NEW ZEALAND METEOROLOGICAL OFFICE CIRCULAR NOTE NO 9.

BAROMETRIC TENDENCY TABLES.

by
F/Lt. C.J. Seelye.

A stage has been reached in the extension of our knowledge concerning average barometric tendencies in New Zealand and surrounding areas when sufficient information is available to provide useful tables for the forecaster. The available data are derived from the following sources:-

(a) Tabulations of hourly pressure values for Auckland, Ohakea and Wigram.

(b) Meteorological Office Note. No. 23 for Wellington.

(c) For five New Zealand stations, viz., Cape Reinga, Gisborne, Farewell Spit, Greymouth and Puysegur Point as well as for Norfolk, Kermadec and Chatham Islands, barograph charts from which Dr. F. Bondy has directly tabulated the tendencies.

(d) Mean hourly pressure values for Apia as published in the Annual Reports of the Apia Observatory.

(e) Three hourly pressure means for the Australian State Capitals supplied by the Commonwealth Bureau.

Previously, tables for some of the foregoing stations have been circulated within the New Zealand Meteorological Service, but the present values should be regarded as superceding the former as in several cases the period of the records has been extended and, furthermore, the seasonal means have been re-checked to the nearest tenth millibar against the original figures. The values here given represent the contribution to the tendency arising from the pure cyclic diurnal variation of pressure, all non-cyclic changes having been eliminated from these averages.

Table 1 contains the mean tendencies for each of the four seasons for 19 stations at three hourly intervals in New Zealand Mean Time or appropriate zone time

To derive results closer to the synoptic hours and, in part, to obviate difficulties caused by departures from simultaneity in the stations reports it has been thought advisable to re-estimate the tendencies. The necessary adjustments were effected graphically from the curves showing the daily march of pressure, such curves being readily traceable from the information contained in Table 1. For example, taking the midnight pressure as base point and denoting tendencies by "t" with suffixes to indicate the time, we plot t_{03} at 03 hours; $(t_{03} + t_{06})$ at 06 hours; etc; until finally $(t_{03} + t_{06} + t_{09} + t_{12} + t_{15} + t_{18} + t_{21} + t_{24})$ at 24 hours, but as this is zero for a pure cyclic we are brought back to the base line. From the resulting curve the tendencies at any desired time may easily be read off. The general similarity of the curves obtained is a confirmation that the present data are sufficient to give reasonably reliable means.

Tables 2 (A - D), one for each season, set out the approximate mean tendencies, as deduced from such graphs, appropriate to each of the main synoptic maps for 00, 03, 06, etc. G.M.T. The continuance of summer time in New Zealand has been assumed and allowances have been made for conditions existing in July, 1942, but it should be noted that some stations may be subject to irregularities by as much as 30 minutes in these observing times. The Apia reporting times have been taken as being at 01, 06, 11½ and 19 G.M.T., and the Norfolk and Australian times as a three hourly sequence commencing at 02 G.M.T. (= 10½ Norfolk Time, or 09 Eastern Australian Time). For Perth, however, the sequences commence at 24 G.M.T. (= 08 Western Australian Time). Alternative

Australian values are given on the assumption of reports a half hour earlier than the above during the operation of Summer time within Australia.

From such tables reported tendencies can be adjusted to eliminate the normal diurnal change and the revised value used to indicate the development and movement of pressure and frontal systems either in a qualitative manner or by arithmetical computation using Petterssen's or similar rules.

It should be mentioned that on meteorologically quiet days the march of pressure may deviate markedly from the average. The dominant feature of all the variations is the 12-hourly component which is very regular from day to day; but the 24-hourly component which, for the nineteen stations considered has an average amplitude about 60% of that of the 12-hourly component, is very largely dependent on the local weather, being as a rule better developed on clear days than on dull. Moreover, this 24-hourly component is greatly reinforced over the Australian Continent where large diurnal variations of temperature produce corresponding changes in pressure. While we have no precise data on the three-hourly tendencies within Australia, the pronounced continentality of the pressure fluctuations is clearly shown in the tables and diagrams of the Commonwealth Bureau of Meteorology Publication on "Mean Diurnal Variations of Corrected Mean Sea Level Pressures in 1/1000 inches. From 0900 to 1500 hrs. and from 0900 to 2100 hrs. (Local Time)." The six-hourly period 0900-1500 hrs. is that normally of greatest change, 0900 hrs. being close to the primary maximum and 2100 hrs. being close to the lowest minimum. An extreme case is exemplified by Charleville, Southern Queensland, where the average barometer fall over this period amounts to 4·8 millibars equivalent to two consecutive tendencies of approximately -24 each.

