

NEW ZEALAND METEOROLOGICAL SERVICE CIRCULAR NOTE

NO. 65.

REPORT ON CENTRAL NORTH ISLAND UPPER WIND  
INVESTIGATION SEPTEMBER TO NOVEMBER 1949.C. G. GREEN WITH COMMENTS BY I. S. KERR.

As a result of reports by pilots that observed winds in the central region of the North Island frequently departed considerably from those forecast, it was decided to provide a self-contained and mobile pilot balloon station for a period of three months to investigate the problem. This unit was available from the beginning of September to the end of November, 1949.

The complaints had been received from pilots on the main routes between Wellington and Auckland, and it was decided to locate the unit initially at Taumarunui.

After approximately two months with no indication of abnormal winds, a report was received from a pilot that he had experienced a definite wind which was at variance with the forecast, and the region concerned appeared to be about Pipiriki (39°29'S., 175°02'E.). The pilot balloon unit was therefore moved to the nearest convenient locality at Raetihi, about 23 miles east of Pipiriki, for the final month.

The winds measured at 7,000 and 10,000 feet by pilot balloon have been compared with those reported from New Plymouth and Ohakea at the same times and the results are summarised below.

The method of observation at the mobile station and at New Plymouth was the single theodolite one, using a pilot balloon with 120 ft tail. At Ohakea this method was used for some of the runs and MK.II G.L. radar for the majority. The latter method gives winds which are, in the mean, reliable although the accuracy of the wind found for any one particular level is dependent on the skill of the operator and on his having recorded the readings of his instruments at the correct moment.

The theodolite method under good conditions probably gives results accurate to 5 to 10 degrees in direction, but when the balloon is ascending at an uneven rate as, for example, when turbulence is present, there will be an irregularity in the motion of the balloon itself and the total uncertainty may amount to 10 to 20 degrees. For this reason it is probable that individual differences of 30 degrees in direction and 5 knots in speed between any two stations are not significant provided the differences for a large number of observations are evenly distributed about zero. In light winds greater differences in direction may also be non-significant.

The observations from the various stations have been examined in considerable detail for vector difference, difference in direction and difference in speed, both in individual cases and in means. The best summary of the results is that given in the table below. Difficulties in making comparisons are that the periods during which observations were made at Taumarunui and Raetihi are different (Taumarunui 3rd September to 24th October, 1949; Raetihi 30th October to 29th November, 1949), and that in very many cases the balloons could not be followed to the necessary altitudes of 7,000 and 10,000 feet because of cloud. In addition the number and period of observations is not sufficient to make the results conclusive.

The first part of the table below was prepared by taking differences of direction only between the two temporary stations and New Plymouth and Ohakea and then separating these into cases when one or both winds are below 10 knots, and when both winds were 10 knots or over. The former figures, the less significant, are enclosed in brackets.

The second part is the means of all winds used in the above comparisons. Two values appear in each case against Taumarunui and Raetihi as the same flights could not always be compared with both Ohakea and New Plymouth.

The division into winds with south or north component was made arbitrarily as it appeared likely that winds with a pronounced north or south component were those most likely to be changed in direction or force and this was in line with the complaints on which the whole enquiry was instituted. The division is made on the basis of the wind direction at Ohakea or New Plymouth.

A study of the first part of the table shows a slight anticlockwise shift of the order of 10 degrees from New Plymouth and Ohakea to Taumarunui at 7,000 feet in southerly winds and a clockwise shift of perhaps 20 degrees at 7,000 feet in northerly winds. No consistency was evident in a comparison between Raetihi and the two permanent stations. On two cases when Raetihi differed markedly from New Plymouth the cause appeared to be local effects at the latter place caused by Mt. Egmont.

To separate the significant deviations from an even flow of air over the area those occasions were examined on which the winds at Taumarunui or Raetihi differed from those at New Plymouth or Ohakea by more than 40 degrees in direction or by more than 5 knots in speed. Many of these were not significant (e.g. in light variable winds), but those in which one or both winds exceeded 10 knots were totalled and the proportion of total winds in this category is as follows:-

	<u>7,000 ft.</u>	<u>10,000 ft.</u>
New Plymouth - Taumarunui	3/17	1/10
Ohakea - Taumarunui	7/25	4/19
New Plymouth - Raetihi	9/30	7/20
Ohakea - Raetihi	10/30	4/21

The winds at both Taumarunui and Raetihi were frequently lighter than those at Ohakea and New Plymouth, and with winds of 20 to 40 knots at the latter stations the difference was often 40%. However this was not an invariable rule and on other occasions, with equivalent wind directions the agreement was good. In much rarer cases the wind at Taumarunui or Raetihi was stronger than that at Ohakea or, particularly, New Plymouth. As this appeared to be most pronounced in winds from between east and south it is most probable that it is due to a reduction in the New Plymouth wind speed caused by orographical effects from Mt. Egmont.

