ANNUAL AND DIURNAL VARIATION OF THUNDERSTORMS

IN NEW ZEALAND AND OUTLYING ISLANDS

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ABSTRACT

The distribution of thunder-hours has been studied using routine hourly observations, electrical storm reports, and observations of special phenomena.

There are distinct patterns of variation with time of year and time of day. Over the country as a whole frequencies are highest in November - December - January and lowest in July - August. They are also low in February - March. However the maximum incidence in many western areas is in the winter/spring period while some northern coasts have relatively high frequencies in autumn.

Diurnally, although a maximum in the afternoon is widespread, many places have a distinct secondary maximum of thunder-hours in the night or morning. The night/morning maximum is the primary maximum all year on the west coast of the South Island and in all seasons except summer in many other western and northern areas.

1. Introduction

Thunderstorms in New Zealand are relatively infrequent and do not constitute the significant fraction of the weather that they do in some countries. They are still an important factor in, for example, power line failure, local flooding and hail damage. They are of intrinsic meteorological interest.

An account of the incidence of thunderstorms in New Zealand was given by Kidson and Thompson (1931) based on records kept by voluntary observers. More recently Tomlinson (1976) presented a statistical treatment of the variability of annual thunder-days along with details of the seasonal variability.

Thunderstorms in New Zealand generally occur at some form of surface trough or convergence zone which may be on the synoptic scale or on the mesoscale. A relatively small number result from the destabilising effect of high country heat sources in certain anticyclonic conditions. Unpublished studies have shown that the synoptic environment of non-frontal thunderstorms in New Zealand is generally characterised by cyclonic relative vorticity in the middle and high troposphere and often by weak vertical wind shear, e.g., near the axis of an upper trough.

The transient and localised nature of thunderstorms is such that statistics on their occurrence are not easy to compile as it is still necessary to rely on non-routine observations for information over much of the country. The reliability of such observations was discussed by Kidson and Thompson (1931).

Although Tomlinson (1976) has shown that monthly statistics of thunder-days covering 20 years have means which are much less stable than the annual means, nevertheless it is possible to identify distinct patterns in the variation of thunderstorms during the year, and to relate these patterns tentatively to physical causes. This study considers the month-to-month variations as well as the diurnal variations of thunderstorms, and the differences in the diurnal variation from season to season.

2. Data and Analysis

2.1 Data sources

Observations from the following sources have been used in this study: -

Group A: Stations which make routine hourly reports. These comprise 10 meteorological offices, including four on outlying islands, and 12 other places, mostly flight service offices at aerodromes.

Group B: New Zealand Electricity Department stations, substations and depots. These made electrical storm reports including times at which thunderstorms began and ended. Some observations at neighbouring sites were pooled into subgroups.

Group C: Climatological and rainfall stations from which thunder-day statistics can be obtained. Some of these stations gave times of occurrence of phenomena but only a few were analysed because of the time involved in manual processing.

The locations of all these stations are shown in Fig.1.

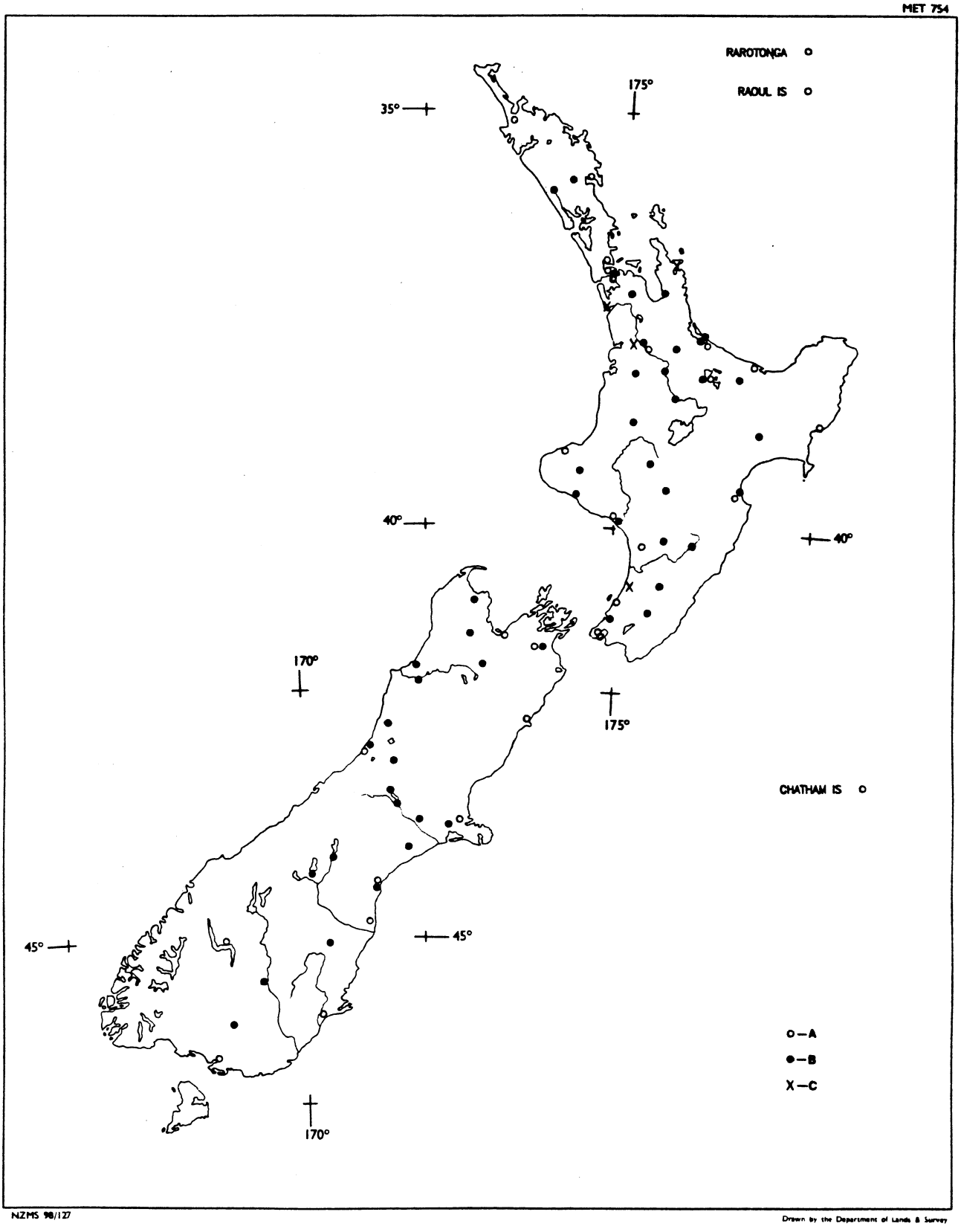


Fig. 1: Map showing distribution of thunderstorm reporting stations used in this study. Groups A, B, C explained in text.

2.2 Treatment of data

Records from Group A which are in computer files were analysed to give the number of thunderstorm reports per 100 hourly observations for each hour and month. The period of record for most of the meteorological office stations was from either January 1960 or February 1962 to June 1980. They were used as the basic data set in determining the annual and diurnal variations of thunderstorm frequencies.

Although some of these stations do not observe 24 hours a day the patterns of thunderstorm occurrence are sufficiently well defined for valid inferences to be drawn.

The reports from Group B were processed manually to obtain occurrences of thunder in each hour, day, and month for the period 1957 to 1969. Records for a few months were missing. Data from these and Group C stations were used to extend the geographical coverage of the basic set.

Each hour within which thunder was reported at a Group A station was classified as a thunder-hour. Occurrences of thunder at Group B and Group C stations were classified similarly.

In order to determine the similarity of thunder-hour and thunder-day distributions during the year, the months in which the two largest local maxima occur at each Group B station were counted; a local maximum being a value exceeding the neighbouring values on either side. The distributions of months in which these maximum frequencies occurred when summed for all stations are shown in Fig.2 as differences between observed and expected values. Although there are differences between the two distributions, it was concluded that thunder-day data, which are more widely available, can be used to supplement the thunder-hour records.

To improve the definitions of spatial patterns, data at a large sample of stations were converted into cumulative monthly frequencies. Various percentiles and differences between percentiles were then mapped. This procedure also enabled data from different sources and periods of record to be compared.

A similar procedure was followed to obtain patterns of diurnal variation, using cumulative hourly totals from Group A and Group B stations.

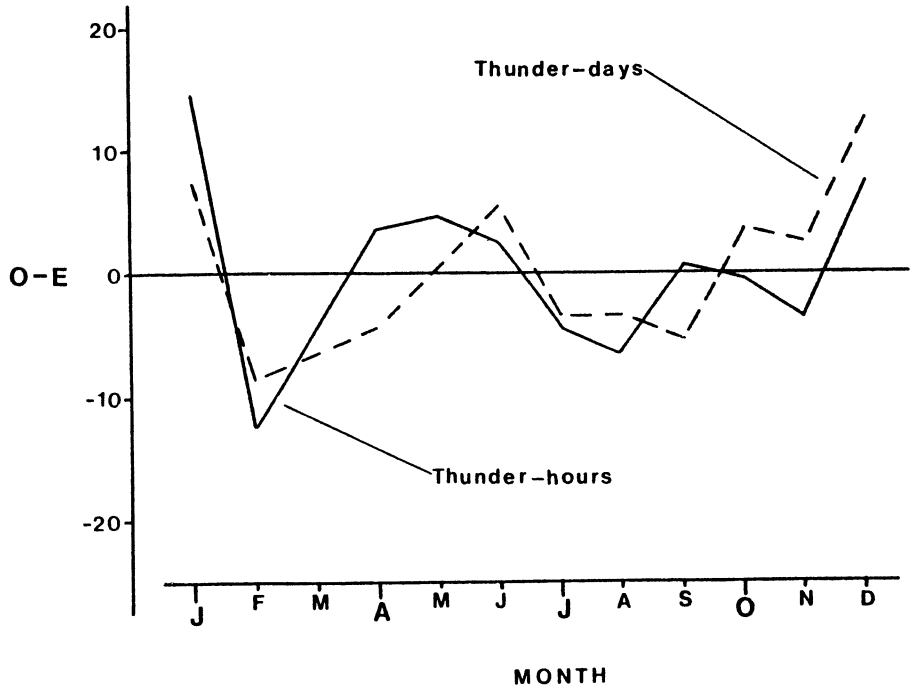


Fig. 2: Differences between the observed annual variation (O) and the variation expected by chance (E) of (i) thunder-hours (ii) thunder-days, based on sums of the two largest local maxima in the monthly distributions at Group B stations.

Zones having similar patterns of annual and diurnal variation were identified, and boundaries between such zones have been mapped subjectively. These boundaries should be considered as transition zones, some of which may be quite broad and others sharp.

3. Variation of thunderstorm frequencies

3.1 Regional patterns of annual variation by month

The monthly frequencies of thunder-hours at selected stations are presented in Table 1. The average annual number and mean monthly frequencies are also shown. Figure 3 contains amplitude-phase vectors of the maximum in the monthly distribution at each station plotted in the same way as wind arrows. The amplitude of the variation is represented by the ratio

$$\frac{\text{maximum frequency - minimum frequency}}{\text{mean monthly frequency}} \times 100\%$$

and the phase is shown in clock-dial form, where March is plotted as 3 o'clock, June as 6 o'clock etc. The arm refers to the month with the highest frequency.

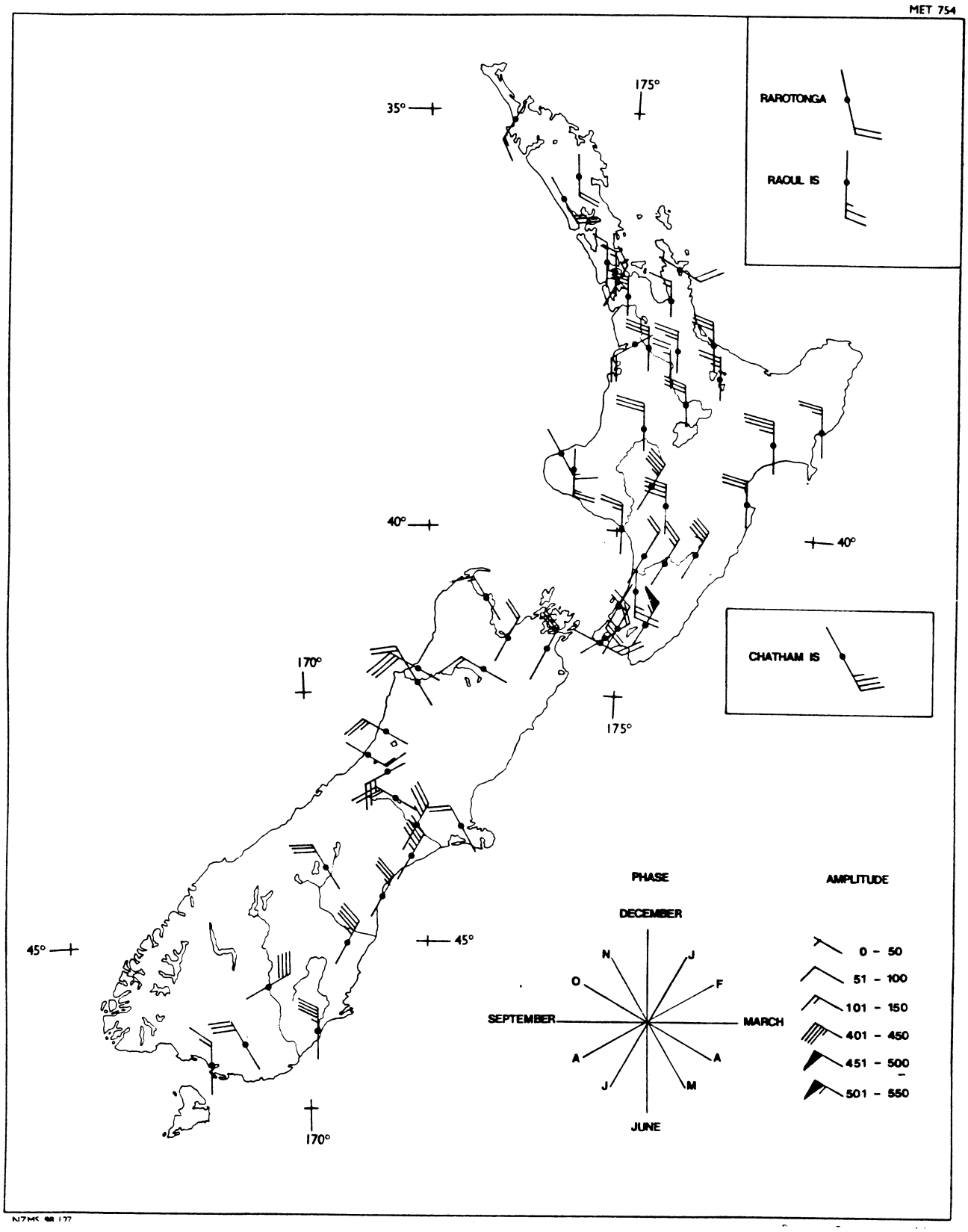


Fig. 3: Amplitude and phase of the maximum in the monthly distribution of thunder-hours at selected stations plotted as vectors. See text for details.

