

Introduction to the POWER Project

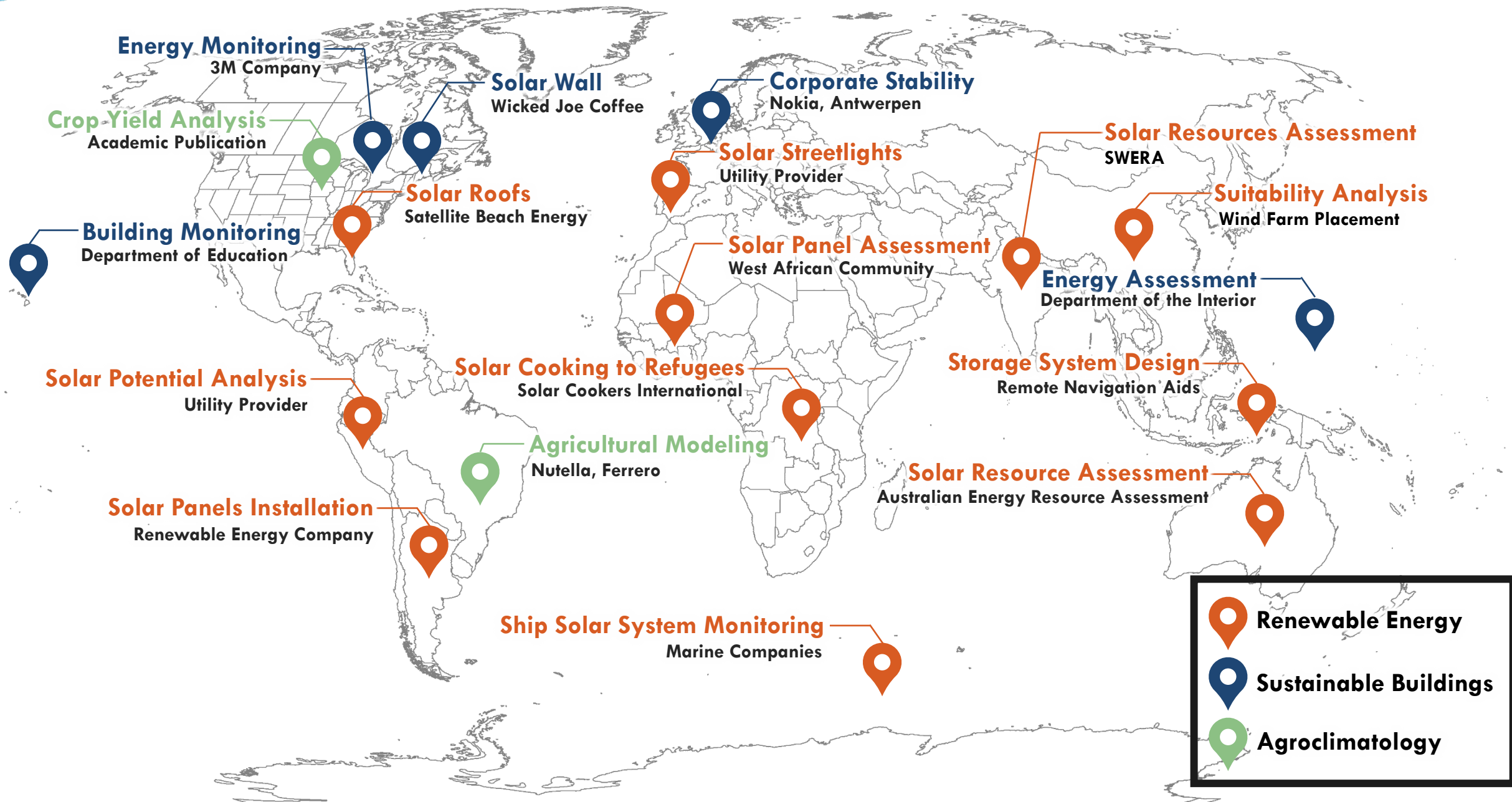
2022 ASA-CSSA-SSSA International Annual Meeting

November 2022





What are POWER's Impacts on the Community?

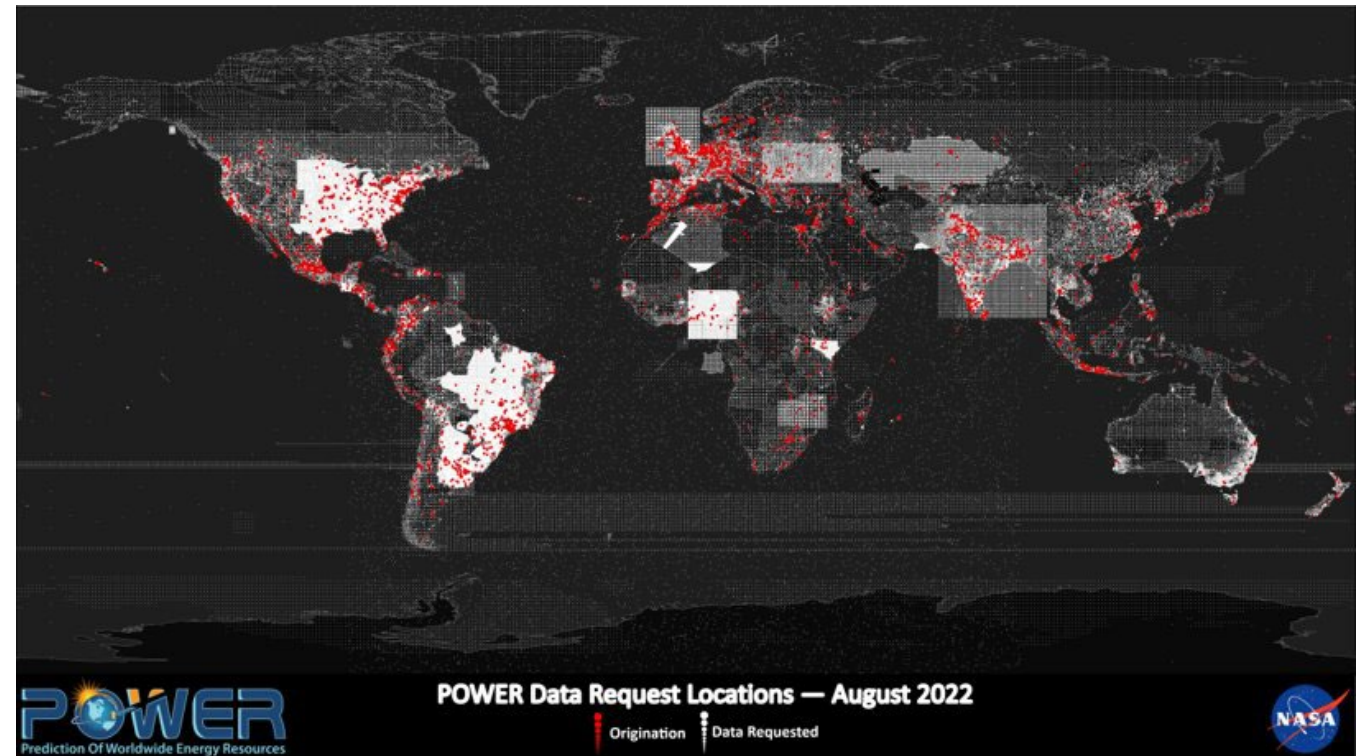


POWER's User Metrics

Access to the POWER Web Services is free and anonymous, but we collect a variety of metrics to assess usage.

