Precipitation Processing System (PPS)

STORM
User Guide

Version 2.4

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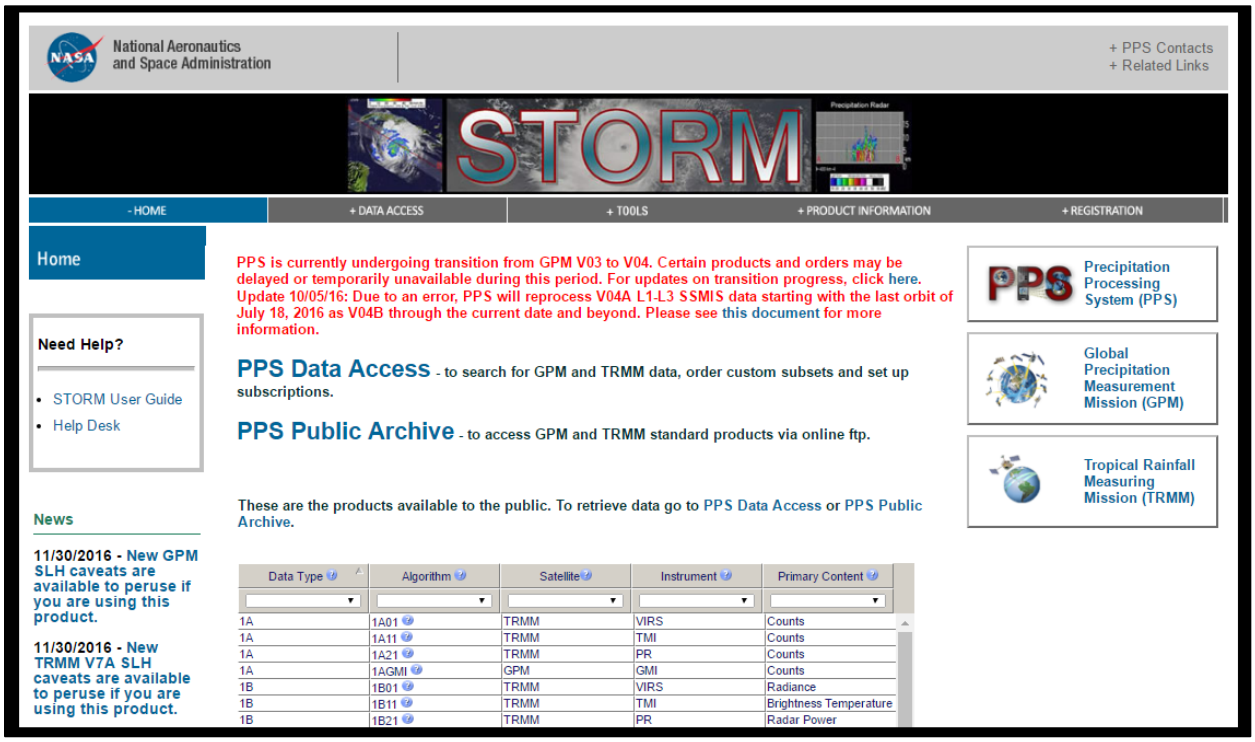
TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 DESCRIPTION

STORM (https://storm.pps.eosdis.nasa.gov) is a publicly available Web-based data access interface for the Global Precipitation Measurement (GPM) Mission's Precipitation Processing System (PPS). PPS is one of the first measurement-based processing systems approved by NASA Headquarters; it employs a recognized scientific measurement and provides continuity between data from previous and future satellite missions. PPS generates precipitation data using radar and microwave measurements from the Precipitation Measurement Missions (PMM), including GPM and the Tropical Rainfall Measuring Mission (TRMM).

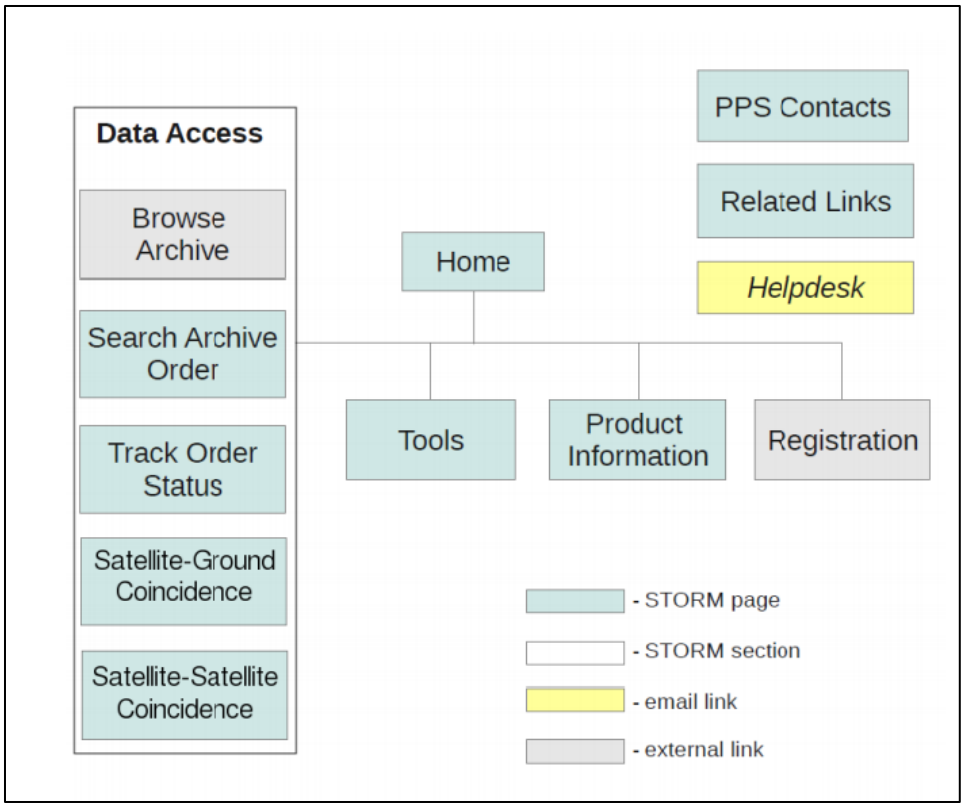


1.2 PURPOSE

The purpose of STORM is to provide the science community, students, and the public with an opportunity to learn about GPM data, search for data, order custom subsets, and subscribe to receive subset products produced in the future.

1.3 SITE MAP

Depicted and described below are the main elements of the STORM site.



Data Access is the core of STORM that allows users to access PPS data in various ways.

- ***Browse Archive*** is a link to the PPS public online archive. Users can search for data by drilling down through the directories.
- ***Search Archive/Order*** is the interface to use when searching for data based on various parameters, setting up subscriptions, and ordering custom subsets.
- ***Track Order Status*** allows you to check on the status of your orders and subscriptions, and to cancel subscriptions.
- ***Satellite-Ground and Satellite-Satellite Coincidence*** allow you to explore the coincidence interfaces without requiring registration or involving data download.

Tools provides links to tools for exploring and using PPS data. This page includes links to the 3D Web-Based data visualizations generated using CesiumJS. You can find a guide to those products on the Tools page as well.

Product Information provides links to documentation related to PPS products.

Registration is an external link to a Web-based tool for registering your e-mail to access PPS products through FTP or to order through STORM.

PPS Contacts provides contact information of PPS personnel and affiliates.