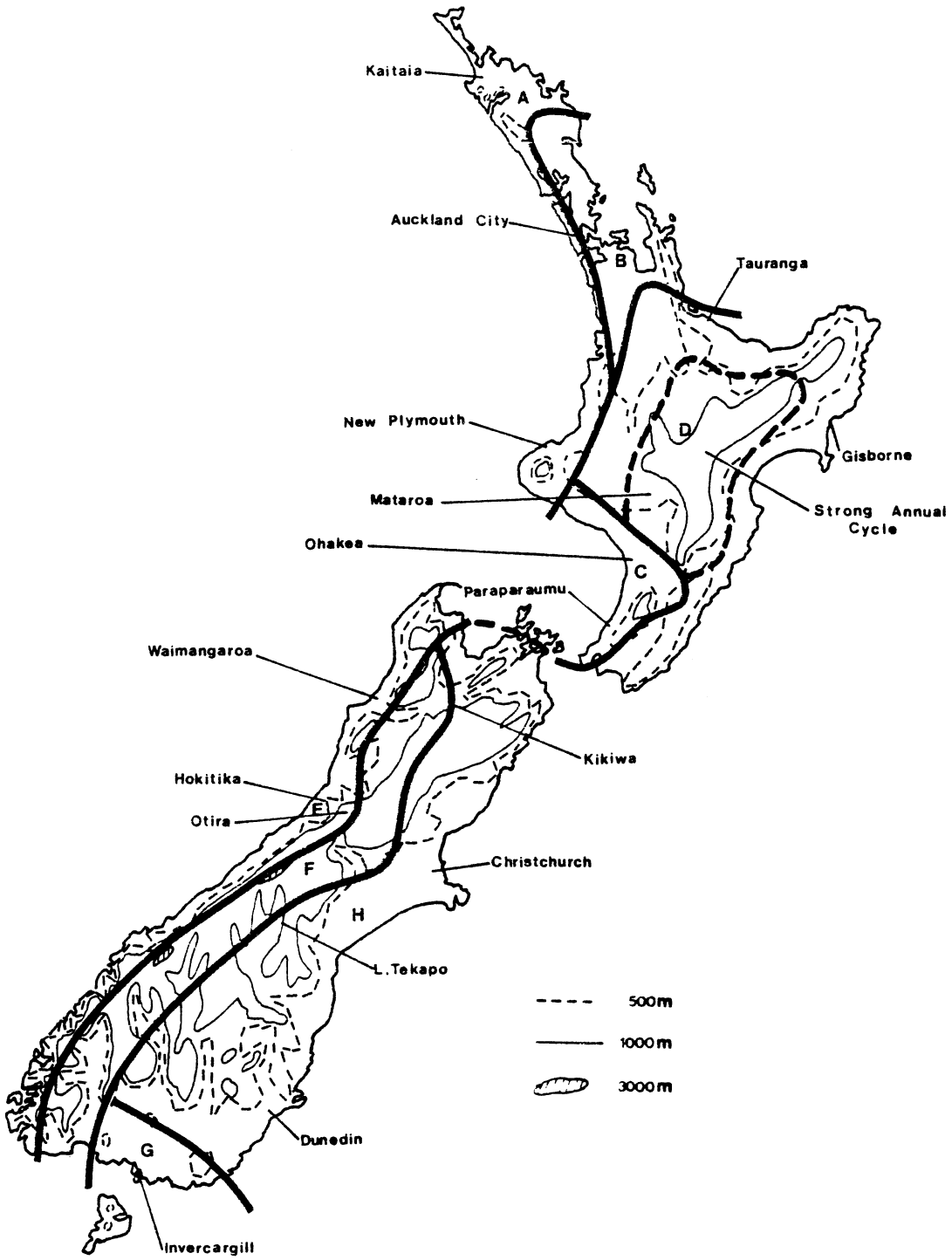


Fig. 4(a): Location of principal patterns of annual variation of thunder-hours. A - Kaitaia, B - Auckland, C - Ohakea, D - Continental, E - West Coast, F - Alpine, G - Invercargill, H - Continental.

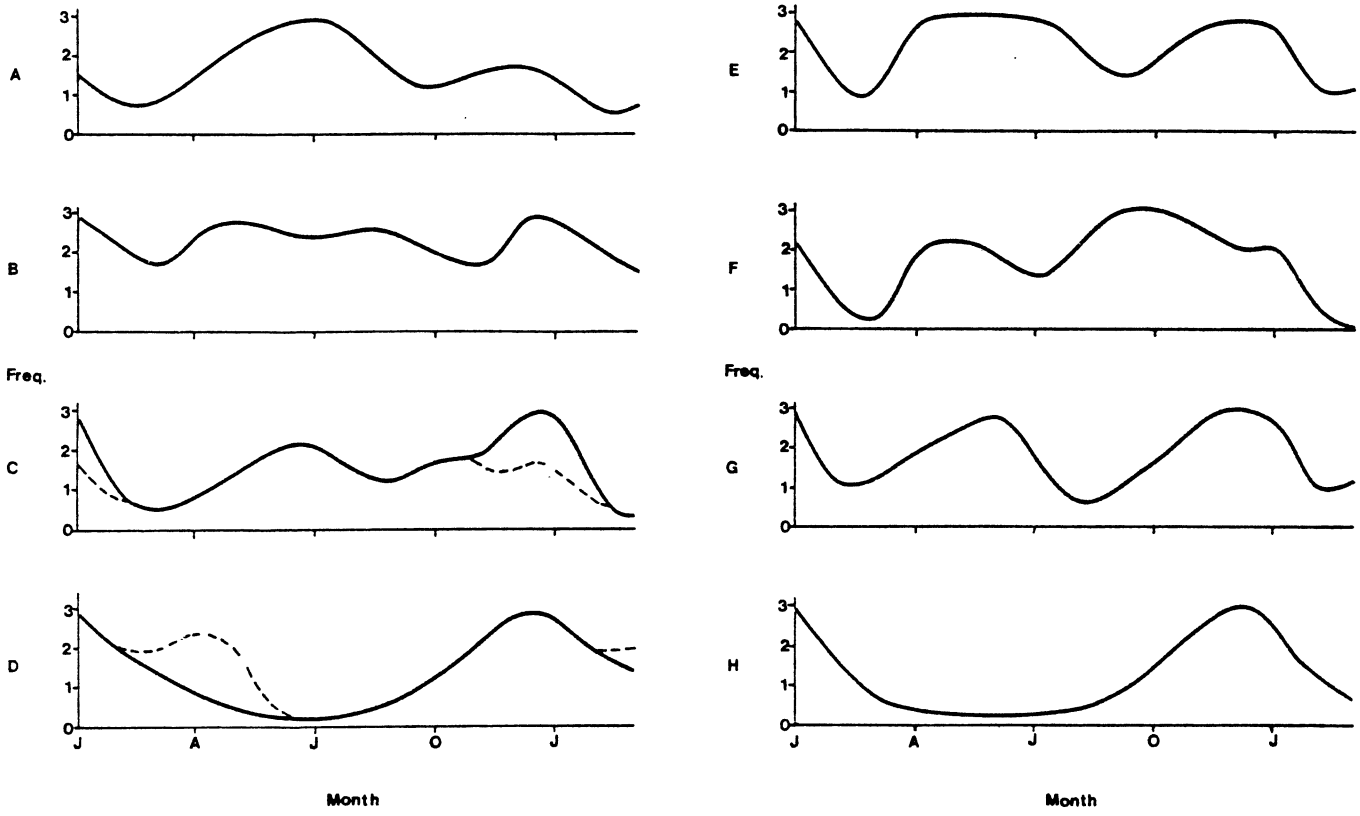


Fig. 4(b) Idealised curve (full line) with arbitrary scale at left for each pattern of annual variation of thunder-hours. Significant variants indicated by broken lines.

Significant features of Table 1 and Fig. 3 have been summarised in Fig. 4 which shows principal patterns of annual variation and their geographical distribution. For each pattern an idealised curve is given. Histograms for a selection of particular sites are presented in Fig. 5. There are four main patterns in the North Island:

(A) The "Kaitaia" pattern. In the north of Northland thunder-hours are most frequent from April to September. In the other six months they are half as frequent. This pattern extends southward along the west coast, becoming less pronounced and also modified by the appearance of a secondary peak in December or January. The ten-year record at Raoul Island indicates that the distribution is similar there.

(B) The "Auckland" pattern. There is an annual cycle with a December-January maximum but the corresponding minimum is masked by fairly uniform frequencies, appearing from April to September, which approximate the monthly average.

(C) The "Ohakea" pattern. Compared with other western coastal regions, the southwest of the North Island has few thunderstorms, and the number decreases progessively from north to south. In most of the region frequencies are low in the February-May period, while maxima are found in winter-spring months and/or in December-January.

(D) The "continental" pattern. In this large region the main mountain ranges do not provide a line of demarcation between patterns except in the extreme south. The main features are a sharp maximum in December-January and a minimum in June, July, and August. The annual cycle is particularly strong close to the mountains but weakens towards the coast. Unlike region (C) frequencies are relatively high in the autumn months especially in coastal parts of Bay of Plenty, Gisborne, and Hawkes Bay.

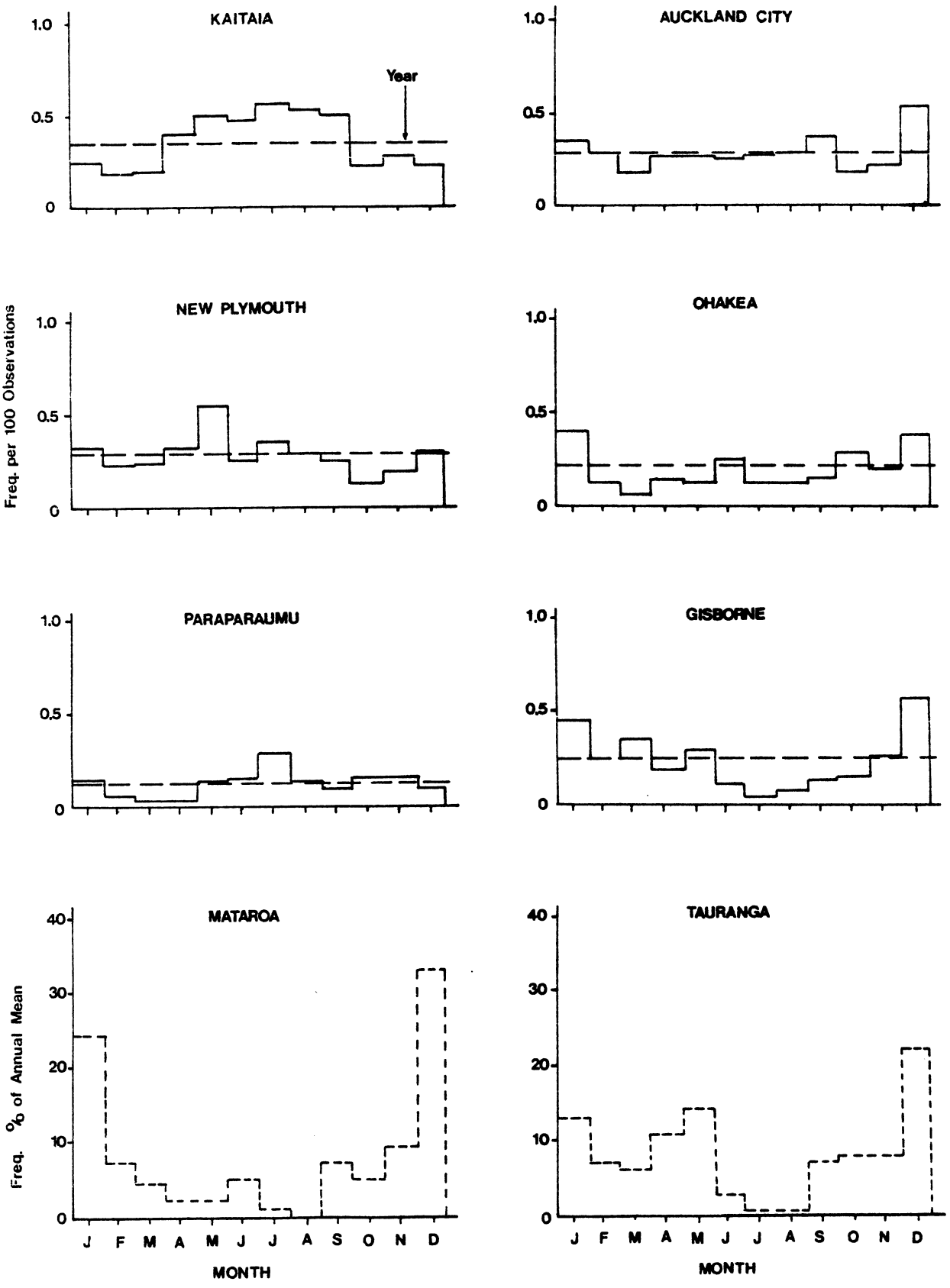
In the South Island the main ranges do appear to act as a substantial boundary between different patterns of thunderstorm variation:

(E) The "West coast" pattern. There are similarities to the annual variation in regions (A) and (C) of the North Island. Frequencies are low in February and March but high in most other months.

