

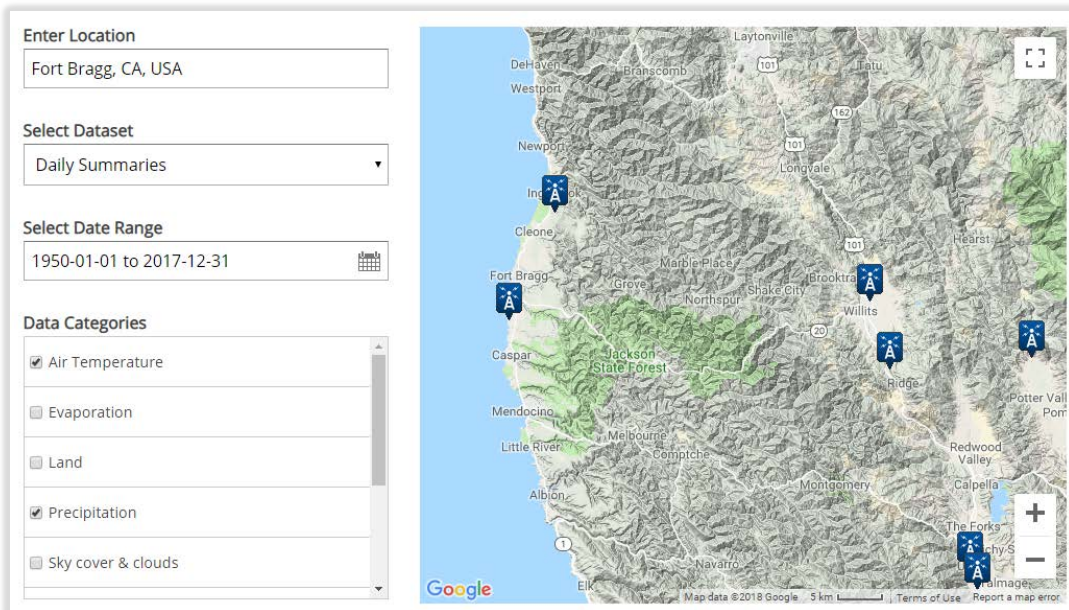
Obtaining Precipitation Data and Temperature Data 2.0

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VELMA requires daily precipitation and temperature data (drivers) NOAA has weather stations all across the US, but most of the stations have missing data for one of both of the drivers. These instructions will walk you through downloading both types of data and filling in NOAA weather station data gaps with Daymet data, which is more generalized but consistent.

Obtaining NOAA Climate Data

1. Navigate to the Data Tools: Find a Station page on the NOAA website (<https://www.ncdc.noaa.gov/cdo-web/datatools/findstation>)
2. Either search your desired location in the “Enter Location” box, or use the map to zoom into your area of interest
3. In the “Select Dataset” drop down, select Daily Summaries
4. For the “Select Date Range”, choose a date range
 - a. Give a broad range in order to get more results (ex: 1950-2017)
 - b. Make sure the start date is January 1st and the end date is December 31st (ex: Start Date: 1/1/1980. End Date: 12/31/2016). This will make sure you have only full years of data.
5. For “Data Categories” select the “Air Temperature” and “Precipitation” checkboxes



6. Click on the weather tower icons on the map to bring up more information on the tower. Note the “Start/End” dates and the percent “Coverage”. Ideally you want:
 - a. A weather tower near the center of the watershed

- b. High percent coverage
- c. A long period of record (many years between the start and end)

7. Look at the available weather tower and decide which one will be best for you watershed
8. Once you have chosen a watershed, select “ADD TO CART”
9. In the top left corner of the window select “Cart (Free Data) 1 item”

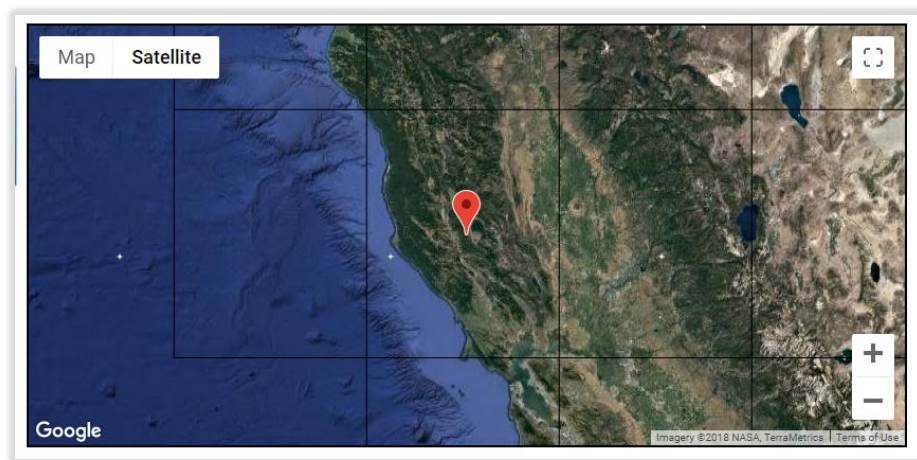
10. This will take you to your Cart Options. For output format select “Custom GHCN-Daily CSV”
11. In the “Select the Date Range” you can change the range if you want a different data range. If not leave as is.
12. Select the orange “CONTINUE” button
13. On the “Station Detail & Data Flag Options” page, uncheck “Station Name”
14. For “Units” change it to “Metric”
15. For “Select data types for custom output” check “Precipitation” and “Air Temperature”
16. Select the orange “CONTINUE” button

17. Review your order. If everything looks good then enter your email address, verify your email, then select the orange “SUBMIT ORDER” button
18. You will receive an email indicating that your request has been submitted, then a second email once your request is complete. This usually only takes a few minutes
19. Click “Download” on your request complete email. This will download the CSV file onto your computer

Obtaining Daymet Data

Now we will download data from Daymet for the same years as the NOAA data. We can then use the Daymet data to fill in any missing NOAA data.