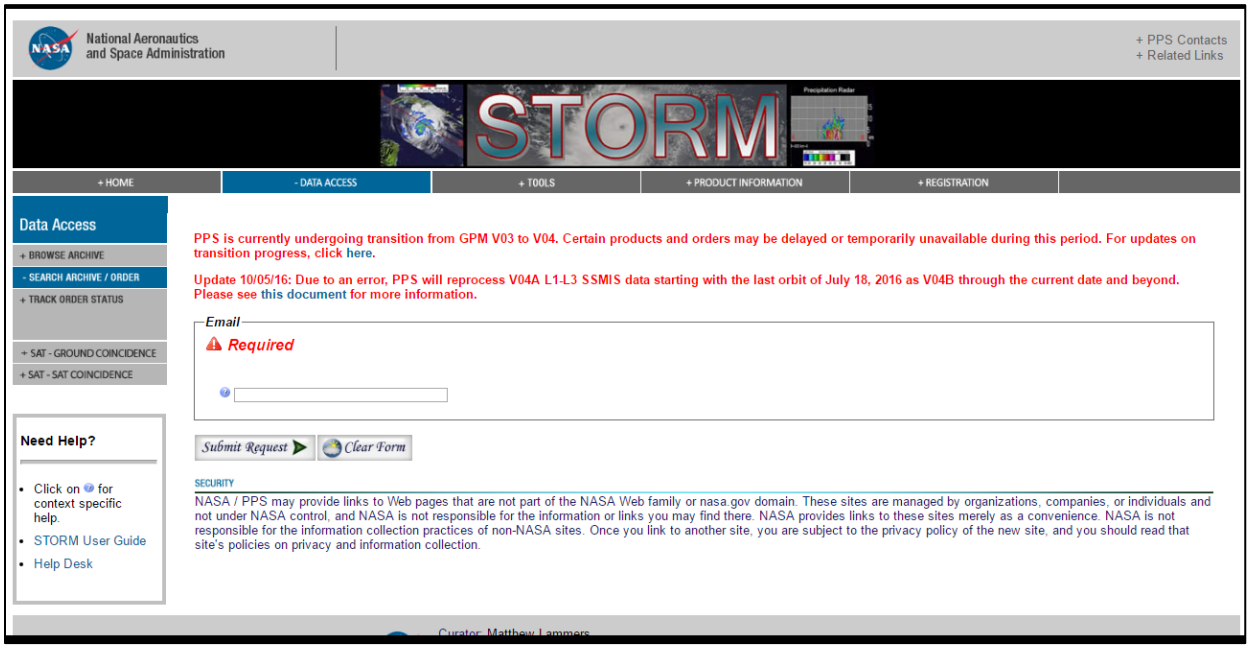
Related Links provides links to useful and relevant Web sites.

Helpdesk is a link from which to send an e-mail to the PPS Helpdesk.

2.0 DATA ACCESS USAGE SCENARIOS

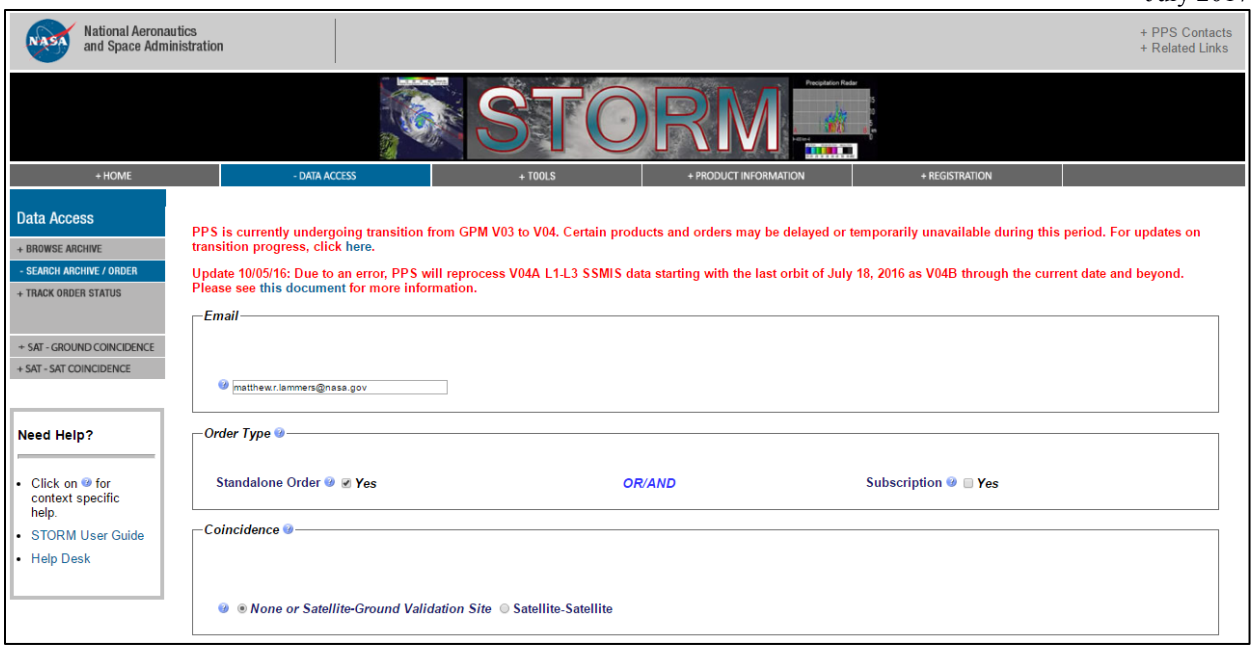
The scenarios below describe the typical usage of the STORM data search and ordering interface. To begin, click on Data Access on the horizontal menu on the top, or if you are on a different page of the Data Access section, click on Search Archive/Order on the left navigation menu.

To access the Data Search/Order interface, you are required to provide an e-mail address.



This e-mail must be registered and verified with PPS; otherwise, you will be prompted to complete the registration process. If you see this message, click on Register to be directed to an external tool to register your e-mail for access to PPS data.

Once a registered e-mail address is provided, you may search and order PPS data based on various criteria.



2.1 SEARCH AND ORDER FULL GRANULES

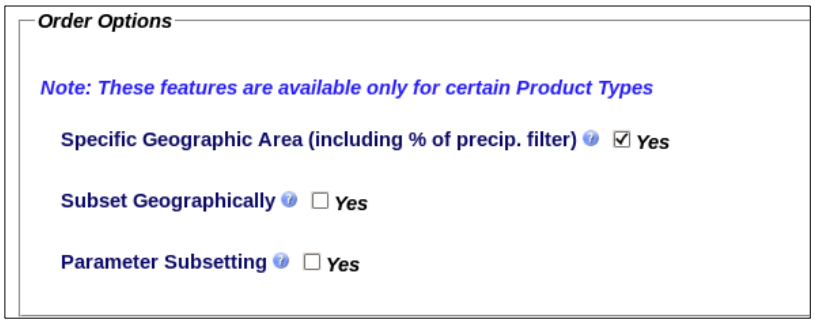
2.1.1 Search for Granules By Product Type, Temporal Criteria, and Geographic Location

2.1.1.1 Overview

These are the steps to perform the most basic search for granules. The only required inputs are Product Type and Temporal Criteria. You may also select a geographic location to limit the search results to a specific geographic area. In this scenario, the result of the search is a list of full granules that can be downloaded immediately one at a time. For your convenience, instead of downloading granules individually you may choose to submit an order and receive an e-mail with a list of granule locations at the online archive and scripts to retrieve the files.

2.1.1.2 Search Criteria Selection

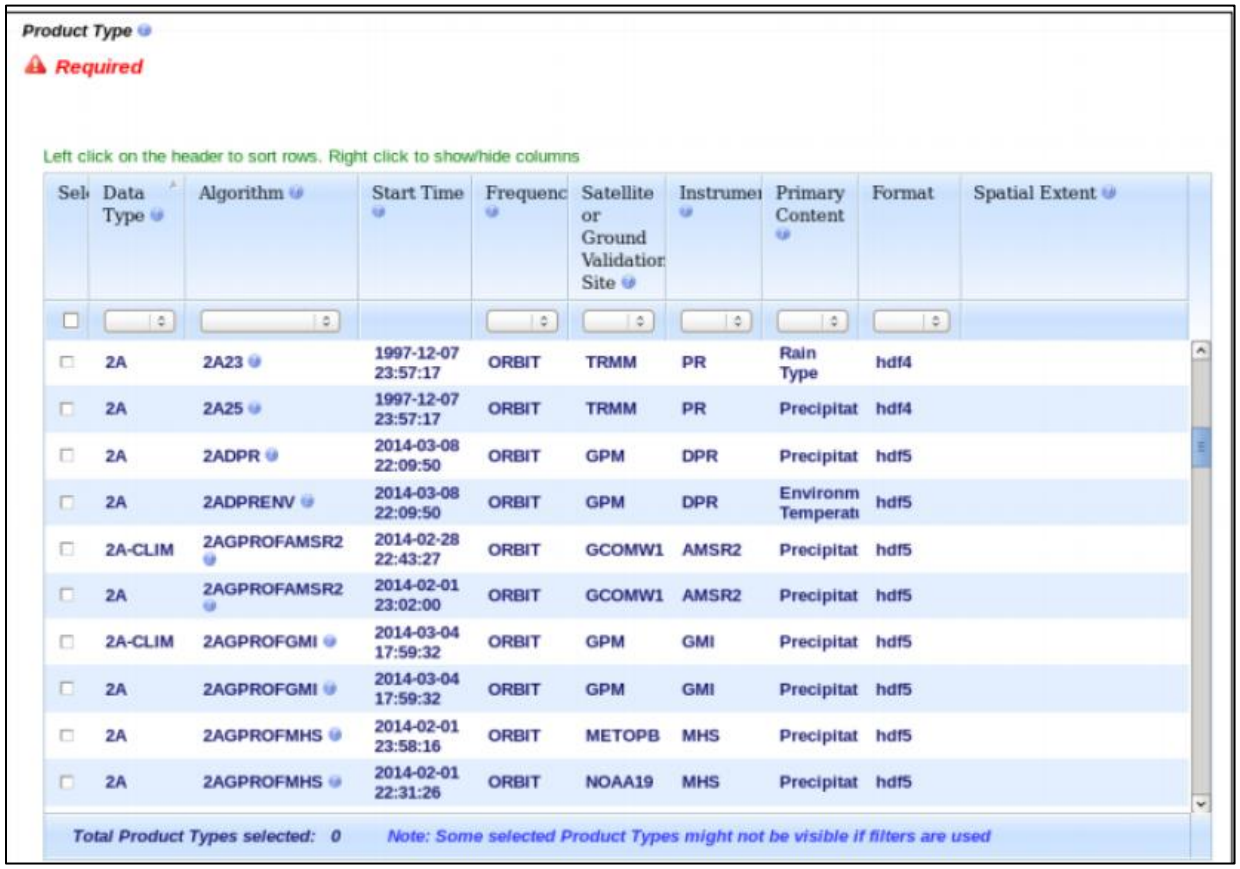
2.1.1.2.1 Select Specific Geographic Area Option



