Descriptions of PRISM Spatial Climate Datasets for the Conterminous United States

Created June 2013
Last revised October 2019

Summary of October 2019 revisions since last document release in August 2016.

New dataset version for all elements except precipitation was completed in October 2019:

- Implemented adjustment for SNOTEL YSI Extended Range temperature measurements that were incorrectly transformed from voltage to temperature by NRCS
- Applied an algorithm to day-shift COOP temperature observations that were reported on the wrong day
- Included upper-air temperature and dew point grid point data to improve high-elevation accuracy
- Improved PRISM's ability to render unusual temperature inversions

Data networks recently added (see Table A1 for a full list of networks):

- HPRCC (northern plains), KSTATE (Kansas), KYMESONET (Kentucky), LCRA (Texas), UGA (Georgia), UPPERAIR (NCAR/NCEP Reanalysis), USA (South Alabama), USCRN (US Climate Reference Network), and WTEXAS (Texas)

The PRISM Climate Group works on a range of projects, some of which support the development of spatial climate datasets. The resulting array of datasets reflects the range of project goals, requiring differing station networks, modeling techniques, and spatial and temporal resolutions. Whenever possible, we offer these datasets to the public, either free of charge, or for a fee, depending on the size and difficulty of delivering the dataset and funding for the activity. In order for users to make informed decisions about which dataset is most appropriate for their needs, this document provides information on the PRISM spatial climate datasets currently available. We start with an overview of the array of PRISM datasets, then discuss each in turn. Summary tables are provided for quick reference.

It should be noted up front that these datasets are not static entities, but are in a constant state of change. New networks are being added periodically to some datasets. Even those designed for long-term consistency experience changes due to improvements in data handling and quality control procedures. We will endeavor to keep this documentation current, but inconsistencies are bound to arise.

Overview

PRISM datasets provide estimates of six basic climate elements: precipitation (ppt), minimum temperature (tmin), maximum temperature (tmax), mean dew point (tdmean), minimum vapor pressure deficit (vpdmin), and maximum vapor pressure deficit (vpdmax). Two derived variables, mean temperature (tmean) and vapor pressure (vpr), are sometimes included, depending on the dataset. Descriptions of the climate elements and derived variables are given in Table 1.

Table 1. Descriptions of climate elements available from PRISM datasets. Basic descriptions are for the daily time interval, with additional monthly time interval information given in brackets. Monthly station values are calculated from daily data.

Abbreviation	Type	Description
Ppt	Modeled climate element	Daily [monthly] total precipitation (rain+melted snow)
Tmax	Modeled climate element	Daily maximum temperature [averaged over all days in the month]
Tmin	Modeled climate element	Daily minimum temperature [averaged over all days in the month]
Tmean	Derived variable	Daily mean temperature, calculated as (tmax+tmin)/2
Tdmean	Modeled climate element	Daily mean dew point temperature [averaged over all days in the month]
Vpdmin	Modeled climate element	Daily minimum vapor pressure deficit [averaged over all days in the month]
Vpdmax	Modeled climate element	Daily maximum vapor pressure deficit [averaged over all days in the month]
Vpr	Derived variable	Vapor pressure, derived from tdmean

A summary of the PRISM datasets is given in Table 2. There are two main classes of PRISM datasets: long-term averages and time series. Long-term averages, or "normals," abbreviated "Norm" in Table 2, are 30-year averages for periods with years ending in 0, such as 1961-90 and 1971-2000. An "81" represents a 1981-2010 average, and is the current normals dataset. An "m" denotes that the dataset has a monthly time step.

Time series datasets are abbreviated with an "LT" or "AN" (Table 2). LT, which stands for long term, refers to time series focused on temporal consistency. AN, which stands for all networks, refers to time series focused on providing the best estimate possible, at the expense of temporal consistency. For time series datasets, an 81 refers to the start year of the climatology used in the CAI (Climatologically-Aided Interpolation) process; see Time Series Datasets section. An "81" means that it is based on the 1981-2010 climatology. A "d" denotes a daily time step. An "m" denotes a monthly time step.

When an analysis or re-analysis of a dataset is released, it is given a version number, preceded by an "M" for monthly data, or "D" for daily data; for example, a daily dataset may be denoted as version D2. These version numbers are imbedded in the names of the downloadable zip files.

Table 2. Summary of the PRISM spatial climate datasets active as of October 2019. See Table 1 for descriptions of climate elements and derived variables.

