

Readme File for the data presented in:

S. E. Godsey, D. Marks, P. Kormos, M. Seyfried, Enslin, C., J. McNamara and T. Link, 2017, Eleven years of mountain weather, snow, soil moisture and stream flow data from the rain-snow transition zone - the Johnston Draw catchment, Reynolds Creek Experimental Watershed and Critical Zone Observatory, USA, Ag Data Commons, USDA Agricultural Library, <http://dx.doi.org/10.15482/USDA.ADC/1402076>.

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Data presented in the paper are all stored as ASCII text files.

Header information in the enclosed files includes:

Date_time	Date followed by time, separated by space (example: YYYY/mm/dd HH:mm – 24-hour time format)
WY	Water Year
Year	Calendar Year
Month	Month of Year
Day	Day of Month
Hour	Hour of Day
Minute	Minute of Hour
T_a	Air Temperature ~3 m above ground surface (°C)
RH	Relative Humidity ~3 m above ground surface (0 - 1)
e_a	Water Vapor Pressure ~3 m above ground surface (Pa)
T_d	Dew Point Temperature ~3 m above ground surface (°C)
w_s	Wind Speed ~3 m above ground surface (ms ⁻¹)
w_d	Wind Direction ~3 m above ground surface (° from N)
S_i	Incoming Solar Radiation (W m ⁻²)
z_s_site	Snow Depth at specified site (cm)
ppt_a	Wind Corrected Precipitation (mm)
perc_snow	Fraction of precipitation that is snow (unitless ratio from 0 to 1)
s_m_5	Soil Moisture at 5cm depth (m ³ m ⁻³ - dimensionless)
s_m_20	Soil Moisture at 20cm depth (m ³ m ⁻³ - dimensionless)
s_m_35	Soil Moisture at 35cm depth (m ³ m ⁻³ - dimensionless)
s_m_50	Soil Moisture at 50cm depth (m ³ m ⁻³ - dimensionless)
s_m_75	Soil Moisture at 75cm depth (m ³ m ⁻³ - dimensionless)
s_m_90	Soil Moisture at 90cm depth (m ³ m ⁻³ - dimensionless)
s_m_100	Soil Moisture at 100cm depth (m ³ m ⁻³ - dimensionless)
T_g_5	Soil Temperature at 5cm depth (°C)
T_g_20	Soil Temperature at 20cm depth (°C)
T_g_35	Soil Temperature at 35cm depth (°C)
T_g_50	Soil Temperature at 50cm depth (°C)
T_g_75	Soil Temperature at 75cm depth (°C)
T_g_90	Soil Temperature at 90cm depth (°C)
T_g_100	Soil Temperature at 100cm depth (°C)
Q	Stream Discharge (m ³ s ⁻¹)

Meteorological Data

Precipitation:

3 time-series precipitation files, ascii comma-separated (csv) with 1 header row –
rc.tg.dc.jd-125_ppt.txt, rc.tg.dc.jd-124_ppt.txt, rc.tg.dc.jd-124b_ppt.txt

Data from all precipitation gauges in the JD watershed.

Precipitation for 125 and 124 were wind-corrected using the dual-gauge method described by *Hanson et al.* (2004). Precipitation for 124b was wind-corrected using wind data and the standard WMO method as applied by *WMO (2008)*. The percent snow was calculated using the methods developed by *Marks et al.* (2013), using the during-storm dew point temperature (T_d) where:

$T_d < -0.5\text{ }^{\circ}\text{C}$	1.0 Fractional Snow (All Snow)
$-0.5\text{ }^{\circ}\text{C} \geq T_d < 0\text{ }^{\circ}\text{C}$	$((-T_d / 0.5) * 0.25) + 0.75$ Fractional Snow
$0\text{ }^{\circ}\text{C} \leq T_d < +0.5\text{ }^{\circ}\text{C}$	$((-T_d / 1.0) * 0.75) + 0.75$ Fractional Snow
$1.0\text{ }^{\circ}\text{C} \leq T_d$	0.0 Fractional Snow (No Snow)

- 125 and 124b are dual gauge precipitation stations (pair of modified Belfort Universal gages, one shielded, one unshielded).

- 124b is a shielded gauge precipitation station (modified Belfort Universal Gage, with a wind shield).

Each record in precipitation files contains Date_time, WY, Year, Month, Day, Hour, Minute, ppt_a, and perc_snow separated by comma. Date_time refers to the end of the hour over which the cumulative precipitation was recorded, and is reported in the format YYYY-mm-dd HH:mm.

Weather:

11 time-series weather station data files, ascii comma-separated (txt) with 1 header row -
rc.tg.dc.jd-125_met.txt, rc.tg.dc.jd-124_met.txt, rc.tg.dc.jd-124b_met.txt, rc.tg.dc.jd-jdt1_met.txt,
rc.tg.dc.jd-jdt2_met.txt, rc.tg.dc.jd-jdt2b_met.txt, rc.tg.dc.jd-jdt3_met.txt, rc.tg.dc.jd-jdt3b_met.txt,
rc.tg.dc.jd-jdt4_met.txt, rc.tg.dc.jd-jdt4b_met.txt, rc.tg.dc.jd-jdt5_met.txt

Meteorological forcing data from all stations in the JD watershed.

