



## Preview of SAM's New Solar Resource Data Download Features

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- Preview of SAM's New Model for Bifacial PV Modules, Recording available
- **Preview of SAM's New Solar Resource Data Download Features, Today**
- Modeling PV Systems with Multiple MPPT Inverters, October 18

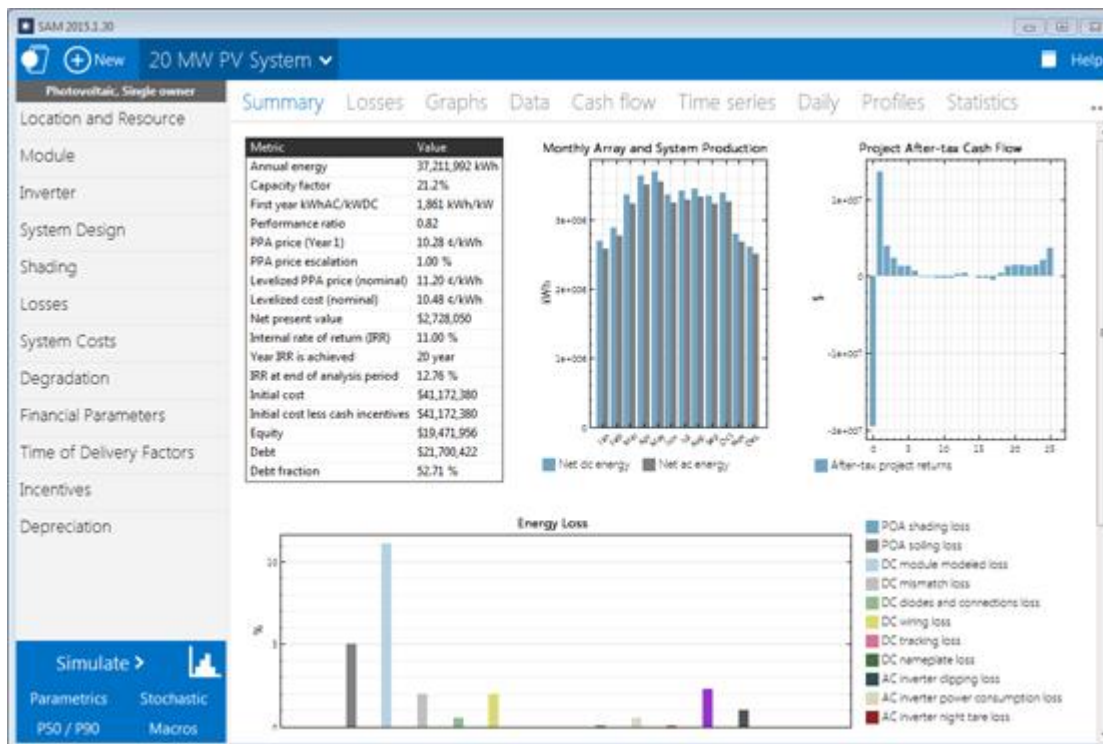
For registration links  
and recordings of past webinars, go to  
<https://sam.nrel.gov/webinars>

# System Advisor Model (SAM)

SAM is free software for modeling the performance and economics of renewable energy projects.

<https://sam.nrel.gov>

- Developed by NREL with funding from DOE
- Windows, Mac, and Linux
- One or two new versions per year
- Software Development Kit (SDK)
- Open source project
- Support
  - Help system
  - Documents on website
  - Online forum
  - Contact form on website



# SAM Beta Version

## Windows

[https://sam.nrel.gov/sites/default/files/content/public\\_releases/sam-beta-windows-2018-9-13.exe](https://sam.nrel.gov/sites/default/files/content/public_releases/sam-beta-windows-2018-9-13.exe)

Beta releases expire on 9/13/2019, official release later this fall.

Please send any feedback to

<https://sam.nrel.gov/support>, or  
[sam.support@nrel.gov](mailto:sam.support@nrel.gov)

# What we'll cover today

- Weather data and SAM
- Overview of National Solar Radiation Database (NSRDB)
- Motivation for updating Location and Resource input page
- Demonstration of new features
- SAM tools for working with weather data
- Questions and answers

# SAM and Weather Data

# SAM's different solar energy models require different hourly or subhourly data in a weather file

	Photovoltaic (PV)	Concentrating Solar Power (CSP)
Latitude and longitude	•	•
Time zone	•	•
Elevation above sea level	•	•
Direct Normal Irradiance (DNI)	•	•
Diffuse Horizontal Irradiance (DHI)	•	
Global Horizontal Irradiance (GHI)		
Dry bulb temperature	•	
wet bulb temp or dew point		•
Relative humidity		•
Atmospheric pressure		•
Wind speed	•	•
Albedo	(•)	
Snow depth	(•)	

## SAM's weather file processor can calculate values for some weather data elements

- Calculate DNI and GHI from Global Horizontal (GHI) and either DNI or GHI for photovoltaic models
- Use plane-of-array (POA) data for photovoltaic models
- Calculate dew point or wet-bulb temperature when missing from dry bulb temperature, relative humidity, and atmospheric pressure for CSP models

See the “Weather Data Elements” topic in SAM's Help system for more details.



