



## The Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)

USFS – NASA Joint Applications Workshop, 30 April – 2 May 2019

Presented by Paul Moth



National Snow and Ice Data Center  
*Advancing Knowledge of Earth's frozen regions*



University of Colorado **Boulder**

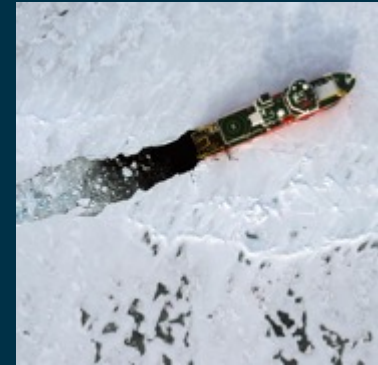
# National Snow and Ice Data Center



manages and distributes  
scientific data



researches the cryosphere and  
data science



supports data users



supports local and Traditional  
Knowledge

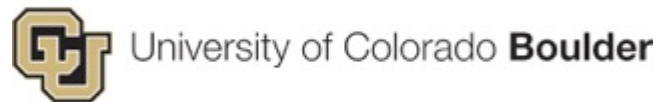


provides tools for data users

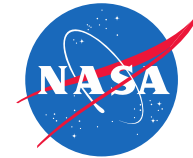


informs the public about the  
cryosphere

# Affiliations



# Sponsors



# AppEEARS - Overview

- <https://lpdaacsvc.cr.usgs.gov/appeears/>
- Earthdata login required
  - <https://urs.earthdata.nasa.gov/>
- This demo does not require a personal Earthdata login...BUT, you might as well get one because AppEEARS is cool
- #easyanalysis

# AppEEARS – Overview

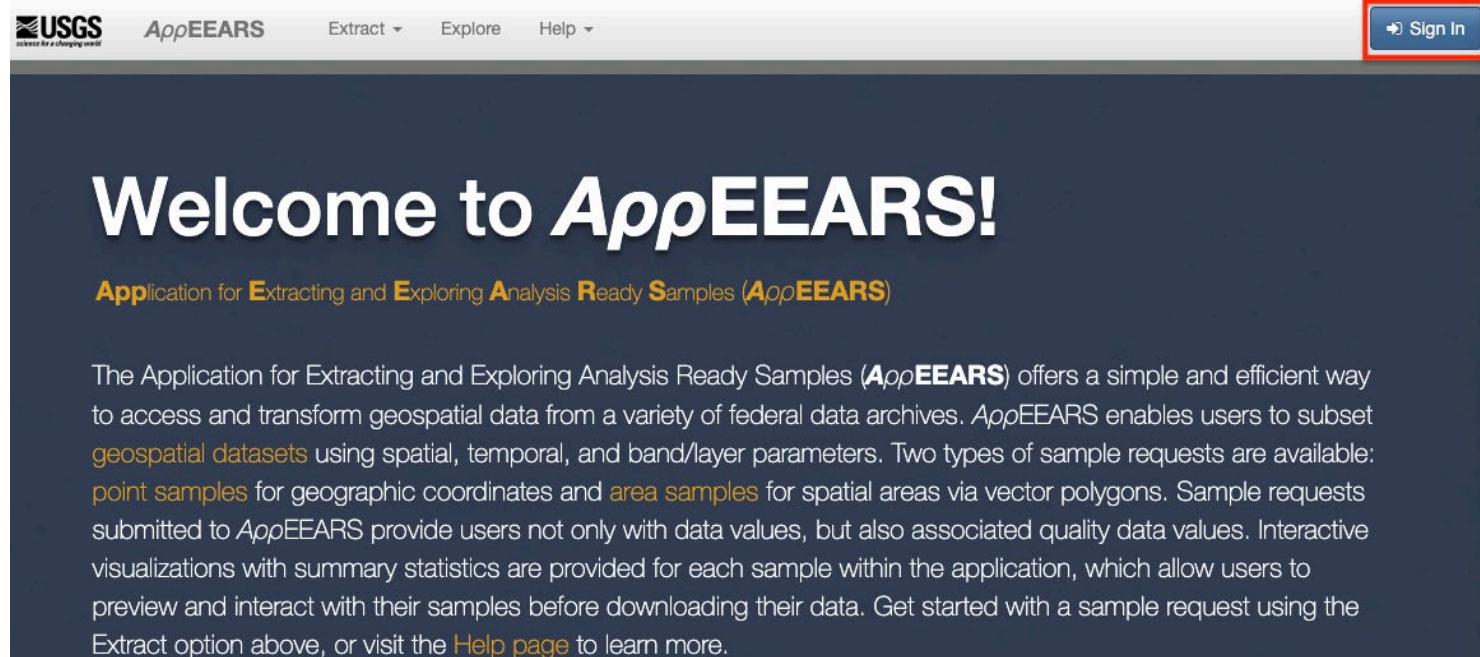
- Analysis ready point and area data samples
- Subset data sets – spatial, temporal, and layer parameters
- Re-format to .csv and GeoTIFF
- Re-project area data samples
- View results with time series graphs and tables, scatter plots, box and whisker plots
- Compare layer parameters
- Size limits
  - 10,000 raster files, 450 GB per request, 7.2 GB per raster

# AppEARS – Available data sets

- <https://lpdaacsvc.cr.usgs.gov/appeears/products>
  - MODIS – NDVI, evapotranspiration, snow cover, et al.
  - SMAP – Soil moisture, freeze thaw, CO2, et al.
  - SRTM – Digital elevation models
  - VIIRS – NDVI, albedo, surface reflectance, et al.
  - WELD – NDVI, reflectance, et al.
  - And more...

