

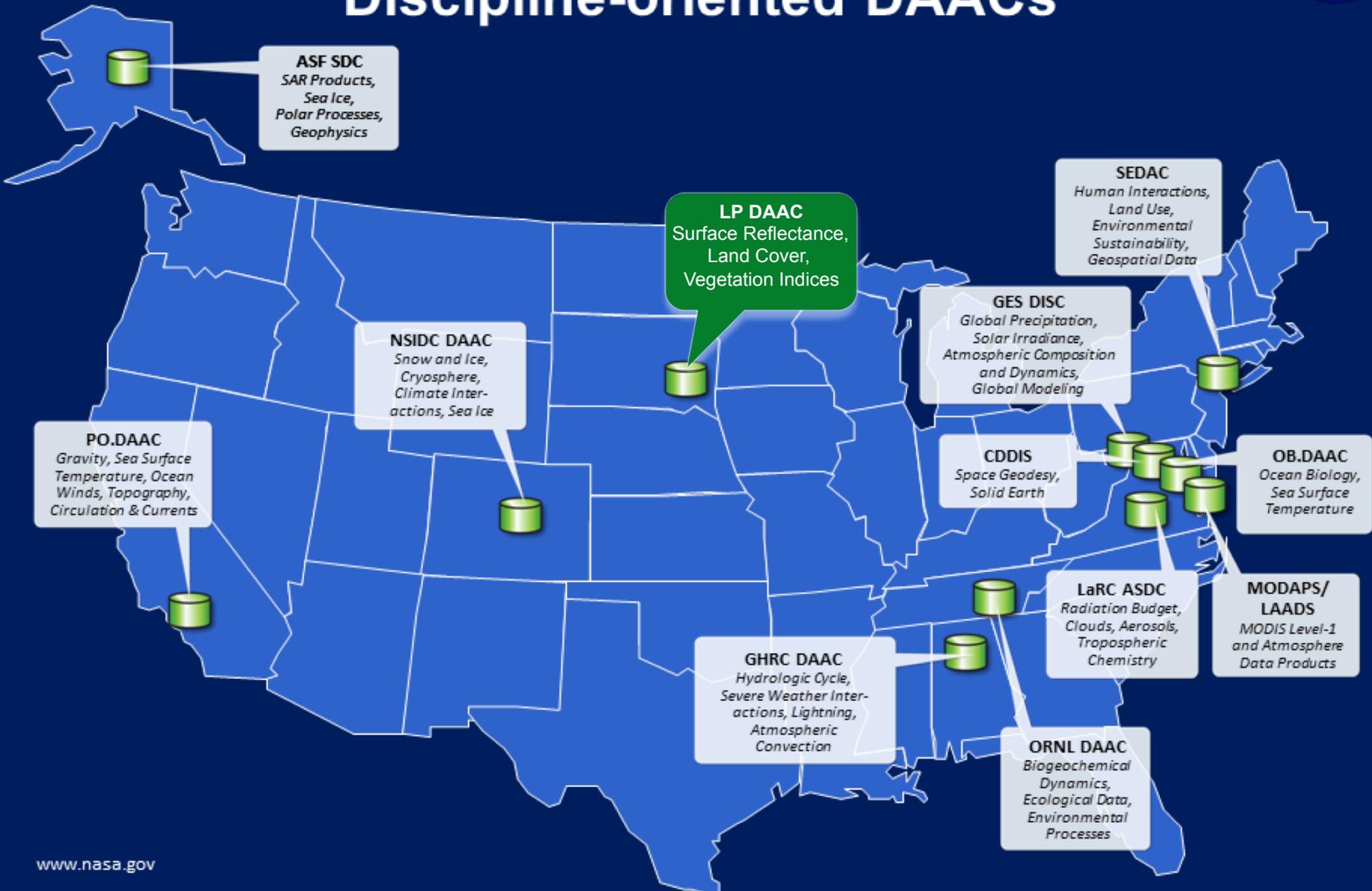
Land Remote Sensing Data and AppEEARS: An Introduction

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Discipline-oriented DAACs



What does the LP DAAC do?

