FILE COPY

NEW ZEALAND METEOROLOGICAL OFFICE CIRCULAR NOTE NO.10.

FOG FORECASTING AT NELSON.

By Pilot Officer C.S.Ramage.

FOGS on 20 - 22nd June,1942.

HISTORY

20th. The day was clear and humid throughout, with no wind. The upper wind was strong westerly and at 3000' a marked inversion existed above very stable moist air. The fog commenced to form at 1930 hours and thickened rapidly. During the night it remained not more than 20 ft. deep, and just two hours after sunrise a temporary clearance revealed two marked inversions, one at 100 ft and the other at about 1000 ft.

21st. The clearance was, I think due to the breaking through of the first inversion and it persisted for half an hour until mixing under the higher inversion caused the fog to close in again and completely fill the underlying space. The sun, which had previously been visible, disappeared for the day, and visibility remained below 150 yds.

With nightfall however, mixing ceased and the fog collapsed, the moon being visible at 2100hours, when the fog depth was about 150 -200ft.

22nd. By early morning the fog was less than 50 ft deep but did not have the well marked top of the previous morning, isolated patches existing at higher levels. At 0640 a cold front passed, accompanied by an immediate clearance.

Throughout the whole period the wind did not exceed 2 mph.

The existence of the two inversions is interesting. The lower was due to radiation, and during the night of 20-21st confined the fog to a very shallow layer. The higher was extremely stable, and according to pilots reports remained unbroken throughout. On the night 21-22nd, radiation from the ground was cut off and although the fog collapsed, no ground inversion developed. There was however enough cooling to cause a fine steady drizzle from 1800 -1400, producing 0.01 inches of rain.

SUGGESTION:

Use of a simple fog forecast diagram would have shown that conditions on the afternoon of the 20th were completely favourable for the formation of a thick radiation fog before midnight.

Data:

Temperature at 1400 hours.	20th.	55.4°	F.
Dew Point		50°	F.
Average range of cooling from 1400-1600		21°	F.
Average fall in dewpoint (Petterssen p.17)		4°	F.

A diagram has been constructed, assuming the temperature falls linearly and the dewpoint falls linearly after 1800 hours (Petterssen) see figure 1.

It can be seen that condensation would begin at 1800 hours, and that by 1900 enough water would exist as droplets to reduce the visibility to 1000yds.

T and Td for 1700 are also shown evidencing a somewhat greater rate of cooling than had been assumed.

To avoid overlooking similar ideal fog forming situations in the future I have extracted from the Nelson Forms 17 of the past 4 years, Average temperature falls on calm clear nights between the observation hour of 1400 and 0600 and also average dew point falls for the same period, based on Petterssen's proportion of 1/5 to 1/6 the temperature fall.

APRIL - September.			OCTOBER — MARCH		
Temp. at 1400 between limits.	Average fall in T.	Average fall in Td.	Temp. at 1400 between limits.	Average fall in T	Average fall in Td.
			70° -80°	25°	4° - 5°
60° - 70°	24°	4° - 5°	60° -70°	21°	4°
50° - 60°	21°	4°			
40° - 50°	21°	4°			

These figures have real value, in that the variation of individual ranges from the average was quite small, especially during April - September. They are, however, not intended as an absolute guide to the forecasting of all fogs or frosts at Nelson, but rather a s a quick method of forecasting the occurrence of severe fogs or frosts, as in the case considered. In addition, since the minimum temperature during midsummer occurs at about 0400 and at 0700 in midwinter, for the purpose of forecasting about 2° - 4° should be added to the average ranges for those periods.

CONDITIONS ON IITH August 1942.

During the afternoon of 11th August, after a cold front had passed Nelson at about 0600 hours, it became apparent that conditions were ideal for the formation of a radiation fog that night. At 1400 hrs the dry bulb read 58.4° and the dewpoint was 49. Cloud was 2/10 cumulus with a N E 10 mph blowing. Thus, assuming that this cloud would dissappear during the evening and allowing for a fall of 22° in the dry bulb and 4°-5° in the dewpoint, I forecasted at 1600 the liklihood of a fog forming at about 2300 hours. However, no fog occurred. The diagram, figure 2, shows the dry bulb and dewpoint readings during the night.