# AppEEARS – Login

- Login to <https://lpdaacsvc.cr.usgs.gov/appeears/>
  - Username: usfs\_2019
  - Password: UsFs\_2019

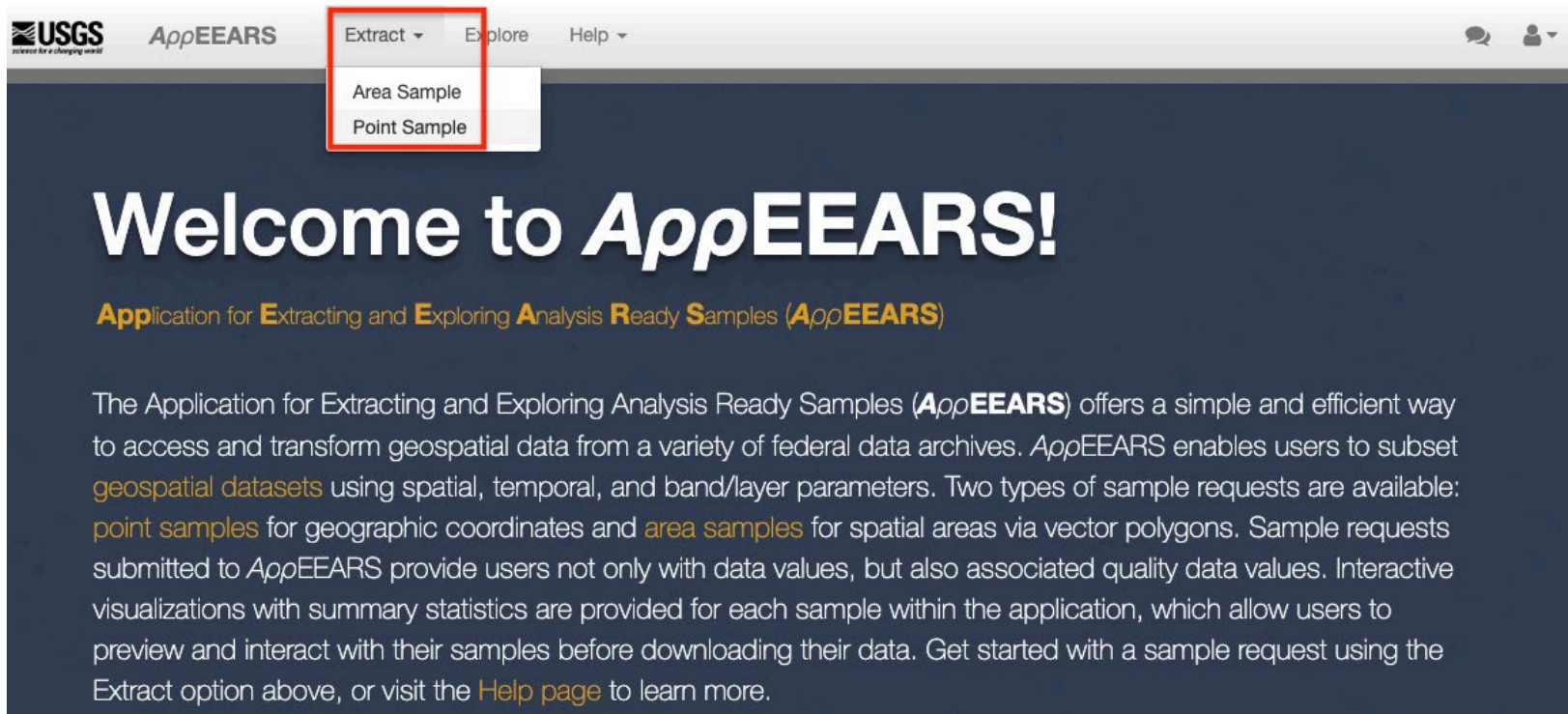


The screenshot shows the AppEEARS web application interface. At the top, there is a navigation bar with the USGS logo, the AppEEARS title, and links for Extract, Explore, and Help. A red box highlights a 'Sign In' button in the top right corner. Below the navigation bar, the main content area has a dark blue background. It features a large white heading 'Welcome to AppEEARS!' followed by a subtitle 'Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)'. A paragraph of text describes the application's purpose: 'The Application for Extracting and Exploring Analysis Ready Samples (AppEEARS) offers a simple and efficient way to access and transform geospatial data from a variety of federal data archives. AppEEARS enables users to subset geospatial datasets using spatial, temporal, and band/layer parameters. Two types of sample requests are available: point samples for geographic coordinates and area samples for spatial areas via vector polygons. Sample requests submitted to AppEEARS provide users not only with data values, but also associated quality data values. Interactive visualizations with summary statistics are provided for each sample within the application, which allow users to preview and interact with their samples before downloading their data. Get started with a sample request using the Extract option above, or visit the Help page to learn more.'





