NorWeST Observed Stream Temperature Points

Tags

stream, water, temperature, hydrography

Summary

These data were originally intended to be used for managing biological resources and predicting species distributions that are affected by August mean stream temperature. Note that metadata specific to each layer is in the XML file provided.

Description

These data represent modeled stream temperatures for a portion of a larger dataset known as the Great Northern Landscape Conservation Cooperative (GNLCC) (http://greatnorthernlcc.org/). This metadata record is a combined description for two spatial data feature types, vector lines and points, which cover the same geographic area. The line features are derived from NHDPlus (http://www.horizon-systems.com/NHDPlus/index.php) (USEPA and USGS, 2010) stream lines and the point data represent 1 km intervals along the NHDPlus stream network. Both datasets contain identical modeled stream temperature attributes. These modeled stream temperatures were generated as part of the U.S. Forest Service NorWeST stream temperature project http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html.

These data reside in ESRI shapefile format, ArcGIS version 10.2. The line and point shapefile extents correspond to NorWeST production units, which generally relate to 6 digit (3rd code) hydrologic unit codes (HUCs). August mean stream temperature was the metric selected to be modeled in the NorWeST temperature model. Use of this metric allowed the largest proportion of data in the NorWeST observed temperature database to be used (~80%), which facilitated calibration of the model to thousands of unique stream sites across the region. The vector stream line data were derived from the NHDPlus data through a process referred to as reconditioning.

This reconditioned data set was modified from the original NHDPlus data to ensure stream connectivity, which was required to fit spatial statistical models to the stream network data. Braided channels, most canals, and disconnected streams were deleted from NHDPlus. Additionally, where three or more segments converged into a single downstream segment the stream layer was manually edited to offset two of the three segments.

Because many stream segments were deleted, this dataset does not contain all of the line features of the original NHDPlus data. The FLoWS and STARS toolboxes (http://www.fs.fed.us/rm/boise/AWAE/projects/SpatialStreamNetworks.shtml) were used to identify topological errors and generate the final spatial layer. The stream lines were further processed into 1 km segments to be used as input for the NorWeST stream temperature model. The point shapefiles correspond to the mid-point location for each 1 km stream segment. Stream temperatures were modeled at each point location. Modeled temperature values were subsequently attributed back to the 1 km stream line dataset. Stream temperatures were modeled from a set of covariate predictors using spatial statistical software called SSN and STARS (Ver Hoef et al. 2006).
(http://www.fs.fed.us/rm/boise/AWAE/projects/SpatialStreamNetworks.shtml)

The spatial covariates used for modeling stream temperature were derived from various sources as described below:

1. Air temperature_August (C). Mean August air temperature across the river basin derived from the dynamically downscaled NCEP RegCM3 reanalysis (Hostetler et al. 2011). Data were downloaded from the USGS Regional Climate Downscaling website (http://regclim.coas.oregonstate.edu/index.html).

2. Stream discharge_August (m3/s). Mean August stream discharge across the river based derived from USGS flow gages on streams with minimal water abstraction or storage reservoirs. Data were downloaded from the NWIS website (http://waterdata.usgs.gov/nwis/rt).

3. Elevation (m). Elevation at stream temperature sites was used to represent the vertical trend towards cooler air temperatures. Data were obtained from the 30-m resolution digital elevation model associated with NHDPlus (USEPA and USGS, 2010). Data were downloaded from http://www.horizon-systems.com/NHDPlus/NHDPlusV1_home.php.

4. Latitude (m). The y-coordinate at stream temperature sites from the Albers Equal Area projection was used to represent latitude and the poleward trend towards cooler air temperatures.

5. Canopy %. The percent canopy variable from the 2001 version of the National Land Cover Database (NLCD; Homer et al., 2007) was used to represent stream shade at each temperature site. Canopy % values in areas with recent wildfires between 2001 and 2008 were reduced based on U.S. Forest Service burn severity data following procedures developed by Miller et al. (2009). NLCD data were downloaded from http://www.mrlc.gov/nlcd2001.php.

