American Avalanche Association
and
USDA Forest Service National Avalanche Center

Snow, Weather, and Avalanches: Observational Guidelines for Avalanche Programs in the United States

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Snow, Weather, and Avalanches:
Observational Guidelines for Avalanche Programs in the United States

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Back cover photograph by Kelly Elder.

Preface

This set of guidelines represents a milestone of sorts for our industry. It has been over 35 years since the U.S. Forest Service established the Westwide Avalanche Network and shortly thereafter introduced the "blue and green sheets", establishing a standard for avalanche observations in the United States. Clearly, many things have changed since then and the time seemed right to update and expand the current observational standard. Luckily for us, our friends at the Canadian Avalanche Association allowed us access to their publication, *Observation Guidelines and Recording Standards for Weather, Snowpack and Avalanches,* and we were able to build the current document using both the Westwide and CAA guidelines as a solid foundation.

There are a few points I would like to emphasize about these guidelines. First of all, they are meant to be a professional reference. This document is not a guide to evaluating avalanche danger or a safety manual, topics that are more than adequately covered in other texts. We believe this document will be most useful to people who have had professional experience and training, but it may also be helpful to those just getting started in the avalanche business. Of course, guidelines such as these are never a substitute for good, hands-on training by an experienced colleague or in a reputable avalanche course.

Second, these guidelines represent a work in progress. This document is not meant to be the final word in avalanche observations. Rather, it is a consensus of what a number professionals believe are the proper methods for collecting and reporting observations. We hope this document will be updated every 5 to 10 years so it can accurately represent our continually evolving field.

Third, the goal of the document is to establish some common methods. There are many different observations that can be made to better predict and understand avalanches, and each may have great utility in their particular application. However, it benefits everyone if standardized methods are used for *commonly* collected data. Doing so increases the ease of communication between operations, and it may also develop long term datasets that will provide future insights into avalanche processes.

Finally, the establishment of these guidelines is not an attempt to inhibit innovation. Everyone is strongly encouraged to develop new methods and ideas, and to present those ideas to the broader avalanche community in the many forums available, such as *The Avalanche Review* or at the *International Snow Science Workshop*. As those methods become used more broadly throughout our field, we envision their incorporation into future versions of this document.

The preparation of this document did not come easily. The American Avalanche Association and the Forest Service National Avalanche Center have been working on it for over a year. It took the collaborative efforts of numerous individuals and a collective spirit of cooperation to come to consensus on many issues. Ron Perla, in his closing comments on the document, summed it up best when he stated, "This is quite a diverse group to satisfy in a standards program. The working group has chosen an unenviable task. Go bravely forward." So, forward we went. We hope this document will become a useful reference for you and your avalanche operation.

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Bozeman, Montana
August, 2004

Acknowledgements

This document is a collection of protocols and common practices developed during more than 60 years of avalanche work in the United States. Common practice in the United States, in turn, developed through fruitful collaborations with scientists and practitioners in Canada, Europe, Scandinavia, Asia, and other parts of the world. Although the people that contributed to what is now common practice are too numerous to mention here, I acknowledge their contribution to our field and the methods described within this document.

To develop this document, the Working Group on Observational Guidelines started with a publication of the Canadian Avalanche Association (CAA) entitled *Observational Guidelines and Recording Standards for Weather, Snowpack, and Avalanches*. The CAA has devoted a tremendous amount of time and money towards creating and maintaining that document, which has become a symbol of professional practice in North America. I sincerely appreciate the CAA's past and present efforts to promote common practice amongst avalanche programs, and for allowing the U.S. community to benefit from their effort. Within the CAA, Clair Israelson was a constant source of encouragement and always kept his eye on the goal of providing quality information to avalanche practitioners, and Brent Strand allowed us to benefit from his publication and organizational experience.

The American Avalanche Association (AAA) and the USDA Forest Service National Avalanche Center (NAC) provided the majority of the funds and infrastructure to develop this document. This project could not have been completed without the support and encouragement of Russell Johnson (AAA President) and Doug Abromeit (NAC Director). The American Avalanche Institute also contributed funds to the production of this manual.

