



PACIFIC REGION TECHNICAL NOTES

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Mountain Forecast Verification - Freezing Level 1982/83

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INTRODUCTION

Over the past few years, verification of snowfall amount forecasts has been carried out for selected locations in B.C. With the new format of the mountain forecast guidance this past winter, it was decided to expand to a greater number of locations, as well as to attempt a verification of the freezing level and wind forecasts. Only the early morning forecast guidance package transmitted under the forecast headers FPCN50 and FPCN51 was considered.

THE DIFFICULTIES

Verification of snowfall amount is fairly straightforward. Snow accumulations over 12 or 24 hours are recorded at a number of sites within each forecast region. These amounts can be compared to the forecast values. Variability of snowfall in the mountains makes such verification only meaningful at the specific site, but with the use of several locations within each region, a useful measure of the relative accuracy of the forecasts can be attained.

The problem with verifying the freezing level and wind arises from a shortage of observed data. These observations are only available at the 5 radiosonde sites (see Figure 1). Furthermore, of the 5, only one (WVK) is well situated in a forecast region. The remainder are located either outside or on the periphery of the forecast regions. In the case of sharp freezing level gradients (not uncommon in the winter), and strong wind shears, the radiosonde values are often unrepresentative. For this reason, no verification of these parameters was attempted in previous years. When perusing the accompanying results, these shortcomings of the data must be kept in mind.

Forecasts for 5 of the mountain regions were verified using the radiosonde reports as indicated:

Skeena (North Coast)	- ANN (Annette)
Vancouver Island	- YZT (Port Hardy)
South Coast	- UIL (Quillayute)
Thompson-Okanagan	- WVK (Vernon)
Cariboo	- YXS (Prince George)

Great care must be taken in using the results at the coastal locations. Much more confidence can be placed in the interior data.

THE FREEZING LEVELS

Observed freezing level values were subtracted from the forecast to obtain a difference. A positive difference indicates an overforecast and a negative one, an underforecast. These were further separated into 10 ranges - within + 100 metres, + 101 to 249 metres, + 250 to 499 metres, + 500 to 1000 metres, and + more than 1000 metres. The results are graphically portrayed by Figure 2. The number of events falling into each range for "today" (Day-1), and "tomorrow" (Day-2) are depicted for each of the 5 sites.

For the Skeena Mountains a tendency to overforecast is apparent. Since it is known that, in the winter, the freezing level at Annette is usually higher than over most of the forecast region, the real overforecast is probably greater than indicated by the graph. On Vancouver Island, however, a similar high-side skew is desirable since most of the island will have higher values of freezing level than Port Hardy. The preponderance of low forecasts at Quillayute is also to be expected, as in most cases the South Coast Mountains will tend to be in cooler air.

Verification of the Thompson-Okanagan region would tend to produce the most meaningful result since the Vernon site is fairly central. The graph indicates a definite high bias. A significant number of occurrences of overforecasts up to 1000 metres are apparent. Only a small bias (to underforecast) is seen at Prince George. The large number of forecasts within 100 metres of the actual is aided by a significant occurrence of surface freezing levels in this region.

Figure 3 provides a summary at all 5 sites for Day-1 and Day-2. It is seen that on the first day just over 32% of the forecasts are within 100 metres of the observed. This falls to 26% on the second day forecast. Using a more realistic degree of accuracy (within 250 metres of the actual), Day-1 shows a 60.4% success rate, and Day-2 54%. With a + 500 metre window these figures rise to about 84% on Day-1 and close to 80% on Day-2.

TRENDS

Forecast trends were assessed by comparing the Day-2 forecast values with the Day-1. Thus each forecast was assigned one of three possible trend characteristics - upward, downward, or no change. Differences of 100 metres or less were considered as "no change". These trends were compared with the actual direction of movement of the freezing level (without consideration of the magnitude of this movement). Figure 4 provides a summary of the trend statistics for each of the five sites. Correct trends range from 63% at Prince George to only 44% at Vernon. Using a larger range (say 250 metres) for the "no change" case, these figures would be somewhat higher.

CONCLUSIONS

Because of the previously mentioned difficulties in verifying freezing level forecasts, these results have to be used with some caution. A few trends, however emerge. There is a bias to forecast high in the Skeena Mountains and in the Thompson-Okanagan. This does not appear to be a problem in the other regions.

Freezing level forecasts within 250 metres of the actual are considered quite adequate. Some skill is shown in attaining this degree of accuracy.