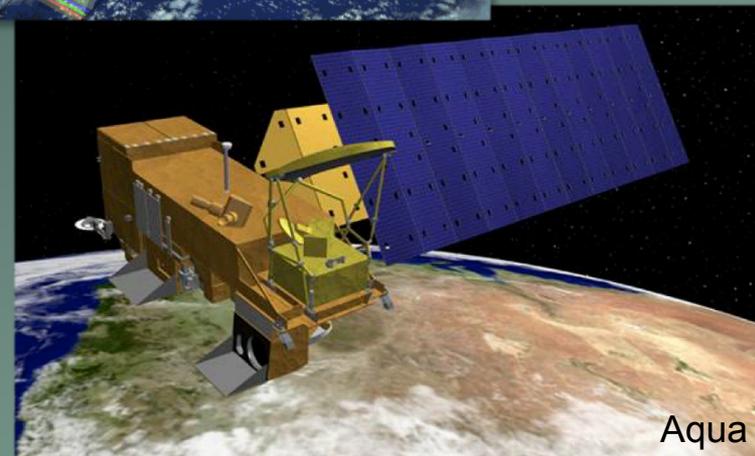
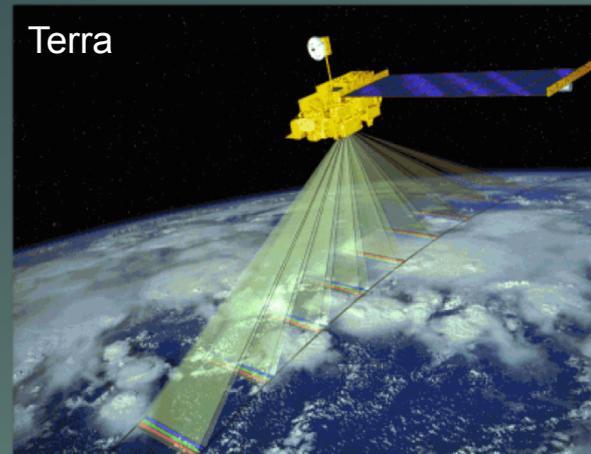
Processes, archives, and distributes land data products to NASA PI's, DOI land managers, and 100,000's of users in the public earth science remote sensing community



MODIS

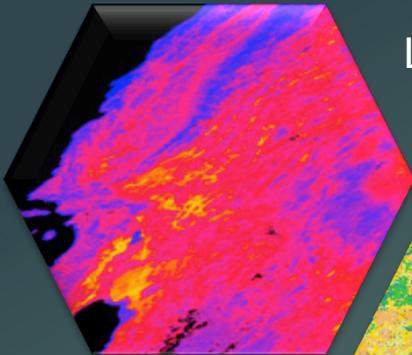
Moderate Resolution Imaging Spectroradiometer

- NASA mission designed to measure large-scale global dynamics across land, oceans, and the atmosphere
- Generate daily, continuous, global, multispectral, multi-temporal data to build a holistic record of Earth's parameters
- MODIS launched onboard Terra (December 18, 1999) and Aqua (May 4, 2002)
- Version 6 data products began to be released in August 2015

