



# Climate Monitoring in the Mediterranean Coast Network 2019

## *Santa Monica Mountains National Recreation Area*

Natural Resource Report NPS/MEDN/NRR—2022/2360



**ON THE COVER**

Paramount Ranch, Santa Monica Mountains National Recreation Area  
NPS

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# **Climate Monitoring in the Mediterranean Coast Network 2019**

*Santa Monica Mountains National Recreation Area*

Natural Resource Report NPS/MEDN/NRR—2022/2360

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## Executive Summary

This report details the climate (temperature, precipitation, drought, and streamflow) of Santa Monica Mountains National Recreation Area (NRA) during 2019. Gridded GIS maps are used to present broad-brush conditions across the region for each month. This regional presentation is compared to detailed data from Remote Automated Weather Stations (RAWS), weather stations in Global Historical Climatology Network (GHCN), and data from USGS stream gages. Prior to analysis, a set of data quality control checks were performed by the authors in accordance with an established National Park Service protocol (Rocky Mountain Climate Working Group 2010). Key points summarizing calendar year 2019 are presented as bullets in the Conclusion section at the end of the report.

There was significant spatial and month to month variability in the data that provided exceptions to these generalizations, so an examination of the regional maps are key to understanding the climatic patterns for 2019. Readers can download the data used in this report and make custom climate graphs and tables of their own by visiting [www.ClimateAnalyzer.org](http://www.ClimateAnalyzer.org)

## Acknowledgments

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## Glossary

30-year average or “normal” — Official 30-year averages for each weather station are issued every 10 years by NOAA. Prior to 2011, the official reference period was 1971–2000.

B-91 Forms — Paper data sheets that are used to record climate data at weather stations

GHCN — Global Historical Climatology Network

NOAA — National Oceanic and Atmospheric Administration

PRISM — Parameter-elevation Regression on Independent Slopes Model.  
See <http://www.prism.oregonstate.edu/>

RAWS — Remote Automated Weather Station

Tmax / Tmin — Mean daily Maximum / Minimum Temperatures

US Drought Monitor — A broad brush assessment of drought conditions. See <https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>

# Introduction

This report details the climate (temperature, precipitation, drought, streamflow) of Santa Monica Mountains National Recreation Area during 2019. Climatic events are presented both from a local perspective, with data from individual weather stations, and from a regional perspective, with maps that depict broad-scale conditions across southern California during each month of the year. The climatic conditions of 2019 are also compared to a historical context, based on a 30-year average or “normal” period calculated over the years 1981–2010, and to data from the UCLA weather station that spans 1933–present.

Typically, when a weather report states that a particular month was “warmer than average” or “cooler than normal,” the comparison is to a set of averages calculated over an agreed upon time period. These averages, which are known as “climatological normals,” are updated every 10 years by the National Oceanic and Atmospheric Administration (NOAA). From 1991–2000, meteorological measurements were compared to 1961–1990 averages; from 2001–2010 the reference period was 1971–2000; and starting in calendar year 2011, most weather data has been compared to 1981–2010 averages. NOAA further defines climatological normals as follows:

“In the strictest sense, a “normal” of a particular variable (e.g., temperature) is defined as the 30-year average. For example, the minimum temperature normal in January for a station in Chicago, Illinois, would be computed by taking the average of the 30 January values of monthly-averaged minimum temperatures from 1981 to 2010. Each of the 30 monthly values was in turn derived from averaging the daily observations of minimum temperature for the station. In practice, however, much more goes into NCDC’s Normals product than simple 30-year averages. Procedures are put in place to deal with missing and suspect data values. In addition, Normals include quantities other than averages such as degree days, probabilities, standard deviations, etc. Normals are a large suite of data products that provide users with many tools to understand typical climate conditions for thousands of locations across the United States.”

Those interested in additional climate-related information for Santa Monica Mountains National Recreation Area and the surrounding areas should seek:

The ClimateAnalyzer: [www.ClimateAnalyzer.org](http://www.ClimateAnalyzer.org). This web site allows you to create custom graphs and tables from both official, unedited data and from the corrected datasets used in this report. You can also download all the data from the weather stations in the area as spreadsheets.

Western Regional Climate Center (<http://www.wrcc.dri.edu/>)

Drought Monitor (<https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>)

NOAA (National Oceanic Atmospheric Administration) National Weather Service  
(<http://www.cpc.ncep.noaa.gov/>)

USGS (U.S. Geological Survey) Water National Information System  
(<http://waterdata.usgs.gov/nwis>)

# Methods

## Selection of Datasets

In order to place Santa Monica Mountains National Recreation Area within a regional context, gridded, map-based estimates of precipitation and temperature were used to provide a broad overview of climatic conditions in the area. These estimates were generated with a statistical modeling technique that interpolates precipitation and temperature values between actual climate stations while also accounting for the effects of aspect and elevation. Known as the Parameter-elevation Regression on Independent Slopes Model (PRISM; <http://www.prism.oregonstate.edu/>), this approach has a long history of use in the western United States, and it has been shown to provide robust products in a wide variety of studies (Daly et al. 2008). In this report, PRISM data from calendar year 2019 are compared to 1981–2010 PRISM averages for each month by calculating the percent of normal precipitation (2019 precipitation divided by 1981–2010 precipitation, multiplied by 100) or the temperature departure (2019 temperature minus 1981–2010 average temperature) for each grid cell on the map of southern California.

Records from individual precipitation and temperature observing stations were included as a way to highlight intra-regional variability. The process of selecting specific stations included in this report is described in the Rocky Mountain Climate Protocol (Rocky Mountain Climate Working Group 2010). Generally, the selection criteria were:

1. Stations provide good spatial coverage within and near the parks of interest. In the case of Santa Monica Mountains NRA, RAWS stations were chosen because they are located within the administrative boundaries of the recreation area (Figure 1) and are routinely consulted by NPS staff. In addition, National Weather Service (NWS) stations were chosen from nearby locations. Data from the NWS stations are available through the Global Historical Climatology Network (GHCN). GHCN stations have several advantages, including their relatively long period of record (Appendix 1), and the availability of established 30-year averages that can be used to quantify the difference between the current year and “normal” conditions. The weather stations used in this report are shown in Figure 1.
2. Stations provide a sufficient length of record to provide historical context for current observations. For this report, GHCN stations were not considered if they had not been in operation during the period 1981–2010 at a minimum.
3. Instrumentation at individual stations is relatively consistent over the life of the record.
4. Instrumentation and siting standards used in selected networks are suitable for providing consistent, continuous, and long-duration records of climate and streamflow.