6. Cumulative drainage area (km sq.). The value of CUMDRAINAG in NHDPlus (USEPA and USGS, 2010) at each stream temperature site was used to represent stream size and amount of insolation. It was assumed that larger streams had been exposed to insolation over a greater length and were less shaded by adjacent riparian vegetation. Data were downloaded from http://www.horizon-systems.com/NHDPlus/NHDPlusV1_home.php.

7. Stream slope %. The stream slope value in NHDPlus (USEPA and USGS, 2010) at a stream temperature site. It was assumed that slope affects flow velocity and equilibration time to local heating conditions. Steeper slopes, therefore, should negatively affect stream temperatures because conditions further upstream at higher elevations have greater influence on local temperatures. Data were downloaded from http://www.horizon-systems.com/NHDPlus/NHDPlusV1_home.php.

8. Mean annual precipitation (mm). The value of AREAWTMAP in NHDPlus (USEPA and USGS, 2010) at each stream temperature site. Areas with high annual precipitation may have higher water yields that cool streams. Data were downloaded from http://www.horizon-systems.com/NHDPlus/NHDPlusV1_home.php.

9. Base flow index (BFI). The value of the base flow index (Wolock, 2003) at a stream temperature site. Streams with larger baseflows and groundwater contributions are thought to be colder than other streams and potentially less sensitive to climate warming. Data were downloaded from http://ks.water.usgs.gov/pubs/abstracts/of.03-263.htm.

10. Glacier %. The percentage of the catchment area classified as glacier at each temperature site. Summaries were computed using a standard flow accumulation routine. This covariate represents the local cooling effect that glaciers may have on downstream temperatures. Data were downloaded from http://glaciers.research.pdx.edu/Downloads.

11. Lake %. The value of NLCD11PC in NHDPlus (USEPA and USGS, 2010), which is the percentage of the catchment area classified as open water, at a temperature site. This covariate represents the warming effect that natural lakes and many reservoirs have on downstream temperatures. Data were downloaded from http://www.horizon-systems.com/NHDPlus/NHDPlusV1_home.php.

12. Tailwater. Categorical predictor variable coded as 0/1 to indicate whether a stream temperature site is downstream from a reservoir that creates an anomalously cold tailwater. Using the SSN and STARS tools along with the covariate predictors, various mean August stream

temperature scenarios were modeled. The scenarios include the 19 year average from 1993-2011, the 10 year average from 2002-2001, and single year scenarios for the years 1993 through 2011.

Referenced Cited:

Homer, C., Dewitz, J., Fry, J., Coan, M., Hossain, N., Larson, C., Herold, N., McKerrow, A., VanDriel, J.N., and Wickham, J. 2007. Completion of the 2001 National Land Cover Database for the Conterminous United States. Photogrammetric Engineering and Remote Sensing, 73:337-341.

Hostetler, S.W., J.R. Alder, and A.M. Allan. 2011. Dynamically downscaled climate simulations over North America: Methods, evaluation and supporting documentation for users: U.S. Geological Survey Open-File Report 2011-1238, 64 p. website: http://regclim.coas.oregonstate.edu/index.html

USEPA and USGS, 2010. NHDPlus Version 1 (NHDPlusV1) User Guide, available online at http://www.horizon-systems.com/NHDPlus/NHDPlusV1_documentation.php

OR
http://www.horizon-systems.com/NHDPlus/NHDPlusV2_documentation.php#NHDPlusV2%20Metadata

Check the individual metadata XML file for NHD Plus version number

Miller, J.D., E.E. Knapp, C.H. Key, C.N. Skinner, C.J. Isbell, R.M. Creasy, J.W. Sherlock, 2009. Calibration and validation of the relative differenced Normalized Burn Ratio (RdNBR) to three measures of fire severity in the Sierra Nevada and Klamath Mountains, California, USA. Remote Sensing of the Environment, 113:645-656.

