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Minimum Temperature Forecast for the Okanagan for Feb. 9, 1982
(Forecast Investigation)

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INTRODUCTION

Between February 7 and 9 of 1982, a cooling trend over southern B.C. resulted in a wide range of overnight minimum temperatures in the Okanagan Region. The public forecast issued on the afternoon of February 8 failed to forecast the overnight minimum at Kelowna Airport.

At the request of the Kelowna Airport briefing office, a study was conducted to determine the cause for the large discrepancy between the forecast and the actual overnight minimum at Kelowna Airport.

SYNOPTIC SITUATION

The strong short wave (s/w) ridge at 500 mb over southern Yukon Feb. 8/12Z (dashed line in Fig. 1a) moved to central B.C. during the next 24 hours (Fig. 1b). The associated surface high of 1048 mb. (marked by an * in Fig. 1a) was near Fort Nelson on Feb. 8/12Z. On Feb. 9/12Z, the surface high of 1033Z mb. had moved to Vernon which is 25 miles north of Kelowna (Fig. 1b).

The numerical models indicated this cooling trend with the Canadian Spectral (Can. Spec.) giving the greatest cooling over the region (Fig. 1d).

ASSESSMENT OF PREDICTORS

While the guidance material from various sources indicated cooling, the forecasters had quite a varied choice of numbers. Table 1 displays the guidance available for determining overnight minimums at various locations in southern B.C.

From table 1 we can see that the CMC FT point guidance for Penticton (located about 30 miles south of YLW) called for an overnight low of -32°C. As well, the Can. Spec. model forecast a drop of about 15°C at 850 mb.(see Figs. 1b and 1d).

Table 2 lists the changes that actually occurred at some stations over the southern interior. The location of most of these stations are shown in Fig. 2a and 2b with the exception of Kamloops (YKA) which lies about 65 miles north of Kelowna Airport (YLW).

The average temperature drop at most stations between the night of Feb. 8 and 9 was about 5°C (table 1 and 2). At the the 850 mb. level, the radiosonde station at Vernon (WVK), located about 15 miles north of Kelowna, recorded a drop of 7°C between the morning of Feb. 8 and 9.

These changes closely followed the trend indicated by the US numerical models; in particular, the temperature change in the planetary boundary layer (PBL) of the LFM model and the change in the thickness field of the US global spectral model (SMG).

While the public forecast could have been more precise, the general range of temperatures suggested by the forecasts were fairly close to what occurred. The afternoon forecast of Feb. 8 indicated overnight lows would be -10 to -12°C for the Okanagan region. The average of the overnight lows (excluding YLW) was about -16°C; hence the forecast was 5°C short of what occurred.

On the other hand, if the forecast had called for lows of say -23°C, then the forecast would have been about 7°C colder than the regional average. Also, forecasting -23°C would have meant forecasting a record; a practice most forecasters refrain from doing.

KELOWNA AIRPORT

The difficulty in forecasting minimum temperatures for YLW is due to its location within the Okanagan valley.

In Fig. 2b, the mean January overnight minimums for some Okanagan stations are listed. The January minimums were used as the temperature range involved and the synoptic situation more closely resembles events that occur in January.

From this list (Fig. 2b), we see that YLW is, on the average, 3.5°C colder than Kelowna, a reporting location (Fig. 2b) closer to the population centre of Kelowna.

With the exception of Kelowna Airport (marked by 1 in Fig. 2b) most of the reporting stations are in areas where they are exposed to possible modifying effects of northerly or southerly winds along Okanagan Lake.

On the other hand, YLW lies between two ridges (Fig. 2b), cutoff from the main valley and out of the reach of any modifying Okanagan valley winds. Thus, YLW is a candidate for lower nighttime temperatures.

A double mass analysis of YLW temperature trends by J. Bowling further reveals the effect of this cold air drainage on the overnight minimums at YLW. Quoting from his study, "As indicated by the change of slope between 1968 and 1969, the temperatures after 1969 are approximately 1.5°C less than the same temperatures before 1969. Upon subsequent investigation, I found that the location of the thermometers was re-located 39 feet lower on October, 1968. The consequent increased exposure to the greater weight of cool air sliding down the valley walls at night would explain the noticeable decrease in daily mean temperatures."

Generally, the placing of a thermometer at a lower elevation will result in higher maximums (hydrostatic equation). Since the above study showed a drop in the mean daily temperature, this would mean that the effect of the new location on overnight minimums would be even more dramatic if only overnight minimums had been considered in the analysis mentioned above.