- Metrics include: data sources, access methods, user's approximate location, the user's data location, and server performance information, etc.
- POWER fulfills 4+ million data requests for over 17,000 unique users per month
- The POWER metadata object on [NASA's Open Data Portal in the Earth Science category](#) is number two (2) with 54,0017 views!
- On [NASA ArcGIS Online the POWER project](#) has one of the highest viewed content items with over 1,433,000 views!

Before Geospatial Services		After Geospatial Services	
1999/06/01 to 2018/05/01		2018/05/01 to Present	
Requests	35,988,533	Requests	237,937,342
Data Volume	3,612 GB	Data Volume	31.17 TB
<i>*The data volume is available from 6/01/2019.</i>		Unique Users	560,189





POWER's Data Distribution Improvements

2014 to 2018

ASCII/Text Files

```

MHT2M 1981 01 -26.72 -26.58 -28.34 -28.10 -28.83 -29.41 -29.88 -28.82 -27.64 -27.48 -28.55 -27.68 -26.37 -27.82 -26.67
-29.42 -28.52 -1.65 -27.66 -29.84 -27.80 -27.92 -28.82 -31.27 -34.25 -34.68 -33.18 -33.14 -32.16 -32.03
MHT2M 1981 01 -1.48 -35.57 -31.95 -37.67 -37.68 -36.77 -36.35 -35.46 -35.74 -37.38 -37.68 -39.91 -38.18 -38.54 -38.56
MHT2M 1981 01 -1.54 -39.14 -40.67 -39.32 -39.05 -40.79 -41.95 -44.22 -42.70 -45.11 -44.46 -49.08 -49.99 -49.99 -49.99
MHT2M 1981 03 -42.85 -43.93 -42.98 -41.94 -34.12 -37.78 -42.41 -46.37 -46.72 -47.03 -48.78 -45.59 -35.47 -43.88 -45.69
-45.18 -45.99 -49.28 -51.15 -51.43 -52.53 -49.18 -52.45 -52.32 -54.46 -49.93 -46.18 -48.93 -52.92 -51.45
MHT2M 1981 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46 -51.79 -46
MHT2M 1981 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41 -41.15 -41
MHT2M 1981 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44 -49.82 -44
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-37.81 -36.88 -39.83 -40.71 -40.48 -40.13 -38.62 -36.48 -34.87 -33.66 -34.85 -34.38 -34.72 -35.06 -49.99 -38.88
MHT2M 1981 12 -33.44 -34.55 -34.46 -32.23 -38.58 -38.80 -31.23 -38.97 -38.61 -27.23 -26.67 -28.88 -28.09 -28.39 -28.74
-28.84 -28.88 -28.92 -38.75 -29.95 -27.73 -26.42 -27.68 -28.39 -28.86 -27.27 -26.32 -24.19 -24.61 -26.46 -26.39
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-28.47 -28.37 -38.28 -32.25 -33.74 -35.49 -33.89 -31.88 -33.83 -34.23 -33.69 -33.88 -33.16 -32.19 -33.13 -32.15
MHT2M 1982 02 -27.26 -27.29 -31.11 -30.52 -32.32 -34.29 -36.12 -36.55 -39.54 -41.53 -42.82 -42.27 -42.16 -48.71 -38.61
-38.92 -42.78 -41.88 -39.12 -41.54 -41.54 -47.89 -52.52 -52.85 -53.54 -51.24 -47.22 -48.92 -49.26 -50.88 -52.99 -53.45 -55.32
MHT2M 1982 03 -48.84 -45.81 -45.97 -47.89 -52.52 -52.85 -53.54 -51.24 -47.22 -48.92 -49.26 -50.88 -52.99 -53.45 -55.32
-55.14 -47.38 -43.76 -43.42 -45.33 -47.48 -47.62 -39.28 -45.38 -53.66 -41.17 -48.93 -52.88 -54.82 -54.96 -53.23
MHT2M 1982 04 -55.25 -55.43 -51.93 -52.86 -55.97 -57.29 -57.76 -56.54 -57.24 -54.34 -51.18 -46.83 -44.61 -47.98 -52.65
-48.79 -43.15 -41.18 -41.17 -45.26 -58.88 -56.93 -56.18 -55.15 -58.11 -51.79 -53.58 -54.89 -51.45 -53.18 -49.99 -88
MHT2M 1982 05 -58.82 -49.75 -54.28 -58.88 -58.12 -48.39 -45.58 -46.88 -49.14 -51.62 -58.17 -54.41 -58.17 -47.37 -47.37
-48.43 -58.33 -51.84 -58.88 -46.36 -54.65 -54.25 -57.92 -58.97 -68.42 -58.85 -57.95 -56.83 -53.24 -53.72 -57.18
MHT2M 1982 06 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18 -58.18

```

- Web accessible data access
- Fast response time for data requests
- Parameter structure:
 - 64,800 (180 x 360) ASCII Files
 - 259,200 (360 x 720) ASCII Files

2018 to 2021

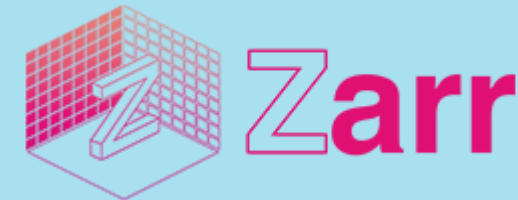
NetCDF



- CF Compliant
- Time Series Chunked
- Limited File Compression
- Multiple Parameters in File
- Common Variables/Dimensions
- Data Update by Data Parameter
- Direct Data Access via OPeNDAP

2021 to Present

Zarr (Cloud Optimized)



~10TB+ Managed Archive

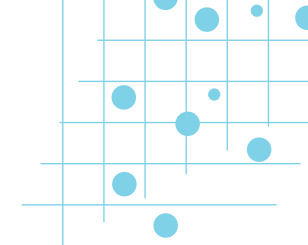
- Time Series Chunked
- Advanced File Compression
- Folder/File Based Parameters
- Common Variables/Dimensions
- Optimized for Cloud Storage and Disks
- Independently Editable Metadata as JSON
- Data Update by All Parameters Concurrently
- Direct Access via Cloud-Based Storage



Open Data
on AWS Data
Exchange



POWER's Analysis Ready Data (ARD) - Access Methods

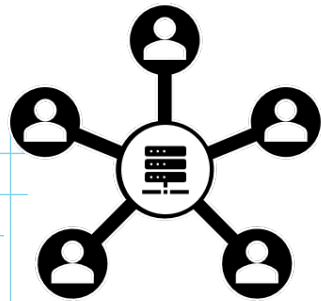


POWER provides an integrated services suite to efficiently access environmental data, pre-computed analysis reports for management of energy production, and monitoring energy efficiently systems, as source data for modeling software.