Ver Hoef, J.M., E.E. Peterson, and D. Theobald. 2006. Spatial statistical models that use flow and stream distance. Environmental and Ecological Statistics 13:449-464. Wolock, D.M. 2003. Base - Flow Index Grid for the Conterminous United States. U.S. Geological Survey open-file report 03-263, USGS, Lawrence, KS.

Credits

U.S. Forest Service; Rocky Mountain Research Station; Air, Water, and Aquatic Environments Program (AWAE). http://www.fs.fed.us/rm/boise/awae_home.shtml

Use limitations

These data should be used with the understanding that the stream temperature values contained herein are modeled temperatures, not actual temperatures, and are subject error. The USDA Forest Service makes no warranty, expressed or implied, including the warranties of merchantability and fitness for a particular purpose, nor assumes any legal liability or responsibility for the accuracy, reliability, completeness or utility of these geospatial data, or for the improper or incorrect use of these geospatial data. These geospatial data and related maps or graphics are not legal documents and are not intended to be used as such. The data and maps may not be used to determine title, ownership, legal descriptions or boundaries, legal jurisdiction, or restrictions that may be in place on either public or private land. Natural hazards may or may not be depicted on the data and maps, and land users should exercise due caution. The data are dynamic and may change over time. The user is responsible to verify the limitations of the geospatial data and to use the data accordingly.

ArcGIS Metadata ►

Citation ►

TITLE NorWeST Observed Stream Temperature Points

Resource Details ►

CREDITS

U.S. Forest Service; Rocky Mountain Research Station; Air, Water, and Aquatic Environments Program (AWAE).
http://www.fs.fed.us/rm/boise/awae_home.shtml

Resource Constraints ►

CONSTRAINTS

LIMITATIONS OF USE

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Fields ►

DETAILS FOR OBJECT NorWeST_ObservedTempPoints_xxx►

DEFINITION

Attribute Table

FIELD FID ►

FIELD DESCRIPTION

Internal feature number.

DESCRIPTION SOURCE

ESRI

DESCRIPTION OF VALUES

Sequential unique whole numbers that are automatically generated.

FIELD Shape ►

FIELD DESCRIPTION

Feature geometry.

DESCRIPTION SOURCE

ESRI

DESCRIPTION OF VALUES

Coordinates defining the features.

FIELD OBSPRED_ID ►

FIELD DESCRIPTION

A unique ID for each feature

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD ELEV ►

FIELD DESCRIPTION

Elevation in meters

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD CANOPY ►

FIELD DESCRIPTION

Percent canopy for each 1 km stream segment

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD TAILWATER ►

FIELD DESCRIPTION

Categorical predictor variable coded as 0/1 to indicate whether a stream temperature site is downstream from a reservoir that creates an anomalously cold tailwater.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD SLOPE ►

FIELD DESCRIPTION

Slope (rise/run) for each NHDPlus stream reach

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD PRECIP ►

FIELD DESCRIPTION

NHDPlus precipitation measure (mm)

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD CUMDRAINAG ►

FIELD DESCRIPTION

Cumulative drainage area (sq. km) for each NHDPlus stream reach

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD Y_COORD ►
FIELD DESCRIPTION
Y coordinate of Albers Equal Area projection with units meters, used as surrogate for latitude

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD NLCD11PC ►
FIELD DESCRIPTION
Percent cumulative open water from NHDPlus, derived from National Land Cover Dataset

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD BFI ►
FIELD DESCRIPTION
Base flow index. Base flow to total flow as a percentage

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD Air_Aug ►
FIELD DESCRIPTION
August mean air temperature for the NorWeST processing unit

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD GLACIER ►
FIELD DESCRIPTION
The percentage of the catchment area classified as glacier at each temperature site.

