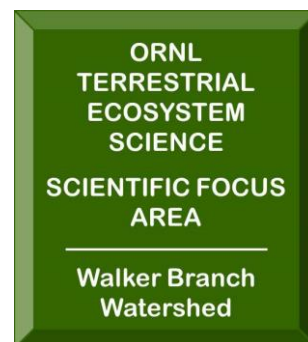


Walker Branch Watershed: Daily Climate and Soil Temperature Data



Summary:

This data set reports daily climate and soil temperature data for Walker Branch Watershed. As part of the long-term Walker Branch project, daily climate and soil temperature data were collected using instruments on a meteorological tower located in an upper slope of the watershed. This data set contains one data file of daily climate and soil temperature data from 1993 through 2010. Measurement collection began in 1993 as part of the Throughfall Displacement Experiment (TDE) in the control (ambient) plot. Measurements include daily integrated values for above canopy incident photosynthetically active radiation, above canopy incident total radiation, air temperature, relative humidity, rainfall, soil temperature at 10-15 cm, and wind speed. Measurements of incoming rainfall, irradiance, and photosynthetic photon flux density were obtained in a nearby clearing until 1998 when above canopy observations were added to the ambient plot tower.

Data Citation:

Cite this data set as follows:

Mulholland, P.J., and N.A. Griffiths. 2016. Walker Branch Watershed: Daily Climate and Soil Temperature Data. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tennessee, U.S.A.
<http://dx.doi.org/10.3334/CDIAC/ornlsfa.008>

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Data and Documentation Access:

For public access to WBW data please visit the ORNL TES-SFA Web Site:

<http://tes-sfa.ornl.gov/>

Walker Branch Watershed website: <http://walkerbranch.ornl.gov/>

Long-term monitoring of WBW is continuing through the National Ecological Observatory Network (NEON), and data are available from the NEON website: <http://www.neonscience.org/>.

Publications related to this data set:

- Curlin, J.W., and D.J. Nelson. 1968. Walker Branch Watershed project: Objectives, facilities, and ecological characteristics. ORNL/TM-2271. Oak Ridge National Laboratory, Oak Ridge, TN.
- Hanson, P.J., D.E. Todd, J.S. Riggs, M.E. Wolfe, and E.G. O'Neill. 2001. Walker Branch Throughfall Displacement Experiment Data Report: Site Characterization, System Performance, Weather, Species Composition, and Growth. ORNL/CDIAC-134, NDP-078A. Carbon Dioxide Information Analysis Center, U.S. Department of Energy, Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A. 158 pp.
- Hanson, P.J., D.E. Todd, and J.S. Amthor. 2001. A six year study of sapling and large-tree growth and mortality responses to natural and induced variability in precipitation and throughfall. *Tree Physiology* 21: 345-358.
- Hanson, P.J., D.E. Todd, and M.A. Huston. 2003. Walker Branch Throughfall Displacement Experiment (TDE), In: Hanson, P.J. and S.D. Wullschleger, eds., *North American Temperate Deciduous Forest Responses to Changing Precipitation Regimes*. Springer, New York, pp. 8-31.

Data Policy - Sharing, Access, and Use Recommendations: ORNL TES-SFA Data Policy - [Data Policy and Fair-Use Statement](#)

Related Data Sets: Historical precipitation, stream discharge, and stream chemistry data are available at <http://tes-sfa.ornl.gov/>. Environmental data from WBW are also available from the NEON website: <http://www.neonscience.org/>.

Walker Branch Watershed (WBW) Project Description:

Walker Branch Watershed (WBW) is a forested watershed on the Oak Ridge Reservation and has been the site of long-term environmental research since the 1960s. Hydrological, biogeochemical, and ecological studies in WBW have made important contributions to our understanding of the effects of changes in atmospheric deposition and climate variability and change in this region (see <http://walkerbranch.ornl.gov/publications.shtml> for complete list of publications).

Objectives of the WBW long-term observations have been to:

1. Quantify responses of an eastern upland oak forest ecosystem to inter-annual and long-term variations in climate and atmospheric deposition of sulfur and nitrogen, and
2. Provide integrated, long-term data on climate, forest vegetation, soil chemistry, and hydrologic and chemical fluxes at the catchment scale to support other focused research projects on the Oak Ridge Reservation and elsewhere in the region.