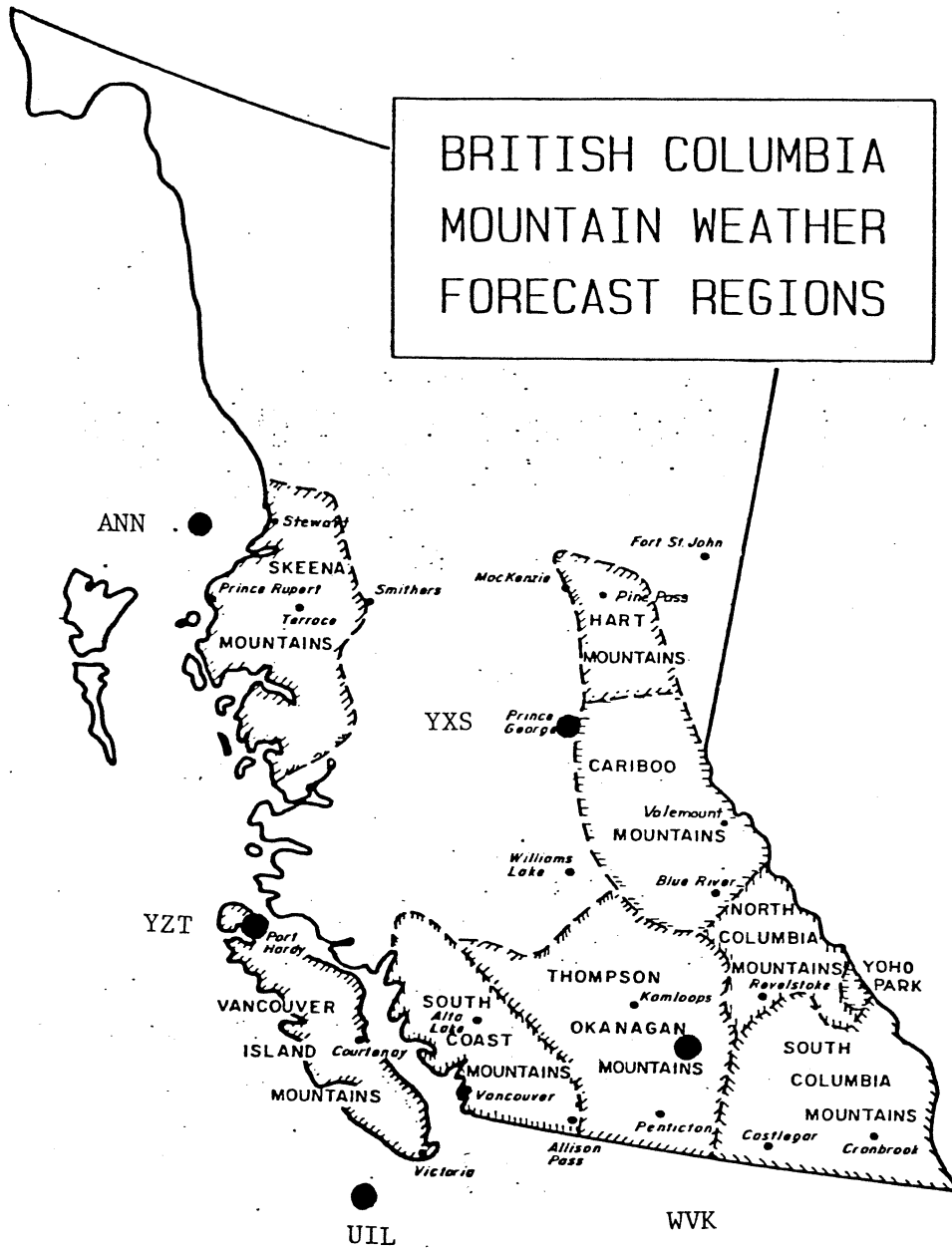


Figure 1. Map showing the mountain forecast regions and the location of the 5 radiosonde sites.