Supplement to N.Z. Meteorological Office Circular Note No. 9

By F/Lt. C.J. Seelye.

In the issue of Barometer Tendency Tables last July an advance of 30 minutes was assumed for Australian Summer time. As, however, a full hour change has been adopted the following revision is given for the present Summer time system. These values will therefore, replace the original footnotes to Tables 2a, 2b, and 2c.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR)

DURING AUSTRALIAN SUMMER TIME (1 HOUR) ONLY.

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
				SPRING.					
Brisbane	+10	-3	-21	-4	+15	+9	-7	+1	
Sydney	+10	-8	-12	-4	+14	+7	-7	0	
Melbourne	+10	-7	-11	-2	+14	+3	-9	+2	
Hobart	+ 7	-10	-10	+5	+12	+4	-8	0	
Adelaide	+11	- 2	-13	-4	+13	+6	-9	-2	
Perth	+ 4	+ 9	- 6	-10	- 2	+10	+2	-7	
				SUMMER.					
Brisbane	+9	-2	-14	-6	+13	+ 9	-10	+1	
Sydney	+7	-2	-11	-6	+12	+ 7	- 7	0	
Melbourne	+10	-6	- 9	-5	+12	+ 3	-9	+4	
Hobart	+5	-6	-7	-2	+12	+ 3	-8	+3	
Adelaide	+11	-2	-12	-9	+11	+ 8	-8	+1	
Perth	+8	+9	-8	-12	- 5	+10	+4	-6	
				AUTUMN.					
Brisbane	+11	0	-20	-2	+13	+8	-8	-2	
Sydney	+10	-3	-12	-4	+10	+6	-6	-1	
Melbourne	+10	-4	-12	-0	+10	+2	-6	0	
Hobart	+ 8	-6	- 9	+1	+11	+1	-6	0	
Adelaide	+10	0	-13	-5	+10	+6	-6	-2	
Perth	+ 2	+9	- 4	-13	- 3	+11	+3	-5	

Corrections are required for Perth where observations during normal times are made at 09 W.A.T. (01 G.M.T.) and not at 08 W.A.T. as stated previously. The following values should be substituted for those appearing in Table 2.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR)

PERTH.

(Normal reportingtimes other than during Summer Time)

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
Spring	+ 7	+ 7	-10	-10	+5	+10	-4	-5	
Summer	+10	+ 5	-10	-12	0	+11	-1	-3	
Autumn	+ 4	+10	-11	-12	+4	+10	-3	-2	
Winter	+ 1	+10	- 8	-11	+7	+ 8	-3	-4	

TABLE 1.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR) AT THREE HOURLY INTERVALS.