# AppEEARS point sample – AM vs. PM SMAP soil moisture in AZ and NM NFs



USGS **AppEEARS** Extract Explore Help

Area Sample  
Point Sample

## Welcome to *AppEEARS*!

**Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)**

The Application for Extracting and Exploring Analysis Ready Samples (**AppEEARS**) offers a simple and efficient way to access and transform geospatial data from a variety of federal data archives. AppEEARS enables users to subset **geospatial datasets** using spatial, temporal, and band/layer parameters. Two types of sample requests are available: **point samples** for geographic coordinates and **area samples** for spatial areas via vector polygons. Sample requests submitted to AppEEARS provide users not only with data values, but also associated quality data values. Interactive visualizations with summary statistics are provided for each sample within the application, which allow users to preview and interact with their samples before downloading their data. Get started with a sample request using the Extract option above, or visit the [Help page](#) to learn more.


- Extract ► Point Sample




# AppEEARS point sample– Start a new request




## Extract Point Sample




### Start a new request

A screenshot of the 'Extract Point Sample' web form. The form has several sections: a top section for 'Request ID' and 'Request Name', a middle section for 'Coordinates' with a map of the United States, and a bottom section for 'Metadata'. The 'Coordinates' section is highlighted with a red dashed border.



### Copy a previous request

You don't have any previous requests to copy.



### Upload a request file

**Drop a JSON file containing the request to copy or [click here](#) to select the file.**

JSON request files (\*.request.json) are included in the download bundle available from any AppEEARS requests.

# AppEEARS point sample– Copy previous request

## Extract Point Sample

The screenshot displays the AppEEARS interface with three main options:

- Start a new request**: Represented by a pencil icon. Below it is a thumbnail of the 'Extract Point Sample' form, which includes fields for 'Enter a name for this request', 'Enter a description for this request', 'Select a point sample', 'Map', 'Map Data', and 'Map Data Source'.
- Copy a previous request**: Represented by a document icon. This option is highlighted with a red border. Below the icon, it shows the text 'USFS: AZ and NM' and an information icon.
- Upload a request file**: Represented by an upload icon. Below it is a dashed blue box containing the text: 'Drop a JSON file containing the request to copy or [click here](#) to select the file.' and 'JSON request files (\*.request.json) are included in the download bundle available from any AppEEARS requests.'

- Copies all details from a previous submission
- Let's look at project details...
- Extract ➤ Point Sample ➤ Copy a previous request ➤ USFS: AZ and NM

# AppEEARS point sample – Project details

## Extract Point Sample

Enter a name to identify your sample

USFS: AZ and NM

Upload coordinates from a file

Drop a CSV file containing the coordinates or [click here](#) to select the file. Coordinates can also be entered manually in the uploaded coordinates box.

The CSV file can contain up to 4 columns separated by commas with each coordinate on a separate line.

1. ID (optional) - uniquely identifies the coordinate
2. Category (optional) - label to group common coordinates
3. Latitude - latitude in decimal degrees (-90 to 90)
4. Longitude - longitude in decimal degrees (-180 to 180)

Uploaded coordinates (ID, Category, Lat, Long): 80

Carson NF, 1, 36.5516300895, -106.182557251  
Carson NF, 2, 36.1943642274, -105.550864953  
Carson NF, 3, 36.7056191061, -105.386807616  
Carson NF, 4, 36.7922114587, -107.267766651  
Carson NF, 5, 36.6911816253, -107.385851211  
Carson NF, 6, 36.1699882549, -105.685111925  
Carson NF, 7, 36.4099153036, -105.57371562  
Cibola NF, 1, 36.4436489104, -102.726953131  
Cibola NF, 2, 34.2669668384, -107.628092914  
Cibola NF, 3, 35.2218537736, -108.273642851  
Cibola NF, 4, 33.7070549469, -107.460143829  
Cibola NF, 5, 35.6831055497, -99.7621294467

Start Date

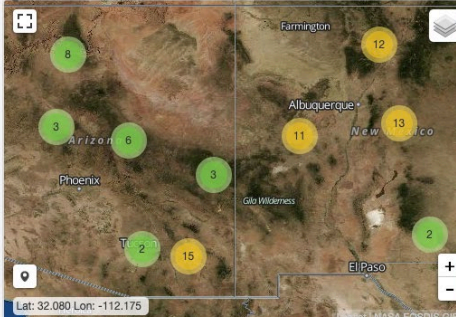
04-01-2018

End Date ⓘ

03-31-2019

☐ Is Date Recurring?

