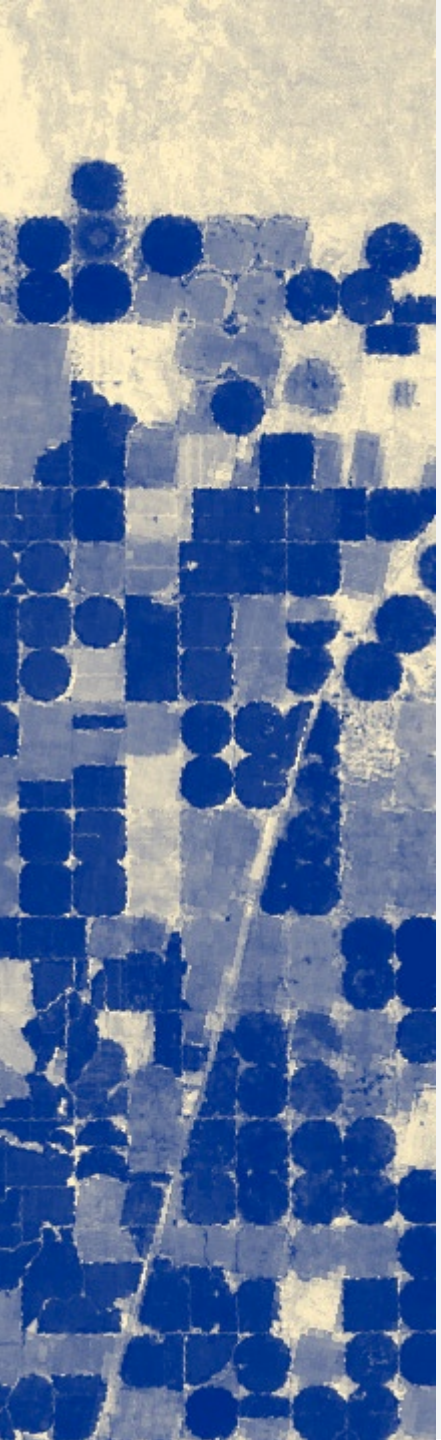


National Aeronautics and
Space Administration

ARSET
Applied Remote Sensing Training
http://arset.gsfc.nasa.gov
@NASAARSET

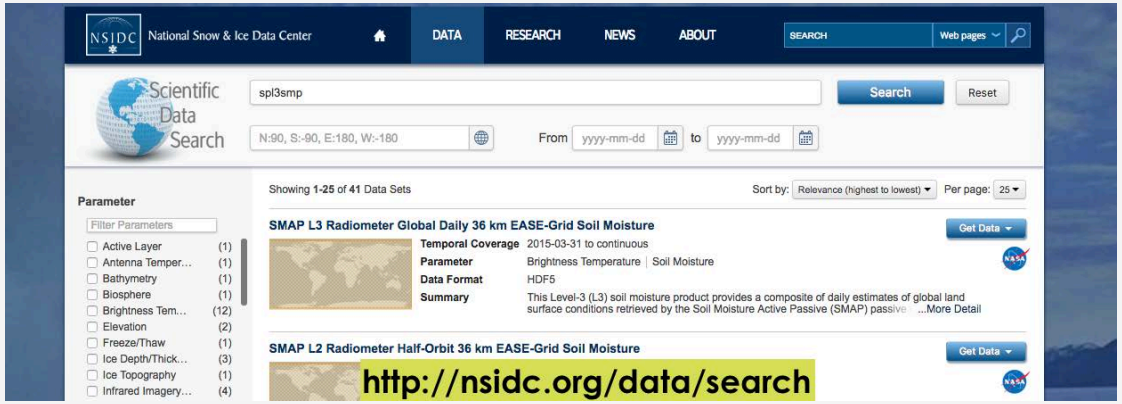
Session Three:
Accessing Soil Moisture Active Passive (SMAP) Data

Amy FitzGerrell, National Snow and Ice Data Center (NSIDC)

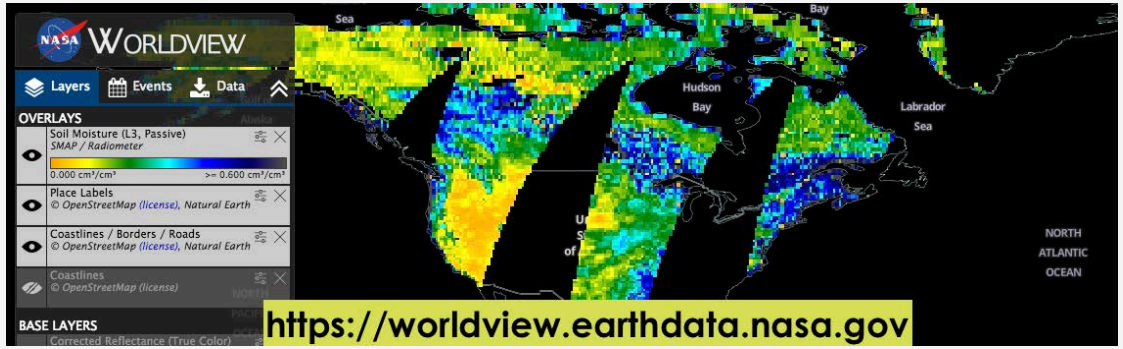
September 15, 2016

SMAP Data Access Options

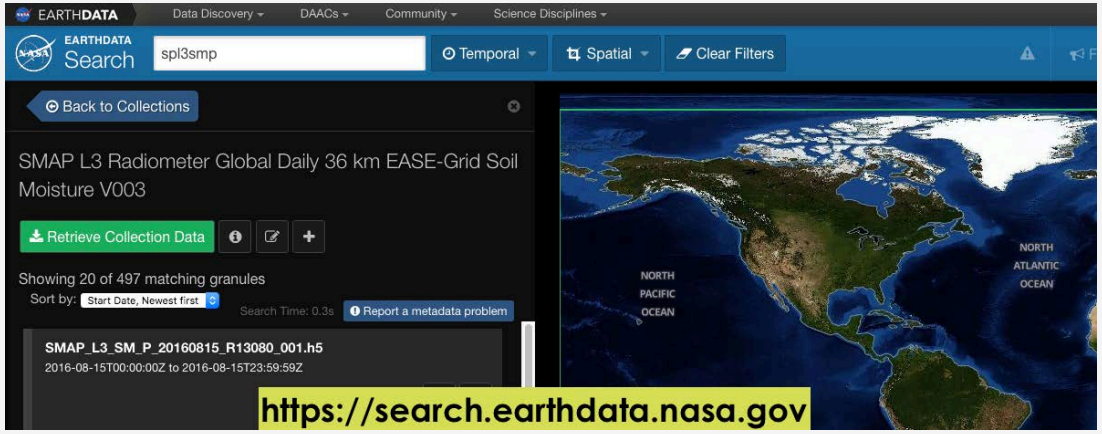
Data Search, Documentation and Access: NSIDC



Data Visualization and Download: Worldview



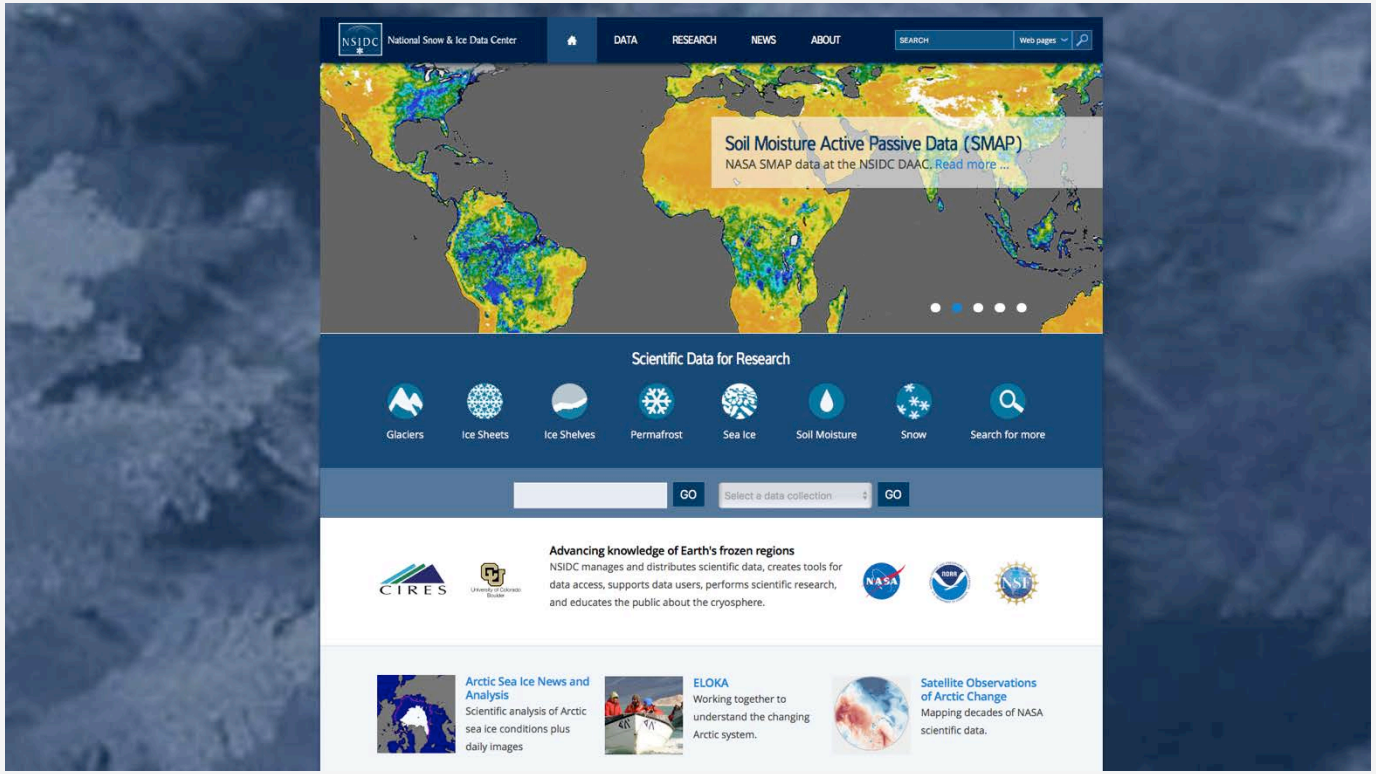
Data Access and Output Customization: Earthdata Search



Discovering SMAP Data at NSIDC

http://nsidc.org/

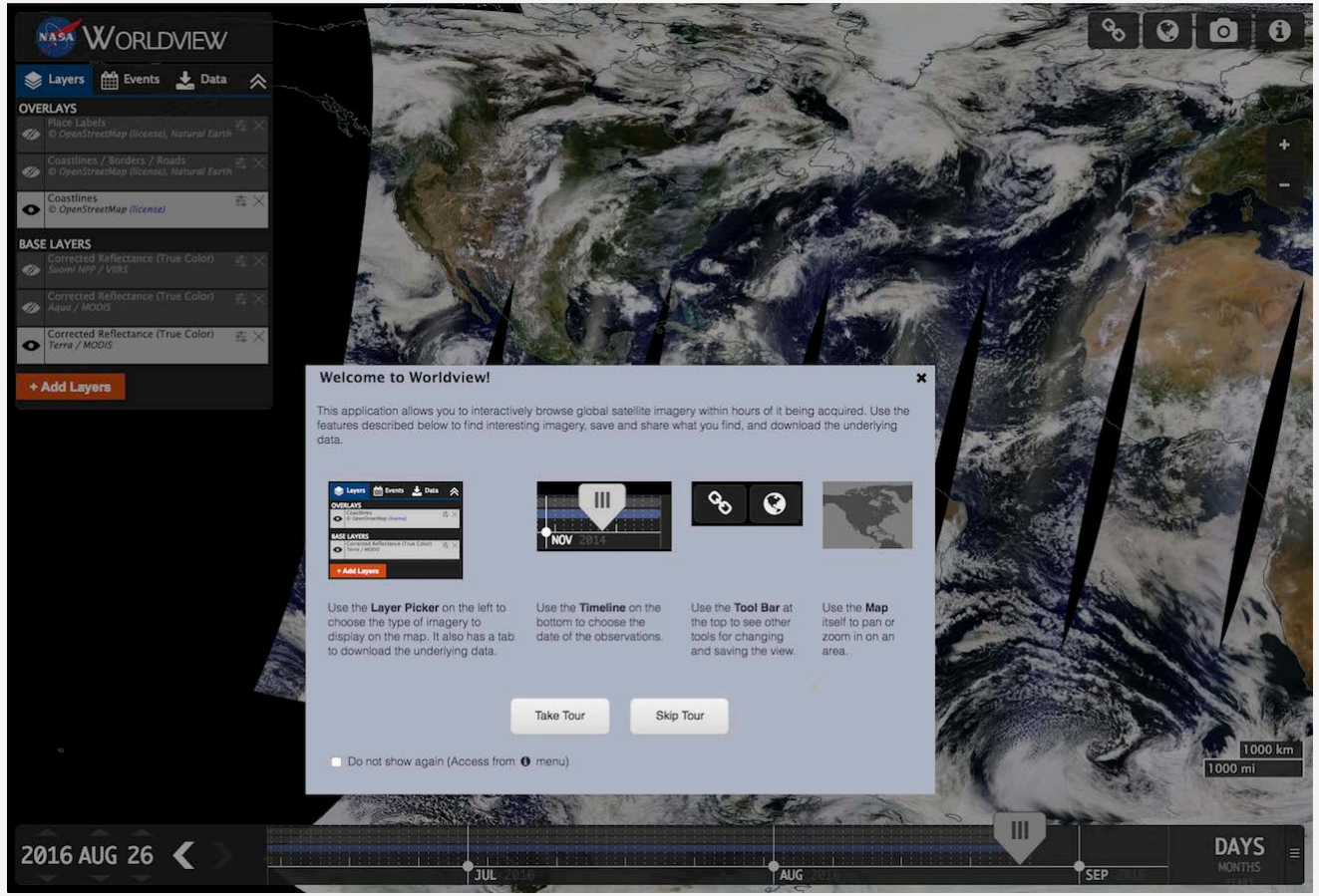
- NASA National Snow & Ice Data Center (NSIDC) is a Distributed Active Archive Center (DAAC)
- 1 of 12 NASA Earth Observing System Data and Information System (EOSDIS) DAACs
- Distributes nearly 500 NASA data sets
  - primarily focused on the cryosphere
- After the introduction, we'll take a tour of NSIDC's Scientific Data Search



Exploring SMAP Data in NASA's Worldview

http://worldview.earthdata.nasa.gov/

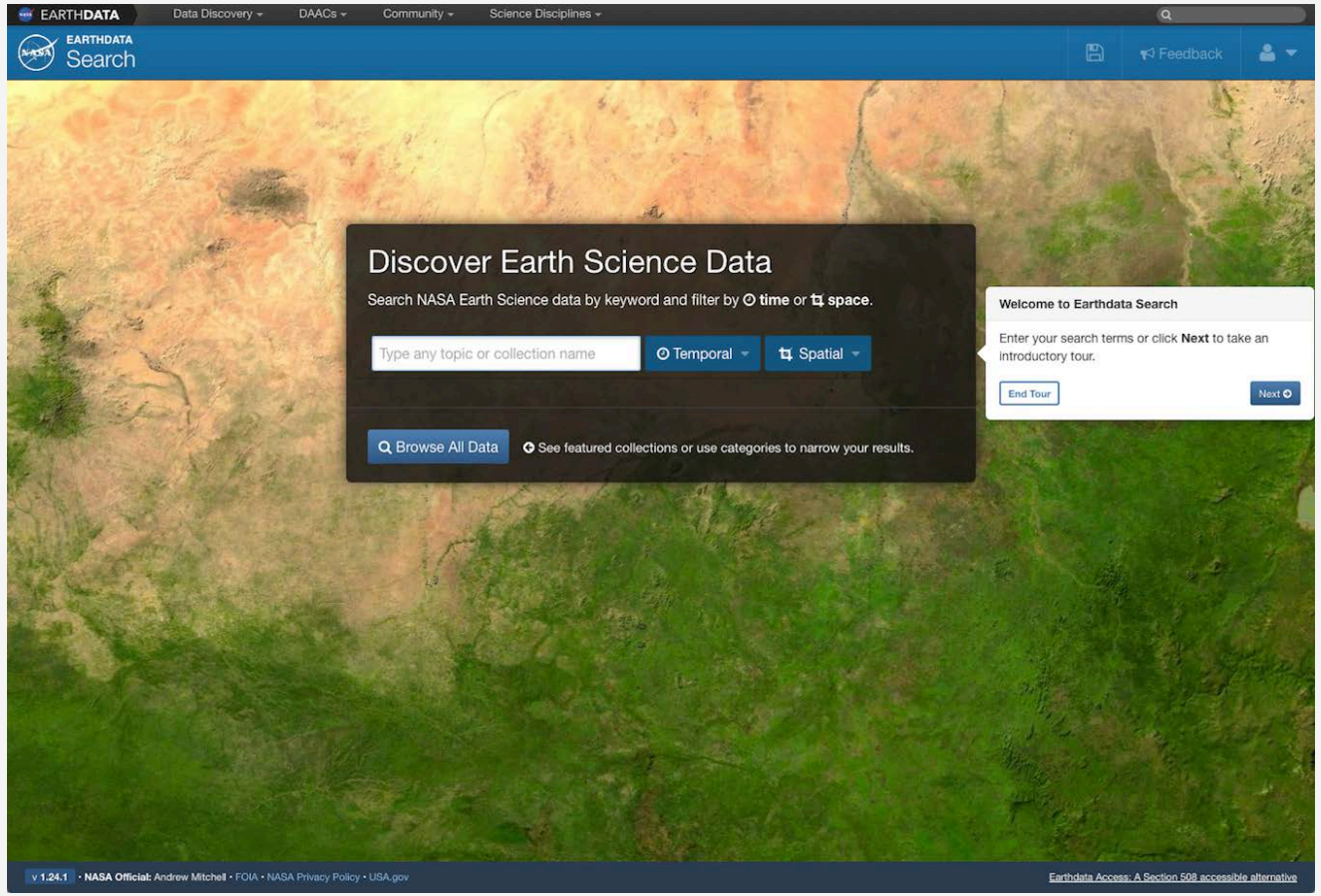
- Worldview provides you with the ability to interactively browse global, full-resolution satellite imagery and download the underlying data & image files
- Uses Global Imagery Browse Services (GIBS)
- Most of the 100+ available products are updated within 3 hrs of observation
- After the demonstration of SMAP data discovery & access at NSIDC, I'll take you through a tour of Worldview



Accessing SMAP Data with NASA's Earthdata Search

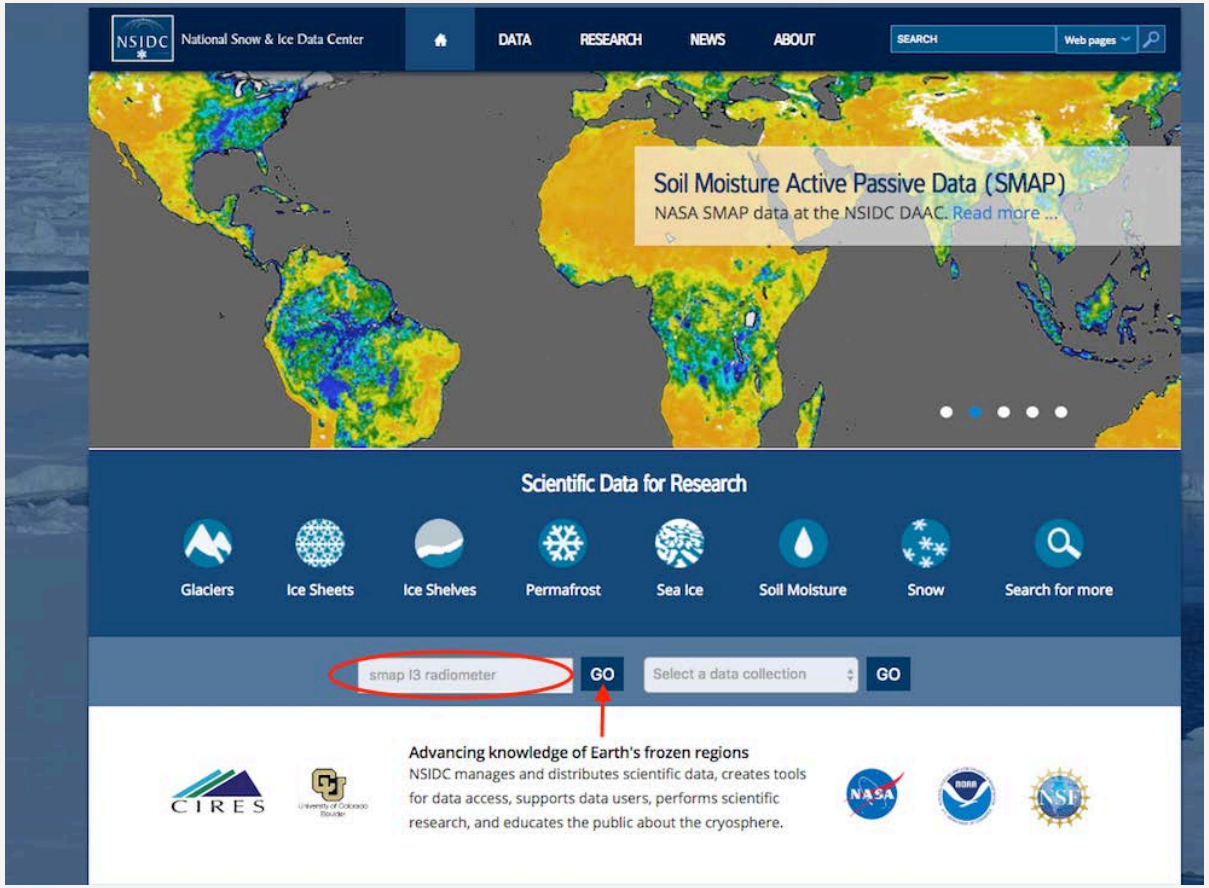
http://search.earthdata.nasa.gov/search

- Connects users to their data by making data search, discovery, and access available in one application
- Offers the ability to search across disciplines and DAACs
- For the last live demonstration, I'll go through
  - the interface's filtering options to hone a search for SMAP L3 Radiometer Global Daily 36 km EASE-Grid Soil Moisture (SPL3SMP)
  - available ordering and subsetting options