- POWER enhances data discovery, access, and distribution as Analysis Ready Data (ARD) for direct application of inputs to decision to support tools, modeling and forecasting packages, and as inputs to scientific research is provided via multiple services:
 - [Application Programming Interface \(API\)](#)
 - [AWS Open Data Registry \(S3 Hosted\)](#)
 - [Geospatial Feature & Image Services](#)
 - [OPeNDAP Services](#)



APIs



AWS ODR

Registry of Open Data on AWS

NASA Prediction of Worldwide Energy Resources (POWER)

Description
NASA's goal in Earth science is to observe, understand, and model the Earth system to discover how it is changing, to better predict change, and to understand the consequences for life on Earth. The Applied Sciences Program serves NASA and Society by expanding and accelerating the realization of societal and economic benefits from Earth science, information, and technology research and development.

Resources on AWS

Description
POWER's Analysis Ready Data (ARD) Datasets

Resource type
S3 Bucket

Amazon Resource Name (ARN)
`arn:aws:s3:::power-analysis-ready-datasets`

AWS Region
us-west-2

AWS CLI Access (No AWS account required)
`aws --no-sign-request s3://power-analysis-ready-datasets/`

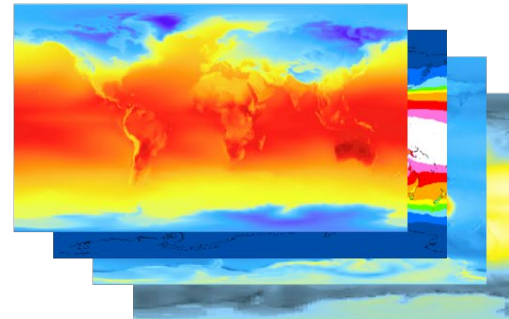
Region
Browse Buckets

Description
POWER's S3 ODR Datasets

Resource type
S3 Bucket

Amazon Resource Name (ARN)

Geospatial Services



OPeNDAP

OPeNDAP

Contents of /POWER/

Name	Last Modified	Size	DAP Response Links	Dataset Viewers
annual/	2021-12-17T18:57:51GMT	-	-	-
monthly/	2021-12-17T18:57:49GMT	-	-	-

OPeNDAP Types (L1 to L2)
Documentation: This site is an ongoing project that supports the effort to advance understanding of Earth and develop technologies to improve the quality of life on our home planet.

Responsible NASA Official: John M. Kuesterer
 • Site Contact: NASA Earth System Data User Services - [Contact Us](#)
 • Last Updated: 02/04/2022



POWER's Application Programming Interfaces (API)

The POWER Application Programming Interfaces (API) delivers Analysis Ready Data (ARD) for inputs to decision to support tools, modeling and forecasting packages, and as inputs to scientific research by providing:

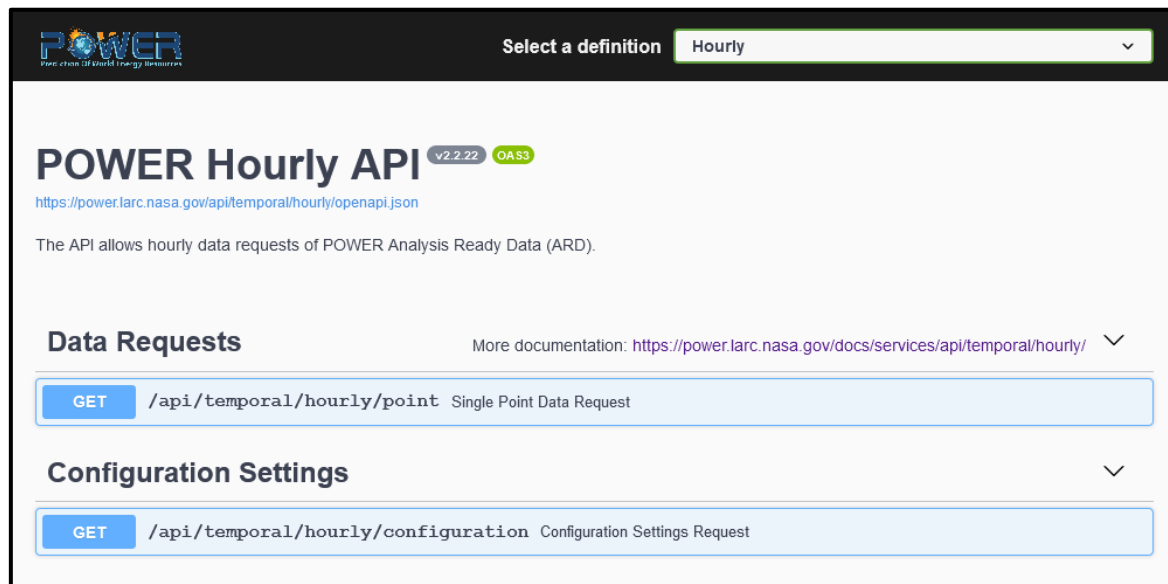
- Complete access to entire database without any other services
- Direct integration into external applications; users can submit a request and a response will be returned without leaving their application!
- User specified subsets converted into user community specific units and provides formats like ASCII, ICASA, CSV, GeoJSON, NetCDF, and more!