Dataset	Time Period	Climate Elements	Time Step	Modeling Resolution	Output Resolution	Modeling Method	Latest Version and Release Date
Long-Term Averages							
Norm81m	1981-2010	Ppt, tmin, tmax, tmean*, tdmean, vpdmin, vpdmax	Monthly, annual average	30 sec	30 sec, 2.5 min (~4km)	DEM and CAI	Ppt, tmin, tmax, tmean: M2, Jul 2012 Tdmean, vpdmin, vpdmax: M2, Dec 2014
Time Series							
LT81m	Jan 1895 - ongoing	Ppt, tmin, tmax, tmean*, tdmean, vpr*, vpdmin, vpdmax	Monthly, annual time series	30 sec	30 sec	CAI (1981-2010)	Ppt: M2, Aug 2013 Tmin, tmax, tmean, tdmean, vpr, vpdmin, vpdmax: M3 Oct 2019
AN81m	Jan 1895 - ongoing	Ppt, tmin, tmax, tmean*, tdmean*, vpdmin, vpdmax	Monthly, annual time series	30 sec	30 sec, 2.5 min	CAI (1895-present); CAI/AHPS (ppt, 2002-present)	1981-present ppt: M3, Jul 2015 1895-1980 ppt: M2, Aug 2013 Tmin, tmax, tmean, tdmean, vpdmin, vpdmax: M3 Oct 2019
AN81d	1 Jan 1981 - ongoing	Ppt, tmin, tmax, tmean*, tdmean, vpdmin, vpdmax	Daily time series	30 sec	30 sec, 2.5 min	CAI (1981-present); CAI/AHPS (ppt, 2002-present)	Ppt: D2, Jul 2015 Tmin, tmax, tmean, tdmean, vpdmin, vpdmax: D2 Oct 2019

* Element is not modeled directly with PRISM, but derived from other modeled elements.

Long-Term Average ("Normals") Dataset

The normals are baseline datasets describing average monthly and annual conditions over the most recent three full decades, and are our most popular datasets (Table 3). The most recent PRISM normals are for the period 1981-2010. Long-term average datasets for ppt, tmax, and tmin were modeled with PRISM using a digital elevation model (DEM) as the predictor grid. Tdmean was modeled with PRISM in the form of dew point depression (tmin – tdmean), using CAI with tmin as the predictor grid. Vpdmin and vpdmax were modeled with PRISM using CAI with tdmean, in combination with tmin and tmax, respectively, as the predictor grids. The normals are used in the interpolation of the time series datasets (see CAI discussion in the Time Series Datasets section). Given their importance, the normals are carefully developed and subjected to extensive peer review whenever possible. A description of the PRISM modeling system, the process used to create the previous 1971-2000 temperature and precipitation normals, and an uncertainty analysis are available from Daly et al. (2008). The 1981-2010 normals for temperature and precipitation were prepared using similar methods to those used in the 1971-2000 normals, but with additional station networks. The development of 1981-2010 normals for tdmean, vpdmin, and vpdmax is described in Daly et al. (2015).

Table 3. Summary of the station data used in the PRISM Norm81m dataset. Descriptions of the station networks are given in appendix Table A1.

Element	Norm81m Data Sources
Tmax, tmin	AGRIMET, ASOS/ISH, CDEC, COOP, EC, HJA, MEXICO, NDBC, RAWS, SNOTEL, UPPERAIR, WBAN, WRCC
Ppt	AGRIMET, CDEC, COCORAHS, COOP, EC, HDSC, HJA, MN, NDSWC, NVDWR, OKMESONET, RAWS, SFWMD, SNOTEL, SNOWCOURSE, STORAGE, USLTER, WBAN, WRCC
Tdmean, vpdmin, vpdmax	AGRIMET, ASOS/ISH, COAGMET, CDEC, COOP, HJA, NDBC, OKMESONET, RAWS, SCAN, UPPERAIR, WBAN

Norm81m

Climate elements: tmin, tmax, tmean (derived), ppt, tdmean, vpdmin, vpdmax

Units and scaling: tmin, tmax, tmean, tdmean (deg C); ppt (mm); vpdmin, vpdmax (hPa); all values are floating point

Description: Monthly 30-year "normal" dataset covering the conterminous US, averaged over the period 1981-2010. Interpolation method for tmin, tmax, and ppt used a DEM (digital elevation model) as the predictor grid. Interpolation of tdmean used tmin as the predictor grid. Interpolation of vpdmin and vpdmax used tdmean, in combination with tmin and tmax, respectively, as the predictor grids.

Status: The most recent Norm81m analysis for tmax, tmin, tmean, and ppt was completed in July 2012 (version M2). The most recent Norm81m analysis for tdmean, vpdmin, and vpdmax was completed in December 2014 (version M2).

Availability: 800m and 4km versions available at http://prism.oregonstate.edu

Caveats: Norm81m cannot be compared directly to PRISM normals for previous time periods (e.g., Norm71m) to assess climatic changes between different periods. Station networks and data values are not consistent between the datasets. Each time the normals are created, we try to include new and better sources of data so that the product continues to reflect the state of knowledge regarding climatic values and spatial patterns. Dataset uses all stations, regardless of time of observation, which means that stations with morning observation times could exhibit cool biases for tmin, and stations with afternoon observation times could exhibit warm biases for tmax.