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD Flow_Aug ►
FIELD DESCRIPTION
August mean stream flow metric for the NorWeST processing unit

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S1_93_11 ►

FIELD DESCRIPTION

Scenario 1, Historical composite scenario representing 19 year average August mean stream temperatures for 1993-2011.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S3_1993 ►

FIELD DESCRIPTION

Scenario 3, Historical scenario representing August mean stream temperatures for 1993

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S4_1994 ►

FIELD DESCRIPTION

Scenario 4, Historical scenario representing August mean stream temperatures for 1994

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S2_02_11 ►

FIELD DESCRIPTION

Scenario 2, modeled stream temperature from 2002-2011.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S5_1995 ►

FIELD DESCRIPTION

Scenario 5, Historical scenario representing August mean stream temperatures for 1995

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S6_1996 ►

FIELD DESCRIPTION

Scenario 6, Historical scenario representing August mean stream temperatures for 1996

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S7_1997 ►

FIELD DESCRIPTION

Scenario 7, Historical scenario representing August mean stream temperatures for 1997

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S8_1998 ►
FIELD DESCRIPTION
Scenario 8, Historical scenario representing August mean stream temperatures for 1998

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S9_1999 ►
FIELD DESCRIPTION
Scenario 9, Historical scenario representing August mean stream temperatures for 1999

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S10_2000 ►
FIELD DESCRIPTION
Scenario 10, Historical scenario representing August mean stream temperatures for 2000

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S11_2001 ►
FIELD DESCRIPTION
Scenario 11, Historical scenario representing August mean stream temperatures for 2001

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S12_2002 ►
FIELD DESCRIPTION
Scenario 12, Historical scenario representing August mean stream temperatures for 2002

DESCRIPTION SOURCE
USFS RMRS Boise Aquatic Sciences Lab

FIELD S13_2003 ►
FIELD DESCRIPTION
Scenario 13, Historical scenario representing August mean stream temperatures for 2003

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S14_2004 ►

FIELD DESCRIPTION

Scenario 14, Historical scenario representing August mean stream temperatures for 2004

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S15_2005 ►

FIELD DESCRIPTION

Scenario 15, Historical scenario representing August mean stream temperatures for 2005

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S16_2006 ►

FIELD DESCRIPTION

Scenario 16, Historical scenario representing August mean stream temperatures for 2006

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S17_2007 ►

FIELD DESCRIPTION

Scenario 17, Historical scenario representing August mean stream temperatures for 2007

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S18_2008 ►

FIELD DESCRIPTION

Scenario 18, Historical scenario representing August mean stream temperatures for 2008

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S19_2009 ►

FIELD DESCRIPTION

Scenario 19, Historical scenario representing August mean stream temperatures for 2009

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S20_2010 ►

FIELD DESCRIPTION

Scenario 20, Historical scenario representing August mean stream temperatures for 2010

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S21_2011 ►

FIELD DESCRIPTION

Scenario 21, Historical scenario representing August mean stream temperatures for 2011

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD FTYPE ►

FIELD DESCRIPTION

This attribute is only for the predicted temperature locations. This attribute is the NHDPlus feature type and can have one of two values, either 'StreamRiver' or 'ArtificialPath'. This is an NHDPlus defined attribute

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD WATERBODY ►

FIELD DESCRIPTION

This attribute is only for the predicted temperature locations. This attribute is for prediction points that fall within an NHDPlus water body feature. Values may be 0 or 1. 1 represents a point or stream segment within a water body feature. This attribute was generated at the Boise Lab to designate line segments that fall within water bodies.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S22_PredSE ►

FIELD DESCRIPTION

Standard errors of stream temperature predictions

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S23_1C ►

FIELD DESCRIPTION

Scenario 23, Future scenario adds 1.00 degree C to S1_93-11

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S24_1C_D ►

FIELD DESCRIPTION

Scenario 24, Future scenario adds 1.00 degrees C to S1_93-11 but also accounts for differential warming of streams by using historical temperatures to scale temperature increases so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S25_2C ►

FIELD DESCRIPTION

Scenario 25, Future scenario adds 2.00 degrees C to S1_93-11

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S26_2C_D ►

FIELD DESCRIPTION

Scenario 26, Future scenario adds 2.00 degrees C to S1_93-11 but also accounts for differential warming of streams by using historical temperatures to scale temperature increases so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S27_3C ►