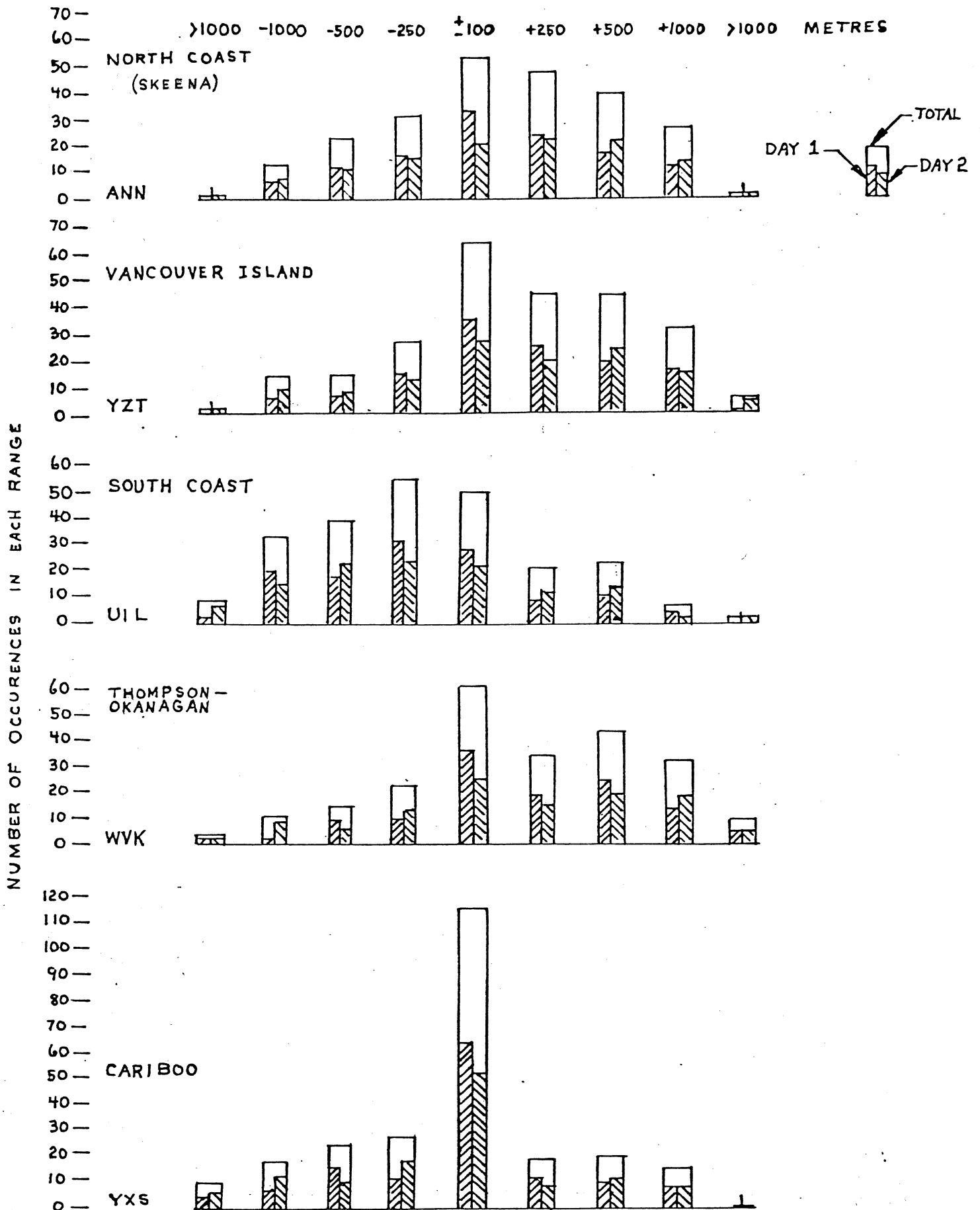


Figure 2

Freezing Level Verification Dec. 82 - Mar. 83
Distribution of Forecast Error

	DAY 1						DAY 2							
	ANN	YZT	UIL	WVK	YXS	TOTAL	%	ANN	YZT	UIL	WVK	YXS	TOTAL	%
← > -1000	0	0	2	2	3	7	1.2	1	2	6	2	5	16	2.8
- 500 to 1000	6	5	19	2	5	37	6.1	7	8	14	9	11	49	8.8
- 250 to 499	12	6	17	9	14	58	9.6	11	7	22	6	9	55	9.9
- 101 to 249	16	14	32	10	10	82	13.6	15	12	23	13	17	80	14.4
LOW - 1 to 100	15	16	18	8	9	66	10.9	10	11	12	8	4	45	8.1
HIGH 0 to 100	18	19	10	28	55	130	21.6	10	16	10	17	47	100	17.9
+ 101 to 249	24	25	8	19	10	86	14.3	23	19	12	15	7	76	13.6
+ 250 to 499	17	19	10	24	8	78	12.9	22	24	13	19	10	88	15.8
+ 500 to 1000	12	16	4	14	7	53	8.8	14	15	2	18	7	56	10.1
→ > 1000	0	1	0	5	0	6	1.0	1	4	2	5	0	12	2.2
within ± 100							32.5							26.0
within ± 250							60.4							54.0
within ± 500							84.3							79.7

Figure 3

Summary of the Number of Events in Each Category

TREND	ANN	YZT	UIL	WVK	YXS	MEAN
% CORRECT	49	50	58	44	63	52.8
% INCORRECT	51	50	42	56	37	47.2

Figure 4

Freezing Level Trends