#### Conclusion.

Owing to the limited nature of the investigation which lasted only three months, and the observational methods, which prevented observations under conditions of low cloud which are particularly prevalent with northerly winds, no firm conclusions can be reached.

It can, however, be stated that during the period 3rd September to 29th November, 1949, there was no evidence of any abnormally strong winds in the Taumarunui or Raetihi areas, but that the effect of the high country in the interior of the Island

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is frequently to reduce considerably the strength of the wind, even at the 7,000 feet, and on occasions, the 10,000 feet level.

The changes in wind direction were generally within the accepted limits of forecast accuracy and were of a nature which might normally be deduced from the orography of the country.

## CLOCKWISE SHIFT OF WIND IN DEGREES

	7000 ft. winds with S. Component	7000 ft. winds with N. Component	10,000 ft. winds with S. Component	10,000 ft. winds with N. Component
New Ply south to Taumarunui	-30, -30, -20, -10, -10, 0, 0, +20, +20  (-30, 0, +80)	0, +20  (+40, +40, +50)	-20, -10, 0, +10, +20, +30  (-10)	+20  (+10, +60)
Ohakea to Taumarunui	-40, -30, -20 -10, -10, -10, -10, 0, +20, +20  (-70, -20, 0)	+20, +20, +20 +40, +40  (-150, 0, +30, +40, +50, +100)	-20, -10, -10, -10, -10, -10, 0, 0, 0, +10, +40  (-30, -10, -10, +20)	(0, 0, +50, +150)
New Plymouth to Raetihi	-30, -10, 0, 0, 0, +10, +40, +50, +60  (-30, -30, -20, -10, -10, -10, 0, +10, +10, +20, +100)	-50, -50, -20, -10, +20, +20.  (-80, -50, -30, +60)	-30, -30, -10, -10, 0, 0, 0, +10, +10, +10, +10, +40.  (-50, -20, +60)	-50, -10  (-30, -10, +60)
Ohakea to Raetihi	-40, -30, -10, 0, 0, 0, +10, +10, +20, +30.  (-60, -20, -10, -10, -10, +10, +10, +130, +160)	-30, -30, -10, 0, +10, +10, +20, +20  (-20, +30, +90)	-10, -10, -10, -10, 0, 0, 0, 0, +10, +20, +30, +40  (-160, -60, -60, +30)	-40, -20, +10, +20  (+10)

NOTE:- Figures in brackets refer to occasions when one or both winds were of less than 10 knots.

## MEAN SPEED IN KNOTS OF ALL WINDS CONSIDERED ABOVE.

	7000 ft. winds with S. Component		7000 ft. winds with N. Component		10,000 ft. winds with N. Component		10,000 ft. winds with N. Component
New Plymouth	17.1		9.6		16.0		Insufficient Data
Taumarunui	13.8	16.3	8.8	12.6	17.3	17.2	
Ohakea		17.0		16.7		16.6	

New Plymouth	11.4		14.7		14.7		Insufficient Data
Raetihi	13.2	12.8	11.8	14.0	15.5	16.8	
Ohakea		16.2		16.8		16.5	

## CENTRAL NORTH ISLAND UPPER WIND INVESTIGATIONS

### Comments by I S Kerr on the Report and some further observations

1 A number of aircraft reports last year and in 1948 suggested that deflections of 30-40 degrees occurred in westerly conditions and these prompted my request for an investigation but in order to answer the question conclusively it would be necessary to have a large number of balloon flights reaching 7000-10,000 feet from several points on the route. These would at the same time enable the reliability of the pilots' reports to be assessed.

2 As the recent investigation did not produce sufficient data for such an assessment and the deductions possible as to the extent of orographical influences are extremely limited I have attempted to answer both questions using data accumulated during the last nine months in the following manner. Occasions between 1<sup>st</sup> July 1949 and 31<sup>st</sup> March 1950 when winds between 5000 and 10,000 feet at Auckland and Ohakea were from between northwest and south-southwest and pilots' wind estimates were available have been examined. Pilot balloons from New Plymouth, Raetihi and Taumarunui which reached the required heights on the days selected were so rare that they have not been considered. The wind reported from aircraft on each occasion has been compared with a wind arrived at by interpolation between Whenuapai and Ohakea winds at the same level. Both the early morning and late morning flights were considered. Occasions when directions differed by 20 degrees or more and speeds by 10 knots or more have been sorted out. They have been further sub-divided into groups depending on the directions and the sign of the difference. The results are summarised in the Appendix.

