

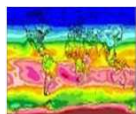
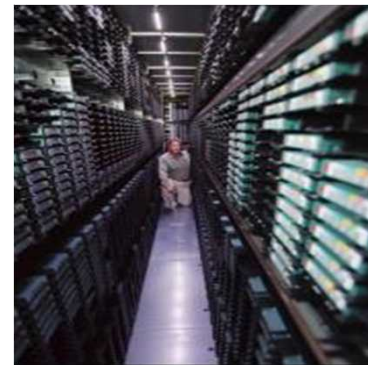
Analyzing Multidimensional Scientific Data in ArcGIS

NASA Atmospheric Science Data Center (ASDC)

Matthew Tisdale, NASA Langley Research Center (LaRC), matthew.s.tisdale@nasa.gov

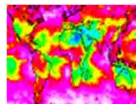
The NASA Atmospheric Science Data Center (ASDC) at a Glance

- Curates more than **300 unique science products** and provides data services for over **44 science projects**
- **4.65 Petabytes of data, over 58 million files**, are in the archive as of October 2017
- Data distributed to over **165,000** customers in **158** countries



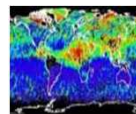
Radiation Budget - The radiation budget takes into account the sum of all radiation, transferred in all directions, through the Earth's atmosphere and to and from space.

Instruments: CERES



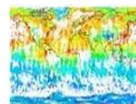
Clouds - A visible aggregate of minute water droplets and/or ice crystals in the atmosphere above the Earth's surface.

Instruments: CALIPSO, MISR



Aerosols - Suspension of particles of condensed matter (liquid, solid, or mixed) in a carrier gas (usually air).

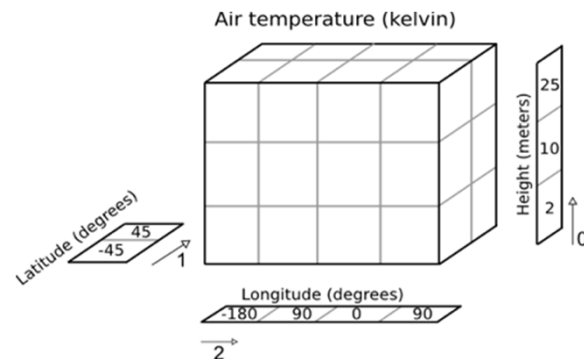
Instruments: CALIPSO, MISR, SAGE III



Tropospheric Composition - Measurements of chemical constituents in the atmosphere including the major (non-H₂O) greenhouse gases (CO₂, CH₄, O₃, N₂O).