Selected coordinates



Lat: 32.080 Lon: -112.175

Add coordinates using the tool. View coordinate details by clicking the markers on the map.

Select the layers to include in the sample ⓘ

SMAP Soil Moisture  
SPL3SMP:005, 36000m, Daily, (2015-03-31 to Present)

☒ Soil\_Moisture\_Retrieval\_Data\_AM\_soil\_moisture  
☐ Soil\_Moisture\_Retrieval\_Data\_PM\_soil\_moisture  
☐ Soil\_Moisture\_Retrieval\_Data\_AM\_surface\_temperature

Selected layers

☒ Soil\_Moisture\_Retrieval\_Data\_AM\_soil\_moisture 36000m, Daily —

☒ Soil\_Moisture\_Retrieval\_Data\_PM\_soil\_moisture 36000m, Daily —

- Add different products, point locations, and start and end dates
- Do NOT submit if signed in under previous log info

The logo for the National Snow and Ice Data Center (NSIDC), featuring a stylized globe with a snowflake and the acronym NSIDC.

# AppEEARS point sample – Order status and download and explore data

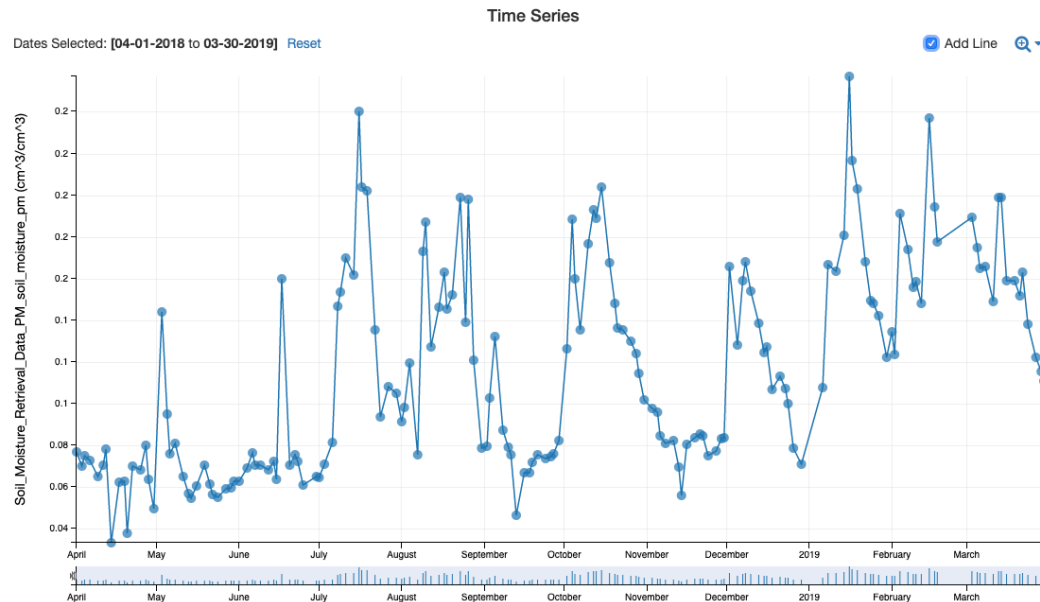
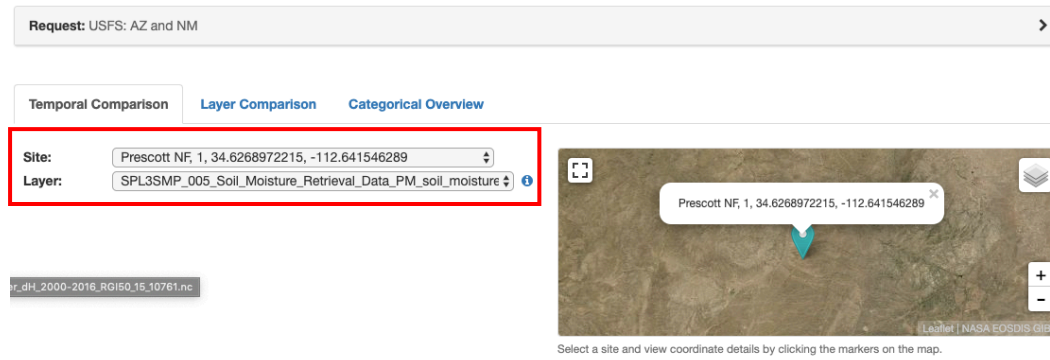


## Explore Requests

Request	Type	Status	Details	Date Submitted	Date Completed	
<a href="#">USFS: Kaibab</a>	Area Sample	Done		04-09-2019 4:32:13 pm CDT	04-09-2019 4:41:29 pm CDT	
<a href="#">USFS: AZ and NM</a>	Point Sample	Done		04-09-2019 3:04:39 pm CDT	04-09-2019 5:43:27 pm CDT	