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1. Data Set Overview:

This data set reports the daily climate and soil temperature data in Walker Branch Watershed from 1993-2010. Measurements include daily integrated values for above canopy incident photosynthetically active radiation, above canopy incident total radiation, air temperature, relative humidity, rainfall, soil temperature at 10-15 cm, and wind speed. Measurements of incoming rainfall, irradiance, and photosynthetic photon flux density were obtained in a nearby clearing until 1998 when above canopy observations were added to the ambient plot tower.

2. Data Characteristics:

Spatial Coverage:

Measurement collection began in 1993 as part of the Throughfall Displacement Experiment (TDE) in the control (ambient) plot (Fig. 1). Measurements of incoming rainfall, irradiance and photosynthetic photon flux density were obtained in a nearby clearing (Fig. 1) until 1998 when above canopy observations were added to the ambient plot tower. Clearing data were used to represent above-canopy conditions for the experimental site for the years 1993-1997.

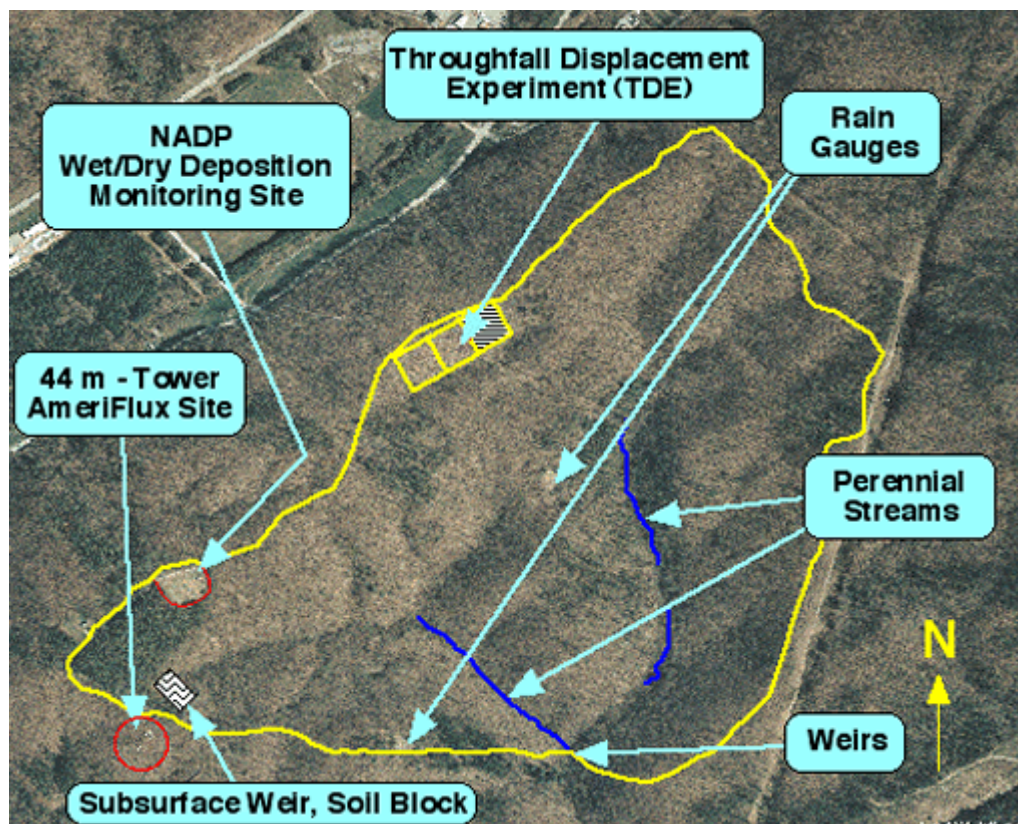


Figure 1 – Map of Walker Branch Watershed showing the location of various instrumentation. The ambient (control) TDE tower where climate and soil temperature data were collected is located in the middle of the 3 TDE plots (from left to right: wet, ambient, dry). The climate variables measured at the nearby clearing (collected until 1998) were collected from the ‘NADP Wet/Dry Deposition Monitoring Site’.