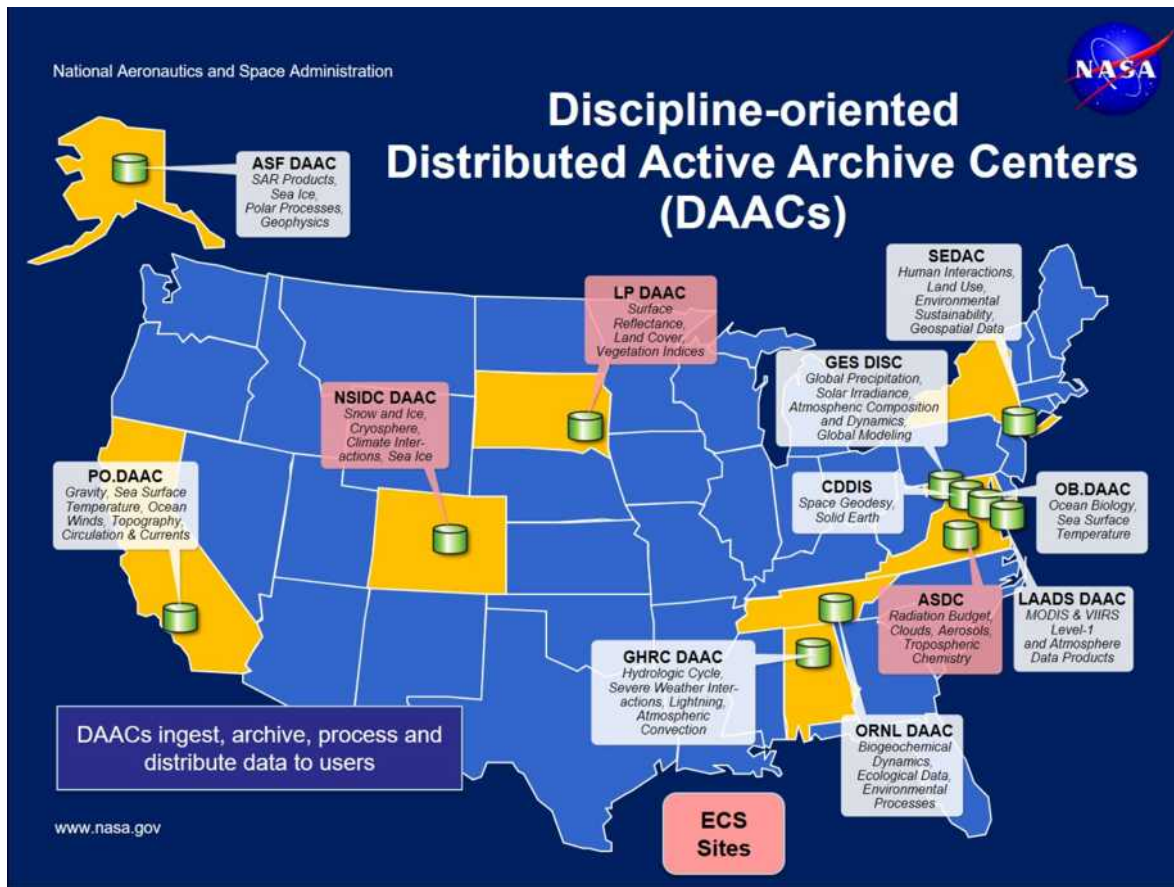
Instruments: MOPITT, TES

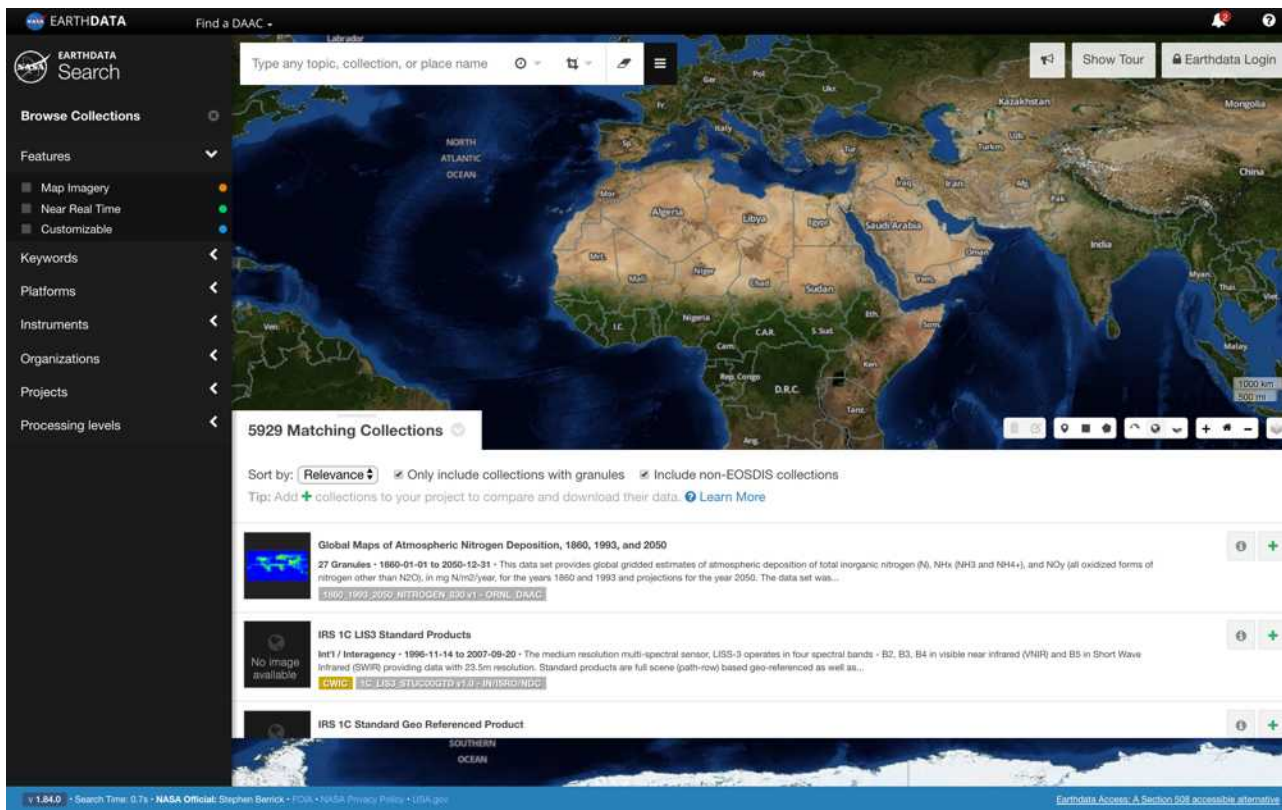
Hierarchical Data Format (HDF)