The synoptic conditions during Feb. 8 and 9 favoured overnight cooling. After an afternoon of gusty conditions over the region, the winds abated and the skies cleared. The surface high settled near Vernon. The subsequent radiational cooling was strong enough to allow formation of the characteristic low level jet of 15 knots near the inversion at 900 mb (Fig. 1c). But at the surface, the winds were generally light (Fig. 1c).

At Vernon, a wind of 6 knots was from the south, off Okanagan Lake. The temperature and dew point were -17 and -21°C respectively (Fig. 1c). On the other hand, at YLW, the wind was from 030 about 3 knots. The direction is parallel to the smaller valley in which YLW lies. At the coldest hour, the temperature and dew point were -22 and -23°C respectively (Fig. 1c).

With the lack of clear exposure to main valley winds, the cold air is entrapped about YLW. As a result, overnight minimums at YLW at times can differ significantly from other locations.

CONCLUSIONS

The afternoon forecast of February 8 failed to adequately reflect the overnight minimum at YLW. As well, the forecast did not adequately forecast the wide range in the overnight minimums.

The forecasters at PWC had anticipated the strong afternoon winds to continue overnight. However, an analysis showed that the opposite occurred and the winds became calm in some areas.

Had the forecast office anticipated the correct sequence of events, a correct forecast would have called for overnight lows ranging from -13 to -23°C. This forecast would also correctly depict the proper range of temperatures which can occur in synoptic situations such as the present one which triggered this investigation.

ACKNOWLEDGEMENT

Thanks to R. Sarrazin for his help in preparing the diagrams.

REFERENCE

Bowling, J., 1981, Project Assignment - AWS Advanced Meteorology Course for Technicians.

Table 1

Minimum Temperature Guidance

SMG(US)	FOUS76		FMCN3		CMC POINT FT	CMC 850 mb	LOWS of Feb. 8 '82
Δth	Δth	ΔPBL	YKA	YYF	YYF min.	ΔT(850 mb)	WVK -13°C
-5 dam	-5 dam	-4°C	-13°C	-9°C	-32°C	-15°C	YKA -12°C
							YYF - 9°C
							YLW -18°C
							PCC -13°C(na)
							KE -13.5°C(na)
							MEAN MIN.
							(exc. YLW)-12°C

Table 2

Actual Values Reported

Δth	ΔT(850 mb)	LOWS of Feb. 9 '82
-6 dam	-7°C	WVK -17°C
		YKA -20°C
		YYF -13°C
		YLW -22.6°C(rec)
		PCC -16.5°C
		KE -16°C(rec)
		MEAN MIN.
		(exc. YLW)-16.5°C

LEGEND

SMG(US)	US Baroclinic model-spectral global model
FOUS76	Forecast output statistics from the Limited Fine Mesh Model
FMCN3	Grid point temperature forecast derived from Can. Spec. Model
CMCM POINT FT	Terminal forecast derived form the Can. Spec. Model
ΔT	change in temperature
Δth	change in the 1000-500 mb thickness field
ΔPBL	change in the planetary boundary layer temperature
na	not available at PWC on a real-time basis
rec	new record temperature established for that day
exc	excluding
WVK	Vernon Radiosonde Station
YKA	Kamloops Airport
YYF	Penticton Airport
YLW	Kelowna Airport
PCC	Kelowna Pollution Control Centre
KE	Kelowna East

