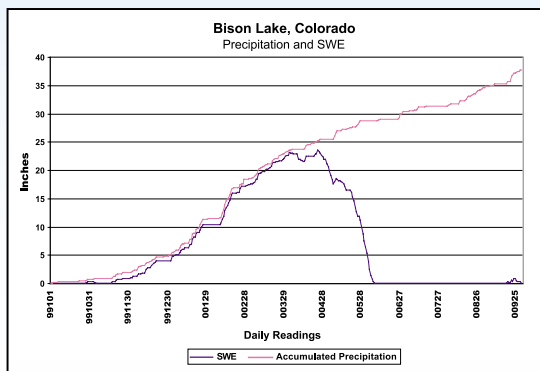


## Data Quality

Each midnight (2400 hour) certain sensors must pass a limited automated computer-screening program that flags data that fails minimum requirements before the data are placed into the CCF database. Manual checking of the quality controlled data is done by the DCO's and reedited if necessary. These weekly edits are loaded into the database. A final edit is completed annually for each site prior to archiving.

## Data Management and Accessibility

Remote site data is stored and managed at the National Water and Climate Center. Data can be accessed by direct logon with user accounts, hardcopy and in real-time via the internet at [www.wcc.nrcs.usda.gov](http://www.wcc.nrcs.usda.gov). Various analysis, reports and products can be found at this site in addition to the raw data.



**Example of snow water equivalent and accumulated precipitation plot for Bison Lake SNOTEL, Colorado (Elevation 10,880', Colorado River Basin)**

## For More Information

contact the NRCS State Office in any of the western states; their Web pages can be found under "Links", line 5, under "Water Supply" on the NWCC homepage (see below).

Alaska: 907-271-2424 ext. 113  
Arizona: 602-280-8841  
California: 530-792-5624  
Colorado: 720-544-2852  
Idaho: 208-378-5741  
Montana: 406-587-6844  
Nevada: 775-784-5878 ext. 151  
New Mexico: 505-761-4436  
South Dakota: 605-587-6844  
Oregon: 503-414-3266  
Utah: 801-524-5213  
Washington: 360-428-7684  
Wyoming: 307-261-6481

Water & Climate Monitoring Branch Leader  
National Water and Climate Center  
101 SW Main St., Suite 1600  
Portland, OR 97204  
Phone: 503-414-3031 Fax: 503-414-3101

[www.wcc.nrcs.usda.gov](http://www.wcc.nrcs.usda.gov)

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February 2003

United States Department of Agriculture



National Water and Climate Center

**SNOTEL**  
(SNOWpack TELEmetry)



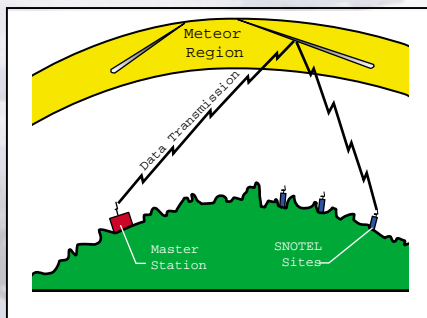
# SNOTEL

## Introduction

The Natural Resources Conservation Service (NRCS) installs, operates and maintains an extensive, automated system designed to collect snowpack and related climatic data in the Western United States and Alaska. This system, called SNOTEL (for SNOWpack TELemetry), operates over 660 remote sites in mountain snowpack zones. Congress mandated NRCS (then the Soil Conservation Service) in the mid-1930's "to measure snowpack in the mountains of the West and forecast the water supply." Manual measurement of snow courses was the norm until 1980.

SNOTEL now provides reliable and efficiently collected data needed to produce water supply forecasts and to support the resource management activities of NRCS and others.

The modern SNOTEL network also serves climate studies, air and water quality investigations, climate changes, and endangered species habitat. The high-elevation watershed locations, broad coverage, and real-time operation of the network provide important data to researchers, river and reservoir managers, emergency managers for natural disasters such as floods and droughts, and for power generation.



**SNOTEL Meteor-burst System**

## Meteor Burst Technology

SNOTEL uses meteor burst communication technology to communicate data in near real-time. VHF radio signals are reflected at a steep angle off the ever present band of ionized meteorites existing from about 50 to 75 miles above the earth. Satellites are not involved; NRCS operates and controls the entire system.

These sites are generally located in remote high-mountain watersheds where access is often difficult or restricted. Access for maintenance by NRCS and cooperators includes various modes from hiking and skiing to helicopters.

SNOTEL sites are designed to operate unattended and without maintenance for up to a year or longer. Batteries are charged by solar cells. Six NCRS Data Collection Offices (DCO) monitor daily site statistics and provide maintenance response.

The NRCS operates three meteor burst master stations located near Boise, Idaho, Ogden, Utah and Anchorage, Alaska. The master stations gather the remote site data and forward it to the Central Computer Facilities (CCF) located at the National Water and Climate Center (NWCC) in Portland, Oregon. At the CCF, it is converted to engineering units and is initially screened for errors, databased and made available to the public via the NWCC web site (<http://www.wcc.nrcs.usda.gov>).

## SNOTEL System Capabilities

The basic SNOTEL site provides snowpack water content via pressure sensing snow pillow, snow depth, all-season storage precipitation accumulation, and air temperature with daily maximums, minimums, and averages.

The newest SNOTEL sites are enhanced with new hardware consisting of a meteor burst radio and datalogger. Many of these new SNOTEL sites provide complete weather station functions along with soil moisture and temperature measurements at various depths.

The atmospheric sensor data is generally acquired every 10 seconds, while the soil moisture and soil temperature measurements are done every 15 minutes.

## Standard SNOTEL Site Configuration

*(Daily Values Archived)*

Parameter Measured	Data Sensing
Air Temperature	Shielded thermistor
Precipitation	Storage type gage
Snow Water Content	Snow pillow device and a pressure transducer
Snow Depth	Sonic sensor

## Enhanced SNOTEL Site Configuration

*(Generally Report Hourly)*

*Also includes Standard Site Configuration.)*

Parameter Measured	Data Sensing
Barometric Pressure	Silicon capacitive pressure sensor
Relative Humidity	Thin film capacitance-type sensor
Soil Moisture	Dielectric constant measuring device. Measurements are taken at standard depths of 2", 4", 8", 20", and 40"
Soil Temperature	Encapsulated thermistor. Typical measurements are at 2", 4", 8", 20" and 40" depths.
Solar Radiation	Pyranometer
Wind Speed and Direction	Propeller type anemometer

Other sensors can be added to any of the enhanced SNOTEL sites such as water quality sensors.

System performance is usually above 99%. Data from missing reports are estimated to provide a serially complete data set.