## Downloading and Displaying SMAP Data

Introduction

For this exercise, we will be downloading SMAP soil moisture data from two web portals, NASA Earthdata and NASA's Distributed Active Archive Center (DAAC) at National Snow and Ice Data Center (NSIDC) Download portal. For the NASA Earthdata download, SMAP data can be subset, projected, and reformatted into GeoTIFF data for viewing in a geospatial software such as QGIS. For the NSIDC download, data are available in the .hdf format and can be viewed and displayed in software such as HDFView.

Part 1: NASA Earthdata Download

- Visit NASA Earthdata: https://earthdata.nasa.gov/
    - In order to download data, you need a free Earthdata account. If you do not have one, visit http://urs.earthdata.nasa.gov/users/new and sign up.
- On the Earthdata website, go to the top right and click on Data Discovery, then Earthdata Search

- In the Earthdata search bar type in: SMAP 36 km Soil Moisture
- Click on Browse All Data.
- Four matching datasets should then be displayed. Click on the SMAP L3 Radiometer Global Daily 36 km EASE-Grid Soil Moisture V0004 option
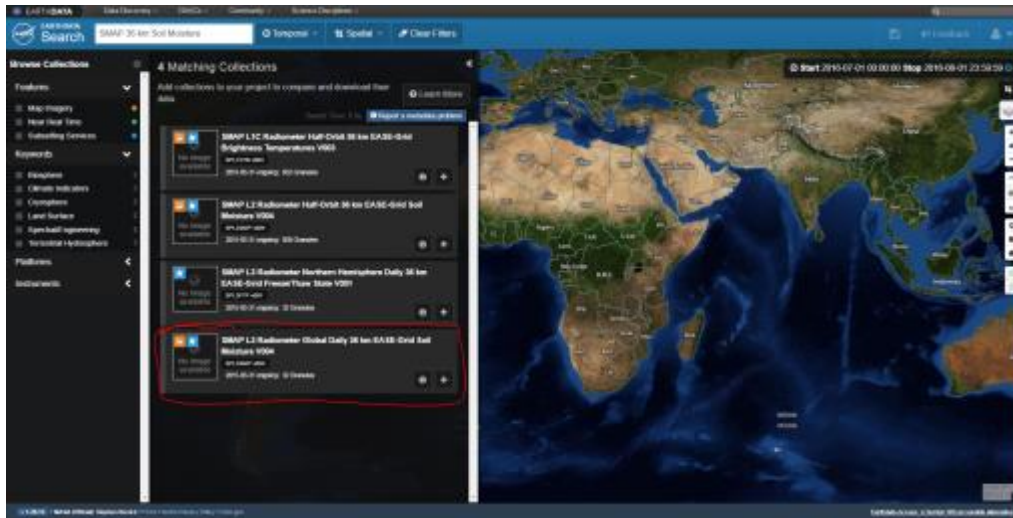
- You will then see a note pop up stating that the collection shows approximate full resolution data obtained from the Global Imagery Browse Services (GIBS). Clikc Close.
- Now you can set the date and location parameters.
- Click on the map to move to Alaska.
- On the top blue panel, you can select the time period. Click on the Temporal button

- For the Start date, click on 2016, then June, then choose June 1st.
- For the end date, click on 2016, then June, then choose June 14th. This will provide you with two weeks of data. Then click on Apply Filter. You should then see the imagery displayed on the map.

- Click on the Spatial button and choose Rectangle. Then click and drag on the map to select the state of Alaska.
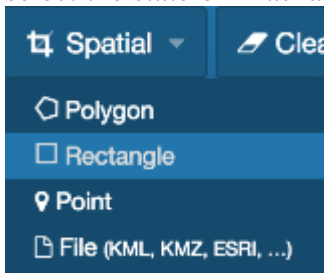
- You will then see the list of all SMAP soil moisture data available for the time period selected.
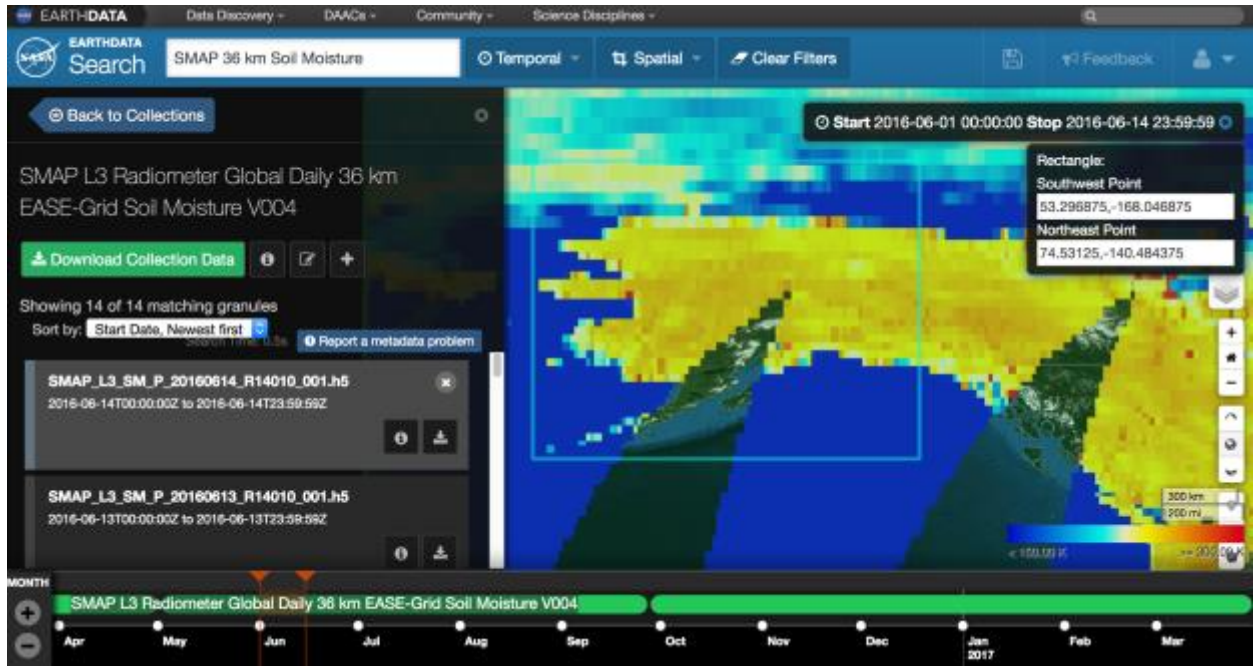
- Click on the Download Collection Data button to download the entire dataset for that time period.
- You will then be able to review the data selection, choose your delivery method, output format, spatial subset, projection, and band sub-setting.
- Under Service Options, select the SPL3SMP.4 ESI Service. This will allow you to choose the specific features of your data download.
- Enter your email address below. If you are logged in, your user email should automatically appear.
- For the Reformat Option, choose GeoTIFF
- Click on the Enter Bounding Box option under Spatial Sub-setting. You should see the bounds you have already selected on the map automatically entered here.
- Under projection options, select Universal Transverse Mercator.