1. Log in with you Daymet account, if you do not have an account you will need to register, it's free (<https://urs.earthdata.nasa.gov/>)
2. Once you are logged in, navigate to the Daymet Single Pixel Extraction Tool (<https://daymet.ornl.gov/single-pixel/>)
3. Drag and drop the red icon into the pixel containing your watershed
4. Zoom in and adjust the red icon if needed



5. Now scroll down to adjust the parameters
6. Under variables, hold down the CTRL button and select PRCP, TMAX, and TMIN
 - a. This will allow us to download only the precipitation and temperature data
7. For the Date Range, change the Start and End Date to match your NOAA data's data range

A screenshot of the Daymet Single Pixel Extraction Tool parameter selection interface. It features a 'Variables' section on the left with a list of variables: ALL, DAYL, PRCP, SRAD, SWE, TMAX, TMIN, and VP. The 'PRCP', 'TMAX', and 'TMIN' variables are highlighted. To the right of the variables list, there are two radio buttons: 'Date Range' (selected) and 'Years'. Below these, there are two text input fields: 'Start Date' with the value '1980-01-01' and 'End Date' with the value '2016-12-31'. At the bottom, there is a horizontal slider bar.

- Click on the green “Download Data” button. A CSV will be downloaded onto your computer

Combining NOAA and Daymet Data

Reorganized and Format Data

- Reorganize/delete rows until the only columns are “DATE”, “PRCP”, “TMAX”, and “TMIN”

	A	B	C	D	E	F	G	H	I	J
1	STATION	DATE	DAPR	MDPR	PRCP	SNOW	SNWD	TMAX	TMIN	TOBS
2	USC00043161	1/1/1950			0	0	0			
3	USC00043161	1/2/1950			6.6	0	0	11.1	1.1	3.9
4	USC00043161	1/3/1950			0	0	0	6.7	-2.2	-1.7
5	USC00043161	1/4/1950			0.5	0	0	7.8	-2.2	-0.6
6	USC00043161	1/5/1950			0	0	0	10	-1.1	-0.6
7	USC00043161	1/6/1950			0	0	0	11.1	-0.6	0.6
8	USC00043161	1/7/1950			0	0	0	11.7	0	7.2

	A	B	C	D
1	DATE	PRCP	TMAX	TMIN
2	1/1/1950	0		
3	1/2/1950	6.6	11.1	1.1
4	1/3/1950	0	6.7	-2.2
5	1/4/1950	0.5	7.8	-2.2
6	1/5/1950	0	10	-1.1
7	1/6/1950	0	11.1	-0.6
8	1/7/1950	0	11.7	0
9	1/8/1950			
10	1/9/1950		0.4	1.1

- Make a new column titled “TEMP”, and enter a function so that it finds the average of TMAX and TMIN

SUM					=(D2+C2)/2
	A	B	C	D	E
1	DATE	PRCP	TMAX	TMIN	TEMP
2	1/1/1950	0			=(D2+C2)/2
3	1/2/1950	6.6	11.1	1.1	
4	1/3/1950	0	6.7	-2.2	

- Double click on the bottom left hand corner of the cell to populate the rest of the column with the equation.
- Now make a new column called “TEMP”. We will need to convert the temperature from Fahrenheit to Celsius

- 4.
5. Highlight the entire "TEMPC" column, then copy and paste it back in using the "Values" paste option. This will make the values no longer associated with the formula/other cells
6. Delete the "TMAX" and "TMIN"
7. You should now only have the following columns: DATE, PRCP, TEMPC


Use Microsoft Visual Basic for Applications to Find and Add Missing Dates

NOAA data can be patchy and have missing dates. We will now use a VBA code to find these missing dates, add the row, and then populate the missing date. Code source:

<https://answers.microsoft.com/en-us/msoffice/forum/all/add-a-blank-row-where-found-missing-date-in-a-row/2439904b-112d-4801-aca3-db801b38a6e2>

1. While in excel, click ALT and F11 at the same time to open the VBA window
2. Right click on "This Workbook", select insert, and select Module
3. In the pop up window, paste this code

```
Sub insertrows_Fill()
Dim MyColumn As String, x As Long, diff As Long
Dim LastRow As Long, Area As Range
MyColumn = "A"
For x = Cells(Rows.Count, MyColumn).End(xlUp).Row To 3 Step -1
diff = Cells(x, MyColumn) - Cells(x - 1, MyColumn)
    If diff > 1 Then
        Rows(x).Resize(diff - 1).Insert
    End If
Next x
LastRow = Cells(Cells.Rows.Count, MyColumn).End(xlUp).Row
For Each Area In Range(MyColumn & "3:" & MyColumn & LastRow). _
    SpecialCells(xlCellTypeBlanks).Areas
    Area(1).Offset(-1).AutoFill Destination:=Range(Area(1).Offset(-1).Resize(Area.Rows.Count + 1).Address)
Next
End Sub
```

4. Click the Green play button , this will find and add all missing dates. Exit out of the VBA window

Fill in Missing Dates with Daymet Data

Now use the DayMet Data to fill in the missing information in the NOAA data. When you have filled in all the information, save the precipitation and temperature data into individual CSVs, containing ONLY the data.

	A
1	3.75
2	6.25
3	6.25
4	8.25
5	9
6	6.5
7	6.75
8	7.25
9	10
10	10.75
11	6.5
12	6.25