Data Requests: ~140,000 a Daily

Follow Open Standards: OpenAPI, GeoJSON, and more

Links:

- <https://power.larc.nasa.gov/api/pages/>
- <https://power.larc.nasa.gov/docs/services/api/>



The screenshot shows the POWER API documentation page for the Hourly API. At the top, there is a logo for POWER and a dropdown menu labeled "Select a definition" with "Hourly" selected. Below the logo, the title "POWER Hourly API" is displayed with version "v2.2.22" and "OAS3" tags. The URL "https://power.larc.nasa.gov/api/temporal/hourly/openapi.json" is provided. A description states: "The API allows hourly data requests of POWER Analysis Ready Data (ARD)." Under the heading "Data Requests", there is a link to "More documentation: https://power.larc.nasa.gov/docs/services/api/temporal/hourly/". Two API endpoints are listed in a table-like format:

Method	Endpoint	Description
GET	/api/temporal/hourly/point	Single Point Data Request
GET	/api/temporal/hourly/configuration	Configuration Settings Request

Example API Request:

https://power.larc.nasa.gov/api/temporal/daily/point?start=20210801&end=20210830&longitude=-4.75&latitude=-4.750&&community=ag¶meters=ALLSKY_SFC_SW_DWN,T2M



POWER Data in the Cloud

POWER is a part of a [NASA Space Act Agreement](#) with EOSDIS Earthdata.

- This Space Act enables direct data store access via cloud-based services.
 - Allowing users to directly access the POWER Analysis Ready Data (ARD) of ~8.5TB
 - The ARD grows at ~.5 TB/Year
 - The data is:
 - Cloud and Analysis Optimized
 - Have Community-Driven Parameters
 - Machine Learning Ready
 - Enable interactive tutorials with large amounts of data
- The POWER data archive is listed in the AWS Open Data Portal (sustainable data initiative).

aws

Contact Us Support English My Account Sign In Create an AWS Account

Products Solutions Pricing Documentation Learn Partner Network AWS Marketplace Customer Enablement Events Explo > Q

Open Data on AWS

Share any volume of data with as many people as you want

Contact us

When data is shared on AWS, anyone can analyze it and build services on top of it using a broad range of compute and data analytics products, including [Amazon EC2](#), [Amazon Athena](#), [AWS Lambda](#), and [Amazon EMR](#). Sharing data in the cloud lets data users spend more time on data analysis rather than data acquisition.

The [Registry of Open Data](#) on AWS makes it easy to find datasets made publicly available through AWS services. [Browse available data](#) and [learn how to register your own dataset](#).

Find publicly available data on AWS

AWS PUBLIC DATASETS: UNLOCKING THE POTENTIAL OF OPEN DATA IN THE CLOUD

AWS Public Datasets: Unlocking the

AWS Partner Story: NASA



“We now have an agile, scalable foundation on which to do all kinds of amazing things. Much like with the exploration of space, we’re just starting to imagine all that we can do with it.”

Bryan Walls

Imagery Experts Deputy Program Manager, NASA



Geospatial Feature & Image Services

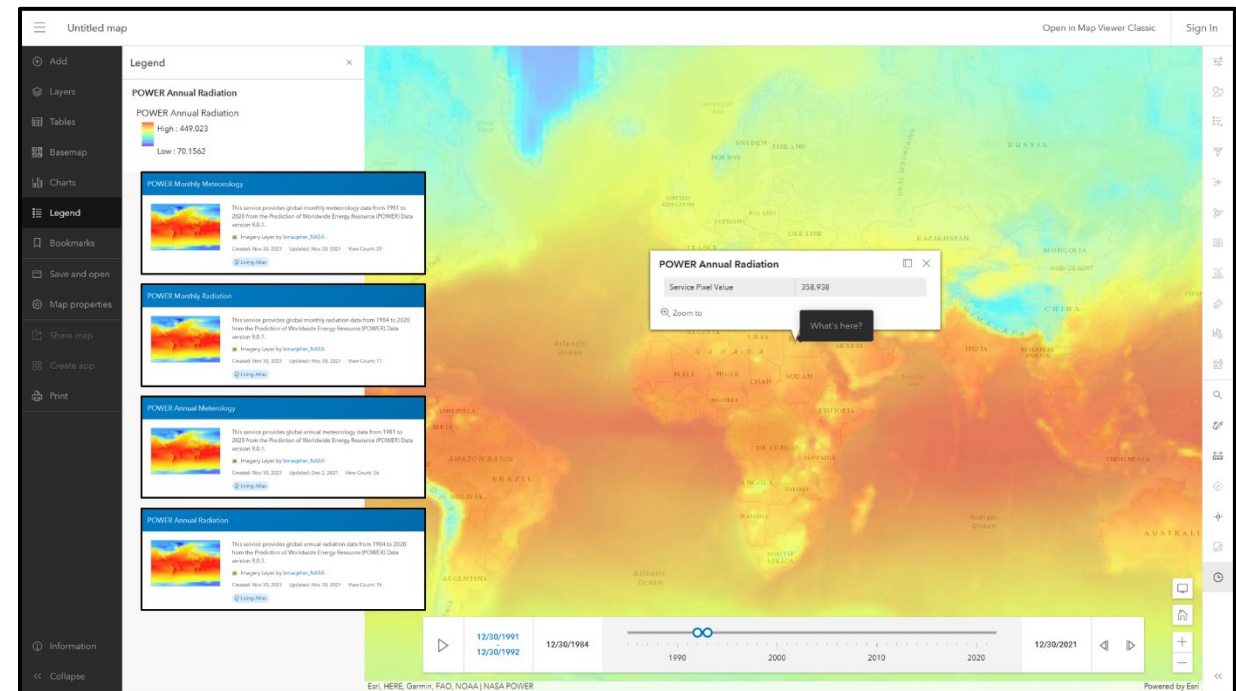
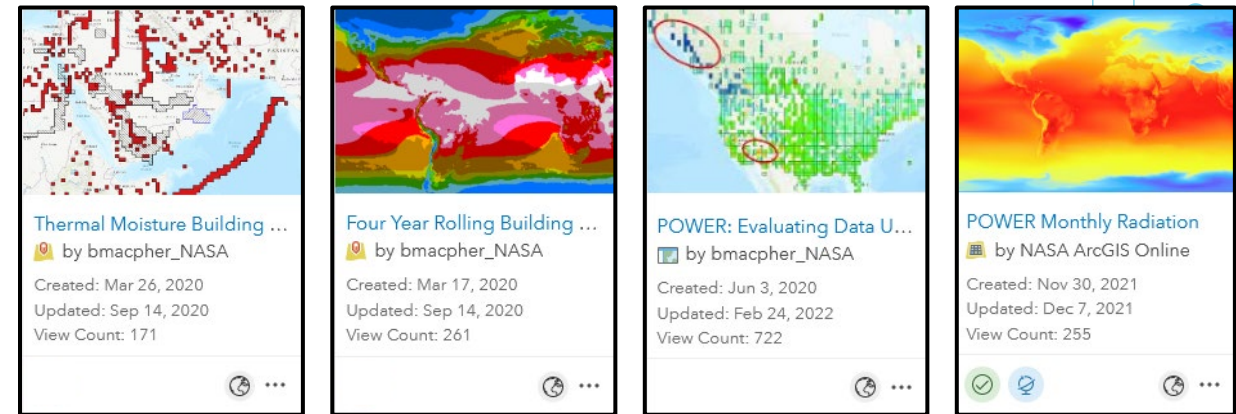
POWER provides Esri® ArcGIS Image and Feature Services that allow users to efficiently interact with the POWER data in Geographic Information System (GIS) applications and related tools.