(F) The "Alpine" pattern. There is a minimum in July but the main characteristic of the Alpine region is the particularly large number of occurrences in most of the months from August to December or January.

(G) The "Invercargill" pattern. In coastal Southland the mean annual variation is the most regular in the country with distinct maxima in June and December, minima in February and August.

(H) The "continental" pattern. The large eastern area of the South Island has a pattern of annual variation characterised by a maximum in the November-December-January period and low frequencies in most other months, but there are several variants. Frequencies are generally highest in the Nelson area, towards the Alpine region and in coastal Otago. They are particularly low in Marlborough, parts of Canterbury and inland Otago where thunderstorms are very rare in June, July, and August. In most of the region there are significantly more occurrences in the spring months than in autumn.


KAITAIA
Year
AUCKLAND CITY
NEW PLYMOUTH
OHAKEA
PARAPARAUMU
GISBORNE
MATAROA
TAURANGA
Freq. per 100 Observations
Freq. % of Annual Mean
1.0
0.5
0
40
30
20
10
J F M A M J J A S O N D
MONTH

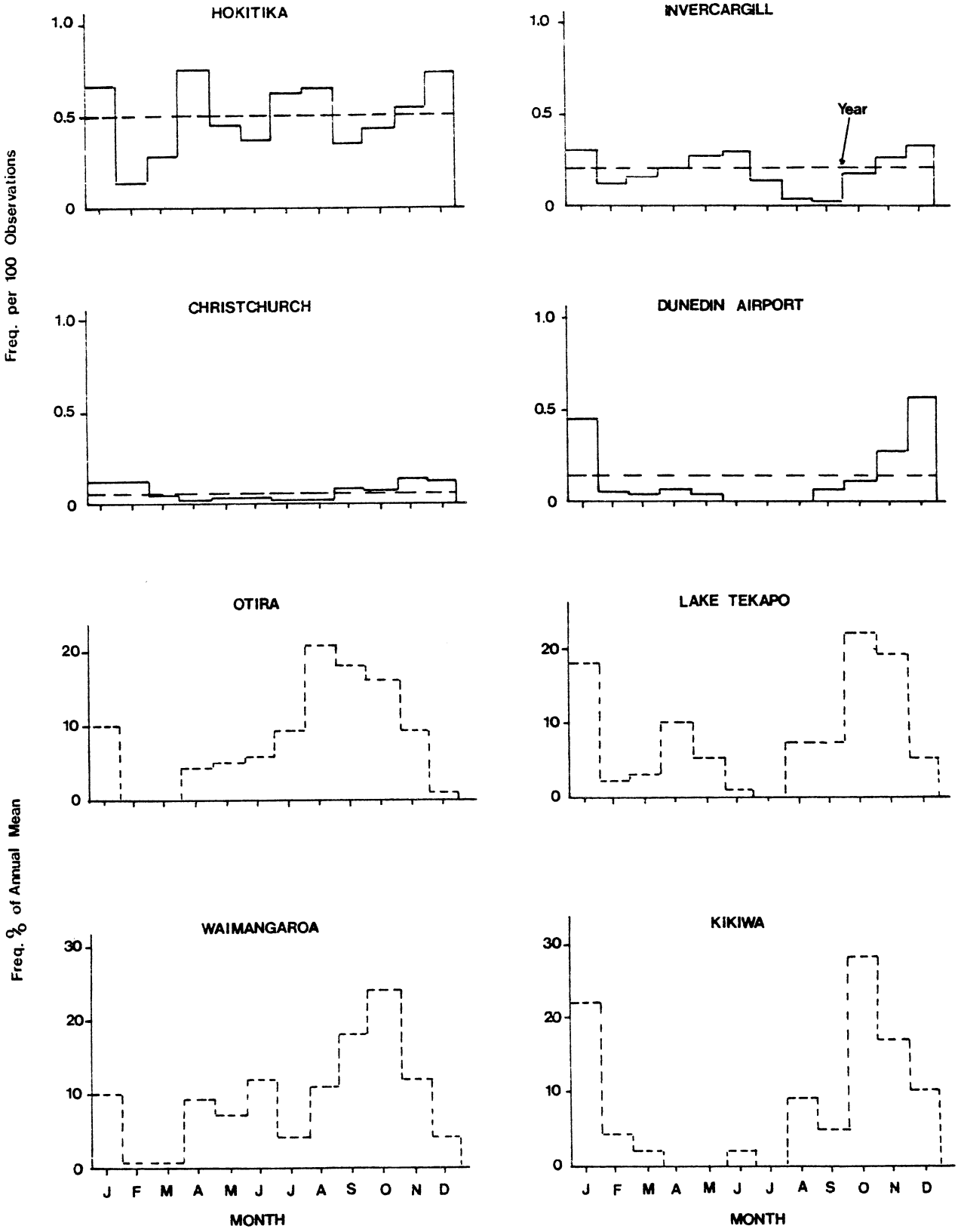


Fig. 5: Histograms of annual variation of thunder-hours at particular sites (see Fig. 4).

Intermediate between the bimodal pattern of Invercargill and the flat spring/summer maximum of Christchurch lies the Dunedin Airport pattern with a very sharp December-January maximum.

At the Chatham Islands there is a peak in May and minimum frequencies occur in February, March, July and August.

3.2 Regional patterns of diurnal variation

Table 2 shows the hourly frequencies per 100 observations averaged over all months at Branch Meteorological Offices. Figure 6(a) contains amplitude-phase vectors of the primary maximum in the hourly distribution for selected type A and type B stations. The phase of any distinct secondary maximum is shown in Fig. 6(b). Local times are used throughout. Figure 6 and Table 2 reveal three widespread features:

(i) A maximum in the afternoon hours;
(ii) A minimum in the morning;
(iii) One or more maxima during the night.

The relative importance of these varies from one region to another. In general, each region of distinctive diurnal variation is associated with a particular pattern of annual variation. This can be seen from Fig.7, in which three regions of broadly similar pattern are delineated.

The westernmost region is characterised by

(i) diurnal variation of small or moderate amplitude,
(ii) highest frequencies during the night hours (1800-0600).

This pattern is found also at Rarotonga and Raoul Island where the highest frequencies, at night, are three to four times the lowest frequencies*.

In the east of the South Island and in the southeast of the North Island the distribution consists of a sharp afternoon maximum and few or no occurrences at other times.

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* Finkelstein (1963) showed that diurnal variation of rainfall amounts on these islands has a maximum at night, but a suggested explanation linking night rain with weak vertical velocities is not consistent with the strong updraughts associated with thunderstorms.

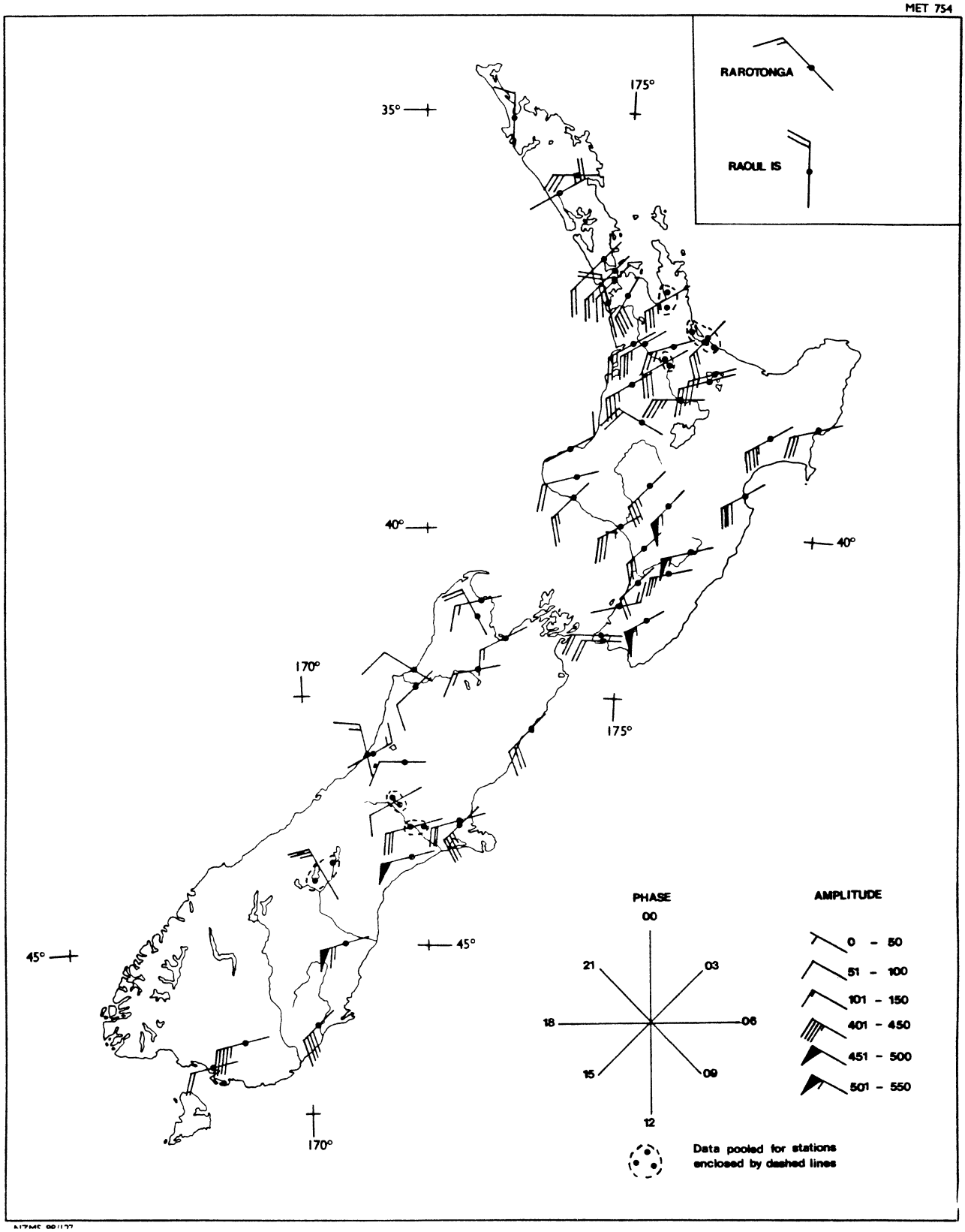

Fig. 6(a) Amplitude and phase of the primary maximum in the hourly distribution of thunder-hours at selected stations plotted as vectors.

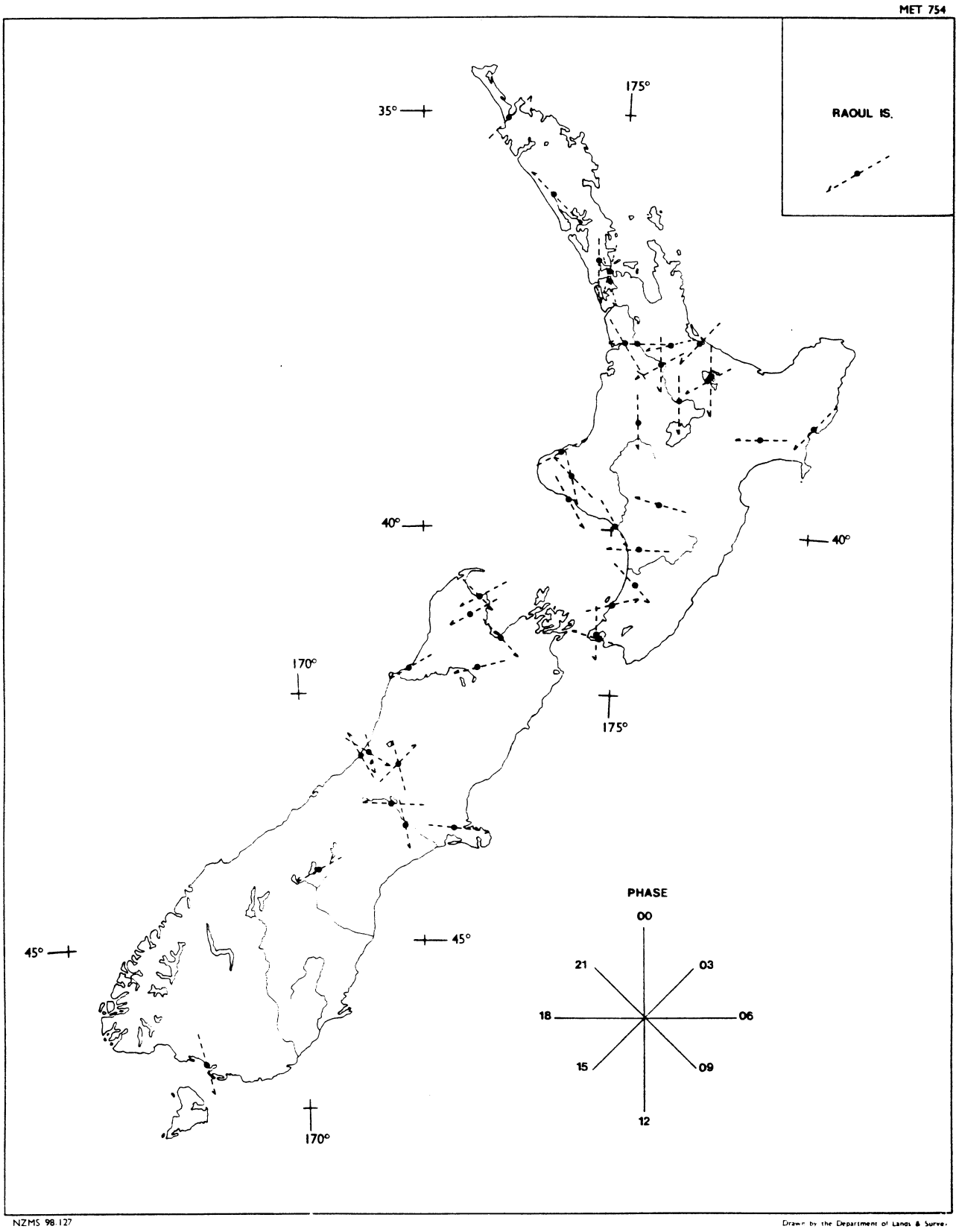

Fig. 6(b) Phase of significant secondary maximum in the hourly distribution of thunder-hours.