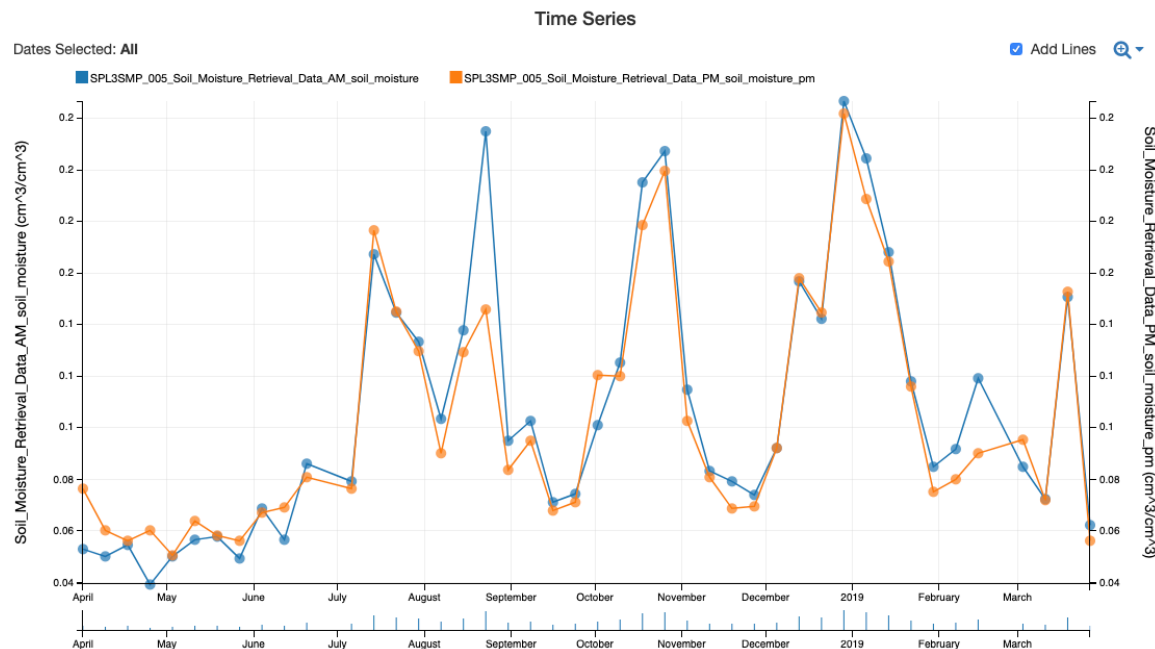
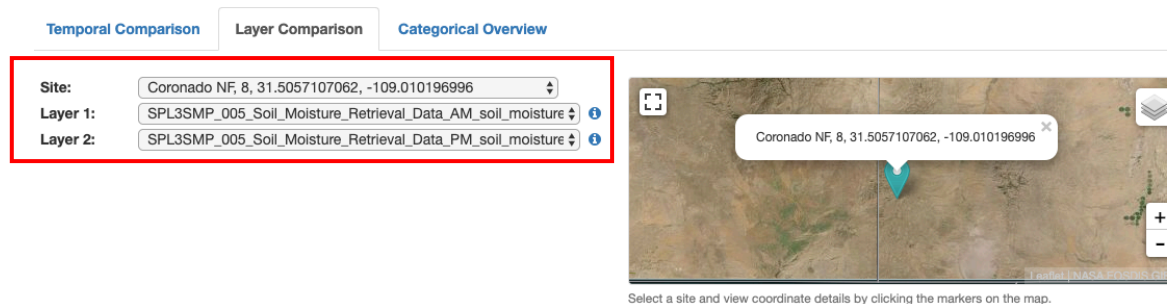


# AppEARS point sample – Temporal comparison



- View study sites and layers parameters on graphs
- Change x-axis to customize temporal coverage on graphs and tables

