

METEOROLOGICAL SUPPORT TO AVALANCHE

FORECASTING IN BRITISH COLUMBIA

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Introduction

This paper will outline briefly the type of services provided by the Pacific Weather Centre in support of Avalanche Forecasting in British Columbia. The Pacific Weather Centre is one of six major offices across Canada and is responsible for the production of all weather forecasts for the B.C. Region. We are a component of the Pacific Region, Atmospheric Environment Service, D.O.E. The office is in operation 24 hours a day, seven days a week, and has a staff of some 25 professional meteorologists, together with support staff.

The beginning of our service to the people interested in avalanches goes back to the winter of 1964-65 when the public forecaster began issuing warnings whenever heavy or prolonged snowfalls were expected in Rogers Pass. Prior to that time, the generalized public forecast was the only information available to interested parties. Since then, there has been a steady growth in service until, at present, all areas of the province are covered by specialized mountain forecasts and all the major meteorological parameters affecting avalanche hazard are forecast.

Mountain Forecasting

We issue two mountain forecasts each day during the period November 1st to April 30th. The first, issued at 6:00 a.m., gives a forecast of the expected weather for that day and the day following. The second, issued at 3:00 p.m., covers that night and the next day and gives an outlook for the third day. The province is divided into eight climatologically similar regions for the purpose of this forecast, and, for each, the following elements are predicted:

- a) heavy snowfalls
- b) prolonged snowfalls
- c) wind speed and direction at elevation
- d) freezing levels
- e) marked changes in temperature such as might be caused by an advancing warm front.

The forecasts are preceded by a short summary in which the forecaster can highlight certain features of the forecast or explain the synoptic reasoning and indicate his confidence in his prognosis.

Special Weather Advising Team

Until last year, these forecasts were issued by the public forecaster as part of his regular duties. However, during the past few years there has been an increasing demand for specialized forecasts in a number of areas e.g., forestry, agriculture and flood situations. It was felt that these interests could best be served by the creation of a special unit using the most experienced forecasters - not only experienced but also specialists in these fields. This special unit, the Special Weather Advising Team (SWAT), was formed later in 1975 and made responsible for the provision of meteorological forecasts to specialized users. In addition to the formal, written forecasts, the SWAT meteorologist is available, in person or by phone, for consultation and discussion. Thus, if a user has a particularly critical period coming up, he can personally discuss the weather prospects with the forecaster.

Observation Network

Following the report of the Avalanche Task Force (Godfrey et al., 1974), there has been close liaison with the B.C. Department of Highways, through Mr. G. Freer, the Senior Avalanche Coordinator. Working with the AES, he has developed a network of some 40 highway weather reporting stations which augment our own observing network. This has been further enhanced, mainly through the efforts of Mr. J. Emslie of AES, by the addition of daily reports from 10 ski resort operators. There are also five stations reporting from the National Parks.

The observations received from these points are particularly important to the success of the forecast programme inasmuch as they give information about areas of the province which is frequently not available from our AES network - mountain passes, smaller communities, areas at higher elevation, etc. We consider them so useful that we re-transmit them to our satellite weather offices throughout the province where they are used to assist in such things as briefings for small aircraft and forecasting for the travelling public. In this programme, the following elements are observed:

- a) Cloud and weather
- b) Temperature
- c) Windspeed and direction

- d) Snowpack depth
- e) Amount of new snow
- f) 24-hour total snowfall amount and in the ski resort reports - visibility.

The reports are coded in numerical form and fed directly to the computer at the Pacific Weather Centre. The computer decodes the reports for forecast office use and retransmission.

Forecast Improvement

Considerable development has been done at the Vancouver Weather Office to improve the forecasts of snowfall amount. Quantitative precipitation forecast methods have been developed using a variety of techniques including a quite successful discriminate analysis method. As data from the augmented network accumulates, further refinement in these procedures is expected.

In conclusion, the programme has been quite successful and the rapport with the Highways Division and with other users has been good.

References

Godfrey, D.D., Schaerer, P.A., Trembley, R.J., Freer, G.L., and Evans, S.G. 1974. British Columbia Department of Highways Avalanche Task Force. Report on findings and recommendations to the Honourable Graham R. Lea, Minister of Highways, September 30, 1974, British Columbia Department of Highways, Victoria, 33 pp.

Discussion

ARMSTRONG: Do you use any particular value for the density of new snow?

GIGLIOTTI: In our climate, from three years of data, we find that the ratio of water content to snow varies from 1:10 to 1:20. At Rogers Pass, I believe that the average is about 1:14.

KINGERY: Forecasting seems to be concerned mostly with predicting a total amount of snow. At our area, Alpine Meadows, we feel that precipitation rate or intensity (precipitation per hour) is important. Is it possible for the Weather Service to forecast for this quantity also?

- SIMMS: At Jackson, we feel that precipitation intensity is important. The Cheyenne weather office gives us expected times of frontal passages; these correlate well with periods of high precipitation intensity.
- PERLA: The level of support a Weather Service Office can furnish depends on its geographical position with respect to the avalanche area. An example of an optimum situation is the location of the Salt Lake weather station with respect to Alta. The station is approximately 30 miles upstream from Alta. Occasionally, radiosonde balloons would fly directly over Alta. Salt Lake forecasters were quite good in predicting snowfall amounts, periods of high precipitation intensity, frontal passages, and "holes" in storms that would allow artillery control. In particular, one forecaster (Barry Nielsen) took much interest in the avalanche problems at Alta, worked a winter with Dr. LaChapelle, and developed an orographic precipitation model that worked quite well in practice. The Alta Avalanche Study Centre had a teletype link to the Salt Lake Weather Office, and obtained the upper-air soundings as soon as they were completed. These would be relayed to the snow rangers to help them decide on control strategies. During especially critical periods, the Weather Service would release additional balloons on request of the snow rangers.
- EMSLIE: The Provincial Government of British Columbia is taking an increased interest in the problem. This winter we plan to summarize meteorological data, and to work with ski resorts and other avalanche-threatened areas to find out what variables are important.
- FREER: With respect to optimizing support from the Atmospheric Environment Service, it is necessary to establish good contacts, to visit the weather office and meet with the forecasters in order to explain the problems of your area. The programme should be based on mutual exchange data. It also helps if the forecaster can make a trip to the avalanche area, and discuss problems on the site.