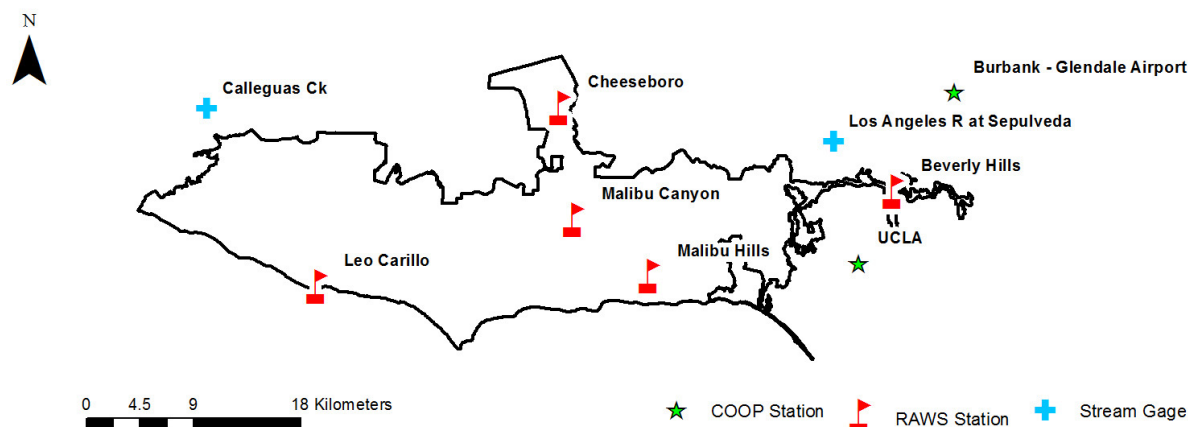


**Figure 1.** Map showing key climate stations and stream gauges in and near Santa Monica Mountains National Recreation Area. Cooperative Observer (COOP) stations are accessed through the Global Historical Climatology Network (see text).

As a way of presenting the integrated effects of temperature and precipitation, maps from the US Drought Monitor (<https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>) were used to depict broad-brush conditions across the region. Even though the watercourses in the region are human-controlled and not directly tied to rainfall, USGS stream gage data (<http://waterdata.usgs.gov/nwis>) were used to contrast streamflow during the 2019 water year, which ran from October 2018 to September 2019, with historical conditions. The locations of weather stations cited in this report are shown in Figure 1. Metadata for these stations can be accessed from the internet links provided in Appendix 1.

### Quality Control of Global Historical Climatology Network Data (GHCN)

All of the GHCN stations used in this report are operated by the National Weather Service (NWS). These stations are sometimes referred to as “Cooperative Observer” (COOP) stations because in most cases their measurements are recorded by volunteer human observers and submitted to NWS for aggregation and error checking.

Data from these weather stations undergo quality control and error-checking by NWS, and as part of this process many of the observations in the data files are assigned “flags” (letter or number codes) that indicate potential problems or other factors that should be taken into consideration when interpreting the data. Consequently, the author of this report has created software tools that assist in the interpretation of the data flags and diagnostic plotting of the data. Following guidelines from Kittel (2008), Kittel et al. (2009), and Rocky Mountain Climate Working Group (2010), the Qa/Qc employed by these software tools involved graphing and visual inspection of each time series, evaluation of the data quality flags that accompany each observation, comparison with historical observations and observations from surrounding sites, and logical consistency tests (e.g., confirming that minimum daily temperatures were lower than the daily maximum temperatures). Point observations provided by the GHCN stations were also compared to corresponding estimates from the PRISM datasets and to the original datasheets (B-91 forms) used by weather station staff. When possible, data missing in the electronic records were recovered from the original datasheets and hand

entered by the author of this report. If more than 3 days of precipitation data were missing for a particular month, a monthly total was not calculated, and the entire month was instead considered missing. Similarly, if more than 5 days of mean daily maximum temperature (Tmax) or mean daily minimum temperature (Tmin) were missing, monthly average temperatures were not calculated. The data handling was conservative, i.e., no data points were changed unless it was very clear that an erroneous value, for example a precipitation measurement with a missing decimal point that could be verified on the original station records, was found. Readers can download the data used in this report and make custom climate graphs and tables of their own by visiting [www.ClimateAnalyzer.org](http://www.ClimateAnalyzer.org)

### **Quality Control of RAWS Station Data**

Because RAWS data are collected hourly, daily Tmax, Tmin, and precipitation values must be derived from the automated data stream. Furthermore, precipitation is recorded as a running total that must be translated into daily measurements. If any particular day in a record was missing more than six hours of measurements, the entire day was considered missing. In addition, if the temperature during any day varied by less than 2 degrees Fahrenheit, data for the entire day was considered invalid due to instrumental error and replaced with missing values. Once daily statistics had been calculated, diagnostic plots were used to screen for physically impossible measurements (e.g. 500 degrees Fahrenheit), which were ascribed to instrumental error and considered missing; and the missing data criteria just described for GHCN stations were used to calculate monthly statistics.

## Results

### Temperature, Precipitation, and Drought Status During Calendar Year 2019

The patterns described in this section are often stated as broad generalizations. In most cases there was significant variability across the region and exceptions to the patterns described here were common. In order to appreciate this variability, it is important to examine the PRISM maps and compare them to the weather station data presented below.

### Broader Picture – The End of Drought

During the course of 2019, a multiyear drought was finally broken. Santa Monica Mountains NRA started the year with D2 “Severe Drought” status and finally became drought free during December (Figure 2).