Discovering SMAP Data at NSIDC

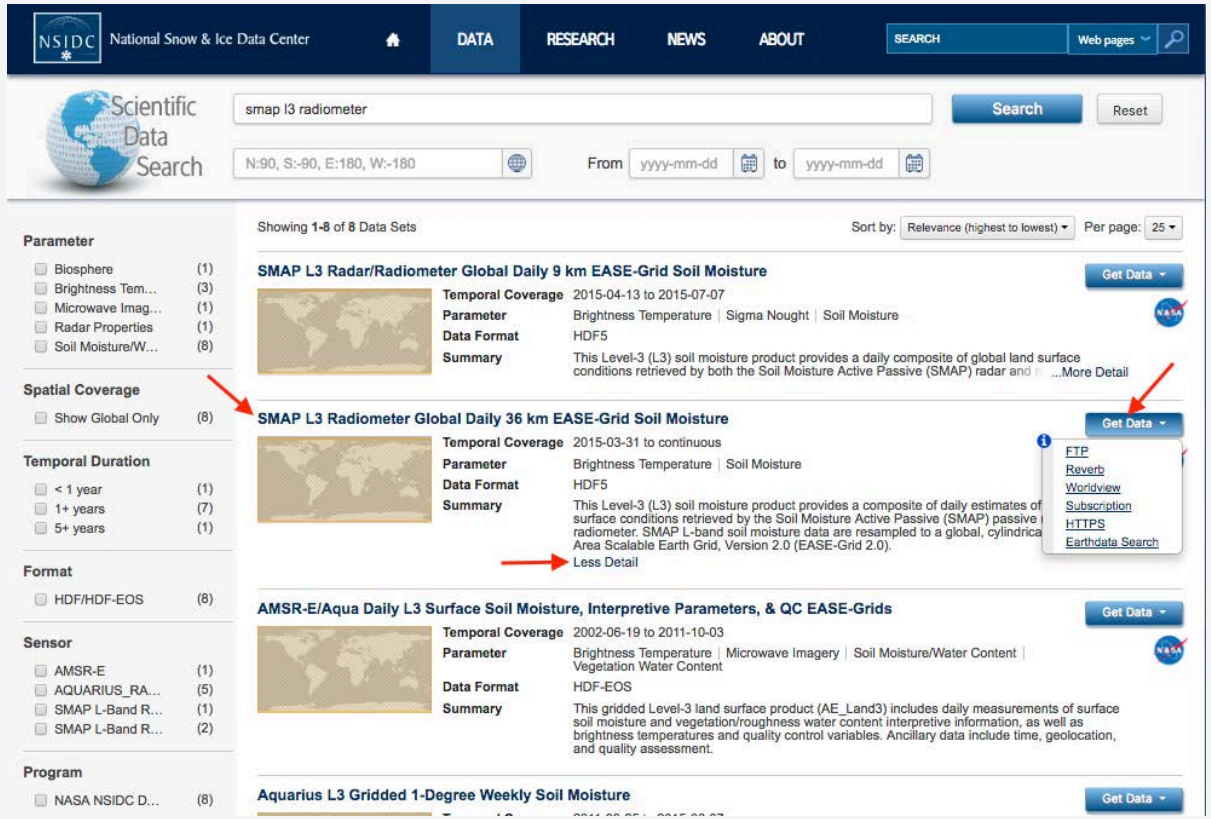
http://nsidc.org



Discovering SMAP Data at NSIDC

http://nsidc.org

Clicking on the data set name in the Search results will take you to the collection's catalog page

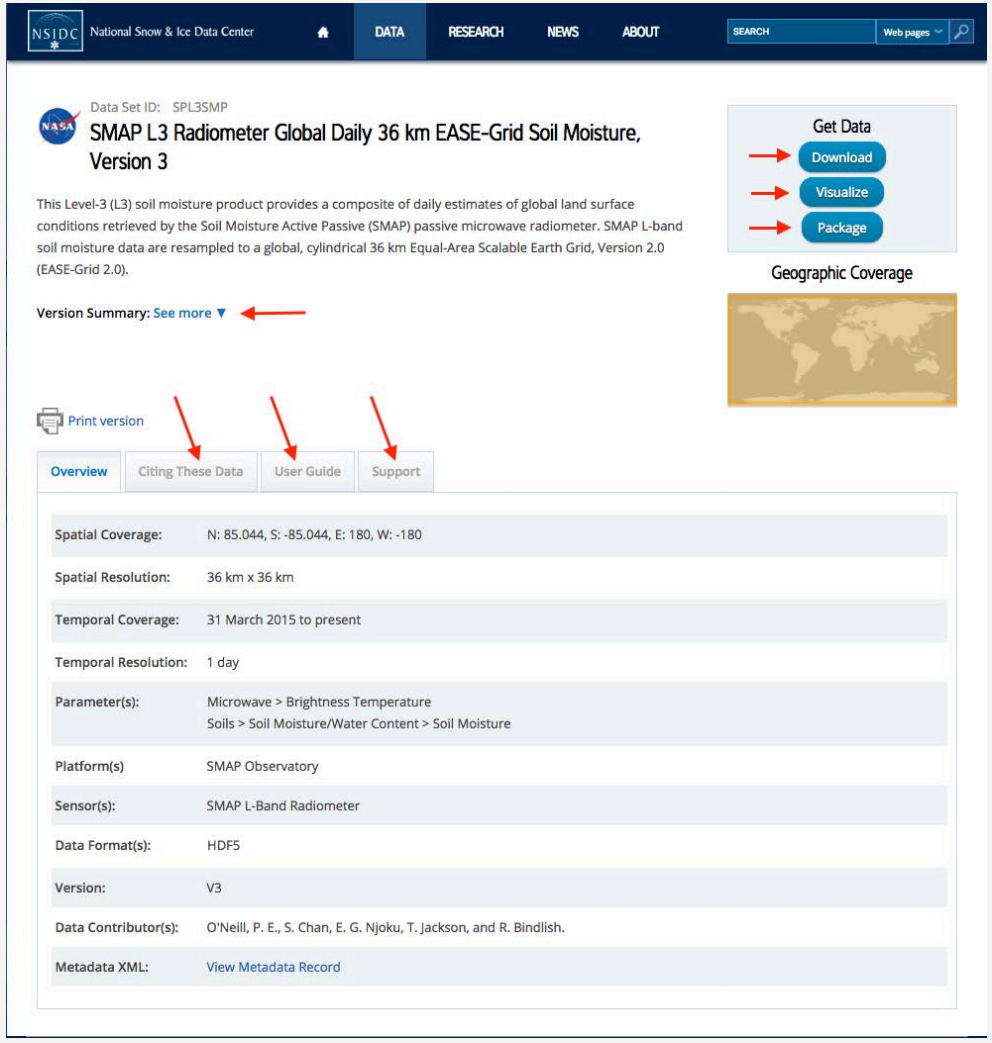


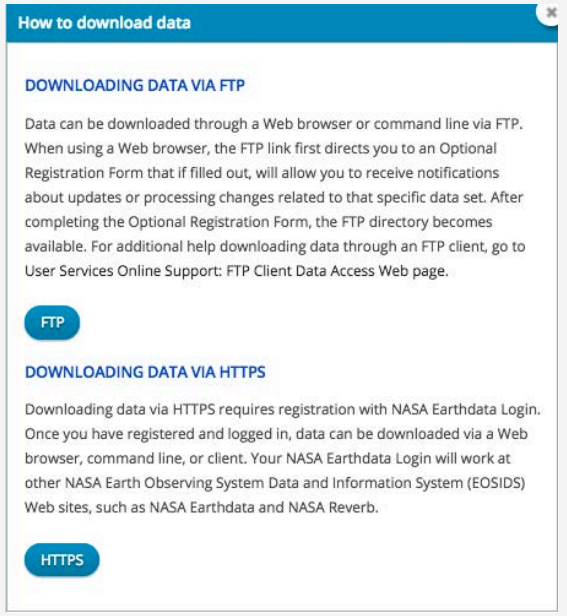
Discovering SMAP Data at NSIDC

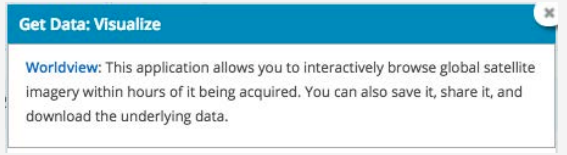
http://nsidc.org

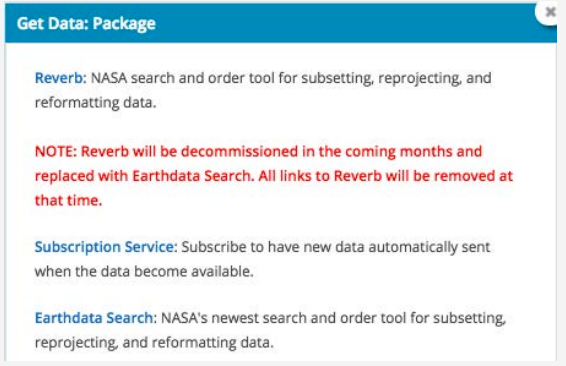
From the catalog page, you can use the Get Data options to explore options to download, visualize, and customize your data order

You'll also notice that there's an overview of the data in the collection. Clicking on the different tabs will highlight how to cite this data, provide you with a user guide, and how to reach NSIDC for support