Time Series Datasets

The long-term average datasets discussed above are modeled with PRISM using a DEM as the predictor grid. In contrast, the time series datasets are modeled using a method called climatologically-aided interpolation (CAI). In CAI, the long-term average datasets, or combinations of them, serve as the predictor grids. The idea behind CAI is that the best first guess of the spatial pattern of climatic conditions for a given month or day is the long-term average pattern. CAI is robust to wide variations in station data density, which is necessary when modeling century-long time series.

There are two types of time series datasets: those created to provide the best possible estimates at a given time step, and those created with long-term consistency in mind. Table 4 lists the station networks used in each type of time series dataset. A more detailed description of the station data networks used is given in Appendix A. Time series datasets providing the best possible estimates, abbreviated “AN” (all networks), use all of the station networks and data sources ingested by the PRISM Climate Group. Time series datasets focusing on long-term consistency, abbreviated “LT” (long term), may not use all available station networks, but instead focus on networks that have been in existence for at least twenty years. The goal of the LT datasets is to provide better temporal consistency than the AN datasets. However, even the LT datasets are not currently suitable for calculating multi-decadal climate trends. Although longer-term networks are used, grids still contain non-climatic variations due to station equipment and location changes, stations openings and closings, and varying observation times.

Table 4. Summary of the PRISM time series datasets. Methodological details are provided in the Time Series Datasets section. Descriptions and time histories of the station networks are given in appendix Tables A1-A4.

	AN81m	**AN81d**	**LT81m**
Focus	Best estimate	Best estimate	Temporal consistency
Data Sources	All stations included, regardless of observation time	All stations included, but with time of observation constraint	Only "long-term" networks having at least some stations with ≥ 20 years of data included. All stations included, regardless of observation time.
Tmax, tmin	AGRIMET, AGWXNET, ASOS/ISH, CIMIS, COAGMET, COOP, DEOS, EC, FAWN, HJA, KSTATE, KYMESONET, LCRA, LUKEAFB, MEXICO, NCECONET, NDAWN, NDBC, NEVCAN, NJWXNET, OKMESONET, RAWS, SCAN, SNOTEL, UGA, UPPERAIR, USA, WBAN, WRCC, WTEXAS	Same as AN81m, except non-PRISM Day observations are excluded	AGRIMET, ASOS/ISH, COOP, EC, HJA, MEXICO, RAWS, SNOTEL, WBAN, WRCC
Tdmean, vpdmin, vpdmax	AGRIMET, AGWXNET, ASOS/ISH, CIMIS, COAGMET, DEOS, EC, FAWN, HJA, KSTATE, KYMESONET, LCRA, LUKEAFB, MEXICO, NCECONET, NDAWN, NDBC, NEVCAN, NJWXNET, OKMESONET, RAWS, SCAN, UGA, UPPERAIR, WBAN, WTEXAS	Same as AN81m, except non-PRISM Day observations are excluded	ASOS/ISH, HJA, RAWS, WBAN
Ppt	AGRIMET, AGWXNET, ASOS/ISH, COAGMET, COCORAHS, COOP, DEOS, EC, FAWN, HDSC, HJA, HYD, KSTATE, KYMESONET, LCRA, LUKEAFB, MEXICO, MN, NCECONET, NDAWN, NDSWC, NEVCAN, NJWXNET, RAWS, SCAN, SFWMD, SNOTEL, UGA, WBAN, WRCC, WTEXAS; AHPS RADAR Stage 2 and 4 grids; non-PRISM Day COOP stations re-apportioned	Same as AN81m, except non-PRISM Day observations are excluded	AGRIMET, COOP, EC, HJA, MEXICO, MN, NDSWC, RAWS, SNOTEL, WBAN,WRCC
None can be used safely to calculate multi-decadal climate trends			

LT81m

Climate elements: tmin, tmax, tmean (derived), ppt, tdmean, vpr (derived), vpdmin, vpdmax

Units and scaling: tmin, tmax, tmean, tdmean (deg C); ppt (mm); vpr, vpdmin, vpdmax (hPa); all values are floating point

Description: Monthly dataset covering the conterminous US, starting on January 1895 and ending on the most recently completed month. Emphasis is on long-term consistency, and uses only station networks having at least some stations with ≥ 20 years of data. Interpolation method for all elements is CAI, using 1981-2010 monthly climatologies as the predictor grids.

Given that station data for tdmean, vpdmin, and vpdmax extend back to the 1930s at the earliest (most start in the 1940s), data for these climate elements were extended back to 1895 at a subset of approximately 250 long-term stations by estimating their values based on temperature and precipitation. Specifically, monthly tdmean was estimated by multiple linear regression functions with precipitation, tmin, and trange (tmax-tmin) as the independent variables. Vpdmin and vpdmax were estimated in two steps: (1) calculating "first-guess" vpdmin using tmin and the estimated tdmean, and first-guess vpdmax using tmax and the estimated tdmean; and (2) estimating vpdmin and vpdmax by second-order polynomial regression functions with their respective first-guess values as the independent variables.