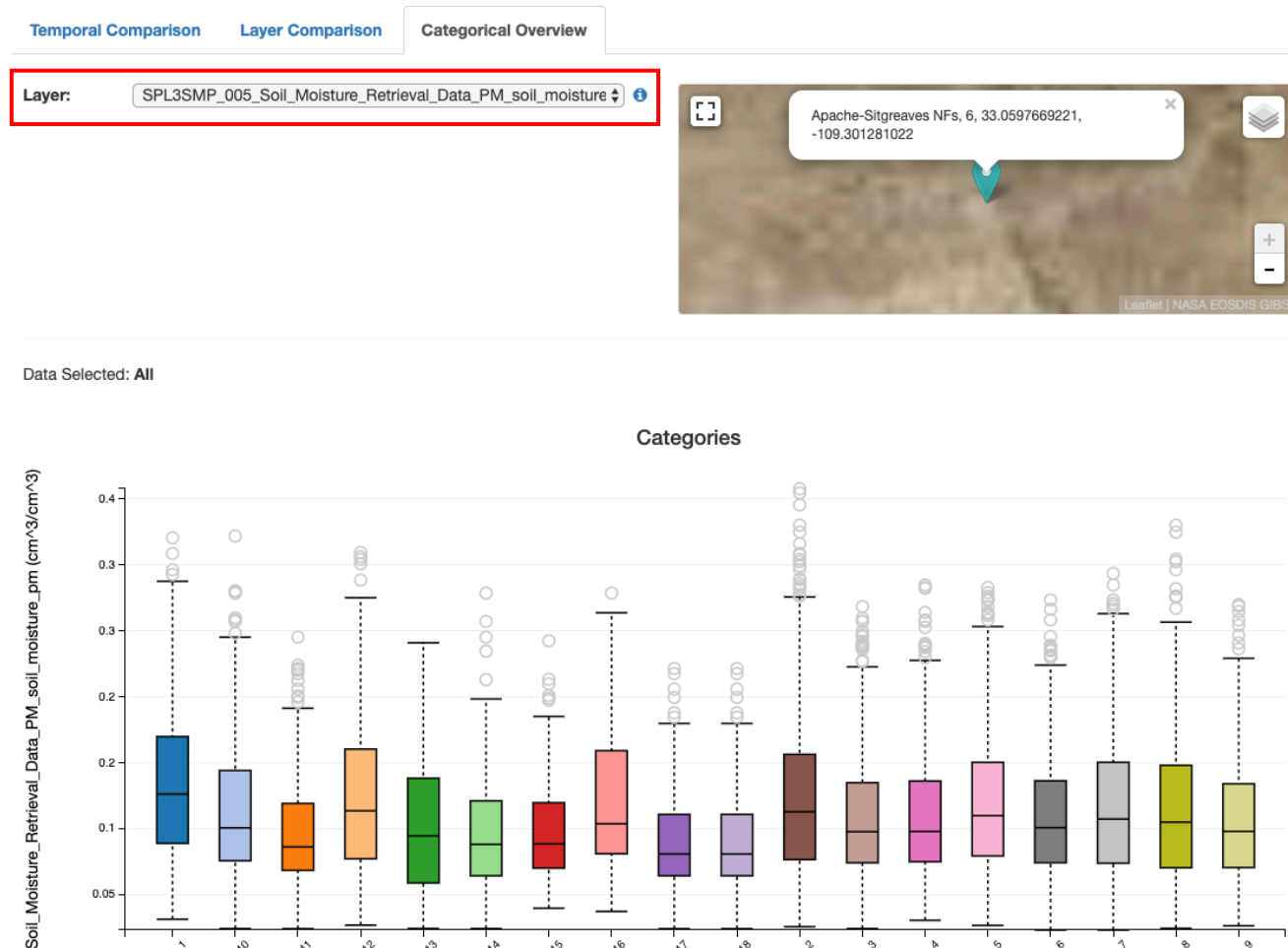
# AppEEARS point sample – Layer comparison



- Compare different layer parameters on the same graph
- Time series, scatter plots, and tables are included
- Adjust x-axis to alter temporal coverage