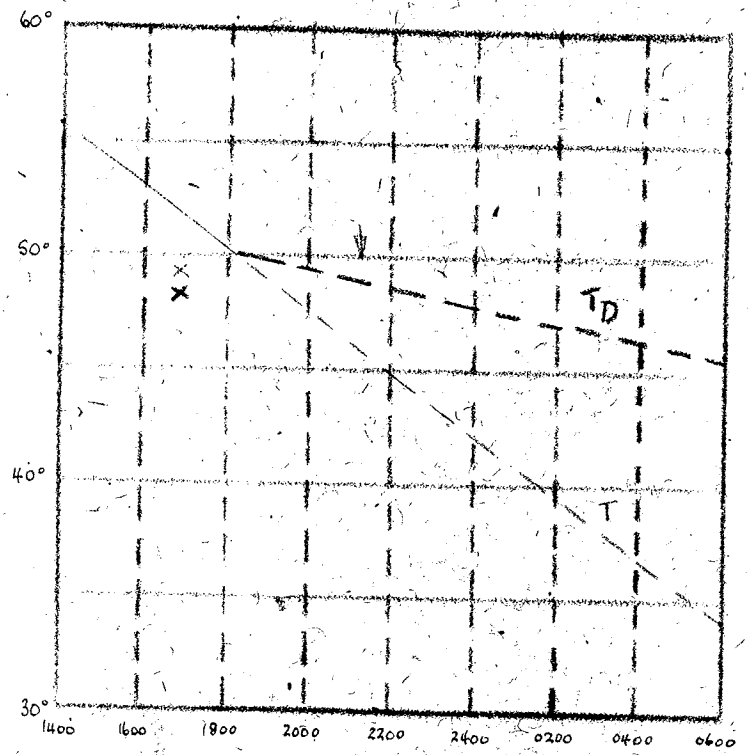
Apparently all possible conditions for the formation of a thick radiation fog had been fulfilled. The sky remained completely clear all night and no wind blew.

A possible explanation is that the air was too still for the fog to form. This absence of any mixing at all caused only the narrowest layer of air to be cooled and moisture from it condensed directly on to the ground, resulting in a much more rapid dew point fall than had been anticipated. This was borne out by a heavy fall of dew.

A comparison can be made between the 12th August and 21st June; On 21st June, winds were 5-10mph. from ground to 2000 ft, but on 12th August, winds did not exceed 3 mph from ground level to 3000 ft, and thereafter to 10,000 ft did not exceed 4-5 mph.

Thus the complete absence of mixing is explained and another factor introduced into fogforecasting.

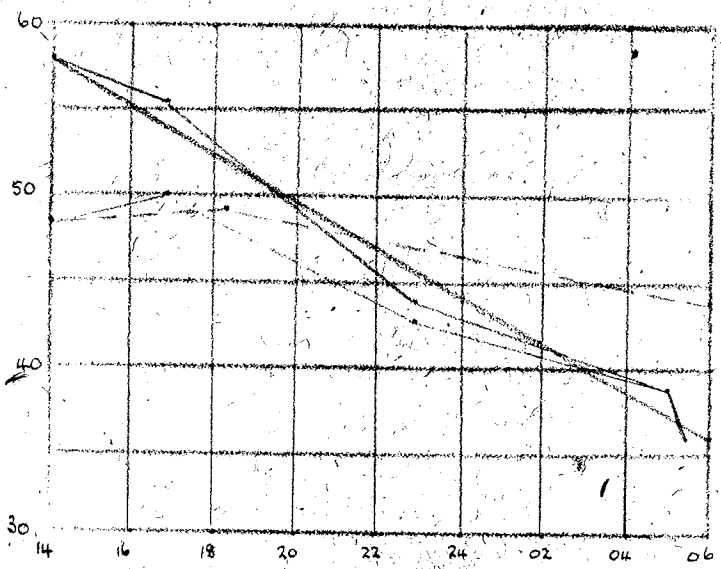
NELSON. 14.8.42.



× = T AT 1700 HRS.

× = T_D AT 1700 HRS.

FIG. I.



ACTUAL DRY BULB FALL ——————

COMPUTED DRY BULB FALL ——————

COMPUTED DEW POINT FALL — — —

ACTUAL DEW POINT FALL ——————

FIG. II.