A public and technical review process dramatically improved the content, form, and structure of this document. I would like to thank everyone who submitted comments during this process. They include: Pat Ahern, Jon Andrews, Dale Atkins, Don Bachman, Hal Boyne, Doug Chabot, Steve Conger, Nolan Doesken, Dave Hamre, Bill Glude, Liam Fitzgerald, Ron Johnson, Chris Joosen, Art Judson, Janet Kellam, Tom Kimbrough, Mark Kozak, Bill Lerch, Chris Lundy, Tom McKee, Art Mears, Peter Martinelli Jr., Rod Newcomb, Ron Perla, and Nancy Pfeiffer. I apologize to anyone that I forgot.

There are some individual contributions that are worthy of mention. Ian McCammon provided the field book figures and snow profile reporting forms. Dale Atkins was very helpful in creating the accident forms in Appendix H and the metadata fields in Appendix C. Dan Judd provided the sample programs in Appendix E. Joyce VanDeWater drew the illustrations in Chapter 2. Snow symbol fonts created at the Swiss Federal Institute for Snow and Avalanche Research appear throughout the document. Janet Kellam, Jeff Deems, and Doug Wewer found most of the lingering errors, and Connie Lemos provided guidance on the page format and layout. Many photographers provided images for this publication and they are listed with their contribution.

Lastly I would like to thank the members of the Working Group on Observational Guidelines for their dedication and patience during the development of this document.

Ethan Greene
Working Group on Observational Guidelines, Chairman
July, 2004

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✧Sections that describe parameters included in a standard observation.

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Introduction

This document contains a set of guidelines for observing and recording snow, weather, and avalanche phenomena. These guidelines were prepared for programs that contain some type of avalanche forecasting operation, but can be applied to other programs. The guidelines are presented as a resource of common methods and are intended to promote efficient and fruitful communication amongst professional operations and between research and operational communities.

The observations presented in this manual were selected to support active avalanche forecasting programs. Observing these parameters will help avalanche forecasters make informed and predictable decisions, provide current and accurate information, and document methods and reasons for operational decisions. Recording these parameters will assist program managers to document and analyze unusual events, benefit pattern recognition and statistical forecasting methods, and assist research into snow and avalanche phenomena. In addition, there is often little snow and weather data collected in mountainous areas and data collected by avalanche forecasting programs can make important contributions to climatological and mountain systems research. Our hope is that this manual will help forecasters carefully choose the observations that will support their programs, and that those observations will generate high quality and consistent data.

It is unlikely that any one operation will make all of the observations outlined within this document. Individual program managers should select a set of parameters that their staff can observe routinely. Programs with specialized needs may have to look elsewhere for information on additional observations. A set of references is listed in Appendix A for this purpose.

Structure of this Manual

This manual is divided into three chapters and nine appendices. Within each chapter, methods for composing an observational scheme are presented first. A standard observation is presented next, and the remainder of each chapter is devoted to describing detailed methods for observing and recording a particular phenomenon. The appendices provide additional information without distracting from the main topics within the manual.

Units

The avalanche community within the United States typically uses a system of units that combines elements of both the English and International (SI) systems. In this document we have attempted to adhere to the SI system whenever possible. In the United States, personnel of avalanche operations and users of their products may not be familiar with all SI units. For this reason individual programs should choose a unit system that suits their particular application. A recommended system of units, an alternative system of English units, and methods for converting values between the two systems are presented in Appendix B. The most noticeable deviation from the SI system is the unit for elevation. In North America most topographic maps use feet as the unit for elevation. For this reason the recommended unit for elevation remains the foot. Throughout the document the recommended unit appears in the text with the common alternative unit adjacent in parentheses. Long-term data records should be stored in the recommended system of units in Appendix B. Data records submitted to a central database are assumed to be in the recommended system unless otherwise stated in the accompanying metadata file (see Appendix C).

Data Codes and Symbols

Symbols and data codes for many of the observations in this document appear in tables within each section. The use of these codes will save space in field books and on log sheets. Many of the codes in Chapter 1 follow conventions from the meteorological community. The codes in Chapters 2 and 3 were chosen to conform to common methods in the avalanche community and to promote efficient communication.