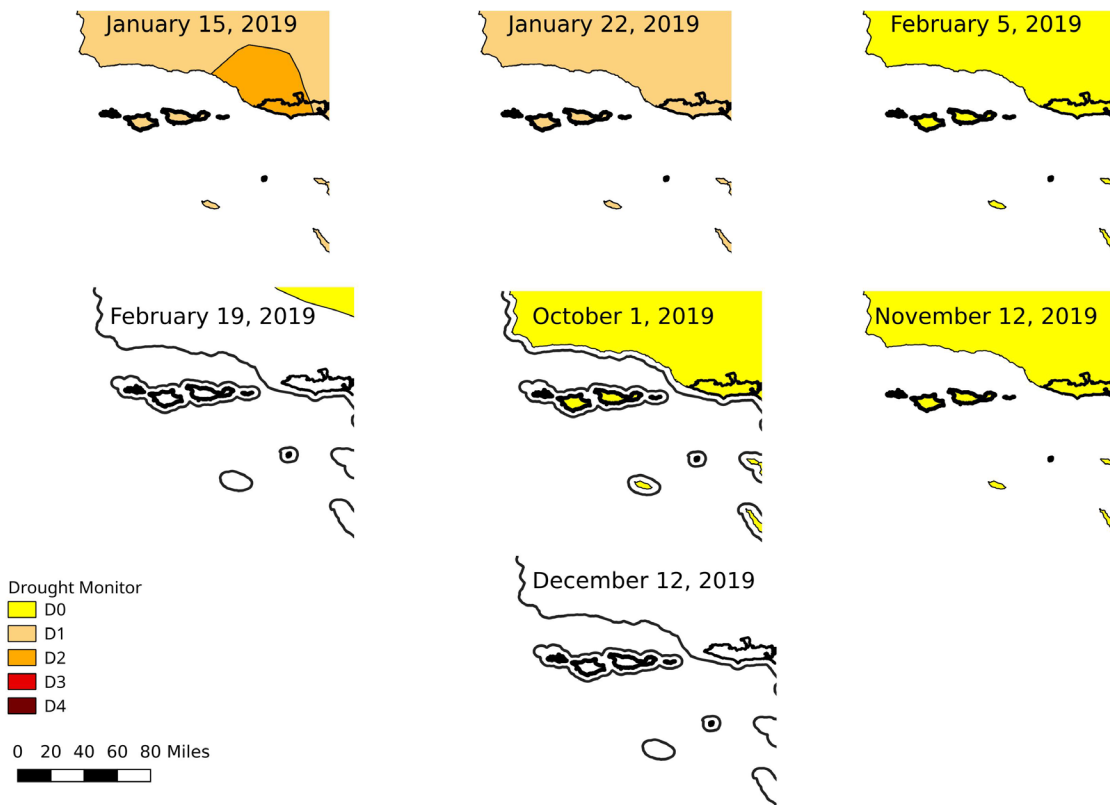


**Figure 2.** U.S. Drought Monitor maps for Santa Monica Mountains NRA during 2019. Santa Monica Mountains NRA is outlined in black on the coast. White areas = Pacific Ocean. For more information visit: <https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>

### **Weather Station Temperature and Precipitation Data**

Generally speaking, there are two components to drought: high temperatures, which increase evapotranspiration, exacerbating drought; and precipitation, or the lack thereof. Calendar year 2019 had near-average annual temperatures and above average annual precipitation (Figures 3–4, Tables 1–3). At the UCLA weather station, total annual precipitation was 146% average, while average daily high temperature was exactly average (71.8 degrees Fahrenheit), and the average night-time low temperature was only 1.2 degrees above average. September–November had above average daytime highs, while the other months were near or below average. April and June–October had above average night-time lows, while the other months were near or below average (Figures 3–4, Tables 1–3).

Of the non-summer months, January, February, November, and December had above average precipitation, while the other months were near or below average. Precipitation during the summer months (May–September) is so slight that calculations of percent average are misleading. An increase of only a few hundredths of an inch can mean the difference between an above vs. below average month.

RAWS stations in and near Santa Monica Mountains NRA do not have established 30-year averages, but they recorded similar conditions (Tables 1–3).

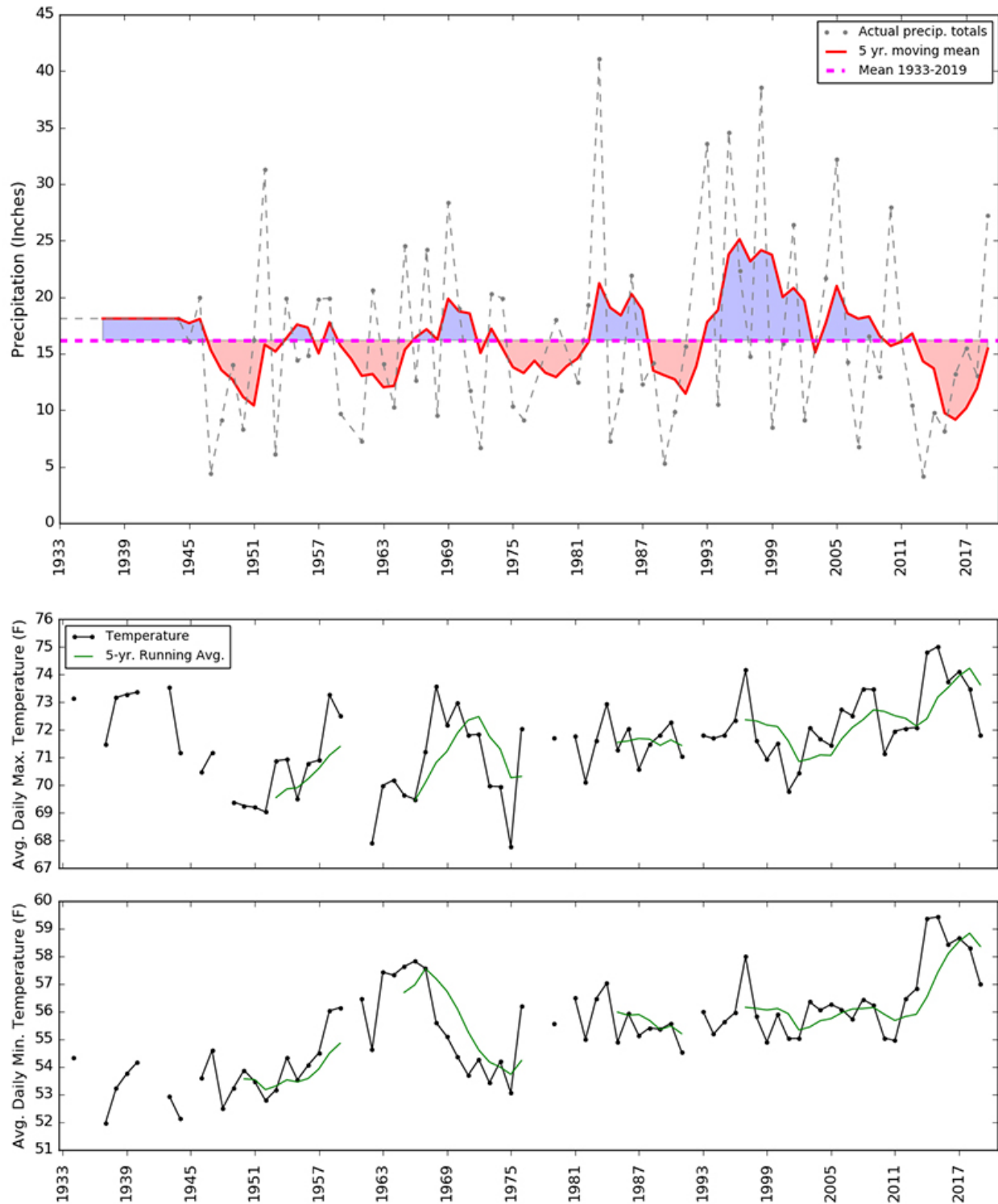


**Figure 3.** Top: total annual precipitation (dots) at UCLA 1933–2019. Red-shaded areas = years when the running mean is below the long-term average (dashed red line). Blue-shaded areas = running mean above the long-term average. Bottom: Annual averages for daily maximum temperature and daily minimum temperature 1933–2019. Green line = 5 year running average of temperatures. Running averages include the current year and the previous 4 years.