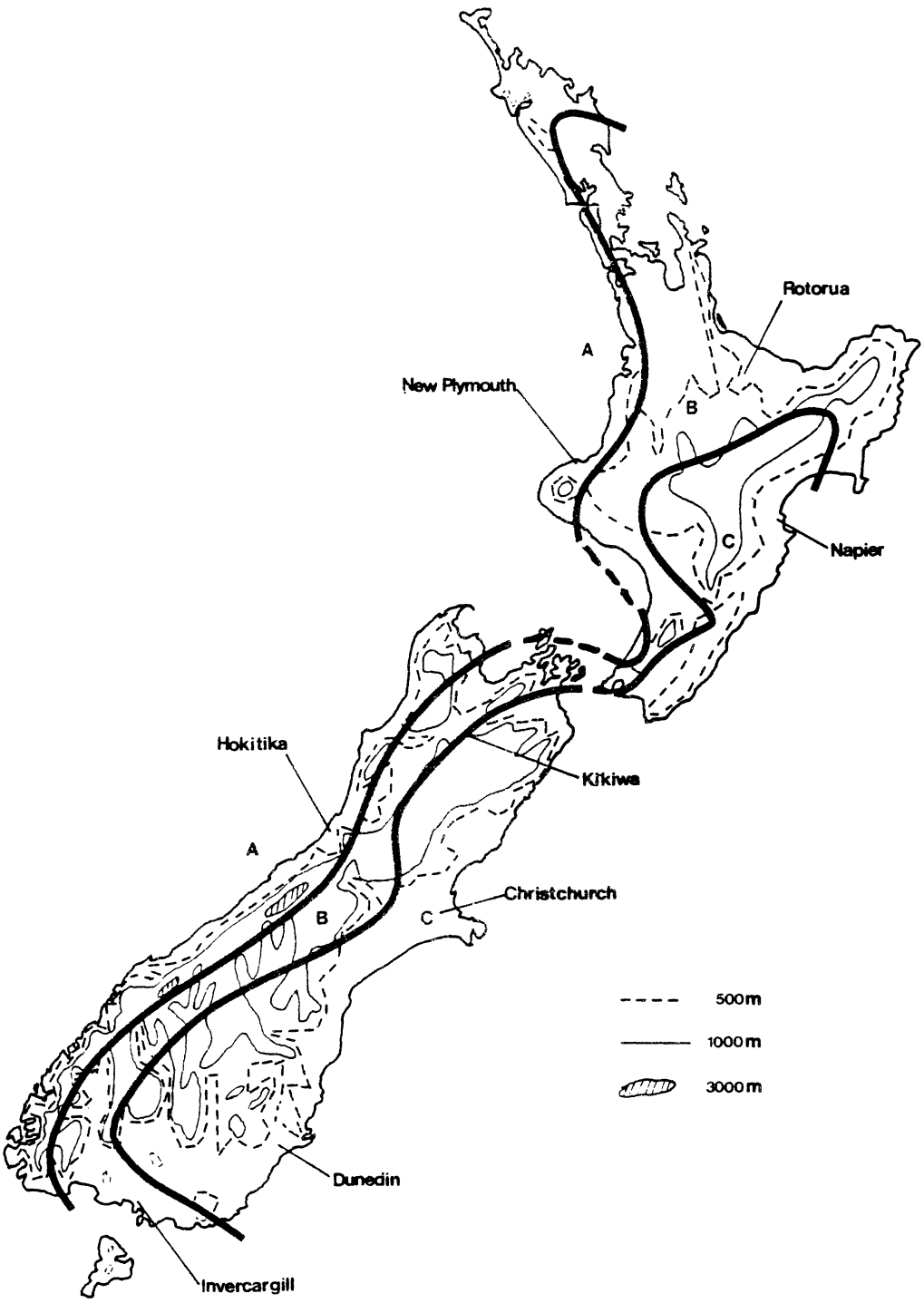

Fig. 7(a): Location of the three principal patterns of diurnal variation of thunder-hours.

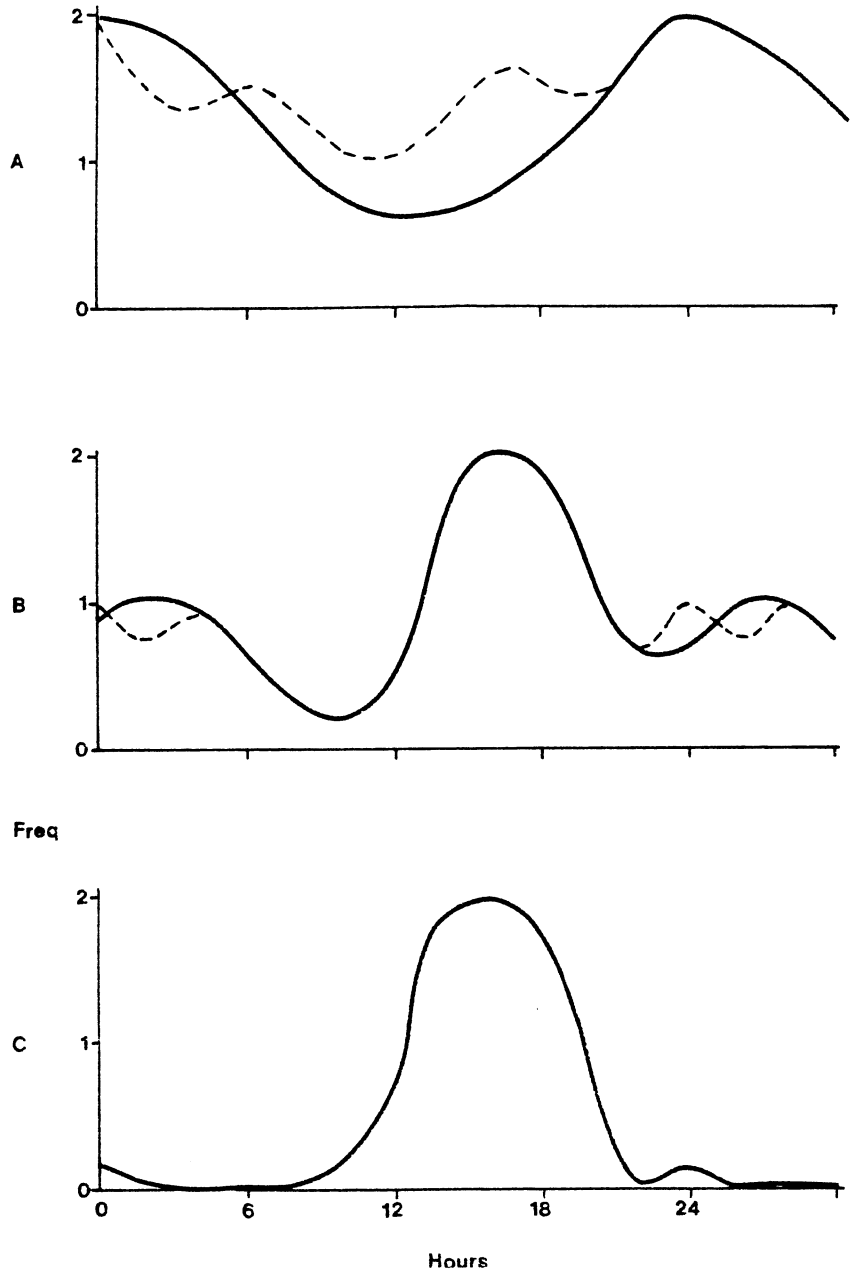

Fig. 7(b): Idealised curve (full line) with arbitrary scale at left for each pattern of diurnal variation of thunder-hours. Significant variants indicated by broken lines.

In the region intermediate between the above two the pattern comprises a bimodal distribution with a pronounced maximum in the afternoon, and a secondary maximum at night. The pattern at Chatham Islands is similar with a small afternoon maximum. Histograms for a selection of stations are shown in Fig.8.

3.3 Combined seasonal and diurnal variation

In Table 3 are displayed the mean frequencies per 100 hourly observations in each two-hour time interval, at selected stations for each of the four conventional seasons. For this table the opportunity was taken to include data up to December 1982. The table reveals the relative seasonal frequencies as well as seasonal changes in the pattern of diurnal variation at each station.

Several features of these patterns appear to be significant:

(1) At Kaitaia, where the amplitude of the diurnal variation (defined as peak frequency minus mean frequency) over all seasons is less than 50% of the mean, there is little seasonal change in the 1200-1800 period, but marked changes at all other times. Relative to the daily mean for the year, frequencies for night and morning combined (1800-1200) are three times as great in winter as in summer, with intermediate values in spring and autumn. Only in summer does the pattern consist of primary peak in the afternoon and secondary peak in the early hours as at most North Island stations.

(2) The Auckland(city) pattern differs markedly from that at Kaitaia. In all four seasons there is an afternoon maximum. Only in autumn are frequencies at night (early hours) comparable with afternoon. Afternoon frequencies are higher in winter and spring than in autumn.

(3) The composition of the Auckland Airport pattern shows the following differences from the city pattern. The afternoon maximum is pronounced in summer and spring only. It almost disappears in winter when night and morning peaks appear, typical of the Kaitaia pattern. Evening (1800-2400) frequencies are relatively high in summer and autumn, but decline in winter and reach a minimum in spring. Although the stations are only 20 km apart, these differences can possibly be explained in terms of the differing local topography, including disposition of land and water surfaces, in relation to the scale of thunderstorm cells.

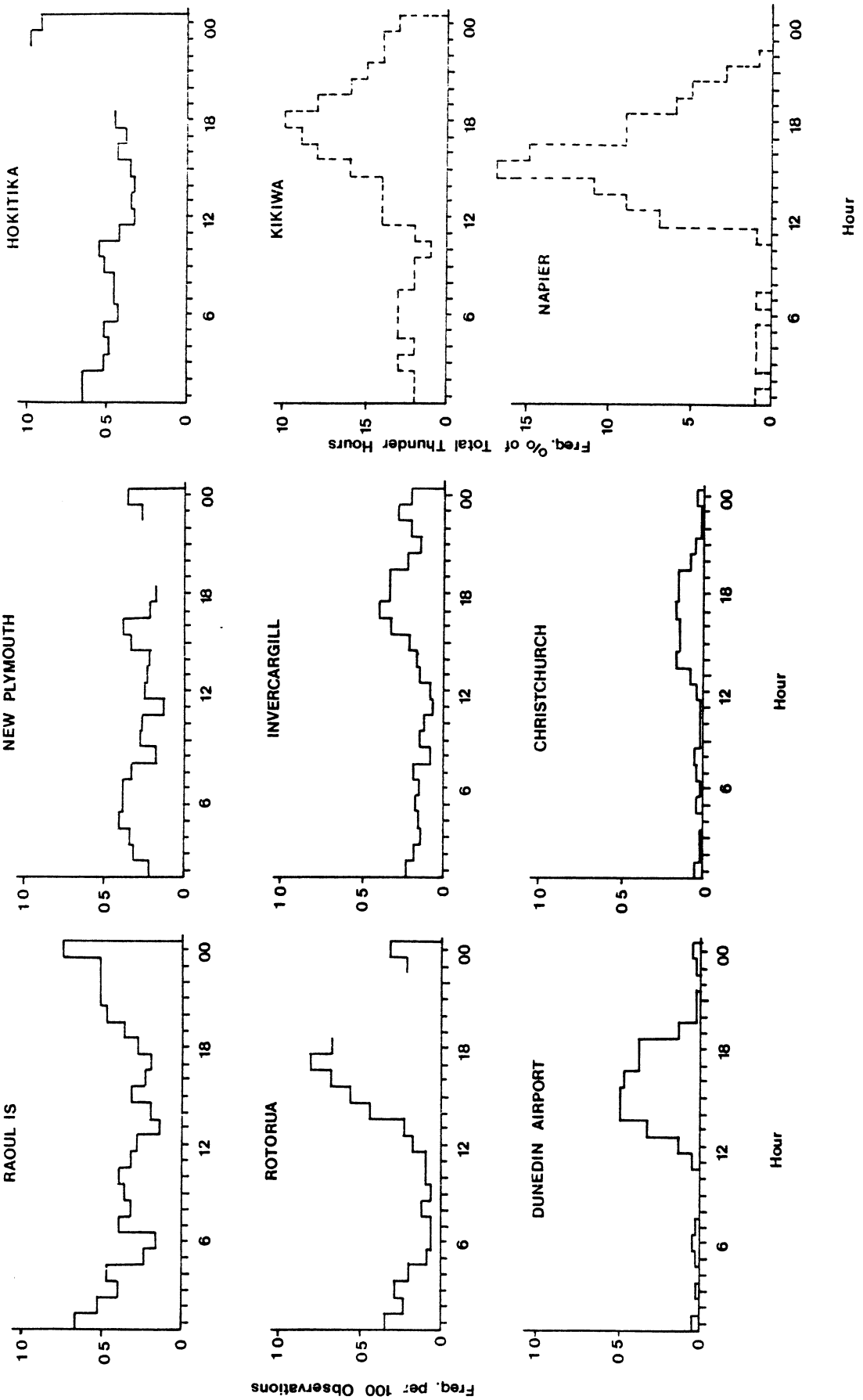

Fig. 8 Histograms of diurnal variation of thunder-hours at particular sites (see Fig. 7).