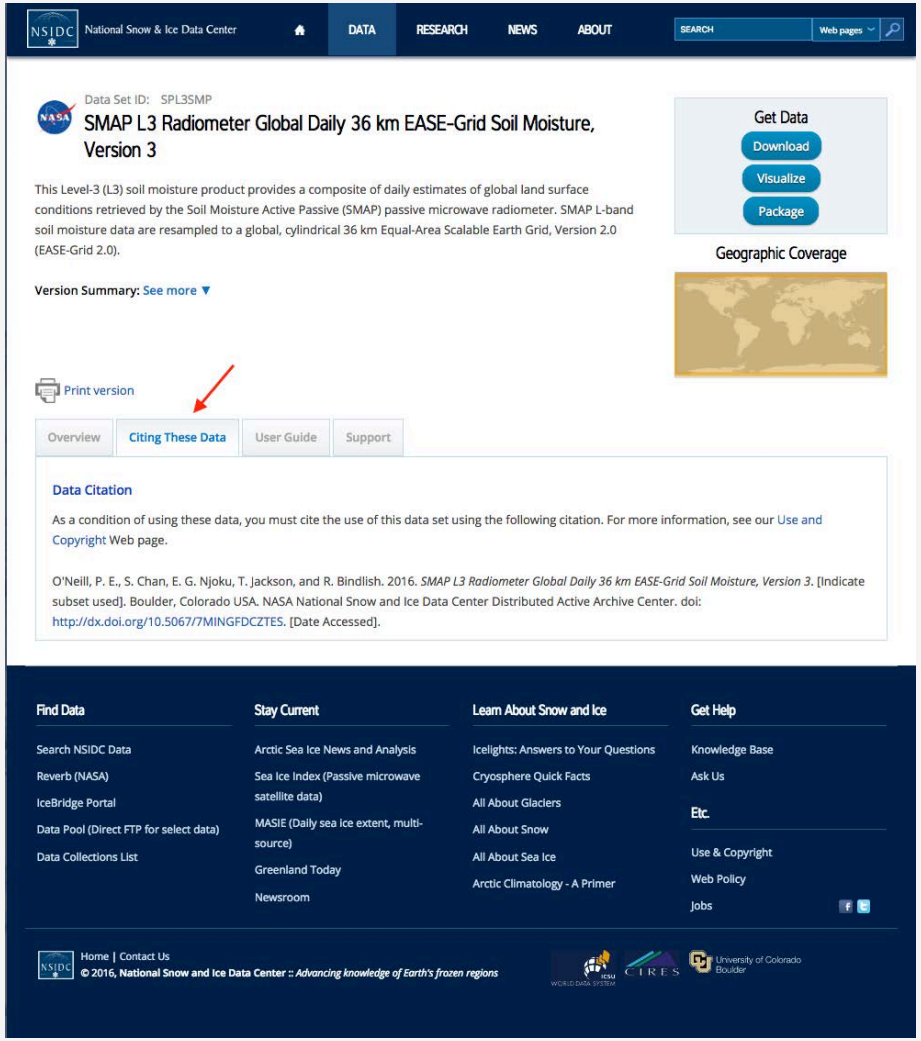






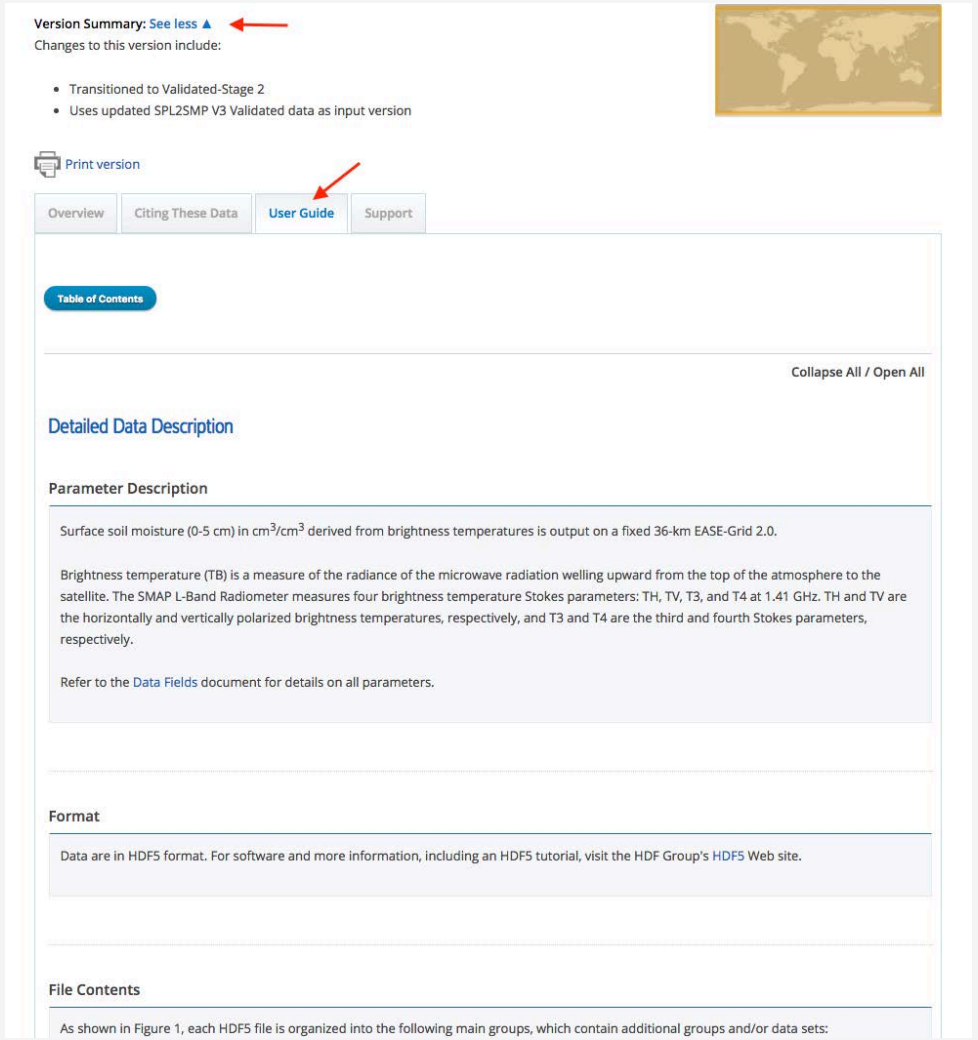
Discovering SMAP Data at NSIDC

http://nsidc.org



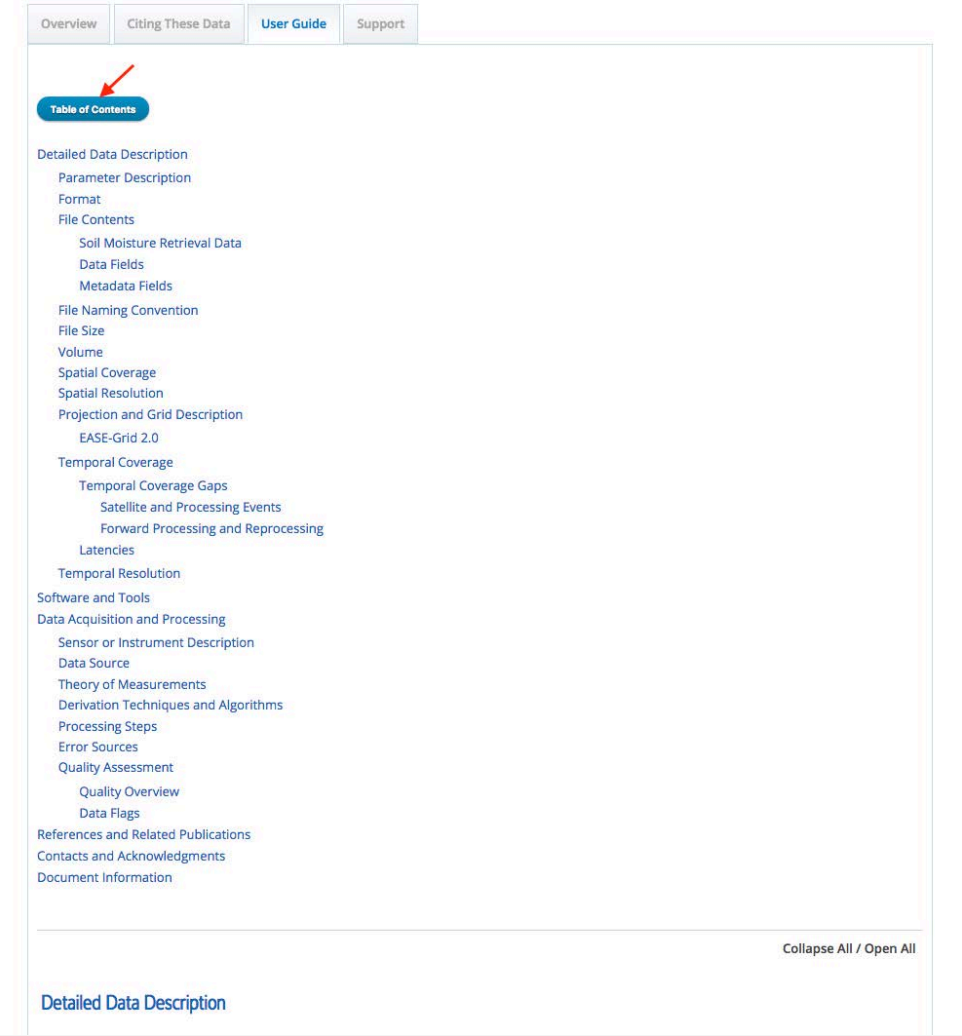
Discovering SMAP Data at NSIDC

http://nsidc.org



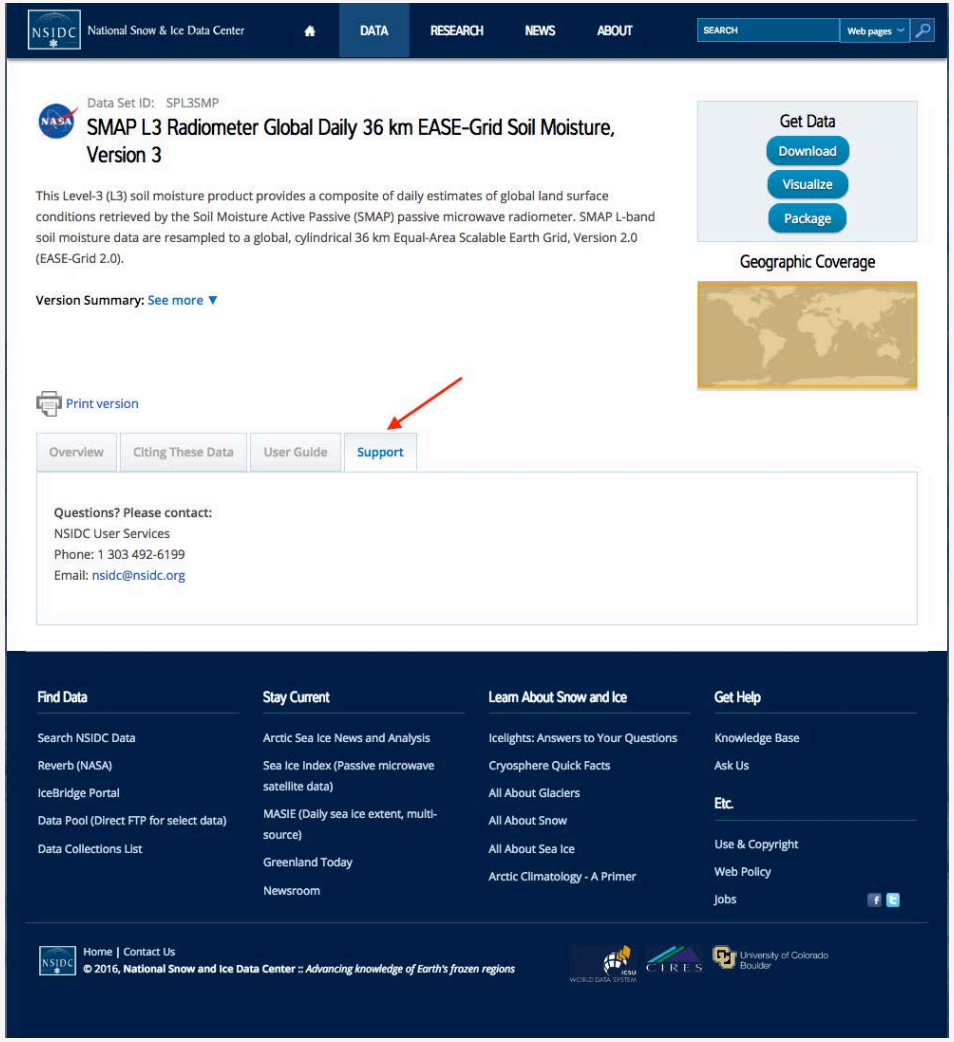
Discovering SMAP Data at NSIDC

http://nsidc.org



Discovering SMAP Data at NSIDC

http://nsidc.org



Tools that work with SMAP HDF5-formatted Data

http://nsidc.org/data/smap/tools

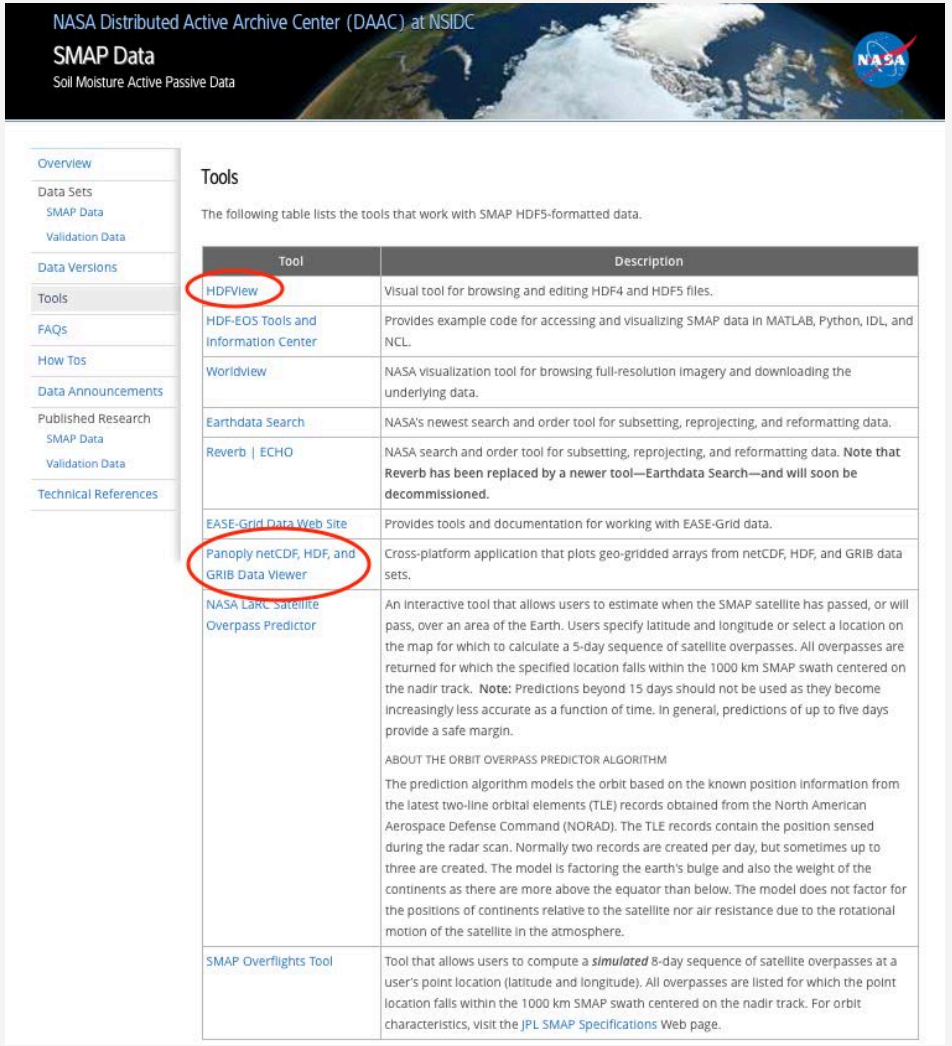
The native format of SMAP Data files is HDF5. NSIDC offers a tools page with a couple of tools for easy viewing of the HDF5 files: HDFView and Panoply.

For the SPL3SMP collection, Earthdata Search service options allow for the reformatting of the native HDF5 files to:

GeoTIFF, ASCII, NetCDF-3, NetCDF4-CF, KML, and HDF-EOS5

For a detailed table of what subsetting, reformatting, and reprojection services are available for SMAP collections, please see:

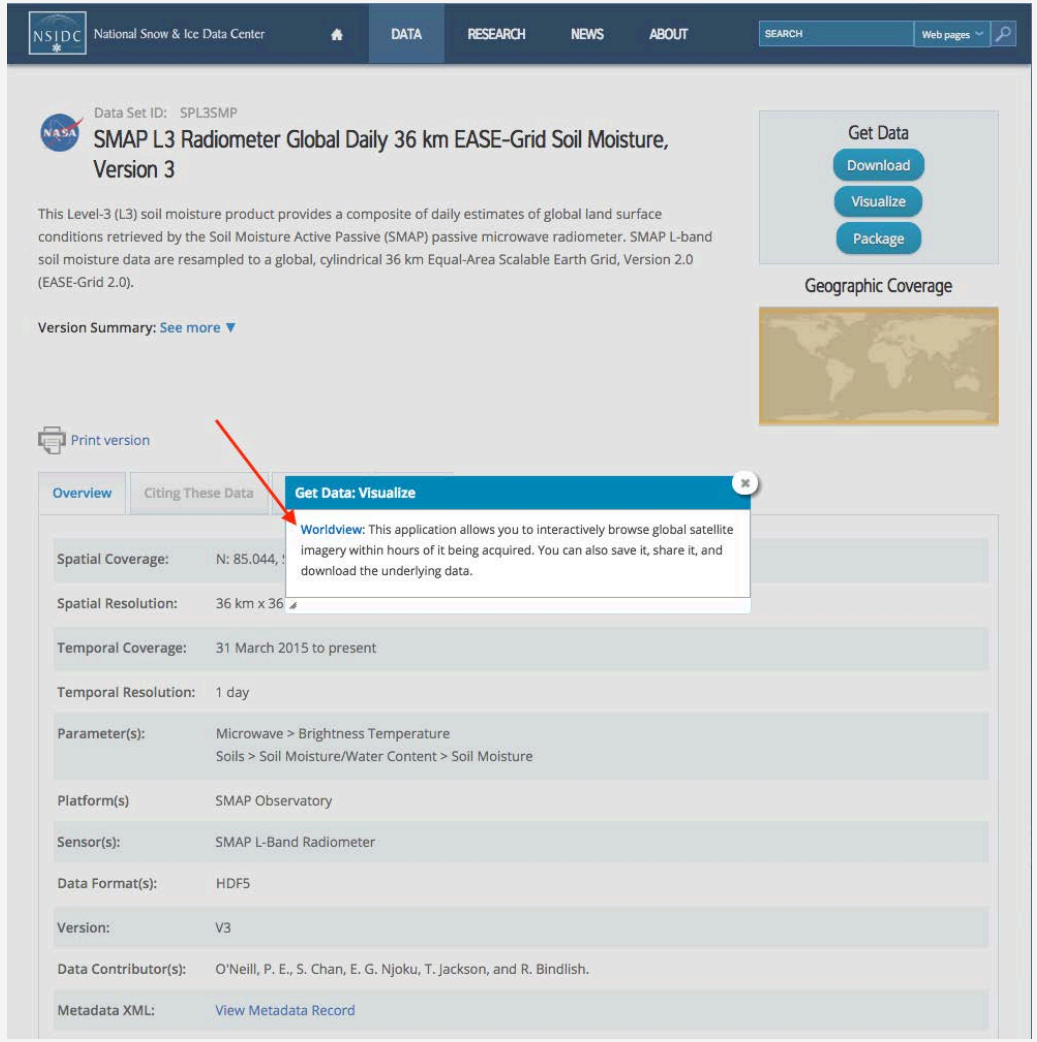
https://support.nsidc.org/entries/97456598-What-data-subsetting-reformatting-and-reprojection-services-are-available-for-SMAP-data-



Discovering SMAP Data at NSIDC

http://nsidc.org

Revisiting the Visualize button under Get Data, let's click Worldview and explore what this application has to offer.

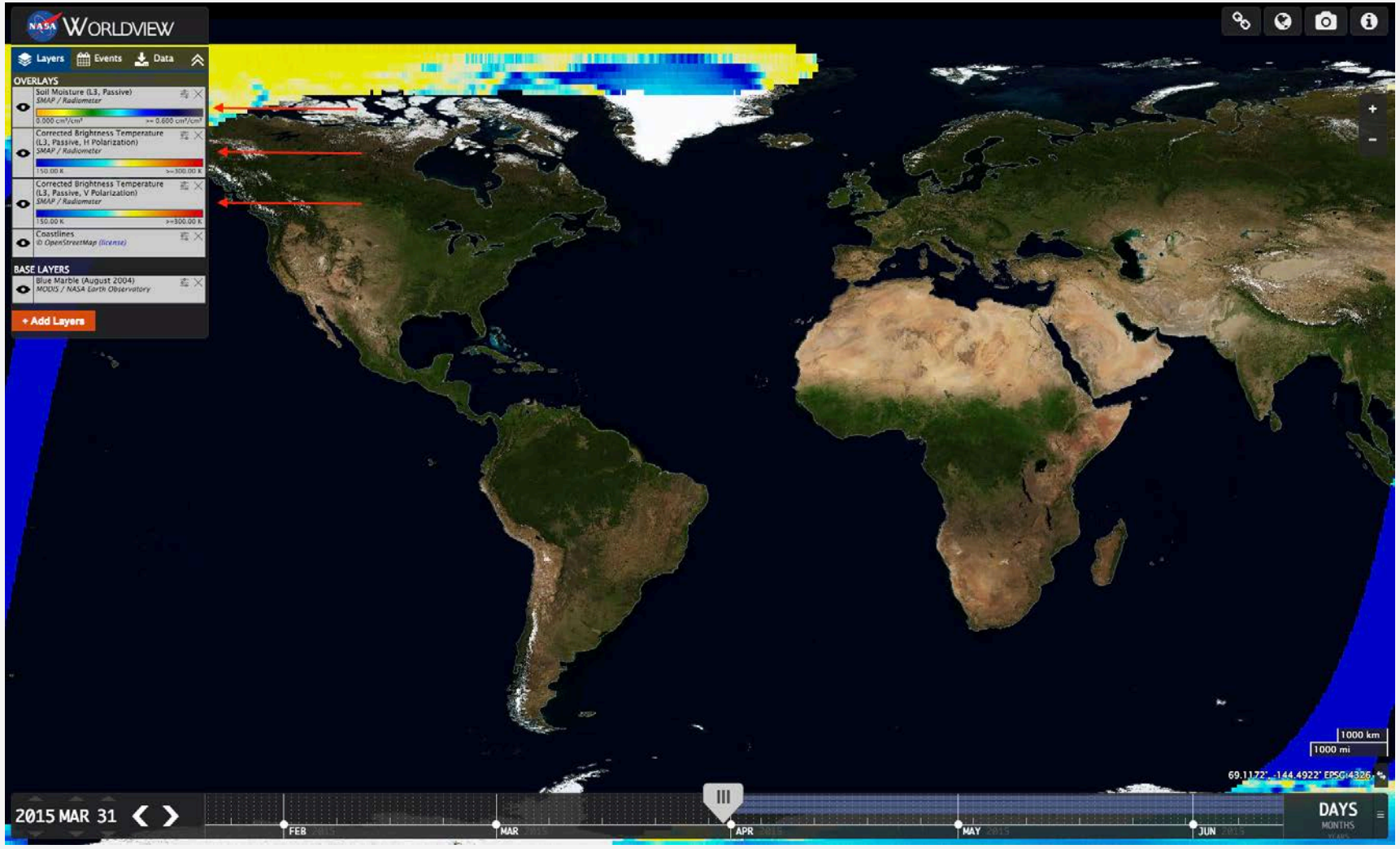


Visualizing and Accessing SMAP Data from Worldview

Launching Worldview from the SPL3SMP product page at NSIDC, you'll notice a few of the data set's parameters are included in the Overlays section by default.

Layers can be repositioned, by dragging, to change the draw order

- The layer at the top of the list draws on top of the layers below.

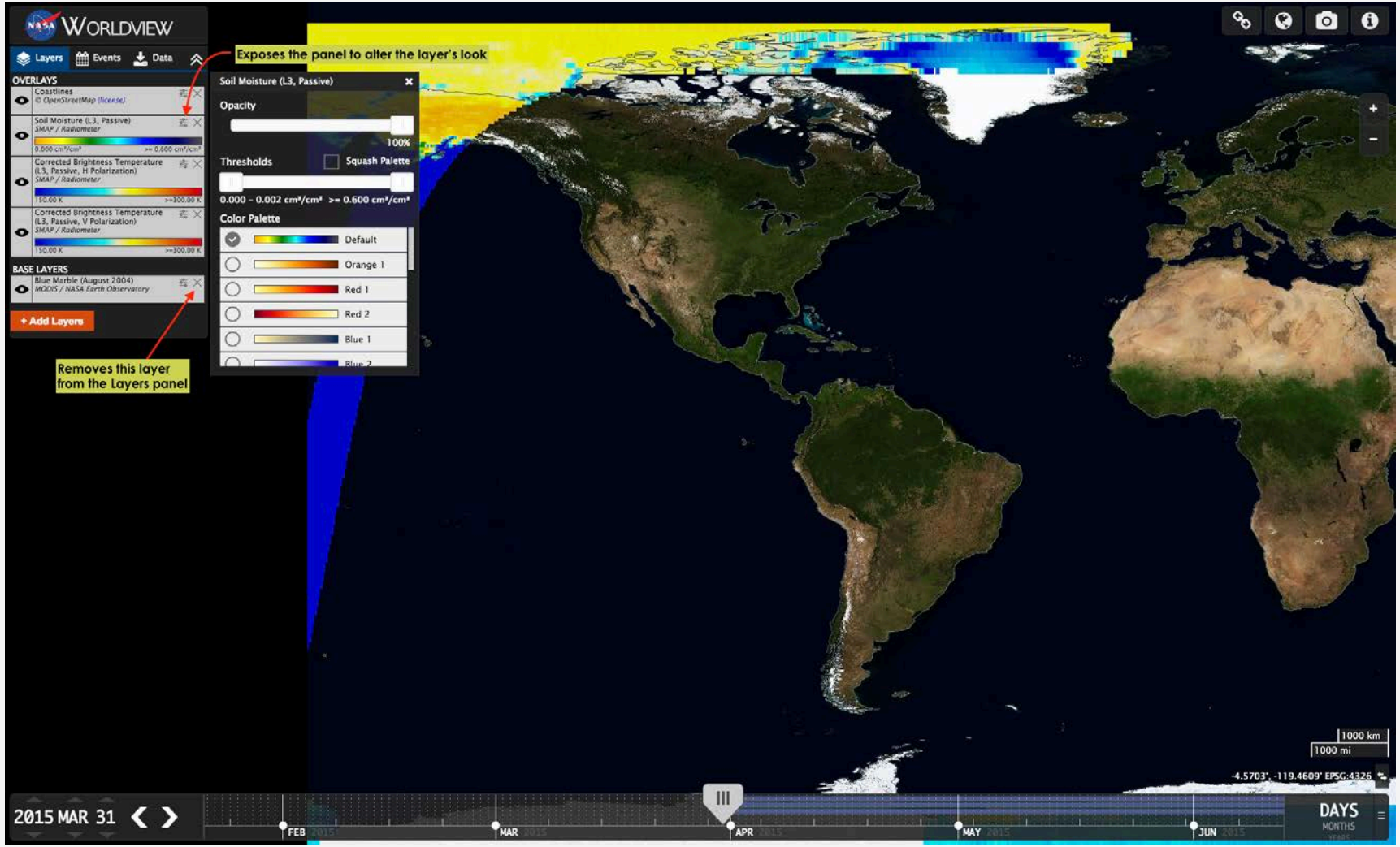


Visualizing and accessing SMAP Data from Worldview

Here, I've repositioned the Coastlines layer above Soil Moisture – notice the outlines visible in the Arctic over the Soil Moisture data.

Also, clicking on the slider-bar symbol will open a dialogue to allow for changing the layer's opacity, thresholds and color palette.

Clicking the "X" symbol for a layer removes it from the Layers panel.

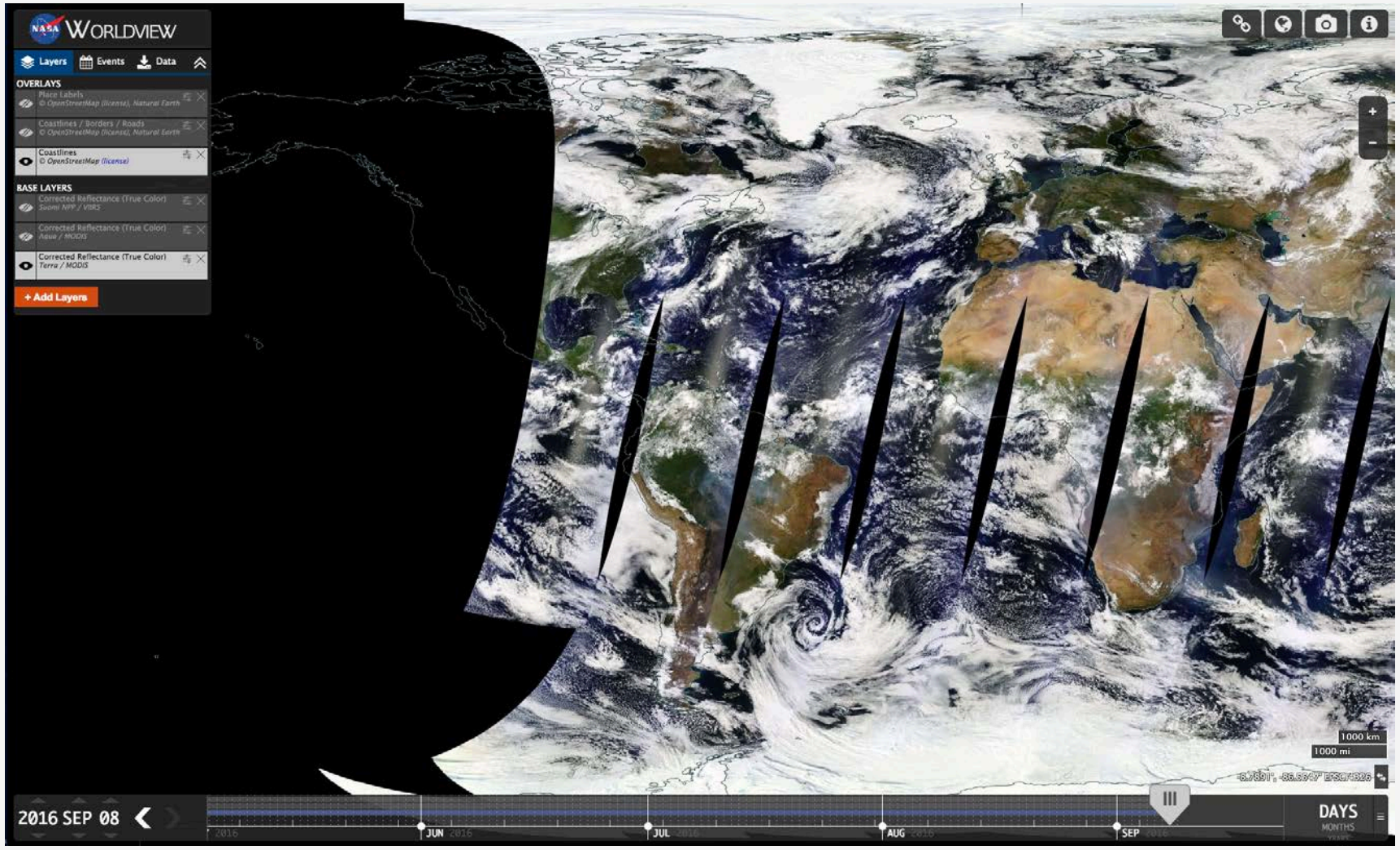


Visualizing and Accessing SMAP Data from Worldview

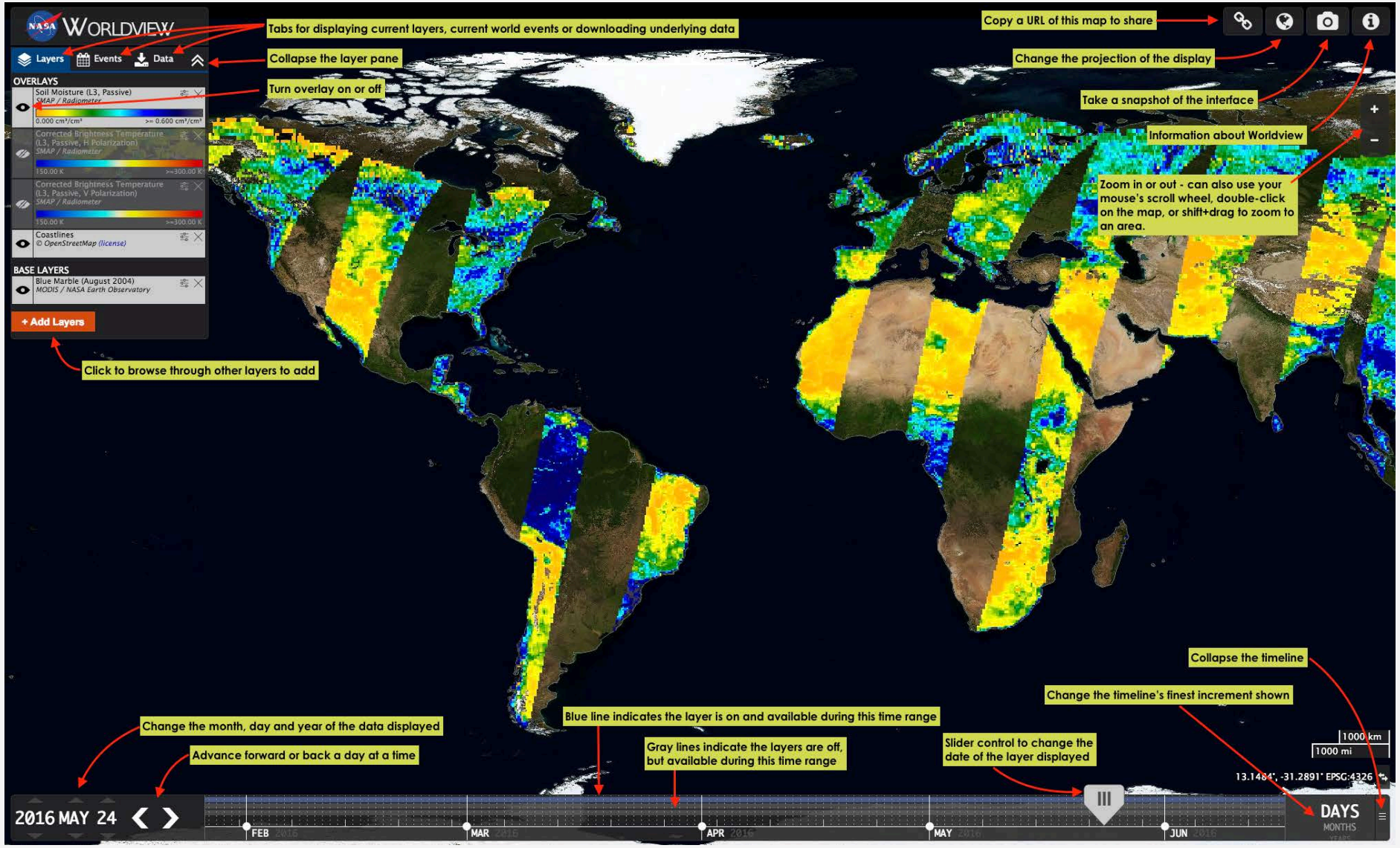
http://worldview.earthdata.nasa.gov

If you were to enter the URL above in your browser, you would see the default Overlays and Base Layers are different from what opens at NSIDC's link to Worldview from the SMAP product page.