Site boundaries: Latitude and longitude given in decimal degrees. Source Google Earth.

Site (Region)	Longitude	Latitude	Elevation (meters amsl)	Geodetic Datum
Location of TDE control site climate tower.	35.96657	-84.28146	348	WGS84
Location of nearby clearing where some measurements were made prior to 1998.	35.96177	-84.28654	342	WGS84

Temporal Coverage:

Time period: The data set covers the period from January 1, 1993 to December 31, 2010.

Data File Description:

All of the data are contained in 1 comma separated (*.csv) file. Missing values are represented by -9999.

- File #1: WBW_climate_soil_temperature.csv

Data Dictionary:

File #1: WBW_climate_soil_temperature.csv

Column	Heading	Units/ Format	Description	Measurement Method
1	DATE	YYYYM MDD	Measurement date.	
2	PAR_INT	mol/m ²	Integrated incident photosynthetically active radiation (PAR).	Measured above canopy using a quantum sensor (LiCor LI-191SA).
3	RAD_INT	MW/m ²	Integrated incident total radiation.	Measured above canopy using a pyranometer sensor (LiCor LI-200SA).
4	RAD_DAILY	W/m ²	Mean daily radiation.	Measured above canopy using a pyranometer sensor (LiCor LI-200SA).
5	PRECIP	mm	Daily precipitation.	Measured above canopy using a tipping bucket rain gauge. Hourly total values summed over each day.
6	AIR_T_MIN	°C	Daily 1 hour minimum air temperature.	Measured 1-m above the soil surface using thermistors. Determined from hourly mean values.
7	AIR_T_MEAN	°C	Daily mean air temperature.	Measured 1-m above the soil surface using thermistors. Calculated from hourly mean values.
8	AIR_T_MAX	°C	Daily 1 hour maximum air temperature.	Measured 1-m above the soil surface using thermistors. Determined from hourly mean values.
9	RH_MIN	%	Daily 1 hour minimum relative humidity.	Measured using a hygrometer (Model MP-100, Rotronics Instrument Corporation). Determined from hourly mean values.
10	RH_MEAN	%	Daily mean relative humidity.	Measured using a hygrometer (Model MP-100, Rotronics Instrument Corporation). Calculated from hourly mean values.
11	RH_MAX	%	Daily 1 hour maximum relative humidity.	Measured using a hygrometer (Model MP-100, Rotronics Instrument Corporation). Determined from hourly mean values.
12	SOIL_T_MIN	°C	Daily 1 hour minimum soil temperature.	Measured at 15-cm depth in the soil using thermistors. Determined from hourly mean values.
13	SOIL_T_MEAN	°C	Daily mean soil temperature.	Measured at 15-cm depth in the soil using thermistors. Calculated from hourly mean values.
14	SOIL_T_MAX	°C	Daily 1 hour maximum soil temperature.	Measured at 15-cm depth in the soil using thermistors. Determined from hourly mean values.
15	WIND_SPEED	m/s	Mean daily wind speed.	Measured using an anemometer (4 m above the canopy). Calculated from hourly mean values.
Historical Walker Branch datasets are available at: http://tes-sfa.ornl.gov/ and information about Walker Branch Watershed is available at: http://walkerbranch.ornl.gov/ .				
Missing data denoted as '-9999'.				

