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Meteorological Data near Rabbit Ears Pass, Colorado, U.S.A., 1984–2008

Data Series 415

U.S. Department of the Interior
U.S. Geological Survey

Cover photo: Meteorological tower near Rabbit Ears Pass, Colorado, April 11, 2007.
(Photography by Douglas R. Halm, U.S. Geological Survey)

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KEN SALAZAR, Secretary

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Contents

Figure

Table

Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
millimeter (mm)	0.03937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
kilometer (km)	0.5400	mile, nautical (nmi)
meter (m)	1.094	yard (yd)
	Area	
square meter (m^2)	0.0002471	acre
hectare (ha)	2.471	acre
square hectometer (hm^2)	2.471	acre
square kilometer (km^2)	247.1	acre
square centimeter (cm^2)	0.001076	square foot (ft^2)
square meter (m^2)	10.76	square foot (ft^2)
square centimeter (cm^2)	0.1550	square inch (ft^2)
square hectometer (hm^2)	0.003861	section (640 acres or 1 square mile)
hectare (ha)	0.003861	square mile (mi^2)
square kilometer (km^2)	0.3861	square mile (mi^2)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8×°C)+32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C=(°F-32)/1.8$$

Altitude, as used in this report, refers to distance above the vertical datum.

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

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Introduction

In 1983, a snowmelt energy budget study was initiated by the U.S. Geological Survey on a small watershed near Rabbit Ears Pass, Colorado to better understand snowmelt processes. The study included data collection from hydrological and meteorological instrumentation. In 2007, the project was terminated, although air temperature and relative humidity (RH) data collection are still active at the time of this report (2009). Interest in long term, high-altitude meteorological sites has increased recently due to the increased awareness of global climate change. The meteorological data collected near Rabbit Ears Pass may aid researchers involved in global climate change studies.

Purpose and Scope

The purpose of this report is to publish a long-term, high-altitude meteorological data set. Meteorological data for air temperature, RH, wind speed, and precipitation are presented for the years 1984–2008.

Site Description

The research watershed is located near Rabbit Ears Pass, about 18 kilometers (km) southeast of Steamboat Springs, Colorado (fig. 1). The study area is the watershed of a tributary of Walton Creek and is approximately 200 hectares (ha) and ranges in altitude from 2,910–3,035 meters (m). The watershed is predominantly covered by soil with a few areas of exposed bedrock. It is about 30 percent forested with mostly coniferous forest and diffuse patches of Aspen (Peters and Leavesley, 1995). Average annual precipitation for the period 1971–2000 ranges from 1,270–1,400 millimeters (mm) per year (Oregon Climate Services, 2008).

Methods

Temperature, RH, and wind speed instruments were mounted on a 10-m tower located in a large clearing (lat 40.3994° N., long 106.6459° W.) at 2,962 m (fig. 1). A precipitation gage was located in a clearing (lat 40.3945° N., long 106.6488° W.) approximately 600 m from the tower at 2,899 m. Two temperature and RH sensors were mounted on the tower, one at 5 m and one at 2 m above the ground surface. The wind speed sensor was mounted on the tower at 2 m. During snow cover, when snow depth increased or decreased, the sensors were moved to keep them approximately 2 m and 5 m above the snow surface.

Air temperature and RH were measured using three different instruments during the study period. The initial installation used two Campbell Scientific 201 thermistor/RH sensors. The Campbell Scientific 201 sensor contained a Phys-Chemical Research model PCPC–11 RH sensor with an accuracy of +/- 3 percent and a Fenwal UUT–51J1 thermistor with an accuracy of +/- 0.2 °C. On January 7, 1985, the Campbell Scientific 201 sensors were replaced with Campbell Scientific 207 sensors, which are essentially the same as the Campbell Scientific 201 sensors but configured for the new line of Campbell Scientifics data loggers. On March 24, 1997, the Campbell Scientific 207 sensors were replaced with Campbell Scientific HMP35C temperature and RH sensors. The Campbell Scientific HMP35C sensor contained a thermistor for temperature with an accuracy of +/- 0.4 °C, and a Vaisala capacitive polymer H chip for measuring RH with an accuracy of +/- 2 percent. Wind speed was measured by a Met-One 014A anemometer, with an accuracy of +/- 0.11 meters per second (m/s) that was set and maintained at 2 m above ground or snow surface. Precipitation was measured using a Belfort Universal Recording Rain Gage 5–780 Series with an accuracy of ½ of 1 percent, and sensitivity of 0.25 mm.