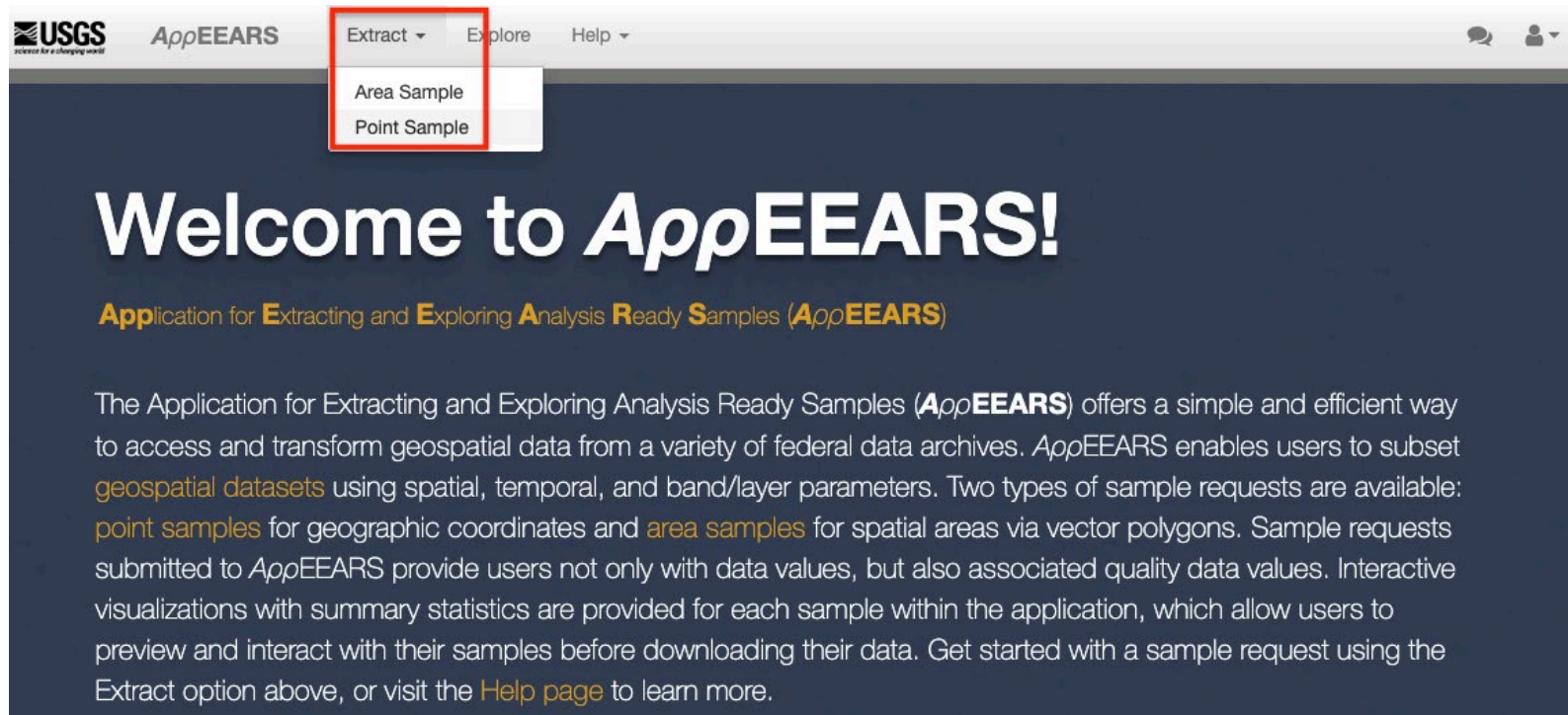


# AppEEARS point sample – Categorical overview



- Explore the distribution of sample data within categories
- Box and whisker plots display total number of samples, median, and interquartile ranges

# AppEEARS area sample – Soil moisture and evapotranspiration in Kaibab National Forest





- Extract ➤ Area Sample ➤ Copy previous request ➤ USFS: Kaibab

# AppEEARS area sample – project details

Enter a name to identify your sample


USFS: Kaibab


Upload a file or draw a polygon using the  or  icon

Drop a vector polygon file containing the area feature(s) to extract or [click here](#) to select the file.

Supported file formats:

- ESRI Shapefile (.zip including .shp, .dbf, .prj, and .shx files)
- GeoJSON (.json or .geojson)


Start Date: 04-01-2018 


End Date: 03-31-2019 


☐ Is Date Recurring?


Select the layers to include in the sample

**Terra MODIS Evapotranspiration (ET & LE)**  
MOD16A2.006, 500m, 8 day, (2001-01-01 to Present)

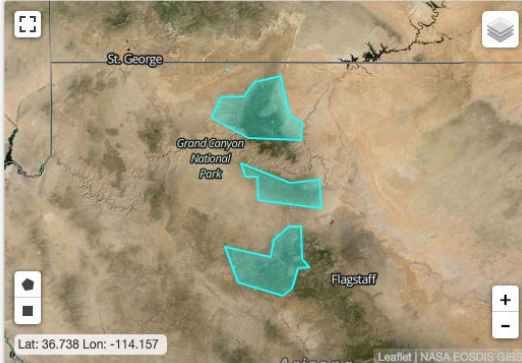
☐ ET\_QC\_500m 

☐ LE\_500m 

☐ PET\_500m 

☐ PLE\_500m 


Selected file (\_MACOSX/.\_Kaibab)




Lat: 36.738 Lon: -114.157


To clear a polygon, draw a new polygon or upload a vector polygon file.


Selected layers

☐ Soil\_Moisture\_Retrieval\_Data\_AM\_soil\_moisture 9000m, Daily 

☐ ET\_500m 500m, 8 day 

Output Options

File Format: GeoTiff 

Projection: Geographic 

Datum: WGS84  
EPSG: 4326  
PROJ.4: +proj=longlat +datum=WGS84 +no\_defs









**NOTE:** Be aware that any reprojection of data from its source projection to a different projection will inherently change the data from its original format. All reprojections use GDAL's [gdalwarp](#) function in combination with the PROJ.4 string listed above. For additional information, see the [AppEEARS help documentation](#).