By selecting Specific Geographic Area, you can limit your search results to full granules that include data for a specific geographic area. Some granules may extend outside of the defined area. When selected, a map will display at the bottom of the page.

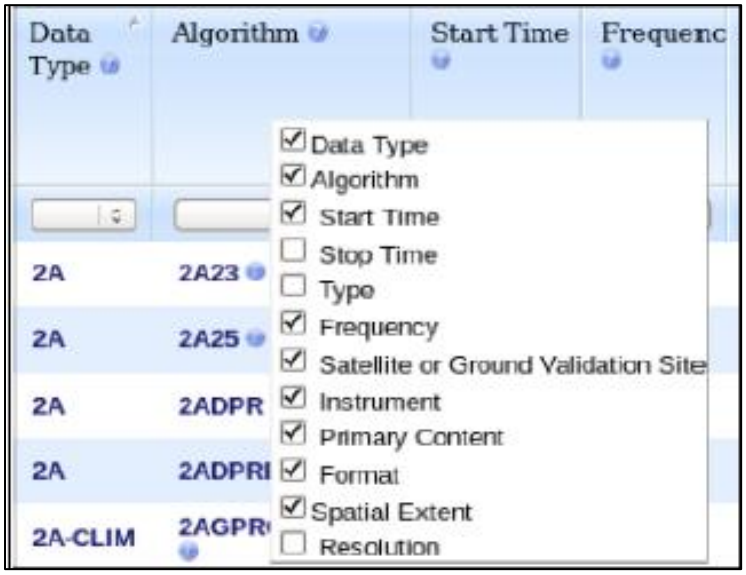
This map is where you define your specific geographic area. You can zoom in and out and also choose to display a map or satellite image. To define a specific area, input Latitude and Longitude values and either click the Draw button at the lower left or click on the square at the top left and use your mouse to define the geographic area.

2.1.1.2.2 Select Product Type



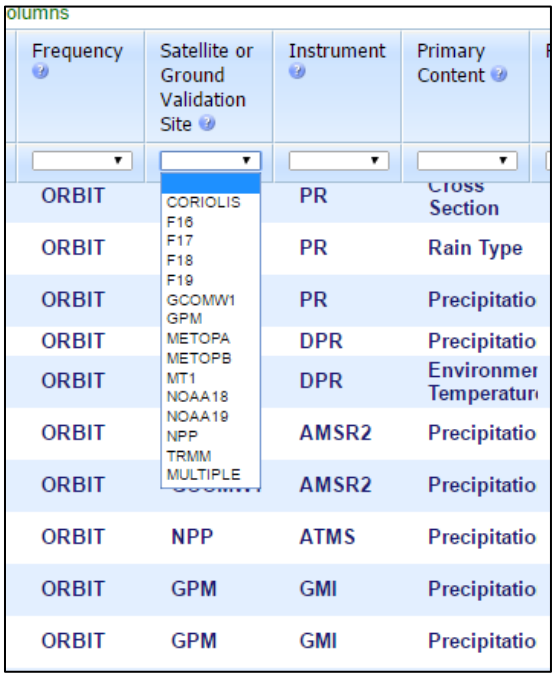
This is the list of available science products. The list of available products changes depending on the selected Order Options.

To select all products, select the checkbox at the top left. Left click on a column header to sort rows by that column. Right click on a column header to hide/show columns.



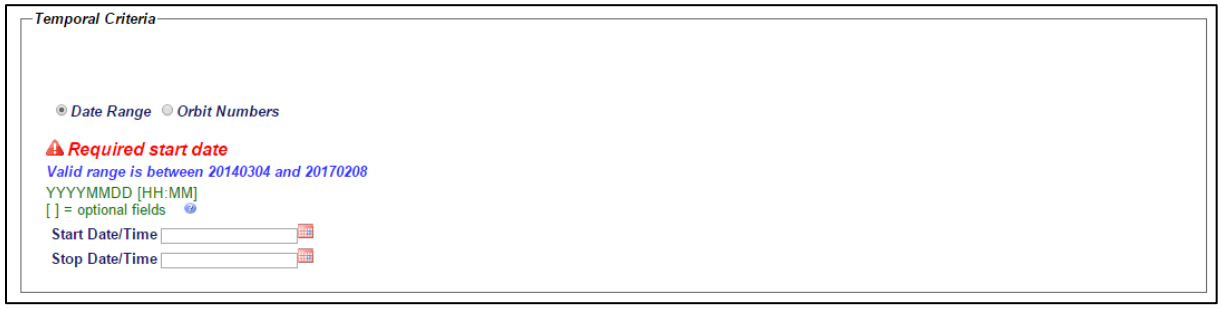
To get information about an algorithm, click on the icon next to an algorithm name. It will provide you with a brief description and in most cases with a link to full documentation.

You may narrow down the list of product types by using filters (pull-down menus and text boxes) in the header.

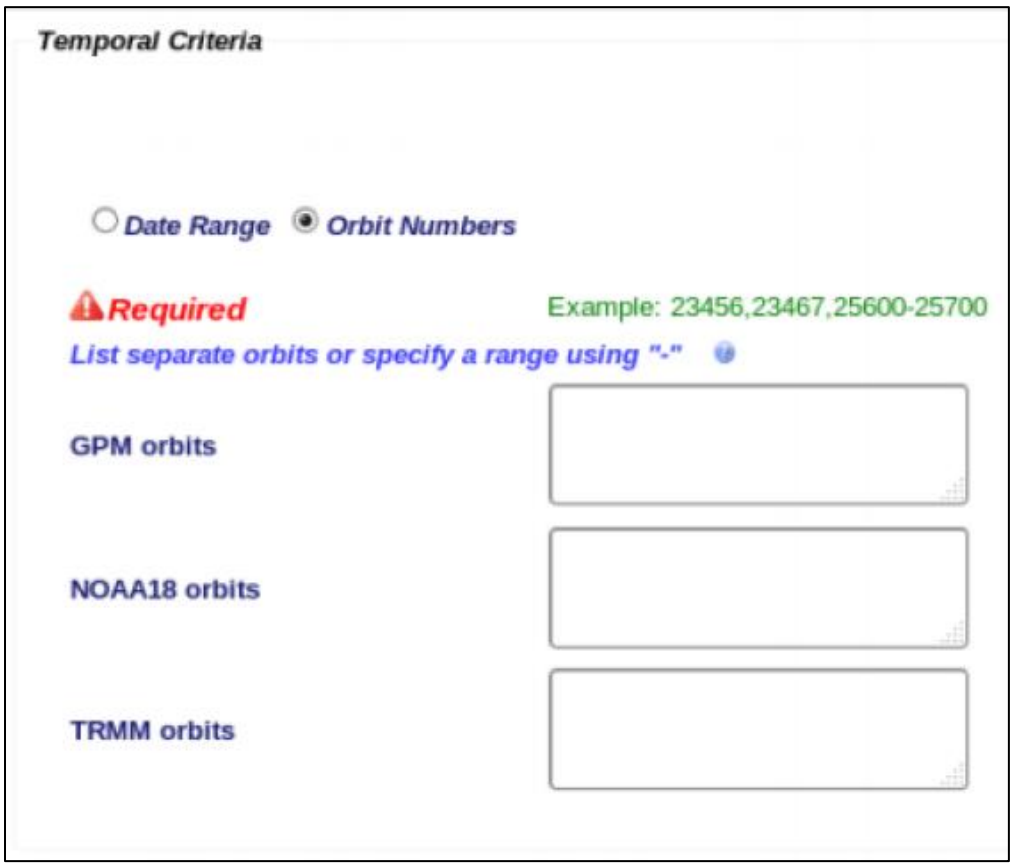


2.1.1.2.3 Select Temporal Criteria

Temporal criteria can be specified ether as Date Range or Orbit Numbers.