Status: The most recent re-analysis was completed in Oct 2019 (full period of record) for all elements except ppt, and updated with new data for subsequent months (version M3). The LT81m version of ppt became available in August 2013 (M2).

Availability: LT81m is only available at 800m resolution for a fee; contact prism_orders@nacse.org

Caveats: Dataset should not be used to calculate multi-decadal climate trends. Although longer-term networks are used, grids still contain non-climatic variations due to station equipment and location changes, station openings and closings, and varying observation times.

AN81m

Climate elements: tmin, tmax, tmean (derived), ppt, tdmean, vpdmin, vpdmax

Units and scaling: tmin, tmax, tmean, tdmean (deg C), ppt (mm); vpdmin, vpdmax (hPa); all values are floating point

Description: Monthly dataset covering the conterminous US, starting on January 1895 and ending on the most recently completed month. Emphasis is on arriving at the best estimate, regardless of temporal consistency, and uses all station available networks.

Interpolation method for tmin and tmax is CAI, using 1981-2010 monthly climatologies as the predictor grids.

For ppt, the latest version is M3 for 1981-present only. For 1895-1980, the latest version of ppt continues to be M2. Differences between M2 and M3 are summarized in Table 5; the main difference between the two versions is that in M3, the monthly and daily grids are post-processed to be equal to each other at the end of each month. The M3 dataset uses the CAI interpolation method in the western US (Rockies westward) for all years. East of the Rockies, the monthly values are forced to equal the sum of the AN81d daily version D2 values for 1981-present. Thus, the interpolation method in the central and east is effectively the same as AN81d, which is CAI from 1981-2001, and a combination of CAI and RADAR from 2002-present. See the AN81d description for details on M3/D2 interpolation methods and station data handling. The previous M2 ppt dataset used the monthly time step CAI interpolation method in all areas for all years.

New AN81m versions of tmax, tmin tmean, tdmean, vpdmin, and vpdmax were completed in October 2019 (M3). This version included a number of improvements. Several new station networks were added, and NCAR/NCEP

Reanalysis grid points of temperature and relative humidity (converted to tdmean) were added to improve high-elevation estimates. A day-shifting algorithm was applied to daily COOP tmin and tmax observations made in the morning (qualifying as PRISM Day), to better align data that appeared to be on the wrong day, creating spatial anomalies in the resulting grids; the result was a dramatic decrease in the number of spatial anomalies identified and rejected by the PRISM spatial QC system. The PRISM parameterization was modified to allow a wider range of relationships between the station data and the climatological grid (in the CAI procedure); the result was a more detailed rendition of unusual temperature inversions that are not present in the normals. Finally, an adjustment was made to SNOTEL temperature data for stations employing the YSI Extended Range temperature sensor; it was discovered that the NRCS had used an erroneous equation to transform voltage to temperature.

In some western agricultural areas, starting in the 1980s, the AN81m version of tdmean, vpdmin, and vpdmax may be very different than those of LT81m. AN81m includes several networks that have stations sited in irrigated fields (e.g., AGRIMET, CIMIS, COAGMET). These locations can have relatively high tdmean (low vpd) values compared to surrounding areas, especially in summer. These networks are not used in LT81m, because they do not represent natural climatic variations, but are used in AN81m, because they provide accurate information at their time and location. See Daly et al. (2015) for details.

Given that station data for tdmean, vpdmin, and vpdmax extend back to the 1930s at the earliest (most start in the 1940s), data for these climate elements were extended back to 1895 at a subset of approximately 250 long-term stations by estimating their values based on temperature and precipitation. Specifically, monthly tdmean was estimated by multiple linear regression functions with precipitation, tmin, and trange (tmax-tmin) as the independent variables. Vpdmin and vpdmax were estimated in two steps: (1) calculating "first-guess" vpdmin using tmin and the estimated tdmean, and first-guess vpdmax using tmax and the estimated tdmean; and (2) estimating vpdmin and vpdmax by second-order polynomial regression functions with their respective first-guess values as the independent variables.

Status: The most recent re-analysis of tmin, tmax, tmean, tdmean, vpdmin, and vpdmax is M3, which was released in October 2019 (full period of record). This version, denoted by the M3 file name identifier, is the active version and is updated with data from subsequent months. The most recent re-analysis of ppt is also M3, which was released on 1 July 2015 for the period January 1981- December 2014; an additional update was released on 15 July 2015 for January-June 2015. M3 is the active version and is updated with new data for subsequent months. Version M2 up through June 2015 will continue to be available via FTP (see data_archive directory), but updates to this version ended on 1 July 2015. Before 1981, the most recent ppt re-analysis continues to be M2, which was released in July 2013.