FIELD DESCRIPTION

Scenario 27, Future scenario adds 3.00 degrees C to S1_93-11

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S28_3C_D ►

FIELD DESCRIPTION

Scenario 28, Future scenario adds 3.00 degrees C to S1_93-11 but also accounts for differential warming of streams by using historical temperatures to scale temperature increases so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S29_2040 ►

FIELD DESCRIPTION

Scenario 29, Future scenario based on global climate model ensemble averages that represent the A1B warming trajectory for 2040s (2030-2059). Future stream deltas within a processing unit were similar and based on projected changes in August air temperature and stream discharge.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S30_2040D ►

FIELD DESCRIPTION

Scenario 30, Future scenario based on global climate model ensemble averages that represent the A1B warming trajectory for 2040s (2030-2059). Future stream deltas within a processing unit were based on similar projected changes in August air temperature and stream discharge, but also accounted for differential warming of streams by using historical temperatures to scale temperature increases so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S31_2080 ►

FIELD DESCRIPTION

Scenario 31, Future scenario based on global climate model ensemble averages that represent the A1B warming trajectory for 2080s (2070-2099). Future stream deltas within a processing unit were similar and based on projected changes in August air temperature and stream discharge.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S32_2080D ►

FIELD DESCRIPTION

Scenario 32, Future scenario based on global climate model ensemble averages that represent the A1B warming trajectory for 2080s (2070-2099). Future stream deltas within a processing unit were based on similar projected changes in August air temperature and stream discharge, but also accounted for differential warming of streams by using historical temperatures to scale temperature increases so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S37_9311M ►

FIELD DESCRIPTION

Historical composite scenario representing 19 year average Maximum Weekly Maximum Temperature (MWMT or 7DADM) for 1993-2011.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S38_2040M ►

FIELD DESCRIPTION

Future Maximum Weekly Maximum Temperature (MWMT or 7DADM) stream scenario based on global climate model ensemble average projected changes for the A1B warming trajectory in the 2040s (2030-2059). Future stream deltas are identical at all sites within a NorWeST unit.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S39_2040DM ►

FIELD DESCRIPTION

Future Maximum Weekly Maximum Temperature (MWMT or 7DADM) stream scenario based on global climate model ensemble average projected changes for the A1B warming trajectory in the 2040s (2030-2059). Future stream deltas within a NorWeST unit account for differential sensitivity among streams so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S40_2080M ►

FIELD DESCRIPTION

Future Maximum Weekly Maximum Temperature (MWMT or 7DADM) stream scenario based on global climate model ensemble average projected changes for the A1B warming trajectory in the 2080s (2070-2099). Future stream deltas are identical at all sites within a NorWeST unit.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD S41_2080DM ►

FIELD DESCRIPTION

Future Maximum Weekly Maximum Temperature (MWMT or 7DADM) stream scenario based on global climate model ensemble average projected changes for the A1B warming trajectory in the 2080s (2070-2099). Future stream deltas within a NorWeST unit account for differential sensitivity among streams so that cold streams warm less than warm streams.

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD COMID ►

FIELD DESCRIPTION

COMID for the underlying 1:100,000 scale NHDPlus stream lines (*Check the individual metadata XML file for NHD Plus version number*).

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

FIELD GNIS_NAME ►

FIELD DESCRIPTION

GNIS_NAME for the underlying 1:100,000 scale NHDPlus stream lines (*Check the individual metadata XML file for NHD Plus version number*).

DESCRIPTION SOURCE

USFS RMRS Boise Aquatic Sciences Lab

OVERVIEW DESCRIPTION ►

ENTITY AND ATTRIBUTE OVERVIEW

Records were queried for "FTYPE" = 'ArtificialPath' AND "WATERBODY" = 1.

Those modeled segments or points that were part of a lake or waterbody feature had their scenario fields calculated to equal -9999.