(G + 11½ Hrs.)	Hour	00	03	06	09	12	15	18	21
Cape Reinga (6 yrs).	Spring	+3	−5	+1	+9	−3	−10	−2	+7
	Summer	+4	−5	+2	+8	−3	−8	−7	+9
	Autumn	+2	−3	−1	+8	−3	−10	−1	+8
	Winter	+2	−3	−1	+10	−4	−11	+1	+6
Auckland (4½ yrs).	Spring	−1	−6	+5	+6	−7	−10	+4	+9
	Summer	−2	−7	+6	+4	−4	−8	0	+11
	Autumn	−1	−5	+1	+8	−7	−9	+4	+9
	Winter	−1	−4	+1	+9	−8	−9	+6	+6
Gisborne (3 yrs).	Spring	−2	−7	+5	+5	−5	−8	+4	+8
	Summer	0	−7	+3	+4	−4	−7	0	+11
	Autumn	0	−5	+1	+7	−5	−7	+3	+6
	Winter	−2	−5	+1	+7	−8	−5	+8	+4
Ohakea (2½ yrs).	Spring	−1	−6	+4	+6	−8	−8	+5	+8
	Summer	−2	−6	+4	+4	−4	−7	0	+11
	Autumn	−1	−4	+1	+8	−7	−7	+3	+7
	Winter	0	−3	0	+10	−8	−9	+5	+5
Wellington (24½ yrs).	Spring	−2	−5	+5	+4	−5	−6	+3	+6
	Summer	−2	−5	+5	+3	−4	−6	+0	+9
	Autumn	−1	−4	+2	+6	−6	−5	+3	+5
	Winter	−1	−4	+2	+7	−7	−5	+5	+3
Farewell S. (5 yrs).	Spring	+4	0	+1	+4	−2	−8	−3	+4
	Summer	+5	0	+1	+5	−1	−7	−6	+3
	Autumn	+4	0	0	+5	0	−8	−4	+3
	Winter	+3	−1	0	+5	−1	−8	−1	+3
Greymouth (6 yrs).	Spring	+3	−3	−1	+7	−2	−8	−2	+6
	Summer	+3	−4	0	+6	−1	−4	−5	+5
	Autumn	+3	−2	−2	+7	0	−8	−3	+5
	Winter	+2	−1	−1	+7	−1	−10	0	+4
Wigram Christchurch (5½ yrs).	Spring	−2	−5	+4	+5	−6	−8	+3	+9
	Summer	−2	−6	+4	+4	−5	−6	0	+11
	Autumn	0	−4	+1	+8	−6	−10	+3	+8
	Winter	0	−4	0	+9	−5	−9	+5	+4
Puysegur Point (5 yrs).	Spring	+2	−3	−1	+6	−3	−6	0	+5
	Summer	+2	−4	−1	+5	−2	−4	−2	+6
	Autumn	+1	−3	−2	+6	−1	−6	+1	+4
	Winter	+1	−2	−2	+5	−2	−7	+3	+4
Chatham Island (5½ yrs).	Spring	+1	−2	−1	+3	−3	−5	+1	+6
	Summer	+3	−3	0	+3	−2	−4	−3	+6
	Autumn	+1	−2	0	+4	−2	−5	0	+4
	Winter	+2	−1	0	+4	−4	−6	+2	+3

TABLE 1 (CONTD).

	Hour	00	03	06	09	12	15	18	21
Kermadecs (3 yrs). (G + 11½ Hrs).	Spring	-1	-8	+4	+4	-8	-8	+7	+10
	Summer	0	-9	+4	+2	-6	-7	+3	+13
	Autumn	0	-5	0	+8	-8	-9	+5	+9
	Winter	-1	-5	+2	+9	-10	-8	+7	+6
Norfolk Island (4 1/3 Yrs). (G + 11½ Hrs).	Spring	+1	-8	0	+9	-3	-12	+1	+12
	Summer	+2	-9	+1	+7	-2	-9	-3	+13
	Autumn	+1	-6	-2	+10	-3	-13	+2	+11
	Winter	+1	-4	-3	+10	-3	-14	+3	+10
Apia (13 yrs). (G-11½ Hrs).	Spring	+1	-7	+5	+9	-12	-14	+5	+13
	Summer	+2	-8	+5	+7	-9	-13	+3	+13
	Autumn	+1	-7	+3	+11	-12	-15	+5	+14
	Winter	+1	-5	+3	+11	-12	-16	+5	+13
Brisbane (G + 10 Hrs)	Spring	+4	-9	+8	+8	-11	-23	+10	+13
	Summer	+3	-12	+8	+7	-7	-18	+5	+14
	Autumn	+2	-10	+3	+12	-9	-20	+10	+12
	Winter	+3	-7	+2	+11	-10	-23	+12	+12
Sydney (G + 10 Hrs)	Spring	0	-7	+6	+6	-10	-13	+5	+13
	Summer	0	-8	+6	+5	-6	-11	0	+14
	Autumn	0	-6	+3	+9	-8	-12	+4	+10
	Winter	+1	-4	+2	+9	-9	-13	+5	+9
Melbourne (G + 10 Hrs)	Spring	-3	-8	+7	+6	-10	-11	+7	+12
	Summer	-4	-8	+9	+6	-8	-10	+2	+13
	Autumn	-2	-6	+5	+10	-10	-12	+6	+9
	Winter	-1	-4	+2	+10	-10	-10	+6	+7
Hobart (G + 10 Hrs)	Spring	-3	-7	+5	+2	-11	-8	+10	+12
	Summer	-4	-7	+7	+1	-7	-7	+4	+13
	Autumn	-3	-5	+3	+7	-10	-9	+8	+9
	Winter	-2	-4	+1	+7	-8	-9	+8	+7
Adelaide (G + 09½ Hrs).	Spring	-4	-8	+7	+8	-11	-11	+6	+13
	Summer	-3	-8	+10	+7	-9	-13	+2	+14
	Autumn	-2	-6	+5	+10	-10	-13	+6	+10
	Winter	-2	-4	+1	+10	-9	-12	+7	+9
Perth (G + 08 Hrs).	Spring	-4	-5	+7	+7	-10	-10	+5	+10
	Summer	-1	-3	+10	+5	-10	-12	0	+11
	Autumn	-3	-2	+4	+10	-11	-12	+4	+10
	Winter	-3	-4	+1	+10	-8	-11	+7	+8