Example Data Records:

```

DATE,PAR_INT,RAD_INT,RAD_DAILY,PRECIP,AIR_T_MIN,AIR_T_MEAN,AIR_T_MAX,RH_MIN,RH_MEAN,RH_MAX,SOIL_T_MIN,SO
IL_T_MEAN,SOIL_T_MAX,WIND_SPEED
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20101227,20.85,9.07,105.00,0.0,-7.67,-2.35,2.81,41.32,71.95,100.30,4.30,4.91,5.44,0.74
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20101229,10.57,4.93,57.10,0.2,1.17,5.45,9.79,49.54,70.99,98.30,5.24,5.89,6.56,0.59
20101230,8.01,3.68,42.63,2.3,7.06,10.46,14.45,61.52,72.93,103.70,6.58,7.15,7.82,0.57
20101231,2.63,1.12,13.02,63.0,5.83,10.46,13.21,99.80,104.43,106.70,7.87,9.22,9.91,0.92

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3. Data Application and Derivation:

This dataset was intended to provide data on climate parameters and soil temperature for the TDE project that evaluated the effects of altered precipitation regimes on forest ecosystems. These data were also used to characterize climatic conditions for studies on watershed hydrological and biogeochemical fluxes. These data were used in various publications on forest ecology, hydrology, and biogeochemistry in Walker Branch.

4. Quality Assessment:

These data are considered at Level 2. Level 2 indicates that, in addition to the Level 1 checks, the product is a complete, externally consistent data product that has undergone interpretative and diagnostic analyses and can be shared with the public. Level 1 indicates an internally consistent data product that has been subjected to quality checks and data management procedures. Instrument calibrations were carried out following the manufacturer's instructions and analyses followed published procedures.

5. Data Acquisition Materials and Methods:

Site Description:

Walker Branch Watershed (WBW) is a 97.5 ha second-growth forest on the U.S. Department of Energy's Oak Ridge Reservation in east Tennessee, USA. There are two headwaters streams that drain the watershed: the West Fork drains 38.4 ha and the East Fork drains 59.1 ha (Curlin and Nelson 1968). The watershed is underlain by bedrock (Knox Dolomite) with deep soils, primarily Utisols. Vegetation is primarily oaks (*Quercus prinus*, *Quercus alba*), tulip poplar (*Liriodendron tulipifera*), red maple (*Acer rubrum*), and American beech (*Fagus grandifolia*) (Johnson 1989, Kardol et al. 2010). The climate is typical of the southern Appalachian region, with a mean annual temperature of 14.5°C and mean annual precipitation of 135 cm (Curlin and Nelson 1968, Johnson 1989).

Climate and Soil Temperature Measurements:

As part of the long-term Walker Branch project, daily climate and soil temperature data were collected using instruments on a meteorological tower located in an upper slope location within the watershed. These measurements started in 1993 as part of the Throughfall Displacement Experiment (TDE) in the control (ambient) plot and continued through 2010. Measurements include daily integrated or averaged values for incident photosynthetically active radiation, incident total radiation, air temperature, relative humidity, rainfall, soil temperature at 10-15 cm, and wind speed. Measurements of incoming rainfall, irradiance and photosynthetic photon flux density were obtained in a nearby clearing until 1998 when above canopy observations were added to the ambient plot tower. Clearing data were used to represent above-canopy conditions for the experimental site for the years 1993-1997.

Above canopy irradiance was measured using a pyranometer sensor (LiCor LI-200SA), above canopy photosynthetic photon flux density was measured using a quantum sensor (LiCor LI-191SA), relative humidity was measured using a hygrometer (Model MP-100, Rotronics Instrument Corporation), rainfall was measured with a tipping bucket rain gauge, and wind speed was measured with an anemometer (4 m above the canopy). Sub-canopy air temperature was measured at approximately 1 m above the soil surface in a location shielded from direct solar radiation. Soil temperatures were measured at 15 cm depth at 4 locations. All temperatures were measured with thermistors (LiCor, Inc.) set to read over a -10 to 50°C range. Climate data were logged as hourly means on data loggers (Li-1000, LiCor Inc.).

6. References:

- Curlin, J. W., and D. J. Nelson. 1968. Walker Branch Watershed project: objectives, facilities, and ecological characteristics. ORNL-TM-2271. Oak Ridge National Laboratory, Oak Ridge, Tennessee.
- Johnson, D. W. 1989. Site description. Pages 6-20 *in* D. W. Johnson and R. I. Van Hook (editors). Analysis of biogeochemical cycling processes in Walker Branch Watershed. Springer-Verlag, New York, New York.
- Kardol, P., D. E. Todd, P. J. Hanson, and P. J. Mulholland. 2010. Long-term successional forest dynamics: species and community responses to climatic variability. *Journal of Vegetation Science* 21:627-642.

7. Data Access:

This data is available through the Oak Ridge National Laboratory (ORNL) Carbon Dioxide Information Analysis Center (CDIAC)

Data Archive Center:

Contact for Data Center Access Information:

E-mail: <http://cdiacservices.ornl.gov/feedback.cfm>