New station networks are being added periodically, which means Table 4 may be out of date for the most recent months. However, historical data from new networks are not incorporated until a new version of AN81m is created.

Availability: 4km version available at http://prism.oregonstate.edu. 800m dataset available for a fee; contact prism_orders@nacse.org

Caveats: Dataset should not be used to calculate multi-decadal climate trends. Grids may contain non-climatic variations due to station equipment and location changes, openings and closings, and varying observation times, and the use of relatively short-term networks.

Table 5. Comparison of M3 (monthly) and D2 (daily) ppt versions with previous M2 and D1 versions.

	M3/D2	**M2/D1**
Release Date	Monthly (M3): Jul 2015 Daily (D2): Jul 2015	Monthly (M2): Aug 2013 Daily (D1): Jun 2013
Time Period Covered	Monthly (M3): Jan 1981-present Daily (D2): 1 Jan 1981-present	Monthly (M2): Jan 1895- Jun 2015 Daily (D1): 1 Jan 1981-30 Jun 2015
Station Data	*Summary: Input station data for monthly and daily interpolations are the same* Non-PRISM Day and multi-day accumulations at COOP stations are re-apportioned and included in both daily and monthly interpolations Stations are subjected to the monthly data completeness criterion (<= 2 missing days per month) for both daily and monthly interpolations	*Summary: Input station data for monthly and daily interpolations are different* Non-PRISM Day and multi-day accumulations at COOP stations are omitted from daily interpolation, but accepted for monthly interpolation Stations are subjected to the monthly data completeness criterion (<= 2 missing days per month) for monthly interpolation, but not for daily interpolation
Daily/monthly grid reconciliation	*Summary: At the end of each month, the daily values sum to the monthly values* Mountain areas of western US: Daily grid values are forced to sum to monthly grid values at the end of each month Central and Eastern US and flat areas of West: Monthly grid values are forced to equal the sum of the daily grid values at the end of each month	*Summary: At the end of each month, the daily values do not necessarily sum to the monthly values* Monthly and daily grids are not reconciled
Interpolation Method	*Summary: Owing to the grid reconciliation, monthly and daily interpolation methods are effectively the same* Monthly: CAI 1895-2001 over entire domain; CAI 1895-present western US; CAI+RADAR in central and eastern US 2002-present Daily: CAI 1981-2001 over entire domain; CAI 1981-present western US; CAI+RADAR in central and eastern US 2002-present	*Summary: Monthly and daily interpolation methods are not necessarily the same* Monthly: CAI over entire domain, entire period Daily: CAI over entire domain, entire period in western US; CAI+RADAR in central and eastern US 2002-2015

AN81d

Climate elements: tmin, tmax, tmean (derived), tdmean, ppt, vpdmin, vpdmax

Units and scaling: tmin, tmax, tmean, tdmean (deg C); ppt (mm); vpdmin, vpdmax (hPa); all values are floating point

Description: Daily dataset covering the conterminous US, starting on 1 January 1981 and ending on the most recent day. Emphasis is on arriving at the best estimate, regardless of temporal consistency, and uses all station networks ingested by the PRISM Climate Group. Interpolation method for tmin and tmax is CAI, using 1981-2010 monthly climatologies as predictor grids.

For ppt, the latest version is D2. Differences between D1 and D2 are summarized in Table 5. Starting on 1 January 2002, both D1 and D2 ppt versions use a combination of CAI and RADAR interpolation in the central and eastern US. The RADAR version is created using the National Weather Service Stage 2 unbiased (ST2un) and 4 (ST4) 4km gridded radar products from the Advanced Hydrometeorological Prediction System (AHPS). On a pixel-by-pixel basis, a "besting" process compares the R^2 values from the PRISM regressions of climate vs. station ppt (CAI) and ST2un vs. station ppt (RADAR). ST2un, rather than ST4, is used to estimate the predictive power of RADAR, because ST2un does not have individual station observations incorporated, which makes for a fairer comparison to CAI than ST4, which has many stations assimilated into the grid estimates. Based on this comparison, a RADAR weighting factor (0-1) is calculated. The weighting factor is then applied to the ST4 AHPS grid when averaging it with the CAI grid, to form a hybrid estimate.

Over the entire conterminous US, the daily ppt amounts from AN81d version D2 and monthly AN81m version M3 are processed to equal each other at the end of each month. In mountainous terrain areas of the western US (Rockies westward), the daily grid values are forced to sum to the AN81m monthly grid values. AN81m uses the CAI interpolation method in these areas. The AN81m monthly grids are believed to be superior to the daily grids in mountainous areas because the interpolation of longer time-step data better captures persistent orographic precipitation patterns than daily interpolation. To match the monthly values at the end of a month, the daily values are increased or decreased on a constant percentage basis. In the case where the monthly ppt value is measurable (>= 0.01" or 2.54 mm), and the sum of the daily ppt grids is below measurable but non-zero, new wet days may be added, selected from the wettest ppt days available from the daily grids. An inverse-distance weighted grid of the number of wet days as reported by stations provides the number of wet days that should be added. In the case where the daily grid values sum to zero, i.e., there are no days where non-zero precipitation occurred, no wet days are added and the monthly value is set to zero.