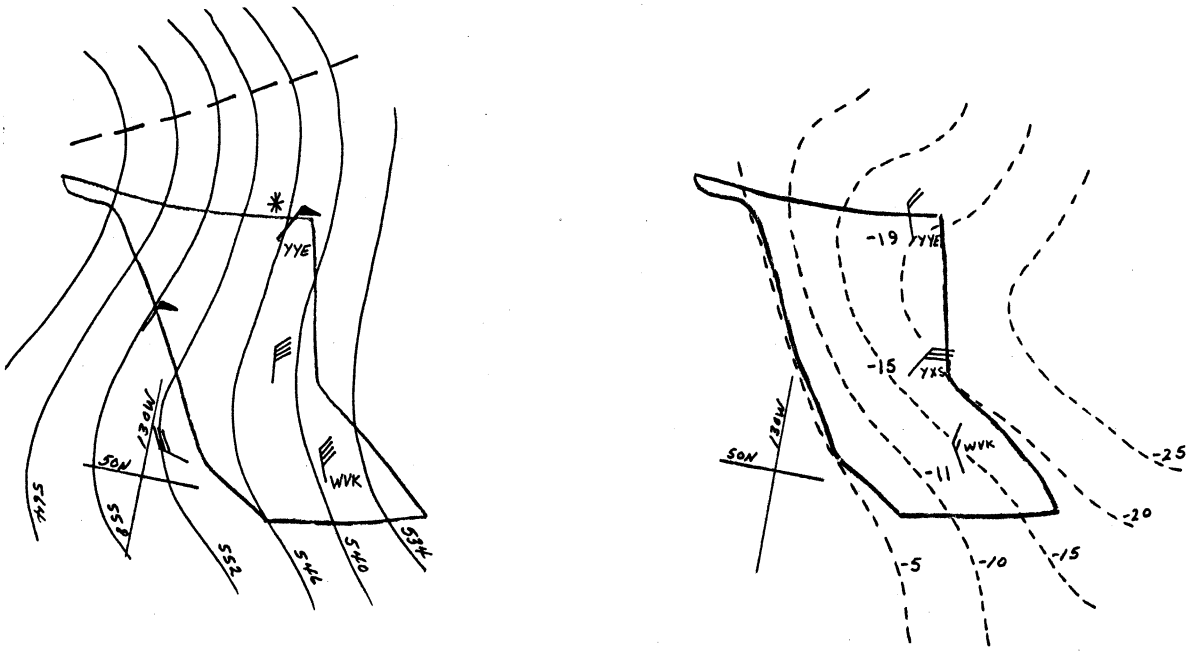

Fig. 1a. 500mb height field and 850mb temp. field for Feb. 8 12z.

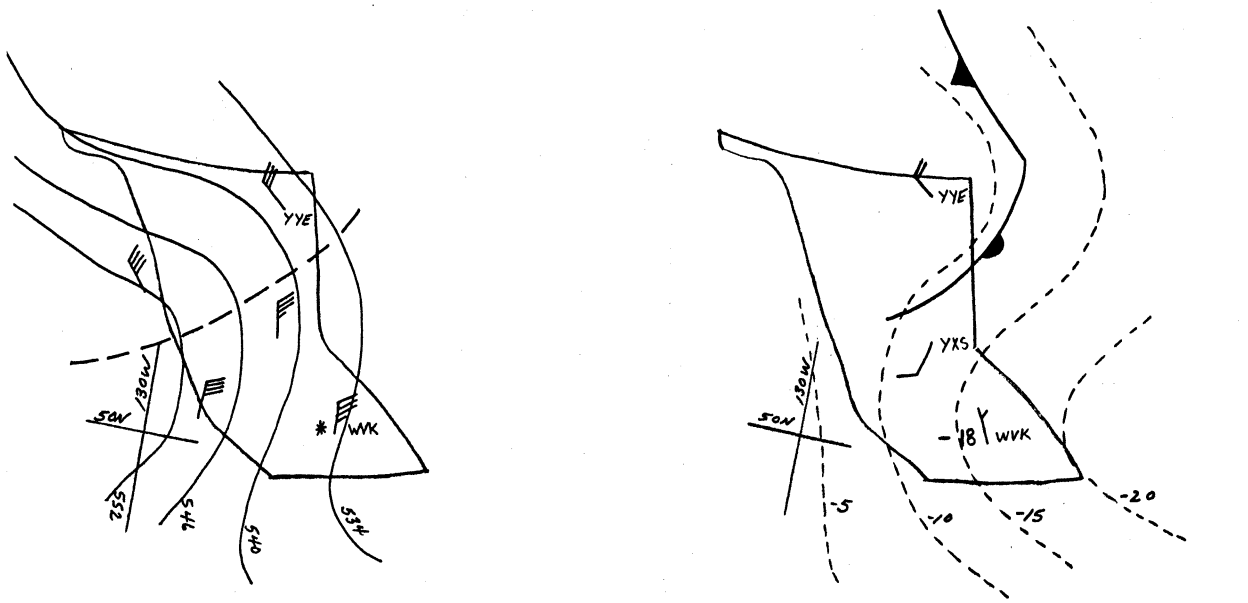

Fig. 1b. 500mb height field and 850mb temp. field for Feb. 9 12z.