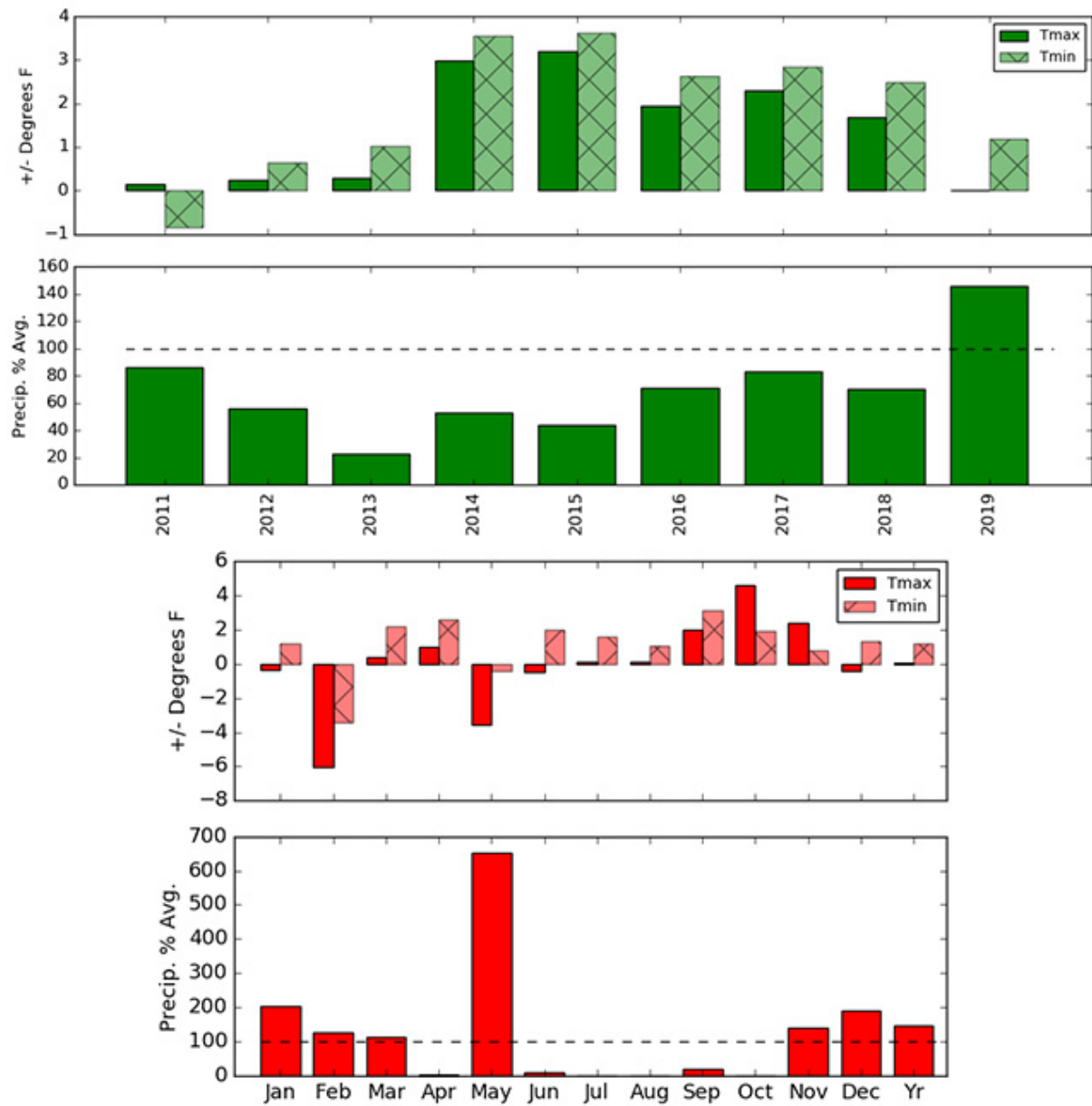


**Figure 4.** Top: Departure of 2011–2019 annual precipitation, annual average daily maximum temperature (Tmax), and annual average daily minimum temperature (Tmin) from 1981–2010 averages at UCLA. Bottom: Monthly departures of precipitation, Tmax, and Tmin from 1981–2010 averages during 2019.

**Table 1.** Total Monthly Precipitation in inches during 2019 and percent of 1981–2010 averages at key weather stations in and near Santa Monica Mountains National Recreation Area. Precipitation is so low during summer months that departure calculations can be misleading.

| Month | UCLA                    |              | Burbank<br>Glendale<br>Airport <sup>1</sup> | Beverly<br>Hills <sup>2</sup> | Malibu<br>Canyon <sup>2</sup> | Leo<br>Carrillo <sup>2</sup> | Cheeseboro <sup>2</sup> | Malibu<br>Hills <sup>2</sup> |
|-------|-------------------------|--------------|---------------------------------------------|-------------------------------|-------------------------------|------------------------------|-------------------------|------------------------------|
|       | 2019<br>Precip.<br>(in) | %<br>average | 2019<br>Precip.<br>(in)                     | 2019<br>Precip.<br>(in)       | 2019<br>Precip.<br>(in)       | 2019<br>Precip.<br>(in)      | 2019<br>Precip.<br>(in) | 2019<br>Precip.<br>(in)      |
| 1     | 8.19                    | 205          | 5.34                                        | 8.31                          | 9.28                          | 0.88                         | 6.75                    | 8.54                         |
| 2     | 6.449                   | 127          | 6.53                                        | 7.56                          | 7.44                          | 4.38                         | 5.32                    | 6.7                          |
| 3     | 3.26                    | 115          | 2.04                                        | 2.72                          | 3.25                          | 1.52                         | 2.59                    | 3.29                         |
| 4     | 0.04                    | 4            | 0.08                                        | 0.09                          | 0.06                          | 0.01                         | 0.06                    | 0.08                         |
| 5     | 2.027                   | 651          | 0.89                                        | 1.13                          | 1.45                          | 1.21                         | 0.95                    | 1.88                         |
| 6     | 0.01                    | 11           | 0.06                                        | 0.05                          | 0                             | 0.07                         | 0.03                    | 0.28                         |
| 7     | 0                       | 0            | 0                                           | 0                             | 0                             | 0                            | 0                       | 0                            |
| 8     | 0                       | 0            | 0                                           | 0.01                          | 0                             | 0                            | 0                       | 0                            |
| 9     | 0.05                    | 20           | 0.05                                        | 0.03                          | 0.02                          | 0                            | 0.06                    | 0.12                         |
| 10    | 0                       | 0            | 0                                           | 0                             | 0                             | 0                            | 0                       | 0                            |
| 11    | 1.93                    | 142          | 1.85                                        | 2.41                          | 2.17                          | 1.68                         | 2.04                    | 1.96                         |
| 12    | 5.28                    | 192          | 4.35                                        | 4.83                          | 6.3                           | 4.86                         | 4.37                    | 6.1                          |
| YR    | 27.21                   | 146          | 21.18                                       | 27.14                         | 29.97                         | 14.61                        | 22.17                   | 28.95                        |

<sup>1</sup> No 1981–2010 averages are available for the Burbank station.