Water vapor pressure (e_a) was calculated using air temperature (T_a), relative humidity (RH) and software tools (Image Processing Workbench, version 2.0) developed by *Marks et al.* (1999). T_d was calculated using the calculated e_a . These IPW tools allow for optimized accuracy of e_a and T_d when temperatures approach 0°C . All parameters (T_a , RH, e_a , T_d , S_i , w_s , and w_d) were processed according to the WMO standards as summarized by *Zahumenský* (2004). All data were gap-filled using multiple linear regression with nearby long-term Reynolds Creek sites 144 and 145. Snow depth was processed using a snow filter tool created by Dr. Patrick Kormos. This tool requires a start and end of the snow season and maximum snow depth. From these, the filter tool creates a line of best fit using a custom user defined smoothing window. For more information on this tool, contact Dr. Patrick Kormos at Patrick.Kormos@ars.usda.gov. Meteorological instruments are polled every 10 sec and those polled values are averaged and recorded every 15 minutes. The reported hourly data in these records is the average of the 15-min data, and the Date_time refers to the end of the hour over which samples are averaged, and is reported in the format YYYY-mm-dd HH:mm.

- rc.tg.dc.jd-jdt1_op.txt, rc.tg.dc.jd-jdt2_op.txt, rc.tg.dc.jd-jdt4_op.txt, and rc.tg.dc.jd-jdt5_op.txt:
Each record contains Date_time, WY, Year, Month, Day, Hour, Minute, T_a , RH, e_a , and T_d separated by comma.

- rc.tg.dc.jd-jdt2b_op.txt, rc.tg.dc.jd-jdt3_op.txt, rc.tg.dc.jd-jdt3b_op.txt, and
rc.tg.dc.jd-jdt4b_op.txt:

Each record contains Date_time, WY, Year, Month, Day, Hour, Minute, T_a, RH, e_a, T_d, w_s, and w_d separated by comma.

– rc.tg.dc.jd-125_op.txt, rc.tg.dc.jd-124_op.txt, rc.tg.dc.jd-124b_op.txt:

Each record contains Date_time, WY, Year, Month, Day, Hour, Minute, T_a, RH, e_a, T_d, S_i, w_s, and w_d separated by comma.

The instrumentation installed at the stations in the JD watershed includes:

Vaisala HMP45C	- air temperature and humidity
Met One WS 034B	- wind speed
Met One WD 034B	- wind direction
Eppley PSP	- incoming solar radiation

Stream, Snow, and Soils Data:

Soils:

9 time-series soil moisture and temperature files, ascii comma-separated (txt) with 1 header row - rc.tg.dc.jd-124ba_stm.txt, rc.tg.dc.jd-124bs_stm.txt, rc.tg.dc.jd-jdt1_stm.txt, rc.tg.dc.jd-jdt2_stm.txt, rc.tg.dc.jd-jdt2b_stm.txt, rc.tg.dc.jd-jdt3_stm.txt, rc.tg.dc.jd-jdt3b_stm.txt, rc.tg.dc.jd-jdt4_stm.txt, rc.tg.dc.jd-jdt4b_stm.txt

Soil temperature and moisture data from all JD sites. Soil temperature is serially complete and gap-filled whereas soil moisture has not been gap-filled. All soils files contain Date_time, WY, Year, Month, Day, Hour, Minute, T_g*, s_m* separated by comma; - the suffix represented by the asterisk after T_g and s_m indicate the depth in cm at which the sensors were installed. The reported values of T_g* and s_m* are the instantaneous values reported at the date and time indicated.

Instrumentation = Stevens Hydra Probe SDI-12

Stream_Discharge:

1 time-series stream discharge file, ascii comma-separated (txt) with 1 header row – rc.tg.dc.jd-125b_sf.txt

Stream discharge measured at the outlet of the JD watershed. Stream discharge (Q) was processed using methods developed by *Pierson et al.* (2001).

The *rc.tg.dc.jd-125b_sf.txt* data file contains Date_time, WY, Year, Month, Day, Hour, Minute, and Q separated by commas. The reported Q is the instantaneous value reported at the date and time indicated.

Instrumentation = stage recorder, pressure transducer and drop box weir.

Snow_Depth:

1 time-series snow depth file, ascii comma-separated (txt) with 1 header row - rc.tg.dc.jd-zs.txt

Snow depth data from all JD sites (zs_125, 124, 124b, 1, 2, 2b, 3, 3b, 4, 4b, 5). The snow depth file contains Date_time, WY, Year, Month, Day, Hour, Minute, z_s_124, z_s_124b, z_s_125, z_s_jdt1, z_s_jdt2, z_s_jdt3, z_s_jdt 4, z_s_jdt 5, z_s_jdt 2b, z_s_jdt3b, z_s_jdt4b separated by commas. The reported snow depth is the instantaneous value in centimeters reported at the site, date and time indicated.