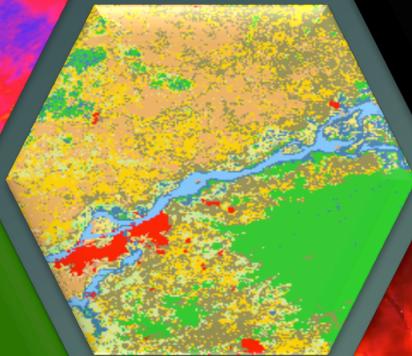


MODIS Land Data Products

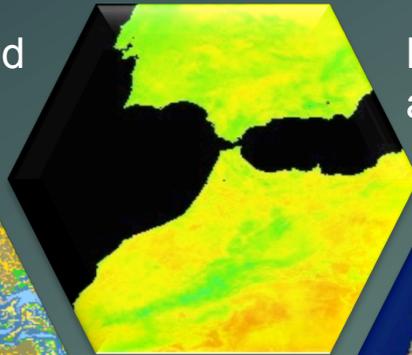
BRDF
And
Albedo



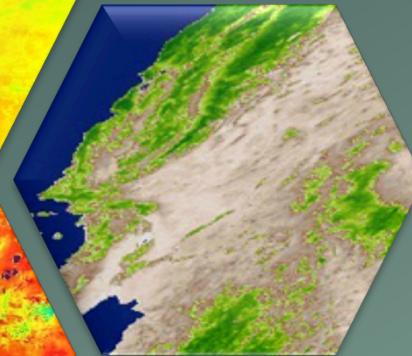
Land Cover and
Vegetation
Cont. Fields



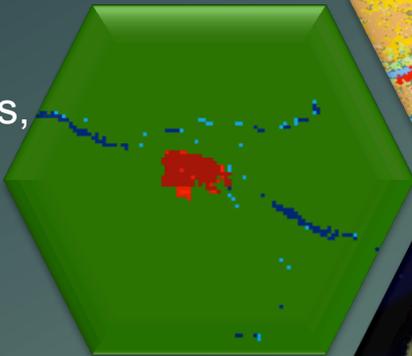
Land Surface Temperature
and Emissivity



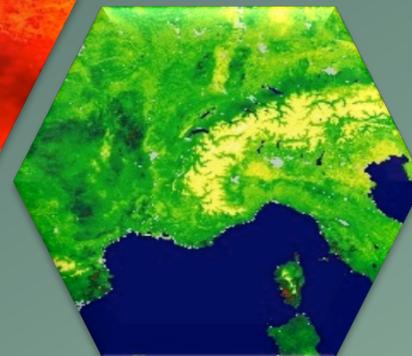
Vegetation
Indices and



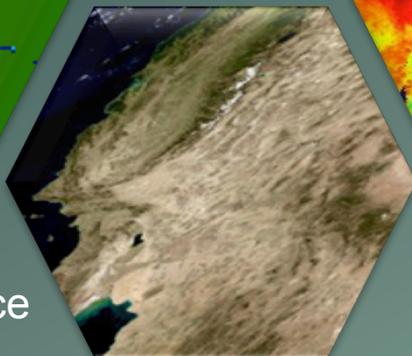
Thermal
Anomalies,
Fire, and
Burned
Area



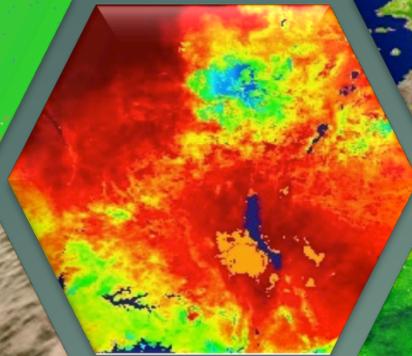
Leaf Area
Index and
FPAR



Surface
Reflectance



Gross & Net
Primary
Productivity



NASA VIIRS Products

- NASA VIIRS data products are being generated in a MODIS-like format using modified MODIS algorithms to extend the legacy of Terra and Aqua MODIS
- VIIRS launched onboard the Suomi National Polar-orbiting Partnership (S-NPP) on October 28, 2011
- NASA VIIRS Surface Reflectance products were released on March 24, 2017



More to come!