Preferred container for NASA EOS data

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





EARTHDATA Search

Find a DAAC

Type any topic, collection, or place name

Show Tour Earthdata Login

Browse Collections

Features

- Map Imagery
- Near Real Time
- Customizable

Keywords

Platforms

Instruments

Organizations

Projects

Processing levels

5929 Matching Collections

Sort by: **Relevance** ☒ Only include collections with granules ☒ Include non-EOSDIS collections

Tip: Add collections to your project to compare and download their data. [Learn More](#)

Global Maps of Atmospheric Nitrogen Deposition, 1860, 1993, and 2050

27 Granules - 1860-01-01 to 2050-12-31 - This data set provides global gridded estimates of atmospheric deposition of total inorganic nitrogen (N), NH₃ (NH₃ and NH₄), and NO_y (all oxidized forms of nitrogen other than NO₂, in mg N/m²/year, for the years 1860 and 1993 and projections for the year 2050. The data set was...

IRS 1C LIS3 Standard Products

Int'l Interagency - 1996-11-14 to 2007-09-20 - The medium resolution multi-spectral sensor, LIS-3 operates in four spectral bands - B2, B3, B4 in visible near infrared (NIR) and B5 in Short Wave Infrared (SWIR) providing data with 23.5m resolution. Standard products are full scene (path-row) based geo-referenced as well as...

IRS 1C Standard Geo Referenced Product

Earthdata Search

v 1.84.0 - Search Time: 0.7s - NASA Official: Stephen Berrick - FOIA - NASA Privacy Policy - USA.gov

Earthdata Address: A Section 508 accessible alternative

Tools Used with NASA Data Products

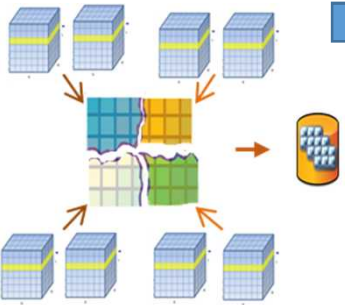
- Significant increase in the number of users interested in using NASA Earth Science data in a GIS
 - Per the ACSI survey results for “Top tools used to work with data”: ArcGIS ranked number 1 at 64%
- GIS is utilized to support the delivery of priority data products, experiment with various geospatial technologies, and expand geospatial capabilities.