<sup>2</sup> RAWs do not have 30-year averages.

**Table 2.** Average daily maximum temperatures (Tmax) during 2019 and departure from 1981–2010 averages expressed as  $\pm$  Degrees F.

| Month | UCLA              |                                  | Burbank<br>Glendale<br>Airport | Beverly<br>Hills  | Malibu<br>Canyon  | Leo<br>Carrillo   | Cheeseboro        | Malibu<br>Hills   |
|-------|-------------------|----------------------------------|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|       | 2019<br>Tmax (°F) | Tmax<br>Departure<br>( $\pm$ °F) | 2019<br>Tmax (°F)              | 2019<br>Tmax (°F) | 2019<br>Tmax (°F) | 2019<br>Tmax (°F) | 2019<br>Tmax (°F) | 2019<br>Tmax (°F) |
| 1     | 66.8              | -0.35                            | 65.2                           | 66.3              | 65.6              | 64.2              | 61.4              | 61.7              |
| 2     | 60.8              | -6.06                            | 59.0                           | 60.5              | 59.1              | 58.6              | 55.2              | 54.9              |
| 3     | 67.8              | 0.35                             | 68.0                           | 70.0              | 67.5              | 64.5              | 64.3              | 62.6              |
| 4     | 70.5              | 0.99                             | 74.3                           | 76.1              | 72.9              | 66.3              | 74.6              | 68.5              |
| 5     | 66.8              | -3.54                            | 69.4                           | 71.6              | 68.7              | 65.4              | 70.8              | 63                |
| 6     | 72.3              | -0.52                            | 79.1                           | 80.4              | 75.1              | 67.9              | 84.0              | 70.7              |
| 7     | 77.2              | 0.12                             | 86.9                           | 88.5              | 81.8              | 71.7              | 93.3              | 80.4              |
| 8     | 78.7              | 0.08                             | 89.5                           | 91.1              | 83.9              | 72.9              | 95.4              | 83.6              |
| 9     | 80.3              | 2.01                             | 85.6                           | 89.6              | 85.1              | 75.9              | 89.2              | 80.1              |
| 10    | 80.0              | 4.57                             | 82.9                           | 87.2              | 82.3              | 76.1              | 83.1              | 77.3              |
| 11    | 73.6              | 2.36                             | 74.7                           | 78                | 74.9              | 68.9              | 75.2              | 71.5              |
| 12    | 66.3              | -0.41                            | 63.7                           | 64.31             | 64.8              | 63.1              | 61.2              | 60.8              |
| YR    | 71.8              | +0                               | 75.0                           | 77.0              | 73.6              | 68.0              | 75.8              | 69.7              |

**Table 3.** Average Daily Minimum Temperatures (Tmin) during 2019 and departure from 1981–2010 averages expressed as  $\pm$  Degrees F.

| Month | UCLA              |                                  | Burbank<br>Glendale<br>Airport | Beverly<br>Hills  | Malibu<br>Canyon  | Leo<br>Carrillo   | Cheeseboro        | Malibu<br>Hills   |
|-------|-------------------|----------------------------------|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|       | 2019<br>Tmin (°F) | Tmin<br>Departure<br>( $\pm$ °F) | 2019<br>Tmin (°F)              | 2019<br>Tmin (°F) | 2019<br>Tmin (°F) | 2019<br>Tmin (°F) | 2019<br>Tmin (°F) | 2019<br>Tmin (°F) |
| 1     | 52.1              | 1.2                              | 45.5                           | 49.8              | 41.7              | 55.0              | 50.4              | 52.0              |
| 2     | 47.2              | -3.44                            | 42.9                           | 43.6              | 37.1              | 48.9              | 42.5              | 44.7              |
| 3     | 53.4              | 2.16                             | 49.3                           | 49.9              | 42.2              | 53.8              | 48.6              | 50.8              |
| 4     | 55.6              | 2.57                             | 54.6                           | 53.1              | 47.3              | 54.6              | 52.8              | 53.9              |
| 5     | 55.2              | -0.42                            | 53.7                           | 51.6              | 48.7              | 55.4              | 49.8              | 51.1              |
| 6     | 60.4              | 1.96                             | 60.0                           | 57.2              | 55.8              | 59.2              | 56.9              | 56.9              |
| 7     | 63.3              | 1.6                              | 64.5                           | 60.7              | 57.5              | 61.3              | 62.6              | 62.5              |
| 8     | 63.4              | 1.07                             | 64.6                           | 62.0              | 55.7              | 62.3              | 64.0              | 64.9              |
| 9     | 64.6              | 3.09                             | 64.9                           | 63.4              | 55.3              | 63.2              | 63.7              | 65.4              |
| 10    | 60.7              | 1.92                             | 55.4                           | 60.3              | 44.4              | 61.2              | 60.8              | 62.78             |
| 11    | 55.3              | 0.8                              | 49.0                           | 54.7              | 39.6              | 56.1              | 54.7              | 57.2              |
| 12    | 52.0              | 1.34                             | 45.1                           | 48.8              | 39.7              | 53.8              | 48.6              | 50.8              |
| YR    | 57.0              | +1.2                             | 54.2                           | 54.7              | 47.1              | 57.1              | 54.7              | 56.2              |

### El Nino – La Nina Status

The El Nino – Southern Oscillation (ENSO) is an oscillation of the ocean – atmosphere climate system centered over the tropical Pacific Ocean that follows a rough cycle of approximately 2–7 years. When ENSO is in its “El Nino phase,” sea surface temperatures in the central and eastern tropical Pacific are warmer than average, and this generally produces warmer, drier conditions in the northern continental United States and cooler, wetter conditions in the southern United States, particularly the southwest. In contrast, the opposite conditions prevail when ENSO is in its “La Nina phase.” More information on ENSO can be found on the NOAA web site located here:

<http://www.pmel.noaa.gov/tao/elnino/el-nino-story.html>

Calendar year 2019 began with El Nino conditions and transitioned during the course of the year to nearly neutral and then back to El Nino in November and December. For long-term El Nino patterns, consult NOAA here:

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensostuff/ensoyears.shtml](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml)

### PRISM maps depicting spatial patterns in departure from 1981–2010 averages

The regional precipitation and temperature patterns seen in the PRISM maps (Figures 5–7) are similar to the patterns seen in the weather station data. Of the non-summer months, January, February, November, and December had above average precipitation (Figure 5). September–November had above average daytime highs, while the other months were near or below average. January, April and June–October had generally above average night-time lows, while the other months were near or below average (Figures 6–7).