TABLE 2A.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR.)

SPRING (Sept. Oct. Nov).

Approximately corrected to present reporting times, July, 1942.

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
C. Reinga	+1	-10	-5	+6	+6	-5	-2	+9	
Auckland	-4	-10	0	+9	+2	-6	+2	+7	
Gisborne	-3	-8	0	+8	+2	-7	+1	+7	
Ohakea	-5	-9	+1	+8	+2	-5	+1	+7	
Wellington	-3	-6	-1	+6	+1	-4	+1	+6	
Farewell S.	0	-7	-6	+3	+4	+2	-1	+5	
Greymouth	0	-8	-4	+6	+4	-3	-2	+7	
Christchurch	-3	-8	-2	+8	+3	-5	0	+7	
Puysegur Point	0	-6	-2	+4	+3	-2	-2	+5	
Chatham Is.	+1	-6	-3	+6	+4	-2	-2	+2	
Kermadec Is.	-7	-8	+3	+10	+3	-8	0	+7	
Norfolk Is.	+5	-9	-9	+9	+9	-6	-7	+8	
Apia	-14	..	+8	..	+1	..	+8	..	
Brisbane	+8	-11	-23	+10	+13	+4	-9	+8	
Sydney	+6	-10	-13	+5	+13	0	-7	+6	
Melbourne	+6	-10	-11	+7	+12	-3	-8	+7	
Hobart	+2	-11	-8	+10	+12	-3	-7	+5	
Adelaide	+10	-8	-12	+3	+13	-1	-8	+3	
Perth	+9	-6	-10	-2	+10	+2	-7	+4	
Brisbane	+9	-6	-25	+5	+14	+7	-9	+5	(During
Sydney	+9	-10	-12	+1	+13	+4	-8	+3	(Australian
Melbourne	+8	-8	-12	+3	+14	-1	-8	+4	(Summer
Hobart	+6	-11	-10	+8	+12	+1	-8	+2	(Time
Adelaide	+11	-6	-12	-1	+13	+3	-9	+1	(Only.
Perth	+9	-3	-11	-5	+11	+4	-7	+2	

TABLE 2B.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR).

SUMMER (Dec. Jan. Feb.)

(Approximately corrected to present reporting times, July, 1942.

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
C. Reinga	0	-8	-8	+6	+7	-5	0	+8	
Auckland	-2	-8	-3	+10	+3	-8	+2	+6	
Gisborne	-2	-7	-3	+10	+4	-7	0	+5	
Ohakea	-2	-7	-4	+10	+3	-6	0	+6	
Wellington	-3	-6	-3	+8	+3	-5	+1	+5	
Farewell S.	+2	-6	-7	-1	+6	+2	-1	+5	
Greymouth	+1	-4	-5	+3	+4	-3	-1	+5	
Christchurch	-4	-6	-4	+9	+4	-6	-1	+8	
Puysegur Point.	-1	-4	-3	+5	+4	-3	-3	+5	
Chatham Is.	0	-4	-4	+3	+6	-2	-2	+3	
Kermadec Is.	-6	-7	-1	+11	+5	-7	0	+5	
Norfolk Is.	+4	-7	-8	+6	+10	-5	-6	+6	
Apia	-13	..	+6	..	+2	..	+9	..	
Brisbane	+7	-7	-18	+5	+14	+3	-12	+8	
Sydney	+5	-6	-11	0	+14	0	-8	+6	
Melbourne	+6	-8	-10	+2	+13	-4	-8	+9	
Hobart	+1	-7	-7	+4	+13	-4	-7	+7	
Adelaide	+9	-7	-13	-2	+14	0	-9	+8	
Perth	+9	-8	-12	-5	+10	+4	-6	+8	
Brisbane	+8	-4	-16	-1	+13	+7	-11	+4	During Australian Summer Time Only.
Sydney	+7	-4	-11	-4	+13	+4	-8	+3	
Melbourne	+8	-8	-9	-1	+12	0	-9	+7	
HOBART	+4	-7	-7	+1	+12	0	-8	+5	
Adelaide	+10	-5	-12	-5	+12	+5	-9	+4	
Perth	+8	+2	-11	-4	+10	+3	-4	-4	

TABLE 2C.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR.

