec.

Z"N"E" pour celles données par les Columbia avec galvanomètres de 100 sec.

L'heure est inscrite à chaque minute sur les séismogrammes par la Société Radio-Canada au moyen d'une ligne téléphonique avec une précision de ± 0.1 sec. à l'année. Cette Société nous fournit en même temps un courant alternatif de 60 cycles de fréquence absolument constante, pour les moteurs des enregistreurs. De plus, le signal horaire de l'Observatoire du Dominion relayé par le poste local de radio CBF, à 01 00 00 p.m. s'enregistre automatiquement sur tous les séismogrammes.

Les positions géographiques des épicentres ainsi que l'heure d'origine et la profondeur sont toujours empruntées à U.S.C.G.S. pour les séismes éloignés. Pour les locaux, ces données nous sont fournies par l'Observatoire du Dominion, et cela est indiqué chaque fois. Pour sauver de l'espace, nous ne mentionnons pas U.S.C.G.S. à chaque séisme.

Nous indiquons aussi quelques fois, après une phase, sur la ligne suivante, la période de l'onde du sol et son amplitude en microns.

Nous tenons à exprimer publiquement notre reconnaissance à l'Observatoire du Dominion qui envoie chaque année ses techniciens refaire l'étalonnage complet de tous les séismographes et pour toute la gamme des fréquences, par la méthode de Willmore.

M. Buist, S.J.

Du 1er JUILLET au 31 DECEMBRE 1963

1 juil. 20.8 S., 169.2 E.
Loyalty Isl.

h	about 33 km.			
H	17	53	12	
eP'Z	18	13	28	

1 juil.

iP$_n$Z	20	00	04.2	d
iS$_n$			43.2	

1 juil. 46.5 N., 153.6 E.
Kurile Isl.

h	about 69 km.		
H	22	39	57.8
ePZ	22	51	52

2 juil. 2.4 S., 77.6 W.
Ecuador

h	about 33 km.		
H	02	52	53.0
ePZ	03	01	32

2 juil.

eZ	07	57	48

4 juil. 7.5 N., 76.9 W.
N.W. Colombia

h	about 41 km.			
H	08	03	47.6	
iPZ	08	11	05.0	d

4 juill. 26.3 S., 177.7 W.
Tonga Isl. region

h	about 158 km.			
H	10	58	13.2	
eP'Z	11	16	41.5	d
ePPZ"		17	56	
eSN"		25	40	
eSPZ'		27	40	
eE"		28	33	
eSSN"		33	57	
iE"		35	38	

4 juil. 18.5 S., 12.6 W.
St. Helena Isl. region

h	about 33 km.		
H	22	56	15.7
eLZ"	23	35.5	

5 juil. 11.6 S., 77.5 W.
Peru

h	about 55 km.			
H	05	48	13.4	
ePZ	05	57	54	d
eSE"	06	05	44	
eS$_c$SE"		07	34	

5 juil. 12.8 N., 88.9 W.
Near coast of El Salvador

h	about 85 km.		
H	14	40	54.7
iPZ	14	47	42

7 juil. 42.2 S., 84.4 E.
Indian Ocean

h	about 33 km.		
H	00	01	13.3
eP'Z	00	21	11

7 juil. 39.6 N., 111.9 W.
Central Utah

h	about 33 km.		
H	19	20	42.3
ePZ	19	26	41

8 juil. 0.3 N., 17.8 W.
Mid Atlantic Ocean

h	about 33 km.		
H	11	05	07.5
ePZ	11	16	09
eSSSN"			32.3

8 juil. 65.8 N., 153.9 W.
Central Alaska

h	about 33 km.		
H	17	49	30.9
ePZ	17	57	51.5
eSSN"	18	07.9	

9 juil. 46.3 N., 153.7 E.
Kurile Isl.

h	about 33 km.			
H	03	04	37.4	
ePZ	03	16	41.5	

9 juil. 15.2 N., 94.0 W.
Mexico-Guatemala border

h	about 33 km.			
H	04	20	50.6	
ePZ	04	27	39.4	d
epPZ			51.5	

9 juil. 8.5 N., 83.0 W.
Costa Rica-Panama border

h	about 31 km.			
H	09	24	33.3	
iPZ	09	31	49.0	c
iPPZ"		33	21	
eSN"		37	44	
eSSSZ"		41	02	

9 juil. 29.1 S., 68.1 W.
La Rioja Prov. Argentina

h	about 33 km.			
H	18	56	12.6	
ePZ	19	07	48	

10 juil. 46.1 N., 153.9 E.
Kurile Isl. region

h	about 33 km.			
H	03	14	41	
ePZ	03	26	47	

10 juil. 46.3 N., 152.9 E
Kurile Isl. region

h	about 33 km.			
H	05	22	57.1	
ePZ	05	35	02.8	d
eSE"		45	00	
eSSE"		50	15	

10 juil. 13.4 N., 44.9 W.
N. Atlantic Ocean

h	about 37 km.			
H	09	49	29.6	
ePZ	09	57	04.0	c

10 juil. 16.3 S., 72.2 W.
S. Peru

h	about 90 km.			
H	11	47	35.1	
iPZ	11	57	45.0	d

10 juil. 39.7 N., 112.0 W.
Central Utah

h	about 33 km.			
H	12	07	35	
iPZ	12	12	45.0	d

10 juil. 8.8 N., 82.9 W.
Panama

h	about 51 km.			
H	18	22	47.9	
eLZ"	18	45		

10 juil. eLZ" 19 32

12 juil. 7.0 N., 73.2 W.
Colombia

h	about 127 km.			
H	06	43	51.5	
iPZ	06	51	04.0	d

12 juil. 46.8 N., 153.6 E.
Kurile Isl. region

h	about 33 km.			
H	15	28	08.5	
ePZ	15	40	11.0	d
eSE"		50	09	

12 juil. 33.9 N., 140.7 E.
Off S. coast of Honshu, Japan

h	about 73 km.			
H	23	42	03	
eLZ"	00	35		

13 juil. 29.6 N., 51.0 E.
Near W. coast of Iran

h	about 44 km.			
H	08	24	24.7	
ePZ	08	37	21	

13 juil. 44.3 N., 148.8 E.
Kurile Isl.

h	about 33 km.			
H	13	58	25.7	
ePZ	14	10	49	

14 juil. 30.5 S., 177.2 W.
Kermadec Isl. region

h	about 33 km.			
H	00	02	22.8	
eLZ"	00	57		

14 juil. 10.4 N., 62.6 W.
Off coast of N. Venezuela

h	about 24 km.			
H	05	41	43.0	
ePZ	05	48	46.5	d
ePPZ"		50	06	
eSE"		54	21	
eE		56	41	

14 juil. 31.7 N., 69.1 W.
San Juan Prov. Argentina

h	about 110 km.			
H	09	08	32.7	
ePZ	09	20	15.7	d

14 juil. 30.2 S., 177.4 W.
Kermadec Isl.

h	about 42 km.			
H	14	28	22.1	
eLZ"	15	33		

15 juil. 55.6 N., 162.0 E.
Kamchatka

h	about 60 km.			
H	08	41	07.5	
ePZ	08	52	06	

16 juil. 43.1N., 41.5 E.
Georgia S.S.R.

h	about 33 km.			
H	18	27	18.4	
ePZ	18	38	56	c
eSN"		48	36	
ePSE"		49	09	
eSSE"		53	34	

17 juil. 43.1 N., 41.5 E.
Georgia S.S.R.

h	about 33 km.			
H	11	57	06.7	
ePZ	12	08	45	

18 juil. 49.1 N., 126.9 W.
Vancouver Isl. region

h	about 78 km.			
H	00	04	05.3	
ePZ	00	11	13.5	d

18 juil. 61.0 S., 22.3 W.
Sandwich Isl. region

h	about 33 km.			
H	04	58	09.2	
eP'Z	05	17	40	
eN"		33	30	

18 juil. 18.5 S., 69.5 W.
N. Chile

h	about 72 km.			
H	05	25	04.3	
ePZ	05	35	32	d

19 juil. 45.4 N., 8.2 E.
Ligurian Sea

h	about 33 km.			
H	05	45	28.0	
iPZ	05	55	04.5	c
eSN"	06	02	54	

19 juil. 43.3 N., 8.1 E.
Ligurian Sea

h	about 33 km.			
H	05	46	05.2	
iPZ	05	55	41.5	c
iSN"	06	03	30	

19 juil. 36.3 N., 141.0 E.
Near E. coast of Honshu, Japan

h	about 70 km.			
H	09	00	44.8	
eLZ"	10	00		

20 juil. 65.2 N., 133.7 W.
Yukon

h	about 33 km.			
H	00	11	35.0	
ePZ	00	18	46.8	d

20 juil. 47.2 N., 152.2 E.
Kurile Isl. region

h	about 108 km.			
H	02	13	45.3	
ePZ	02	25	39.5	

20 juil. 57.6 S., 148.5 E.
Macquarie Isl. region

h	about 33 km.			
H	06	36	10.8	
eP'Z	06	56	05	
eSSN"	07	19	23	

22 juil. 13.6 N., 89.9 W.
El Salvador

h	about 34 km.			
H	00	16	33.1	
ePZ	00	23	19	

22 Juil. 6.1 S., 148.9 E.

New Britain
h about 59 km.
H 00 29 14.9
eP'Z 00 48 13
eSSN" 01 06.2

22 juil. 12.5 S., 73.7 W.
N. Peru
h about 79 km.
H 16 33 22.2
ePZ 16 43 09.0 d

23 juil. 41.5 N., 141.9 E.
Tsugaru Strait
h about 91 km.
H 06 17 51.5
iPZ 06 30 32.5 d

24 juil. 24.6 N., 122.0 E.
Near E. coast of Formosa
h about 33 km.
H 11 32 17.7
eSSSE" 12 17.5

25 juil. 6.8 N., 73.0 W.
N. Colombia
h about 152 km.
H 07 04 21.9
iPZ 07 11 32.2 c
iZ 12 07
iPPZ 13 07