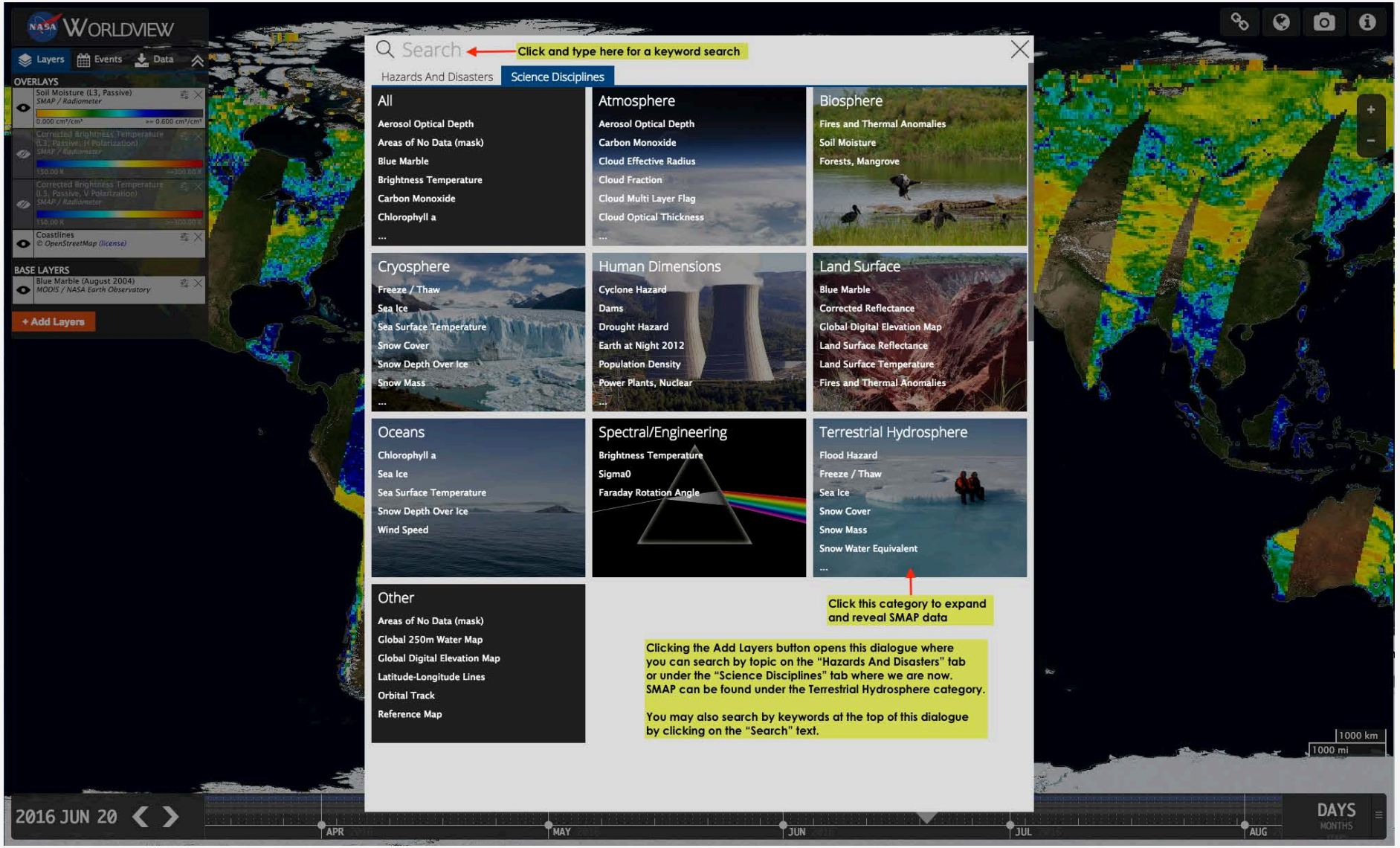
I'll go back to Worldview pre-loaded with SPL3SMP from the NSIDC site, and give you a tour of the interface.



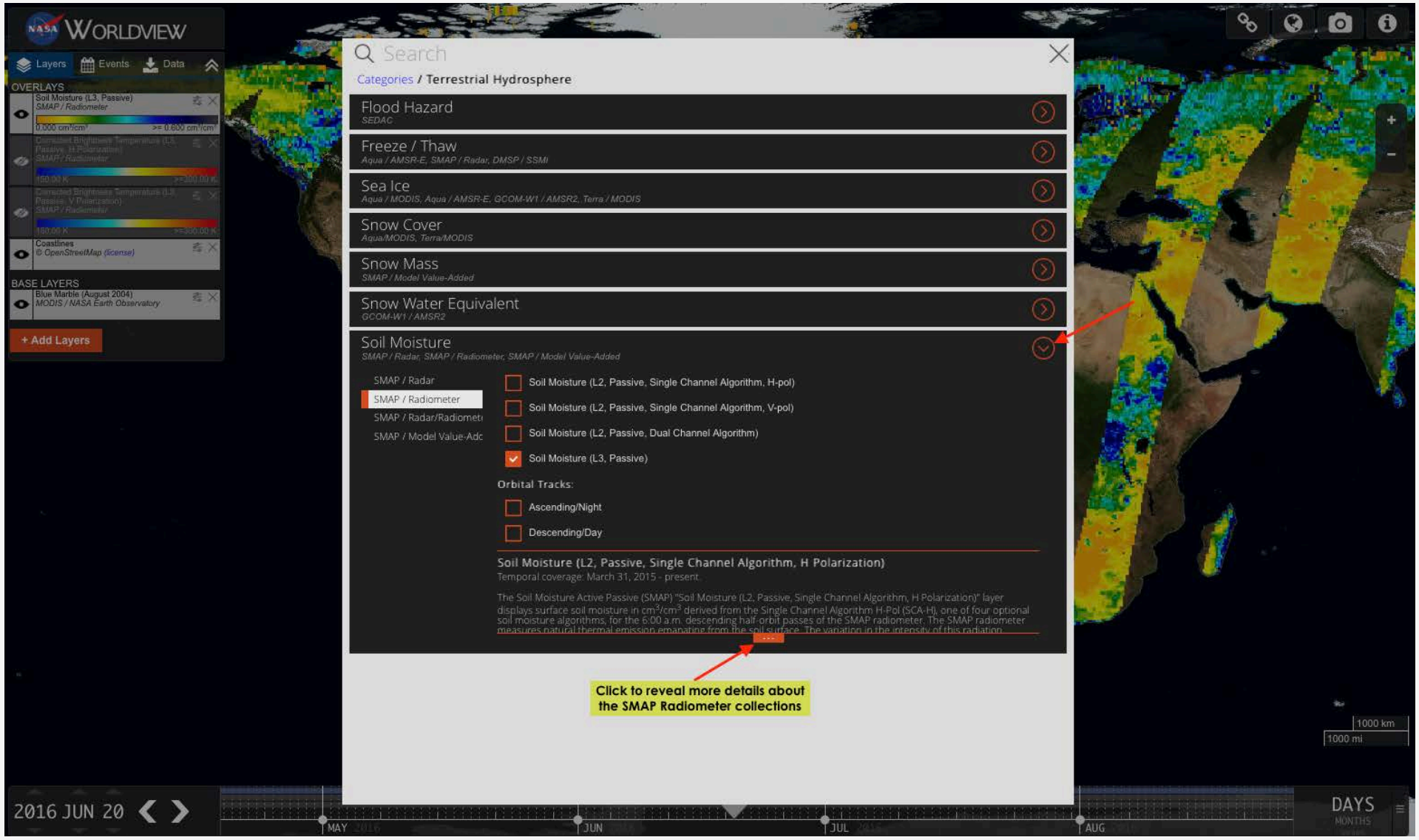
Exploring the Worldview Interface Further:



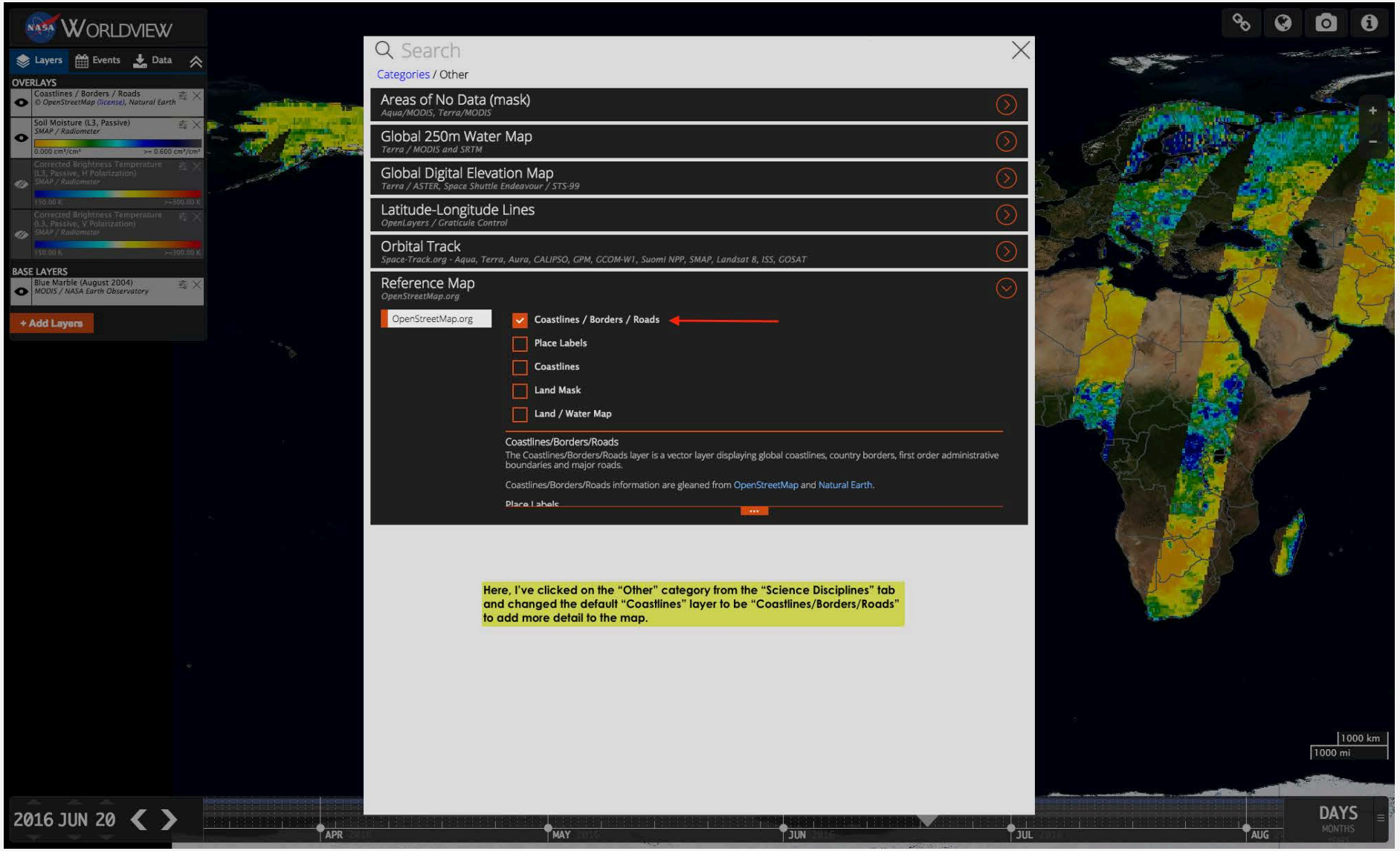
Exploring Layer options:



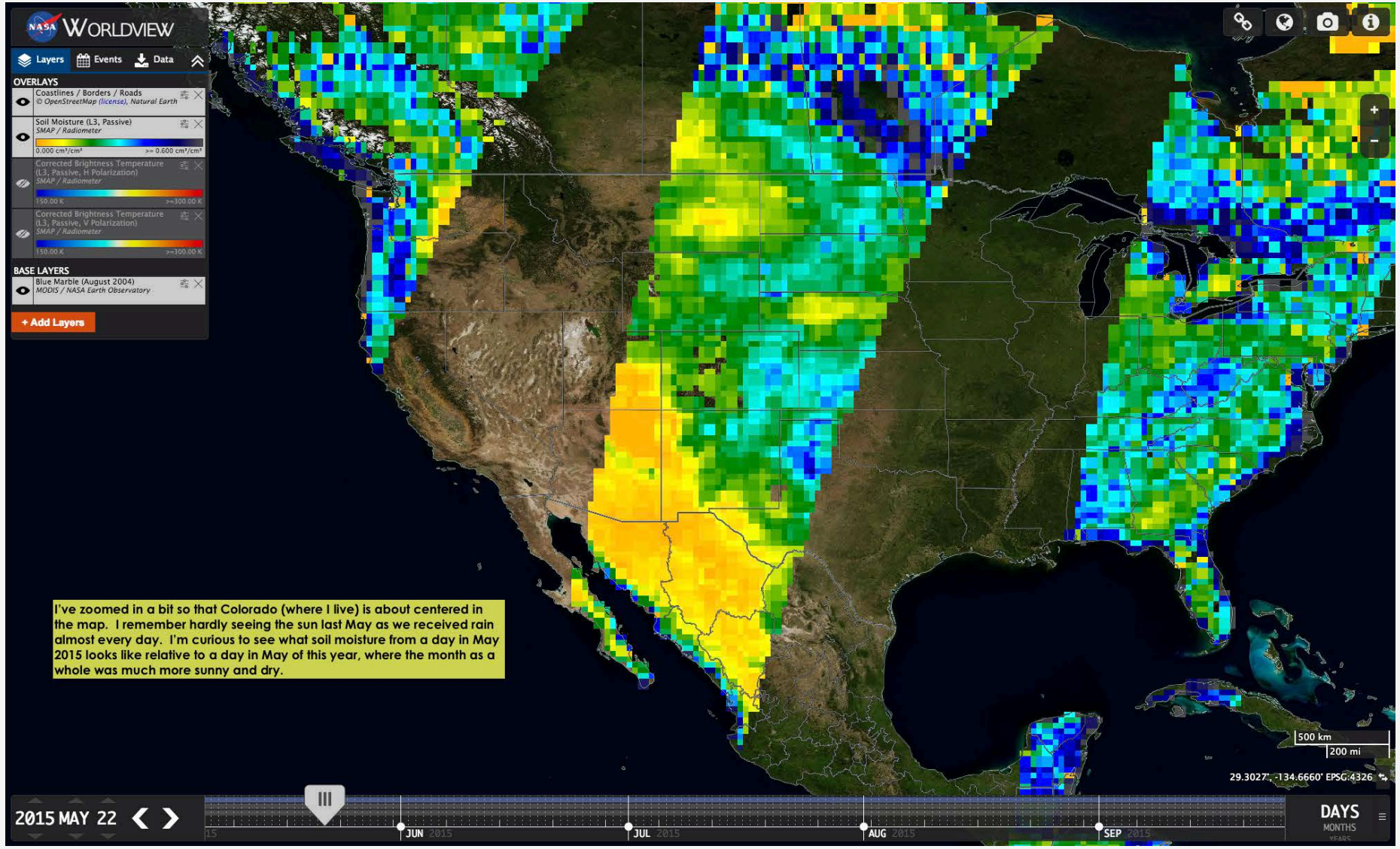
SMAP Layer options:



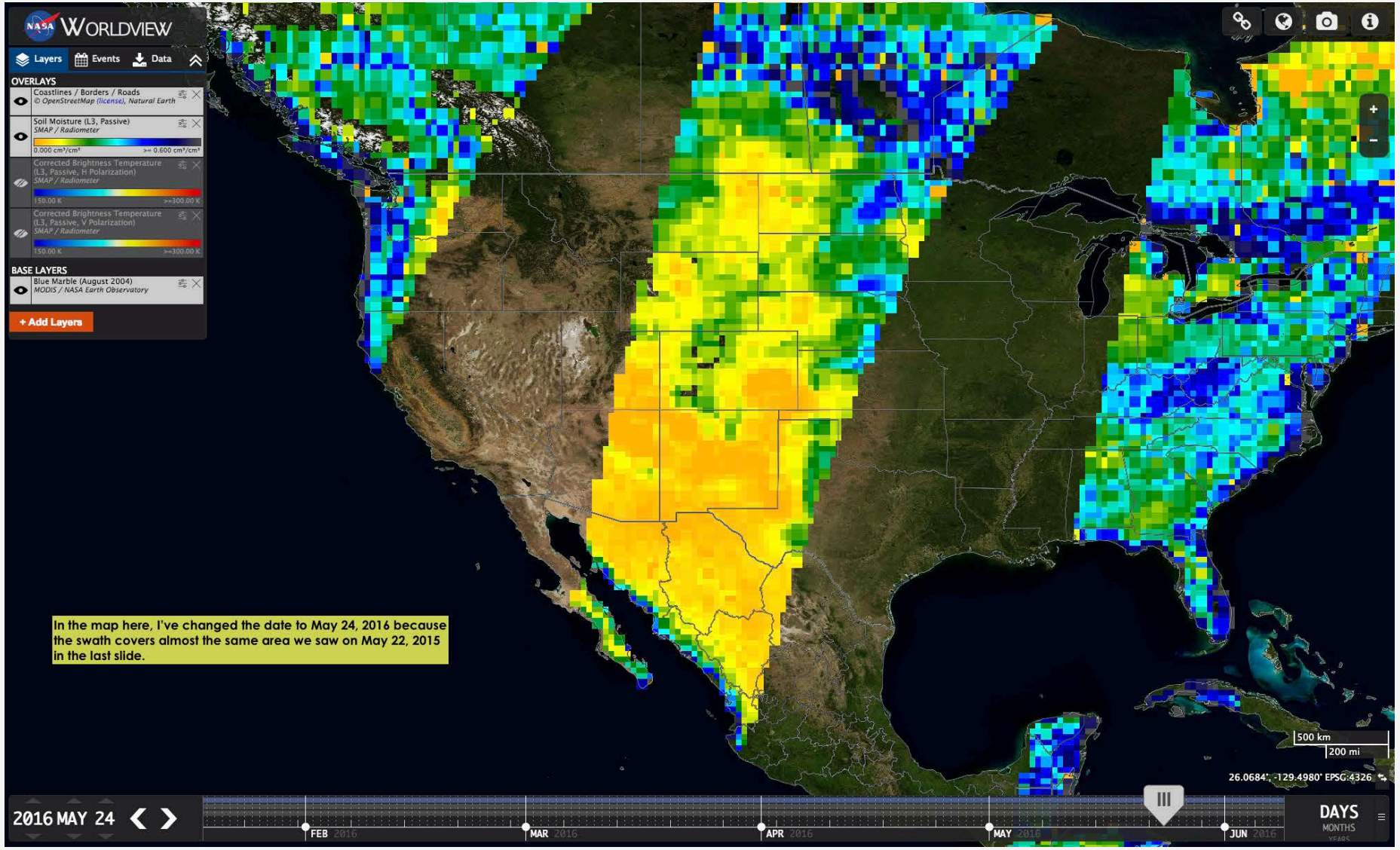
Adding an overlay: Coastlines / Borders / Roads