# Time series graph of hourly data for photovoltaic modeling



# SAM reads weather data from a text file in the SAM CSV format

```
phoenix_az_33.448377_-112.074037_psmv3_60_tmy.csv x
1 Source, Location ID, City, State, Country, Latitude, Longitude, Time Zone, Elevation, Local Time Zone, Dew Point Unit
2 NSRDB, 310820, -, -, -, 33.45, -112.06, -7, 321, -7, c, w/m2, w/m2, w/m2, c, mbar, Degrees, m/s, v2.0.1
3 Year, Month, Day, Hour, Minute, Dew Point, DHI, DNI, GHI, Pressure, Temperature, Wind Direction, Wind Speed
4 1998, 1, 1, 0, 0, 1.5150146484375, 0, 0, 0, 956, 10.545068359375023, 84, 4
5 1998, 1, 1, 1, 0, 0.627410888671875, 0, 0, 0, 956, 9.642938232421898, 83, 4
6 1998, 1, 1, 2, 0, -0.191650390625, 0, 0, 0, 956, 8.810174560546898, 83, 4
7 1998, 1, 1, 3, 0, -0.7799072265625, 0, 0, 0, 955, 8.211938476562523, 83, 4
8 1998, 1, 1, 4, 0, -1.0946044921875, 0, 0, 0, 955, 7.891900634765648, 82, 4
9 1998, 1, 1, 5, 0, -1.20257568359375, 0, 0, 0, 955, 7.782037353515648, 81, 4
10 1998, 1, 1, 6, 0, -1.265655517578125, 0, 0, 0, 955, 7.717767333984398, 80, 4
11 1998, 1, 1, 7, 0, -1.18536376953125, 0, 0, 0, 955, 7.799371337890648, 80, 4
12 1998, 1, 1, 8, 0, 0.889801025390625, 24, 338, 49, 956, 9.909692382812523, 82, 3
13 1998, 1, 1, 9, 0, 4.219818115234375, 53, 683, 222, 956, 13.292260742187523, 85, 3
14 1998, 1, 1, 10, 0, 8.23760986328125, 67, 818, 387, 956, 17.370355224609398, 97, 2
15 1998, 1, 1, 11, 0, 11.3858642578125, 75, 881, 509, 955, 20.565301513671898, 115, 2
16 1998, 1, 1, 12, 0, 13.73919677734375, 79, 907, 574, 954, 22.953912353515648, 136, 2
17 1998, 1, 1, 13, 0, 14.839935302734375, 79, 907, 576, 953, 24.071435546875023, 155, 1
18 1998, 1, 1, 14, 0, 14.762115478515625, 75, 882, 514, 952, 23.992486572265648, 172, 1
19 1998, 1, 1, 15, 0, 13.650054931640625, 68, 823, 396, 952, 22.863549804687523, 184, 1
20 1998, 1, 1, 16, 0, 11.0322265625, 54, 696, 234, 953, 20.206658935546898, 193, 0
21 1998, 1, 1, 17, 0, 7.9166259765625, 27, 376, 59, 953, 17.045007324218773, 182, 0
22 1998, 1, 1, 18, 0, 6.90533447265625, 0, 0, 0, 953, 16.018731689453148, 127, 0
23 1998, 1, 1, 19, 0, 6.11773681640625, 0, 0, 0, 953, 15.219354248046898, 107, 1
24 1998, 1, 1, 20, 0, 5.483306884765625, 0, 0, 0, 953, 14.575433349609398, 105, 1
25 1998, 1, 1, 21, 0, 4.91253662109375, 0, 0, 0, 953, 13.996118164062523, 108, 2
26 1998, 1, 1, 22, 0, 4.382568359375, 0, 0, 0, 952, 13.458184814453148, 113, 2
27 1998, 1, 1, 23, 0, 3.82037353515625, 0, 0, 0, 951, 12.887475585937523, 119, 2
28 1998, 1, 2, 0, 0, 3.293487548828125, 0, 0, 0, 951, 12.352502441406273, 126, 2
29 1998, 1, 2, 1, 0, 2.777587890625, 0, 0, 0, 951, 11.828515625000023, 131, 2
30 1998, 1, 2, 2, 0, 2.32659912109375, 0, 0, 0, 951, 11.370416259765648, 134, 1
31 1998, 1, 2, 3, 0, 1.9180908203125, 0, 0, 0, 951, 10.955468750000023, 132, 1
32 1998, 1, 2, 4, 0, 1.55499267578125, 0, 0, 0, 951, 10.586602783203148, 123, 1
33 1998, 1, 2, 5, 0, 1.24969482421875, 0, 0, 0, 951, 10.276330566406273, 114, 1
34 1998, 1, 2, 6, 0, 1.04010009765625, 0, 0, 0, 951, 10.063287353515648, 109, 1
35 1998, 1, 2, 7, 0, 1.08245849609375, 0, 0, 0, 951, 10.106317138671898, 109, 2
```

# SAM CSV format has several benefits over older formats

- Use spreadsheet software and text editors to modify or create
- Generate from script
  - Custom data
  - Convert from other formats
- Flexible format
  - Columns can be in any order
  - SAM ignores columns it does not need
- Format is used by NREL NSRDB

SAM also reads weather files in EPW and legacy NREL “TMY2” and “TMY3” file formats.

# Typical year and single year data

- Typical meteorological year (TMY) data
  - One year of data represents a multi-year historical period
  - Look at data over several years, choose month that best represents that month's solar resource over the period.
  - Each month in a TMY file is for a different year
- Single-year data
  - One year of data for a particular year

# See the “Weather Data” chapter in SAM’s Help system for more

The screenshot shows the SAM Help system interface. The title bar reads "System Advisor Model (Open Source) Help". The navigation menu includes: Back, Home, Web site, Forum, Email support, Release notes, Scripting reference, About, and Close. The left sidebar lists various help topics, with "Weather Data" selected. The main content area is titled "SAM CSV Format Description".

## SAM CSV Format Description

The SAM CSV format is a comma-separated text format for SAM's solar performance models. It uses a standard CSV format that you can edit in any spreadsheet program, text editor, or other appropriate software.

The SAM CSV format supports hourly and sub-hourly data with up to a one-minute resolution. SAM recognizes the weather file's time resolution based on the number of data rows in the weather file. For example, SAM recognizes a file with 8,670 data rows as an hourly data file, and a file with 35,040 rows as 15-minute data. A minute column is optional for hourly data, and required for sub-hourly data. By default, for hourly data SAM calculates sun position angles at the mid-point of the hour. However, if you specify the optional minute column for the hourly data, SAM calculates the sun position at the minute indicated in that column. For sub-hourly data, sun angles are calculated for the minute indicated in the Minute column. See [Time Convention and Sun Position](#) for additional details.

SAM requires a valid value for all time steps for each data element. It does not fill data gaps. It does perform some checks on the weather data before running a simulation, and displays messages about problems with the data in the simulation [notices](#). You can also run the **Solar Resource File Checker** [macro](#) to perform the checks without running a simulation.

### Header

The header rows provide location information and metadata, and identify the data columns.

#### Row 1

Row 1 contains labels for the location data and metadata, and must include at least the following, which may be in any order and with any capitalization:

- *Latitude*
- *Longitude*
- *Time zone*
- *Elevation*

The optional **Units flag** indicates that your weather file includes an extra header row for measurement units. By default, the SAM CSV format does not include a row for measurement units in the header. To include a units row in the header, add *hasunits* to Row 1, and set its value in Row 2 to *yes*. Then add a row after the data column heading row (described as Row 3 below) with units for each column. If *hasunits* is *no*, or is omitted from Row 1, SAM assumes that the header does not include a row for units. SAM ignores the information in the units row, but it can be useful to help you keep track of units.