25 juil. 42.1 N., 21.5 E.
S. Yugoslavia
2000 killed at Skopje
h about 33 km.
M: 5.5
H 04 17 16.7
ePZ 04 27 52.5 d
eSE" 36 36
eSSSE" 43.4

26 juil. 28.5 N., 112.0 W.
Gulf of California
h about 33 km.
H 13 40 29.5
eLZ" 14 00

26 juil. 9.7 S., 78.5 W.
Near coast of Peru
h about 62 km.
H 23 48 26.5
iPZ 23 57 54.5 d

27 juil. 43.9 N., 128.3 W.
Off coast of Oregon
h about 33 km.
H 06 27 03.0
ePZ 06 34 28

28 juil. 51.7 N., 174.5 W.
Andreanof Isl. Aleutian Isl.
h about 33 km.
H 04 17 50.7
ePZ 04 28 05

28 juil. 11.3 S., 112.1 E.
Off coast of Java
h about 21 km.
H 07 55 21.9
iP'Z 08 15 01.5 d
ipP'Z 06.2

28 juil. 19.2 S., 71.9 W.
Off coast of N. Chile
h about 110 km.
H 09 37 18
iPZ 09 47 41.0 c

28 juil. 52.6 N., 158.9 E
Kamchatka
h about 33 km.
H 12 11 27.9
ePZ 12 22 51.0

28 juil. 51.9 N., 174.2 W.
Andreanof Isl. Aleutian Isl.
h about 33 km.
H 14 48 07.3
ePZ 14 58 22.2 d

28 juil. 4.9 S., 152.7 E.
New Ireland region
h about 69 km.
H 16 32 25.0
eP'Z 16 51 15

28 juil. 46.6 N., 153.1 E.
Kurile Isl. region
h about 33 km.
H 18 51 36.7
iPZ 19 03 40.3

29 juil. 27.8 N., 55.6 E.
S. Iran
h about 37 km.

H 06 10 22.6
iPZ 06 23 39.0

29 juil. 30.2 S., 177.3 W.
Kermadec Isl.
h about 39 km.
H 20 14 07.3
eSKSE" 20 34 53
eSSN" 51 48

30 juil. 29.6 S., 177.3 W.
Kermadec Isl. region
h about 33 km.
H 05 45 53.3
eSKSE" 06 11.7
eSKKSE" 13.0
eSSN" 22 34

30 juil. 51.7 N., 158.1 E.
Kamchatka
h about 33 km.
H 06 52 22.7
ePZ 07 03 52.2 c

30 juil. 11.4 N., 87.3 W.
Off W. coast of Nicaragua
h about 33 km.
H 12 25 39.3
iPZ 12 32 39 c

30 juil. 29.2 S., 112.1 W.
Easter Isl. region
h about 33 km.
H 12 57 25.3
eLE" 13 34.3

30 juil. 55.9 S., 27.5 W.
Sandwich Isl.
h about 33 km.
H 13 51 57.8
eP'Z 14 10 35

31 juil. 29.8 S., 177.2 W.
Kermadec Isl.
h about 65 km.
H 01 44 18.8
eLZ" 02 45

1 août 55.3 N., 161.8 E.
Near E. coast of Kamchatka
h about 50 km.
H 10 45 02.7
ePZ 10 56 05

1 août 29.8 S., 177.2 W.
Kermadec Isl. region
h about 59 km.
H 15 20 55.9
eLZ" 16 26

2 août 56.2 N., 34.1 W.
N. Atlantic Ocean
h about 41 km.
H 09 07 18.0
ePZ 09 12 54

2 août 56.3 N., 34.5 W.
N. Atlantic Ocean
h about 33 km.
H 09 13 46.8
ePZ 09 19 22

3 août 37.0 N., 88.8 W.
Illinois-Kentucky border
h about 18 km.
H 00 37 50.3
eZ 00 44 37

3 août 7.6 S., 173.8 E.
Solomon Isl.
h about 402 km.
H 03 48 06.4
eP'Z 04 06 15.4 c

3 août 7.7 N., 35.8 W.
Mid-Atlantic Ocean
h about 33 km.
H 10 21 36.6
iPZ 10 30 28.5 d
ipPZ 37.7
iZ" 32 13
iSZ" 37 38
iScSN" 40 11
iSSN" 41 08

3 août 7.8 N., 35.9 W.
Mid-Atlantic Ocean
h about 33 km.
H 10 34 25.7
eP 10 43 13

3 août 52.0 N., 174.3 W.
Andreanof Isl. Aleutian Isl.
h about 33 km.
H 16 29 35.8
ePZ 16 39 50.0 c
iZ 40 06

4 août 30.7 S., 178.3 W.
Kermadec Isl.
h about 37 km.
H 20 26 04.1
eP'Z 20 44 52

4 août 9.4 S., 114.2 E.
S. of Java
h about 117 km.
H 07 08 47.1
eP'Z 07 28 08
eZ 31 43

4 août 4.1 S., 80.9 W.
Near N. coast of Peru
h about 34 km.
H 12 07 24.4
ePZ 12 16 14.1 c

6 août 57.0 N., 33.6 W.
N. Atlantic Ocean
h about 33 km.
H 13 36 35.6
ePZ 13 42 19

7 août 13.6 N., 90.9 W.
Near S. coast of Guatemala
h about 67 km.
H 18 36 46.6
iPZ 18 43 33.7 d

8 août 54.2 N., 168.1 W.
Fox Isl.. Aleutian Isl.
h about 33 km.
H 02 14 54.4
iPZ 02 25 48.6 c
ePPZ 28 23
eSN" 34 42
eSSSN" 42 30

8 août 35.9 S., 103.6 W.
Easter Isl. region
h about 33 km.
H 10 58 23.1
eLZ" 11 36.9

9 août 15.3 S., 175.7 W.
Fiji Isl. region
h about 33 km.
H 14 36 45.9
ePZ 14 55 32
ePSN" 05.2
eSSN" 11 20

10 août 54.4 S., 132.8 W.
S. Pacific Ocean
h about 33 km.
H 18 07 26.2
eLZ" 18 57

11 août 60.5 S., 154.9 E.
Belleny Isl. region
h about 33 km.
H 01 34 22.2
eP'Z 01 54 14
eSSN" 02 17.0

11 août 38.8 S., 140.9 E.
Near E. coast of N.Honshu, Ja
h about 45 km.
H 07 37 20.4
ePZ 07 50 19.6

12 août 32.5 S., 71.1 W.
Near coast of Central Chile
h about 92 km.
H 01 05 34.1
ePZ 01 17 21.8 d

12 août 2.1 N., 90.4 W.
Galapagos Isl.
h about 33 km.
H 13 06 46.1
ePZ 13 15 06

12 août 25.3 N., 62.7 E.
Near coast of W. Pakistan
h about 33 km.
H 18 29 38.8
eLZ" 19 24

13 août 55.0 N., 156.4 W.
Kodiack Isl. region
h about 33 km.
H 03 26 45.4
iPZ 03 35 42.6 d

13 août 19.1 S., 173.9 E.
Tonga Isl. region
h about 28 km.
H 06 52 06.1
eLZ" 07 48

13 août 19.3 S., 173.7 W.
Tonga Isl.
h about 33 km.
H 21 52 37.4

ePSE" 22 21.4
eSSE" 27 30

13 août 21.4 S., 175.2 W.
Fiji Isl. region
h about 33 km.
H 02 46 44.1
eLZ" 03 35

14 août 22.3 S., 68.7 W.
N. Chile
h about 120 km.
H 14 32 36.7
iPZ 14 43 22.9 c
ipPZ 52.1

14 août 3.4 S., 135.4 E.
W. Irian
h about 33 km.
H 18 43 55.5
eLZ" 19 54

15 août 37.9 N., 141.6 E.
Near E. coast of Honshu, Japan
h about 59 km.
H 06 11 34.3
iPZ 06 24 35.0 c
iZ 52
ePPZ 28 12
eSKSN" 35 02
iSKKSN" 27
eSN" 44
ePSN" 36 36
eSSN" 41 40
eE 48 48

15 août Dominion Observatory,
felt a few miles N. of Cornwall
eP, Z 14 08 14.5
iS, Z 28.5

15 août 10.0 S., 78.6 W.
Near coast of Central Peru
h about 80 km.
H 14 36 01.2
iPZ 14 45 29.0 c

15 août 13.8 S., 69.3 W.
Peru-Bolivia border
h about 543 km.
H 17 25 05.9

iPZ 17 34 15.4 c
iZ" 28
pPZ" 36 20
iSE' 41 40.0
47 sec., 300 micr.
iN" 43 20

16 août 48.9 S., 122.8 E.
S. of Australia
h about 33 km.
H 23 19 31.1
eLZ" 00 43

17 août 30.6 N., 130.9 E.
Ryukyu Isl. region
h about 33 km.
H 11 12 41.2
ePZ" 11 26.4
eSE" 38 04
eSSE" 44 56

17 août 17.7 N., 94.3 W.
Veracruz, Mexico
h about 163 km.
H 11 34 23.4
iPZ 11 40 40.2 c
ipPZ 41 18

17 août 20.3 S., 67.4 W.
S. Bolivia
h about 33 km.
H 20 56 42
iPZ 21 07 29.5 c

18 août 19.5 N., 45.4 W.
N. Atlantic Ocean
h about 33 km.
H 15 58 14.3
ePZ 16 03 40

18 août 50.3 N., 176.9 W.
Andreanof Isl. Aleutian Isl.
h about 33 km.
H 18 43 16.1
iPZ 18 53 45.2 d
iPcPZ 54 25
eSN" 02 23

18 août 32.1 S., 178.1 W.
Kermadec Isl. region
h about 33 km.
H 20 27 41.9
eLZ" 21 18

19 août 32.0 S., 177.9 W.
Kermadec Isl. region
h about 33 km.
H 04 24 00.4
eLZ" 05 29

20 août 4.1 N., 76.5 W.
Colombia
h about 59 km.
H 13 19 50.3
iPZ 13 27 32.6 c
epP 51

20 août 41.2 N., 142.7 E.
Off E. coast of Honshu, Japan
h about 50 km.
H 15 48 12.2
iPZ 16 01 09.0 c
eSE" 11 34