A Quick Comparison of Soil Moisture Across Time…

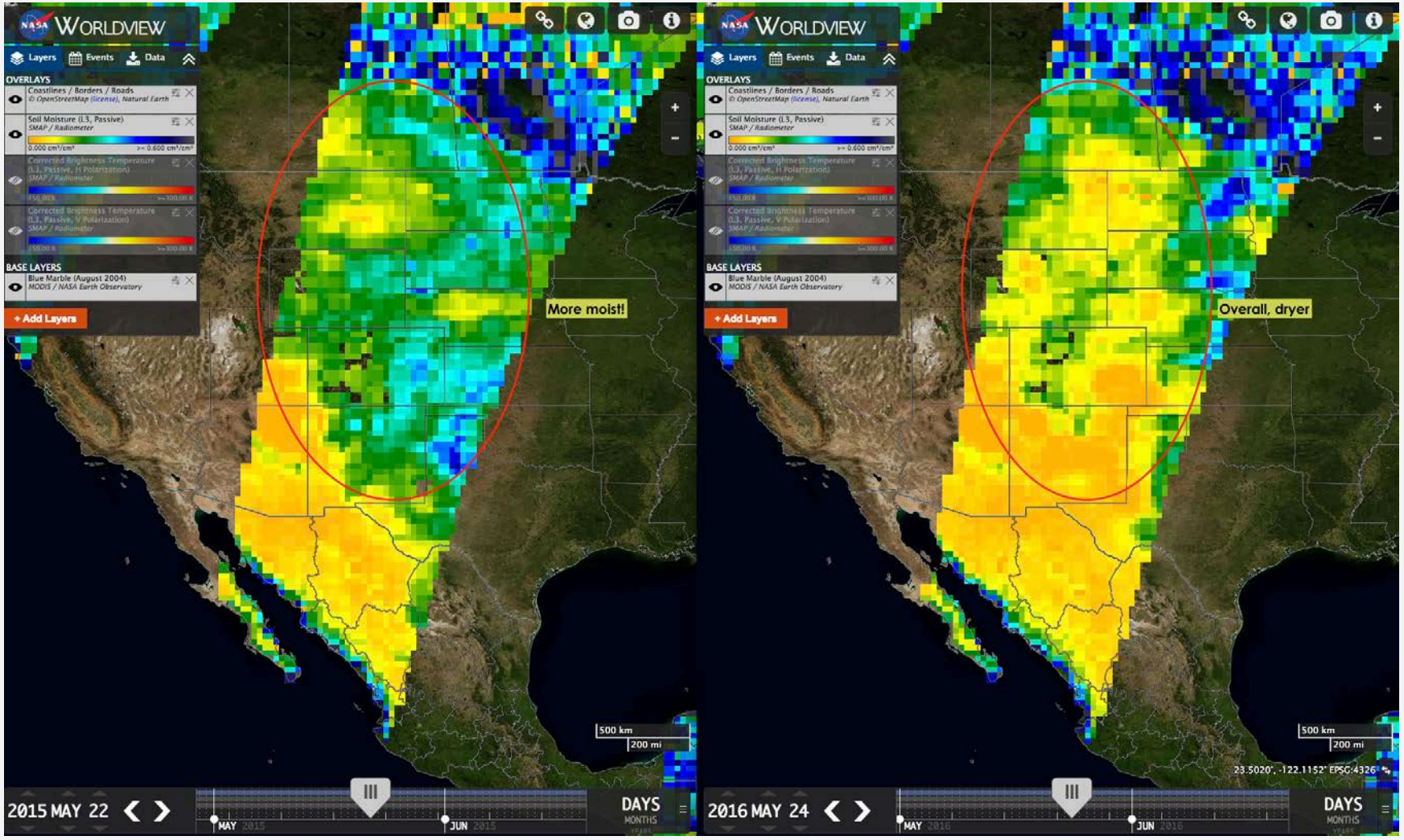


A Quick Comparison of Soil Moisture Across Time…

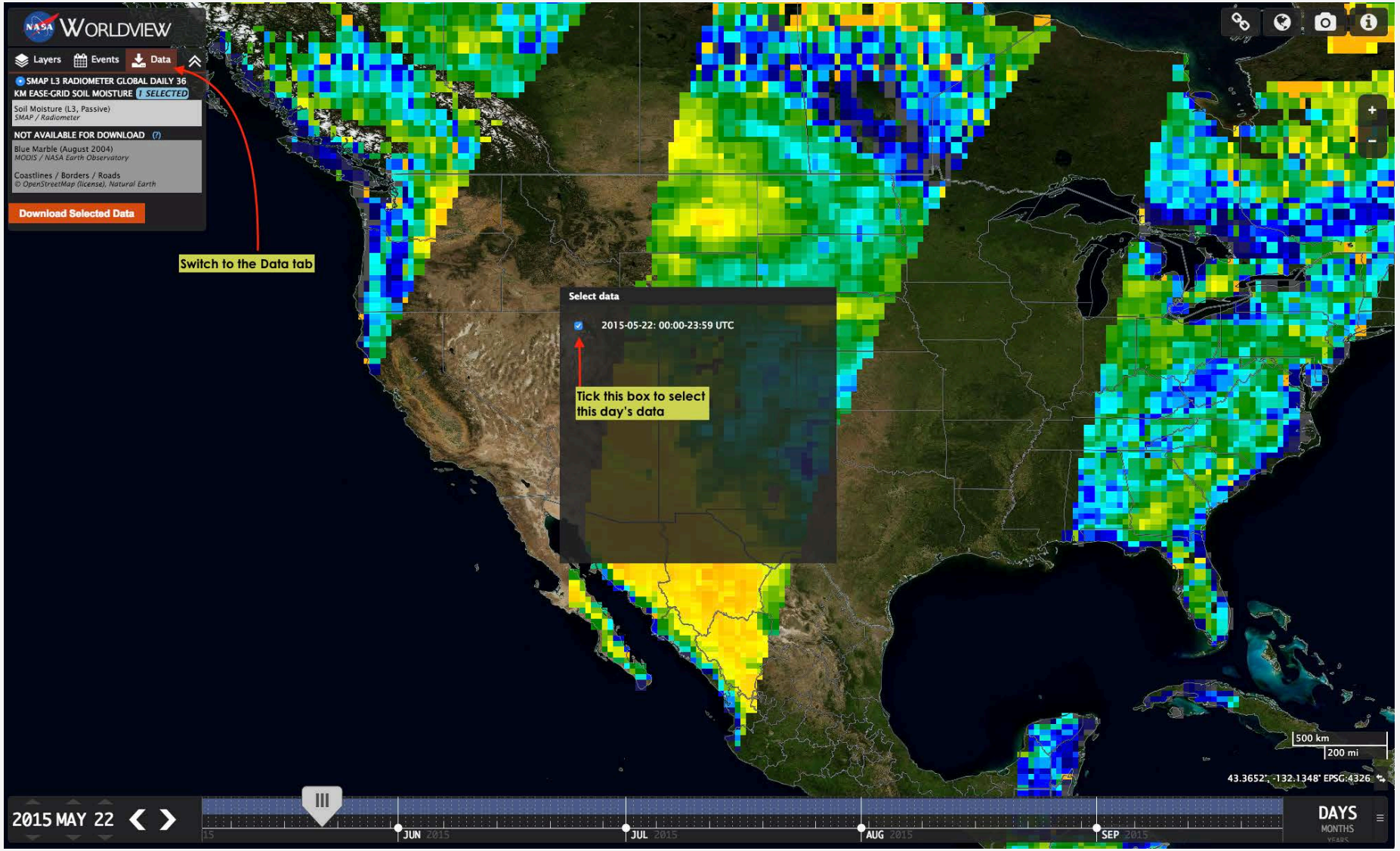


A Quick Comparison of Soil Moisture Across Time…

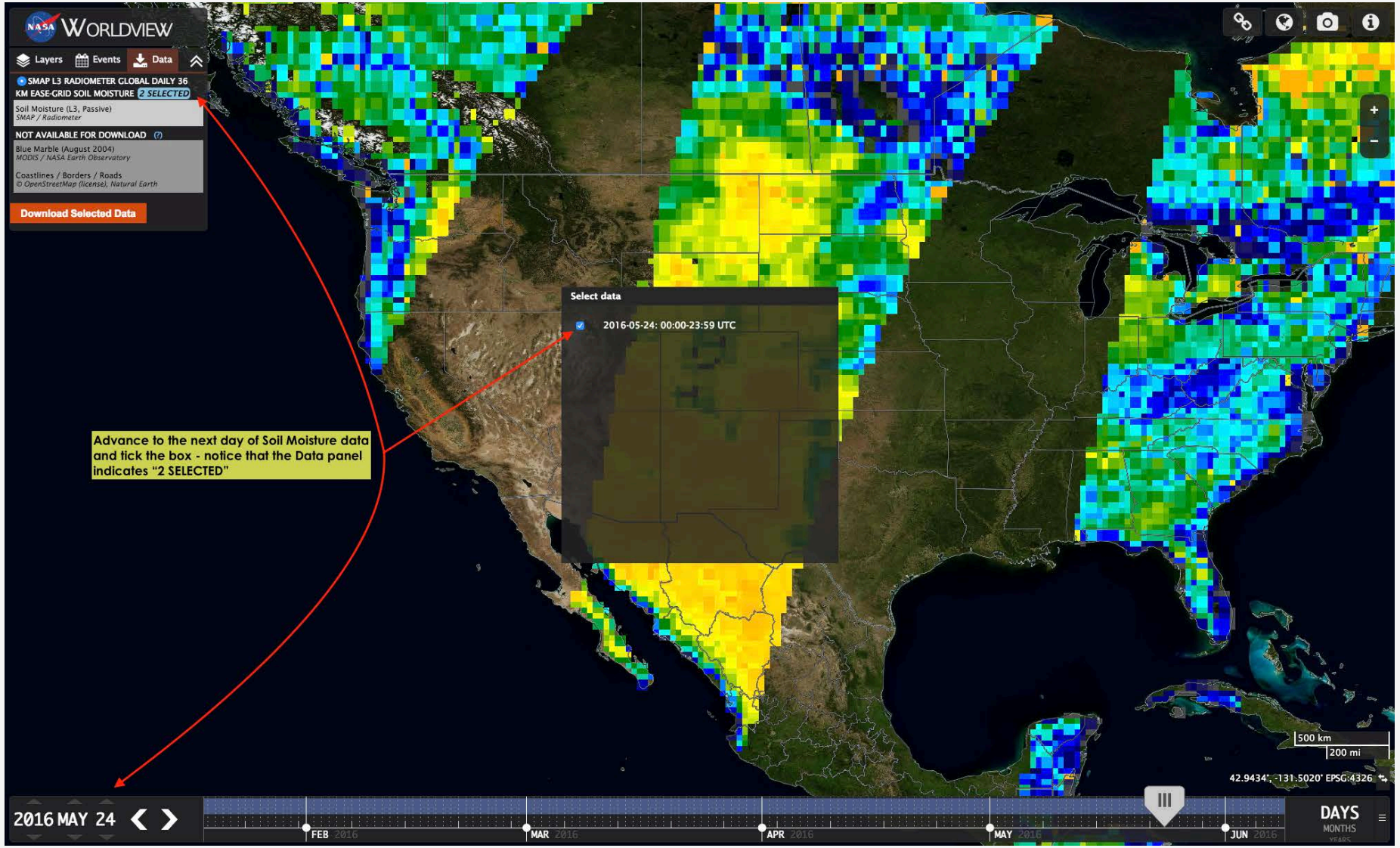
I can use the “Share this Map” option to copy links for the two days that I’d like to compare and view them in browser windows placed side by side for a quick visualization of the soil moisture differences between the two dates.



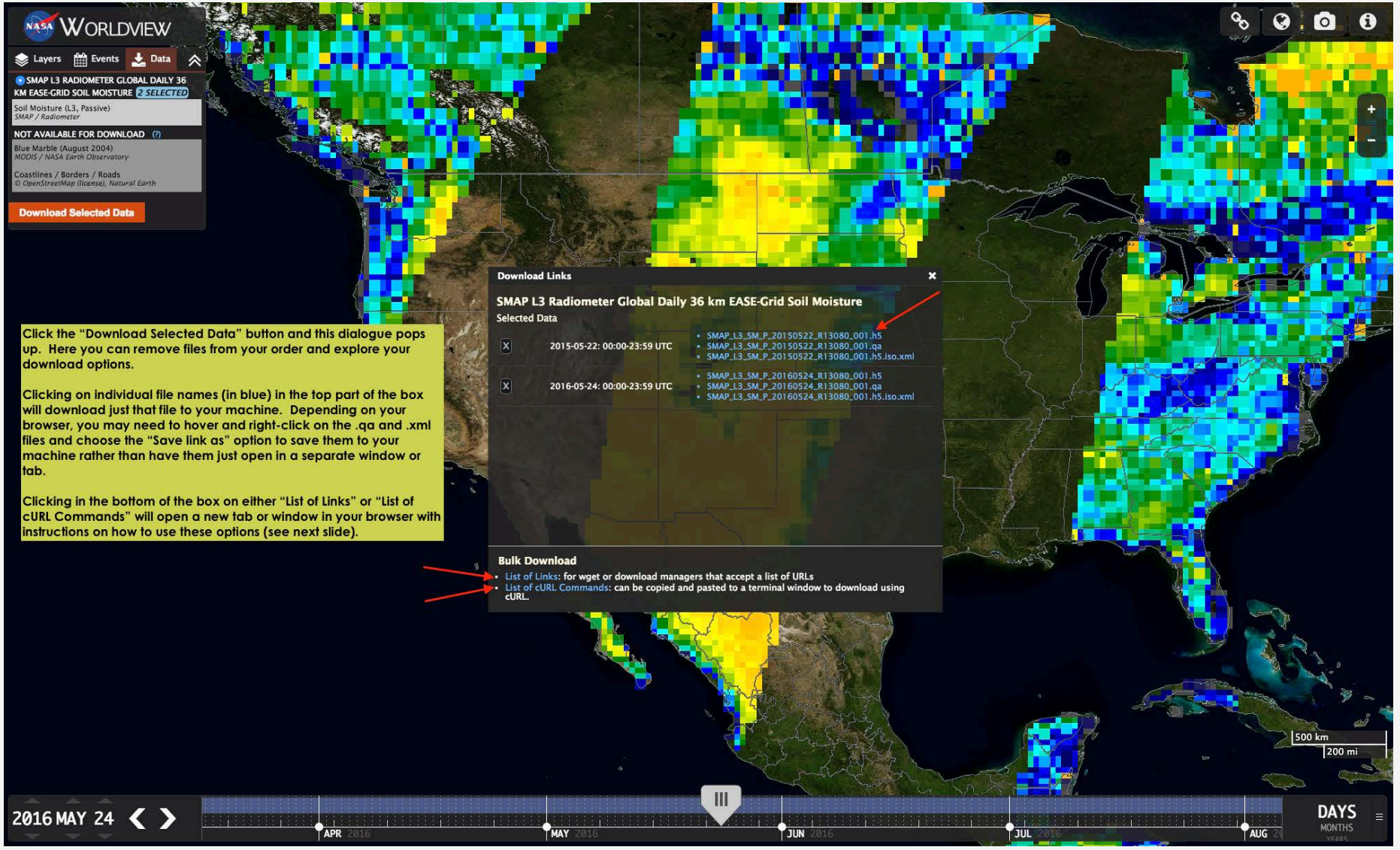
Downloading from Worldview:



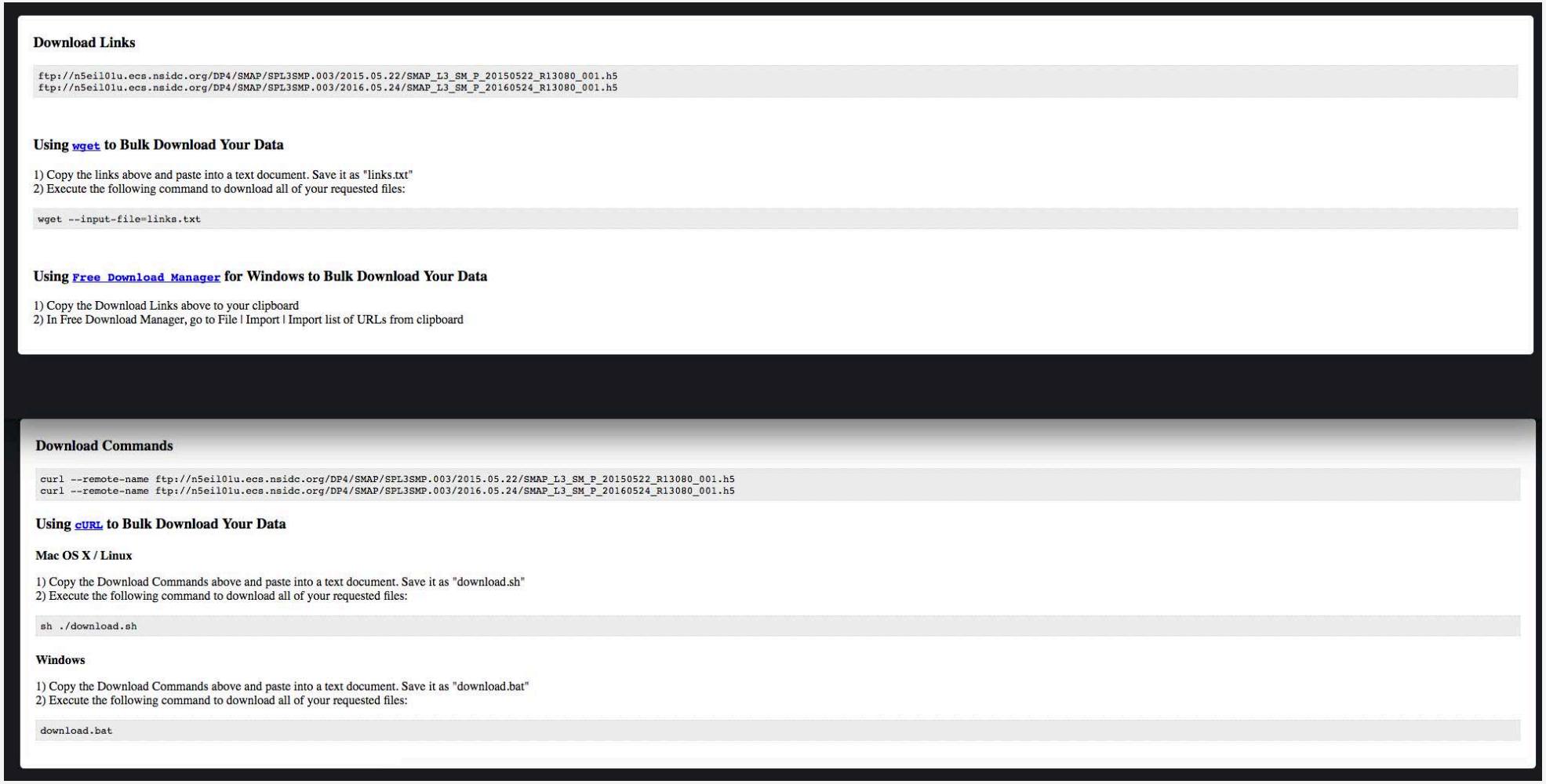
Downloading from Worldview:



Downloading from Worldview:



Downloading from Worldview:



Download Links

```
ftp://n5eil01u.ecs.nsidc.org/DP4/SMAP/SPL3SMP.003/2015.05.22/SMAP_L3_SM_P_20150522_R13080_001.h5
ftp://n5eil01u.ecs.nsidc.org/DP4/SMAP/SPL3SMP.003/2016.05.24/SMAP_L3_SM_P_20160524_R13080_001.h5
```

Using wget to Bulk Download Your Data

1) Copy the links above and paste into a text document. Save it as "links.txt"
2) Execute the following command to download all of your requested files:

```
wget --input-file=links.txt
```

Using Free Download Manager for Windows to Bulk Download Your Data

1) Copy the Download Links above to your clipboard
2) In Free Download Manager, go to File | Import | Import list of URLs from clipboard

Download Commands

```
curl --remote-name ftp://n5eil01u.ecs.nsidc.org/DP4/SMAP/SPL3SMP.003/2015.05.22/SMAP_L3_SM_P_20150522_R13080_001.h5
curl --remote-name ftp://n5eil01u.ecs.nsidc.org/DP4/SMAP/SPL3SMP.003/2016.05.24/SMAP_L3_SM_P_20160524_R13080_001.h5
```

Using cURL to Bulk Download Your Data

Mac OS X / Linux

1) Copy the Download Commands above and paste into a text document. Save it as "download.sh"
2) Execute the following command to download all of your requested files:

```
sh ./download.sh
```

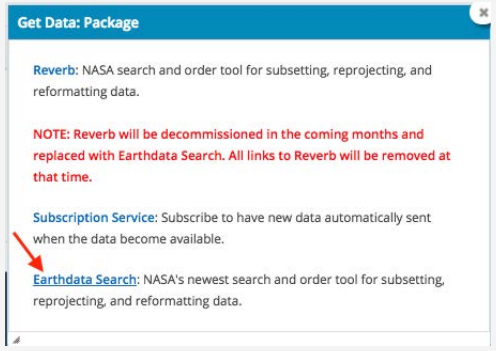
Windows

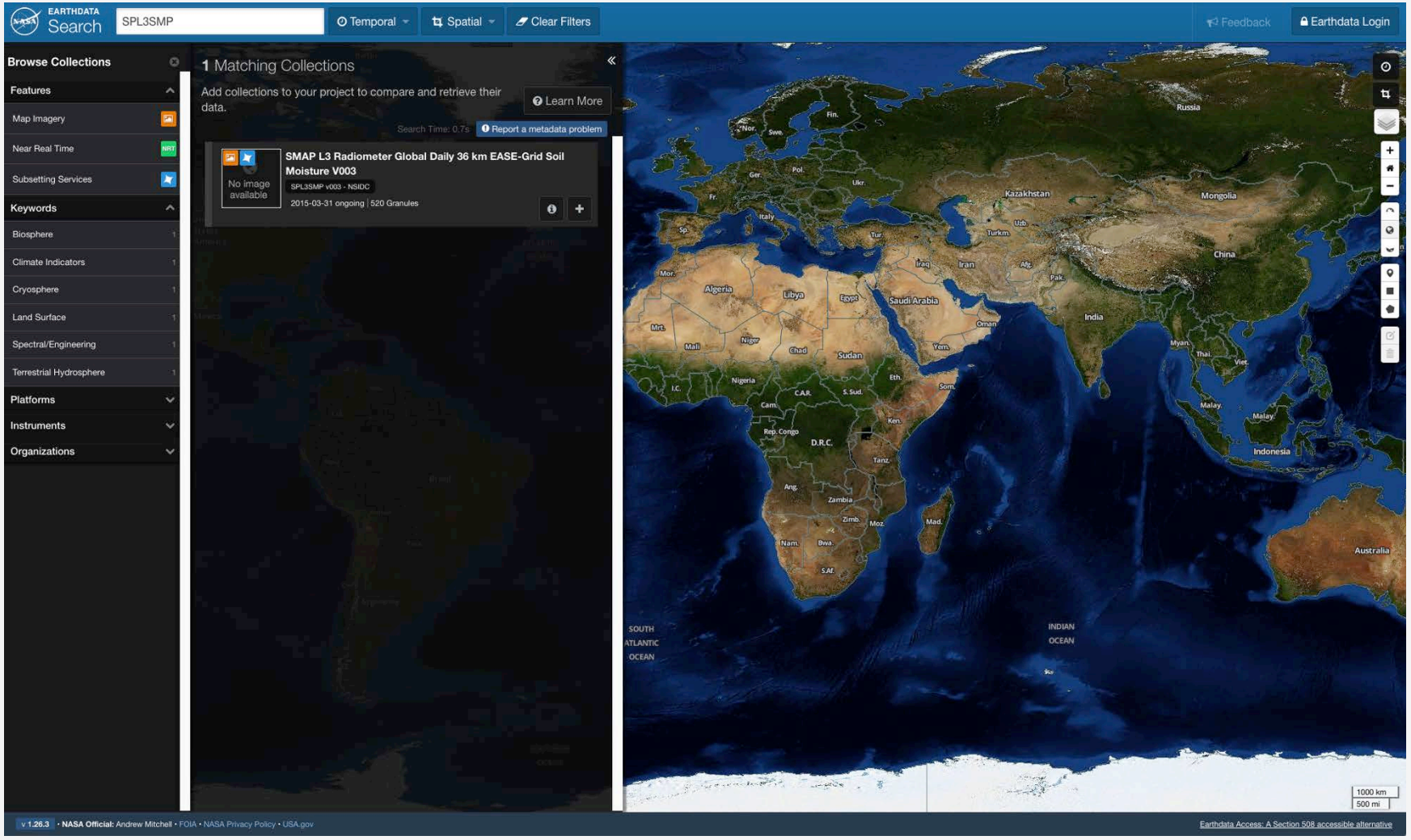
1) Copy the Download Commands above and paste into a text document. Save it as "download.bat"
2) Execute the following command to download all of your requested files:

```
download.bat
```