By default, you are prompted to provide the Start Date/Time and Stop Date/Time of the data you are requesting. If time is not specified (date supplied only), the Start Time defaults to midnight (00:00:00) of the date specified. The Stop Time defaults to 23:59:59 of the date specified.

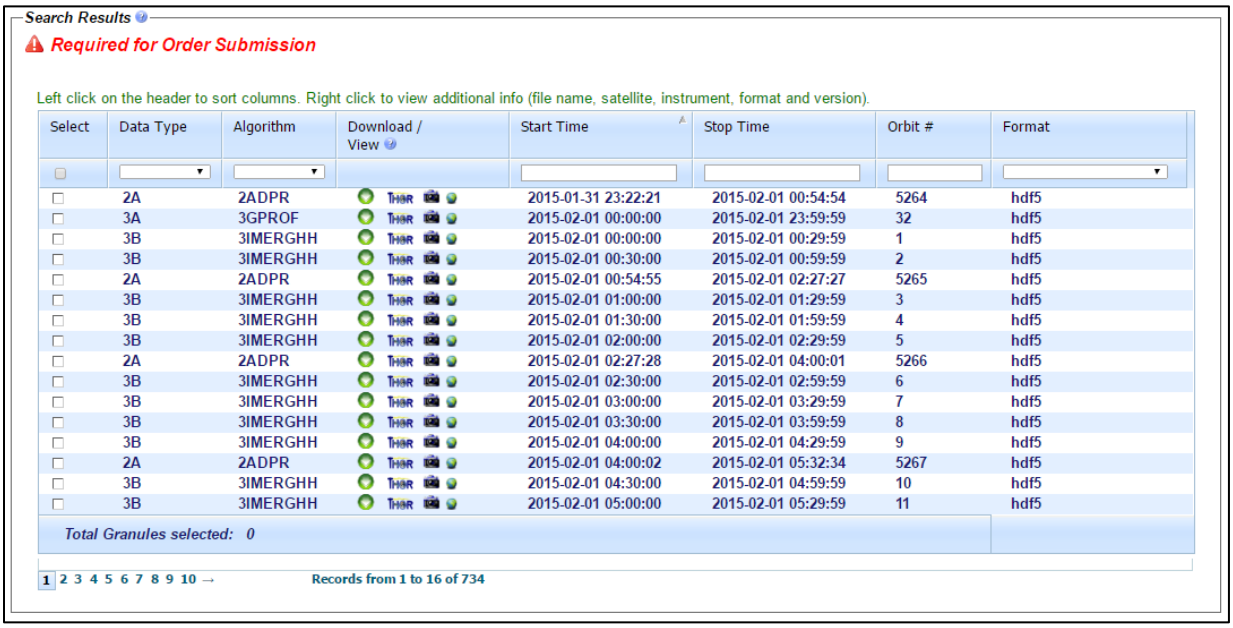


If the Orbit Numbers option is selected, you are prompted to specify orbit ranges for each platform to be included in the search results. For products that are not "Orbit" based (Level 3), Orbit Number will refer to the day or month of the year (1-12 for monthly products, 1-365 for daily products), so for products that span multiple years, you will get files for the same day each year the product was available.

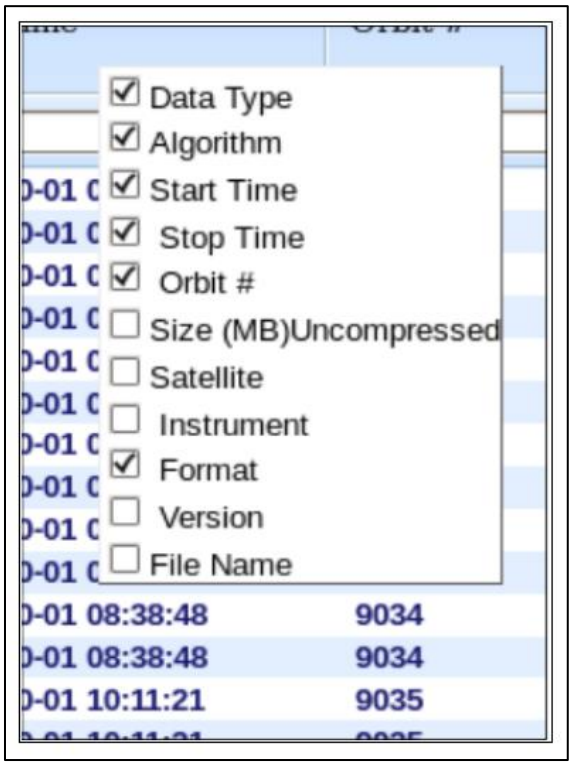
2.1.1.2.4 Select Data Format

Currently a window to select a different data format from HDF5 will only appear if you select the Level 1C GMI or Level 3 IMERG-HH/M products. STORM has the ability to output the 1C GMI product in BUFR format effective May 2017, and so the option is available beneath the Date Range window. Similarly, Level 3 IMERG-HH/M can be output in GRIB2 format using this toggle. It can be expected that future developments will allow other products to be output in different formats, as well as other formats being selectable through this window.

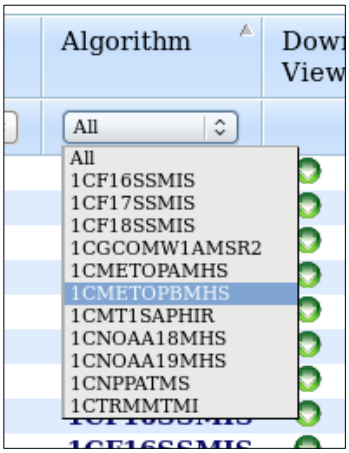
2.1.1.3 View Granules in Search Results; Download/Select Granules To Include in Your Order



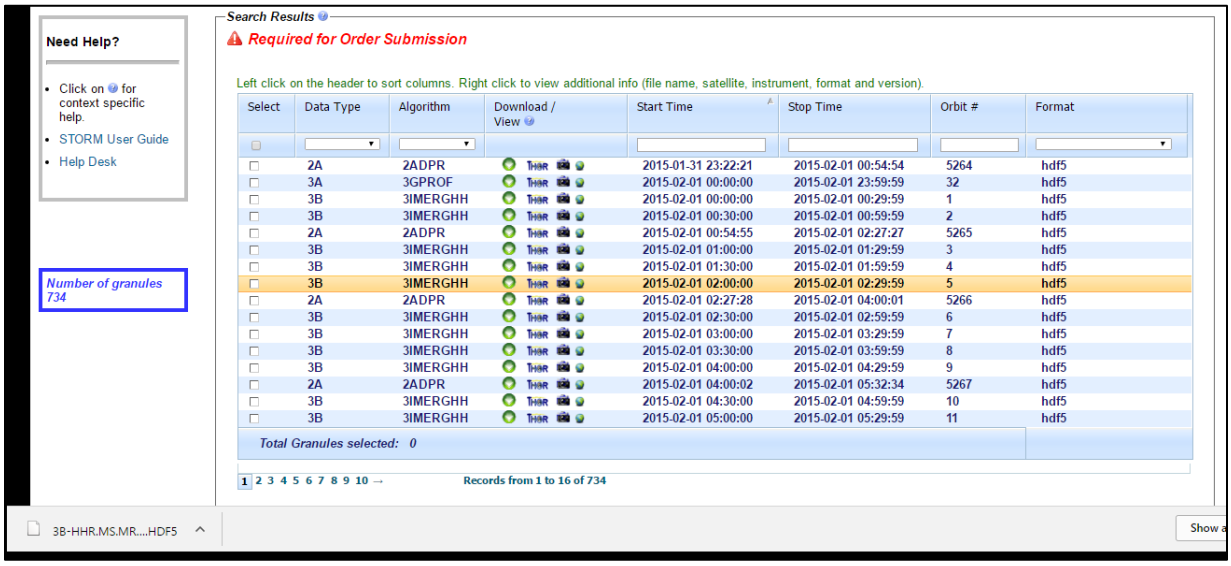
To select all granules, select the checkbox at the top left. If there are more than 2,000 granules in the list, only 2,000 will be available, but by selecting all, the order will include all granules. Left click on a column header to sort rows by that column. Right click on a column header to hide/show columns.