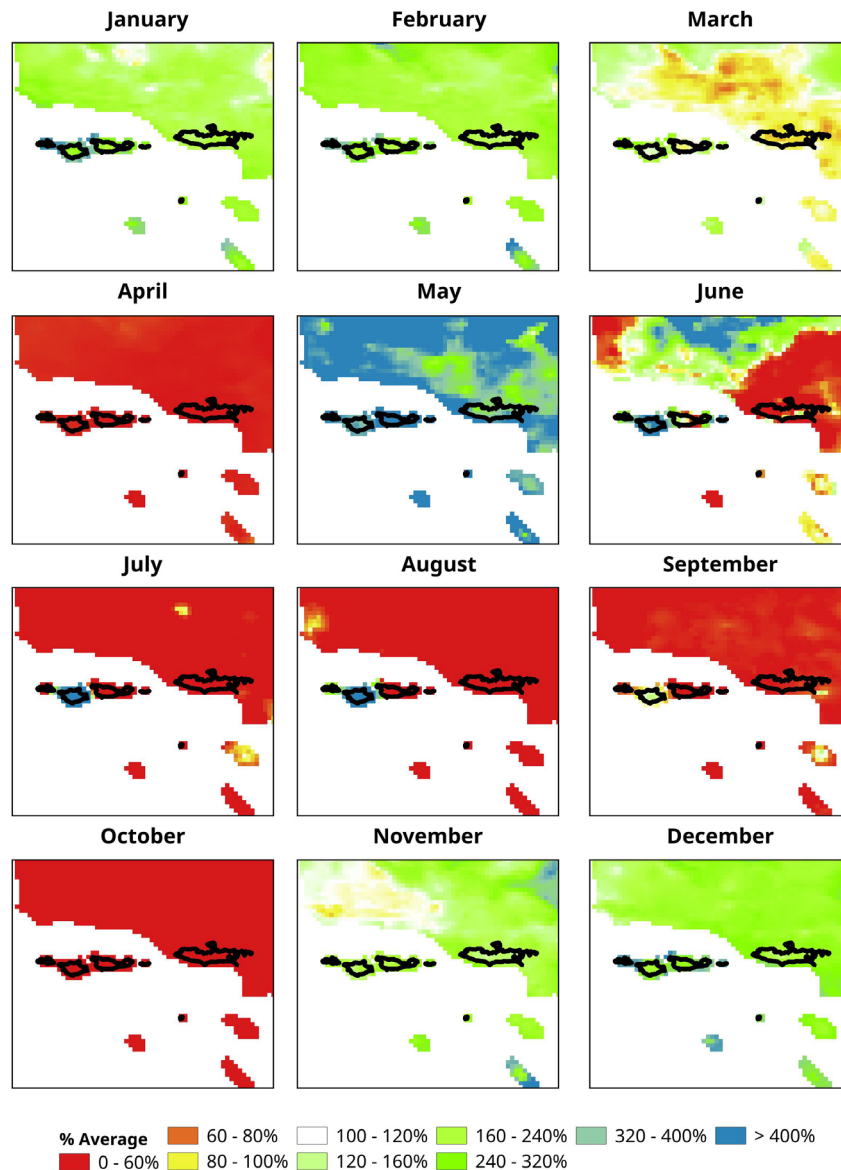


**Figure 5.** Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2019 monthly precipitation as a percentage of 1981–2010 averages. White areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