2017 ACSI RESULTS – All DAACs

	2017	2017
	%	N
Tool(s) used to work with data-		
ArcGIS	64%	2,349
Convert to Vector	4%	159
ENVI	32%	1,176
ERDAS/IMAGINE	21%	766
Excel	27%	980
Ferret	1%	28
Geomatica	4%	148
Global Mapper	15%	562
GrADS	3%	118
GRASS	12%	435
HDFLook	1%	51
HDFView	9%	311
HEG	2%	67
IDL	11%	400
IDV	1%	26
IDRISI	7%	248
MapReady	1%	41
MATLAB	18%	649
MODIS Reprojection Tool (MRT)	10%	355
NCL	3%	100
Panoply	5%	201
Quantum GIS (QGIS)	37%	1,344
R	19%	680
SeaDAS	3%	123
Other/open source	18%	676
Don't know/Not applicable	1%	28
Number of Respondents	3,656	3,656

Utilizing the ArcGIS Platform as an End-to-End Solution for Processing, Analyzing, and Visualizing NASA's Scientific Data

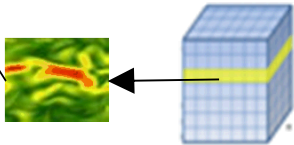
ArcGIS Multidimensional Mosaic Dataset Indexing HDF/netCDF/GRIB Data Warehouses



- Aggregate (mosaic) spatial, time, and vertical dimensions

Mosaic Index

OBJ	Raster	Name	Variable *	Standard Time
1	<Raster	hycom_glb_reg01.nc.water_temp.0	water_temp	5/17/2013
2	<Raster	hycom_glb_reg01.nc.water_temp.1	water_temp	5/17/2013
3	<Raster	hycom_glb_reg01.nc.water_temp.2	water_temp	5/17/2013
4	<Raster	hycom_glb_reg01.nc.water_temp.3	water_temp	5/17/2013
5	<Raster	hycom_glb_reg01.nc.water_temp.4	water_temp	5/17/2013

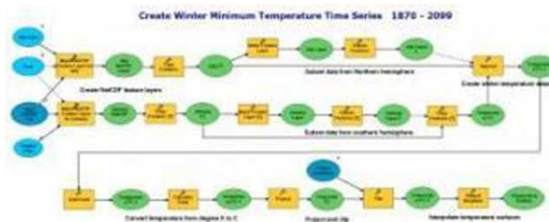
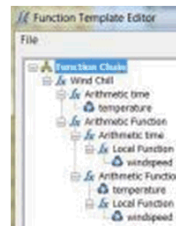


Publish ArcGIS Image Service



Raster Functions

- On-the-fly Computing
 - Image Processing (NDVI, pansharpen, image classification, etc.)
 - Raster Calculator (Convert Celsius to Fahrenheit)
- Processes the pixels that are requested
- Can be chained and avoid intermediate results

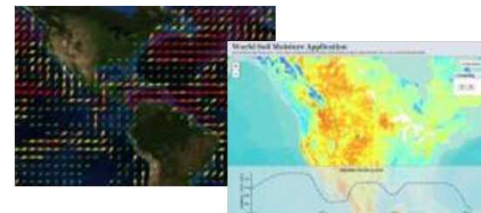


Usable by ArcGIS Platform



Visualization

- Visualize temporal change of a variable
- Visualize a variable at any vertical dimension
- Visualize flow direction and magnitude variables



Prediction Of Worldwide Energy Resources (POWER) GIS

SSE GIS has merged into POWER GIS

- SSE-GIS capabilities merged into POWER GIS (<https://power.larc.nasa.gov/>)
- Includes all available parameters for climatological values
- Interactive maps with geospatial visualization tools
 - Time series slider and swiping tools, etc.