21 août 14.3 N., 72.5 W.
Caribbean Sea
h about 33 km.
H 03 39 22.6
iPZ 03 45 41.5 d
eSE" 50 47
eSSE" 52 12

22 août 63.2 N., 148.5 W.
Central Alaska
h about 101 km.
H 03 58 43.2
ePZ 04 06 43.7 c

22 août 42.0 N., 126.2 W.
Off coast of Oregon
h about 33 km.
H 09 27 09.3
ePZ 09 34 24
eSN" 40 18

22 août 3.8 S., 104.2 W.
about 1500 km. W. of Galapagos Is.
h about 33 km.
H 18 18 49.3
eLZ" 18 46

22 août 9.4 S., 158.0 E.
Solomon Isl.
h about 33 km.
H 19 52 25.0

ePʼZ 20 11 27
eSSE" 30 04

22 août 4.3N., 76.4 W.
Colombia
h about 100 km.
H 23 20 21.1
iPZ 23 27 58.7 d
ipPZ 28 17.7
isPZ 38.0

23 août 52.4 N., 159.6 E.
Off coast of Kamchatka
h about 33 km.
H 13 09 25.3
ePZ 13 20 47

23 août 4.4 S., 134.9 E.
Irian
h about 95 km.
H 21 28 12
eP'Z 21 46 19

24 août 22.4 S., 68.5 W.
N. Chile
h about 66 km.
H 01 41 40.5
iPZ 01 52 34.6 c
ipPZ 57.3

25 août 48.7 N., 148.8 E.
Sea of Okhotsk
h about 134 km.
H 02 20 12.7
ePZ 02 32 05

25 août 45.2 N., 151.3 E.
Kurile Isl. region
h about 33 km.
H 05 21 19.4
ePZ 05 33 33

25 août 38.9 N., 38.4 E.
Central Turkey
h about 33 km.
H 06 11 43.3
ePZ 06 23 35 d

25 août 17.5 S., 178.8 W.
Fiji Isl. region
h about 565 km.
H 12 18 12.5

eP'Z 12 35 46.0
iPPZ 36 42.5
epPPZ" 38 27
iSKSE" 41 38
iSN" 43 38
eSPZ" 45 34
eE" 49 08
eSSN" 51 48
iN" 55 32

26 août 51.6 N., 157.0 E.
Near E. coast of Kamchatka
h about 105 km.
H 08 45 32.4
iPZ 08 56 57.0 d

26 août iP!Z 16 29 42.4 d
iS E' 48.0
Δ 50 km.

27 août 45.9 S., 75.3 W.
Near coast of S. Chile
h about 33 km.
H 03 23 32.6
eSE" 03 37 34
eSSE" 53.8

27 août 16.1 N., 96.9 W.
Oaxaca, Mexico
h about 38 km.
H 23 40 42.9
iPZ 23 47 41.7 d

28 août 16.3 N., 96.9 W.
Oaxaca, Mexico
h about 33 km.
H 02 40 21.3
ePZ 02 47 14

28 août 61.9 S., 164.5 E.
Belleny Isl. region
h about 33 km.
H 12 48 22.1
eP'Z 13 08 04

28 août ePZ 15 22 48

29 août 39.6 N., 74.2 E.
Sinkian Prov. China
h about 31 km.
H 08 53 48.4
iPZ 09 06 48.5 c

eSKSN" 17 20
eSE" 44
ePSN" 18 58
eSSN" 24 02

29 août 7.1 S., 81.6 W.
Off coast of Peru
h about 23 km.
H 15 30 31.4
iPZ 15 39 59.3 d
iSN" 47 07
iScSE" 49 36
eSSN" 51 20
iSSSN" 53 36

29 août 15.5 S., 172.9 W.
Tonga Isl. region
h about 37 km.
H 20 57 31.5
ePSE" 21 25 40
eSSE" 31 42

30 août 8.7 S., 108.6 E.
Off S. coast of Java
h about 33 km.
H 00 16 36.3
eP'Z 00 36 07

30 août 23.3 S., 66.3 W.
Juyjuy Prov. Argentina
h about 239 km.
H 00 43 19.0
iPZ 00 54 00.5 d

30 août 44.8 N., 80.1 E.
China-Kazakh S.S.R. border
h about 33 km.
H 04 46 25.0
eLZ" 05 31

30 août 23.4 S., 175.4 W.
Tonga Isl.
h about 33 km.
H 13 51 51.6
eLZ" 14 49

31 août 11.9 N., 87.0 W.
Off W. coast of Nicaragua
h about 48 km.
H 13 08 46.3
iPZ 13 15 39.0 d

1 sept. 5.4 N., 82.4 W.
S. of Panama
h about 61 km.
H 11 11 13.7
ePZ 11 18 51.5

1 sept. 11.3 N., 85.5 W.
Nicaragua
h about 120 km.
H 22 57 34.1
ePZ 23 04 21

2 sept. 33.9 N., 74.7 E.
N. India
h about 44 km.
H 01 34 31.6
eLN" 02 45

2 sept. 14.0 S., 76.4 W.
S. Peru
h about 41 km.
H 04 10 18.4
iPZ 04 20 18.7 d

2 sept. 45.4 N., 150.9 E.
Kurile Isl.
h about 33 km.
H 11 44 00.2
ePZ 11 56 09 d

2 sept. 18.2 S., 62.6 W.
Bolivia
h about 33 km.
H 13 02 07
eLN" 13 29.0

2 sept. 50.5 N., 129.4 W.
Vancouver Isl. region
h about 33 km.
H 13 27 37.4
ePZ 13 34 46

2 sept. 25.7 N., 109.5 W.
Gulf of California
h about 33 km.
H 14 10 44.7
ePZ 14 17 34.0 c
eSN" 23 12

2 sept. 45.4 N., 150.8 E.
Kurile Isl.
h about 33 km.
H 23 45 00.1
ePZ 23 57 14.5 d

3 sept. 45.0 N., 151.0 E.
Kurile Isl.
h about 33 km.
H 04 57 56.7
ePZ 05 10 11.2

3 sept. 45.4 N., 150.9 E.
Kurile Isl.
h about 33 km.
H 05 29 39.5
iPZ 05 41 53.5 d

3 sept. 51.9 N., 173.5 W.
Andreanof Isl. Aleutian Isl.
h about 50 km.
H 06 12 08.9
ePZ 06 22 19.7 d

3 sept. 62.8 N., 25.2 W.
Iceland region
h about 33 km.
H 09 13 33.1
ePZ 09 20 06

3 sept. 6.9 N., 73.1 W.
Colombia
h about 43 km.
H 18 37 42.6
iPZ 18 44 53.3 c

4 sept. 36.1 N., 5.3 E.
Algeria
h about 38 km.
H 05 06 47.0
iPZ 05 16 38.3 d
ipPZ 52.5
eSN" 24 40

4 sept. 71.4 N., 73.3 W.
Near E. coast of Baffin Isl.
h about 33 km.
H 13 32 12.3
Ondes L seulement: le début est arrivé pendant le changement des feuilles

4 sept. e(P)Z 14 34 33

4 sept. e(P) 15 04 32

4 sept. 71.5 N., 72.8 W.
Baffin Isl.
h about 33 km.
H 21 20 18.5
ePZ 21 25 49

4 sept. 71.6 N., 73.5 W.
Near E. coast of Baffin Isl.
h about 33 km.
H 21 41 00.6
ePZ 21 46 28

4 sept. e(P)Z 23 16 42

5 sept. 50.3 N., 129.1 W.
Vancouver Isl. region
h about 33 km.
H 11 36 31.6
eLE" 11 55.0

5 sept. iPZ 21 59 36.8

5 sept. 18.6 N., 106.8 W.
Off coast of Jalisco, Mexico
h about 33 km.
H 23 43 05.0
iPZ 23 50 33.0 d

6 sept. 71.5 N., 73.0 W.
Near E. coast of Baffin Isl.
h about 33 km.
H 01 46 13.3
iPZ 01 51 48.4 c

6 sept. 36.4 N., 130.6 E.
Sea of Japan
h about 33 km.
H 06 03 52.1
ePZ 06 17 16
eSSE 35.3

6 sept. 50.1 N., 129.5 W.
Vancouver Isl. region
h about 31 km.
H 20 31 46.1
eLE" 20 50.0

6 sept. 53.9 N., 165.6 W.
Fox Isl. Aleutian Isl.
h about 33 km.
H 20 56 59.9
ePZ 21 06 41

Off E. coast of S. Korea
h about 33 km.
H 01 16 55.1
eLE" 01 55.0

7 sept. e(P)Z 03 09 13

7 sept. 45.4 N., 150.8 E
Kurile Isl.
h about 33 km.
H 07 13 39.9
ePZ 07 25 54

7 sept. 11.7 S., 13.6 W.
Ascension Isl. region
h about 33 km.
H 08 50 57.5
eLE" 09 23

7 sept. 54.0 N., 160.3 E.
Kamchatka
h about 110 km.
H 12 44 01.1
iPZ 12 55 06.5 c

8 sept. 28.1 S., 176.8 W.
Kermadec Isl. region
h about 57 km.
H 00 47 27.7
e 01 44

8 sept. 36.2 S., 100.5 W.
about 1500 km. S.E. of Easter Isl.
h about 33 km.
H 09 06 16.0
ePZ 09 18 50

8 sept. 23.6 S., 179.8 E.
Fiji Isl. region
hh about 550 km.
H 19 50 29.8
eP'Z 20 08 13
epP'Z" 09 36
eSN" 16.4
eSSN" 25.2

9 sept. 4.4 S., 152.7 E.
New Britain
h about 34 km.
H 02 45 45.5
iP'Z 03 04 38.3 d

ePPZ 06 20
ePPPZ 08 30
eSKSN" 11 44
eSSN" 23 06

10 sept. 14.0 S., 166.2 E.
New Hebrides Isl.
h about 64 km.
H 01 09 47.0
eLZ" 02 11

10 sept. 53.8 N., 159.9 W.
Alaska Peninsula region
h about 33 km.
H 17 01 07.3
iPZ 17 10 23.3 c

10 sept. 19.0 S., 175.8 E.
Tonga Isl. region
h about 33 km.
H 19 14 26.8
eLE" 20 10

11 sept. 44.3 N., 114.7 W.
Central Idaho
h about 15 km.
H 02 08 44.7
eLZ" 02 26.3

12 sept. 22.0 S., 67.6 W.
Chili-Bolivia border
h about 160 km.
H 02 28 53.2
iPZ 02 39 35.0 c
ipPZ 40 17.0

12 sept. 34.9 N., 32.2 E.
Cyprus
h about 55 km.
H 08 18 57.9
ePZ 08 30 39.7 c

12 sept. 7.7 N., 35.9 W.
North Atlantic Ocean
h about 33 km.
H 13 10 17.9
iPZ 13 19 20.0 d

13 sept. 29.1 N., 105.6 W.
Chihuahua, Mexico
h about 33 km.