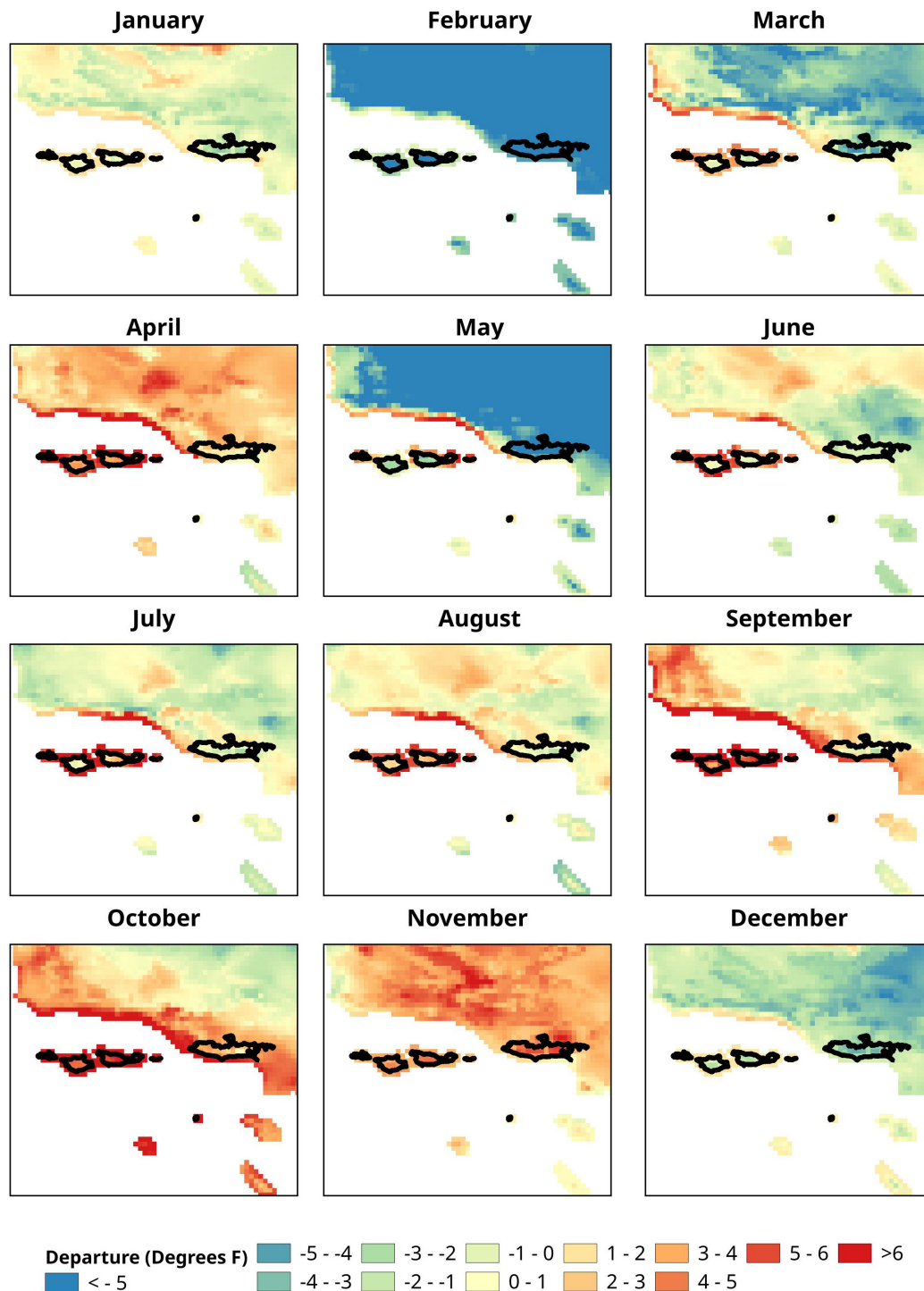


**Figure 6.** Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2019 monthly average daily maximum temperature (Tmax) departure from 1981–2010 averages in degrees Fahrenheit. White areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

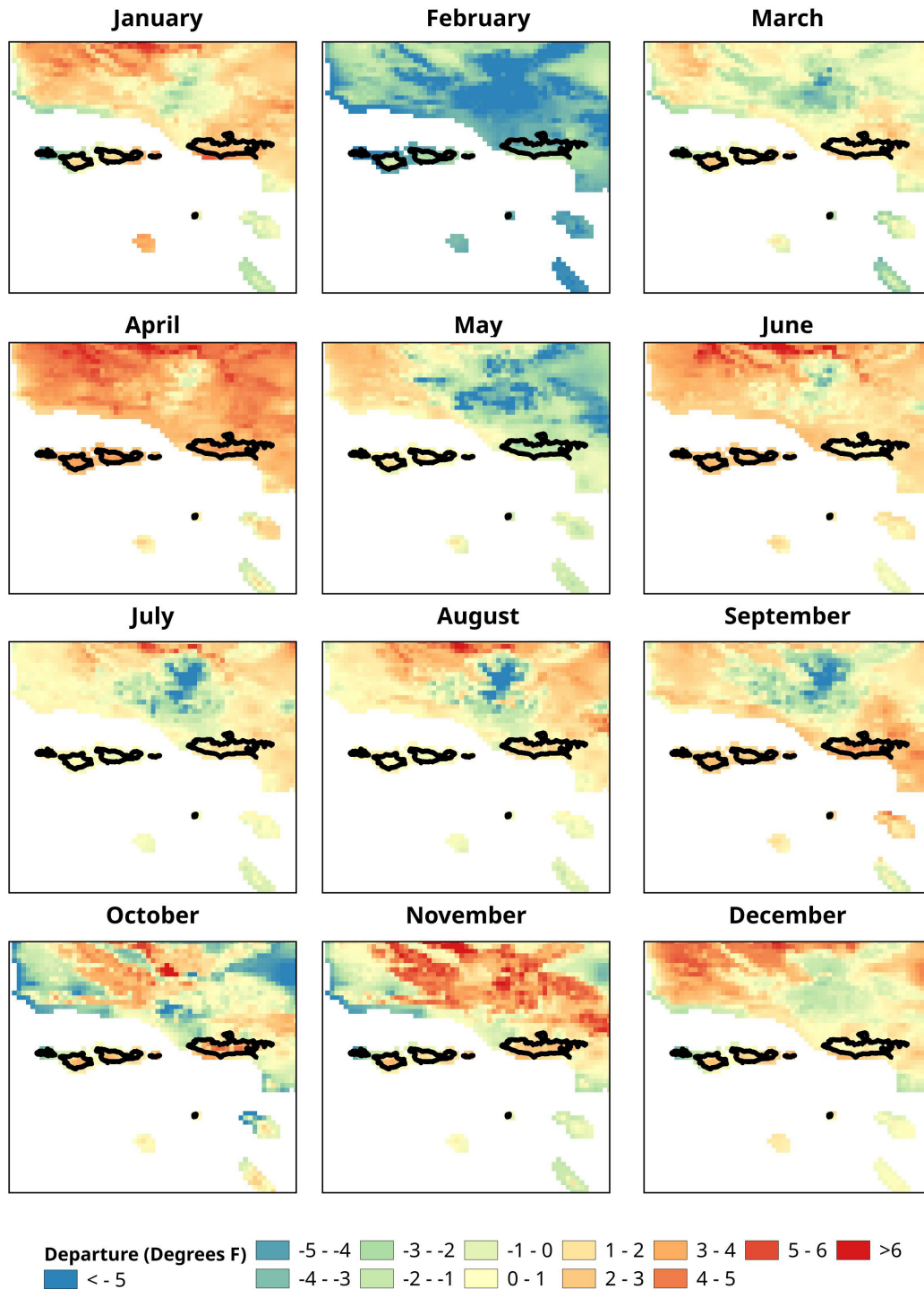


**Figure 7.** Parameter-elevation Regressions on Independent Slopes Model (PRISM) data showing 2019 monthly average daily minimum temperature (Tmin) departure from 1981–2010 averages in degrees Fahrenheit. White areas = Pacific Ocean. For more information, see <http://www.prism.oregonstate.edu/>.

## Streamflow

Since the rivers in and near Santa Monica Mountains NRA are all heavily influenced by human activity, streamflow is as much a result of management priorities as annual climatic events. With the exception of a few large events, stream flows were generally below the 2002–2012 average during 2019 (Figure 8).