- Leave the Band Selection option blank.

- Click Continue at the bottom of the page.
- Review your contact information, and click Submit.
- You should then see a Success page to inform you that the request is being processed. You can also view the progress on via the status bar on that page. Do not leave this page.
- You will then receive a confirmation email to notify you that a request has been submitted and another that the request has been processed.
- Once the processing is finished, you will receive two links on the Success page.

- Click on the second .zip link. Your data will automatically download into a zipped folder. Within this zipped folder, you will see a folder for each date. Within each date, you will have multiple .tif files

- There are two soil moisture data files (AM and a PM retrievals). The .tif files can be displayed in various software, such as ArcGIS, QGIS, or ENVI. The soil moisture data files are labeled: *SMAP_L3_SM_P_20160606_R14010_001_Soil_Moisture_Retrieval_Data_AM_soil_moisture_XXXX*

**Part 2: NASA Distributed Active Archive Center (DAAC)
at National Snow and Ice Data Center (NSIDC) Download**

For this portion of the exercise, you will download SMAP soil moisture data as a .hdf file from the NSIDC SMAP data page.

- Visit NSIDC SMAP Data Page: https://nsidc.org/data/smap/smap-data.html
- Scroll down to and select "SMAP L3 Radiometer Global Daily 36 km EASE-Grid Soil Moisture, Version 4 (SPL3SMP)"

SMAP L3 Radar/Radiometer Global Daily 9 km EASE-Grid Soil Moisture, Version 3 (SPL3SMAP)	N: 85.044, S: -85.044, E: 180, W: -180	2015/04/13 to 2015/07/07	9 km x 9 km	1 day	Brightness Temperature, Sigma Nought, Soil Moisture
SMAP L3 Radiometer Global Daily 36 km EASE-Grid Soil Moisture, Version 4 (SPL3SMP)	N: 85.044, S: -85.044, E: 180, W: -180	2015/03/31 to present	36 km x 36 km	1 day	Brightness Temperature, Soil Moisture
SMAP Enhanced L3 Radiometer Global Daily 9 km EASE-Grid Soil Moisture, Version 1 (SPL3SMP_E)	N: 85.044, S: -85.044, E: 180, W: -180	2015/03/31 to present	9 km x 9 km	1 day	Brightness Temperature, Soil Moisture
SMAP L4 Global Daily 9 km Carbon Net Ecosystem Exchange, Version 2 (SPL4CMDL)	N: 85.044, S: -85.044, E: 180, W: -180	2015/03/31 to present	9 km x 9 km	1 day	Gross Primary Productivity (GPP), Heterotrophic Respiration (R Net Ecosystem

- Click on the blue Download button on the top right.
- A message will pop up with information about downloading from the https site. Note that you will need an Earthdata account as in part one.
- Click on the blue HTTPS button.

- The data are then available for download and are arranged by date.
- Scroll down and click on the folder named 2016.06.01/

- Click on the hdf file SMAP_L3_SM_P_20160601_R14010_001.h5

- This will automatically download the .hdf file on to your computer. There are multiple tools for reading and viewing SMAP data, including HDFView.

Helpful Websites and Additional Information

Here are some additional links for downloading, viewing, and troubleshooting SMAP data:
- Viewing SMAP hdf data with HDFView: http://www.hdfgroup.org/products/hdf5_tools/index.html
- SMAP sample readers (Python, MATLAB, IDL, NCL: http://hdfeos.org/zoo/index_openNSIDC_Examples.php#SMAP
- SMAP Data fields: https://nsidc.org/data/smap/spl3smp/data-fields/v4
- NSIDC Tutorial for viewing SMAP data on NASA Wroldview: https://nsidc.org/sites/nsidc.org/files/SMAP.NASAWorldview-08-16-16.mp4
- SMAP Information and Handbook via Alaska Satellite Facility: https://www.asf.alaska.edu/smap/documents-tools/smap-handbook/