H 10 51 56.6
iPZ 10 58 09.7 d

13 sept. iPZ 17 06 33.5 d

13 sept. 33.3 S., 178,1 W.
Kermadec Isl. region
h about 33 km.
H 21 10 56
eLZ" 22 33

13 sept. 31.3 S., 179.3 W.
Kermadec Isl.
h about 16 km.
H 23 33 32.9
eLZ" 00 38

14 sept. 3.6 S., 131.2 E.
Ceram region
h about 33 km.
H 00 18 33.4
eLZ" 01 22

14 sept. 31.3 S., 179.1 W.
Kermadec Isl.
h about 33 km.
H 00 38 07.5
eLZ" 01 38

14 sept. 31.4 S., 179.0 W.
Kermadec Isl.
h about 33 km.
H 03 52 16.9
eLZ" 04 49

14 sept. 42.2 N., 142.3 E.
Near S. coast of Hokkaido, Japan
h about 50 km.
H 06 45 08.3
ePZ 06 57 49

14 sept. 20.1 S., 68.2 W.
Bolivia-Chili border
h about 33 km.
H 11 48 18
iPZ 11 59 01.22

14 sept. 13.7 S., 166.3 E.
New Hebrides Isl.
h about 20 km.
H 15 25 33.3
eLE" 16 13.5

14 sept. 44.4 N., 114.7 W.
California
h about 33 km.
H 19 46 15.8
ePZ 19 53 27

15 sept. 10.3 S., 165.6 E.
Santa Cruz Isl.
h about 43 km.
H 00 46 54.1
ePZ" 01 02 00
14 sec.
eP'Z 05 47
eSKSE" 12 36
ePSE" 16 44
iSSE" 23 34
iP'P' 23 34
52 sec., 160 mic.

15 sept. 7.2 S., 106.5 E.
Java
h about 33 km.
H 09 09 38
ELZ" 10 20

15 sept. 17.1 S., 173.8 E.
Fiji Isl. region
h about 33 km.
H 10 59 47.7
eLZ" 11 55

16 sept. 78.6 N., 6.7 E.
Svalbard region
h about 33 km.
H 16 14 45.0
eLZ" 16 40

16 sept. 13.4 S., 166.5 E.
Santa Cruz Isl.
h about 28 km.
H 20 05 21.9
eLE" 21 01

17 sept. 12.6 N., 87.1 W.
Nicaragua
h about 144 km.
H 03 48 10
iPZ 03 54 46 d

17 sept. 10.6 S., 78.2 W.
Central Peru
h about 61 km.

iPZ 06 04 07.8 d
ipPZ 25.7
eZN" 11 53

17 sept. 1.5 S., 77.9 W.
Ecuador
h about 178 km.
H 07 34 37.8
iPZ 07 42 53.6 c
ipPZ 43 30.4

17 sept. 10.1 S., 165.3 E.
Santa Cruz Isl.
h about 17 km.
H 19 20 08.2
ePZ" 19 35 19
12 sec.
eP'Z 39 02
iPPZ" 40 14
iSP } E" 50 09
eSKSP }
iSSE" 57 00

18 sept. 40.9 N., 29.2 E.
Turkey
h about 33 km.
H 16 58 12.5
iPZ 17 09 21.9 c
eSN" 18 40

19 sept. 22.5 S., 67.5 W.
Bolivia-Argentina-Chili border
h about 233 km.
H 05 54 08.0
ePZ 06 04 41

19 sept. 31.0 N., 66.8 E.
Afghanistan-Pakistan border
h about 37 km.
H 16 31 15.0
eLZ" 17 04

19 sept. 18.1 S., 69.3 W.
Chili-Bolivia-Peru border
h about 174 km.
H 21 10 18
ePZ 21 20 31 d

20 sept. 76.5 N., 7.9 E.
Svalbard region
h about 33 km.

H 03 03 32.9
ePZ 03 11 42

20 sept. 21.5 S., 68.3 W.
Bolivia-Chili border
h about 125 km.
H 07 25 11.8
ePZ 07 35 51

20 sept. 21.5 S., 68.0 W.
Chili-Bolivia border
h about 155 km.
H 14 41 22.6
ePZ 14 51 59
ipPZ 52 33

20 sept. 17.8 S., 68.8 W.
Peru-Bolivia border
h about 171 km.
H 22 11 32.2
iPZ 22 21 43.1 c
ipPZ 26.4

22 sept. 19.3 S., 175.9 E.
Fiji Isl. region
h about 28 km.
H 02 56 24.3
ePPZ" 03 16 24

22 sept. ePZ 11 52 43

22 sept. 10.3 S., 165.1 E.
Santa Cruz Isl.
h about 33 km.
H 19 28 42.2
eLZ" 20 22

23 sept. 16.6 S., 28.6 E.
N. Rhodesia
h about 33 km.
H 06 40 36.5
eLZ" 07 33

23 sept. 16.6 S., 28.8 E.
N. Rhodesia
h about 33 km.
H 09 01 56.8
eLZ" 09 53.5

23 sept. 33.7 N., 117.0 W.
California
h about 14 km.

H 14 41 51.5
eLZ" 15 01.2

23 sept. 51.3 N., 179.2 W.
Andreanof Isl. Aleutian Isl.
h about 33 km.
H 17 02 36.6
ePZ 17 13 08

24 sept. 28.6 S., 68.4 W.
La Rioja, Prov. Argentina
h about 94 km.
H 08 30 01.6
iPZ 08 41 29.4 d

24 sept. 10.6 S., 78.0 W.
Near coast of Peru
h about 80 km.
H 16 30 16.0
iPZ 16 39 48.1 c
iSE" 47 32
iScSE" 49 39
iSSE" 51 30

25 sept. 16.5 N., 86.6 W.
Off N. coast of Honduras
h about 33 km.
H 00 47 38.0
eLZ" 01 28

25 sept. 16.7 S., 28.7 E.
N. Rhodesia
h about 33 km.
H 07 03 54.6
eLZ" 07 56

25 sept. 10.1 S., 164.5 E.
Solomon Isl.
h about 33 km.
H 14 50 18.1
eLZ" 16 09

26 sept. 56.5 N., 153.4 W.
Kodiak Isl. region
h about 33 km.
H 04 20 21.5
eLE" 04 46.6

26 sept. 50.4 N., 176.9 W.
Andreanof Isl. Aleutian Isl
h about 33 km.
H 05 28 07.3

iPZ 05 38 37
eSE" 47 12

26 sept. 5.6 S., 148.0 E.
New Britain region
h about 156 km.
H 05 55 09.7
eP'Z 06 13 54

27 sept. 17.1 S., 174.6 E.
Fiji Isl. region
h about 33 km.
H 10 28 04.1
eLE" 11 23

28 sept. 10.2 N., 86.0 W.
Near W. coast of Costa-Rica
h about 33 km.
H 05 25 03.2
ePZ 05 32 10

28 sept 31.5 S., 179.6 E.
Kermadec Isl.
h about 457 km.
H 06 58 12.7
eP'Z 07 16 15.0 c

29 sept. 28.3 N., 112.0 W
Gulf of California
h about 33 km.
H 00 00 34
eLN" 00 19

29 sept. 62.0 S., 163.5 E.
Belleny Isl. region
h about 33 km.
H 02 55 05
eP'Z 03 14 38

29 sept. e(P)Z 15 05 41

29 sept. 6.0 N., 125.3 E.
Mindanao, Philippine Isl.
h about 117 km.
H 19 35 01.6
eLE" 20 40.5

29 sept. 36.1 N., 18.0 E.
Ionian Sea
h about 47 km.
H 22 16 38.6
iPZ 22 27 24.5 d

29 sept. 14.4 N., 91.9 W.
Guatemala
h about 61 km.
H 22 44 02.9
ePZ 22 50 48
ipPZ 51 10.5
eSN" 56 20

30 sept. 7.3 N., 76.9 W.
Colombia
h about 33 km.
H 03 46 51
iPZ 03 54 12.0 c
ipPZ 22.2

1 oct. 10.2 N., 84.5 W.
Costa Rica
h about 46 km.
H 10 30 31.6
ePZ 10 37 35

2 oct. 20.8 S., 174.1 W.
Tonga Isl.
h about 33 km.
H 05 47 05.5
eLZ" 06 46

3 oct. 18.3 N., 105.6 W.
Off coast of Colima, Mexico
h about 33 km.
H 01 22 40.6
ePZ 01 29 55.7

3 oct. 58.5 S., 25.1 W.
Sandwich Isl.
h about 54 km.
H 15 48 17.2
eSSE" 16 34.0

3 oct. 32.2 N., 131.6 E.
Kyushu, Japan
h about 33 km.
H 23 24 34.7
ePZ 23 38 16
ePPZ 42 20
eSE" 49 45
eSSE" 56 38
eSSSE" 00 00 30

4 oct. 20.7 S., 174.0 W.
Tonga Isl.
h about 33 km.

