

UTAH AVALANCHE FORECAST CENTER

1984-85 ANNUAL REPORT

I. WEATHER AND SNOWPACK SUMMARY

The 1984-85 season began quickly with a 3-4 foot snowfall on October 18th. The snowfall began warm and gradually decreased in density with no major avalanche problems. This established a strong early season snowpack. Throughout November and December snow fell gradually and developed very few instabilities.

An unusually large number of glide cracks and ground avalanches were observed in November and December. Although these remained small they did create problems in ski areas and in a few places in the backcountry. Their existence was attributed to a relatively unlayered, homogeneous snowcover and warm ground. Some investigation of the snowcover in these areas was attempted, but much further information needs to be acquired before their behavior can be predicted properly.

January brought very cold and dry weather. The snowpack developed thick layers of depth hoar with some layers of surface hoar developing as well. When snow began again in late January and February, avalanches became common. Avalanche warnings were issued on 12 days in February alone.

The January weakness persisted well into the spring. Experienced backcountry travellers got caught in deep, unexpected releases for the rest of the winter. A general uneasiness about snowpack stability prevailed through February, March, and much of April. Each new snowfall brought surface releases as well as deep-slab releases. Significant changes in temperature also triggered deep releases without precipitation events.

An areal survey of the Wasatch Mountains was conducted soon after a particularly intense avalanche cycle in mid-February to observe the extent of avalanching. Two points of interest were illuminated during this survey; 1. Most slabs released well below the uppermost starting zone. 2. Several large paths had no evidence of avalanche activity while smaller paths exhibited extensive activity. Although it is difficult to precisely determine the cause of these features, it may have been due to the loading patterns of each storm or the metamorphic pattern of the weak, TG shear layers. As the winter progressed avalanches released higher and higher within starting zones. Most of late April and May's avalanches released on upper elevation slopes near the ridgelines.

The winter ended almost as quickly as it began. Unseasonably warm weather in early April began a significant wet avalanche cycle with most of the large avalanches releasing on the old buried January TG layer. A mid-month freeze solidified the rest of the snowpack and when warm temperatures returned toward the end of the month, only a few isolated instabilities remained and most of the snowpack gradually melted.

Appendix A shows a time profile of the snowpack at Alta for the 1984-85 season.

Weekly forecasts began on November 1. Twice daily forecasts began on November 22. These were decreased to once daily forecasts on March 1st. Daily forecasts were terminated on April 30th as weather and snowpack conditions stabilized. A few backcountry skiers objected to the season end because they wanted a continued mountain weather forecast (so they could predict corn skiing conditions).

Table 1 is a summary of hazard ratings for this season and last season. This season showed an increase in both high and moderate avalanche days over last season.

TABLE 1. SUMMARY OF FORECAST HAZARD RATING

HAZARD	1983-84	TOTAL	1984-85	TOTAL
LOW	69	39%	52	30%
MOD	83	48%	90	52%
HI	20	12%	30	17%
EXT	1	1%	2	1%

II. ACCIDENTS

Because many backcountry skiers felt that this year's snowpack was particularly hazardous, a generally cautious touring attitude prevailed. Nevertheless, 79 people were reportedly involved in avalanches during 60 separate incidences. Two accidents involved highway travellers on the North Ogden Canyon Road, five accidents involved heli-ski clients and guides, and eight involved ski patrol who were caught and injured during regular control routes in-area. That leaves 45 backcountry incidences. The large number of avalanche incidences and the fact that many experienced guides and patrollers were getting caught indicates that the snowcover was sensitive in a manner that was difficult to detect.

Last year only 24 avalanches were reported that involved people. Again we feel that there were more avalanches that could be added to this tally but were not reported to the center.

Of the 79 people involved in avalanches 40 backcountry skiers triggered slides but were not caught, 24 people were caught and carried down slope, 9 were caught and partly buried, 4 were caught and totally buried, and 2 were caught, totally buried and killed. In addition, Logan, North Ogden, Provo, and Daniels Canyons were all closed by natural avalanches more than once during the winter.