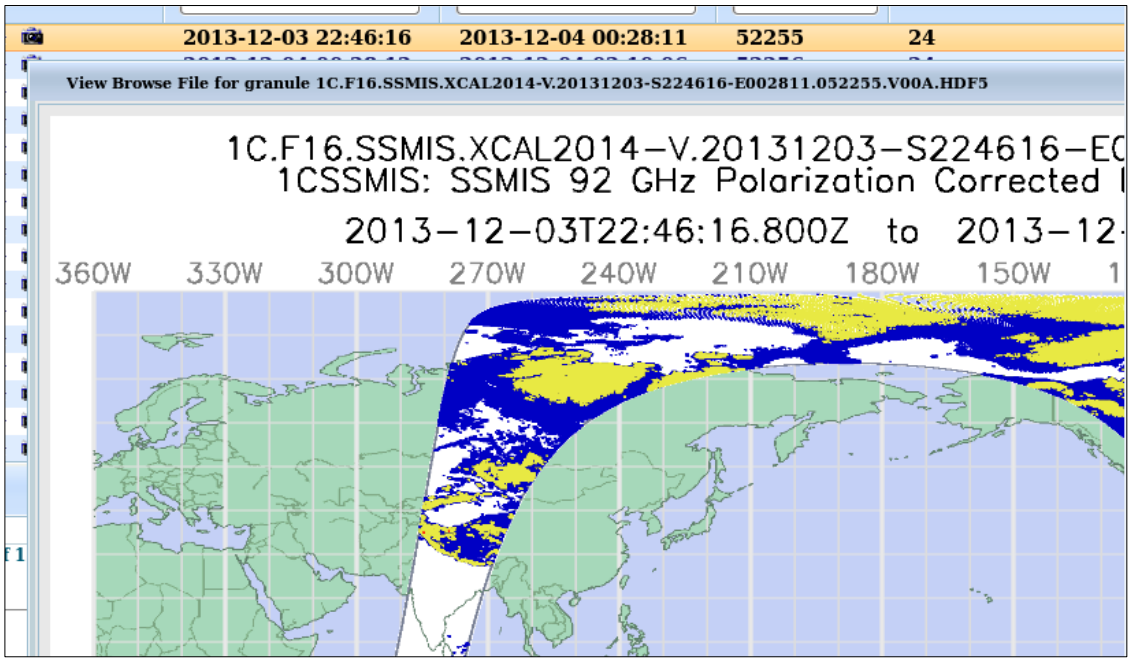
You may narrow down granule search results by using filters (pull-down menus and text boxes) in the header.



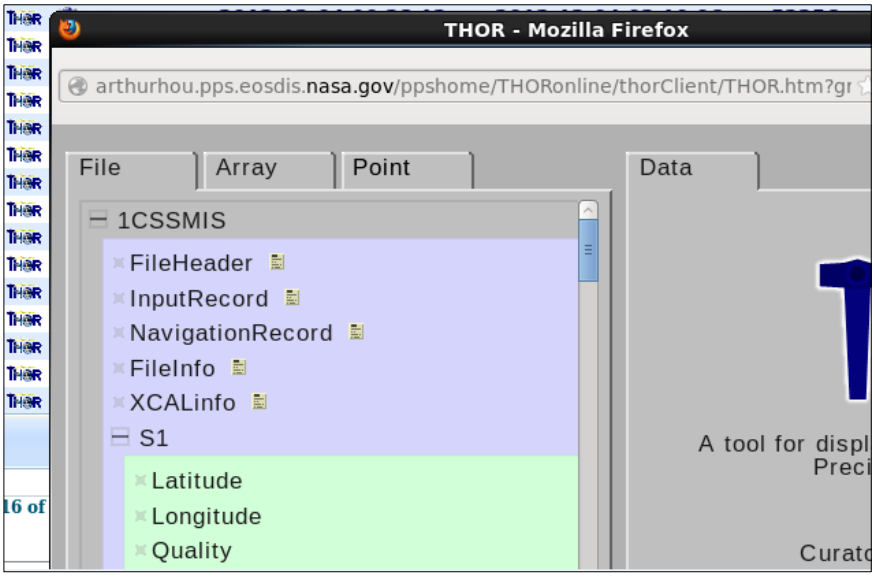
To download a granule, click on the arrow icon: 



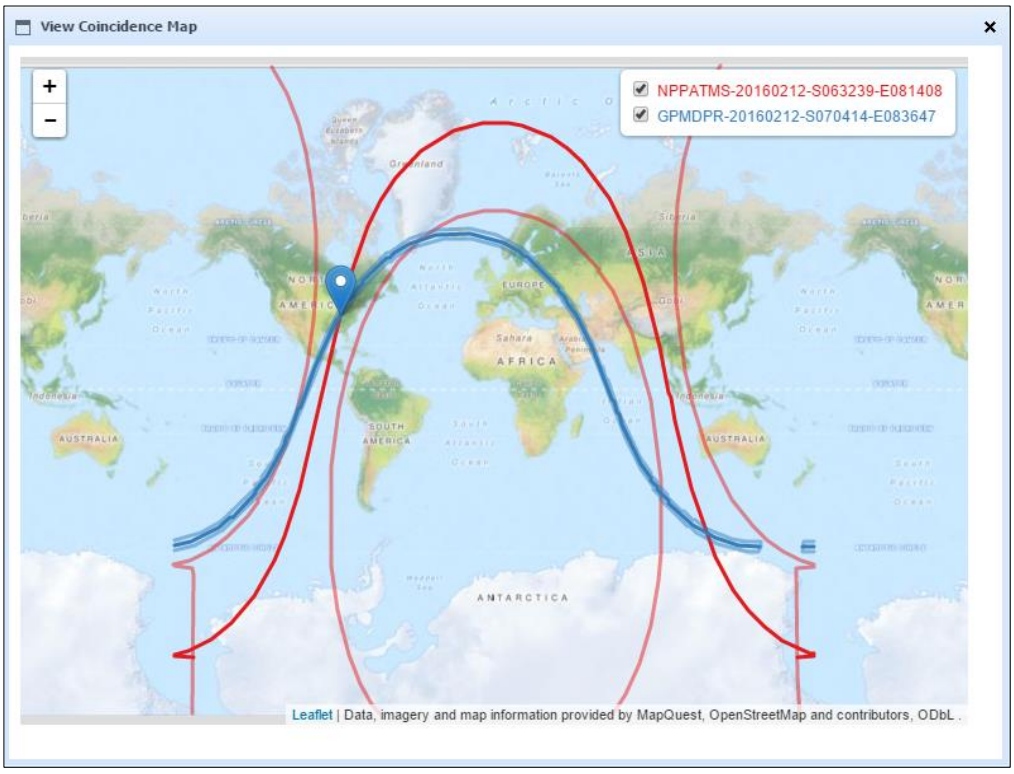
To view a Browse image associated with a granule, click on the camera icon: 