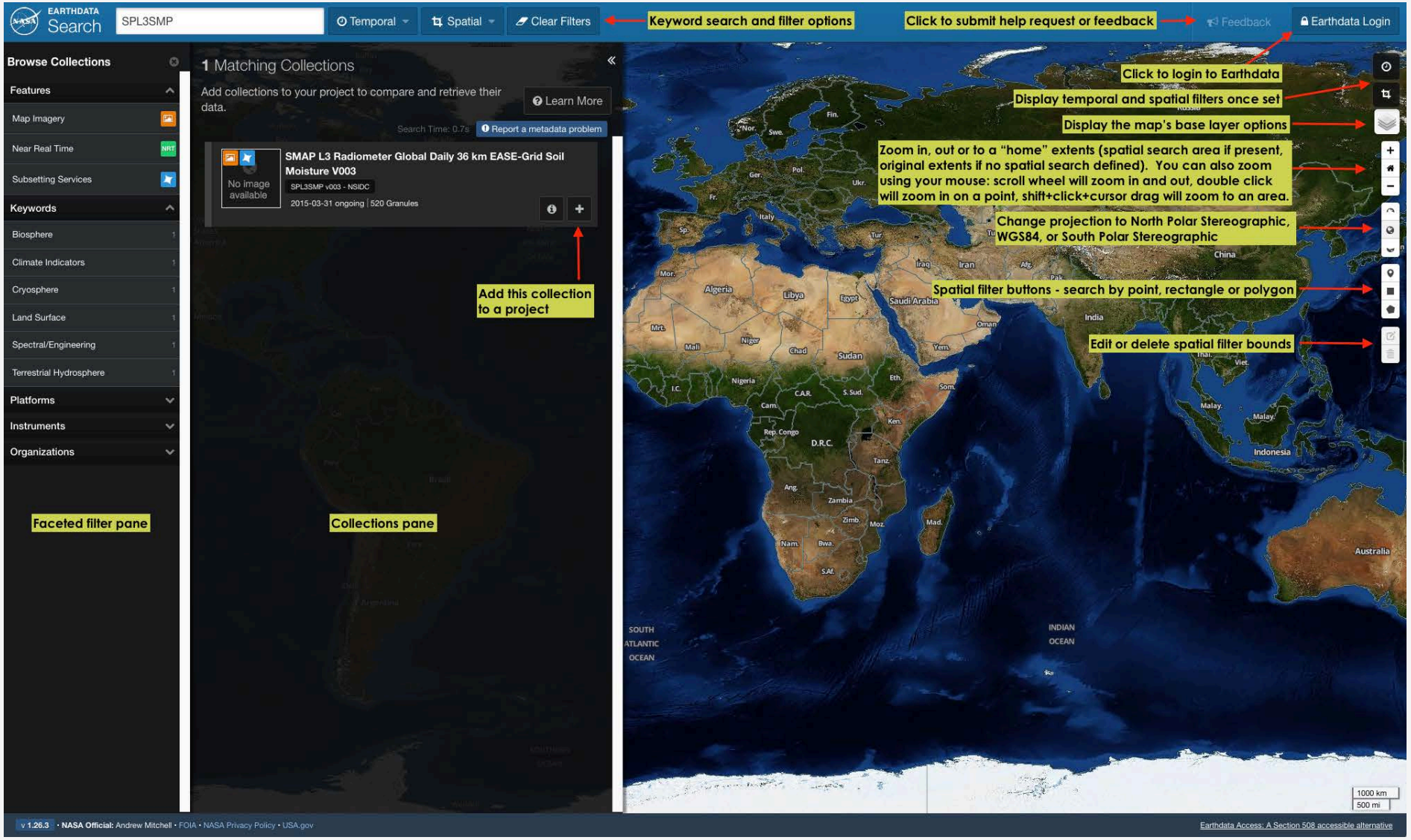
Search and Access SMAP Data from Earthdata Search

Launching Earthdata Search from the SPL3SMP product page at NSIDC, you'll see that the interface is pre-populated with the data set's short name by default and the collection is shown in the Collection's pane.





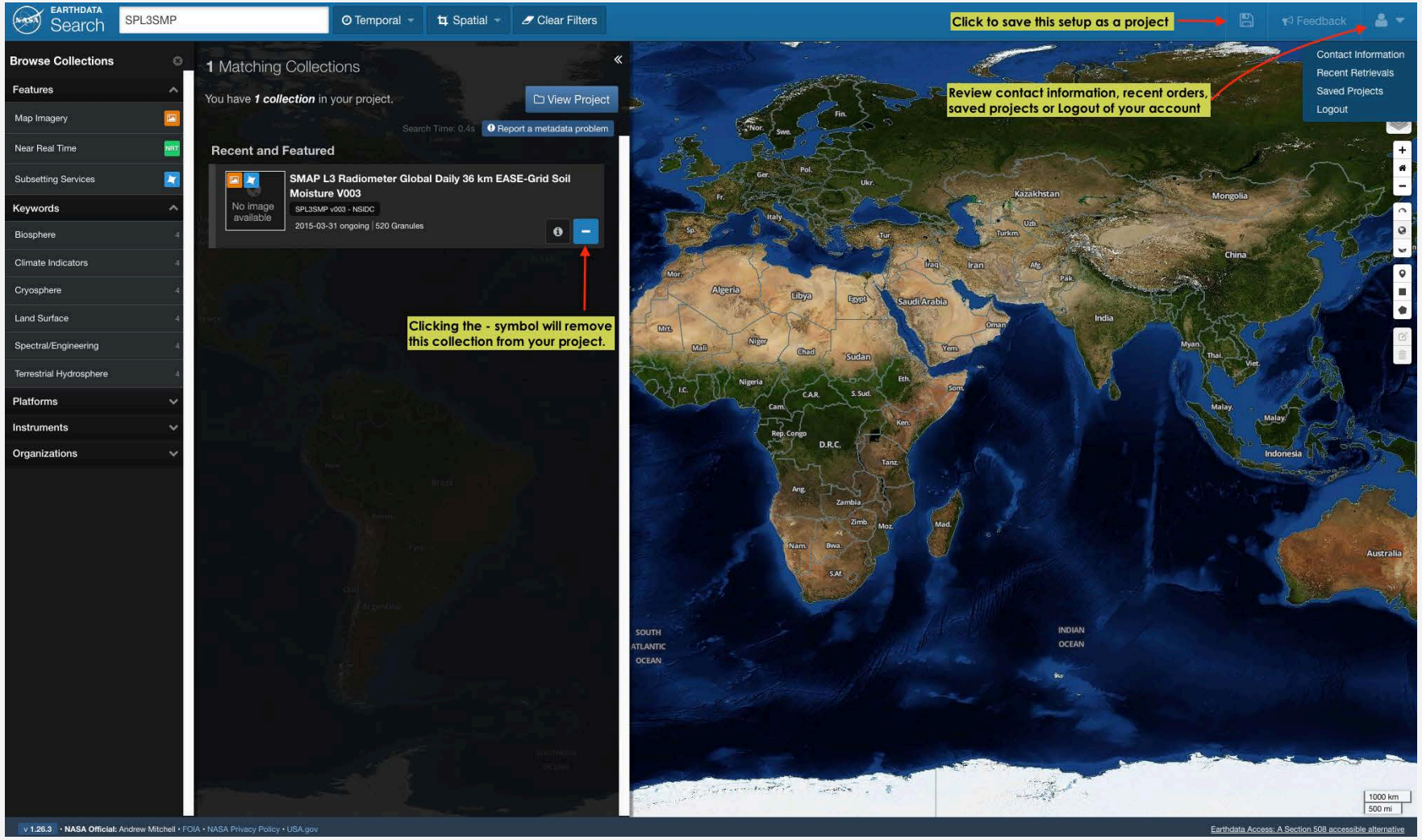
Exploring the Earthdata Search Interface:



Exploring the Earthdata Search Interface – after logging in:

If you don't already have an Earthdata Login, you will have to register for one before ordering data.

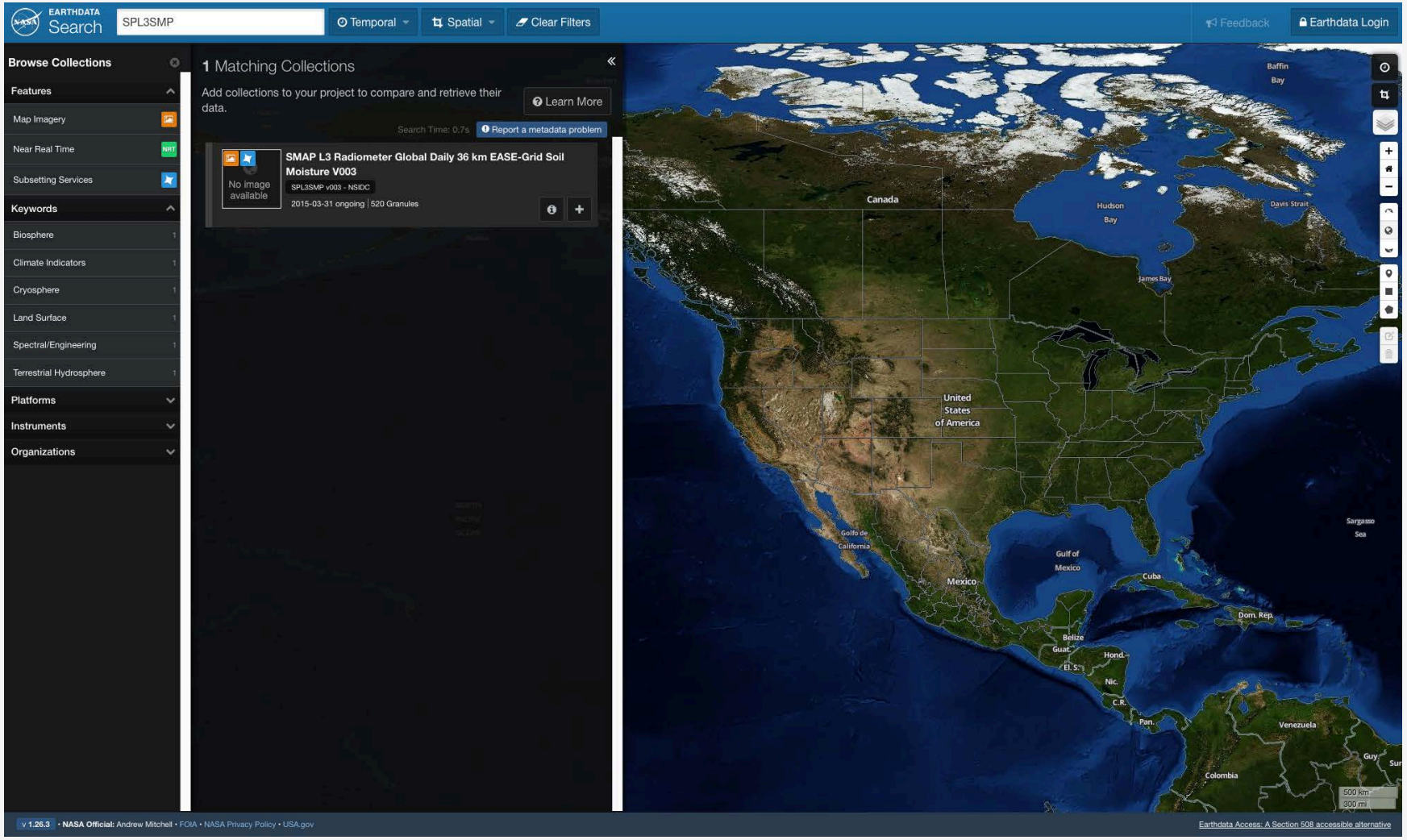
Once you've logged in, you'll see that the interface looks slightly different. You can now save projects, view other projects you've saved, and look through your order history.



Search for, and Download, SMAP Data:

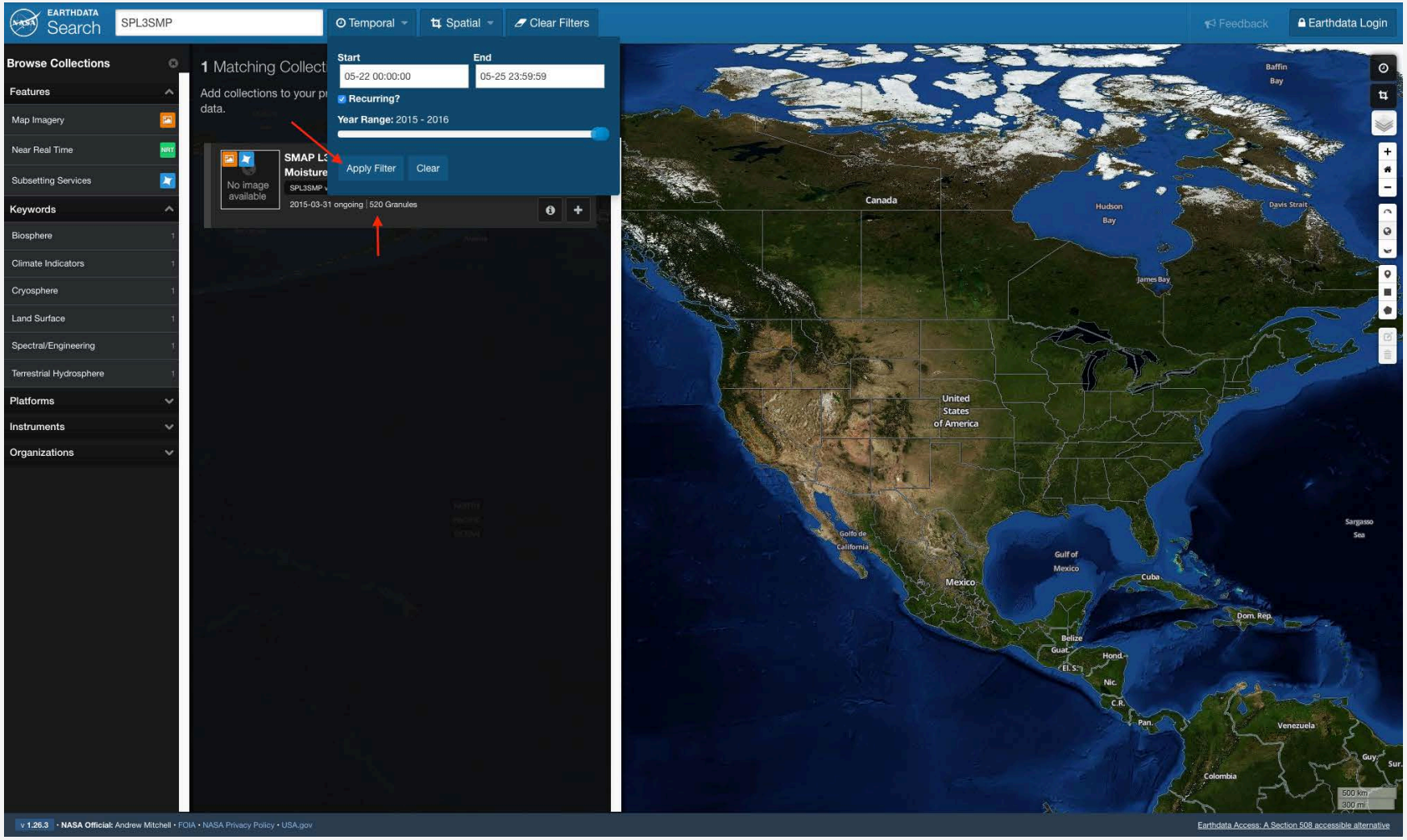
Now I’m going to walk through how you can use Earthdata Search to find, customize, and download the files we visualized and downloaded in Worldview.

I’m going to set temporal and spatial search filters and add the SPL3SMP to a project. From there I’ll go through customizing the data prior to download.



Set Temporal Search Filter:

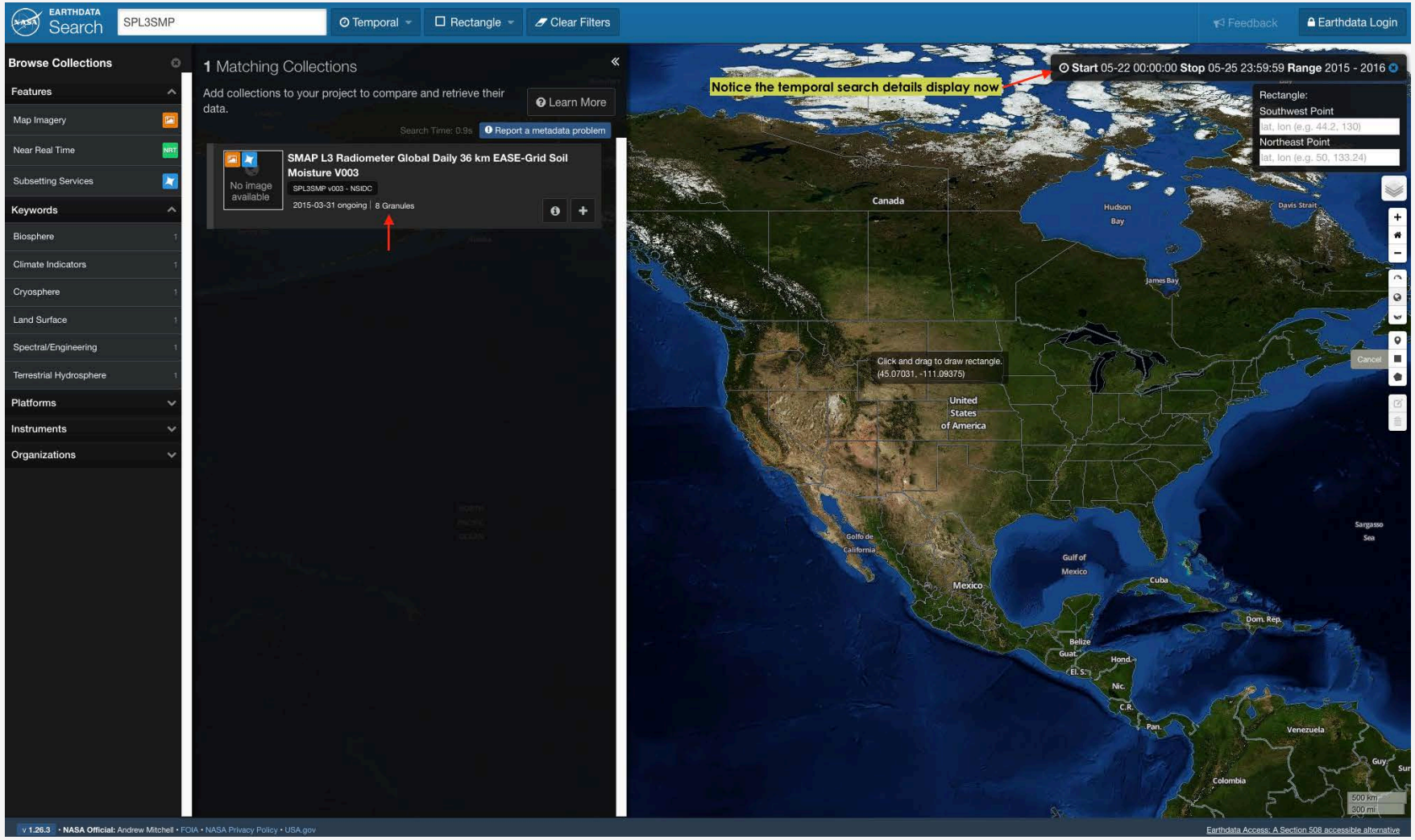
I’m using the “Recurring?” option to limit the granules (files) returned to the dates between May 22 and May 25, 2015 and 2016.



Set Spatial Search Filter:

Notice the granule count has dropped from 520 to 8 granules.