For example, a valid Row 1 might look like this:

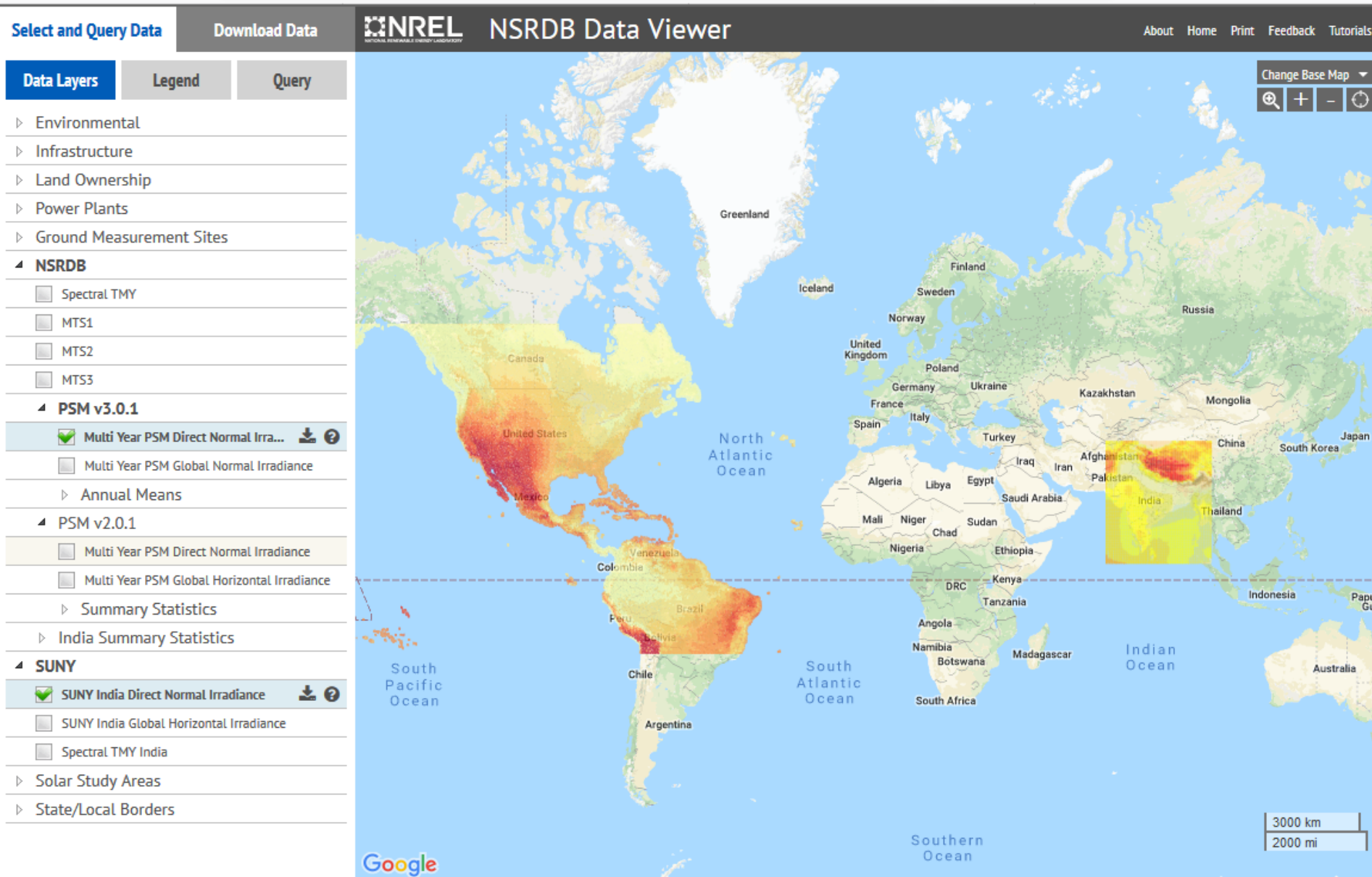
```
Source,Location ID,City,State,Region,Country,Latitude,Longitude,Time Zone,Elevation
```

See the table below for a complete list of Row 1 header fields, accepted labels, and units.