The previous ppt version D1 also uses CAI in the western US but it is performed on a daily, rather than monthly, time step and there is no attempt to reconcile the monthly and daily values.

Station data used in AN81d are screened for adherence to a "PRISM day" criterion. A PRISM day is defined as 1200 UTC-1200 UTC (e.g., 7 AM-7AM EST), which is the same as the AHPS day definition. Once-per day observation times must fall within +/- 4 hours of the PRISM day to be included in the AN81d tmax and tmin datasets. Stations without reported observation times in the NCEI GHCN-D database are currently assumed to adhere to the PRISM day criterion. The dataset uses a day-ending naming convention, e.g., a day ending at 1200 UTC on 1 January is labeled 1 January.

Ppt version D1 does not use stations that fail to meet the PRISM Day criterion, or report multi-day accumulations. In contrast, version D2 takes advantage of an in-house algorithm that estimates PRISM Day station values from non-PRISM Day values at COOP stations, and also disaggregates COOP multi-day accumulations. This is done by creating initial daily ppt grids using PRISM Day stations only, identifying discrete ppt events of one day or more at the station locations, and re-apportioning the non-PRISM Day stations and multi-day accumulations to match the relative ppt amounts taken from the initial gridded PRISM Day ppt events. These re-apportioned daily station values are then added to the daily ppt station dataset and used in a second interpolation run.

In D2, given that the monthly and daily ppt values are reconciled, station values must pass both daily and monthly QC checks to be used in either the daily or monthly interpolation. For example, stations must pass a monthly data completeness check before being used in monthly mapping; if more than two days are missing, the station is rejected for that month. In version D2, stations failing the monthly data completeness check are omitted from the daily interpolation for all days in the month. In version D1, the daily interpolation did not require that the monthly data completeness check be passed.

Status: The most recent re-analysis of tmin, tmax, tmean, tdmean, vpdmin, and vpdmax is D2, which was released in October 2019 (full period of record). This version, denoted by the "D2" file name identifier, is the active version and is updated with data from subsequent months. The most recent re-analysis of ppt is D2, which was released on 1 July 2015 for the period 1 January 1981- 31 December 2014; an additional update was released on 15 July 2015 for 1 January – 30 June 2015. D2 is the active version and is updated with new data for subsequent days. Version D1 up through June 2015 will continue to be available via FTP (see data_archive directory), but updates to this version ended on 1 July 2015.

New station networks are being added periodically, which means Table 4 may be out of date for the most recent months. However, historical data from new networks are not incorporated until a new version of AN81d is developed.

Availability: 4km version available at http://prism.oregonstate.edu. 800m dataset available for a fee; contact prism_orders@nacse.org

Caveats: Dataset should not be used to calculate multi-decadal climate trends. Grids may contain non-climatic variations due to station equipment and location changes, openings and closings, and the use of RADAR data for ppt starting in 2002. Screening stations for adherence to a "PRISM day" criterion does help to minimize time of tmin and tmax observation bias. However, the downside is that this results in the exclusion of a large percentage of stations from the analysis, especially early in the record. For example, in 1981, non-PRISM day COOP temperature stations outnumbered PRISM day stations by about 2 to 1. The two groups were about equal in size in 1990. By 2010, PRISM day COOP stations outnumbered non-PRISM day stations by about 3 to 1.

References

Daly, C., Halbleib, M., Smith, J.I., Gibson, W.P., Doggett, M.K., Taylor, G.H., Curtis, J., and Pasteris, P.A. 2008. Physiographically-sensitive mapping of temperature and precipitation across the conterminous United States. *International Journal of Climatology*, 28: 2031-2064. http://www.prism.oregonstate.edu/documents/pubs/2008intjclim_physiographicMapping_daly.pdf

Daly, C., J.I. Smith, and K.V. Olson. 2015. Mapping atmospheric moisture climatologies across the conterminous United States. *PloS ONE* 10(10):e0141140. doi:10.1371/journal.pone.0141140. http://www.prism.oregonstate.edu/documents/pubs/2015plosone_humidityMapping_daly.pdf

Appendices

Table A1. Descriptions of Station Networks Used in PRISM Spatial Climate Datasets

Table A2. History of station networks used in PRISM monthly time series datasets: Tmax/Tmin

Table A3. History of station networks used in PRISM monthly time series datasets: Precipitation

Table A4. History of station networks used in PRISM monthly time series datasets: Tdmean, Vpdmin, Vpdmax

Table A1. Descriptions of station networks used in PRISM spatial climate datasets.