(4) At New Plymouth, unlike Kaitaia, afternoon frequencies vary considerably with season and show a distinct minimum in winter. Frequencies at other times vary most in autumn when the night maximum is largest and in spring when there is a morning minimum.

(5) In the remaining part of the North Island, where there is a bimodal distribution, seasonal changes are generally small, apart from the afternoon maximum which is much stronger in summer at most places. The secondary maximum is largest in spring and summer at Ohakea, in summer and autumn at Rotorua and in autumn at Gisborne. The night maximum is at least comparable with the afternoon maximum at both Rotorua and Gisborne in autumn, and at Rotorua in winter.

(6) At Nelson an afternoon maximum is dominant in summer but is subsidiary to peaks in the evening and early hours in the other seasons. The night maximum is particularly marked in spring.

(7) In west coast and Alpine regions of the South Island the diurnal variation changes little with season, but night and morning maxima are more evident in winter and spring, and afternoon maxima in summer, especially inland. At Hokitika there is a pronounced night maximum in all seasons, with a particularly large amplitude in spring.

(8) In the Lake Coleridge and Lake Tekapo basins the seasonal changes are dissimilar. The former has a small afternoon maximum in summer. Otherwise little diurnal variation is evident in summer, autumn and winter. Frequencies are higher from 0600 to 1500 than at other times in spring. About Lake Tekapo there is a broad early morning maximum in spring, but low afternoon frequencies and high late evening frequencies in all seasons.

(9) A late afternoon maximum appears at Invercargill in summer. There the spring and winter patterns are similar with maxima of comparable magnitude in the afternoon and at night.

(10) At Rarotonga and Raoul Island relatively high frequencies are found at night in all seasons. Some daytime hours have comparable frequencies in summer.

4. Possible causes of the variations

(a) Annual. Spatial variation in the incidence of thunderstorms can be related broadly to annual cycles of cyclonic activity, surface heating, and land-sea temperature differences, which give rise to favourable environmental conditions. These include cyclonic vorticity, steep lapse rates, and high moisture content (Pettersen, 1956).

The distribution of closed cyclonic circulations over New Zealand is fairly well known and has been documented in studies of cyclone climatology (Taljaard, 1972), and weather type (Kerr, 1944). It shows a minimum in late summer and early autumn (when anticyclonic systems are most frequent) but a maximum over northern New Zealand in winter and early spring (associated with the subtropical jet stream). Upper wind statistics for New Zealand (de Lisle, 1969) show that from May to September the relative vorticity of the mean flow at jet stream levels is cyclonic.

Analyses of sea surface and upper air temperatures (Taylor and Thompson, 1980; Tomlinson, 1975) indicate that air over the sea around New Zealand is least stable, on average, in late autumn and winter. Instability associated with cyclonic westerly flows could then contribute to the observed high frequency of thunderstorms in western districts compared with the minimum in the east. This minimum occurs when the split-flow regime in the upper troposphere is most pronounced (July/August) and high latitude blocking anticyclones are frequent. This also coincides with a thunderstorm minimum in Southland. A related feature appears in an analysis of surface winds at Invercargill by Reid (1982), where the monthly frequencies of easterly directions are highest in July and August.

Cool maritime air associated with southerly or southwesterly flows can force potentially buoyant air to ascend, or can be destabilised by strong surface heating. These mechanisms, which are particularly significant along eastern coasts of New Zealand, are likely to be most effective in late spring and summer months when the contrast between temperatures over sea and over land is greatest. This factor also facilitates the formation of sea breeze convergence zones which can give rise to organised patterns of convection.

Although the annual heating cycle of the ground does not peak until January-February the combination of factors discussed above contributes to the observed widespread maximum of thunder-hours in November, December and January. Neale (1977) found that severe hailstorms have a pronounced maximum frequency from November to January when half the year's severe storms occur.

While circulation systems are less favourable for thunderstorm development after January, high level (mountain) heat sources may still trigger instability as, for example, in central North Island areas. A further exception to the pattern of suppressed thunder-hour occurrence in late summer and early autumn, when the subtropical easterlies are furthest south on average, is seen in the frequencies for northeastern parts of the North Island (compared with southwest) and in Nelson. These are the areas most affected by moist unstable easterly or northeasterly airflows.

The high frequency of thunder-hours during the spring months in South Island Alpine regions coincides with a well-known period of above average westerly wind flow as well as cyclonic activity over the South Island.

(b) Diurnal. The radiation cycle, effects of orography, and local wind systems appear to account for much of the diurnal variation. Maximum destabilisation by daytime heating, as well as location with respect to heat sources and the prevailing flow, are reflected in the widespread afternoon maximum of thunderstorms. Preferential growth over mountainous regions is also favoured then by the divergence-convergence cycle associated with regional "sea breeze" circulations (Revell, 1972). At the same time development over the coast is inhibited by downward motion.

The shift in frequency towards the evening hours and the appearance of secondary maxima at night in coastal regions can be explained by several factors. First, thunderstorm cells may simply be advected from the generating region, or development of new cells may be triggered by downdraught outflows. Such new development would be aided in the coastal zone by the reversal of the divergence-convergence cycle in the evening. Second, additional uplift over windward coasts at night, through the diurnal decrease of windspeed in the boundary layer over land, may release potential

instability, a process which would be aided by outgoing radiation from cloud tops. Some northern coastal waters may be sufficiently warm in autumn to augment this effect. In addition, if the coastline orientation relative to the general wind flow is appropriate, the same boundary layer speed oscillation could result in an extra ageostrophic inflow component across the coast from land to sea at night. The effect of such orographic-topographic influence in coastal regions is discussed by Pettersen (1956, pp 205-209). While some of the above mechanisms may be of minor importance especially when the synoptic scale airflow is strong, they are not implausible when considered in relation to the thunderstorm scale. When the thunder-hour distribution at North Island stations is examined in detail an interesting feature is found. The time of occurrence of the night maximum is around midnight in the north at Kaitaia and Auckland stations but becomes progressively later towards the south. While this is consistent with progression of synoptic features, the reason for the preferential time of origin is unknown apart from the influences outlined above.

5. Conclusions

The monthly and diurnal variations of thunderstorm distribution in New Zealand show considerable spatial differences. The differences appear to result from large-scale seasonal changes in the general circulation and in the pattern of surface heating, which interact with topography and mesoscale or microscale circulations in the boundary layer to modify the potential buoyancy of air masses and cloud systems.

These are the main characteristics of the distribution:

In many coastal areas in the north and west of the country thunderstorms are most frequent in the winter or spring months. The relative frequency of occurrence is high in the night and morning hours with a primary maximum then in many places. Otherwise the diurnal maximum is in the afternoon.

Extensive areas in the east of both Islands experience relatively few thunderstorms but have a marked "summer" maximum. This is associated with a peak frequency in the afternoon while some coastal places show subsidiary maxima at night.

The pattern is more complex in the transition region and particularly in the interior of the South Island where there is a well-defined spring maximum.

Minima of thunderstorm activity occur in July, except on the west coast of the North and South Islands, and also in late summer/early autumn in many districts.

Acknowledgments

Mr S.W. Goulter carried out statistical tests on some of the data. These were helpful in assessing the significance of patterns which were found in different data samples. Final draughting of diagrams was done by Mr D. Hawthorne.

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Table 1: (a) Average monthly frequencies of thunder-hours at stations where routine observations were made, presented as the frequency per 100 observations.

(b) Average monthly frequencies of thunder-hours at Group B and Group C stations (actual values).

Values for the months with the two highest local maxima in each distribution are underlined. Average annual number of thunder-hours also given.

TABLE 1(a):

Station	J	F	M	A	M	J	J	A	S	O	N	D	Year	Annual Average
Kaitaia *	0.25	0.18	0.20	0.40	*0.50*	0.47	*0.56*	0.53	0.49	0.22	0.27	0.23	0.36	25.5
Auckland City	0.35	0.28	0.17	0.26	0.26	0.25	0.27	0.28	*0.37*	0.17	0.21	*0.53*	0.28	24.5
Auckland Airport	*0.52*	0.29	0.21	*0.38*	0.30	0.22	0.26	0.17	0.36	0.18	0.30	0.47	0.31	27.1
Rotorua *	0.57	0.38	0.29	0.14	*0.28*	0.04	0.09	0.15	0.24	0.29	0.33	*0.79*	0.30	21.6
New Plymouth *	*0.32*	0.23	0.24	0.31	*0.54*	0.25	0.35	0.29	0.24	0.12	0.19	0.30	0.28	20.4
Gisborne *	0.46	0.25	*0.35*	0.19	0.29	0.11	0.04	0.07	0.13	0.15	0.26	*0.57*	0.24	17.3
Ohakea	*0.40*	0.12	0.06	0.14	0.13	0.25	0.25	0.11	0.14	*0.28*	0.20	0.38	0.21	18.4
Paraparaumu *	0.14	0.06	0.03	0.03	0.13	0.14	*0.28*	0.12	0.09	*0.15*	*0.15*	0.11	0.12	7.5
Kelburn	0.11	*0.16*	0.03	0.05	*0.13*	0.12	0.10	0.04	0.08	0.13	0.10	0.10	0.10	8.8
Nelson *	*0.32*	0.26	0.24	0.07	0.13	0.06	0.04	0.07	*0.17*	0.08	0.19	0.28	0.16	12.6
Hokitika *	0.67	0.14	0.28	*0.76*	0.45	0.37	0.62	0.66	0.35	0.43	0.54	*0.73*	0.50	35.2
Christchurch	*0.12*	*0.12*	0.05	0.01	0.02	0.02	0.01	0.01	0.08	0.07	*0.13*	0.11	0.06	5.3
Dunedin Airport	0.45	0.04	0.03	*0.06*	0.03	0.00	0.00	0.00	0.05	0.10	0.27	*0.55*	0.13	10.6
Invercargill	0.30	0.12	0.15	0.21	0.27	*0.29*	0.14	0.04	0.10	0.17	0.26	*0.32*	0.20	17.5
Wellington Airport *	*0.07*	0.05	0.01	0.01	0.03	0.05	0.05	0.02	0.05	*0.10*	0.08	0.05	0.05	3.9
Whenuapai *	0.31	0.21	0.20	0.20	0.23	0.20	0.26	0.25	*0.27*	0.15	0.15	*0.44*	0.24	18.1
Rarotonga	*1.20*	0.88	0.71	0.71	*1.33*	0.21	0.06	0.21	0.57	0.72	0.80	0.63	0.68	66.6
Raoul Island	0.05	0.31	0.26	*0.70*	0.32	*0.82*	0.46	0.29	0.32	0.21	0.11	0.65	0.37	31.7
Chatham Islands *	*0.14*	0.03	0.00	0.18	*0.33*	0.15	0.03	0.03	*0.14*	0.05	0.09	0.05	0.10	4.8
Whitianga †	0.00	0.56	0.21	*1.15*	0.46	0.68	0.81	0.44	0.75	*0.89*	0.58	0.62	0.61	-

* Stations marked with an asterisk have a limited diurnal coverage-few or no observations, at certain evening or night hours. This results in an underestimate of total thunder-hours but should have little effect on the pattern of annual variation.

† Based on short record of 3-hourly observations.