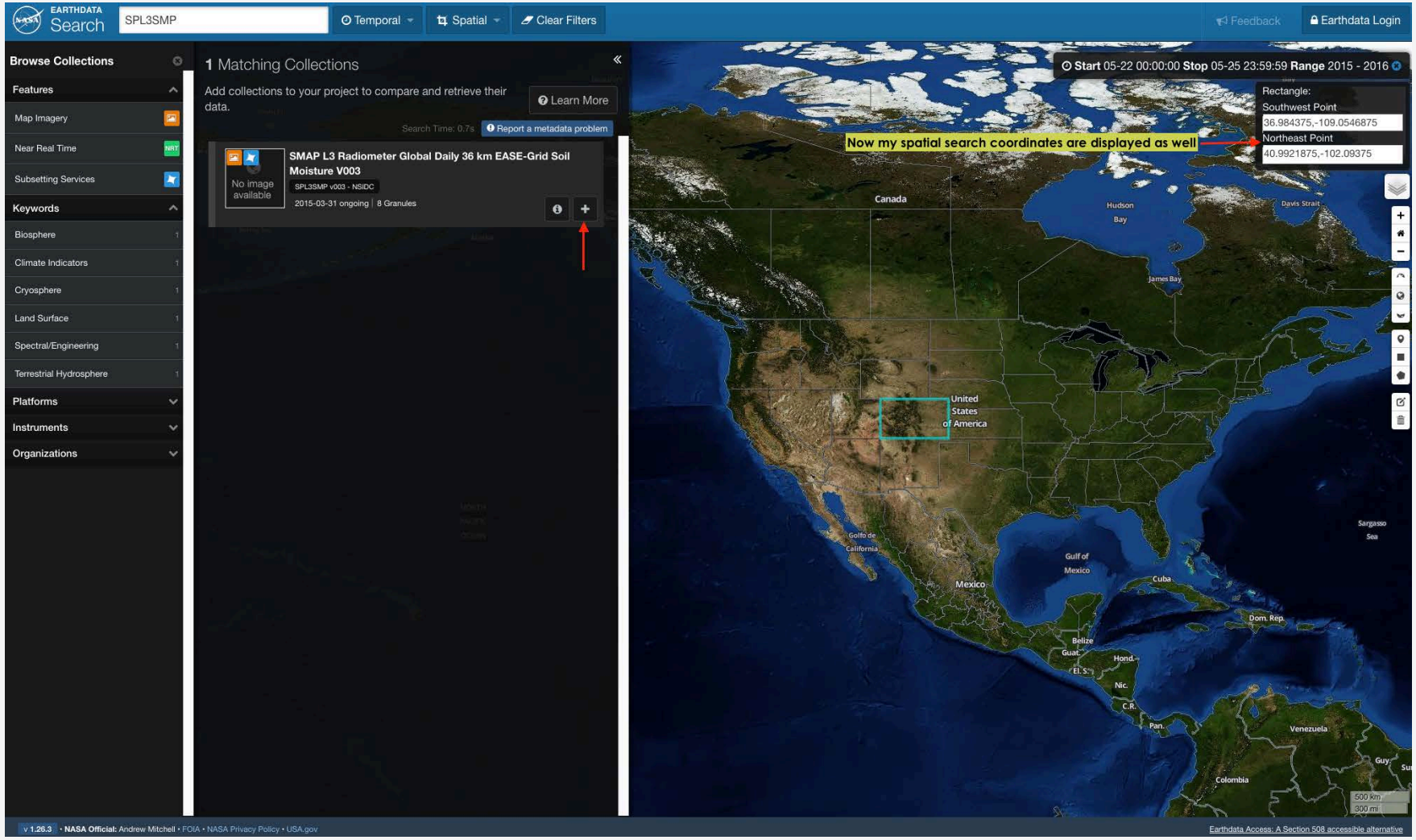
Now I'll set my spatial search filter over Colorado, using the rectangle option.



Add Collection to a Project:

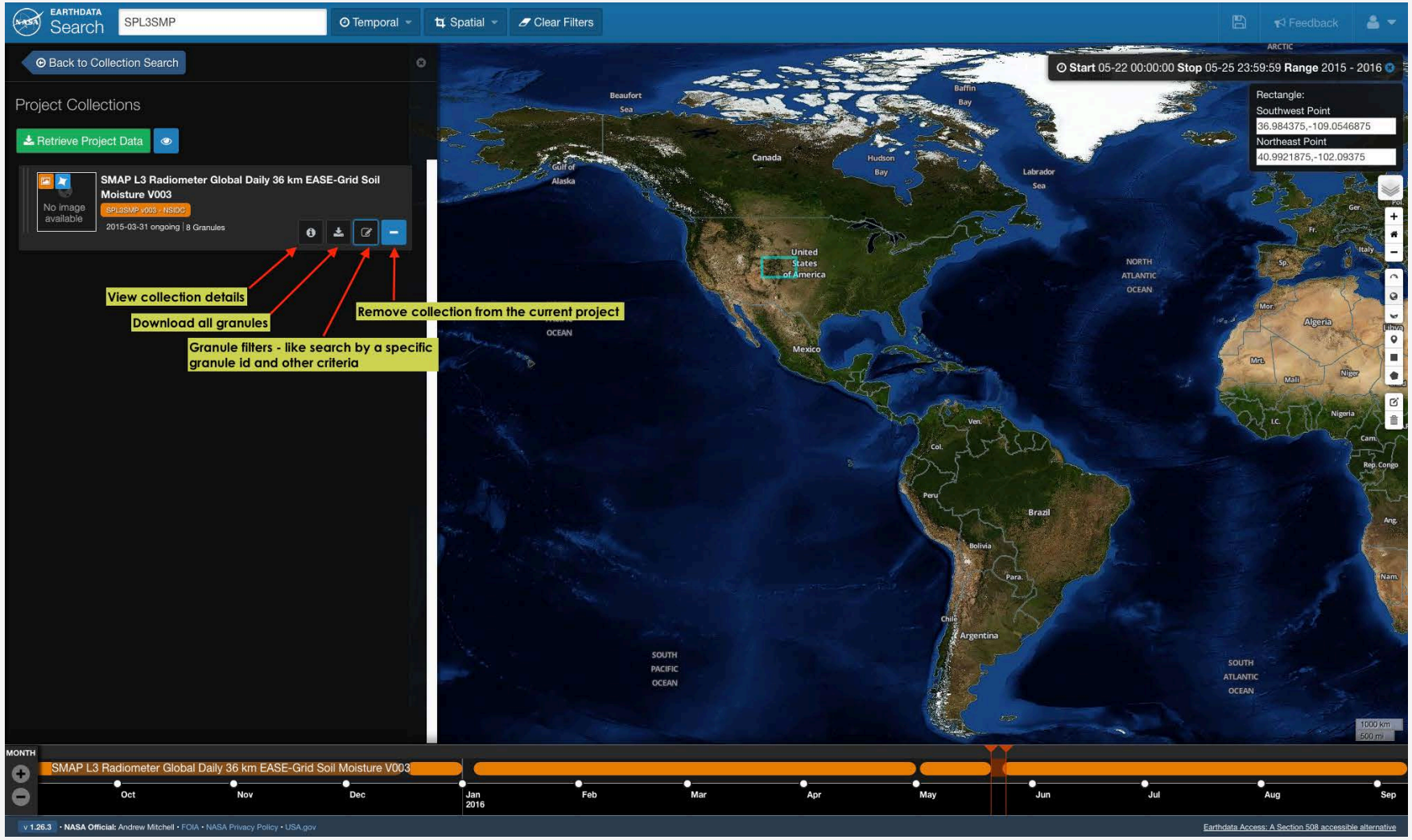
With the spatial search set, the coordinates are displayed along with the details of my temporal search criteria.

I'm going to add my collection to the current project and view it. This is optional – you don't have to use the project feature to order data.



Expand to Reveal the Granule List:

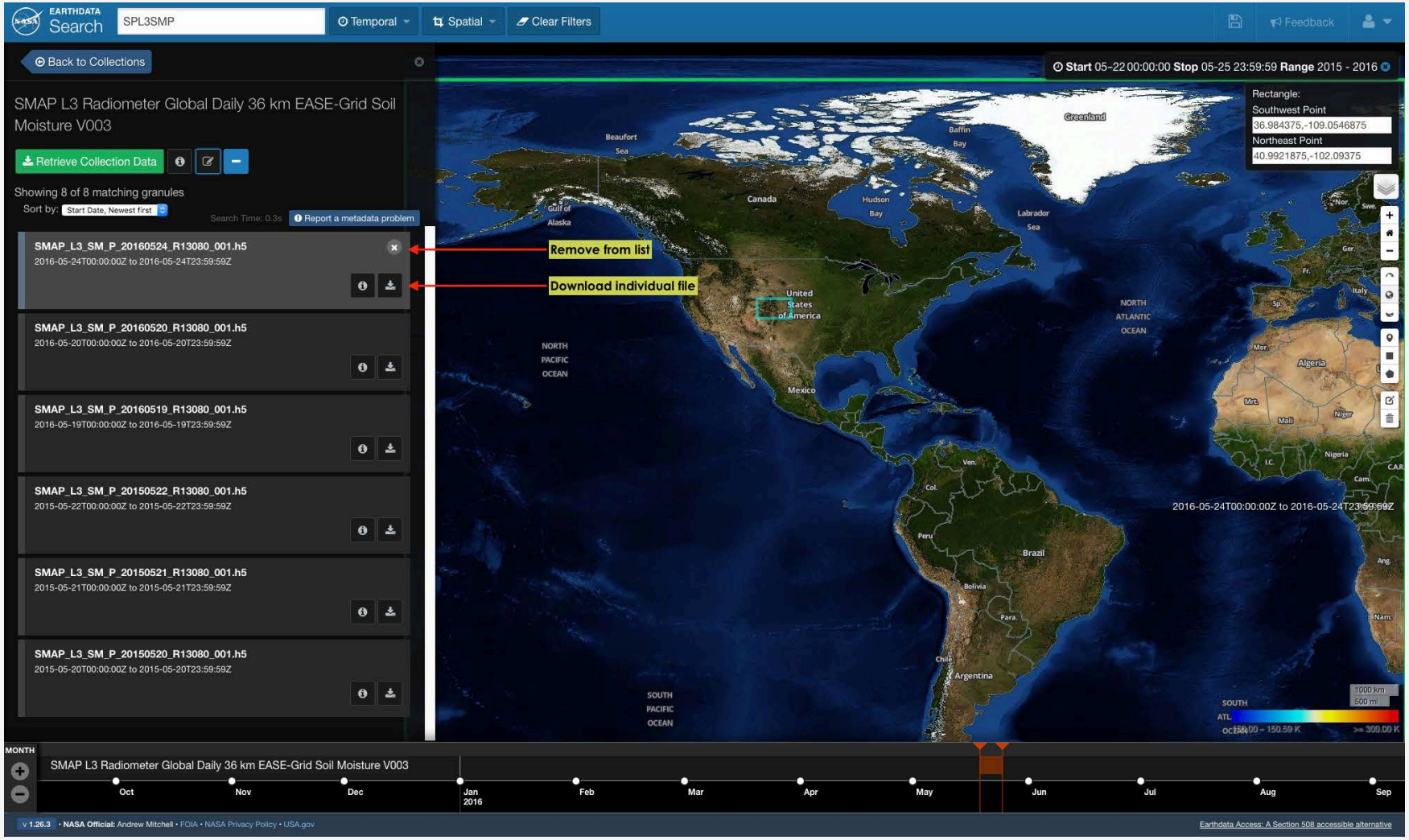
When I click on the text that says “8 Granules” the pane changes to a new view displaying all eight granules.



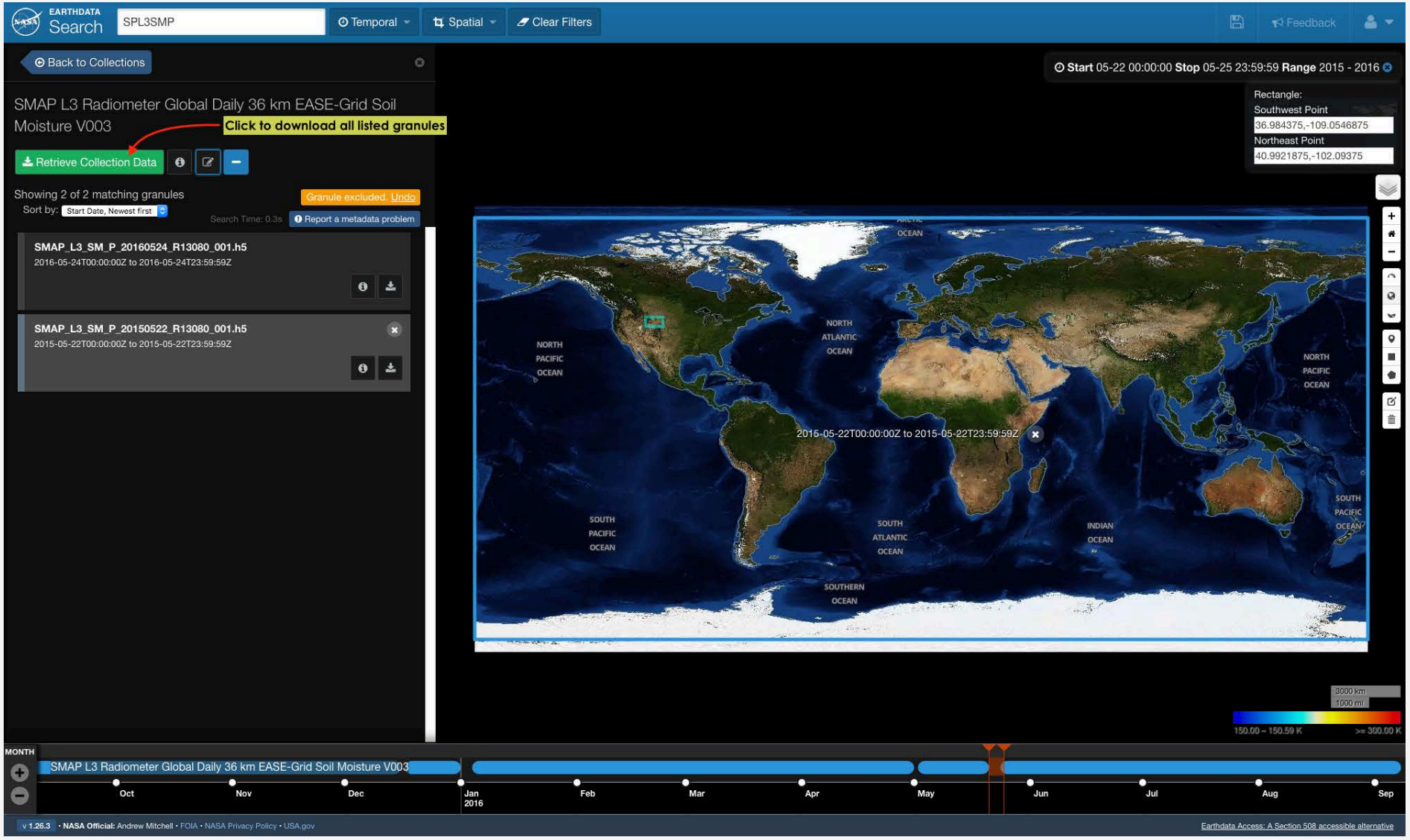
Granules Listed:

Here I can click the download icon to download individual files or the X symbol to delete a file from the list. I'm going to do the latter to leave just the two files I'm interested in listed.

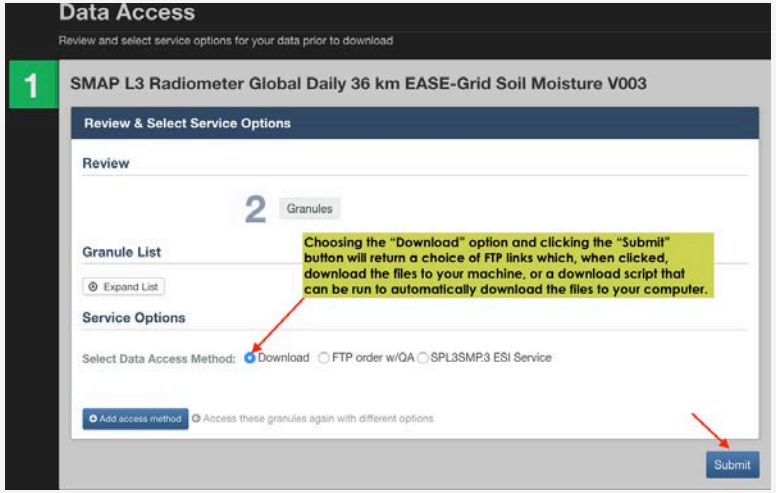
Notice that clicking on a granule name displays the extents of the file on the map.

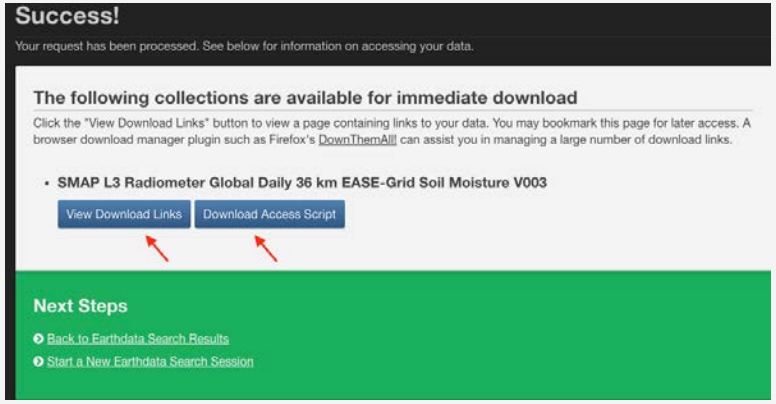


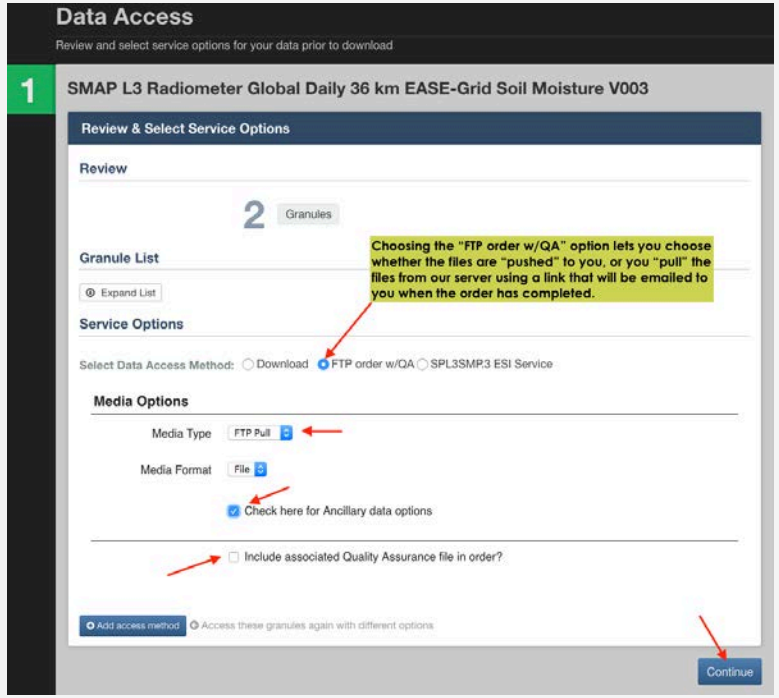
Granules Culled and Ready to Customize and Order:

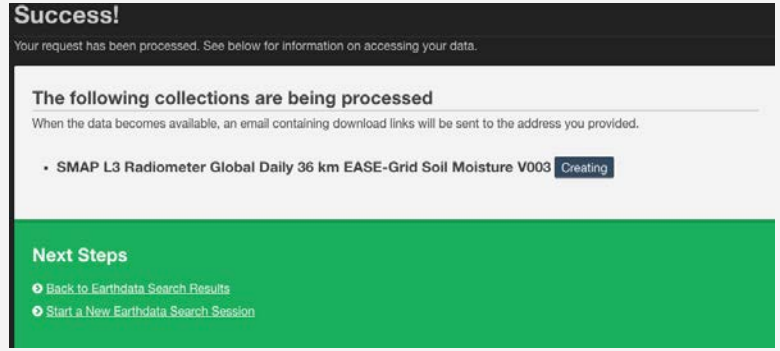


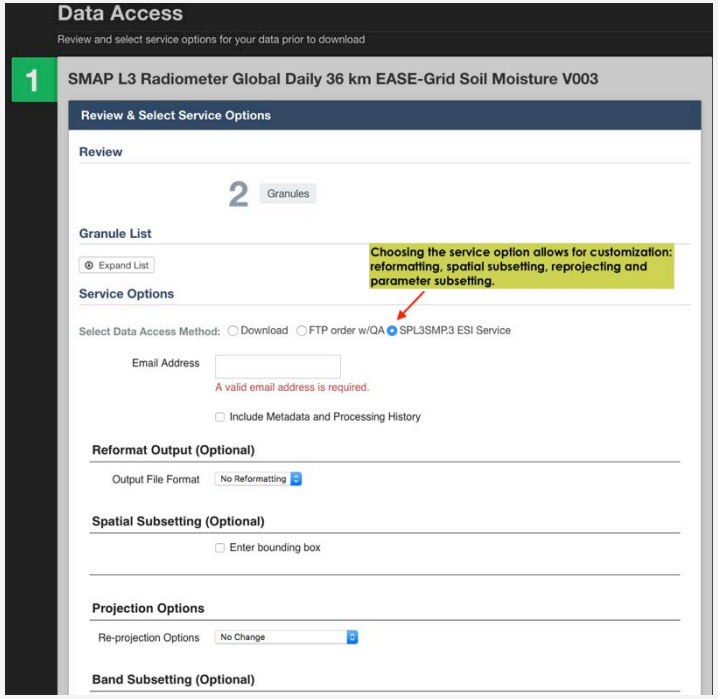
Download Options:



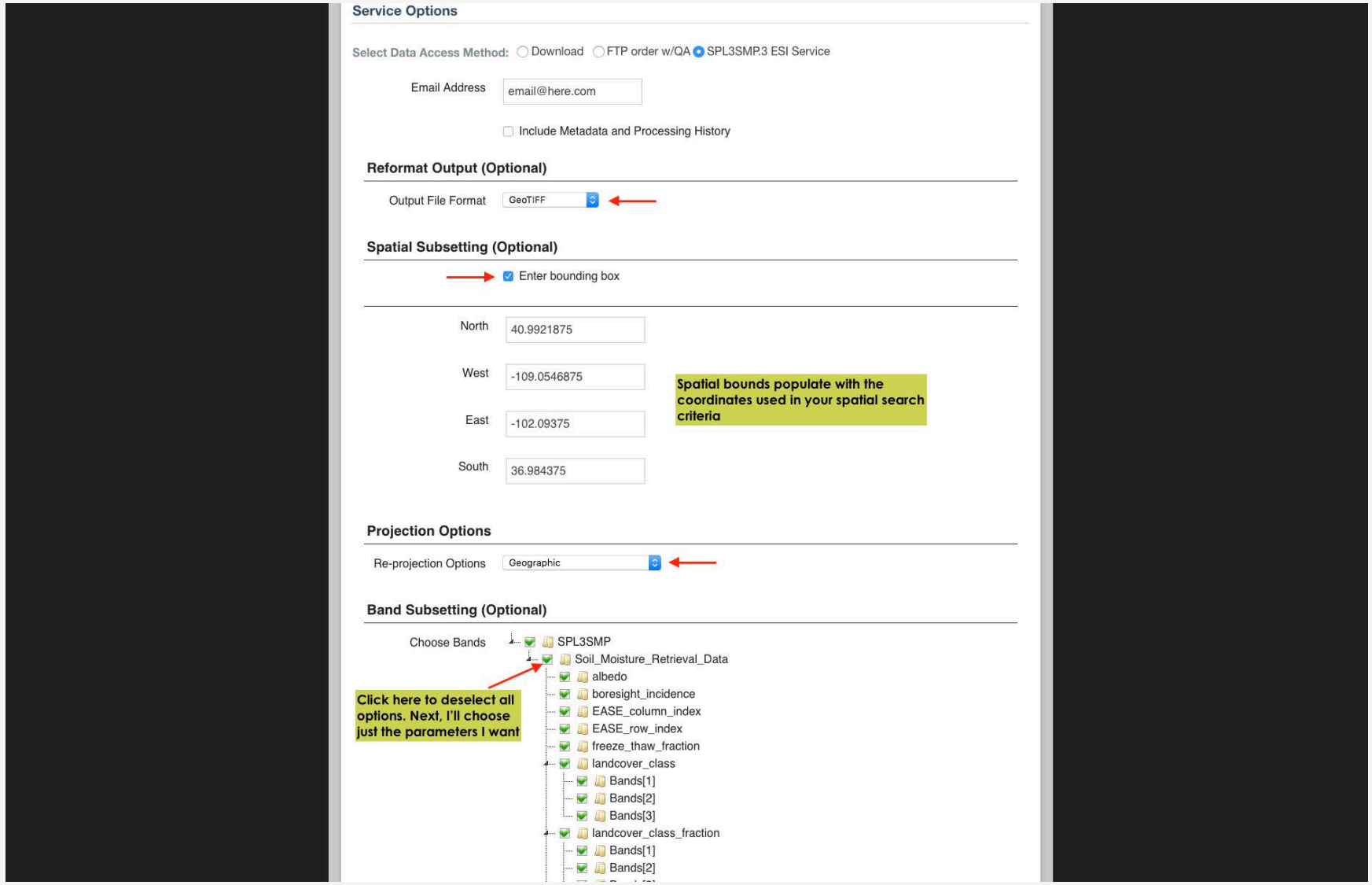








Customizing my Download:



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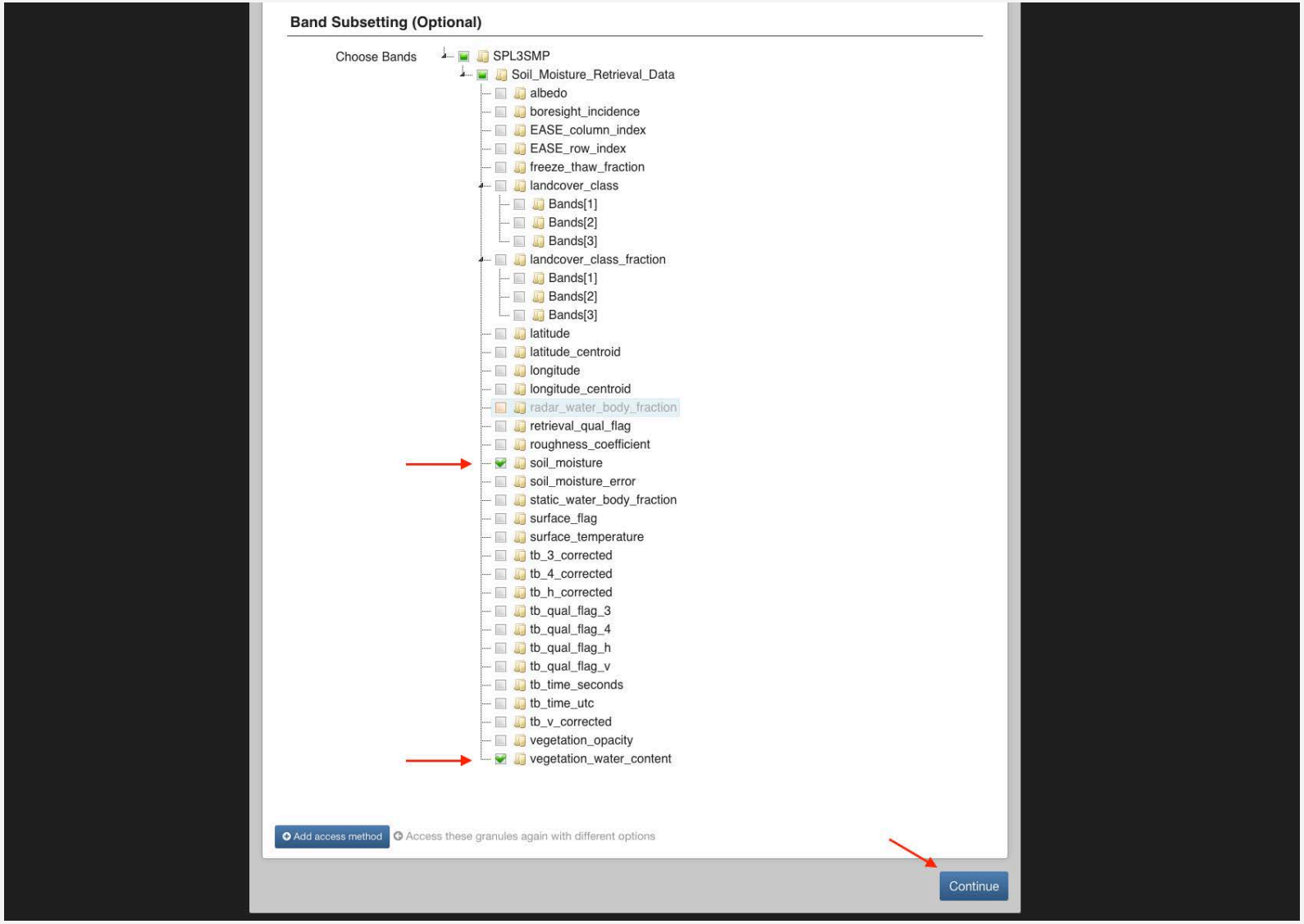
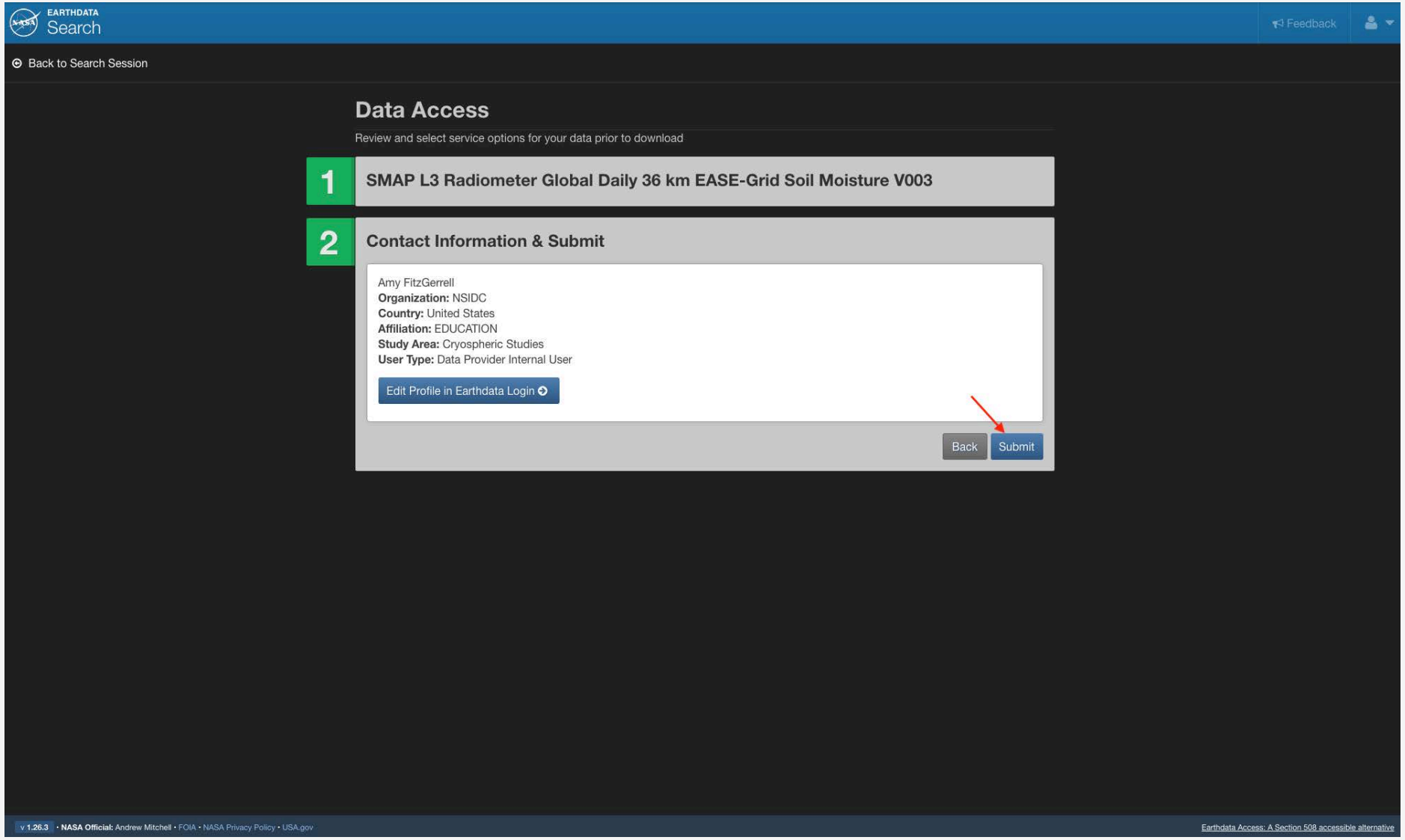
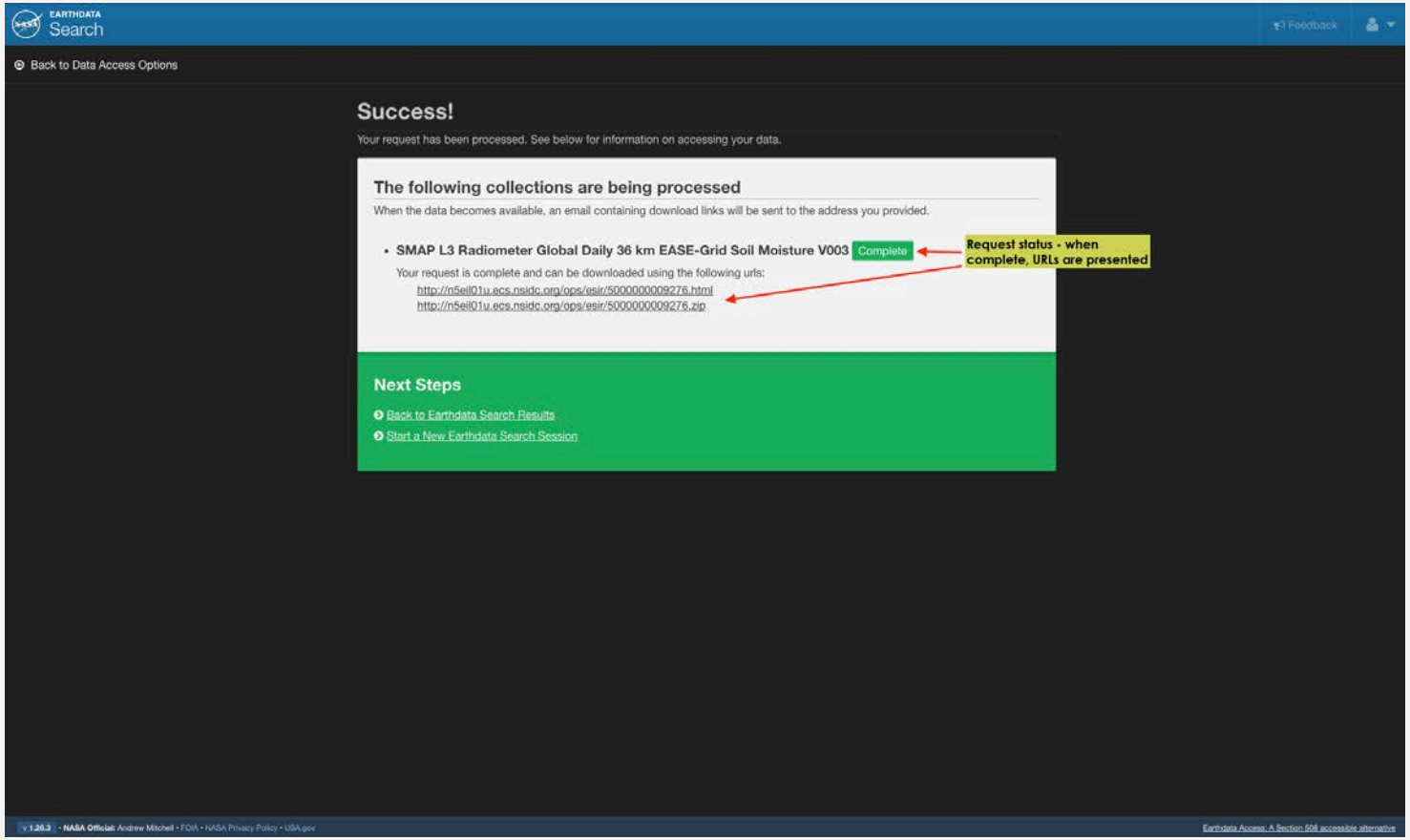


Submitting my SMAP Request:



Retrieving my SMAP Output:

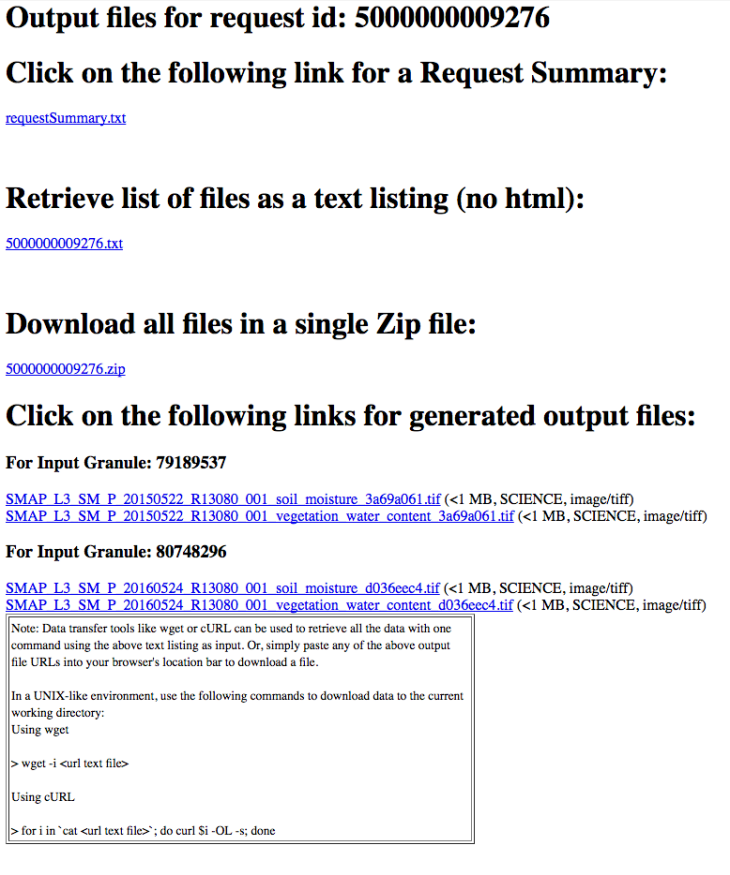
I can click the html link to view request details (which I'll go through next) or I can click the zip file to download everything to my machine at once.



Retrieving my SMAP Output:

Notice that when you choose to reformat output to GeoTIFF, you will receive one tif per band selected for each granule in your request.

I'll download the soil moisture tif images.



Output files for request id: 5000000009276

Click on the following link for a Request Summary:

requestSummary.txt

Retrieve list of files as a text listing (no html):

5000000009276.txt

Download all files in a single Zip file:

5000000009276.zip

Click on the following links for generated output files:

For Input Granule: 79189537

SMAP_L3_SM_P_20150522_R13080_001_soil_moisture_3a69a061.tif (<1 MB, SCIENCE, image/tiff)
SMAP_L3_SM_P_20150522_R13080_001_vegetation_water_content_3a69a061.tif (<1 MB, SCIENCE, image/tiff)

For Input Granule: 80748296

SMAP_L3_SM_P_20160524_R13080_001_soil_moisture_d036eec4.tif (<1 MB, SCIENCE, image/tiff)
SMAP_L3_SM_P_20160524_R13080_001_vegetation_water_content_d036eec4.tif (<1 MB, SCIENCE, image/tiff)

Note: Data transfer tools like wget or cURL can be used to retrieve all the data with one command using the above text listing as input. Or, simply paste any of the above output file URLs into your browser's location bar to download a file.

In a UNIX-like environment, use the following commands to download data to the current working directory:
Using wget

> wget -i <url text file>

Using cURL

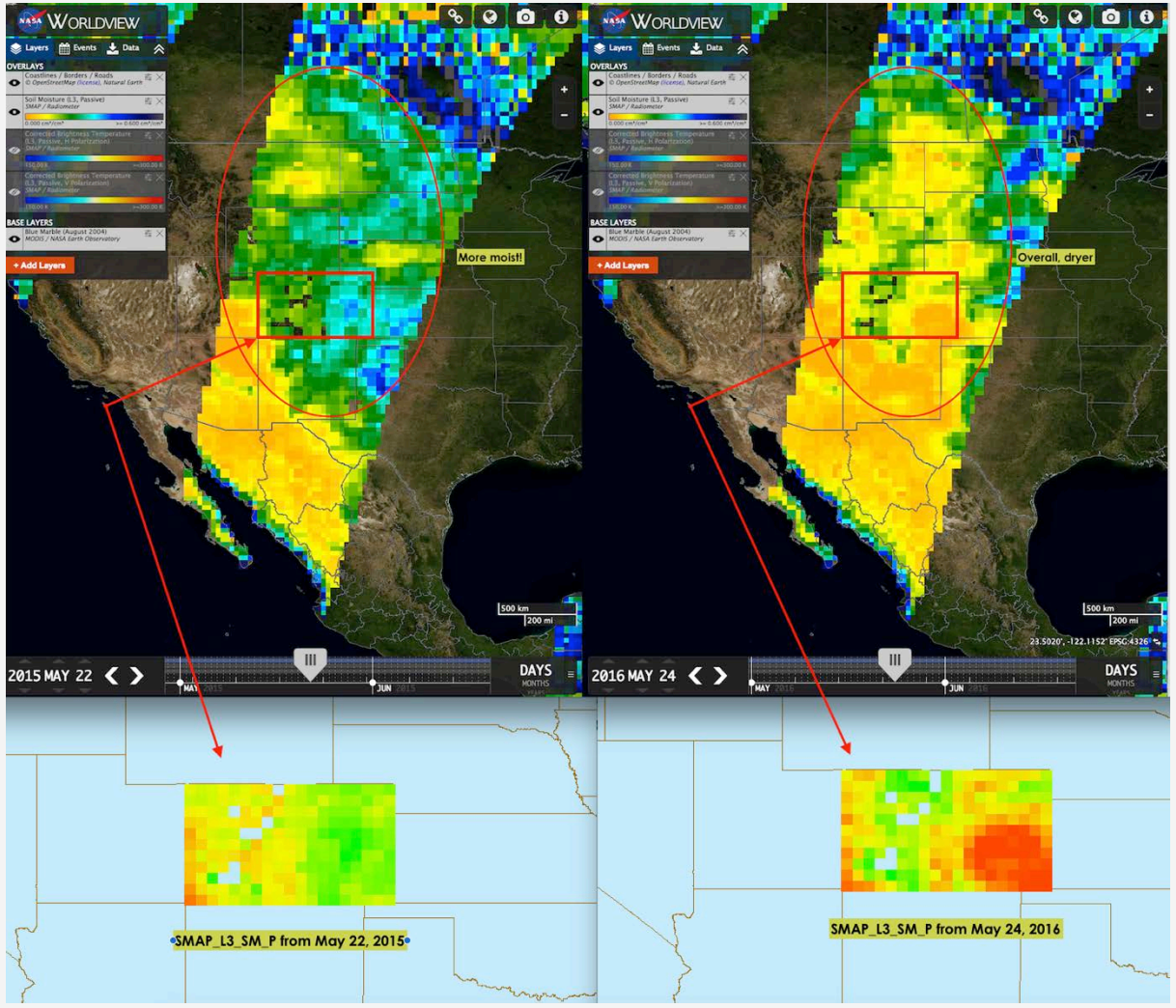
> for i in `cat <url text file>`; do curl $i -OL -s; done

The SMAP Data Final Output – Compared to Worldview:

With the subsetting services I chose, my output soil moisture GeoTIFFs include data just for the state of Colorado.

I've tweaked my GeoTIFFs downloaded from Earthdata Search in ArcMap a bit to apply a similar (but not exact) color pallette, and I'm showing them here against the initial Worldview visualization I put together.

I hope this has been helpful and you enjoy your exploration of the NSIDC, Worldview, and Earthdata Search websites!



This concludes today's session – Are there any questions?

If you have questions in the future and need assistance, we're happy to help! Contact NSIDC User Services via email to nsidc@nsidc.org or call (303) 492-6199