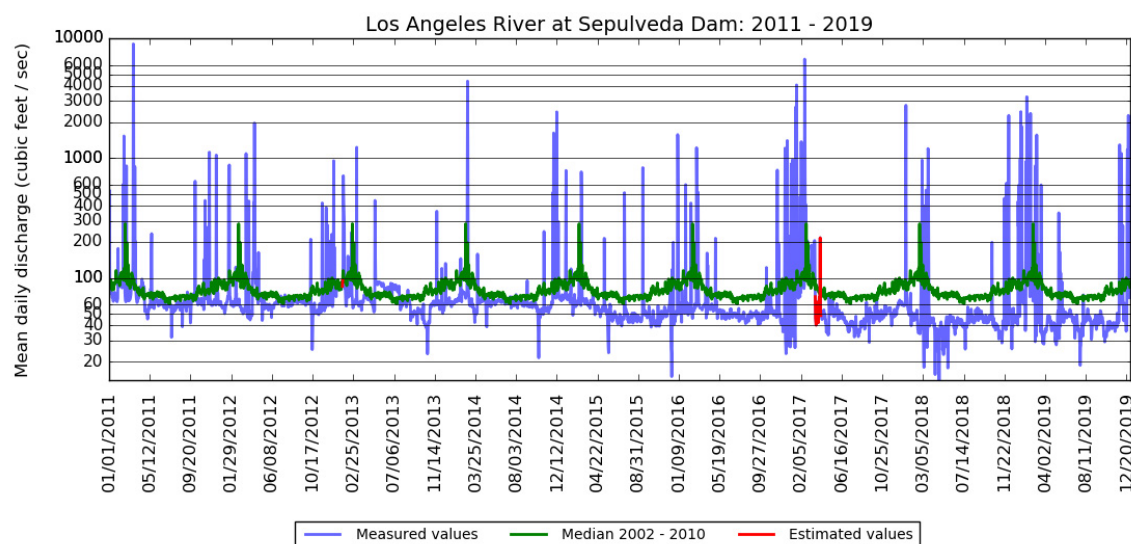


**Figure 8.** Stream flow 2011–2019 on the Los Angeles River at Sepulveda Dam.

## Accumulated Growing Degree Days, an Index of Growing Season Length

Accumulated Growing Degree Days (AGDD) are often used as an index of growing season length. They are calculated as the sum of the differences between the average temperature for each day of the year and a base temperature. This base temperature is often chosen as the threshold below which plants are thought to be metabolically inactive. In the case of AGDD 40, the base temperature is 40 degrees Fahrenheit. Consequently, 40 is subtracted from the mean temperature for each day, and these differences are added up for the entire year, giving a single number. Similarly, AGDD 50 is calculated with a base temperature of 50 (F).

When viewed from the perspective of growing season length, calendar-year 2019 was near average. At UCLA, AGDD 40 was 105% the 1981–2010 average and AGDD 50 was 109% average (Table 4).

**Table 4.** Accumulated Growing Degree Days (AGDD) and days above or below critical temperature thresholds during 2019.

| Station Name               | Time Period    | AGDD40 | AGDD50 | # days >= 90 F | # days <= 32F |
|----------------------------|----------------|--------|--------|----------------|---------------|
| UCLA                       | 2019 Value     | 8904   | 5256   | 8              | 0             |
|                            | 1981–2010 Avg. | 8479   | 4842   | 9.1            | 0.1           |
| Burbank – Glendale Airport | 2019 Value     | 8966   | 5366   | 50             | 0             |
| Beverly Hills              | 2019 Value     | 9436   | 5822   | 67             | 0             |
| Malibu Canyon              | 2019 Value     | 7368   | 3885   | 35             | 20            |
| Leo Carrillo               | 2019 Value     | 8175   | 4555   | 3              | 0             |
| Cheeseboro                 | 2019 Value     | 9205   | 5676   | 81             | 0             |
| Malibu Hills               | 2019 Value     | 8337   | 4775   | 22             | 0             |

## Conclusions

During the course of 2019, a multiyear drought was finally broken. Santa Monica Mountains NRA started the year with D2 “Severe Drought” status and finally became drought free during December.

Calendar year 2019 had near-average annual temperatures and above average annual precipitation. At the UCLA weather station, total annual precipitation was 146% average, while average daily high temperature was exactly average, and average night-time low temperatures were only 1.2 degrees above average.

At the UCLA weather station, total annual precipitation was 146% average, while average daily high temperature was exactly average (71.8 degrees Fahrenheit), and the average night-time low temperature was only 1.2 degrees above average. September–November had above average daytime highs, while the other months were near or below average. April and June–October had above average night-time lows, while the other months were near or below average.

Of the non-summer months, January, February, November, and December had above average precipitation, while the other months were near or below average. Precipitation during the summer months (May–September) is so slight that calculations of percent average are misleading. An increase of only a few hundredths of an inch can mean the difference between an above vs. below average month.

With the exception of a few large events, stream flows were generally below the 2002–2012 average during 2019 (Figure 8).

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## Appendix 1

**Table A-1.** Climate stations in and near Santa Monica Mountains. You can make custom graphs and tables based on all these weather stations by visiting [www.ClimateAnalyzer.org](http://www.ClimateAnalyzer.org). Detailed histories, period of record, and 30-year averages can be accessed from the links provided below.

| Name                                                      | Stn type               | ID       | Metadata                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------|------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Burbank Valley Pump Plant AKA<br>Burbank Glendale Airport | GHCN                   | 41194    | <a href="http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1194">http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca1194</a>                                                                                                                                                                                 |
| UCLA                                                      | GHCN                   | 49152    | <a href="http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca9152">http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca9152</a>                                                                                                                                                                                 |
| Beverly Hills                                             | RAWS                   | –        | <a href="http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCBEV">http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCBEV</a>                                                                                                                                                                                 |
| Leo Carrillo                                              | RAWS                   | –        | <a href="http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCLEO">http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCLEO</a>                                                                                                                                                                                 |
| Malibu Hills                                              | RAWS                   | –        | <a href="http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCMAL">http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCMAL</a>                                                                                                                                                                                 |
| Malibu Canyon                                             | RAWS                   | –        | <a href="http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCMCN">http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCMCN</a>                                                                                                                                                                                 |
| Cheeseboro                                                | RAWS                   | –        | <a href="http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCCHB">http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCCHB</a>                                                                                                                                                                                 |
| Calleguas Creek nr Camarillo                              | USGS<br>Stream<br>Gage | 11106550 | <a href="http://waterdata.usgs.gov/nwis/dv/?site_no=11106550&amp;agency_cd=USGS&amp;referred_module=sw">http://waterdata.usgs.gov/nwis/dv/?site_no=11106550&amp;agency_cd=USGS&amp;referred_module=sw</a>                                                                                         |
| Malibu Creek at Malibu California                         | USGS<br>Stream<br>Gage | 11105510 | <a href="http://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&amp;search_site_no=11105510&amp;agency_cd=USGS&amp;referred_module=sw">http://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&amp;search_site_no=11105510&amp;agency_cd=USGS&amp;referred_module=sw</a> |
| Los Angeles River a Sepulveda<br>Dam                      | USGS<br>Stream<br>Gage | 11092450 | <a href="http://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&amp;search_site_no=11092450&amp;agency_cd=USGS&amp;referred_module=sw">http://waterdata.usgs.gov/nwis/dvstat/?format=sites_selection_links&amp;search_site_no=11092450&amp;agency_cd=USGS&amp;referred_module=sw</a> |

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