BRDF/Albedo, NBAR

Land Surface
Temperature

Land Surface
Phenology

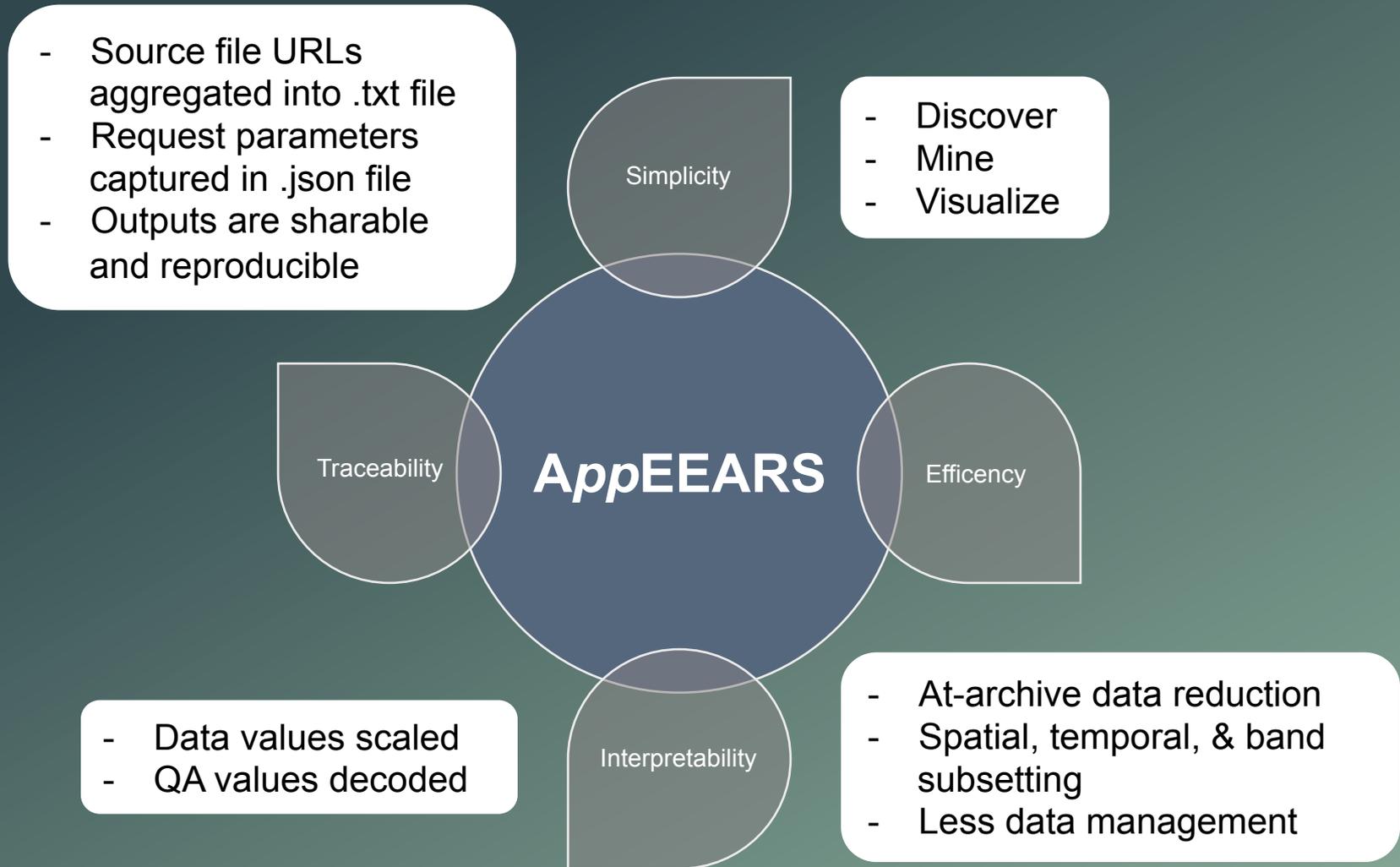
FPAR

Fire, Thermal
Anomalies, and
Burned Area

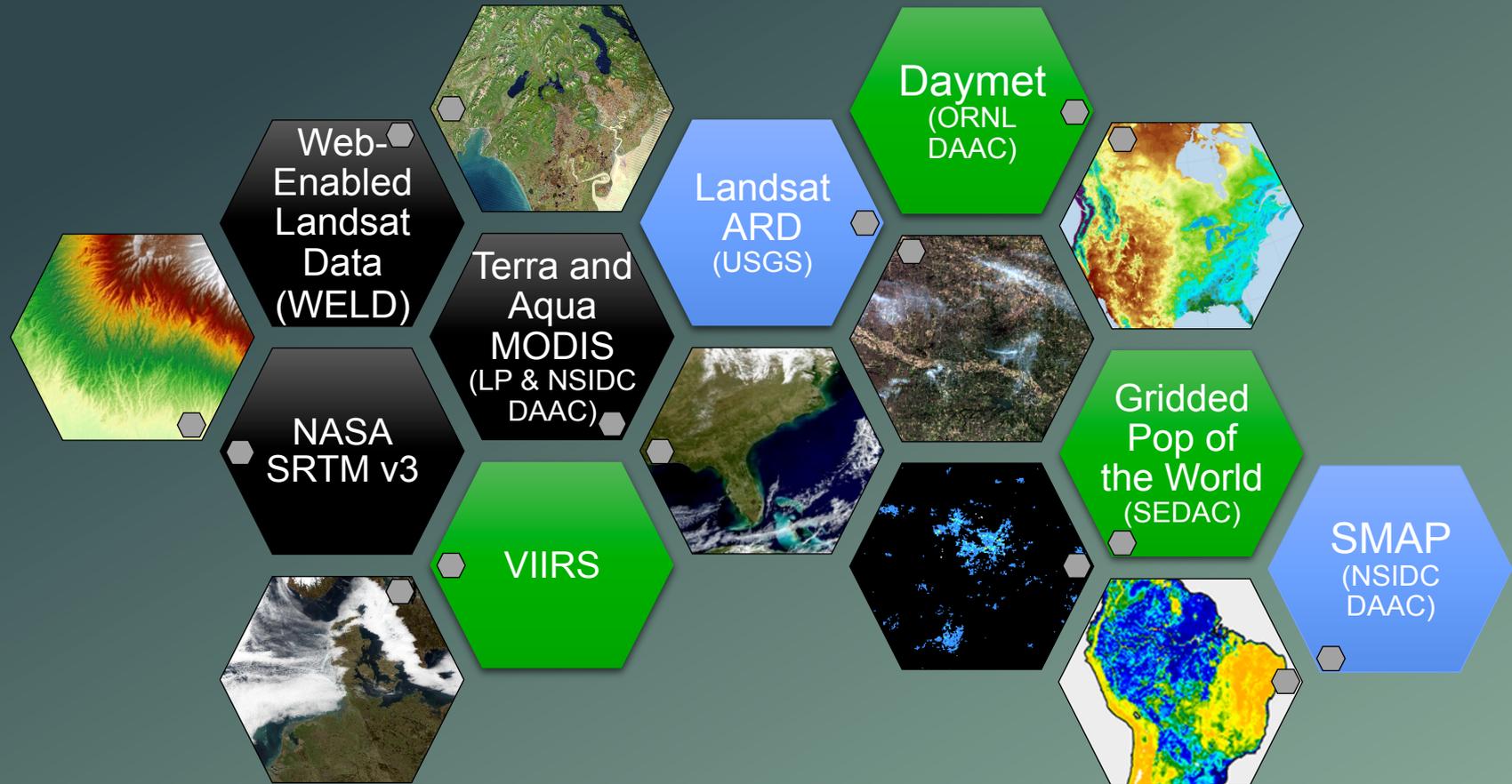
Vegetation
Indices

MAIAC

Application for Extracting and Exploring Analysis Ready Samples



Data available in AppEEARS



Point Extraction - Request Form

 AppEEARS Extract ▾ Explore Order Tracking Help ▾ 🗨 👤 ▾

Extract Point Sample

Enter a name to identify your sample

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 selected 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): 21

US-ARM	CRO	36.6058	-97.4888
US-Bo2	CRO	40.009	-88.29
US-KL3	CRO	42.4736	-85.4474
US-Bn2	DBF	63.9198	-145.3782
US-Slt	DBF	39.9138	-74.596
US-Wi8	DBF	46.7223	-91.2524
US-Blo	ENF	38.8953	-120.6328
US-KS1	ENF	28.4583	-80.6709
US-SP2	ENF	29.7648	-82.2448
US-AR2	GRA	36.6358	-99.5975
US-Arc	GRA	35.5465	-98.04
US-Ctn	GRA	43.95	-101.8466

Start Date 

End Date  

Is Date Recurring?