All sensors were measured by Campbell Scientific CR21 or CR21X data loggers and the readings were stored on Campbell Scientific SM192 or SM716 storage modules. The stored data were either retrieved by a field computer at the site

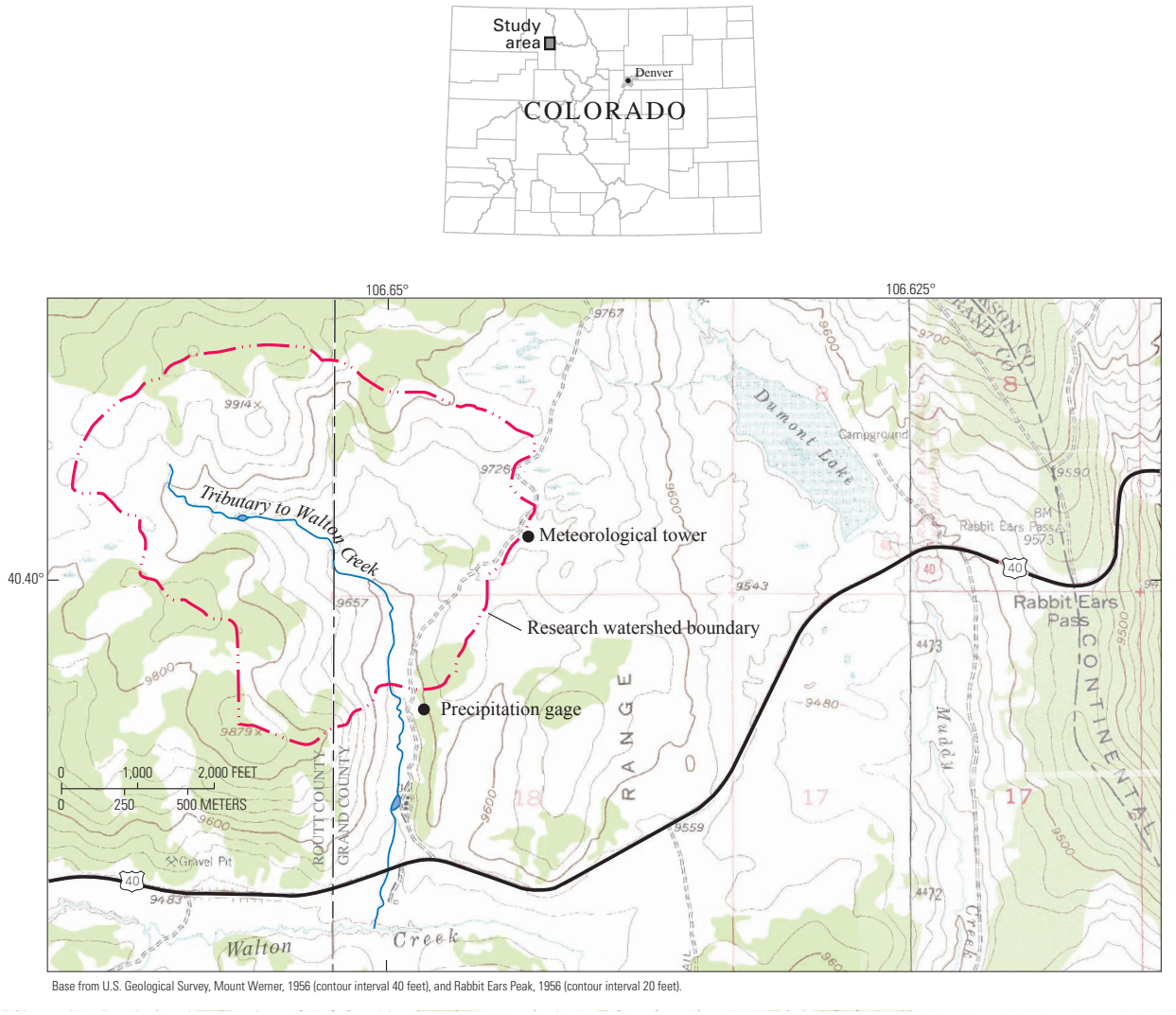

Figure 1. Location of research watershed.

or the storage module was brought back to the office and the data retrieved by an office computer. The meteorological data were then visually inspected and plotted, and obvious outliers and bad data sections were removed.

Meteorological Data Summary and Availability

Temperature data presented in this report were collected from March 1, 1984, to February 20, 2008. RH data were collected from January 26, 1985, to February 20, 2008. Wind speed data were collected from February 17, 1984, to October 1, 2007. Precipitation data were collected from January 1, 1984, to October 1, 2007.

In table 1, temperature data are presented for 5-m and 2-m daily maximum, minimum, and mean values. RH data are presented for 5-m and 2-m daily maximum and minimum values. Wind speed data are presented for 2-m daily maximum and mean values. Precipitation data are presented as daily totals. Table 1 is an Excel spread sheet of the meteorological data and can be accessed at *https//pubs.usgs.gov/ds/415*.

References Cited

Peters, N.E., and Leavesley, G.H., 1995, Biotic and abiotic processes controlling water chemistry during snowmelt at Rabbit Ears Pass, Rocky Mountains, Colorado, USA: Water, Air and Soil Pollution, v. 79, no. 1–4, p. 171–190.

Oregon Climate Service, State annual precipitation maps, 2008, accessed July 3, 2008, at URL *http://www.ocs.oregon-state.edu/index.html*

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