- **Image Services:** new image services for annual radiation, annual meteorology, monthly radiation, and monthly meteorology.
- **Feature Services:** global long-term ASHRAE® building climate thermal-moisture zones, 4-year rolling thermal zones, and period differences

Available on:

- [Esri Living Atlas of the World](#)
- [NASA ArcGIS Online \(AGOL\)](#)
- [ASDC ArcGIS Enterprise](#)

Hyperlink: [NASA AGOL - POWER](#)

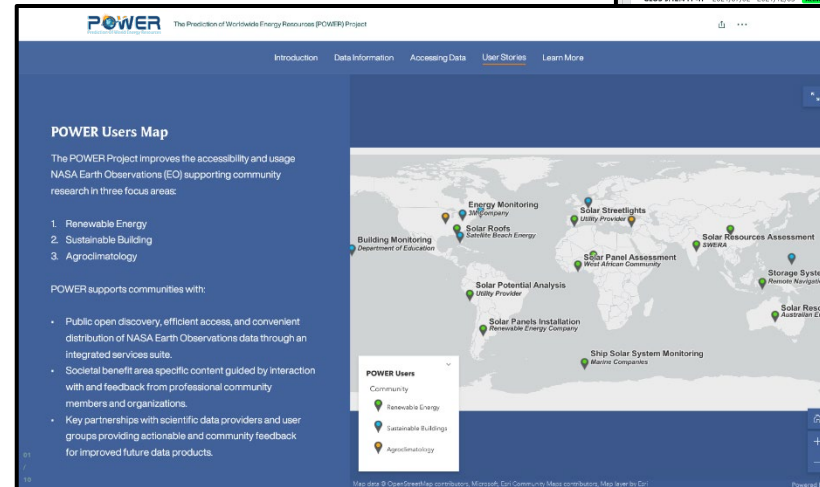
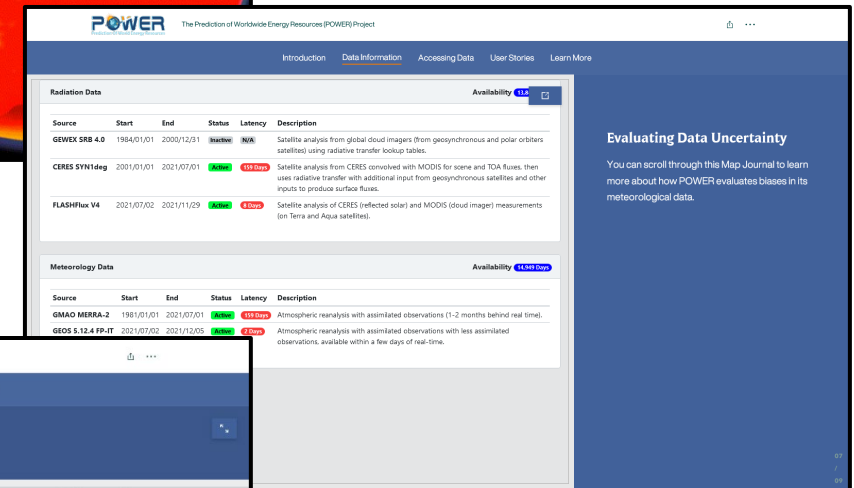
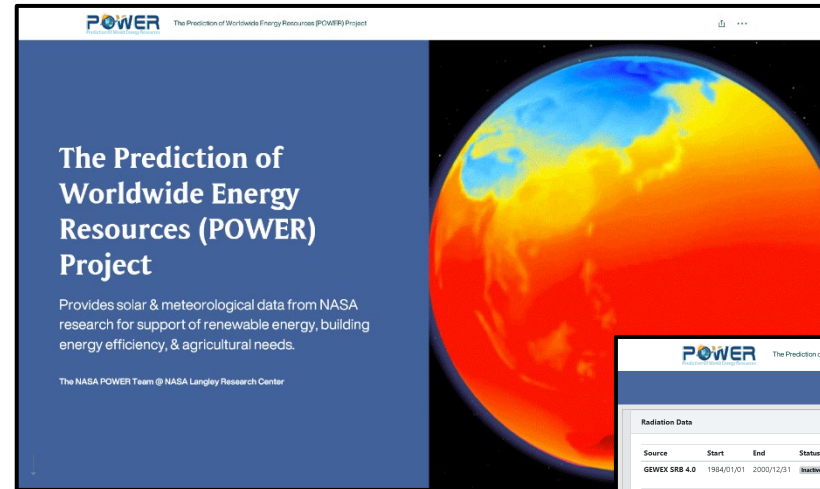




Want to Learn More? Check out POWER's StoryMap.

The POWER Team has developed an Esri® ArcGIS StoryMap.

- Through text, GIFs, videos, and interactive map content, viewers can become more familiar with the project.
- By scrolling through the StoryMap, users learn more about the POWER Project, its data sources, how to access POWER data, POWER's communities and users, and how to discover more POWER-related information.
- Link: <https://arcg.is/0Xe851>





Where is the POWER Documentation?

The POWER Documentation consists of four main sites that are built for both mobile and desktop use:

- **Homepage:** the project overview with links to all POWER resources.
- **Dashboard:** a series of dynamic web pages that provide real-time status information on data processing.
- **API Pages:** the API landing pages that use the OpenAPI specification to create interactive pages for the API endpoints.
- **Methodology Docs:** the projects documentation and methodology providing accurate and detailed information to users.

<https://power.larc.nasa.gov/>

<https://power.larc.nasa.gov/docs/>

The screenshot shows the POWER dashboard interface. It features a sidebar with navigation options like 'Dashboard', 'Availability', 'Hourly & Daily', and 'Monthly & Annual'. The main content area is titled 'Home / Availability / Monthly & Annual'. It contains sections for 'Processing Background', 'Solar Data', and 'Meteorology Data'. The 'Solar Data' section includes a table with columns for Name, Date (Last), Status, and Years. The 'Meteorology Data' section also includes a similar table.