Mission Partner Driving Enhancements

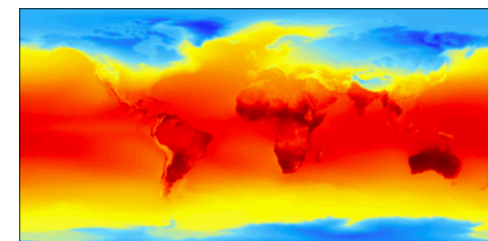
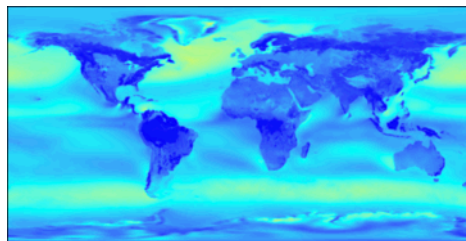
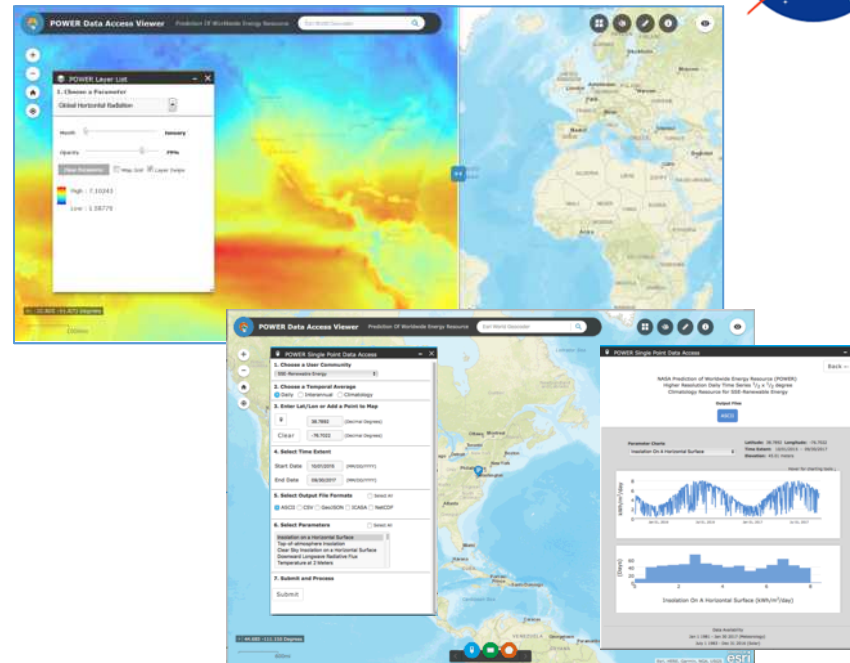
- RETScreen currently developing new web-based software using new POWER API with geoJSON response. (User base 500k+)

Graphical Data Access

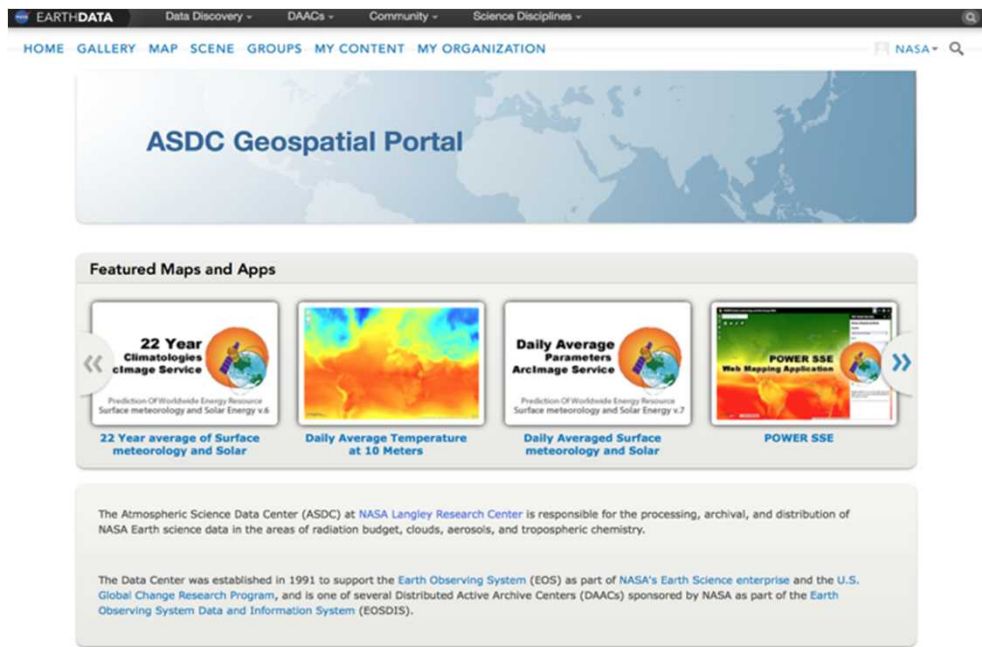
- $\frac{1}{2} \times \frac{1}{2}$ deg; within 5-7 days of observations
- Multiple parameters from FLASHFlux, GMAO, etc. available
- Parameters arranged by application community (i.e., renewable energy, buildings, agroclimatology)
- Multiple data output formats