# NREL National Solar Radiation Database (NSRDB)

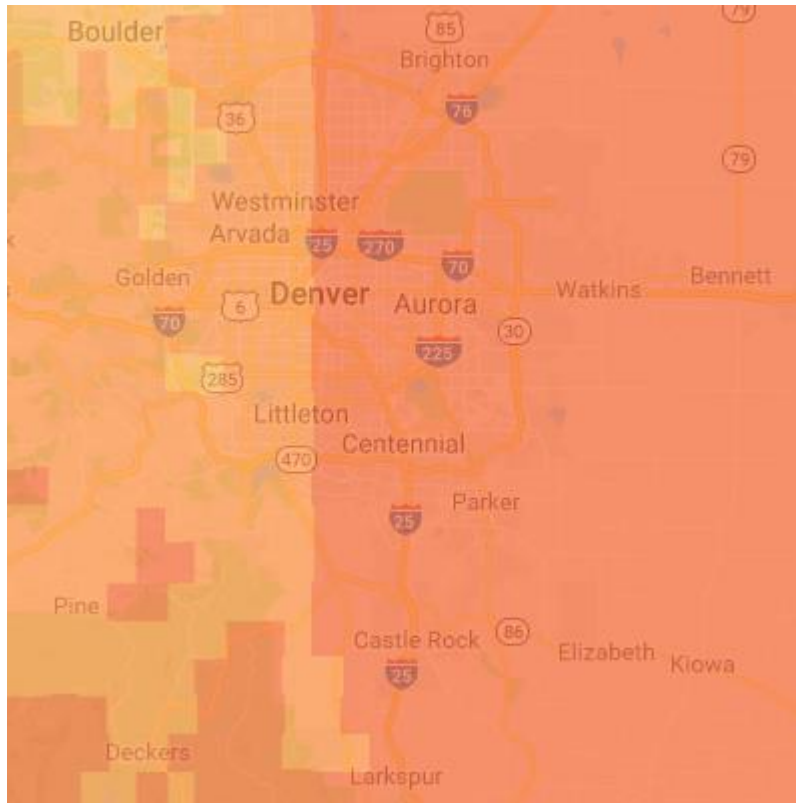


# NREL National Solar Radiation Database data is available for many countries in the Western Hemisphere and South Asia

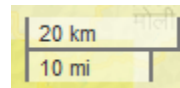
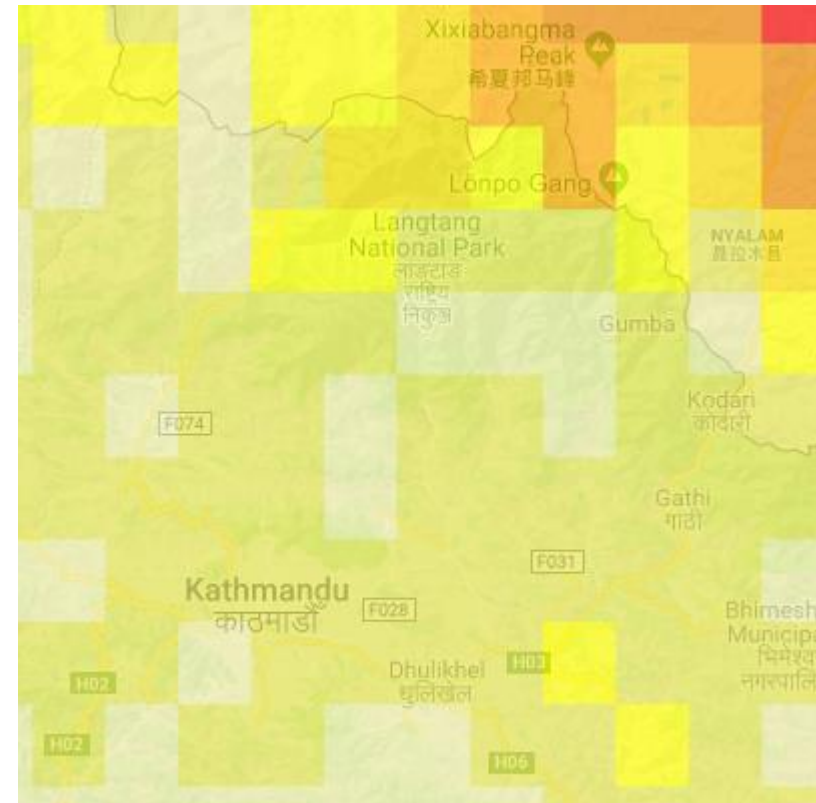


# PSM V3 4 km resolution for Western Hemisphere, SUNY 10 km for Asia

Area around Denver, USA



Area around Kathmandu, Nepal



Both are 400 pixel screenshots of the NSRDB map at the same 20 km scale to show the relative geographic resolution of the data.



# You can download weather files in the SAM CSV format from the NSRDB Data Viewer <https://nsrdb.nrel.gov/nsrdb-viewer>

The screenshot displays the NSRDB Data Viewer interface. On the left, there are two download options: 'NSRDB Data Download (Point)' and 'NSRDB Data Download (Box)'. The main area shows a map of the Southwest United States with a red overlay indicating the selected region. Overlaid on the map is the 'Data Download Wizard' dialog box. The wizard has tabs for 'Spectral TMY', 'Spectral TMY India', 'PSM v2', 'PSM v3', 'SUNY', 'MTS2', and 'Spectral On-demand'. The 'SUNY' tab is selected. Under 'Select Years', the years 2000-2014 are listed with checkboxes, and 'TMY' is checked. Under 'Select Attributes', several attributes are checked, including DHI, DNI, Dew Point, Temperature, and Pressure. Under 'Select Download Options', 'Convert UTC to Local Time' is checked. At the bottom, there is a 'Download Limit Indicator' bar and buttons for 'Edit User Info' and 'Download Data'.

**Select and Query Data** | **Download Data**

**NSRDB Data Download (Point)**   
Download resource data from the National Solar Radiation Database by point. This tool will return data for the station closest to the point drawn.

**NSRDB Data Download (Box)**   
Download resource data from the National Solar Radiation Database by box. This tool will return data for all stations falling within the drawn region.

**NSRDB Data Viewer**

**Data Download Wizard**

Spectral TMY | Spectral TMY India | PSM v2 | PSM v3 | **SUNY** | MTS2 | Spectral On-demand

**International Data**

The National Solar Radiation Database (NSRDB) is a serially complete collection of hourly and half-hourly values of meteorological data and the three most common measurements of solar radiation: global horizontal, direct normal, and diffuse horizontal irradiance. These data have been collected at a sufficient number of locations and temporal and spatial scales to accurately represent regional solar radiation climates.

Supported by the U.S. Department of Energy's SunShot Initiative, the NSRDB is a widely used and relied-upon resource. The database is managed and

[Documentation](#)

Dr. Manojit Sengupta  
National Renewable Energy Lab  
Contact

**Select Years** [Select All](#) [Clear All](#)

2000  2001  2002  2003  2004  2005  
 2006  2007  2008  2009  2010  2011  
 2012  2013  2014  TMY

**Select Attributes** [Select All](#) [Clear All](#)

The minimum required attributes for the SAM PV and CSP models have been selected by default.

DHI  DNI  GHI  
 Clearsky DHI  Clearsky DNI  Clearsky GHI  
 Dew Point  Temperature  Pressure  
 Relative Humidity  Solar Zenith Angle  Precipitable Water

**Select Download Options** [Select All](#) [Clear All](#)

Include Leap Day  Convert UTC to Local Time

Download Limit Indicator

[Edit User Info](#) [Download Data](#)