TABLE 1: (b):

Station	J	F	M	A	M	J	J	A	S	O	N	D	Annual Average
Maungatapere	0.58	0.72	1.08	0.20	0.55	1.22	0.10	0.36	0.27	0.60	1.00	0.75	7.4
Dargaville	0.33	0.36	0.00	0.20	0.91	0.78	0.80	0.73	0.00	0.30	0.00	0.83	5.1
Otahuhu	1.33	1.18	0.58	0.90	0.81	0.89	1.00	0.81	1.45	0.90	0.92	3.00	13.0
Bombay	1.00	0.91	0.25	0.30	0.63	0.67	1.00	0.36	0.81	1.10	1.00	3.25	11.3
Hamilton	2.00	1.09	1.45	0.36	1.18	0.73	1.27	0.90	1.09	2.20	1.25	4.58	18.1
Arapuni	3.50	2.45	2.74	2.27	0.91	0.91	0.73	1.40	2.27	2.90	2.83	6.17	29.1
Whakamaru	2.50	1.18	2.00	0.73	0.36	0.55	0.09	0.60	0.73	0.90	0.92	3.33	13.9
Thames	1.75	1.36	1.82	2.09	1.82	0.55	1.09	1.00	1.18	0.90	1.58	2.67	17.8
Matamata	1.92	1.73	1.00	1.91	0.36	0.64	0.55	0.30	0.73	3.70	2.00	4.17	19.0
Tauranga	3.67	1.91	1.64	3.09	4.00	0.73	0.36	0.20	1.91	2.30	2.33	6.42	28.6
Kawerau	2.17	0.45	2.55	0.45	0.45	0.82	0.18	0.40	0.18	0.30	1.08	2.17	11.2
Ongarue	4.42	0.55	1.64	1.09	0.45	3.18	0.73	1.60	2.09	0.30	0.92	5.08	22.1
Stratford	2.75	0.42	1.83	0.42	0.55	3.73	1.08	0.64	1.73	1.40	0.33	2.00	16.9
Ohakune	4.42	1.00	1.08	0.00	0.45	0.73	0.36	0.36	0.73	0.30	0.67	2.08	12.2
Mataroa	3.58	1.08	0.58	0.25	0.27	0.73	0.18	0.00	1.09	0.80	1.33	4.83	14.7
Wanganui	3.25	0.50	0.83	0.92	0.73	2.64	0.55	0.73	1.00	0.60	0.92	3.92	16.6
Bunnythorpe	3.08	2.08	0.42	1.00	0.91	2.36	0.55	0.27	0.64	1.10	1.33	2.17	15.9
Pauatahanui	1.08	0.25	0.17	0.67	0.55	0.64	0.36	0.36	0.55	0.30	0.58	0.50	6.0
Tuai	3.27	0.50	0.42	0.18	0.42	0.27	0.09	0.18	0.82	0.91	2.33	3.58	13.0
Napier	2.73	1.50	1.08	0.27	0.73	0.00	0.00	0.36	0.36	0.82	1.75	2.83	12.4
Dannevirke	1.73	0.58	0.33	0.00	0.00	0.00	0.09	0.00	0.00	0.55	0.58	1.50	5.4
Greytown	3.64	0.92	0.58	0.00	0.09	0.36	0.00	0.36	0.09	0.55	0.75	1.33	8.7
Motupipi	1.33	1.33	0.45	0.50	1.70	1.30	0.78	1.40	0.90	0.78	1.75	0.67	12.9
Kikiwa	3.67	0.67	0.36	0.08	0.00	0.40	0.00	1.50	0.80	4.56	2.75	1.67	16.5
Blenheim	1.00	0.75	0.00	0.25	0.60	0.00	0.00	0.00	0.10	0.22	0.58	0.25	3.8
Waimangaroa	4.17	0.42	0.36	3.83	2.90	4.90	1.67	4.70	2.00	10.11	4.83	1.75	41.6
Arnold	1.08	0.42	0.33	3.08	3.27	2.09	0.91	2.36	1.45	5.08	3.92	0.17	24.2
Otira	2.42	0.08	0.09	1.00	1.09	1.45	2.18	4.91	4.27	3.83	2.17	0.33	23.8
Lake Coleridge	1.58	0.83	0.64	3.58	2.27	2.00	0.18	1.55	5.09	7.17	5.17	4.25	34.3
Lake Tekapo	3.33	0.33	0.55	1.83	1.00	0.27	0.00	1.27	1.36	4.00	3.42	0.83	18.2
Hororata	3.92	0.92	1.55	0.58	0.45	0.27	0.36	0.09	1.73	0.58	2.17	1.42	14.0
Inangahua	4.67	1.25	0.91	4.50	2.70	2.10	1.00	4.20	3.10	4.22	5.42	1.67	35.7
Ashburton	1.17	0.33	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.25	0.92	0.58	3.4
Timaru	0.67	0.25	0.27	0.00	0.09	0.00	0.00	0.00	0.36	0.08	0.50	0.25	2.5
Livingstone	1.33	0.50	0.08	0.00	0.00	0.00	0.00	0.00	0.17	0.09	1.00	0.58	3.8
Roxburgh	0.45	0.92	0.25	0.17	0.00	0.00	0.00	0.00	0.00	0.33	0.08	0.58	2.8
Gore	1.58	0.50	0.17	0.33	0.00	0.55	0.17	0.00	0.42	0.58	1.83	0.83	7.0
Whatawhata	1.50	0.92	3.00	2.92	3.33	2.75	1.67	3.67	1.75	3.58	3.33	3.00	31.7
Levin	1.32	0.82	0.36	1.14	0.68	2.87	1.00	0.95	0.82	0.91	1.00	1.05	12.5

Table 2:

HOUR	Kaitaia	Auckland City	Auckland Airport	Rotorua	New Plymouth	Gisborne	Ohakea	Paraparumu	Kelburn	Wellington Airport	Nelson	Hokitika	Christchurch	Dunedin Airport	Invercargill	Whenuapai	Rarotonga	Raoul Island
01	0.44	*0.31*	0.32	*0.36*	0.21	0.08	0.15		0.09	(0.00)		0.66	0.05	0.05	0.23	(0.23)	0.86	0.68
02	0.41	0.24	0.22	0.23	0.32	0.11	0.09		0.12	(0.04)		0.66	0.01	0.00	0.19	(0.15)	0.77	0.53
03	0.45	0.16	0.22	0.29	0.35	*0.21*	0.09	(0.04)	0.10	(0.08)	0.20	0.52	0.01	0.02	0.15	(0.14)	0.69	0.40
04	0.37	0.10	0.11	0.20	*0.41*	0.20	0.13	0.11	0.07	0.02	0.20	0.49	0.00	0.00	0.16	0.16	0.60	*0.48*
05	0.35	0.22	0.19	0.09	0.39	0.14	*0.19*	*0.20*	0.09	0.07	0.16	0.51	0.03	0.02	0.17	0.19	0.77	0.24
06	0.25	0.21	0.11	0.07	0.39	0.12	0.17	0.19	0.10	0.07	0.16	0.43	0.01	0.03	0.16	0.11	0.71	0.17
07	0.28	0.22	0.15	0.07	0.33	0.09	0.16	0.16	0.13	*0.08*	0.09	0.46	0.03	0.02	0.19	0.13	0.49	0.40
08	0.19	0.15	0.17	0.12	0.18	0.06	0.13	0.15	0.10	0.05	0.09	0.46	0.04	0.00	0.09	0.13	0.34	0.32
09	0.24	0.19	0.21	0.07	0.28	0.07	0.08	0.09	0.06	0.03	0.15	0.52	0.01	0.00	0.15	0.13	0.37	0.37
10	0.36	0.13	0.11	0.10	0.27	0.07	0.04	0.06	0.03	0.01	0.10	*0.54*	0.01	0.00	0.12	0.13	0.43	0.40
11	0.27	0.15	0.19	0.10	0.13	0.09	0.08	0.12	0.01	0.01	0.07	0.42	0.01	0.05	0.08	0.15	0.34	0.32
12	0.36	0.40	0.58	0.19	0.25	0.19	0.13	0.07	0.06	0.04	0.15	0.33	0.04	0.14	0.09	0.23	0.40	0.29
13	0.28	0.51	0.41	0.24	0.24	0.25	0.24	0.06	0.06	0.04	0.12	0.34	0.08	0.33	0.15	0.36	0.51	0.14
14	0.37	0.49	0.50	0.45	0.22	0.48	0.29	0.10	0.07	0.04	0.12	0.33	*0.17*	*0.50*	0.17	0.47	0.54	0.20
15	*0.52*	*0.67*	*0.65*	0.57	0.33	0.55	*0.52*	0.07	0.07	0.05	0.18	0.36	0.15	*0.50*	0.21	*0.51*	0.43	0.32
16	0.37	0.46	0.60	0.69	*0.39*	0.61	*0.52*	0.04	0.15	0.04	*0.28*	0.44	0.15	0.47	0.32	0.44	0.54	0.23
17	0.37	0.39	0.45	*0.81*	0.21	*0.69*	0.47	*0.18*	*0.18*	0.08	0.19	0.39	*0.17*	0.39	*0.40*	0.33	0.51	0.20
18	0.34	0.40	0.37	0.68	0.18	0.50	0.44	0.17	*0.18*	0.09	0.19	0.46	0.16	0.39	0.33	0.28	0.49	0.29
19		0.36	0.30	(0.72)	(0.15)	(0.13)	0.25	0.16	0.09	0.07	0.14		0.16	0.14	0.33	0.27	0.86	0.38
20		0.28	0.22				0.24	0.16	0.12	0.05	0.17		0.08	0.02	0.22	0.17	1.00	0.48
21		0.16	0.32				0.17	0.10	0.06	0.04	*0.21*		0.05	0.02	0.15	0.12	*1.26*	0.52
22		0.19	0.28				0.09		0.07	0.00	0.18		0.01	0.00	0.20	(0.16)	1.20	0.52
23	0.46	0.15	*0.37*	0.22	0.27	0.14	0.09		0.12	(0.00)	*0.21*	*0.98*	0.01	0.02	*0.28*	(0.14)	1.00	0.52
00	*0.55*	0.22	0.28	0.32	0.36	0.08	0.13		*0.15*	(0.07)	0.15	0.92	0.04	0.05	0.20	(*0.45*)	*1.14*	*0.75*
All	0.36	0.28	0.31	0.30	0.28	0.24	0.21	0.12	0.10	0.05	0.16	0.50	0.06	0.13	0.20	0.24	0.68	0.37

Table 2: Average hourly frequencies of thunder-hours at meteorological offices, presented as the frequency per 100 observations. The primary maximum and any distinct secondary maximum in each distribution are underlined. Values in brackets are based on incomplete coverage while blanks indicate no data available.

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93011 KAITAIA AIRPORT DATA PERIOD 02 1962 TO 12 1982

LAT 35.04S LONG 173.17E HEIGHT 80 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.20	0.56	0.67	0.36	0.45	13967
0200-0400	0.16	0.45	0.77	0.22	0.41	14767
0400-0600	0.19	0.29	0.47	0.16	0.28	15171
0600-0800	0.03	0.34	0.39	0.21	0.24	15277
0800-1000	0.16	0.31	0.52	0.29	0.32	15278
1000-1200	0.22	0.44	0.41	0.18	0.31	15262
1200-1400	0.43	0.21	0.26	0.47	0.34	15248
1400-1600	0.55	0.44	0.39	0.34	0.43	15137
1600-1800	0.21	0.30	0.46	0.36	0.34	13543
1800-2000	0.00	0.00	0.00		0.00	10
2000-2200	0.00	0.00	0.00	0.00	0.00	35
2200-0000	0.09	0.59	0.97	0.55	0.53	12076
ALL HOURS	0.22	0.39	0.52	0.31	0.36	145771

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93115 AUCKLAND CITY DATA PERIOD 08 1962 TO 12 1982

LAT 36.51S LONG 174.46E HEIGHT 45 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.30	0.30	0.19	0.24	0.25	14916
0200-0400	0.16	0.22	0.16	0.13	0.17	14916
0400-0600	0.14	0.24	0.19	0.31	0.22	14916
0600-0800	0.08	0.19	0.19	0.26	0.18	14916
0800-1000	0.16	0.14	0.29	0.13	0.18	14916
1000-1200	0.44	0.24	0.27	0.16	0.27	14915
1200-1400	0.71	0.46	0.35	0.60	0.53	14916
1400-1600	0.74	0.33	0.72	0.50	0.57	14915
1600-1800	0.74	0.22	0.37	0.24	0.39	14916
1800-2000	0.38	0.19	0.43	0.21	0.30	14915
2000-2200	0.35	0.19	0.19	0.21	0.23	14916
2200-0000	0.33	0.14	0.16	0.21	0.21	14916
ALL HOURS	0.38	0.24	0.29	0.27	0.29	178989

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93112 WHENUAPAI DATA PERIOD 01 1960 TO 12 1982

LAT 36.47S LONG 174.38E HEIGHT 26 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.32	0.15	0.22	0.07	0.19	5340
0200-0400	0.19	0.25	0.13	0.05	0.16	7073
0400-0600	0.07	0.12	0.24	0.15	0.15	16470
0600-0800	0.10	0.17	0.17	0.14	0.14	16795
0800-1000	0.02	0.21	0.24	0.05	0.13	16801
1000-1200	0.22	0.24	0.19	0.10	0.18	16801
1200-1400	0.70	0.31	0.21	0.48	0.42	16799
1400-1600	0.75	0.29	0.33	0.54	0.47	16495
1600-1800	0.52	0.27	0.22	0.22	0.31	16367
1800-2000	0.23	0.22	0.39	0.10	0.23	16347
2000-2200	0.09	0.18	0.21	0.04	0.13	10526
2200-0000	0.46	0.21	0.28	0.19	0.28	5674
ALL HOURS	0.31	0.22	0.24	0.19	0.24	161488

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93119 AUCKLAND AIRPORT DATA PERIOD 11 1965 TO 12 1982

LAT 37.01S LONG 174.48E HEIGHT 8 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.16	0.32	0.38	0.16	0.26	12523
0200-0400	0.16	0.29	0.22	0.06	0.18	12522
0400-0600	0.03	0.29	0.19	0.10	0.15	12524
0600-0800	0.06	0.10	0.19	0.29	0.16	12526
0800-1000	0.03	0.19	0.35	0.16	0.18	12526
1000-1200	0.48	0.29	0.13	0.41	0.33	12526
1200-1400	0.80	0.29	0.13	0.48	0.42	12526
1400-1600	1.09	0.48	0.26	0.76	0.65	12526
1600-1800	0.83	0.32	0.19	0.51	0.46	12526
1800-2000	0.42	0.29	0.19	0.06	0.24	12526
2000-2200	0.51	0.45	0.22	0.03	0.30	12526
2200-0000	0.48	0.35	0.26	0.22	0.33	12525
ALL HOURS	0.42	0.30	0.23	0.27	0.31	150302

Table 3: Number of thunderstorm reports per 100 hourly observations at Group A stations arranged by two-hour interval, season and year. 0000-0200 means after 0000 hours and up to 0200 hours, etc.