H 02 47 32.1
eLE" 03 46.5

4 oct. 16.1 N., 96.8 W.
Near coast of Oaxaca, Mexico
h about 41 km.
H 08 34 53
ePZ 08 41 49

4 oct. 30.1 N., 114.3 W.
Gulf of California
h about 14 km.
H 21 19 11.5
ePZ 21 27 43.0 d

5 oct. 43.9 N., 144.4 E.
Hokkaido, Japan
h about 33 km.
H 04 22 26
ePZ 04 34 58

5 oct. 11.6 N., 42.8 E.
French Somaliland
h about 33 km.
H 14 57 47.4
eSSN" 15 29.9

5 oct. 52.1 N., 178.1 E.
Rat Isl., Aleutian Isl.
h about 140 km.
H 20 20 02.7
ePZ 20 30 27 d

5 oct. 45.3 N., 150.0 E.
Kurile Isl.
h about 50 km.
H 23 50 46.3
ePZ 00 03 01

6 oct. 22.0 S., 69.4 W.
N. Chile
h about 33 km.
H 15 01 42.1
ePZ 15 12 36.8

6 oct. 33.9 S., 70.0 W.
Central Chile
h about 101 km.
H 17 15 33.9
ePZ 17 27 28.5
epPZ 56.5

7 oct. 11.6 N., 86.9 W.
Near W. coast of Nicaragua
h about 50 km.
H 03 59 54.1
iPZ 04 06 49.8 d

7 oct. 12.9 S., 76.8 W.
Central Peru
h about 69 km.
H 12 43 53.6
iPZ 12 53 42.2 d
iZ 54.5
ipPZ 54 10.0

7 oct. 1.0 S., 147.5 E.
Admiralty Isl. region
h about 68 km.
H 21 38 53.9
eP'Z 21 58 23

8 oct. 15.1 S., 173.2 W.
Samoa Isl. region
h about 33 km.
H 00 17 01.1
eSKKSE"00 42.0
ePSE" 45.1
eSSE" 51.2

9 oct. eLZ" 02 18.5

9 oct. 53.8 N., 170.5 W.
Bering Sea
h about 250 km.
H 03 21 11.1
ePZ 03 30 44.5

9 oct. 20.3 S., 174.5 E.
Tonga Isl.
h about 33 km.
H 10 36 53.4
eLZ" 11 11

9 oct. 44.0 N., 147.5 E.
Kurile Isl.
h about 33 km.
H 21 20 30
eLZ" 22 09.5

11 oct. 18.0 N., 105.6 W.
Off coast of Jalisco, Mexico
h about 33 km.
H 09 51 16.5
ePZ 09 58 33

11 oct. 17.8 N., 105.9 W.
Off coast of Jalisco, Mexico
h about 33 km.
H 10 17 07.6
ePZ 10 24 29
eSE" 30 28

12 oct. 71.6 N., 73.0 W.
Baffin Isl.
h about 33 km.
H 02 46 48.1
eSN" 02 57 10
eSSE" 58 35
eSSSE" 51

12 oct. 44.8 N., 149.0 E.
Kurile Isl.
h about 40 km.
H 11 26 57.9
iPZ 11 39 17.5 c
iSE" 49 30
eSSE" 54 58
eSSSE" 58 38

12 oct. 44.4 N., 149.2 E.
Kurile Isl.
h. about 45 km.
H 20 21 04.5
ePZ 20 33 37

13 oct. 44.8 N., 149.5 E.
Kurile Isl.
h about 60 km.
H 05 17 57.1
ePZ 05 30 13
iZ 20

13 oct. 46.5 N., 151.6 E.
Kurile Isl.
h about 55 km.
H 05 42 14.2
ePZ 05 54 26.0 d

13 oct. 45.5 N., 150.6 E.
Kurile Isl.
h about 50 km.
H 07 03 23.8
ePZ 07 15 36.5

13 oct. 45.5 N., 151.5 E.
Kurile Isl.
h about 55 km.
H 07 16 42.9
ePZ 07 29 09

13 oct. 46.5 N., 151.8 E.
Kurile Isl.
h about 45 km.
H 07 35 44.7
ePZ 07 47 51

13 oct. 45.7 N., 149.6 E.
Kurile Isl.
h about 30 km.
H 07 48 22.8
iPZ 08 00 54

13 oct. 44.5 N., 151.6 E.
Kurile Isl.
h about 60 km.
H 08 11 32.0
ePZ 08 23 45

13 oct. 44.6 N., 149.6 E.
Kurile Isl.
h about 50 km.
H 09 16 25.9
ePZ 09 28 44.5

13 oct. 44.9 N., 151.0 E.
Kurile Isl.
h about 50 km.
H 09 22 44.6
ePZ 09 34 59.0
iZ 12.0

13 oct. 44.2 N., 150.2 E.
Kurile Isl.
h about 45 km.
H 10 06 23.8
ePZ 10 18 45

13 oct. 44.9 N., 151.1 E.
Kurile Isl.
h about 45 km.
H 11 15 40.4
ePZ 11 27 55.3

13 oct 44.9 N., 150.7E.
Kurile Isl.
h about 55 km.
H 11 22 58.6
ePZ 11 35 13.5 d

13 oct. 45.9 N., 151.8 E.
Kurile Isl.
h about 30 km.
H 12 29 39.2
iPZ 12 41 49.5

13 oct. 44.4 N., 149.4 E.
Kurile Isl.
h about 55 km.
H 12 42 13
ePZ 12 54 31

13 oct. 45.0 N., 150.1 E.
Kurile Isl.
h about 50 km.
H 12 58 21.6
iPZ 13 10 37.7 d
ipPZ 50.8

13 oct. 44.4 N., 151.2 E.
Kurile Isl.
h about 50 km.
H 13 43 25.3
ePZ 13 55 41.0 d

13 oct. 45.3 N., 151.0 E.
Kurile Isl.
h about 25 km.
H 14 03 56.3
ePZ 14 16 12.0 d

13 oct. 44.9 N., 151.7 E.
Kurile Isl.
h about 50 km.
H 13 54 24.8
ePZ 14 06 42

13 oct. 44.5 N., 149.5 E.
Kurile Isl.
h about 50 km.
H 14 26 11.9
ePZ 14 38 31

13 oct. 45.6 N., 150.5 E.
Kurile Isl.
h about 35 km.
H 15 59 52.9
iPZ 16 12 06.4 c
eSE'' 22 11

13 oct. 44.9 N., 150.3 E.
Kurile Isl.
h about 30 km.
H 16 28 52.8
ePZ 16 41 15

13 oct. 18.4 N., 103.1 W.
Near coast of Michoacan, Mexico
h about 50 km.
H 16 45 18.8
iPZ 16 52 19.0 d

13 oct. 44.5 N., 150.4 E.
Kurile Isl.
h about 40 km.
H 16 49 41.2
ePZ 17 02 04

13 oct. 44.3 N., 149.2 E.
Kurile Isl.
h about 45 km.
H 17 31 18.7
ePZ 17 43 39

13 oct. 44.0 N., 150.0 E.
Kurile Isl.
h about 45 km.
H 18 10 55.2
ePZ 18 23 16

13 oct. 45.2 N., 150.8 E.
Kurile Isl.
h about 45 km.
H 18 14 57.5
iPZ 18 27 11.5
ipPZ 24.0

13 oct. 45.7 N., 151.7 E.
Kurile Isl.
h about 45 km.
H 19 26 04.2
ePZ 19 39 48.0 d

13 oct. 45.3 N., 151.4 E.
Kurile Isl.
h about 45 km.
H 19 41 20.5
ePZ 19 53 32

13 oct. 44.7 N., 152.1 E.
Kurile Isl.
h about 50 km.
H 21 55 00.8
iPZ 22 07 13.2 d

13 oct. 45.1 N., 150.9 E.
Kurile Isl.
h about 45 km.
H 22 02 58.1
iPZ 22 15 12.5 d

13 oct. 44.5 N., 150.1 E.
Kurile Isl.
h about 50 km.
H 23 52 22.8
ePZ 00 04 41

14 oct. 45.0 N., 150.9 E.
Kurile Isl.
h about 60 km.
H 00 03 04.1
ePZ 00 15 16

14 oct. 45.9 N., 151.8 E.
Kurile Isl.
h about 25 km.
H 03 31 07.8
ePZ 03 43 19

14 oct. 44.9 N., 150.2 E.
Kurile Isl.
h about 50 km.
H 04 06 01.7
ePZ 04 18 17

14 oct. 44.7 N., 150.6 E.
Kurile Isl.
h about 45 km.
H 04 11 14.0
iPZ 04 23 30.8 d
ipPZ 44.0

14 oct. 2.3 S., 77.6 N.
Peru-Ecuador border
h about 35 km.
H 05 39 17.1
ePZ 05 47 54

14 oct. 44.9 N., 150.7 E.
Kurile Isl.
h about 40 km.
H 04 13 03.1
iPZ 04 25 19.5 d
ipPZ 31.0

14 oct. 44.5 N., 151.0 E.
Kurile Isl.
h about 55 km.
ePZ 05 36 28

14 oct. 52.8 N., 167.1 W.
Fox Isl., Aleutian Isl.
h about 80 km.
H 06 26 11.7
iPZ 06 35 54.3 c

14 oct. 44.6 N., 150.3 E.
Kurile Isl.
h about 45 km.
H 07 15 58.0
ePZ 07 28 16

14 oct. 44.8 N., 151.2 E.
Kurile Isl.
h about 55 km.
H 07 54 33.9
ePZ 08 06 47.3

14 oct. ePZ 11 13 47

14 oct. 44.8 N., 151.0 E.
Kurile Isl.
h about 60 km.
H 13 21 45.2
iPZ 13 33 58.0 d
eSN'' 44 07

14 oct. 45.0 N., 151.1 E.
Kurile Isl.
h about 30 km.
H 13 53 17.4
ePZ 14 05 33.5 d

14 oct. 45.2 N., 151.3 E.
Kurile Isl.
h about 60 km.
H 17 50 15.3
ePZ 18 02 26.7 d

14 oct. 45.0 N., 150.5 E.
Kurile Isl.
h about 45 km.
H 21 08 00.1
ePZ 21 20 14.5

14 oct. 44.3 N., 149.3 E.
Kurile Isl.
h about 45 km.
H 21 19 54.7
ePZ 21 32 15.3

14 oct. 44.5 N., 150.6 E.
Kurile Isl.
h about 45 km.
H 22 35 31.7
iPZ 22 47 50.0 d