		Dataset Usage		
Network Abbreviation	**Description**	**Tmax, Tmin**	**Ppt**	**Tdmean, Vpdmin, Vpdmax**
AGRIMET	Bureau of Reclamation Agricultural Weather Network	All	All	Norm81m AN81m AN81d
AGWXNET	Washington State University's Agricultural Weather Network (AgWeatherNet)	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
ASOS/ISH	Automated Surface Observing System and related networks (e.g., AWOS), and Integrated Surface Hourly (ISH) network *Notes*: ASOS network began installation in 1996, with poor instrumentation for measuring snowfall.	All	AN81m[1] AN81d[1]	All
CDEC	California Data Exchange Center *Notes*: A collection of stations from various networks operating in California.	Norm81m	Norm81m	n/a
CIMIS	California Irrigation Management Information System	AN81m AN81d	n/a	AN81m AN81d
COAGMET	Colorado Agricultural Meteorological Network	AN81m AN81d	AN81m[1] AN81d[1]	Norm81m AN81m
COCORAHS	Community Collaborative Rain, Hail and Snow Network *Notes*: Currently the largest ppt observing network in the US.	n/a	Norm81m AN81m AN81d	n/a
COOP	National Weather Service Cooperative Observer Program *Notes*: These stations are part of the GHCN-D database. COOP is the longest-running climate network in the US.	All	All	n/a
DEOS	Delaware Environmental Observing System	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
EC	Environment Canada	All	All	n/a
FAWN	Florida Agricultural Weather Network	AN81m AN81d	AN81m AN81d	AN81m AN81d
HDSC	NOAA Hydrometeorological Design Studies Center *Notes*: A collection of ppt stations in California used by HDSC and PRISM to produce the NOAA Atlas 14 ppt frequency maps. Period of record ends in 2010.	n/a	Norm81m AN81m	n/a
HJA	HJ Andrews Experimental Forest, Oregon, NSF Long Term Ecological Research Site (LTER); benchmark sites, reference stands, cold air transects *Notes*: Data lag time is currently longer than 6 months, which is our cutoff for operational inclusion; this means that at present, HJA data can be included only when new versions of the datasets are created.	All Exceptions: Tmin only at reference stands, thermograph sites, and	All	Norm81m LT81m AN81m (tdmean only)

		cold air transects; Cold air transects used in AN81 datasets only		
HPRCC	High Plains Regional Climate Center, northern plains state mesonets *Notes*: Mesonets include Nebraska Mesonet and NDAWN	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
HYD	Advanced Hydrologic Prediction Service River Forecast Centers *Notes*: Selected stations from a combination of many different networks. Stations available from networks for which we have direct feeds are excluded (difficulties identifying the source networks in HYD produce occasional duplications).	n/a	AN81m AN81d	n/a
KSTATE	Kansas Mesonet, operated by Kansas State University	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
KYMESONET	Kentucky Mesonet, operated by Western Kentucky University	AN81m AN81d	AN81m AN81d	AN81m AN81d
LCRA	Lower Colorado River Authority Network (Texas)	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
LUKEAFB	Luke Air Force Base network, SW Arizona	AN81m AN81d	AN81m AN81d	AN81m AN81d
MEXICO	Global Historical Climate Network – Mexico *Notes*: These stations are part of the GHCN-D database	Norm81m LT81m AN81m AN81d	Norm81m LT81m AN81m AN81d	AN81m
MN	Minnesota Climatology Working Group, previously called Minnesota HiDen, now called MNGage	n/a	Norm81m LT81m AN81m AN81d	n/a
NCECONET	North Carolina Environment and Climate Observing Network	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
NDAWN	North Dakota Agricultural Weather Network	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
NDBC	National Data Buoy Center *Notes*: Used to characterize near-coastal air temperature and humidity	Norm81m AN81m	n/a	Norm81m AN81m
NDSWC	North Dakota State Water Commission	n/a	Norm81m LT81m AN81m AN81d	n/a
NEVCAN	Nevada Climate-Ecohydrological Assessment Network	AN81m AN81d	AN81m AN81d	AN81m AN81d
NJWXNET	New Jersey Weather and Climate Network	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d