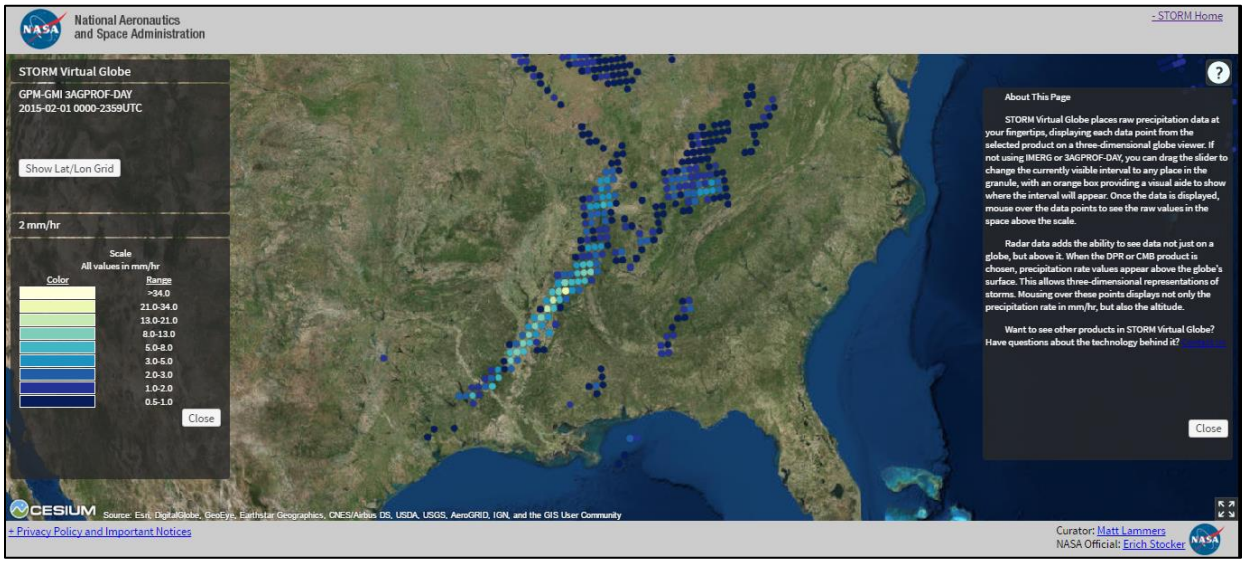
To explore a granule with THOR Online, click on the THOR icon: 



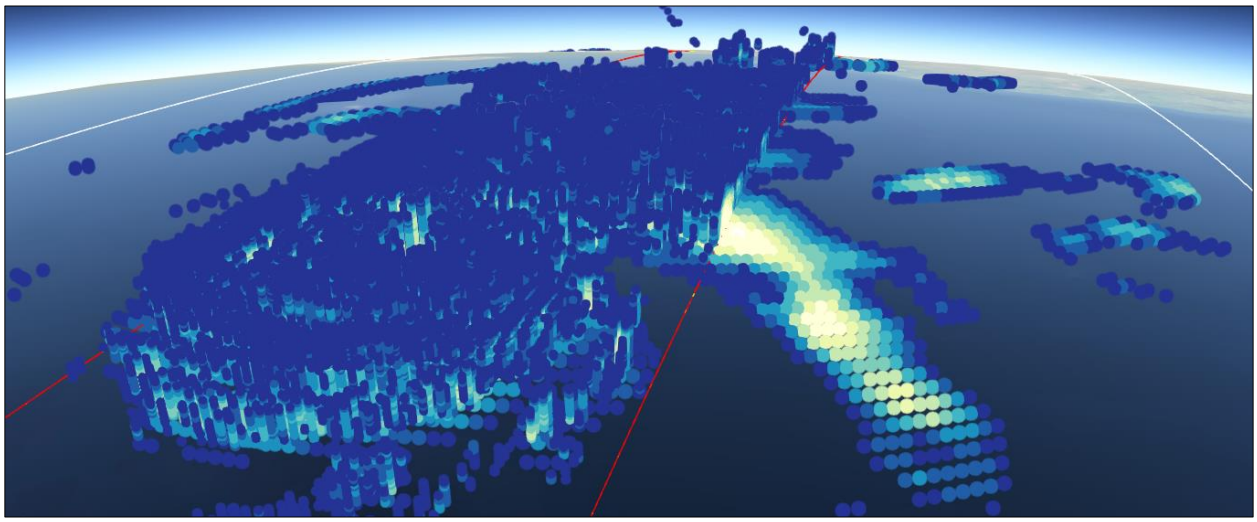
In satellite-satellite coincidence requests, you can dynamically view the coincidence event and the associated swaths by clicking the crossing icon:



Finally, for a quick interactive visualization of the data, STORM Virtual Globe allows for display of a product using a three-dimensional Earth viewer. It can be accessed by clicking the globe icon: . Swath-based products (currently 2AGPROF, 2ADPR, and 2BCMB) can be scrolled through using a rolling 15-minute window, while grid-based products (currently 3AGPROF-DAY and IMERG Half Hour) display the entire globe of data.



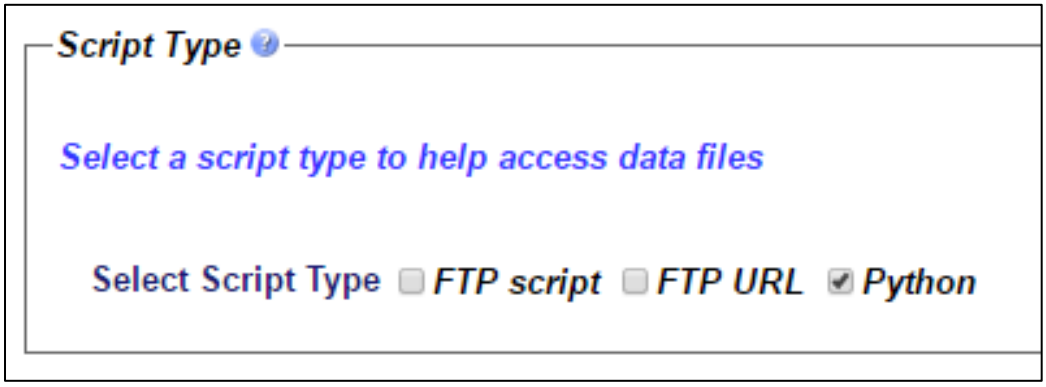
Most products are displayed on the surface of the globe, but 2ADPR features points at all vertical levels with precipitation rates greater than 0.5 mm/hr. All data points can be moused-over to have their values displayed in a text box on the left side of the screen.



In this scenario, granules can be downloaded individually from search results. However, for your convenience, instead of downloading granules individually, you may choose to submit an order and receive an e-mail with a list of granule locations at the online archive and scripts to retrieve the files.

2.1.1.4 Order Submission and Fulfillment

2.1.1.4.1 Select Script Type To Include With Your Order



Selecting one or more script types for acquiring your data files is required, although none are selected by default. These files can be run from your command line to automatically download all of the files included in the request and check their validity.

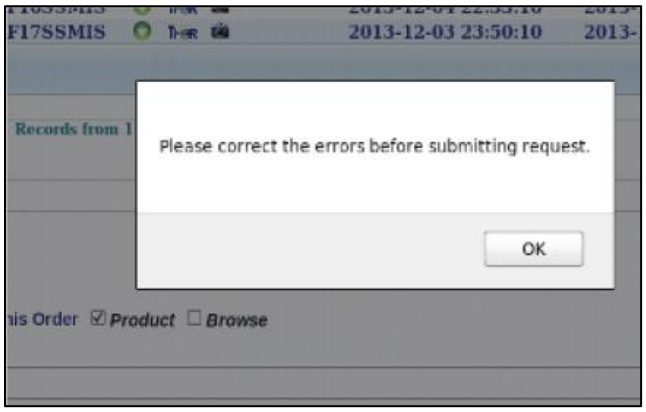
2.1.1.4.2 Select Types of Files To Include With Your Order

By default, only product files will be included with your order. Note that this option is displayed only if Browse files are available.

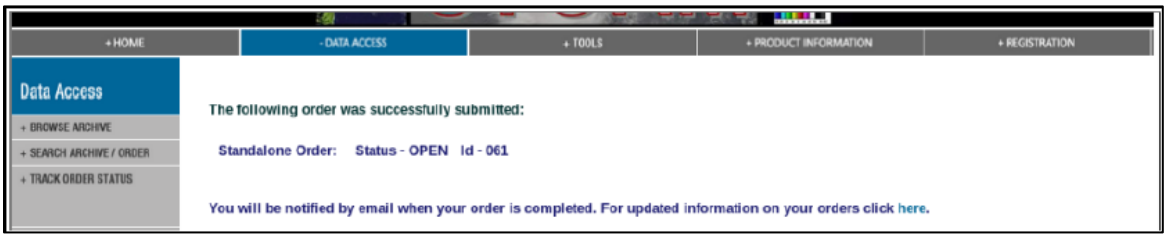
2.1.1.4.3 Submit an Order and View a Confirmation Page

Once all the required information is provided, you can submit your order by clicking on the Submit Request button at the bottom of the page.