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93058 WHANGAREI AIRPORT DATA PERIOD 01 1967 TO 12 1974

LAT 35.46S LONG 174.22E HEIGHT 37 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.34	0.72	0.36	0.52	0.48	2282
0600-0800	0.00	0.16	0.00	0.08	0.06	5060
0800-1000	0.00	0.07	0.00	0.34	0.10	5839
1000-1200	0.14	0.27	0.14	0.28	0.21	5815
1200-1400	0.35	0.27	0.00	0.62	0.31	5819
1400-1600	0.92	0.91	0.28	0.77	0.72	5724
1600-1800	0.77	1.15	0.14	0.49	0.63	3001
1800-2000	0.00	0.00		0.00	0.00	48
2000-2200						0
2200-0000						0
ALL HOURS	0.33	0.43	0.11	0.44	0.33	33588

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93185 TAURANGA AIRPORT DATA PERIOD 01 1968 TO 12 1974

LAT 37.40S LONG 176.12E HEIGHT 4 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.15	0.46	0.16	0.15	0.23	2608
0600-0800	0.08	0.16	0.00	0.16	0.10	5109
0800-1000	0.08	0.16	0.00	0.00	0.06	5111
1000-1200	0.00	0.23	0.16	0.08	0.12	5106
1200-1400	0.16	0.54	0.16	0.24	0.27	5112
1400-1600	0.47	0.31	0.00	0.39	0.29	5114
1600-1800	0.32	0.00	0.00	0.39	0.18	5091
1800-2000	0.00	0.00	0.00	0.48	0.13	765
2000-2200	0.00	0.00		0.00	0.00	10
2200-0000						0
ALL HOURS	0.18	0.25	0.06	0.21	0.17	34026

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93172 WHAKATANE AIRPORT DATA PERIOD 01 1965 TO 12 1969

LAT 37.55S LONG 176.55E HEIGHT 6 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200		0.00			0.00	2
0200-0400						0
0400-0600	0.00	0.00	0.23	0.23	0.12	1619
0600-0800	0.11	0.00	0.00	0.22	0.08	3618
0800-1000	0.00	0.00	0.22	0.11	0.08	3564
1000-1200	0.48	0.00	0.00	0.00	0.11	3557
1200-1400	1.12	0.33	0.00	0.22	0.41	3638
1400-1600	1.78	0.56	0.33	0.55	0.79	3559
1600-1800	1.67	0.23	0.44	0.22	0.62	3536
1800-2000	0.25	0.00	0.47	0.21	0.24	1659
2000-2200	2.38	0.00	0.00	0.00	0.51	195
2200-0000	0.00	0.00	0.00	0.00	0.00	12
ALL HOURS	0.77	0.16	0.19	0.22	0.33	24959

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93243 TAUPO AIRPORT DATA PERIOD 01 1972 TO 08 1975

LAT 38.45S LONG 176.05E HEIGHT 407 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400	0.00				0.00	4
0400-0600	0.00				0.00	9
0600-0800	0.32	1.14	0.00	0.00	0.36	839
0800-1000	0.34	0.00	0.00	0.00	0.08	2526
1000-1200	0.85	0.30	0.00	0.00	0.28	2513
1200-1400	1.42	0.00	0.18	0.27	0.44	1838
1400-1600	1.17	0.19	0.19	0.97	0.58	1887
1600-1800	0.80	0.00	3.03	1.33	0.93	754
1800-2000	0.00				0.00	1
2000-2200						0
2200-0000						0
ALL HOURS	0.80	0.19	0.11	0.35	0.37	10371

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93246 ROTORUA AIRPORT DATA PERIOD 04 1964 TO 12 1982

LAT 38.07S LONG 176.19E HEIGHT 287 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.37	0.44	0.18	0.16	0.29	12733
0200-0400	0.53	0.24	0.06	0.23	0.27	12823
0400-0600	0.15	0.09	0.00	0.06	0.07	13554
0600-0800	0.09	0.09	0.09	0.12	0.10	13679
0800-1000	0.15	0.12	0.03	0.09	0.09	13698
1000-1200	0.33	0.17	0.06	0.09	0.16	13698
1200-1400	0.88	0.00	0.06	0.40	0.33	13685
1400-1600	1.24	0.41	0.11	0.72	0.61	13692
1600-1800	1.53	0.45	0.18	0.60	0.68	13261
1800-2000	2.30	0.11	0.11	1.04	0.55	2706
2000-2200	0.00	0.00	0.00	0.00	0.00	47
2200-0000	0.31	0.37	0.20	0.19	0.27	10712
ALL HOURS	0.57	0.23	0.09	0.26	0.29	134288

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93308 NEW PLYMOUTH AIRPORT DATA PERIOD 06 1968 TO 12 1982

LAT 39.01S LONG 174.11E HEIGHT 27 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.13	0.61	0.31	0.16	0.30	9876
0200-0400	0.24	0.51	0.37	0.19	0.33	10412
0400-0600	0.27	0.43	0.40	0.15	0.31	10633
0600-0800	0.12	0.47	0.43	0.11	0.28	10649
0800-1000	0.31	0.39	0.36	0.18	0.31	10654
1000-1200	0.23	0.19	0.33	0.04	0.20	10653
1200-1400	0.31	0.16	0.22	0.22	0.23	10649
1400-1600	0.62	0.19	0.18	0.48	0.37	10649
1600-1800	0.32	0.39	0.11	0.12	0.23	10028
1800-2000	0.00	0.48	0.11	0.14	0.20	3005
2000-2200	0.00	0.00	0.00	0.00	0.00	219
2200-0000	0.18	0.64	0.36	0.25	0.34	7880
ALL HOURS	0.27	0.39	0.30	0.19	0.26	105307

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93291 GISBORNE AIRPORT DATA PERIOD 02 1962 TO 12 1982

LAT 38.40S LONG 177.59E HEIGHT 4 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.03	0.27	0.09	0.00	0.10	13264
0200-0400	0.17	0.43	0.08	0.08	0.20	14330
0400-0600	0.11	0.29	0.10	0.00	0.12	15202
0600-0800	0.14	0.10	0.05	0.00	0.07	15156
0800-1000	0.03	0.18	0.05	0.00	0.07	15278
1000-1200	0.27	0.13	0.05	0.05	0.12	15267
1200-1400	0.62	0.29	0.05	0.45	0.35	15176
1400-1600	1.33	0.40	0.08	0.37	0.54	15051
1600-1800	1.23	0.38	0.19	0.56	0.56	13854
1800-2000	0.16	0.11	0.00	0.14	0.10	3045
2000-2200	1.64	0.00	0.00	2.67	1.04	289
2200-0000	0.10	0.25	0.00	0.07	0.10	11675
ALL HOURS	0.40	0.27	0.08	0.16	0.22	147587

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93401 OHAKEA DATA PERIOD 01 1960 TO 12 1982

LAT 40.12S LONG 175.23E HEIGHT 48 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.14	0.12	0.09	0.07	0.11	16794
0200-0400	0.24	0.12	0.09	0.05	0.13	16798
0400-0600	0.22	0.24	0.17	0.22	0.21	16799
0600-0800	0.10	0.07	0.17	0.26	0.15	16801
0800-1000	0.05	0.07	0.17	0.07	0.09	16802
1000-1200	0.19	0.02	0.09	0.10	0.10	16800
1200-1400	0.53	0.02	0.28	0.26	0.27	16795
1400-1600	0.75	0.31	0.40	0.45	0.48	16790
1600-1800	0.65	0.19	0.40	0.41	0.41	16801
1800-2000	0.26	0.19	0.24	0.26	0.24	16801
2000-2200	0.17	0.14	0.21	0.07	0.15	16797
2200-0000	0.05	0.09	0.26	0.07	0.12	16796
ALL HOURS	0.28	0.13	0.21	0.19	0.20	201574

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93325 WANGANUI AIRPORT DATA PERIOD 01 1965 TO 12 1969

LAT 39.58S LONG 175.01E HEIGHT 9 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600		0.00	0.00	0.00	0.00	12
0600-0800	0.00	0.00	0.00	0.67	0.16	634
0800-1000	0.00	0.00	0.00	0.13	0.03	3216
1000-1200	0.00	0.00	0.00	0.00	0.00	3592
1200-1400	0.00	0.11	0.11	0.22	0.11	3617
1400-1600	0.78	0.00	0.00	0.11	0.22	3599
1600-1800	0.49	0.25	0.00	0.12	0.21	3314
1800-2000	1.14	0.45	0.00	0.00	0.41	982
2000-2200	0.00	0.00	0.00	0.00	0.00	16
2200-0000			0.00	0.00	0.00	2
ALL HOURS	0.29	0.08	0.02	0.13	0.13	18984

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93405 PALMERSTON N AIRPORT DATA PERIOD 01 1965 TO 12 1969

LAT 40.20S LONG 175.37E HEIGHT 45 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200		0.00	0.00		0.00	5
0200-0400	0.00				0.00	2
0400-0600	0.00	0.00	0.00	0.00	0.00	23
0600-0800	0.00	0.00	0.00	0.24	0.06	1634
0800-1000	0.00	0.00	0.33	0.00	0.08	3602
1000-1200	0.00	0.00	0.11	0.00	0.03	3640
1200-1400	0.34	0.00	0.11	0.00	0.11	3637
1400-1600	0.78	0.00	0.11	0.00	0.22	3629
1600-1800	0.54	0.29	0.14	0.27	0.31	2883
1800-2000	0.34	0.00	0.00	0.00	0.08	1181
2000-2200	0.00	0.00	0.00	0.00	0.00	406
2200-0000	0.00	0.00	0.00	0.00	0.00	77
ALL HOURS	0.29	0.04	0.13	0.06	0.13	20719

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93372 NAPIER AIRPORT DATA PERIOD 01 1970 TO 12 1974

LAT 39.28S LONG 176.52E HEIGHT 2 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.00	0.00	0.00	0.00	0.00	1922
0600-0800	0.00	0.00	0.11	0.11	0.06	3541
0800-1000	0.00	0.00	0.00	0.00	0.00	3565
1000-1200	0.00	0.00	0.00	0.23	0.06	3521
1200-1400	0.11	0.23	0.11	0.23	0.17	3498
1400-1600	0.23	0.11	0.00	0.23	0.14	3565
1600-1800	0.46	0.00	0.00	0.00	0.12	3477
1800-2000	0.00	0.00	0.00	0.00	0.00	329
2000-2200	0.00	0.00	0.00	0.00	0.00	52
2200-0000	0.00	0.00	0.00	0.00	0.00	7
ALL HOURS	0.12	0.05	0.03	0.12	0.08	23477

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93514 WESTPORT AIRPORT DATA PERIOD 01 1970 TO 12 1974

LAT 41.44S LONG 171.35E HEIGHT 2 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.00	0.00	0.00	0.00	0.00	33
0600-0800	0.69	0.48	0.71	0.00	0.47	1669
0800-1000	0.28	0.58	0.29	0.44	0.40	2779
1000-1200	0.00	0.26	0.67	0.40	0.32	3086
1200-1400	0.12	0.00	0.63	0.00	0.19	3215
1400-1600	0.13	0.00	0.26	0.40	0.20	3062
1600-1800	0.00	0.00	0.00	0.32	0.08	1276
1800-2000	0.00	0.00		0.00	0.00	14
2000-2200		0.00			0.00	1
2200-0000						0
ALL HOURS	0.18	0.21	0.46	0.27	0.28	15155

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93417 PARAPARAUMU AIRPORT DATA PERIOD 02 1962 TO 12 1982

LAT 40.54S LONG 174.59E HEIGHT 7 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.00	0.00	0.00	0.00	0.00	1024
0200-0400	0.11	0.11	0.07	0.15	0.11	11090
0400-0600	0.24	0.05	0.26	0.18	0.18	15194
0600-0800	0.08	0.08	0.26	0.16	0.14	15275
0800-1000	0.00	0.10	0.13	0.08	0.08	15277
1000-1200	0.03	0.05	0.23	0.05	0.09	15269
1200-1400	0.05	0.00	0.13	0.13	0.08	15235
1400-1600	0.00	0.03	0.18	0.05	0.07	15230
1600-1800	0.24	0.19	0.13	0.14	0.17	13951
1800-2000	0.27	0.00	0.10	0.27	0.16	7649
2000-2200	0.08	0.15	0.17	0.19	0.15	4726
2200-0000	0.00	0.00	0.00	0.00	0.00	208
ALL HOURS	0.10	0.07	0.17	0.13	0.12	130128

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93436 WELLINGTON AIRPORT DATA PERIOD 01 1960 TO 12 1982

LAT 41.20S LONG 174.49E HEIGHT 6 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.06	0.06	0.00	0.00	0.03	6777
0200-0400	0.10	0.00	0.04	0.14	0.07	11501
0400-0600	0.05	0.05	0.07	0.07	0.06	16790
0600-0800	0.00	0.02	0.09	0.12	0.06	16800
0800-1000	0.00	0.00	0.07	0.00	0.02	16798
1000-1200	0.02	0.00	0.05	0.02	0.02	16799
1200-1400	0.00	0.07	0.00	0.10	0.04	16802
1400-1600	0.07	0.00	0.00	0.10	0.04	16802
1600-1800	0.19	0.00	0.05	0.10	0.08	16800
1800-2000	0.05	0.02	0.00	0.14	0.05	16799
2000-2200	0.06	0.05	0.00	0.03	0.03	14571
2200-0000	0.10	0.05	0.05	0.11	0.08	7853
ALL HOURS	0.06	0.02	0.04	0.08	0.05	175092

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93434 KELBURN, WELLINGTON DATA PERIOD 02 1962 TO 12 1982

LAT 41.17S LONG 174.46E HEIGHT 125 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.11	0.13	0.13	0.08	0.11	15277
0200-0400	0.11	0.08	0.13	0.10	0.10	15278
0400-0600	0.13	0.05	0.10	0.05	0.09	15278
0600-0800	0.03	0.03	0.21	0.16	0.10	15277
0800-1000	0.03	0.03	0.08	0.03	0.04	15278
1000-1200	0.03	0.03	0.03	0.05	0.03	15278
1200-1400	0.08	0.05	0.00	0.13	0.07	15278
1400-1600	0.30	0.03	0.05	0.08	0.11	15278
1600-1800	0.43	0.10	0.08	0.16	0.19	15278
1800-2000	0.13	0.13	0.00	0.16	0.10	15277
2000-2200	0.05	0.10	0.08	0.08	0.08	15275
2200-0000	0.11	0.23	0.10	0.13	0.14	15274
ALL HOURS	0.13	0.08	0.08	0.10	0.10	183326