# Or, better yet, download it directly from SAM!

## Download Weather Files

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

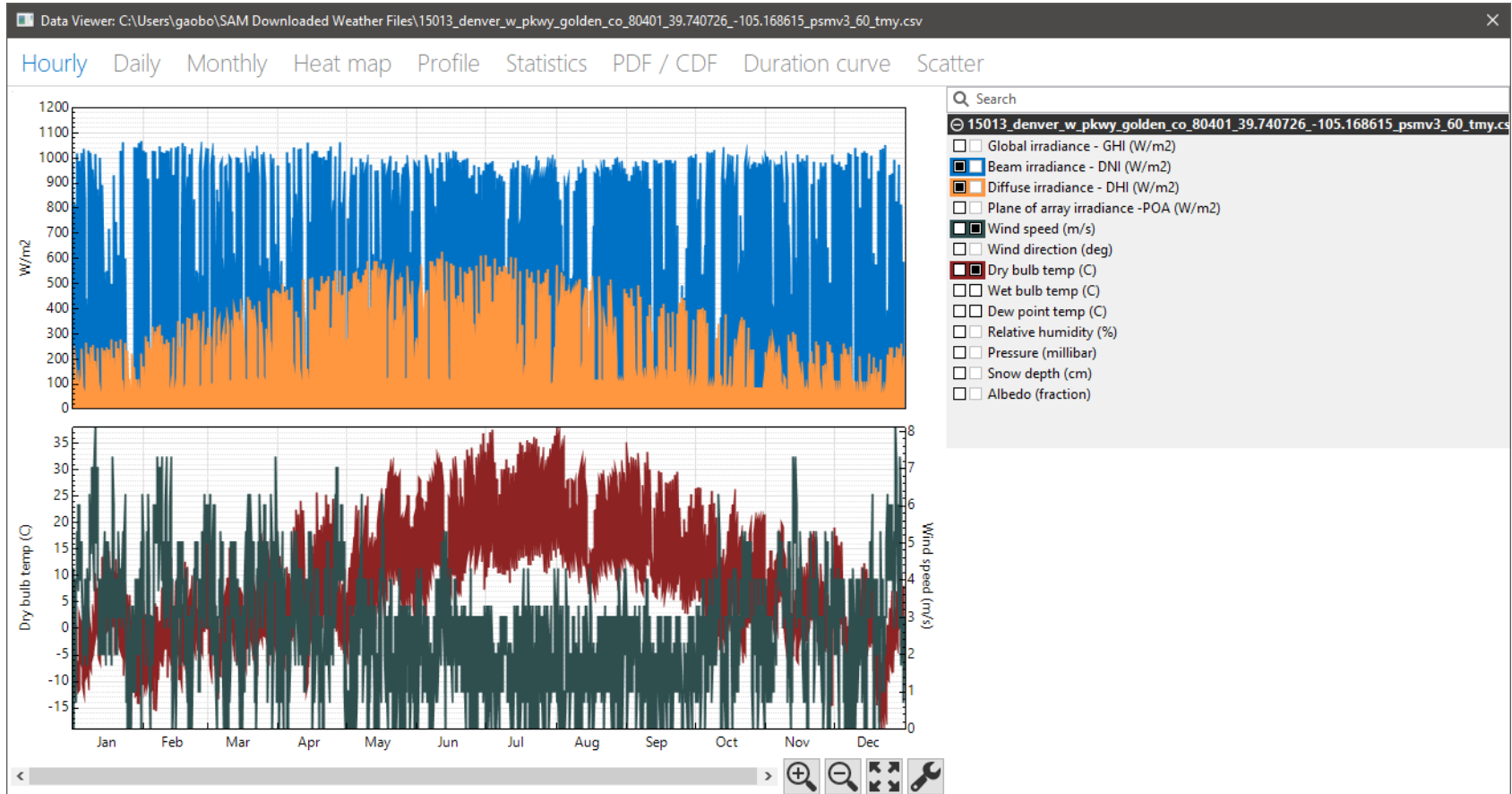
One location  Multiple locations

15013 Denver W Pkwy, Golden, CO 80401

Default TMY file

Download and add to library...

[Go to SAM website Weather Page for information about NSRDB and PVGIS, and for links to other sources of solar resource data](#)



# Overview of New Features

# SAM's new download features allow you to

- Get the latest NSRDB PSM V3 (and SUNY South Asia) data
- Download typical meteorological year (TMY) or single-year files
- Download multiple files for P50/P90 analysis
- Get legacy NSRDB data: MTS1 (1961-1990 TMY2), MTS2/3 (1991-2005/1991-2010 TMY3)

## For the future, we are considering

- Download PVGIS data for locations outside of the NSRDB areas
- Automatically run P50/P90 simulations
- Use 30-minute data by default
- Let us know of other features you would like...

# Before a demonstration, some vocabulary

- Weather file
- Weather file folder
- Solar resource library
- Default weather file collection

# A weather file is a text file that contains weather data for one year

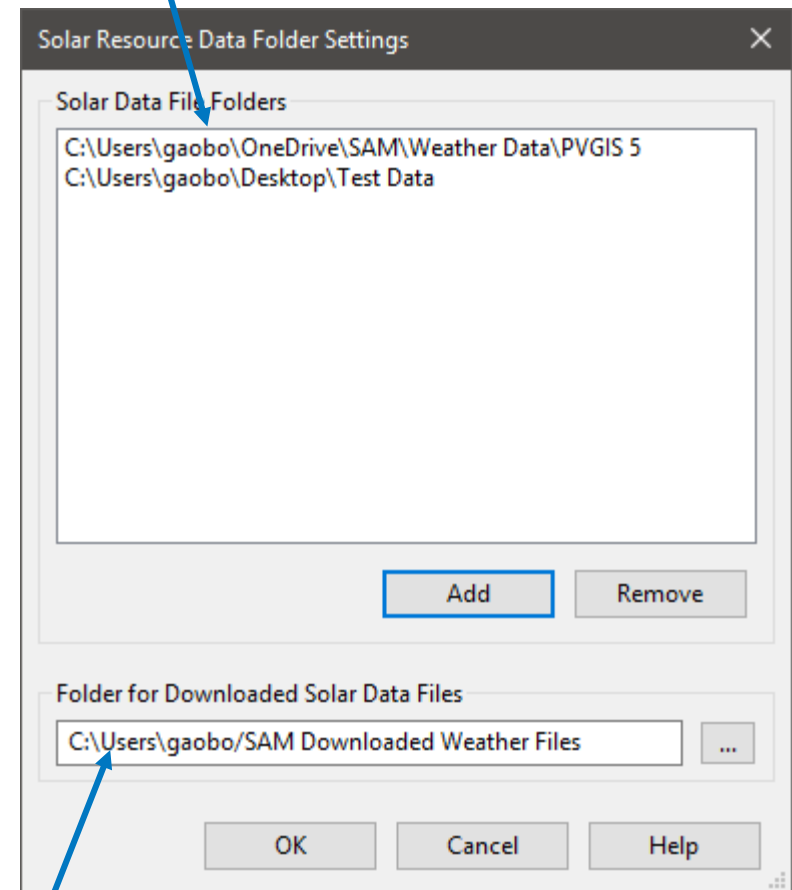
- Can be in SAM CSV, EPW, TMY2 or TMY3
  - SAM CSV is the easiest to work with
- Hourly or subhourly data
- Single-year or typical-year data
- May contain different data, depending on the model
  - Atmospheric pressure required for CSP, but not for PV

```
phoenix_az_33.448377_-112.074037_psmv3_60_tmy.csv
1 Source,Location ID,City,State,Country,Latitude,Longitude,Time Zone,Elevatic
2 NSRDB,310820,-,-,33.45,-112.06,-7,321,-7,c,w/m2,w/m2,w/m2,c,mpax,Degrees,
3 Year,Month,Day,Hour,Minute,Dew Point,DHI,DNI,GHI,Pressure,Temperature,Wind
4 1998,1,1,0,0,1.5150146484375,0,0,0,956,10.545068359375023,84,4
5 1998,1,1,1,0,0.627410888671875,0,0,0,956,9.642938232421898,83,4
6 1998,1,1,2,0,-0.191650390625,0,0,0,956,8.810174560546898,83,4
7 1998,1,1,3,0,-0.7799072265625,0,0,0,955,8.211938476562523,83,4
8 1998,1,1,4,0,-1.0946044921875,0,0,0,955,7.891900634765648,82,4
9 1998,1,1,5,0,-1.20257568359375,0,0,0,955,7.782037353515648,81,4
10 1998,1,1,6,0,-1.265655517578125,0,0,0,955,7.717767333984398,80,4
11 1998,1,1,7,0,-1.18536376953125,0,0,0,955,7.799371337890648,80,4
12 1998,1,1,8,0,0.889801025390625,24,338,49,956,9.909692382812523,82,3
13 1998,1,1,9,0,4.219818115234375,53,683,222,956,13.292260742187523,85,3
14 1998,1,1,10,0,8.23760986328125,67,818,387,956,17.370355224609398,97,2
15 1998,1,1,11,0,11.3858642578125,75,881,509,955,20.565301513671898,115,2
16 1998,1,1,12,0,13.73919677734375,79,907,574,954,22.953912353515648,136,2
17 1998,1,1,13,0,14.839935302734375,79,907,576,953,24.071435546875023,155,1
18 1998,1,1,14,0,14.762115478515625,75,882,514,952,23.992486572265648,172,1
19 1998,1,1,15,0,13.650054931640625,68,823,396,952,22.863549804687523,184,1
20 1998,1,1,16,0,11.0322265625,54,696,234,953,20.206658935546898,193,0
21 1998,1,1,17,0,7.9166259765625,27,376,59,953,17.045007324218773,182,0
22 1998,1,1,18,0,6.90533447265625,0,0,0,953,16.018731689453148,127,0
23 1998,1,1,19,0,6.11773681640625,0,0,0,953,15.219354248046898,107,1
24 1998,1,1,20,0,5.483306884765625,0,0,0,953,14.575433349609398,105,1
25 1998,1,1,21,0,4.91253662109375,0,0,0,953,13.996118164062523,108,2
26 1998,1,1,22,0,4.382568359375,0,0,0,952,13.458184814453148,113,2
27 1998,1,1,23,0,3.82037353515625,0,0,0,951,12.887475585937523,119,2
28 1998,1,2,0,0,3.293487548828125,0,0,0,951,12.352502441406273,126,2
29 1998,1,2,1,0,2.777587890625,0,0,0,951,11.828515625000023,131,2
30 1998,1,2,2,0,2.32659912109375,0,0,0,951,11.370416259765648,134,1
31 1998,1,2,3,0,1.9180908203125,0,0,0,951,10.955468750000023,132,1
32 1998,1,2,4,0,1.55499267578125,0,0,0,951,10.586602783203148,123,1
33 1998,1,2,5,0,1.24969482421875,0,0,0,951,10.276330566406273,114,1
34 1998,1,2,6,0,1.04010009765625,0,0,0,951,10.063287353515648,109,1
35 1998,1,2,7,0,1.082458449609375,0,0,0,951,10.106317138671898,109,2
```