Name	Date (Last)	Status	Years
GEWEX/SRB 3.0	2007/12/31	Inactive	23
FLASHFlux V2	2012/12/31	Inactive	5
FLASHFlux V4	2019/12/31	Active	7

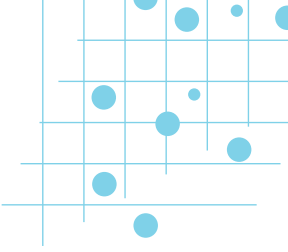
Name	Date (Last)	Status	Years
GMAO MERRA-2	2019/12/31	Active	39

The screenshot shows the NASA Prediction Of Worldwide Energy Resources (POWER) homepage. It features a large globe graphic and the title 'The POWER Project'. Below the title, there is a brief description of the project's purpose: 'Provides solar and meteorological data sets from NASA research for support of renewable energy, building energy efficiency and agricultural needs.' It also mentions that the project is supported by NASA Earth Science's Applied Sciences Program. Under the heading 'POWER's Enhanced Features', there are links to 'Data Methodology', 'Data Services Documentation', and 'Data Access Tutorials'.

The screenshot shows a page from the POWER documentation. It features a search bar at the top right. Below the search bar, there is a large globe graphic. At the bottom right, there is a 'Next Glossary' link with a right-pointing arrow.



Data Access and Analysis Demo Using Jupyter Notebooks

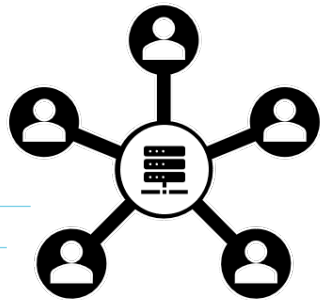


The **POWER** services and data access methods provides efficient access to **POWER** datastore:

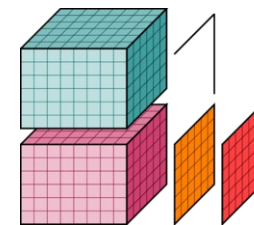
- POWER API data access
- Direct Datastore access from AWS S3 (Zarr access)
- Example use-case of monthly anomalies
 - Pandas, Xarray formats in Python



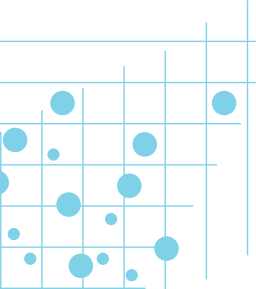
APIs



Zarr

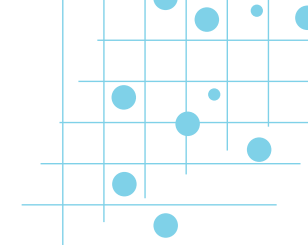


xarray





Demo Notebook: Direct API Access



Retrieve & read data from request

- Build url using string format method, variables
- Execute the request, receive the output
- JSON > Dict > Pandas
- Handle date and null values
- Metadata!

```

Construct the API URL ¶
This fills the base_url based on the inputs provided.

[6]: base_url = r"https://power.larc.nasa.gov/api/temporal/{temporal}/point?Time=LST&parameters={parameters}&community=RE&longitude={longitude}&latitude={latitude}&start={start}0101&end={end}1231&format=JSON"
      query_url = base_url.format(temporal=temporal, parameters=",".join(parameters), start=start, end=end, latitude=latitude, longitude=longitude)
      print ("Here is the API URL:", query_url)

Here is the API URL: https://power.larc.nasa.gov/api/temporal/daily/point?Time=LST&parameters=ALLSKY_SFC_SW_DWN,CLRSKY_SFC_SW_DWN,ALLSKY_SFC_LW_DWN,CLRSKY_SFC_LW_DWN&community=RE&longitude=-0.461389&latitude=51.4775&start=20010101&end=20011231&format=JSON

Request Data
This requests the data from the POWER API URL and convert the JSON response to a Python dictionary object.

[7]: %%time
      main_response = requests.get(url=query_url, verify=True, timeout=30) # Fix this to have timeout.
      json_response = json.loads(main_response.text)

Wall time: 3.02 s

Turning the API response Dictionary and into a Pandas DataFrame.

[8]: df = pd.DataFrame.from_dict(json_response['properties']['parameter'])

      if temporal == 'hourly':
          df.index = pd.to_datetime(df.index, format='%Y%m%d%H')
      elif temporal == 'daily':
          df.index = pd.to_datetime(df.index, format='%Y%m%d')

      df = df.replace(-999.0, 0)
      df.head()

[8]:
      ALLSKY_SFC_SW_DWN  CLRSKY_SFC_SW_DWN  ALLSKY_SFC_LW_DWN  CLRSKY_SFC_LW_DWN
2001-01-01             0.77              1.14             310.71             270.59
2001-01-02             0.46              1.13             328.62             269.72
2001-01-03             0.81              1.18             290.86             256.02
2001-01-04             0.28              1.14             322.09             265.77
2001-01-05             0.42              1.14             312.04             257.60
  
```

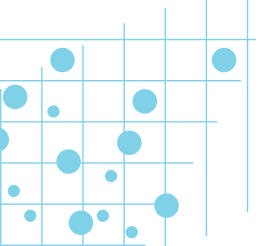
```

[10]: metadata = pd.DataFrame.from_dict(json_response['parameters'])
      metadata

[10]:
      ALLSKY_SFC_SW_DWN  CLRSKY_SFC_SW_DWN  ALLSKY_SFC_LW_DWN  CLRSKY_SFC_LW_DWN
units                  kW-hr/m^2/day      kW-hr/m^2/day      W/m^2                W/m^2
longname All Sky Surface Shortwave Downward Irradiance  Clear Sky Surface Shortwave Downward Irradiance  All Sky Surface Longwave Downward Irradiance  Clear Sky Surface Longwave Downward Irradiance
  
```

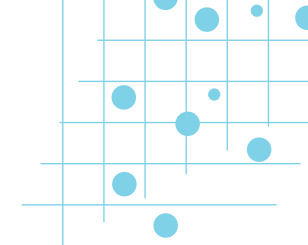


APIs





Demo Notebook: Data Access - Zarr



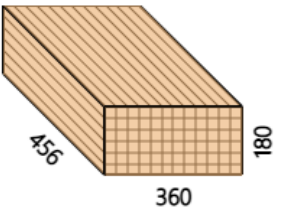
Xarray: Multidimensional Dataset

- Like pandas, xarray is built off numpy
- More powerful than 2-dimensional Pandas DataFrame
- Perfect for reading 3D data from zarr
- Dask chunks data, references it where the Zarr resides
- Xarray dataset from zarr uses less memory than a Pandas DataFrame

```
[3]: %%time
ds.ALLSKY_SRF_ALB
Wall time: 0 ns
```

```
[3]: xarray.DataArray 'ALLSKY_SRF_ALB' (time: 456, lat: 180, lon: 360)
```

	Array	Chunk
Bytes	225.44 MiB	3.13 MiB
Shape	(456, 180, 360)	(456, 30, 30)
Count	73 Tasks	72 Chunks
Type	float64	numpy.ndarray