15 oct. 45.0 N., 151.1 E.
Kurile Isl.
h about 40 km.
H 08 00 11.5
iPZ 08 12 26.5 d
ipPZ 38.3

15 oct. 45.3 N., 150.2 E.
Kurile Isl.
h about 40 km.
H 09 02 08.3
ePZ 09 14 23.5

15 oct. 45.2 N., 150.2 E.
Kurile Isl.
h about 40 km.
H 09 32 08.7
iPZ 09 44 24.5
ipPZ 35.2

15 oct. 67.2 N., 18.4 W.
N. of Iceland
h about 33 km.
H 09 59 30.1
ePZ 10 06 27
eSN'' 12 10

15 oct. 44.6 N., 149.0 E.
Kurile Isl.
h about 50 km.
H 10 47 12.6
iPZ 10 59 32.0 c

15 oct. 46.6 N., 77.6 W.
S.W. Quebec
h about 14 km.
H 12 28 58
PnZ 12 29 45.0
P, Z 51.4
SnN 30 19.1
S, 29

15 oct. 46.3 N., 77.8 W.
S.W. Quebec
h about 14 km.
mag. 3.8

H 13 59 50
Pn 14 00 38.2
Sn 01 11.5

15 oct. 45.3 N., 151.0 E.
Kurile Isl.
h about 35 km.
H 18 23 57.8
ePZ 18 36 26

15 oct. 45.4 N., 151.1 E.
Kurile Isl.
h about 50 km.
H 20 41 30.2
ePZ 20 53 41

15 oct. 3.0 S., 129.9 E.
Ceram
h about 27 km.
H 21 44 58.0
eLE'' 22 41

16 oct. 44.8 N., 150.4 E.
Kurile Isl.
h about 33 km.
H 05 15 36.1
ePZ 05 27 53.7

16 oct. 45.6 N., 151.9 E.
Kurile Isl.
h about 45 km.
H 08 33 42.0
ePZ 08 45 50.7

16 oct. 45.2 N., 150.4 E.
Kurile Isl.
h about 45 km.
H 10 30 55.2
ePZ 10 43 10

16 oct. 42.4 N., 70.7 W.
Near coast of Massachusetts
h about 25 km.
H 15 31 00.7
iPnZ 15 31 58.0 d
SnN 32 32.5

16 oct. 38.6 N., 73.4 E.
Tadzhik, S.S.R.
h about 33 km.
H 15 43 00.8
ePZ 15 56 07.5
eSN'' 16 06 36
PSN'' 08 08

16 oct. 44.4 N., 150.9 E.
Kurile Isl.
h about 80 km.
H 21 30 52.7
ePZ 21 43 13.7

17 oct. 44.6 N., 149.0 E.
Kurile Isl.
h about 45 km.
H 23 24 34.4
iPZ 23 36 54.0 d
eSE'' 47 08

17 oct. 44.5 N., 149.0 E.
Kurile Isl.
h about 45 km.
H 23 54 56.9
ePZ 00 07 17.5

18 oct. 44.5 N., 150.4 E.
Kurile Isl.
h about 60 km.
H 04 01 21.7
ePZ 04 13 38

18 oct. ePZ 08 13 22
ipPZ 37

18 oct. 44.8 N., 150.2 E.
Kurile Isl.
h about 60 km.
H 08 53 33.9
ePZ 09 05 49

18 oct. ePZ 19 45 43

18 oct. 47.6 N., 154.3 E.
Kurile Isl.
h about 40 km.
H 20 05 14.4
ePZ 20 17 10.5

18 oct. 45.2 N., 151.1 E.
Kurile Isl.
h about 45 km.
H 21 22 52.7
iPZ 21 35 06.0 c

19 oct. 18.3 S., 71.2 W.
Near coast of S. Peru
h about 78 km.
H 02 14 17.4
iPZ 02 24 43.0 d

19 oct. 46.8 N., 153.7 E.
Kurile Isl.
h about 45 km.
H 02 18 37.9
ePZ 02 30 39.0 d
eSE'' 40 34

19 oct. 46.6 N., 153.8 E.
Kurile Isl.
h about 33 km.
H 03 34 19.6
ePZ 03 46 22.2 d
eSE'' 56 18

19 oct. 46.8 N., 153.8 E.
Kurile Isl.
h about 25 km.
H 03 47 07.7
iPZ 03 59 10

19 oct. 44.4 N., 150.9 E.
Kurile Isl.
h about 120 km.
H 16 15 21.4
ePZ 16 27 29.3 d

19 oct. 45.2 N., 151.1 E.
Kurile Isl.
h about 33 km.
H 23 11 40.9
iPZ 23 23 55

20 oct. 47.4 N., 151.1 E.
Kurile Isl.
h about 45 km.
H 01 07 35.0
ePZ 01 19

20 oct. 44.7 N., 150.7 E.
Kurile Isl.
h about 25 km.
H 00 53 07.2
ePZ 01 05 27.0
eSE'' 15 46

20 oct. 47.4 N., 151.1 E.
Kurile Isl.
h about 45 km.
H 01 07 35.0
ePZ 01 19 54.5

20 oct. 44.6 N., 150.1 E.
Kurile Isl.

h about 45 km.
H 01 14 05.2
ePZ 01 26 23.3 d

20 oct. 43.9 N., 150.7 E.
Kurile Isl.
h about 50 km.
H 06 10 25.0
iPZ 06 22 43.5 c

20 oct. 44.4 N., 150.0 E.
Kurile Isl.
h about 40 km.
H 09 10 43.9
iPZ 09 23 03.4 c
ipPZ 15.0
i 19.2
eSN" 33 18

20 oct. 44.7 N., 150.2 E.
Kurile Isl.
h about 45 km.
H 11 52 20.7
iPZ 12 04 36.5
ipPZ 48.7

20 oct. 45.1 N., 150.5 E.
Kurile Isl.
h about 45 km.
H 13 21 14.1
iPZ 13 33 28.0 c

20 oct. 44.2 N., 149.6 E.
Kurile Isl.
h about 45 km.
H 17 41 27.3
ePZ 17 53 55

20 oct. 44.2 N., 149.6 E.
Kurile Isl.
h about 45 km.
H 17 58 58.7
ePZ 18 11 18

21 oct. 45.5 N., 149.7 E.
Kurile Isl.
h about 55 km.
H 15 38 24.3
iPZ 15 50 37.2 c

21 oct. 44.1 N., 150.3 E.
Kurile Isl.
h about 65 km.
H 17 20 46.0
ePZ 17 33 06

21 oct. 44.0 N., 150.3 E.
Kurile Isl.
h about 50 km.
H 23 18 41.3
ePZ 23 31 21

21 oct. 44.0 N., 150.1 E.
Kurile Isl.
h about 55 km.
H 23 29 20.7
ePZ 23 41 41.0 d

22 oct. 45.0 N., 150.2 E.
Kurile Isl.
h about 45 km.
H 03 17 15.2
iPZ 03 29 31.3 d

23 oct. 45.7 N., 151.6 E.
Kurile Isl.
h about 20 km.
H 00 06 09.0
iPZ 00 18 22.7 c

23 oct. 31.4 S., 68.7 W.
San Juan Prov. Argentina
h about 110 km.
H 04 24 06.2
ePZ 04 35 46.3

23 oct. 41.2 N., 44.2 E.
E. of Honshu, Japan
h about 50 km.
H 09 47 08.1
iPZ 09 59 50.4 d
ipPZ 10 00 03.7

24 oct. 44.5 N., 150.3 E.
Kurile Isl.
h about 45 km.
H 01 06 25.9
ePZ 01 18 43.5
eSE" 28 54

24 oct. 4.3 N., 78.4 W.
Near W. coast of Colombia
h about 38 km.
H 06 44 18.5
iPZ 06 52 02.5 d

24 oct. 4.4 N., 78.5 W.
Off W. Coast of Colombia
h about 33 km.
H 07 24 03.1
ePZ 07 31 46.5

24 oct. 4.9 S., 102.9 E.
Off S. Coast of Sumatra
h about 50 km.
H 07 26 23.9
eP'Z 07 45 42
iPPZ 48 41
ipP' 55

24 oct. 45.3 N., 150.2 E.
Kurile Isl.
h about 40 km.
H 20 18 12.7
ePZ 20 30 32

25 oct. 45.3 N., 150.2 E.
Kurile Isl.
h about 40 km.
H 10 17 57.1
ePZ 10 30 12.2 c

25 oct. 12.3 N., 144.5 E.
Mariana Isl.
h about 29 km.
H 19 58 58.3
eLZ" 20 54

26 oct. 44.5 N., 150.1 E.
Kurile Isl.
h about 55 km.
H 03 55 39.7
ePZ 04 07 57.3
ipPZ 08 11.2

26 oct. 43.7 N., 150.5 E.
Kurile Isl.
h about 40 km.
H 05 01 31.5
ePZ 05 13 53.2 c
epPZ 14 04.7

26 oct. 44.5 N., 169.8 E.
Kurile Isl.
h about 60 km.
H 05 59 44.2
ePZ 06 12 02.0 c

26 oct. 44.7 N., 149.7 E.
Kurile Isl.
h about 55 km.
H 11 21 47.6
ePZ 11 34 05

26 oct. 44.6 N., 149.8 E.
Kurile Isl.
h about 55 km.
H 11 31 53.0
ePZ 11 44 11

26 oct. 5.2 S., 152.0 E.
New Britain
h about 73 km.
H 22 41 29.8
eP'Z 23 00 20.5

26 oct. 43.8 N., 151.2 E.
Kurile Isl.
h about 33 km.
H 23 58 57.8
ePZ 00 11 18.0

27 oct. 33.1 N., 115.6 W.
Imperial County, California
h about 14 km.
H 14 50 19.7
eL 15 09

27 oct. 24.3 S., 176.1 W.
Tonga Isl. region
h about 33 km.
H 18 24 42.9
eLZ" 19 24