Three Applications (initial version):

- Time series at a single point (daily, monthly, up to 30 years)
- Regional times series (limited area)
- Global climatology (30 year*)



Increasing the discoverability of data, services, maps, and apps



The screenshot shows the NASA ASDC Geospatial Portal interface. At the top is a navigation bar with links: EARTH DATA, Data Discovery, DAACs, Community, and Science Disciplines. Below this is a secondary navigation bar with links: HOME, GALLERY, MAP, SCENE, GROUPS, MY CONTENT, and MY ORGANIZATION. The main content area features a large map of the world with the text "ASDC Geospatial Portal" overlaid. Below the map is a section titled "Featured Maps and Apps" which contains four tiles: "22 Year Climatologies cImage Service", "Daily Average Parameters ArcImage Service", "22 Year average of Surface meteorology and Solar", and "POWER SSE Web Mapping Application". At the bottom of the page, there is a paragraph about the ASDC at NASA Langley Research Center and another paragraph about the Data Center's establishment in 1991.

Examples of Variables Available for Initial Release (Daily and Long Term Averages over a 22 year Period):

- Global Horizontal Radiation
- Diffuse Radiation
- Direct Normal Radiation
- Latitude Tilt Radiation
- Clear Sky Insolation
- Top-of-Atmosphere Insolation
- NO-SUN or BLACK Days
- Air Temperature
- Relative Humidity
- Atmospheric Pressure
- Earth Skin Temperature
- Heating Degree Days Below 18C
- Cooling Degree Days Above 18C



- NASA Official: John M. Kusterer
- Site Curator: NASA Langley ASDC User Services - Contact Us
- NASA Privacy Statement, Disclaimer, and Accessibility Certification
- Copyright Information
- Last Modified Date: July 8, 2015