TABLE 2. AVALANCHE ACCIDENTS

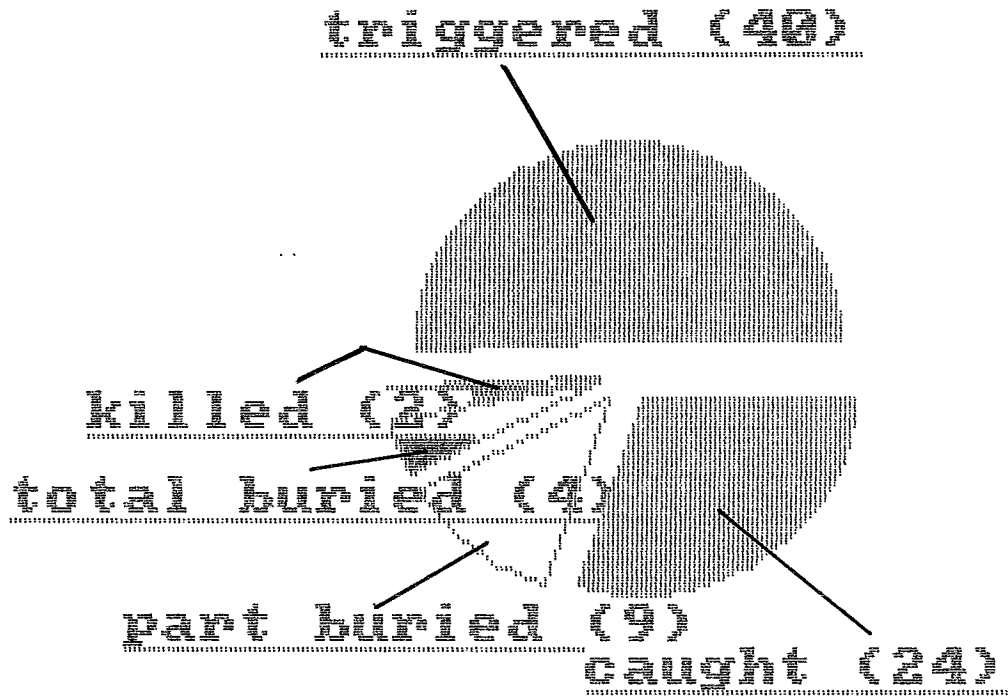


Table 2 illustrates a summary of these incidences.

Summaries of the two avalanche deaths are included in Appendix B and Appendix C. The first skier was killed on February 22. He was a downhill skier in the out-of-bounds area of Powder Mountain. The second skier was killed on March 20th while watching the World Cup events at Park City. Appendix D includes a summary of a spectacular avalanche that buried a fellow 5 feet near Alta. He was located within 20 minutes by the Alta Ski Patrol because of his transmitting rescue beacon. He sustained only minor injuries.

At least one avalanche accident reported involved a snow-board skier. This is an increasingly popular mountain activity, especially with teenage boys. It may prove beneficial to approach this backcountry user group with avalanche education in the future.

Most of the avalanche accidents (25), including the two deaths, occurred during moderate avalanche hazard conditions. Even though the avalanche potential was acute, skiers felt more comfortable skiing when a moderate rating was issued. Unfortunately the instabilities were not easily recognized. 16 of the incidences reported occurred on days when high avalanche hazard ratings were issued and 7 occurred during one day in February when an extreme warning was in effect. Hazard ratings are from the morning of the incident only and may not reflect information that may have been heard by skiers from the report the afternoon before.

III. CALL RATE

An examination of the call rate data shows a 19% drop in the season call rate from the 1983-84 season. While the call rate dropped 16% on the Salt Lake public phone, even larger drops were measured by the Logan and Ogden machines (see Table 3).