If any of the required information is missing, you will get this message:



When the order is successfully submitted, you will get a confirmation page with the order number and a link to the order-tracking page.



2.1.1.4.4 Confirmation E-mail

Once the order is submitted, you will receive a confirmation e-mail with a link to the Order Tracking page (see Section 2.3).

2.1.1.4.5 Order Fulfillment E-mail

Once an order is fulfilled, you will receive an e-mail with a list of files and the FTP location. It will also include scripts and instructions to retrieve data.

2.1.2 Search for Granules By Satellite-Satellite Coincidence Events

2.1.2.1 Overview

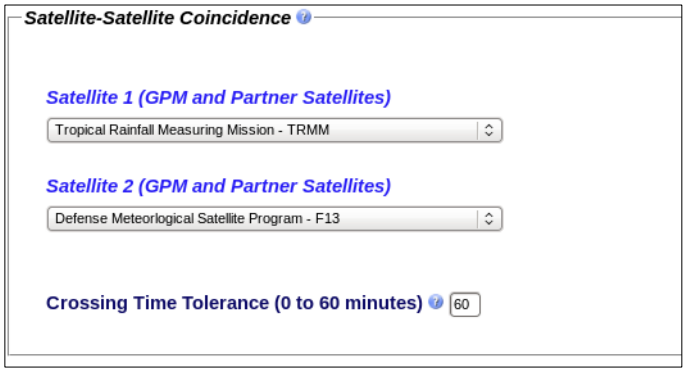
These are the steps to perform a search for full granules based on satellite-satellite coincidence, which is where two specified satellites cross paths within a defined time period. The required input includes Satellite 1, Satellite 2, Crossing Time Tolerance, Product Type, and Temporal Criteria. You may also select a geographic location to limit the coincidence event search results to a specific geographic area. In this scenario, the result of the search is a list of full granules that can be downloaded immediately one at a time. For your convenience, instead of downloading granules individually, you may choose to submit an order and receive an e-mail with a list of granule locations at the online archive and scripts to retrieve the files.

2.1.2.2 Search Criteria Selection

2.1.2.2.1 Select Satellite-Satellite Search Option

Satellite-satellite coincidence is where two specified satellites cross paths within a defined time period.

2.1.2.2.2 Select Satellite 1 and Satellite 2



Satellite-to-satellite coincidence is found using two-line element (TLE) sets as an ephemeris source. Since TLE sets define an average orbit at a certain epoch, the TLE ephemeris drifts, mostly forward or backward along track, over time when compared to a definitive ephemeris source. The TLE ephemeris drift is greater after an orbit boost before a new TLE set is released that defines the new average orbit. The accuracy of TLE sets is dependent upon a number of factors. These range from the particular tracking sensors used and amount of data collected to the type of orbit and condition of the space environment. Since those factors vary from orbit to orbit and set to set, defining an accuracy for TLE sets is extremely difficult. As a guesstimate, coincident event information calculated by PPS is most likely accurate to within 10 seconds or 70 kilometers.

2.1.2.2.3 Specify Crossing Time Tolerance

This is the maximum difference between the time when the first satellite passes over a point on the Earth and the time when the second satellite passes over the same point on the Earth. All coincidence events with crossing time tolerances up to this maximum time are returned.

2.1.2.2.4 Limit Geographic Area (Optional)

By selecting "Limit Coincidence events to a specific geographic area," you can limit your search results to events that occur in the specific geographic area you defined. When selected, a map will display at the bottom of the page. See Section 2.1.1.2.1 for details.

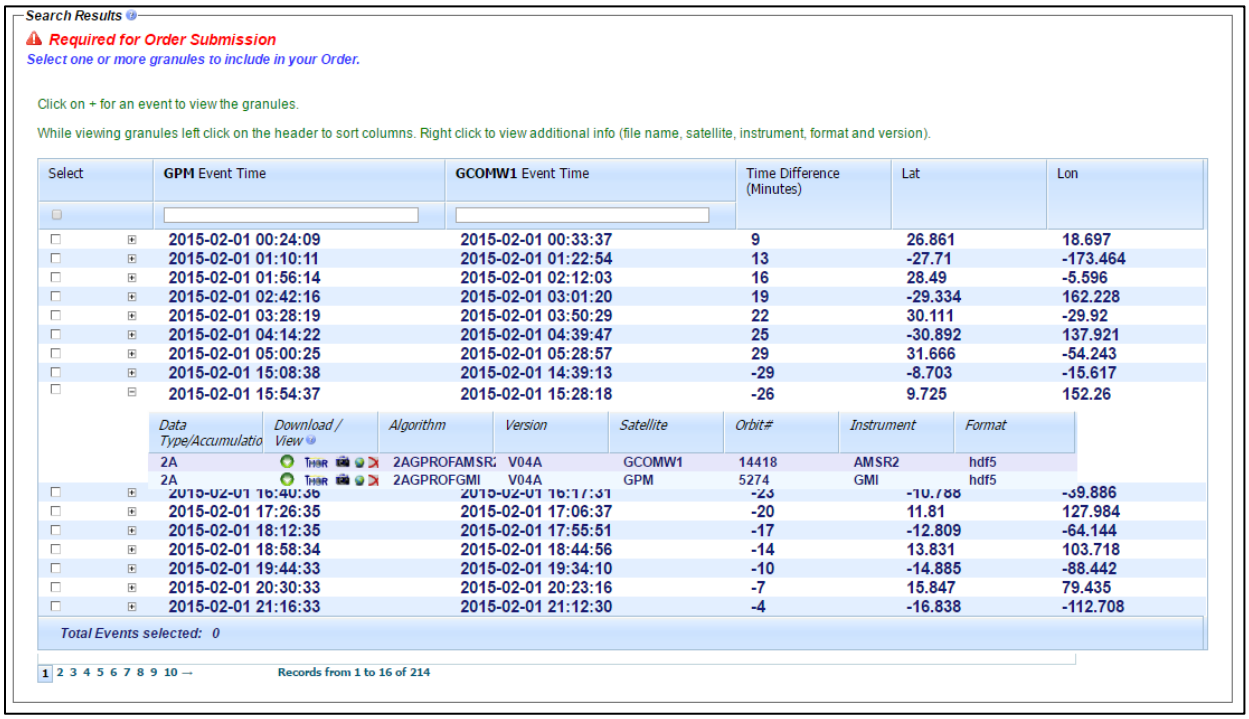
2.1.2.2.5 Select Product Type

See Section 2.1.1.2.2.

2.1.2.2.6 Select Temporal Criteria

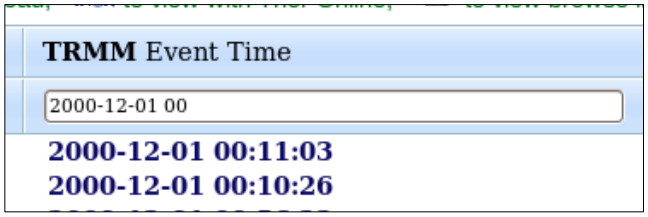
See Section 2.1.1.2.3.

2.1.2.3 View a List of Events in Search Results as Well as Granules for Each Event; Download Granules or Select Granules To Include in Your Order



Left click on a column header to sort rows by that column. To select granules for all events, select the checkbox at the top left. To select all granules for an event, select the checkbox on the left associated with an event. Click on "+" for an event to view the granules. See Section 2.1.1.3 for information on granules display.

You may narrow down a list of events by entering time in the text box in the result header.



2.1.2.4 Order Submission and Fulfillment

See Section 2.1.1.4. Note that in this case the files delivered with your order will also include a file with the mapping between the coincidence events and the granules.

2.1.3 Search for Granules By Satellite-Ground Validation Site Coincidence

2.1.3.1 Overview

These are the steps to perform a search for full granules based on Satellite-Ground Validation Site coincidence. The only system required input is Product Type and Temporal Criteria. However, to limit granule search results to coincidence with a Ground Validation (GV) site, you must select a geographic area over a specific GV site. The GV sites are marked on the map. In this scenario, the result of the search is a list of full granules that can be downloaded immediately one at a time. For your convenience, instead of downloading granules individually you may choose to submit an order and receive an e-mail with a list of granule locations at the online archive and scripts to retrieve the files.