- Do NOT submit the order...i.e. do not get me in trouble



# AppEEARS area sample – Order status and download and explore data

## Explore Requests












Request	Type	Status	Details	Date Submitted	Date Completed	
<a href="#">USFS: Kaibab</a>	Area Sample	Done		04-09-2019 4:32:13 pm CDT	04-09-2019 4:41:29 pm CDT	  
<a href="#">USFS: AZ and NM</a>	Point Sample	Done		04-09-2019 3:04:39 pm CDT	04-09-2019 5:43:27 pm CDT	  

# AppEARS area sample – Download data

## Download Area Sample

Request: USFS: Kaibab

### Supporting Files

	USFS-Kaibab-MOD16A2-006-metadata.xml	ISO 19115 Metadata	21.55 KB
	USFS-Kaibab-SPL3SMP-E-002-metadata.xml	ISO 19115 Metadata	21.23 KB
	README.txt	Instructions and details about the request	17.75 KB
	USFS-Kaibab-granule-list.txt	URLs for all source data used in the extraction	47.05 KB
	USFS-Kaibab-request.json	JSON file which can be used to create a new request	582.63 KB
	MOD16A2-006-ET-QC-500m-Statistics-QA.csv	Statistics for quality layers	3.6 KB
	MOD16A2-006-ET-QC-500m-lookup.csv	Lookup values for the quality bits	2.29 KB
	MOD16A2-006-Statistics.csv	Statistics for layers	6.16 KB
	SPL3SMP-E-002-Soil-Moisture-Retrieval-Data-AM-retrieval-qual-flag-Statistics-QA.csv	Statistics for quality layers	35.4 KB
	SPL3SMP-E-002-Soil-Moisture-Retrieval-Data-AM-retrieval-qual-flag-lookup.csv	Lookup values for the quality bits	621 B
	SPL3SMP-E-002-Statistics.csv	Statistics for layers	51.08 KB

Select: All | None

0 Selected



Download ▾

Name	Size
 MOD16A2.006_ET_500m_doy2018089_aid0001.tif	35.76 KB
 MOD16A2.006_ET_500m_doy2018097_aid0001.tif	36.35 KB
 MOD16A2.006_ET_500m_doy2018105_aid0001.tif	33.21 KB
 MOD16A2.006_ET_500m_doy2018113_aid0001.tif	38.44 KB
 MOD16A2.006_ET_500m_doy2018121_aid0001.tif	35.95 KB
 MOD16A2.006_ET_500m_doy2018129_aid0001.tif	41.34 KB
 MOD16A2.006_ET_500m_doy2018137_aid0001.tif	41.15 KB

- .csv files contain all data samples for each science file
- Download individual or all raster files
- .json files can be used to create a new request



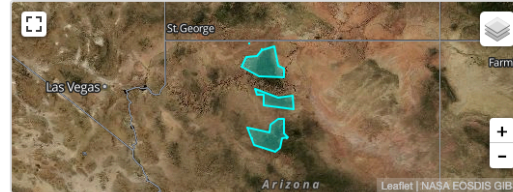
# AppEEARS area sample – Explore data

## View Area Sample

Request: USFS: Kaibab

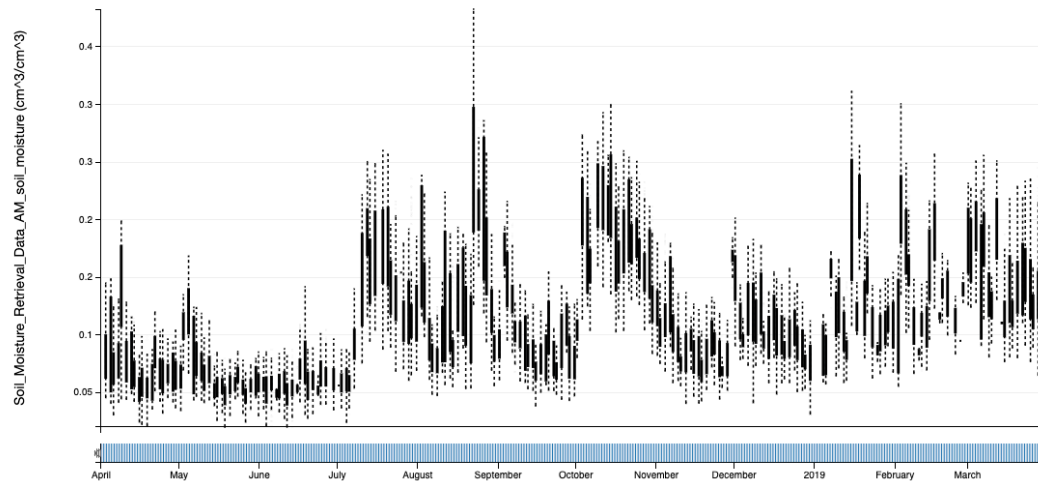
Stats

Feature: aid0001  
Layer: SPL3SMP\_E\_002\_Soil\_Moisture\_Retrieval\_Data\_AM\_soil\_moist



## Layer Stats

Dates Selected: [04-01-2018 to 03-30-2019] Reset



- Change layer parameters
- Adjust time scale on x-axis
- Adjust the mix/max of values on the y-axis



## Questions or feedback?

- AppEEARS related questions: [LPDAAC@usgs.gov](mailto:LPDAAC@usgs.gov)
- SMAP related questions: [nsidc@nsidc.org](mailto:nsidc@nsidc.org)