TABLE 3. PUBLIC INFORMATION PHONE TOTAL CALLS 1982 TO 1985

INFORMATION PHONE	1983	1984	1985	CHANGE 84/85
SLC Public	40,355	38,408	32,476	-17%
SLC Observer	<u>4,357</u>	<u>5,300</u>	<u>4,652</u>	-12%
SLC Total	44,712	43,708	36,701	-16%
Ogden Public	3,671	4,076	2,278	-44%
Provo Public	3,042	2,577	2,386	- 7%
Logan Public	<u>1,890</u>	<u>2,725</u>	<u>1,706</u>	-37%
Area Total	53,315	53,086	43,498	-19%

The drop in call rate may be related to several factors including a perception on the part of the public of a high backcountry hazard. An analysis of the forecast hazard shows that there were a higher number of high hazard days during the 1984-85 season

when compared to the 1983-84 season (Table 1). Ski area use during the past season was higher as evidenced by the increase in day ticket sales. An examination of the monthly call rates (Table 4) for Salt Lake shows a large drop in the months of November, December, January, and April, while the months of February and March are higher than for the same period in the previous year.

TABLE 4. MONTHLY CALL RATES

YEAR	NOV	DEC	JAN	FEB	MAR	APR
1983-84	3,216	10,708	7,073	7,032	5,983	4,396
1984-85	2,827	5,704	5,260	8,399	7,122	3,021

Poor ski conditions during the low call rate months undoubtedly contributed to the overall low season's call total. An informal investigation was attempted to get a better idea of reasons for this drop in call rate. Mountain shops who cater to backcountry skiers, touring centers, avalanche schools, a few backcountry skiers, and avalanche safety personnel were all questioned about backcountry usage and public attitudes toward the UAFC products.

There was some consensus that there was a greater population of backcountry skiers because equipment sales were up and skiers met more parties when they were travelling. However, further investigation seemed to indicate that tourers were concentrating more in low hazard areas. Therefore they were less spread out and appeared more numerous than they actually were. Ski area personnel also reported that there were more touring equipped skiers using lift-serviced areas than in the past. This may indicate that tourers recognized the persistently high hazard, gave up calling the forecast, and relegated themselves to skiing in area or in known safe terrain.

Some people thought that the group dynamics were more sophisticated in that it was assumed that at least one person in the group had called the forecast center instead of all group members, as in the past. This may have contributed to the drop in call rate as well.

Other people thought that better avalanche education had decreased the need for backcountry skiers to get a generalized forecast. More and more are making their own stability assessments. Some felt, too, that the forecasting program had saturated the backcountry community so new converts are sparse. On the other hand, the ski shop in Logan reported a two-fold increase in backcountry usage and could only imagine that not enough people in Logan knew about our service.

There was also a bit of distrust among backcountry skiers because of the imprecise language used in avalanche forecasts. For example, they heard of moderate avalanche hazards, yet saw many avalanches that would indicate a high hazard. This problem has been discussed for many years. Hopefully we're getting closer to a solution as we add more and more specific information into each forecast.

Many backcountry users said that they heard the avalanche forecast over TV and radio so did not have to call the center. This would also contribute to a drop in our call rate without

decrease in our effectiveness.

All those questioned relayed the continuing respect for our service. Duffy McCabe, Park City Ski Area Snow Safety Director, felt that the forecast center's efforts this season resulted in at least 10 fewer avalanche fatalities.

IV. EDUCATION

All UAFC personnel participated in avalanche education this season. Talks were given at ski clubs, ski centers, and visiting avalanche schools. Lectures and field sessions were given to students in avalanche courses in the Forestry Department at Utah State University in Logan, and the departments of Physics, Geography, Geology and Geophysics, and Continuing Education at the University of Utah in Salt Lake City. The U.S. Army winter training program also used UAFC personnel for avalanche training. We estimate that over 600 people were approached through these education programs.