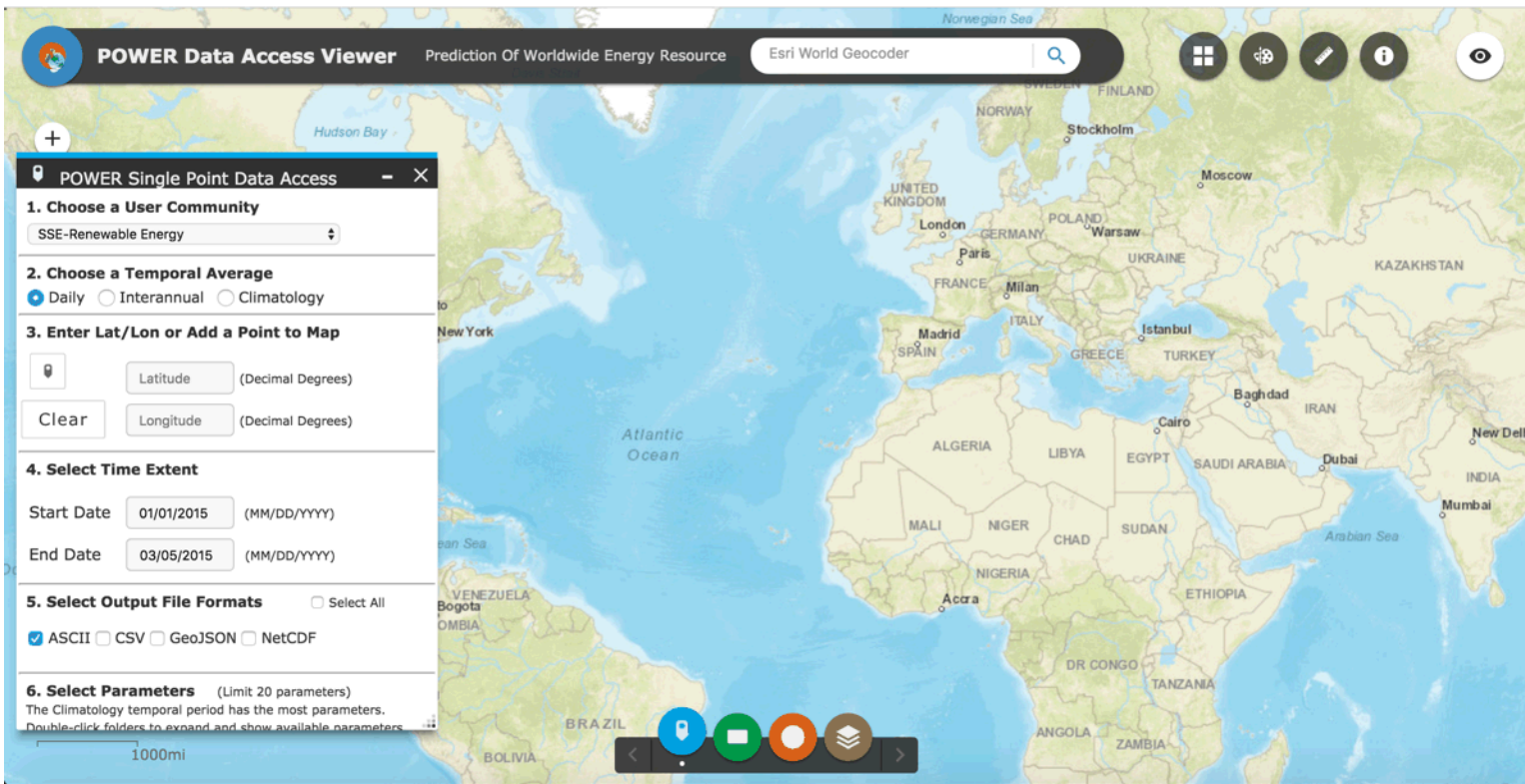


GEOPLATFORM.gov

ArcGIS Living Atlas



<https://asdc-arcgis.larc.nasa.gov/portal>



POWER Data Access Viewer Prediction Of Worldwide Energy Resource

Esri World Geocoder

POWER Single Point Data Access

- 1. Choose a User Community**
SSE-Renewable Energy
- 2. Choose a Temporal Average**
☒ Daily ☐ Interannual ☐ Climatology
- 3. Enter Lat/Lon or Add a Point to Map**
 Latitude (Decimal Degrees)
 Longitude (Decimal Degrees)
- 4. Select Time Extent**
 Start Date: 01/01/2015 (MM/DD/YYYY)
 End Date: 03/05/2015 (MM/DD/YYYY)
- 5. Select Output File Formats** ☐ Select All
☒ ASCII ☐ CSV ☐ GeoJSON ☐ NetCDF
- 6. Select Parameters** (Limit 20 parameters)
 The Climatology temporal period has the most parameters.
 Double-click folders to expand and show available parameters

1000mi

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