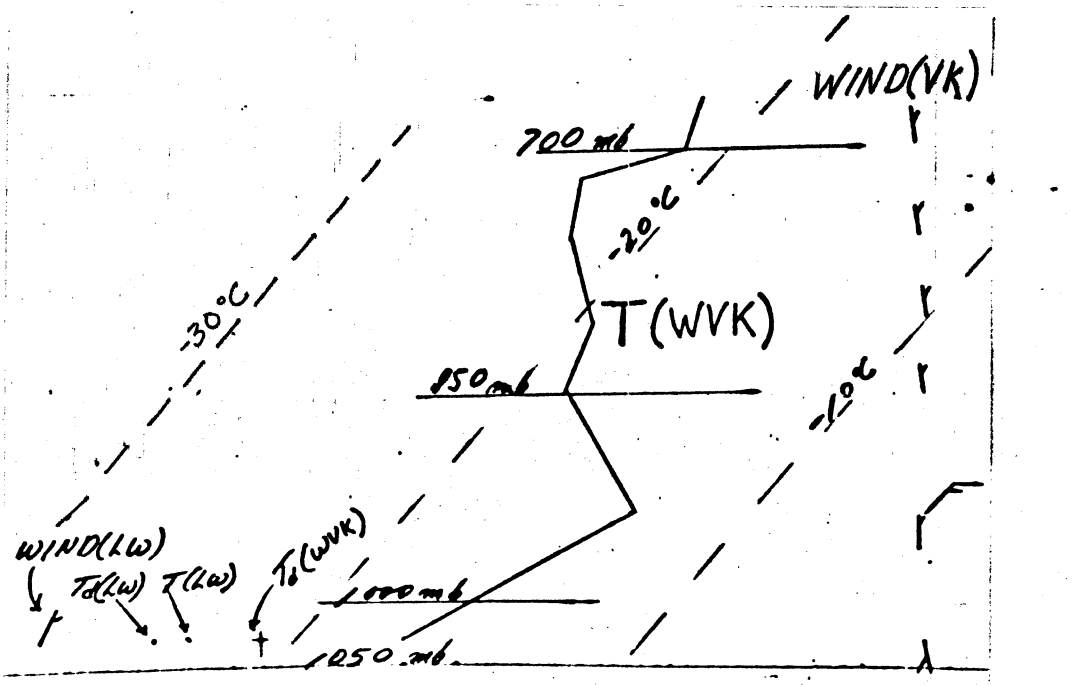

Fig. 1c Vertical temp. and wind sounding for YVK for Feb. 9 12z. YLW's sfc temp, dew point and wind are also included.

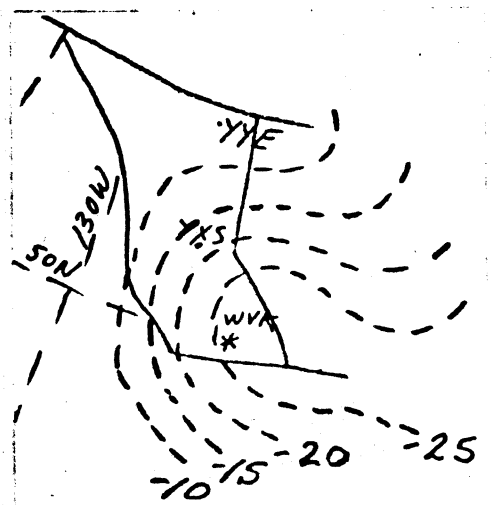

Fig. 1d CMC SPEC. 850mb 24hr forecast temp field for Feb. 9 12z.