V. PERSONNEL

Three full-time avalanche forecasters, Bowles, Ferguson, and Soucie, traded duties throughout the main part of the avalanche season. Each forecaster spent two days a week in the forecast office composing and disseminating twice-daily avalanche forecasts. Three days each week were spent in the field, gathering snowpack information, exchanging information with mountain observers, and maintaining the communication link between observers, ski areas, and backcountry tourers. Some help with instrumentation and observation methods was also provided by UAFC personnel. A fourth forecaster, Lambrose, filled in one day each week at the forecast center and contributed field observations.

At the end of February Soucie and Lambrose were laid off because of budget difficulties. At this time only once daily forecasts were issued and Ferguson and Bowles shared forecasting and observation duties. A distinct drop in communication with backcountry conditions was felt immediately. Lack of information from the Provo area mountains was most dramatically felt since Soucie had established a good rapport with FS personnel and was more familiar with that area than other UAFC personnel. The Logan area also suffered because less time was available to the remaining forecasters for the longer field time required for trips to Logan.

Clearly an effective regional avalanche hazard forecasting program requires at least three full-time forecasters so a complete and consistent field program can be scheduled. Field observations of snowpack characteristics and avalanche occurrences are integral parts of avalanche forecasting.

VI. RESOURCES

The Utah Avalanche Forecasting Center is a cooperative effort. The following explains the contribution of several groups to the program this season.

A. National Weather Service - The NWS provides office space for the UAFC. In addition, invaluable information on mountain weather is contributed by on-duty weather forecasters. All weather forecasting products and facilities are made available to UAFC personnel. In return UAFC personnel keep the on-duty weather forecaster aware of changing mountain weather and field incoming calls about snow conditions.

B. Forest Service - The FS is the administering agency for the UAFC. In addition, FS personnel in outlying districts have helped with avalanche and weather observations. In particular, Mike Vanhorn from the Logan ranger district and Scott Layton from the Ogden district have been especially helpful.

C. Ski Areas - Snow safety personnel at each ski area provided daily weather and avalanche observations throughout the season. In addition, UAFC personnel were welcomed at each area to conduct snowpack investigations and observe control procedures. Weather observation equipment was also maintained by ski area personnel. In return, more specific information on mountain weather

was issued whenever possible and information on snow physics and avalanche mechanics was exchanged whenever applicable.

D. Remote Telemetry (DataCol) - The rivers section of the NWS implemented a DataCol system on their Data General computer. Part of this program retrieved mountain weather information from remote Campbell units. The data was put into a file updated hourly. In addition, the DataCol system contains other weather observation files from around the Western States and forecast products from the NWS. The program makes it possible for remote micro computers to obtain the information via telephone modem. Computer expertise from personnel in the rivers section helped UAFC establish an on-line link to their program and helped work out computer problems encountered when setting up the UAFC IBM/PC.

E. Backcountry Observers - This year our toll-free observation number was advertised over radio, TV, and newspapers. This was designed to encourage backcountry travellers to share information about snow and avalanche conditions. In some cases, calls were returned by UAFC personnel to further discuss observations. This method seemed to work. BC travellers who had never before called the center did so and provided invaluable observations on avalanche occurrences which may not have otherwise been known.

VII. EQUIPMENT

Remote weather sensing equipment managed by Campbell microloggers that were used at Solitude, Snowbird, and Alta last season were left installed over the summer. Because of this they were all damaged by lightning. The UAFC budget covered the cost of repair-

ing these machines before the regular forecast season began.

A new IBM/PC was installed in the forecast center for use this season. It has 256K memory, two floppy disc drives, a Hayes Smartmodem 1200, and an Epson dot matrix printer. Operational use of this computer began in January.

All UAFC products are now composed on the IBM and sent to the AFOS weather wire (for media distribution) via the Hayes Smartmodem. A file system is established to store all daily forecasts, warnings, and correspondences.