NVDWR	Nevada Division of Water Resources *Notes*: Collection of ppt gauges in western Nevada.	n/a	Norm81m	n/a
OKMESO-NET	Oklahoma Mesonet	Norm81m AN81m AN81d	Norm81m AN81m AN81d	Norm81m AN81m AN81d
RAWS	U.S. Forest Service and Bureau of Land Management Remote Automated Weather Stations	All	All[1]	LT81m AN81m AN81d
SCAN	USDA NRCS Soil Climate Analysis Network	AN81m AN81d	AN81m[1] AN81d[1]	Norm81m AN81m AN81d
SFWMD	South Florida Water Management District	n/a	Norm81m AN81m AN81d	n/a
SNOTEL	Natural Resources Conservation Service Snowpack Telemetry *Notes*: The main high elevation network in western mountains.	All	All	n/a
SNOW-COURSE	Natural Resources Conservation Service Snow Course *Notes*: An algorithm was developed to relate April 1 snow water equivalent at the snow courses to winter ppt. Useful in remote mountain areas lacking actual ppt measurements.	NA	Norm81m	NA
STORAGE	Miscellaneous Long-Term Precipitation Storage Gage Stations *Notes*: Storage gauges from various agencies in remote areas of the western US that are checked monthly to yearly.	n/a	Norm81m	n/a
UGA	Georgia Mesonet, operated by the University of Georgia	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
UPPERAIR	National Centers for Environmental Prediction/National Center for Atmospheric Research *Notes*: Used to represent mean temperature and relative humidity at high elevations in free-air topographic positions.	Norm81m LT81m AN81m AN81d	n/a	Norm81m LT81m AN81m AN81d
USA	University of South Alabama Mesonet	AN81m AN81d	AN81m[1] AN81d[1]	AN81m AN81d
USCRN	US Climate Reference Network *Notes*: High-quality NOAA network designed to monitor long-term climatic variations in the US	AN81m AN81d	AN81m AN81d	AN81m AN81d
USLTER	Selected stations from NSF Long Term Ecological Research Sites: Hubbard Brook, Coweeta, Sevietta, Niwot Ridge	n/a	Norm81m	n/a
WBAN	Weather Bureau, Army, Navy *Notes*: These stations are part of the GHCN-D database. In 1996, many WBAN stations converted to ASOS instrumentation.	All	All[1]	Norm81m (tdmean only) LT81m AN81m

				AN81d
WRCC	Western Regional Climate Center	All	All	n/a
WTEXAS	West Texas Mesonet, operated by Texas Tech University	AN81m AN81d	n/a	AN81m AN81d

[1] Network uses unheated tipping bucket rain gauges, which are not suited for measuring precipitation during freezing conditions. Therefore, precipitation data are used during May-Sep only.

Table A2. History of station networks used in PRISM monthly time series datasets: Tmax/Tmin.

	AN81m and LT81m
	AN81m only

	Decade Ending Year												
Network	**1900**	**1910**	**1920**	**1930**	**1940**	**1950**	**1960**	**1970**	**1980**	**1990**	**2000**	**2010**	**2020**
AGRIMET													
AGWXNET													
ASOS/ISH													
CDEC													
CIMIS													
COAGMET													
COCORAHS													
COOP													
DEOS													
EC													
FAWN													
HDSC													
HJA													
HPRCC													
HYD													
KSTATE													
KYMESONET													
LCRA													
LUKEAFB													
MEXICO													
MN													
NCECONET													
NDAWN													
NDBC													
NDSWC													
NEVCAN													
NJWXNET													
NVDWR													
OKMESONET													
RAWS													
SCAN													
SFWMD													
SNOTEL													

SNOWCOURSE													
STORAGE													
UGA													
UPPERAIR													
USA													
USCRN													
USLTER													
WBAN													
WRCC													
WTEXAS													

Table A3. History of station networks used in PRISM monthly time series datasets: Precipitation.

	AN81m and LT81m
	AN81m only

Network	Decade Ending Year												
	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020
AGRIMET													
AGWXNET													
ASOS/ISH													
CDEC													
CIMIS													
COAGMET													
COCORAHS													
COOP													
DEOS													
EC													
FAWN													
HDSC													
HJA													
HYD													
LUKEAFB													
KSTATE													
KYMESONET													
LCRA													
MEXICO													
MN													
NCECONET													
NDAWN													
NDBC													
NDSWC													
NEVCAN													
NJWXNET													
NVDWR													
OKMESONET													
RAWS													
SCAN													
SFWMD													
SNOTEL													
SNOWCOURSE													
STORAGE													

UGA													
UPPERAIR													
USA													
USCRN													
USLTER													
WBAN													
WRCC													
WTEXAS													

Table A4. History of station networks used in PRISM monthly time series datasets: Tdmean, Vpdmin, Vpdmax.

	AN81m and LT81m
	AN81m only

Network	Decade Ending Year												
	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020
AGRIMET													
AGWXNET													
ASOS/ISH													
CDEC													
CIMIS													
COAGMET													
COCORAHS													
COOP													
DEOS													
EC													
FAWN													
HDSC													
HJA													
HYD													
MEXICO													
MN													
KSTATE													
KYMESONET													
LCRA													
NCECONET													
NDBC													
NDSWC													
NEVCAN													
NJWXNET													
NVDWR													
OKMESONET													
RAWS													
SCAN													
SFWMD													
SNOTEL													
SNOWCOURSE													
STORAGE													
UGA													

UPPERAIR													
USA													
USCRN													
USLTER													
WBAN													
WRCC													
WTEXAS													