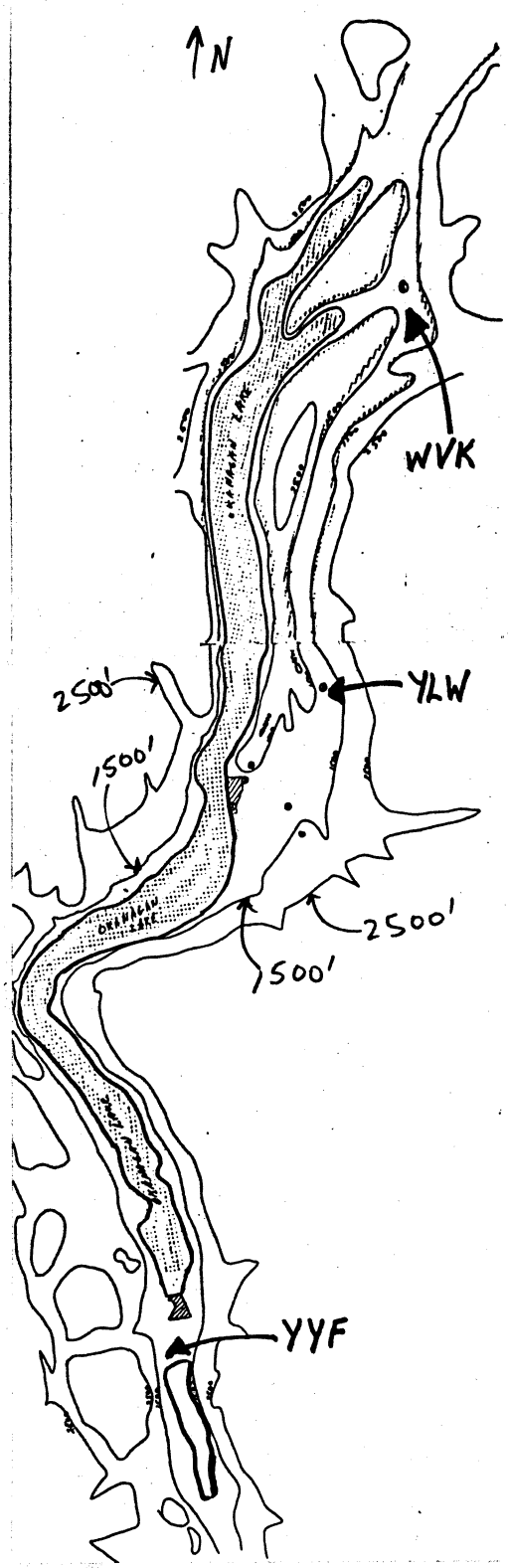

Fig. 2a. General topography along Okanagan Lake

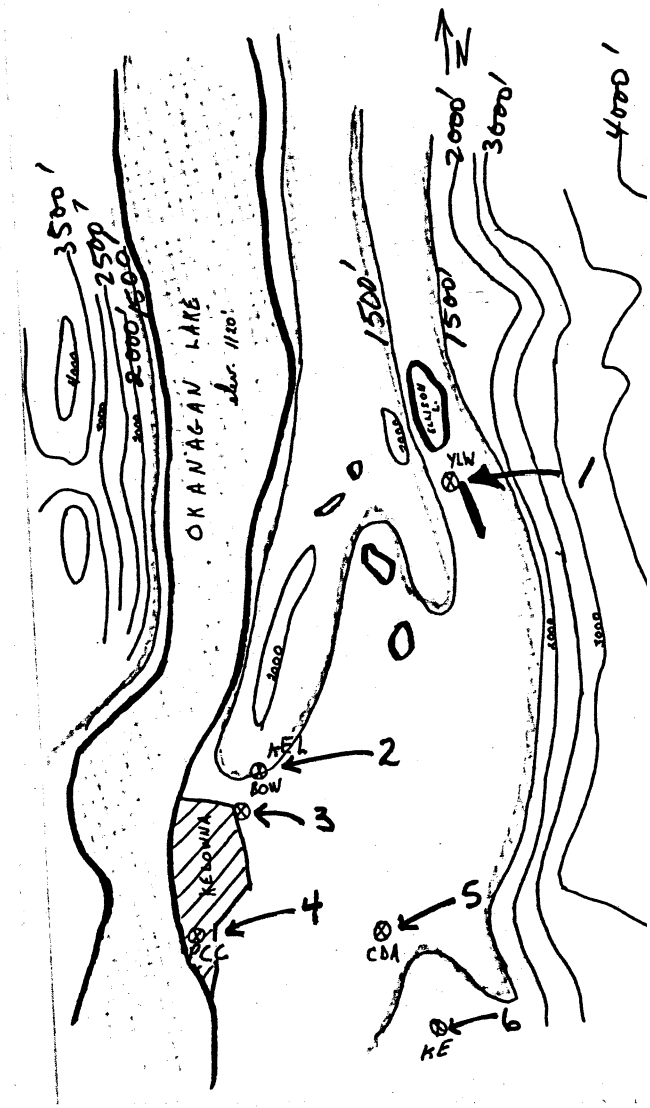

FIG. 2b Location of local temp reports

Station Name	Mean Jan. Min	Dist. from YLW(miles)
1. YLW Airport	-10.2	0
2. Kelowna	-6.7	6
3. Bowes St.	-7.0	6
4. Kel. PCC	-7.9	7
5. Kel. CDA	-8.4	7
6. Kel. East	na	7