Data and weather forecast products are retrieved from the NWS Datacol system, again through the Hayes Smartmodem. Campbell microloggers currently installed throughout the Wasatch mountains can also be accessed through this system for current weather information. An experimental radio-telemetered Campbell unit was installed by the Campbell company on top of Logan peak, an ideal location for sensing mountain weather in the northern part of our forecast area. Transmission problems were extensive and information was inconsistent, but valuable. Future use of these radio-telemetered systems looks promising.

An attempt is being made to communicate with the USFS FLIPS system also. There are some problems with the compatibility of the machines at this time but these problems should be overcome in the near future. This communication capability will allow hard copies of all UAFC products to be transmitted to forest service offices.

In addition forest information will be transmitted to the weather service offices for dissemination.

A graphics adaptor has been added to the IBM as well. This allows the compilation of simple graphs to illustrate trends in data, and map snow and weather properties.

VIII. ADVERTISING

A. In the past several years our main effort to advertise our local call numbers for our recorded forecasts has been by distributing cardboard displays which hold the small stickers with the local recording number. These displays were mainly distributed in the major touring and skiing equipment stores along the Wasatch front and at most of the ski areas. All these stores were recontacted at the beginning of the season and supplies replenished. This effort has seemed adequate until this year as our call rate has gone down, especially in the Logan and Provo areas and somewhat in the Salt Lake area. We feel that we are reaching most of the backcountry skiing population and word of mouth will continue to help carry this along, however, we seem to be missing contact with a large population of backcountry users, for example...snowmobilers. An effort was made to make contact with this user group during the first two years, with little success. More of an effort needs to be put forth by all UAFC personnel to contact this user group possibly by advertising in more snowmobile shops and offering public awareness talks at club or church meetings.

This effort would need some support from a healthier budget.

B. Another area where we lack feedback is determining how most backcountry users find out about our forecast number and whether the information we are including in the forecast is adequate for their needs. Although this information would be valuable to our efforts, it would be very time consuming and unproductive for an avalanche forecaster to spend time gathering this type of information, especially since the best place to gather this information would be at various trailheads. A possibility here would be to find university students that may be interested in studying backcountry statistics or outdoor recreation.

IX. MISCELLANEOUS UAFC ACTIVITIES

A. Mountain Weather - Because the 6 to 12 hour weather forecast is critically important for avalanche forecasting, some effort has been made to improve the availability of mountain weather information and be more precise than the zone forecast currently available through the National Weather Service. This year UAFC personnel began using a reporting form for weather observations and forecasts so more complete reports could be transmitted through the observer recording number. This will be extended next year because the NWS has asked us to help field more calls from the ski areas. So, in addition to filling out this form for telephone recordings, it will also be input into a computer file (using our IBM/PC) for hard-copy dissemination to participating agencies. There was also some talk of establishing a designated mountain weather forecaster through NWS in cooperation with the avalanche center and partly funded by private ski corporations. Preliminary efforts to look into this possibility began in May.

B. Public Telephone Recorders - Channel 4 TV requested use of our recording machines in Ogden, Provo, and Logan. In addition to the avalanche forecast (forest information during the summer) which is available on one incoming line in each city, Channel 4 will add four additional lines to each machine and include information about local weather in each city. The broadcasting will be done by NWS public service personnel and costs of the extra lines will be assumed by Channel 4. Information from outlying forest districts will be sent to the UAFC at NWS through the Forest Service FLIPS computer system. Negotiations for this program and development of the computer communication link to the UAFC IBM/PC began in April.

C. University of Utah Research Institute (UURI) - In 1982 a governor's conference on natural hazards suggested that the problem of avalanches be a component of hazards research programs within the state of Utah. To this end, UURI has proposed a region-wide Hazards Research Institute which would include the study of avalanches. Because of this, and the fact that avalanche forecasting is an imprecise science that needs the benefits of basic research, UAFC personnel have been working in cooperation with UURI personnel to: 1. write avalanche research proposals, 2. investigate the potential for cooperative funding from private industry, state and federal agencies for a research center, and 3. study the possibility of incorporating operational forecasting and research into one unified program.