27 oct. 44.5 N., 150.1 E.
Kurile Isl.
h about 50 km.
H 20 05 38.1
iPZ 20 17 55.3 d
ipPZ 18 10.7

28 oct. 24.3 S., 176.0 W.
Tonga Isl. region
h about 33 km.
H 07 55 12.3
eLZ" 08 49

28 oct. 52.8 N., 159.8 E.
Off E. coast of Kamchatka
h about 33 km.
H 12 03 19.8
ePZ 12 14 39.8 c
iZ 52.5

28 oct. 44.8 N., 149.6 E.
Kurile Isl.
h about 45 km.
H 20 36 56.0
ePZ 20 49 19

29 oct. 24.8 S., 68.6 W.
N. Chile
h about 67 km.
H 15 49 10.3
iPZ 16 00 18
iZ 45.5

30 oct. 4.8 S., 77.9 W.
N. Peru
h about 20 km.
H 01 17 31.1
iPZ 01 26 28.7 c

31 oct. 21.8 S., 175.0 W.
Tonga Isl.
h about 33 km.
H 03 17 42.0
eSSE" 03 53 08

31 oct. 4.9 S., 77.7 W.
N. Peru
h about 60 km.
H 23 19 15.3
iPZ 23 28 08.3 c

1 nov. 44.9 N., 148.9 E.
Kurile Isl.
h about 60 km.
H 22 41 23.8
iPZ 22 53 41.0 d

3 nov. 3.5 S., 77.8 W.
Peru-Ecuador border
h about 33 km.
H 03 10 12.7
iPZ 03 18 56.5 c
iPcPZ 20 15
ePPZ" 53
iSE" 26 02
eSSE" 28 48

3 nov. 4.3 S., 78.3 W.
Peru-Ecuador border
h about 146 km.
H 04 24 48
ePZ 04 33 24.0

3 nov. 49.5 N., 155.6 E.
S. tip of Kamchatka
h about 50 km.
H 04 37 25.2
ePZ 04 49 09

3 nov. 15.6 S., 73.3 W.
S. Peru
h about 112 km
H 07 38 10.7
ePZ 07 48 12.2

3 nov. 3.7 S., 78.3 W.
Near coast of Ecuador
h about 33 km.
H 12 02 28.3
iPZ 12 11 19.6 d

4 nov. 6.8 S., 129.6 E.
Banda Sea
h about 80 km.
H 01 17 08.9
eP'Z 01 36 15
ipP'Z' 43
iPKSE' 39 47
iSKSE' 43 23
iP'P'Z' 57 17

4 nov. 6.9 S., 129.8 E.
Banda Sea
h about 100 km.
H 03 43 15.9
eP'Z 04 02 29

6 nov. 12.8 S., 73.9 W.
S. Peru
h about 86 km.
H 01 01 07.0
ePZ 01 10 53.2
epPZ 11 13

6 nov. 4.2 S., 77.7 W.
N. Peru
h about 170 km.
H 01 28 46.6
iPZ 01 37 22.0 d

6 nov. 2.6 S., 138.4 E.
W. New Guinea
h about 33 km.
H 02 13 16.8
eP'Z 02 32 21

6 nov. 46.3 N., 154.8 E.
Near W. coast of Kamchatka
h about 45 km.
H 09 24 49.2
iPZ 09 36 51.5 c

7 nov. 14.1 N., 146.2 E.
Mariana Isl. region
h about 48 km.
H 12 55 25.6
eLZ" 13 56

8 nov. 45.0 N., 150.9 E.
Kurile Isl.
h about 40 km.
H 08 08 09.2
iPZ 08 20 24.0 d

8 nov. 3.7 S., 78.2 W.
Ecuador
h about 33 km.
H 19 22 54.7
iPZ 19 31 39.4 d

9 nov. 11.9 S., 166.6 E.
Santa Cruz Isl.
h about 112 km.
H 01 13 13.1
eLZ" 01 59

9 nov. 45.3 N., 150.8 E.
Kurile Isl.
h about 33 km.
H 08 51 18.6
iPZ 09 03 33.3 d

9 nov. 9.0 S., 71.5 W.
W. Brazil
h about 600 km.
H 21 15 30.4
iPZ 21 24 01.5 d
iPPZ" 26 04
isPZ" 56
iSN" 31 04
iE" 34 16
iE" 36 54

9 nov. 8.5 S., 72.1 W.
W. Brazil
h about 563 km.
H 23 14 12.6
iPZ 23 22 43.0 d

10 nov. 9.2 S., 71.5 W.
W. Brazil
h about 600 km.
H 01 00 38.8
iPZ 01 09 11.3 d
iSN" 16 04
eSSN" 19 26

10 nov. 9.4 S., 71.3 W.
W. Brazil
h about 600 km.
H 01 36 41.3
iPZ 01 45 16.5 c

10 nov. 44.4 N., 149.0 E.
Kurile Isl.
h about 40 km.
H 17 17 42.7
ePZ 17 30 03.5
eSE" 40 20

11 nov. 44.6 N., 148.9 E.
Kurile Isl.
h about 45 km.
H 09 49 43.3
ePZ 10 02 02.0

11 nov. 9.1 S., 71.4 W.
W. Brazil
h about 585 km.
H 19 54 09.4
iPZ 20 02 43.5 d

11 nov. 4.0 N., 82.6 W.
Off W. coast of Colombia
h about 33 km.
H 20 18 39.7
ePZ 20 26 30.3
eSSE" 36 12

12 nov. 35.5 N., 29.7 E.
Near S.W. coast of Turkey
h about 69 km.
H 07 06 31.2
ePZ 07 18 00.5 d

12 nov. 44.2 N., 149.0 E.
Kurile Isl.
h about 45 km.
H 07 56 53.6
ePZ 08 09 15.5 d

12 nov. 44.2 N., 149.2 E.

Kurile Isl.

h	about 50 km.		
H	08	33	15.9
ePZ	08	45	36.5

13 nov. 9.0 N., 73.3 W.
Colombia

h	about 328 km.		
H	09	01	41
iPZ	09	18	21.8 c

13 nov. 29.9 S., 175.3 W.
Tonga Isl.

h	about 33 km.		
H	17	18	50.1
eLZ"	18	18	

13 nov. 25.3 N., 109.3 W.
Gulf of California

h	about 14 km.		
H	20	03	06.6
ePZ	20	10	05.3

14 nov. 17.5 S., 167.7 E.
New Hebrides Isl.

h	about 33 km.		
H	04	35	48.5
eP'Z	04	54	41

14 nov. 45.7 N., 151.2 E.
Kurile Isl.

h	about 15 km.		
H	05	06	07.5
ePZ	05	18	23

14 nov. 15.1 N., 93.9 W.
Chiapas, Mexico

h	about 33 km.		
H	09	05	47.8
ePZ	09	12	38

15 nov. 4.7 S., 76.8 W.
N. Peru

h	about 152 km.		
H	00	18	52.4
iPZ	00	27	35.8 c

15 nov. 44.3 N., 149.0 E.
Kurile Isl.

h	about 50 km.		
H	21	06	34.0
iPZ	21	18	54.8 c
eSN"		29	14

16 nov. 44.3 N., 140.0 E.
Kurile Isl.

h	about 50 km.		
H	02	30	07.0
ePZ	02	42	28.0 c

16 nov. 41.3 S., 87.5 W.
Off coast of Chile

h	about 11 km.		
H	06	46	15.7
ePZ	06	59	11.5 d

16 nov. 22.3 S., 175.0 W.
Tonga Isl.

h	about 33 km.		
H	22	43	26.4
eLE"	23	42	

17 nov. 7.6 N., 37.4 W.
N. Atlantic Ocean

h	about 33 km.		
H	00	48	02.6
iPZ	00	56	49.5 d
eSE"	01	03	58
eScSE"		06	44
eSSE"		07	21

18 nov. 47.2 N., 148.5 E.
Sea of Okhotsk

h	about 319 km.		
H	01	45	27.6
ePZ	01	57	05

18 nov. 29.9 N., 113.6 W.
Gulf of California

h	about 14 km.		
H	14	38	28.9
iPZ	14	45	21.3 c
ePPZ'		46	47
iSN"		51	02
eScSE"		55	38

18 nov. 29.7 N., 113.8 W.
Gulf of California

h	about 14 km.		
H	16	02	19.9
iPZ	16	09	15.0 c

18 nov. 29.1 N., 114.1 W.
Baja, California

h	about 14 km.		
H	19	07	47.7
ePZ	19	14	49.0

19 nov. 30.9 N., 113.8 W.
Gulf of California

h	about 14 km.		
H	08	23	11.6
ePZ	08	30	08

19 nov. 44.4 N., 149.2 E.
Kurile Isl.

h	about 33 km.		
H	11	00	54.3
iPZ	11	13	16.0 d

19 nov. 53.1 N., 159.6 E.
Off E. coast of Kamchatka

h	about 40 km.		
H	17	38	39.7
ePZ	17	49	58.5
epPZ		50	11

19 nov. 5.0 S., 102.2 E.
Off S. coast of Sumatra

h	about 37 km.		
H	18	17	02.2
eLZ"	19	37	

20 nov. 22.2 S., 175.2 W.
Tonga Isl.

h	about 33 km.		
H	11	59	58.5
eLZ"	12	57	

20 nov. 44.1 N., 149.1 E.
Kurile Isl.

h	about 45 km.		
H	22	33	30.3
ePZ	22	46	04.5

21 nov. 50.3 N., 156.4 E.
S. Kamchatka

h	about 80 km.		
H	21	01	35.3
ePZ	21	13	10.0
ipPZ			25.0

22 nov. 18.5 N., 100.3 W.
Guerrero, Mexico

h	about 120 km.		
H	11	14	03.0
ePZ	11	20	44.8

22 nov. 44.4 N., 149.0 E.
Kurile Isl.

h	about 33 km.		