# A weather file folder is a folder on your computer that contains weather files

- Add and remove weather file folders from SAM's Location and Resource page
- SAM automatically adds any files with the .csv, .tm2, or .epw format to the library
- When you install SAM, it creates a folder to store downloaded files

These folders contain weather files. Add as many as you need.



SAM creates this folder when you install it. You can change it to something else.



## The solar resource library is a list all of your weather files

- SAM builds the solar resource library from the files in your weather file folders
- Different versions of SAM use the same weather file folders, so when you install a new or different version of SAM, it will access the same weather files
- SAM checks weather files for errors before adding them to the library
- You can see header and summary data and view graphs of data for files that are in the library

The solar resource library is stored as a text file in your computer's user application folder (AppData/Local in Windows).

# Choose a file from the solar resource library for the simulation

Choose a file from the library.

**Solar Resource Library**  
The Solar Resource library is a list of weather files on your computer. Choose a file from the library, or use the tools below to add files to the library.

Search for:  Name

Name	Latitude	Longitude	Time zone	Elevation	Station ID	
imperial_ca_32.847553_-115.569439_psmv3_60_tmy	32.85	-115.58	-8	-20	238822	^
phoenix_az_33.448377_-112.074037_psmv3_60_tmy	33.45	-112.06	-7	321	310820	
tucson_az_32.222607_-110.974711_psmv3_60_tmy	32.21	-110.98	-7	730	334602	v

SAM scans the following folders on your computer for valid weather files and adds them to your Solar Resource library. To use weather files stored on your computer, add folders containing the files.

C:\Users\gaobo\SAM Downloaded Weather Files  
C:\Users\gaobo\Desktop\Test Data

Add/remove weather file folders...  
Refresh library

List of weather file folders SAM uses to build the library.

# The weather data summary shows information about the file you selected from the library

## Solar Resource Library

The Solar Resource library is a list of weather files on your computer. Choose a file from the library, or use the tools below to add files to the library.

Search for:  Name

Name	Latitude	Longitude	Time zone	Elevation	Station ID	
imperial_ca_32.847553_-115.569439_psmv3_60_tmy	32.85	-115.58	-8	-20	238822	^
phoenix_az_33.448377_-112.074037_psmv3_60_tmy	33.45	-112.06	-7	321	310820	
tucson_az_32.222607_-110.974711_psmv3_60_tmy	32.21	-110.98	-7	730	334602	v

SAM scans the following folders on your computer for valid weather files and adds them to your Solar Resource library. To use weather files stored on your computer, add folders containing the files.

C:\Users\gaobo\SAM Downloaded Weather Files  
C:\Users\gaobo\Desktop\Test Data

Add/remove weather file folders...

Refresh library

## Weather Data Summary

The following information describes the data in the highlighted weather file from the Solar Resource library above. This is the file SAM will use when you click Simulate.

Weather file: F:\SAMDEV\sam\deploy\solar\_resource\phoenix\_az\_33.448377\_-112.074037\_psmv3\_60\_tmy.csv

View data...

### - Header Data from Weather File

City	-	Station ID	310820	Latitude	33.45 °N
State	-	Data Source	NSRDB	Longitude	-112.06 °E
Country	-	Elevation	321 m	Time zone	GMT -7

### - Annual Averages Calculated from Weather File Data

Global horizontal	5.88 kWh/m <sup>2</sup> /day	Average temperature	22.8 °C
Direct normal (beam)	7.66 kWh/m <sup>2</sup> /day	Average wind speed	1.9 m/s
Diffuse horizontal	1.28 kWh/m <sup>2</sup> /day	Maximum snow depth	NaN cm

# Where is “Choose a Weather File from Your Computer?!!?”

- It's gone
- In LK, you can still use `use_specific_weather_file` and `user_specified_weather_file` to override the library
- We hope that adding your weather files to the solar resource library is a better option

**Solar Resource Library**  
Use the buttons above to download the latest NSRDB files and add them to your solar resource library. Click Folder Settings to add your own weather files to the library. The default library contains legacy weather files. See Help for details.