Select the layers to include in the sample 

Selected layers

<input type="checkbox"/> _500m_16_days_NDVI	500m, 16 day
<input type="checkbox"/> Gpp_500m	500m, 8 day
<input type="checkbox"/> LST_Day_1km	1000m, 8 day

Area Extraction (Beta) - Request Form

USGS AppEEARS Extract Explore Order Tracking Help

Extract Area Sample BETA

Enter a name to identify your sample

Jasper_Fire_Aug2000

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: 01-01-2000

End Date: 09-20-2012

Is Date Recurring?

Select the layers to include in the sample

Search for a product

Selected file (AppEEARS_Area)



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

Selected layers

<input type="checkbox"/> _250m_16_days_NDVI	250m, 16 day
<input type="checkbox"/> LST_Day_1km	1000m, 8 day
<input type="checkbox"/> LST_Night_1km	1000m, 8 day
<input type="checkbox"/> NDVI_TOA	30m, Yearly
<input type="checkbox"/> FireMask	1000m, 8 day

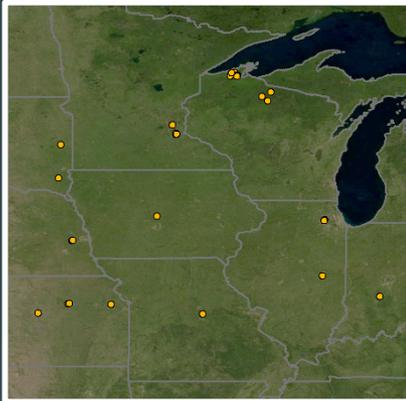
Output Options

File Format: GeoTiff

Projection: Native Projection ✕

▶ Submit ✕ Cancel

AppEEARS Point Example



Study Area

- AmeriFlux towers within the Mid-Continent Intensive
- 40 features total

Time Span

- 2010-2012

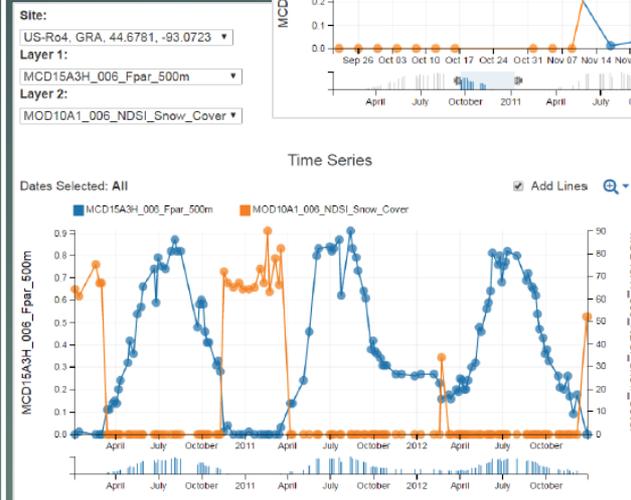
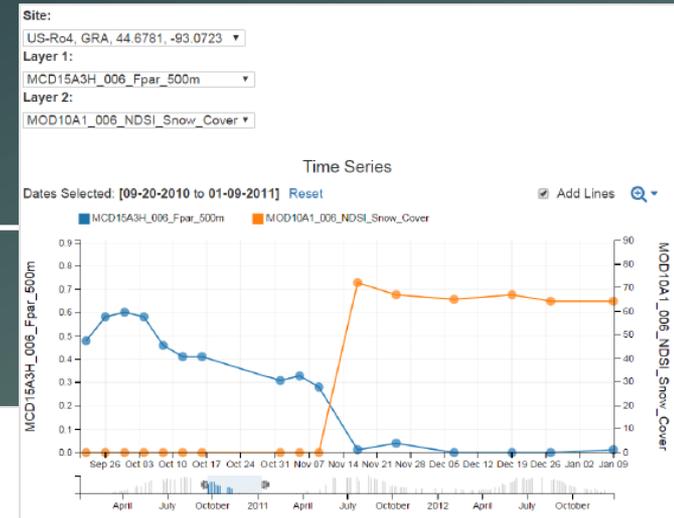
Output Format

- .csv file

Datasets

MODIS Daily Snow Cover (V6)