Instrumentation = Judd depth sensor

DEM:

– This file contains a Geotiff of the Johnston Draw watershed.

Shapefiles:

- This file contains an ArcMap Map Package which includes a shapefile of the watershed boundary and the locations of all the measurement sites.

Other information:

Information regarding the naming convention for stations can be found in the text file called *Naming_Convention.pdf*. Information regarding the instrumentation installed at each station can be found in the text file called *Instrumentation_Information.pdf*.

Data time periods:

All data were collected at the Johnston Draw (JD) watershed, a sub-watershed of the Reynolds Creek Critical Zone Observatory, Idaho. The JD watershed was instrumented by the Agricultural Research Services (ARS) to study the rain-snow transition zone. The ARS installed 2 precipitation and meteorological stations (124, 125) in 2002, an additional 5 tripod stations measuring air temperature, humidity snow depth and wind to form an orographic transect across the rain-snow transition (jdt1, jdt2, jdt3, jdt4, and jdt5) in 2005, and 1 additional wind sheltered precipitation station (124b) in 2006. As all five orographic transect stations were on the north-facing slope, an additional 3 tripod stations (jdt2b, jdt3b, and jdt4b) were installed in 2010 and on south-facing slope. At that time soil temperature and moisture profile systems were attached to all 8 tripod stations, and two profiles were connected to the meteorological & precipitation station at site 124b – one in an aspen grove, and one in the open.

Data for each station for this dataset is available as following:

125b - 1 October 2003 through 30 September 2014 (11 WY)

Location (43.120808 °N, -116.7752263 °W WGS84 / 518285 Easting, 4774255 Northing, UTM, Zone 11)

Elevation: 1496 m MSL

96432 serially complete gap-filled records

125 - 1 October 2003 through 30 September 2014 (11 WY)

Location (43.123278 °N, -116.77641 °W WGS84 / 518188 Easting, 4774529 Northing, UTM, Zone 11)

Elevation: 1508 m MSL

96432 serially complete gap-filled records

124 - 1 October 2003 through 30 September 2014 (11 WY)

Location (43.129186 °N, -116.799392°W WGS84 / 516316.9 Easting, 4775180.4 Northing, UTM, Zone 11)

Elevation: 1804 m MSL

96432 serially complete gap-filled records

124b - 11 November 2006 through 30 September 2014 (8 WY)

Location (43.128604°N, -116.79661°W WGS84 / 516543.4 Easting, 4775116.3 Northing, UTM, Zone 11)

Elevation: 1778 m MSL

69384 serially complete gap-filled records

jdt1 - 5 November 2005 through 30 September 2014 (9 WY)

Location (43.122318°N, -116.779436°W WGS84 / 517942.1 Easting, 4774421.8 Northing, UTM, Zone 11)

Elevation: 1552 m MSL

78048 serially complete gap-filled records

jdt2 - 5 November 2005 through 30 September 2014 (9 WY)

Location (43.122927°N, -116.782798°W WGS84 / 517668.4 Easting, 4774488.7 Northing, UTM, Zone 11)

Elevation: 1613 m MSL

78048 serially complete gap-filled records

jdt2b - 4 March 2011 through 30 September 2014 (4 WY)

Location (43.125801°N, -116.782742°W WGS84 / 517672.2 Easting, 4774807.8 Northing, UTM, Zone 11)

Elevation: 1615 m MSL

31357 serially complete gap-filled records

jdt3 - 21 September 2005 through 30 September 2014 (9 WY)

Location (43.12188°N, -116.785609°W WGS84 / 517440.1 Easting, 4774371.8 Northing, UTM, Zone 11)

Elevation: 1658 m MSL

79128 serially complete gap-filled records

jdt3b - 13 December 2010 through 30 September 2014 (4 WY)

Location (43.125683°N, -116.78562°W WGS84 / 517438.1 Easting, 4774794.1 Northing, UTM, Zone 11)

Elevation: 1661 m MSL

33299 serially complete gap-filled records

jdt4 - 2 November 2005 through 30 September 2014 (9 WY)

Location (43.121593°N, -116.787987°W WGS84 / 517246.7 Easting, 4774339.4 Northing, UTM, Zone 11)

Elevation: 1707 m MSL

78120 serially complete gap-filled records

jdt4b - 4 March 2011 through 30 September 2014 (4 WY)

Location (43.126337°N, -116.788065°W WGS84 / 517239 Easting, 4774866.3 Northing, UTM, Zone 11)

Elevation: 1707 m MSL

31356 serially complete gap-filled records

jdt5 - 2 November 2005 through 30 September 2014 (9 WY)

Location (43.125644 °N , -116.794728 °W WGS84 / 516697.3 Easting, 4774787.9 Northing, UTM, Zone 11)

Elevation: 1748 m MSL

78120 serially complete gap-filled records

Missing data in each file are represented by -9999. Further descriptions of each file can be found below.

References:

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- Zahumenský, I., 2004, Guidelines on quality control procedures for data from automatic weather stations, *World Meteorological Organization, Switzerland*, **955**, 2–6.