Weather file:

**-Header Data from Weather File**

City	<input type="text" value="Phoenix Sky Harbor Intl Ap"/>	Time zone	<input type="text" value="GMT -7"/>	Latitude	<input type="text" value="33.45 °N"/>	<input type="button" value="Folder settings..."/>
State	<input type="text" value="AZ"/>	Elevation	<input type="text" value="337 m"/>	Longitude	<input type="text" value="-111.983 °E"/>	<input type="button" value="Refresh library"/>
Country	<input type="text" value="USA"/>	Data Source	<input type="text" value="TMY3"/>	Station ID	<input type="text" value="722780"/>	<input type="button" value="Open default library folder..."/>

**-Annual Averages Calculated from Weather File Data**

Global horizontal	<input type="text" value="5.74"/> kWh/m <sup>2</sup> /day	Average temperature	<input type="text" value="23.8"/> °C	<input type="button" value="View weather file data..."/>
Direct normal (beam)	<input type="text" value="6.91"/> kWh/m <sup>2</sup> /day	Average wind speed	<input type="text" value="2.8"/> m/s	
Diffuse horizontal	<input type="text" value="1.55"/> kWh/m <sup>2</sup> /day			

**-Files in Library**

Search for:  Name

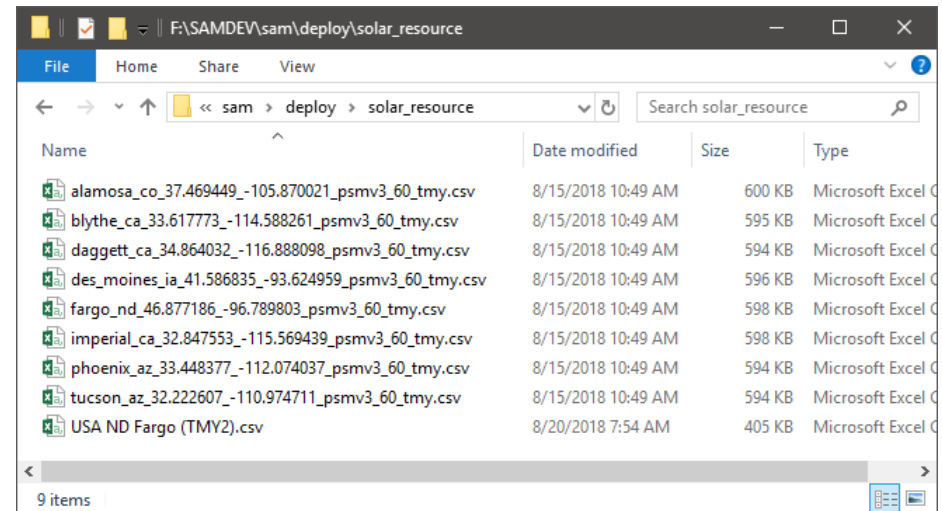
Name	Station ID	Latitude	Longitude	Time zone	Elevation
USA AZ Luke Afb (TMY3)	722785	33.55	-112.367	-7	331
USA AZ Page Muni (amos) (TMY3)	723710	36.933	-111.45	-7	1304
USA AZ Phoenix (TMY2)	23183	33.4333	-112.017	-7	339
USA AZ Phoenix Sky Harbor Intl Ap (TMY3)	722780	33.45	-111.983	-7	337
USA AZ Phoenix Sky Harbor Intl Ap (TMY2)	722780	33.45	-111.983	-7	337

~~**Choose a Weather File from Your Computer**~~

~~Check the box and click Browse to choose a weather file stored on your computer without adding it to the solar resource library. Supported solar weather file formats are SAM CSV, TMY2, TMY3, and EPW.~~

# What about the solar\_resource folder that comes with SAM?

- We now use it to store a few weather files for default configurations
- SAM does add weather files from that folder to the library, but
  - if you store your files in that folder, you might lose them if you uninstall SAM, and
  - files in that folder are not available to different versions of SAM.



# Demonstration

# Download a TMY weather file and add it to your library

## 1. Type a street address

## 2. Click the Download button

**Download Weather Files**

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

One location     Multiple locations

"Type a street address or latitude, longitude (skip for advanced)"    Default TMY file    **Download and add to library...**

[Go to SAM website Weather Page for information about NSRDB and PVGIS, and for links to other sources of solar resource data](#)

### Examples of valid addresses:

golden, co

15013 Denver West Parkway, Golden, CO 80401

39.7, -105.1

Kathmandu, Nepal

Taj Mahal Dharmapuri, Forest Colony, Tajganj, Agra, Uttar Pradesh 282001, India

### What happens:

- SAM converts the address to a latitude/longitude pair using Google API
- SAM queries the NSRDB to see if there is a file for the latitude and longitude
- If there is, SAM downloads the PSM V3 TMY file for that location and puts it in your weather file download folder so that it is added to your solar resource library
- SAM makes an entry in your file download log file so you have a record of the download

# Download a file for a particular year

## 1. Type a street address

## 2. Select **Choose year**

## 3. Click **Download**

**Download Weather Files**

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

One location     Multiple locations

15013 Denver West Parkway, Golden, CO 80401    Choose year    Download and add to library...

[Go to SAM website Weather Page for information about NSRDB and PVGIS, and for links to other sources of solar resource data](#)

## What happens:

- SAM queries the NSRDB to what years are available for the location(s)
- SAM displays a list of available years for you to choose

## 3. Choose a year and click **OK**

Available Years for "15013 Den..."

Choose a year

tmy
1998
1999
2000
2001
2002
2003
2004
2005
2006

OK    Cancel



# Download weather files for a list of locations and add them to your library

**Download Weather Files**

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

One location  Multiple locations

List of Locations  Default TMY file

[Go to SAM website Weather Page for information about NSRDB and PVGIS, and for links to other sources of solar resource data](#)

1. Choose **Multiple locations**

2. Click **Edit data**

4. Click **Download**

## What happens:

- SAM downloads a file for each location and adds it to the download folder (this might take a while for a long list of locations!)
- You should check the download log file to see if there were any problems with the download

Edit Data

Number of Values...

	Location List
1	billings, mt
2	clarksville, tn
3	oberlin, oh
4	seattle, wa
5	denver, co
6	washington, dc

3. Type locations in the table, or import them from a file

Type or import a list of addresses or lat,lon pairs

# Download all available files for a particular location for P50/P90 simulations

**Download Weather Files**

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

One location     Multiple locations

15013 Denver West Parkway, Golden, CO 80401

[Go to SAM website Weather Page for information about NSRDB and PVGIS](#)

Download files for all years (P50/P90) ▾

Download and add to library...