iZ			28.0
eSE"	15	08	26

22 nov. 21.0 S., 67.9 W.
W. Bolivia

h	about 87 km.		
H	18	57	02.5
ePZ	19	07	44
ipPZ			58.3

23 nov. 30.1 N., 114.0 W.
Gulf of California

h	about 14 km.		
H	07	50	46.3
iPZ	07	57	41.5
ePPZ		59	05.0
eSE"	08	03	12
eScSE"		07	48
iE"		11	54

23 nov. 29.9 N., 114.0 W.
Gulf of California

h	about 14 km.		
H	08	32	31
iPZ	08	39	28 d
pPZ			36

24 nov. 46.4 N., 150.0 E.
Kurile Isl.

h	about 40 km.		
H	18	09	08.7
iPZ	18	21	21.0 c

26 nov. 16.6 S., 175.2 E.
Fiji Isl. region

h	about 33 km.		
H	22	50	08.9
eLZ"	23	45	

27 nov. 16.6 S., 72.1 W.
S. Peru

h	about 79 km.		
H	02	19	41.9
iPZ	02	29	55.6 c

27 nov. 23.3 S., 65.8 W.
Jujuy, Prov. of Argentina

h	about 164 km.		
H	07	41	01.3
ePZ	07	52	42

28 nov. 52.2 N., 174.2 E.
Near Isl. Aleutian Isl.
h about 33 km.
H 15 13 11.0
iPZ 15 23 58.7 d

29 nov. 15.1 S., 73.7 W.
S. Peru
h about 124 km.
H 01 58 45
ePZ 02 08 45.0

2 déc. 80.1 N., 0.6 W.
Svalbard region
h about 33 km.
H 20 55 58.8
ePZ 21 03 56.5

2 déc. 51.5 N., 174.0 W.
Andreanof Isl. Aleutian Isl.
h about 55 km.
H 23 52 38.3
iPZ 00 02 51.5 d
ipPZ 03 04.6
eSN" 10 24

3 déc. 2.2 N., 84.5 W.
Off coast of Ecuador
h about 56 km.
H 17 12 01.6
ePZ 17 20 07.2 d

2 déc. 22.4 S., 69.3 W.
N. Chile
h about 18 km.
H 23 03 41.6
ePZ 23 14 40.7 d
iPZ 41.0 c
iN 55
ESN" 23 42
eScSN" 24 54

4 déc. 46.2 N., 153.1 E.
Kurile Isl.
h about 20 km.
H 01 27 34.1
ePZ 01 39 42

4 déc. 7.1 S., 80.4 W.
Near coast of N. Peru
h about 45 km.
H 04 21 22.6
ePZ 04 30 33

4 déc. 46.1 N., 152.9 E.
Kurile Isl.
h about 33 km.
H 08 24 17.1
ePZ 08 36 24

4 déc. 46.0 N., 153.2 E.
Kurile Isl.
h about 40 km.
H 15 44 52.9
iPZ 15 56 59.3 d

4 déc. 35.5 S., 102.8 W.
Easter Isl. region
h about 33 km.
H 15 59 42.1
ePZ 16 12 26
eSE 20 40
eSSE" 26 20

4 déc. 43.6 N., 71.6 W.
New Hampshire
h about 33 km.
H 21 32 34.9
iP_nZ 21 33 14.7 d
iS_nZ 41.0

5 déc. 35.7 S., 103.1 W.
Easter Isl. region
h about 33 km
H 04 23 22.2
eLZ 04 58.8

5 déc. 7.4 N., 77.3 W.
Colombia
h about 33 km.
H 11 29 49.4
ePZ 11 37 10.2 c

6 déc. 5.8 S., 150.3 E.
New Britain
h about 61 km.
H 01 56 42.8
eP'Z 02 15 38

6 déc. 37.5 N., 118.5 W.
Mono County, California
h about 15 km.
H 08 34 23.7
ePZ 08 41 11

7 déc. 22.1 S., 179.4 W.
Fiji Isl. region

h about 546 km.
H 04 07 52.8
iP'Z 04 25 34.0 d

7 déc. 20.8 S., 174.0 E.
Fiji Isl. region
h about 33 km.
H 10 32 39.5
eLZ" 11 29.5

8 déc. 46.4 N., 153.0 E.
Kurile Isl.
h about 20 km.
H 07 53 15.1
ePZ 08 05 22

9 déc. 54.9 N., 159.4 W.
Alaska Peninsula
h about 45 km.
H 05 38 29.5
iPZ 05 47 38.2 c

10 déc. 18.1 S., 68.5 W.
W. Bolivia
h about 79 km.
H 14 49 42.6
iPZ 15 00 08.5 d
iZ 41.0

11 déc. 15.1 S., 173.6 W.
Tonga Isl. region
h about 33 km.
H 00 47 48.3
eLZ" 01 38

11 déc. 51.2 N., 179.3 W.
Andreanof Isl. Aleutian Isl.
h about 32 km.
H 17 08 12.3
iPZ 17 18 47

11 déc. iPZ 22 00 28.8

12 déc. 18.7 N., 107.0 W.
Off coast of Jalisco, Mexico
h about 33 km.
H 00 38 24.6
ePZ 00 45 45

12 déc. 5.7 N., 73.1 W.
Colombia
h about 140 km.
H 20 54 34.8
iPZ 21 01 53.3 c

12 déc. 46.3 N., 150.5 E.
Kurile Isl.
h about 90 km.
H 23 24 36.6
ePZ 23 36 40.3

13 déc. 2.7 S., 78.4 W.
Ecuador
h about 109 km.
H 04 16 13.5
iPZ 04 25 11.0 d

13 déc. 6.9 N., 77.1 W.
N. Colombia
h about 33 km.
H 05 28 07.3
iPZ 05 35 31.7 d

13 déc. 14.5 N., 91.9 W.
Guatemala
h about 139 km.
H 19 57 27.4
ePZ 20 04 04

14 déc. 2.3 S., 61.2 W.
N. Brazil
h about 36 km.
H 00 05 39.8
iPZ 00 14 36.8 c

14 déc. 62.7 N., 149.5 W.
Central Alaska
h about 95 km.
H 07 51 07.9
iPZ 07 59 12.6 d

15 déc. 4.8 S., 108.0 E.
Java Sea
h about 650 km.
H 19 34 45.5
iP'Z 19 52 55.1 c
iSKPZ' 55 31
ipP'Z' 38
iN' 56 04
isPZ' 40
esPPZ" 58 08
ePPPN" 59 04
eSPZ" 20 05 06
ePSN" 06 20

eSSN'' 12 46
eP'P'E'' 13 28
eE'' 22 48
iE'' 26 16

16 déc. 6.4 S., 105.4 E.
Sunda Strait
h about 64 km.
H 01 51 30.6
eP'Z 02 10 57.5
eSSE'' 32.5

16 déc. 12.2 N., 88.4 W.
Off coast of El Salvador
h about 34 km.
H 06 23 20.4
ePZ 06 30 16

16 déc. 45.8 N., 142.6 E.
S. Sakhalin
h about 258 km.
H 11 09 30.4
ePZ 11 21 30.5

16 déc. 37.1 N., 20.9 E.
Ionian Sea
h about 15 km.
H 13 47 56.4
iPZ 13 58 54.3 c

16 déc. 1.6 S., 78.0 W.
Ecuador
h about 170 km.
H 16 41 09.5
ePZ 16 49 29

17 déc. 52.9 N., 165.4 W.
Fox Isl. Aleutian Isl.
h about 33 km.
H 23 22 11.2
ePZ 23 31 50.5

18 déc. 24.8 S., 176.6 W.
Tonga Isl.
h about 46 km.
H 00 30 02.6
ePZ'' 00 45 06
eP'Z 48 43.0
eSKSE'' 55 25
eSKKSE'' 56 18

19 déc. 9.7 S., 79.1 W.
Near coast of Central Peru
h about 56 km.
H 17 04 07.8
iPZ 17 13 36.0 c

22 déc. 6.9 N., 73.0 W.
Colombia
h about 153 km.
H 23 13 52.5
iPZ 23 21 05.0 c

24 déc. 45.4 N., 151.3 E.
Kurile Isl.
h about 50 km.
H 03 00 57.3
ePZ 03 13 08.7
epPZ 22.2

24 déc. 45.5 N., 151.5 E.
Kurile Isl.
h about 55 km.
H 03 27 23.9
ePZ 03 39 35.0

26 déc. 76.5 N., 22.4 E.
Svalbard region
h about 33 km.
H 07 58 22.4
e 08 06 57

28 déc. 5.1 S.,, 153.5 E.
New Ireland region
h about 70 km.
H 05 45 20.2
eP'Z 06 04 32

28 déc. 14.4 N., 92.3 W.
Near coast of Guatemala
h about 33 km.
H 06 57 09.9
ePZ 07 04 09.5

28 déc. 32.7 S., 178.9 W.
Kermadec Isl.
h about 33 km.
H 09 03 52.9
iP'Z 09 22 44.0 c

28 déc. 60.4 S., 51.8 W.
S. Shetland Isl. region
h about 49 km.
H 17 58 33.1
eLZ'' 18 43

29 déc. 18.5 S., 69.7 W.
N. Chile
h about 113 km.
H 17 15 39.2
iPZ 17 26 00.6 c
ipPZ 28.0

30 déc. 45.5 N., 150.6 E.
Kurile Isl.
h about 40 km.
H 13 29 25.3
iPZ 13 41 38.5 c
ipPZ 51.2

30 déc. 18.3 S., 70.1 W.
N. Chile
h about 150 km.
H 16 20 48
ePZ 16 31 05.0

30 déc. 42.4 N., 142.8 E.
Hokkaido, Japan
h about 50 km.
H 20 32 19.5
ePZ 20 45 26

31 déc. 12.4 N., 87.9 W.
Near W. coast of Nicaragua
h about 77 km.
H 14 22 07
iPZ 14 28 52.8 d

31 déc. 56.5 S., 26.0 W.
Sandwich Isl.
h about 30 km.
H 17 37 32.1
eP'Z 17 56 26
ePPZ 57 27
eSS 18 11 54

1 janv. 64 6.8 S., 129.8 E.
Banda Sea
h about 96 km.
H 12 21 56.4
eP'Z 12 41 08

M. Buist, S.J.