3 CONCLUSIONS Of the 60 comparisons made it is seen that 36 show good agreement between aircraft and pilot balloons observations (the two cases of App IV are considered to show agreement). Of the remaining 24, from App II and App III it is seen that 7 are affected by fronts (ie, the interpolations made may not be valid), on 12 occasions the aircraft was flying above or through 5/8 or more cloud. Further the signs of the direction differences are north of west and when they are south of west (cases affected by fronts being ignored). This distribution of signs is also to be noted in the tables of Mr Green's report particularly in the comparison between Ohakea and Raetihi, (less so curiously enough between Ohakea and Taumarunui). It therefore seems highly probable that the discrepancies are not real. If for example the wind reported by a pilot is 20 degrees in error in the opposite sense, to a 20 degree error in the wind estimated from pilot balloon observations we have a 40 degree discrepancy.

There remains however the one occasion during the period of the investigation when conditions were exactly those thought to lead to a distorted wind flow (westerly winds at Whenuapai and Ohakea with isobars having a southwesterly tendency) and a pilot made additional careful observations. Details are given in App V. Little of value can be deduced from one day's data; it is not even certain that this is an example of distortion of the wind field. If it is it would appear that the phenomenon occurs rarely and probably under special conditions of stability, maybe, as in this case, when a markedly stable layer extends from about 1000 to 10,000 feet.

Finally it should be stated that when the investigation was requested the route was being flown by Lodestars which have no drift sights. Since Douglas aircraft have been on the route discrepancies have been smaller and less frequent.

APPENDIX.            SUMMARY OF RESULTS OF COMPARISONS BETWEEN  
AIRCRAFT AND PILOT BALLOON OBSERVATIONS.

1.	No. of comparisons made:	<u>60</u>
	No. of agreements:	<u>34</u>
	No. of direction diffs. 20° or more:	<u>19</u> (includes 3 with speeds differing by 10 knots or more also).
	No. of speed diffs. 10 knots or more:	<u>5</u>
	Special cases (see IV)	<u>2</u>

II. The nineteen cases of direction differences are sub-divided as follows:-

Pilot Balloon Direction S. of W.		N. of W.	
Deviation of aircraft wind + ve	1. 9.49 27. 9.49 26.10.49 3.3.50	clear above 4-6/8 above 5-6/8 front	5.10.49 7.10.49 28.12.49 4.3.50
	<u>4</u>		<u>4</u>
Deviation of aircraft wind - ve	14.7.49 18.10.49 22.10.49 14.1.50 26.1.50 15.3.50 21.10.49	front above 6-7/8 front front in 6-8/8 front above 3-6/8	23.8.49 26.8.49 29.8.49 24.12.49
	<u>7</u>		<u>4</u>

III. Aircraft indicate winds 10 knots or more stronger than either Whenuapai or Ohakea Rawins.

1.7.49	S.W.	above 6-7/8
27.8.49	S.W.	above 3-6/8
13.12.49	S.S.W.	above 6/8
12.1.50	W.	above 4-6/8
28.1.50	W.N.W.	above 8/8

IV. Two special cases.

5.8.49.	Westerly winds at Ohakea, lighter southwest winds at Whenuapai.
13.1.50	Aircraft indicate southwest winds from Wanganui north with approximate speed of Ohakea wind falling off northward.

V. Reports of 18.10.49.

Situation: Depression south of New Zealand and anticyclone in northwest Tasman Sea. Surface isobars southwest over North Island.

<u>Rawin or Pilot</u>	<u>7000'</u>	<u>8000'</u>	<u>10000'</u>
Whenuapai 0600M	300 23		290 27
1100M	250 24		270 29
1700M	260 26		
Taumarunui 0600M	270 31		
1100M	270 13 (4000)		
1700M	230 25		
Ohakea 0600M	270 38	260 40	
1100M	270 38	260 36	

7.

Aircraft Whenuapai-Paraparaumu 0800-1000M at 7000'.

6-7/8 cloud between Raglan and Wanganui tops to 7500'  
Wind Raglan 270 30 knots Ohura 245 40 knots.  
Ohura-Wanganui 265 30 knots.  
Wanganui 275 35 knots.

Afternoon Aircraft Paraparaumu-Whenuapai at 8000'.

Manawatu River Mouth at 1515M	300	15 knots.
Wanganui-Pipiriki	210	14 knots.
Wanganui-Ohura	225	16 knots.
Kawhia-Raglan	265	10 knots.
Raglan	255	16 knots.

Temperature sounding Auckland 1200Z 17/10/49: isothermal layer base  
7500' top 10,000'.

Temperature sounding Ohakea 2100Z 17/10/49: stable layer 5000 to  
11,000 ft. with small  
inversion about 7000 ft.

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