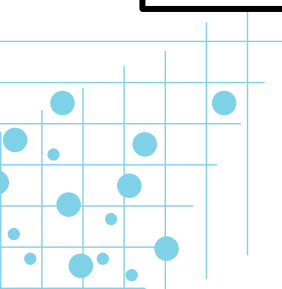
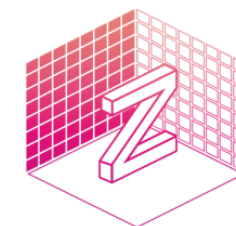
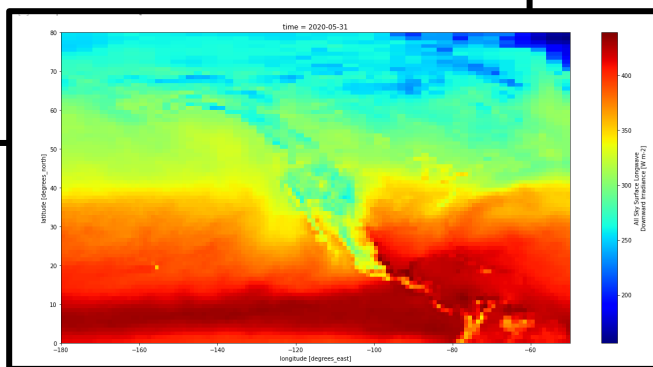


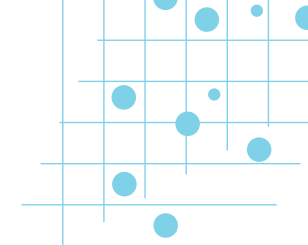
▼ Coordinates:

lat	(lat)	float64	-89.5 -88.5 -87.5 ... 88.5 89.5
lon	(lon)	float64	-179.5 -178.5 ... 178.5 179.5
time	(time)	datetime64[ns]	1984-01-31 ... 2021-12-31

▼ Attributes:

```
long_name : All Sky Surface Albedo
standard_name : All_Sky_Surface_Albedo
units : dimensionless
valid_max : 1.0
valid_min : 0.0
valid_range : [0.0, 1.0]
```





Anomalies: Average difference from the mean.

- Calculate MONTHLY Average from Jan2001 to Dec2019
- Calculate the OVERALL Average temp for the entire time range! (12°C)
- Find the difference for each month in the range

```
[5]: def make_anomalies(series: pd.Series) -> pd.Series:
    """
    This function creates monthly anomalies.

    series: the pandas series to compute the anomalies (required)
    """

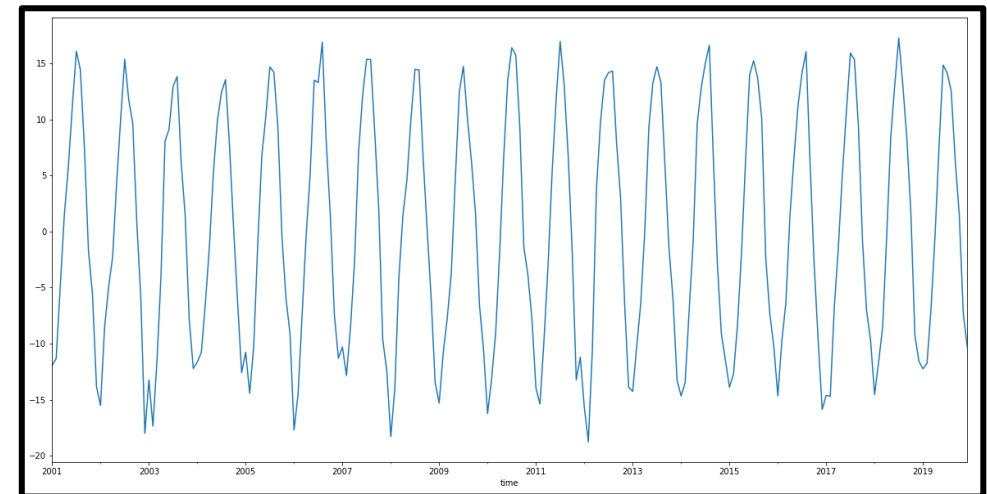
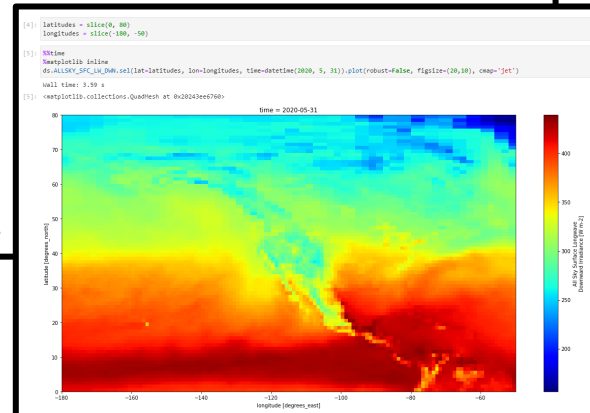
    monthly = series.resample('M').mean() # Avg for each individual month

    monthly_mean = monthly.mean() # 12.024

    return monthly - monthly_mean
```

```
[6]: anomalies = make_anomalies(df[parameter])
    anomalies.head(12)
```

```
[6]: time
2001-01-31 -11.955329
2001-02-28 -11.329753
2001-03-31 -4.982426
2001-04-30  1.349961
2001-05-31  5.692090
2001-06-30 11.127961
2001-07-31 16.060155
2001-08-31 14.422413
2001-09-30  7.503961
2001-10-31 -1.677910
2001-11-30 -5.577039
2001-12-31 -13.844362
Freq: M, Name: T2M, dtype: float64
```