Default TMY file  
Choose year  
Download files for all years (P50/P90)  
Legacy and 30-minute (advanced)

[source data](#)

1. Choose **One location** or **Multiple locations**

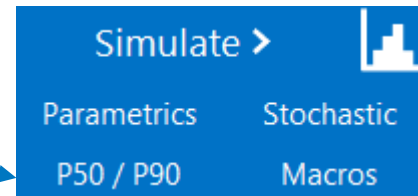
2. Choose **Download files for all years**

2. Click **Download**

## What happens:

- SAM downloads a single-year file for the each year between 1998-2016, and adds them to a folder named for the location you typed in your weather file download folder
- SAM also downloads the TMY file so you can compare it to P50 results of the P50/90 simulation

To run P50/P90 simulations, click **P50/P90**, and navigate to the folder SAM created for the files



P50/P90 How-to video: <https://www.youtube.com/watch?v=C-MSm-srLTM&list=PLC9327B15B66D9B8F&index=2>

# Download legacy or 30-minute weather files

## Download Weather Files

Download the latest weather files from the NSRDB to add to your solar resource library: Download a typical-year (TMY) file for most long-term cash flow analyses, or choose files to download for single-year or P50/P90 analyses. See Help for details.

Legacy and 30-minute (advanced) ▾

Download and add to library...

[Go to SAM website Weather Page for information about NSRDB and PVGIS, and for links to other sources of solar resource data](#)

## 1. Choose Legacy and 30-minute

Choose Weather Files to Download from NSRDB

Use this window to choose weather files to download from the NSRDB to a folder on your computer and add it to your solar resource library. Type an address or latitude and longitude, for example, "15031 denver west parkway golden co" or "40.1,-109.3", and click Search to list all files available in the database for that location. When the list appears, choose the file or files you want to download. For the most up-to-date data, choose PSM files.

The email address you used to register SAM will be sent to the NREL NSRDB. If you do not want share your email address with the NSRDB, click Cancel now.

1. Find location:

2. Choose files to download or click OK to download default PSM hourly TMY file:

- 40.1\_-109.3\_mts2-tmy\_station\_60\_tmy3
- 40.1\_-109.3\_mts2\_station\_60\_2005
- 40.1\_-109.3\_mts2\_station\_60\_2004
- 40.1\_-109.3\_mts2\_station\_60\_2003
- 40.1\_-109.3\_mts2\_station\_60\_2002
- 40.1\_-109.3\_mts2\_station\_60\_2001
- 40.1\_-109.3\_mts2\_station\_60\_2000
- 40.1\_-109.3\_mts2\_station\_60\_1999
- 40.1\_-109.3\_mts2\_station\_60\_1998
- 40.1\_-109.3\_mts2\_station\_60\_1997
- 40.1\_-109.3\_mts2\_station\_60\_1996
- 40.1\_-109.3\_mts2\_station\_60\_1995
- 40.1\_-109.3\_mts2\_station\_60\_1994
- 40.1\_-109.3\_mts2\_station\_60\_1993
- 40.1\_-109.3\_mts2\_station\_60\_1992
- 40.1\_-109.3\_mts2\_station\_60\_1991

3. Choose download folder:

4. Choose file for simulation (optional):

2. Follow instructions in the download window: Choose "MTS1" for Legacy TMY2 data, and "MTS2" for Legacy TMY3 data

# Add files from your computer to the library

**Solar Resource Library**  
The Solar Resource library is a list of weather files on your computer. Choose a file from the library, or use the tools below to add files to the library.

Search for:  Name

Name	Latitude	Longitude	Time zone	Elevation	Station ID
imperial_ca_32.847553_-115.569439_psmv3_60_tmy	32.85	-115.58	-8	-20	238822
phoenix_az_33.448377_-112.074037_psmv3_60_tmy	33.45	-112.06	-7	321	310820
tucson_az_32.222607_-110.974711_psmv3_60_tmy	32.21	-110.98	-7	730	334602

SAM scans the following folders on your computer for valid weather files and adds them to your Solar Resource library. To use weather files stored on your computer, add folders containing the files.

F:\SAM Downloaded Weather Files

Solar Resource Data Folder Settings

Solar Data File Folders

C:\Users\gaobo\OneDrive\SAM\Weather Data

Add/remove weather file folders...  
Refresh library

To remove a folder, choose it and click **Remove**

Click **Add** to add a folder

1. Click **Add/remove**

Choose a different download folder

# Download a weather files from PVGIS and add it to the SAM library: [http://re.jrc.ec.europa.eu/pvg\\_tools/en/tools.html#TMY](http://re.jrc.ec.europa.eu/pvg_tools/en/tools.html#TMY)

The screenshot displays the PVGIS web interface. At the top, the European Commission logo and the text "PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM" are visible. Below the header, a navigation menu includes "Home", "Tools", "Download", "Documentation", "About us", and "News". The main content area is divided into two sections. On the left, a map shows the location of Lubumbashi, with a blue pin and a blue arrow pointing to it. A text overlay reads "1. Click a location on the map". On the right, the "Cursor" information is displayed: "Selected: -11.688, 27.504" and "Elevation (m): 1241". Below this, there are options for "Use terrain shadows" (checked for "Calculated horizon" and unchecked for "Upload horizon file") and buttons for "Download CSV" and "Browse...". A green header for "TYPICAL METEOROLOGICAL YEAR" is visible, with a "Select period" dropdown set to "2005 - 2014". A list of data types is shown on the left, with "TMY" selected. A blue arrow points to the "TMY" button, with a text overlay reading "2. Click the EPW button". At the bottom, there are input fields for "Address" (set to "Eg. Ispra, Italy") and "Lat/Lon" (set to "Eg. 45.81", "Eg. 8.611"), along with "View!", "Download CSV", and "Download EPW" buttons.

3. Download the file to a folder on your computer, and add the folder to SAM's list of weather file folders if it isn't already on the list

# Other Weather Data Tools

# Use built-in macros for the following tasks

- Check the data in a weather file
- Convert from TMY2, TMY3, EPW, and SolarAnywhere formats to SAM CSV
- Use interpolation to convert an hourly weather file to subhourly (5, 10, or 15-minutes) to match load data

1. Click **Macros**

2. Choose a macro

3. Read instructions and set parameter values

4. Click **Run**

The screenshot shows the 'Simulate' menu with options: Parametrics, Stochastic, P50 / P90, and Macros. The 'Solar Resource Interpolation' macro is selected in the left sidebar. The macro dialog box is open, showing instructions and options for running the macro. The 'Interval Length' is set to 'Same as Load' and the 'File selected from' is 'Location and Resource page'.

Thank you!

[www.nrel.gov](http://www.nrel.gov)