AUTUMN (Mar. Apr. May).

Approximately corrected to present reporting times, July, 1942.

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
C. Reinga	0	-10	-4	+7	+4	-2	-2	+7	
Auckland	-4	-10	0	+10	+2	-5	-1	+8	
Gisborne	-2	-7	-1	+6	+3	-5	-1	+7	
Ohakea	-3	-8	-1	+8	+1	-4	-1	+8	
Wellington	-2	-7	0	+5	+2	-4	-1	+7	
Farewell S.	+3	-7	-6	+1	+5	+1	-1	+4	
Greymouth	+3	-8	-6	+5	+4	-1	-3	+6	
Christchurch	-1	-10	-3	+8	+5	-5	-2	+8	
Puysegur Point	+1	-5	-2	+4	+2	-2	-3	+5	
Chatham Is.	+2	-5	-3	+4	+3	-2	-2	+3	
Kermadec Is.	-5	-9	+2	+9	+3	-5	-3	+8	
Norfolk Is.	+7	-10	-9	+9	+9	-5	-6	+5	
Apia	-10	..	+8	..	+1	..	+12	..	
Brisbane	+12	-9	-20	+10	+12	+2	-10	+3	
Sydney	+9	-8	-12	+4	+10	0	-6	+3	
Melbourne	+10	-10	-12	+6	+9	-2	-6	+5	
Hobart	+7	-10	-9	+8	+9	-3	-5	+3	
Adelaide	+10	-7	-13	+2	+10	+2	-7	+3	
Perth	+9	-4	-13	-3	+11	+3	-5	+2	
Brisbane	+12	-4	-20	+3	+14	+5	-10	0	During Australian Summer Time Only.
Sydney	+9	-5	-12	0	+10	+3	-6	+1	
Melbourne	+10	-8	-12	+4	+9	0	-6	+3	
Hobart	+8	-8	-10	+5	+10	-1	-5	+1	
Adelaide	+11	-5	-13	0	+10	+3	-7	+1	
Perth	+8	+1	-13	-7	+10	+6	-5	0	

TABLE 2D.

MEAN TENDENCIES (TENTHS OF 1 MILLIBAR.

WINTER. (Jun. Jul. Aug).

(Approximately corrected to present reporting times, July, 1942.

Nominal Map Time	00	03	06	09	12	15	18	21	G.M.T.
C. Reinga	+1	-11	-3	+6	+4	-3	-3	+9	
Auckland	-5	-10	+3	+7	+1	-4	-1	+9	
Gisborne	-5	-8	+6	+6	-1	-5	-1	+8	
Ohakea	-3	-9	0	+7	+1	-3	-2	+9	
Wellington	-3	-6	+2	+4	0	-3	-1	+7	
Farewell S.	+1	-6	-5	+3	+3	+1	-2	+5	
Greymouth	+2	-9	-3	+4	+2	0	-2	+6	
Christchurch	+1	-10	0	+6	+1	-3	-2	+7	
Puysegur Point	+1	-7	0	+5	+2	-2	-2	+3	
Chatham Is.	-1	-6	-1	+4	+3	-1	-2	+4	
Kermadec Is.	-5	-9	+3	+7	+1	-5	-1	+9	
Norfolk Is.	+7	-12	-8	+9	+8	-4	-4	+4	
Apia	-14	..	+7	..	+1	..	+12	..	
Brisbane	+11	-10	-23	+12	+12	+3	-7	+2	
Sydney	+9	-9	-13	+5	+9	+1	-4	+2	
Melbourne	+10	-10	-10	+6	+7	-1	-4	+2	
Hobart	+7	-8	-9	+8	+7	-2	-4	+1	
Adelaide	+10	-5	-13	+4	+9	0	-4	-1	
Perth	+9	-1	-12	0	+10	+1	-5	-2	