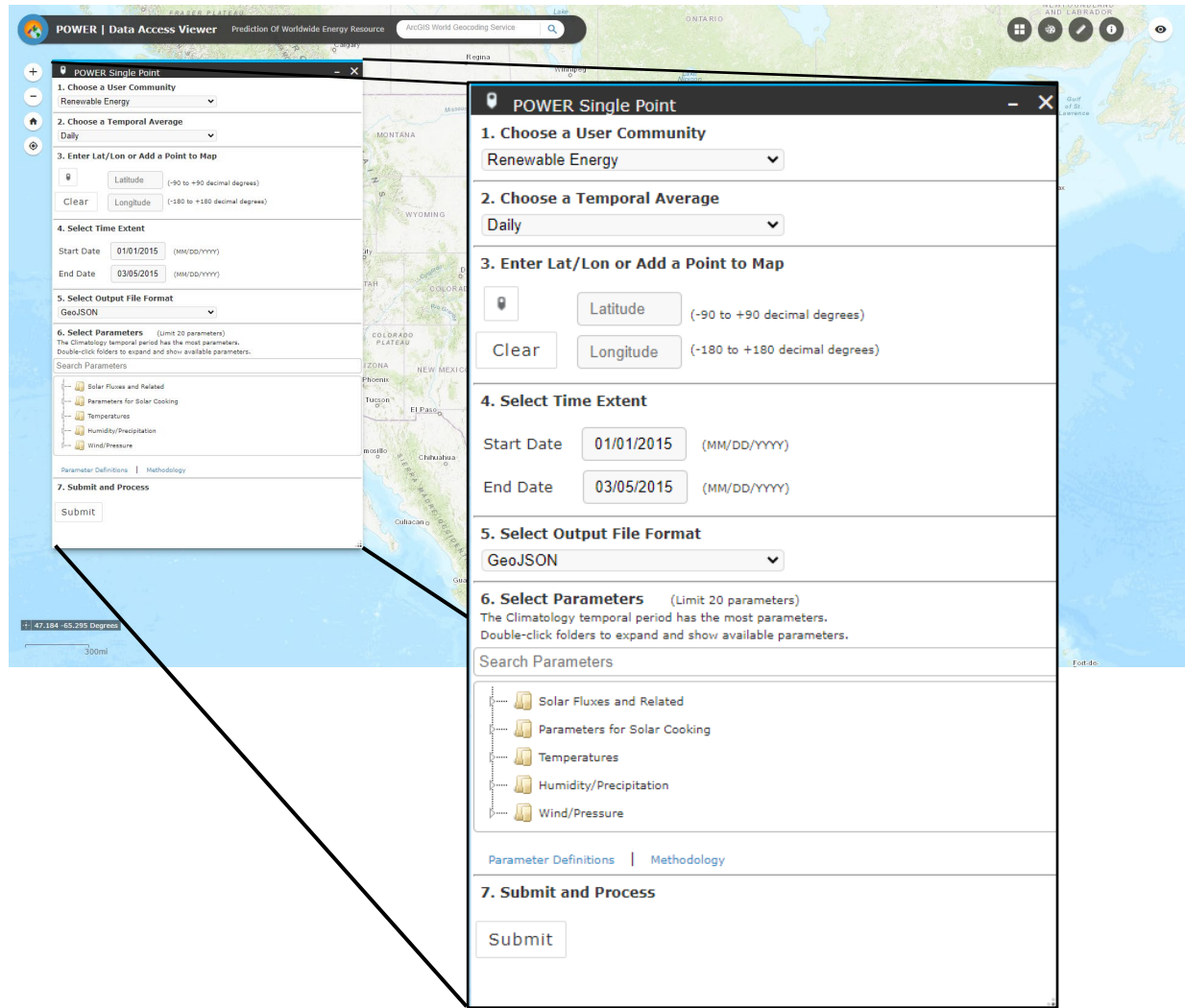


What is the POWER Data Access Viewer (DAV)?

- Provides a front-end web map with a simple user interface via integrated widgets that is responsive and built for mobile and desktop use.
- Allows users to select community specific parameters, units, time periods, and the output formats to efficiently retrieve data from the Application Programming Interface (API).
- Enables users to follow a set of questions and without programming knowledge, to create the API request URL and download the requested data.

<https://power.larc.nasa.gov/data-access-viewer/>

- [DAV Quick Start Guide](#)
- [DAV User Guide](#)



POWER | Data Access Viewer Prediction Of Worldwide Energy Resource ArcGIS World Geocoding Service

POWER Single Point

- 1. Choose a User Community**
Renewable Energy
- 2. Choose a Temporal Average**
Daily
- 3. Enter Lat/Lon or Add a Point to Map**
Latitude (-90 to +90 decimal degrees)
Longitude (-180 to +180 decimal degrees)
Clear
- 4. Select Time Extent**
Start Date: 01/01/2015 (MM/DD/YYYY)
End Date: 03/05/2015 (MM/DD/YYYY)
- 5. Select Output File Format**
GeoJSON
- 6. Select Parameters** (Limit 20 parameters)
The Climatology temporal period has the most parameters. Double-click folders to expand and show available parameters.
Search Parameters:
 - Solar Fluxes and Related
 - Parameters for Solar Cooking
 - Temperatures
 - Humidity/Precipitation
 - Wind/PressureParameter Definitions | Methodology
- 7. Submit and Process**
Submit



POWER's Data Access Viewer (enhanced)

Leveraging [Esri's Calcite Design System](#) to implement new user-driven requirements.

Parameter Selection

User Community
Renewable Energy

Temporal Level
Hourly

Latitude
39.57

Longitude
-113.08

Time Period
12/1/2021 → 12/3/2021

Format
JSON

Parameters
Temperature at 2 Meters ×
All Sky Surface Shortwave Downward Irradiance × Select Parameters

Submit

November 2021

Su	Mo	Tu	We	Th	Fr	Sa
31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%		MCWS	PCWD
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
7	16.6	37.0	∅	35.6	∅	34.3	∅	21.4	∅	20.5	∅	19.6	∅	∅	∅
Dehumidification DP/MCDB and HR						Enthalpy/MCD						Extreme Max WB			
		0.4%		1%		2%		0.4%		1%		2%			
DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB	Extreme Max WB
37.0	12150.0	∅	13.2	11290.0	∅	12.0	10440.0	∅	∅	∅	∅	∅	∅	∅	24.5

Advanced Parameters

Time Standard
Local Solar Time (LST)

Wind Elevation
98,491

Wind Surface
20-m broadleaf and needleleaf trees (75% coverage)

Pressure Correction
5,596,228

Single Point

ALLSKY_SFC_SW_DWN

All Sky Surface Shortwave Downward Irradiance

The total solar irradiance incident (direct plus diffuse) on a horizontal plane at the surface of the earth under all sky conditions. An alternative term for the total solar irradiance is the "Global Horizontal Irradiance" or GHI.

Standard Information

Temporal: Daily Near Real Time

Community: Sustainable Buildings Radiation

Time Standards: LST, UTC

Data Sources: LOOKUP

Units: W/m²

Additional Information

Availability: 1984-01-01 to Near Real Time

Minimum Value: 0 Data Type: Float

Maximum Value: 1500 Significant Digits: 2

POWER | DAVE Dev v0.2.0

Predictor of Worldwide Energy Resource (POWER) | Data Access Viewer Enhanced (DAVE)

Light Mode Dark Mode

Under Active Development

Light Mode Dark Mode

POWER | DAVE Dev v0.2.0

Predictor of Worldwide Energy Resource (POWER) | Data Access Viewer Enhanced (DAVE)

Light Mode Dark Mode

Latitude: 39.57 Longitude: -113.08