- Snow Cover
- MODIS 4-Day LAI & FPAR
- FPAR



**Without
AppEEARS**

- 5,473 files
- 26 GB

**With
AppEEARS**

- 1 .zip file
- 320 KB



AppEARS Area Example

After Moore et al. 2015. A GIS-based method for defining snow zones: application to the western United States



Study Area

- Western United States
 - 11 States
- Single feature shapefile

Time Span

- 2000 – 2010
- January 1st – Jul 1st

Datasets

- MODIS 8d/500 m Snow
 - Snow Cover
- MODIS 8d/1,000 m LST
 - LST
- NASA SRTM 3 arc second
 - Elevation

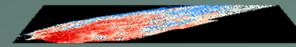
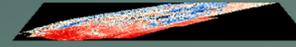
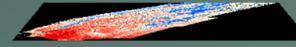
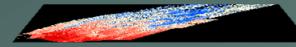
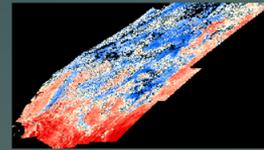
Projection

- Native

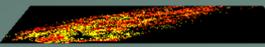
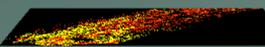
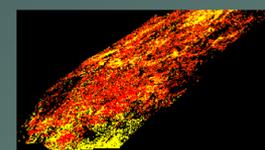
Format

- GeoTIFF

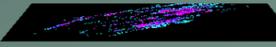
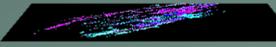
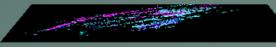
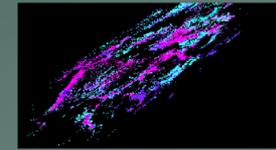
MOD11A2.005
LST_Day_1km



MOD11A2.005
QC_Day



MOD10A2.005
8_Day_Snow_Cover



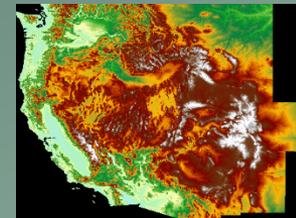
**Without
AppEARS**

- 3,600 files
- 13 GB

**With
AppEARS**

- 600 files
- 2.9 GB

SRTMGL3S
Elevation



AppEARS Area Example

After Wimberly et al. 2009. Assessing fuel treatment effectiveness using satellite imagery and spatial statistics.



Study Area

- Camp 32 Fire (Montana)
 - School Fire (Washington)
 - Warm Fire (Arizona)
- Multi-feature shapefiles
25 features total

Time Span

- 2005-2006

Projection

- CONUS Albers EA

Datasets

WELD CONUS Weekly/30m

- (B4, B7, NDVI)

MODIS 8d/500m Surface Reflectance

- (B2, B7)

MODIS 16d/250m VI

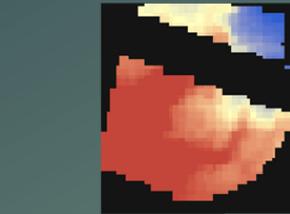
- (NDVI)

Format

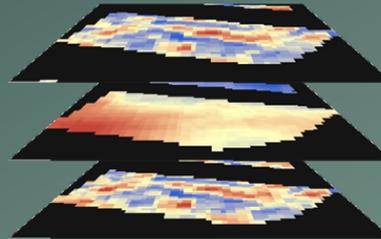
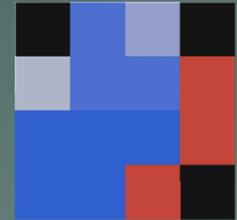
- GeoTIFF

Feature 1

WELDUSWK V015
Band4_TOA_REF



MOD09A1.006
Surf_refl_b02



**Without
AppEARS**

- 900 files
- 101 GB

**With
AppEARS**

- 23,000 files
- 0.02 GB

Plus many remaining
features & variables



Why use AppEEARS?

- Quickly extract time series data from multiple datasets at multiple AOIs
- Reduces the amount of data to download
- Perform EDA of sample results before download
- Receive just the data you want in an easy to analyze format (.csv, GeoTIFF, NetCDF)
- Receive fully decoded MODIS and WELD quality information and SRTM source information

<https://lpdaacsvc.cr.usgs.gov/appears/>