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93545 NELSON AIRPORT DATA PERIOD 02 1962 TO 12 1982

LAT 41.17S LONG 173.14E HEIGHT 2 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.40	0.00	0.00	0.66	0.28	3544
0200-0400	0.27	0.08	0.05	0.32	0.18	15012
0400-0600	0.16	0.16	0.10	0.18	0.15	15272
0600-0800	0.11	0.13	0.05	0.05	0.09	15276
0800-1000	0.19	0.16	0.05	0.08	0.12	15276
1000-1200	0.19	0.16	0.03	0.10	0.12	15278
1200-1400	0.27	0.08	0.03	0.08	0.11	15277
1400-1600	0.51	0.21	0.08	0.10	0.22	15278
1600-1800	0.46	0.21	0.00	0.11	0.19	15209
1800-2000	0.37	0.11	0.06	0.09	0.15	13295
2000-2200	0.22	0.28	0.07	0.22	0.20	11162
2200-0000	0.35	0.15	0.06	0.19	0.19	12667
ALL HOURS	0.28	0.15	0.05	0.15	0.16	162546

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93577 BLENHEIM AIRPORT DATA PERIOD 01 1970 TO 12 1974

LAT 41.31S LONG 173.52E HEIGHT 27 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.00	0.00	0.00	0.74	0.29	349
0200-0400	0.00	0.00	0.00	0.00	0.00	337
0400-0600	0.00	0.00	0.00	0.00	0.00	2153
0600-0800	0.11	0.00	0.00	0.00	0.03	3639
0800-1000	0.11	0.00	0.11	0.00	0.05	3644
1000-1200	0.00	0.00	0.00	0.00	0.00	3641
1200-1400	0.00	0.00	0.00	0.00	0.00	3645
1400-1600	0.11	0.00	0.11	0.00	0.06	3636
1600-1800	0.00	0.00	0.00	0.00	0.00	3544
1800-2000	0.00	0.00	0.00	0.00	0.00	1715
2000-2200	0.00	1.40	0.00	0.00	0.33	609
2200-0000	0.00	0.00	0.00	0.00	0.00	189
ALL HOURS	0.05	0.03	0.03	0.01	0.03	27101

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93772 TIMARU AIRPORT DATA PERIOD 01 1970 TO 12 1974

LAT 44.18S LONG 171.14E HEIGHT 26 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.00	0.00	0.00	0.00	0.00	387
0600-0800	0.00	0.00	0.00	0.00	0.00	3648
0800-1000	0.00	0.00	0.00	0.00	0.00	3652
1000-1200	0.00	0.00	0.00	0.00	0.00	3651
1200-1400	0.11	0.00	0.00	0.00	0.03	3650
1400-1600	0.55	0.11	0.00	0.11	0.19	3651
1600-1800	0.45	0.00	0.00	0.67	0.28	3623
1800-2000	0.43	0.00	0.00	0.00	0.09	2167
2000-2200	0.00	0.00	0.00	0.00	0.00	64
2200-0000	0.00			0.00	0.00	9
ALL HOURS	0.20	0.02	0.00	0.11	0.08	24502

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93585 THE BROTHERS LIGHT DATA PERIOD 01 1970 TO 12 1974

LAT 41.06S LONG 174.27E HEIGHT 66 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400	0.00			0.00	0.00	49
0400-0600	0.00	0.00	0.27	0.00	0.07	3004
0600-0800	0.00	0.13	0.00	0.00	0.03	3090
0800-1000	0.00	0.00	0.25	0.00	0.06	3103
1000-1200	0.13	0.00	0.00	0.00	0.03	3073
1200-1400	0.00	0.00	0.00	0.13	0.03	3109
1400-1600	0.14	0.00	0.00	0.13	0.07	3050
1600-1800	0.00	0.00	0.00	0.26	0.07	1536
1800-2000						0
2000-2200						0
2200-0000						0
ALL HOURS	0.04	0.02	0.08	0.06	0.05	20014

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93795 OAMARU AIRPORT DATA PERIOD 01 1970 TO 12 1974

LAT 44.58S LONG 171.05E HEIGHT 30 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200						0
0200-0400						0
0400-0600	0.00	0.00	0.00	0.00	0.00	545
0600-0800	0.00	0.00	0.00	0.00	0.00	3292
0800-1000	0.00	0.00	0.00	0.22	0.06	3590
1000-1200	0.12	0.00	0.00	0.00	0.03	3587
1200-1400	0.66	0.29	0.00	0.14	0.26	2739
1400-1600	0.13	0.12	0.25	0.37	0.22	3166
1600-1800	0.39	0.11	0.00	0.12	0.15	3279
1800-2000	0.24	0.00	0.00	0.00	0.05	1981
2000-2200	0.00	0.00	0.00	0.00	0.00	9
2200-0000	0.00				0.00	1
ALL HOURS	0.19	0.07	0.03	0.13	0.10	22189

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93614 HOKITIKA AIRPORT DATA PERIOD 11 1963 TO 12 1982

LAT 42.43S LONG 170.59E HEIGHT 39 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.44	0.56	0.79	0.84	0.65	11764
0200-0400	0.36	0.68	0.50	0.68	0.55	13343
0400-0600	0.52	0.78	0.20	0.72	0.55	13864
0600-0800	0.52	0.77	0.49	0.23	0.50	13963
0800-1000	0.57	0.57	0.66	0.40	0.55	13998
1000-1200	0.37	0.43	0.43	0.17	0.35	13979
1200-1400	0.44	0.32	0.46	0.11	0.33	13833
1400-1600	0.45	0.27	0.59	0.29	0.40	13482
1600-1800	0.53	0.35	0.54	0.29	0.43	12218
1800-2000	0.00	0.00	0.00	0.00	0.00	25
2000-2200	0.00	0.00	0.00	0.00	0.00	18
2200-0000	1.11	0.82	0.90	1.04	0.97	10586
ALL HOURS	0.53	0.55	0.54	0.46	0.52	131113

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93780 CHRISTCHURCH AIRPORT DATA PERIOD 01 1960 TO 12 1982

LAT 43.29S LONG 172.32E HEIGHT 30 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.10	0.02	0.00	0.00	0.03	16802
0200-0400	0.02	0.00	0.00	0.00	0.01	16801
0400-0600	0.02	0.00	0.02	0.02	0.02	16802
0600-0800	0.02	0.00	0.05	0.05	0.03	16802
0800-1000	0.07	0.00	0.00	0.00	0.02	16802
1000-1200	0.07	0.00	0.00	0.05	0.03	16802
1200-1400	0.31	0.00	0.05	0.14	0.12	16802
1400-1600	0.29	0.12	0.00	0.17	0.14	16802
1600-1800	0.29	0.12	0.00	0.31	0.18	16802
1800-2000	0.24	0.07	0.05	0.19	0.14	16802
2000-2200	0.05	0.00	0.00	0.07	0.03	16802
2200-0000	0.07	0.02	0.00	0.02	0.03	16802
ALL HOURS	0.13	0.03	0.01	0.09	0.06	201623

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93677 KAIKOURA DATA PERIOD 01 1964 TO 12 1982

LAT 42.25S LONG 173.42E HEIGHT 108 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.00	0.00	0.00		0.00	3
0200-0400	0.00		0.00		0.00	3
0400-0600	0.00	0.08	0.08	0.00	0.04	5588
0600-0800	0.00	0.00	0.00	0.00	0.00	11562
0800-1000	0.00	0.00	0.00	0.00	0.00	13865
1000-1200	0.15	0.03	0.00	0.09	0.07	13826
1200-1400	0.41	0.00	0.00	0.26	0.17	13590
1400-1600	0.83	0.00	0.00	0.24	0.27	13540
1600-1800	0.63	0.19	0.00	0.17	0.23	11854
1800-2000			0.00		0.00	1
2000-2200						0
2200-0000			0.00		0.00	2
ALL HOURS	0.30	0.04	0.00	0.12	0.12	83834

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93844 INVERCARGILL AIRPORT DATA PERIOD 01 1960 TO 12 1982

LAT 46.25S LONG 168.20E HEIGHT 0 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.22	0.12	0.35	0.17	0.21	16800
0200-0400	0.19	0.19	0.17	0.24	0.20	16799
0400-0600	0.14	0.12	0.19	0.33	0.20	16796
0600-0800	0.10	0.21	0.14	0.19	0.16	16800
0800-1000	0.10	0.21	0.07	0.24	0.15	16801
1000-1200	0.07	0.21	0.05	0.07	0.10	16802
1200-1400	0.24	0.19	0.12	0.17	0.18	16801
1400-1600	0.41	0.26	0.24	0.33	0.31	16802
1600-1800	0.72	0.26	0.19	0.33	0.38	16800
1800-2000	0.55	0.29	0.09	0.19	0.28	16525
2000-2200	0.18	0.26	0.17	0.24	0.21	16525
2200-0000	0.22	0.19	0.28	0.33	0.26	16799
ALL HOURS	0.26	0.21	0.17	0.24	0.22	201050

TABLE 3

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93890 DUNEDIN AIRPORT DATA PERIOD 11 1962 TO 12 1982

LAT 45.56S LONG 170.12E HEIGHT 1 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.03	0.03	0.00	0.03	0.02	14626
0200-0400	0.00	0.03	0.00	0.00	0.01	14626
0400-0600	0.00	0.03	0.00	0.05	0.02	14629
0600-0800	0.03	0.00	0.00	0.00	0.01	14628
0800-1000	0.00	0.00	0.00	0.00	0.00	14631
1000-1200	0.25	0.03	0.00	0.05	0.08	14634
1200-1400	1.09	0.08	0.00	0.38	0.39	14632
1400-1600	1.17	0.08	0.00	0.62	0.47	14630
1600-1800	1.10	0.19	0.00	0.33	0.40	14588
1800-2000	0.35	0.15	0.00	0.08	0.14	13883
2000-2200	0.04	0.07	0.00	0.00	0.03	10852
2200-0000	0.08	0.03	0.00	0.00	0.03	14627
ALL HOURS	0.35	0.06	0.00	0.13	0.14	170986

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93997 RAOUL IS DATA PERIOD 11 1970 TO 12 1982

LAT 29.15S LONG 177.55W HEIGHT 38 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.18	0.73	1.09	0.26	0.56	4442
0200-0400	0.28	0.75	0.41	0.21	0.41	5841
0400-0600	0.14	0.34	0.14	0.13	0.19	5942
0600-0800	0.30	0.42	0.48	0.12	0.33	6624
0800-1000	0.43	0.33	0.22	0.48	0.36	7425
1000-1200	0.43	0.22	0.33	0.16	0.28	7428
1200-1400	0.37	0.05	0.38	0.00	0.20	7426
1400-1600	0.44	0.27	0.43	0.00	0.29	7281
1600-1800	0.38	0.33	0.27	0.11	0.27	7349
1800-2000	0.45	0.54	0.45	0.26	0.42	4492
2000-2200	0.28	0.54	0.82	0.34	0.50	7237
2200-0000	0.33	0.65	1.14	0.33	0.61	7326
ALL HOURS	0.34	0.41	0.50	0.20	0.36	78813

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93986 WAITANGI, CHATHAM IS DATA PERIOD 12 1970 TO 12 1982

LAT 43.57S LONG 176.34W HEIGHT 44 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.00	0.00	0.00	0.00	0.00	200
0200-0400		0.00	0.00	0.00	0.00	21
0400-0600	0.00	0.11	0.11	0.00	0.04	4570
0600-0800	0.00	0.22	0.00	0.11	0.08	7429
0800-1000	0.05	0.27	0.11	0.11	0.13	7428
1000-1200	0.10	0.00	0.05	0.22	0.09	7429
1200-1400	0.26	0.11	0.05	0.11	0.13	7430
1400-1600	0.05	0.33	0.11	0.11	0.15	7430
1600-1800	0.00	0.17	0.05	0.06	0.08	6578
1800-2000	0.00	0.00	0.00	0.00	0.00	32
2000-2200	0.00	0.00	0.00	0.00	0.00	193
2200-0000	0.00	0.00	0.00	0.00	0.00	257
ALL HOURS	0.07	0.17	0.07	0.11	0.10	48997

NUMBER OF THUNDERSTORM REPORTS PER 100 HOURLY OBSERVATIONS

STATION 93843 RAROTONGA AIRPORT DATA PERIOD 12 1970 TO 12 1982

LAT 21.11S LONG 159.48W HEIGHT 7 METRES

TIME(NZST)	SUMMER	AUTUMN	WINTER	SPRING	YEAR	TOTAL OBS USED
0000-0200	0.67	1.52	0.11	0.88	0.79	7430
0200-0400	0.88	0.76	0.22	0.71	0.65	7430
0400-0600	1.14	0.92	0.22	0.60	0.73	7430
0600-0800	0.62	0.27	0.22	0.49	0.40	7430
0800-1000	0.62	0.43	0.33	0.16	0.39	7430
1000-1200	0.57	0.33	0.22	0.33	0.36	7430
1200-1400	1.14	0.33	0.11	0.38	0.50	7430
1400-1600	0.83	0.76	0.05	0.22	0.47	7429
1600-1800	0.93	0.54	0.11	0.49	0.52	7429
1800-2000	0.78	1.69	0.05	1.15	0.92	7426
2000-2200	1.56	1.90	0.16	0.99	1.16	7428
2200-0000	1.14	1.58	0.16	1.15	1.01	7430
ALL HOURS	0.91	0.92	0.16	0.63	0.66	89152