2.1.3.2 Search Criteria Selection

2.1.3.2.1 Select Geographic Location Over a Ground Validation Site

See Section 2.1.1.2.1.

2.1.3.2.2 Select Product Type

See Section 2.1.1.2.2.

2.1.3.2.3 Select Temporal Criteria

See Section 2.1.1.2.3.

2.1.3.2.4 View Granule in Search Results; Download Granules or Select Granules To Include in Your Order

See Section 2.1.1.3.

2.1.3.3 Order Submission and Fulfillment

See Section 2.1.1.4.

2.2 ORDER CUSTOM SUBSETS

Note that not all the products can be subsetted. When subset options are selected, a list of available products is updated accordingly.

2.2.1 Order Geographic Subset With % of Precipitation

2.2.1.1 Overview

These are the steps to order full and partial granules within a specific geographic area. Optionally, you may also narrow down the granules included in your order by a percent of precipitation. You may combine this type of subset with a parameter subset (see Section 2.2.2). In this scenario you cannot download granules from search results and must place an order. Subsetted products are not available immediately, as they have to be produced. The Geographic Subset option is not available when granules are searched for by satellite-satellite coincidence.

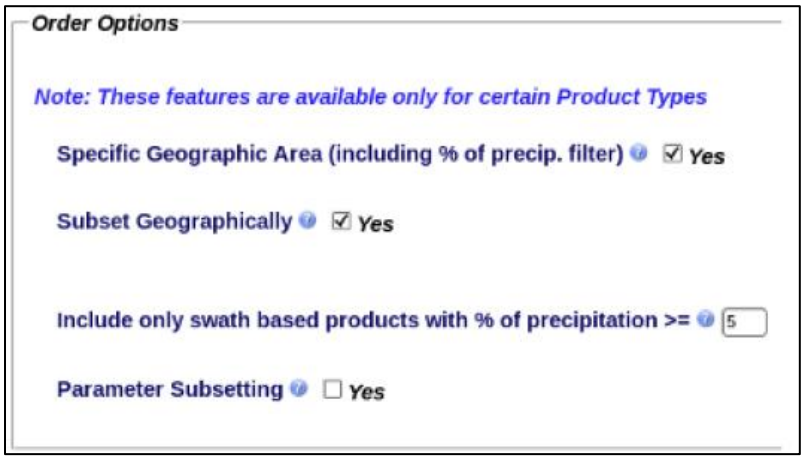
2.2.1.2 Search Criteria and Order Options Selection

2.2.1.2.1 Select Specific Geographic Area Option

See Section 2.1.1.2.1.

In addition, in the case of a geographic subset, you may provide a Location Alias to be used as part of the output file name. Location Alias defaults to the latitude/longitude if not provided.

2.2.1.2.2 Select Subset Geographically



By selecting Subset Geographically, you can limit your search results to full and partial granules that include data for that specific geographic area you defined. No granules will extend outside of the defined area.

2.2.1.2.3 Provide Percent of Precipitation (Optional)

By providing value for "Include only swath-based products with % of precipitation," you are requesting that your order include only granules that have at least the percent of precipitation that you specified. Please note that some or all of the products displayed and selected in your Search Results may not be included in your received final order because the PPS ordering system can only calculate and search for specific granules that meet your precipitation percentage criteria after you submit your order. A typical range for percent of precipitation is between 5% and 20%, unless you are looking at an extremely dry area or an area with frequent precipitation.

2.2.1.2.4 Select Product Type

See Section 2.1.1.2.2.

2.2.1.2.5 Select Temporal Criteria

See Section 2.1.1.2.3.

2.2.1.3 View Granules in Search Results; Select Granules To Include in Your Order

See Section 2.1.1.3. Note that only full granules can be viewed with THOR Online and in Browse images. Subset granules cannot be downloaded immediately, and an order must be placed to obtain the result files.

2.2.1.4 Order Submission and Fulfillment

See Section 2.1.1.4.

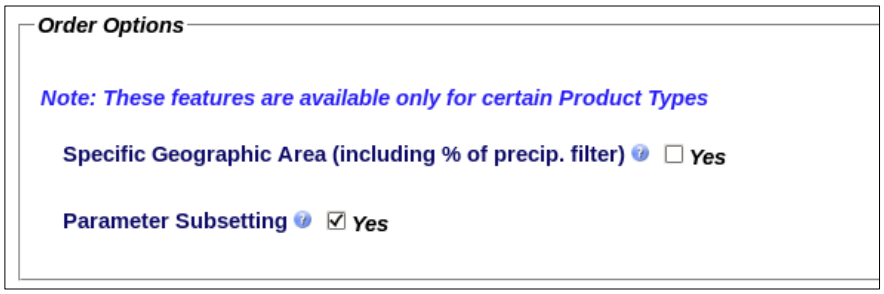
2.2.2 Order Parameter Subset

2.2.2.1 Overview

These are the steps to order granules containing only specific science parameters. You may combine this type of subset with a geographic subset (see Section 2.2.1). In this scenario, you cannot download granules from search results and must place an order. Subset products are not available immediately, as they have to be produced. The Parameter Subset option is not available when granules are searched for by satellite-satellite coincidence. You cannot further subset channels of a parameter.

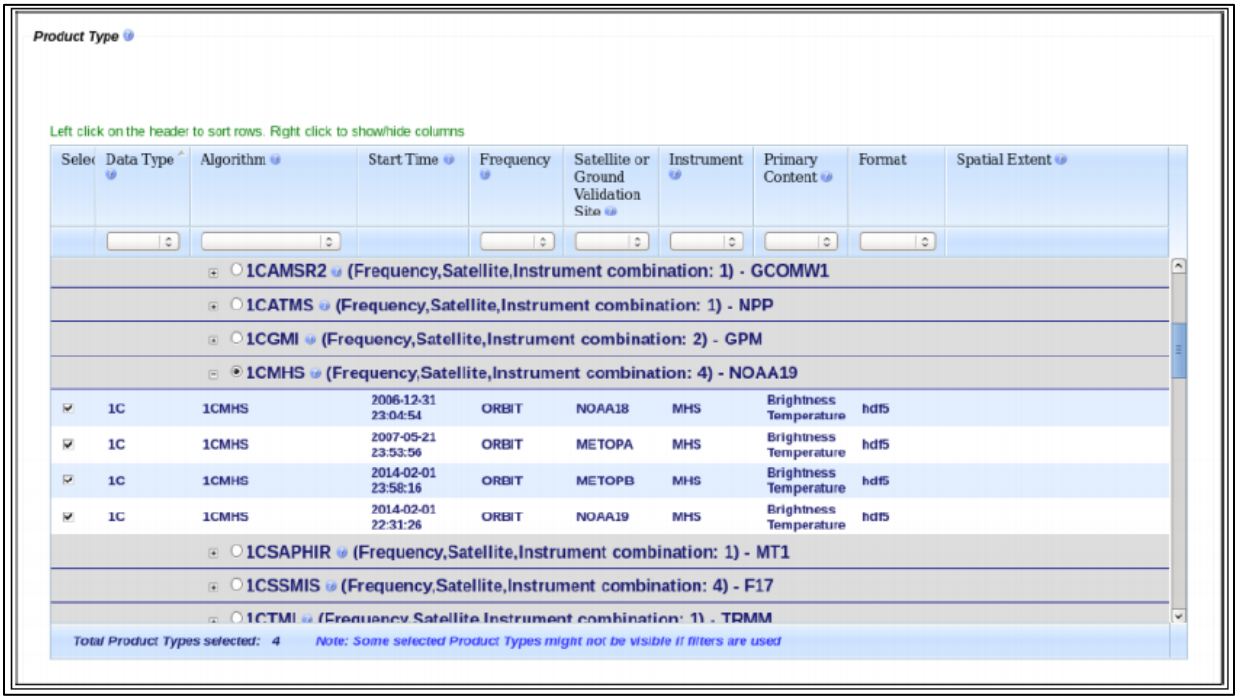
2.2.2.2 Search Criteria and Order Options Selection

2.2.2.2.1 Select Parameter Subset Option



By selecting Parameter Subsetting, you are requesting to produce granules containing only specific science parameters.

2.2.2.2.2 Select Product Type



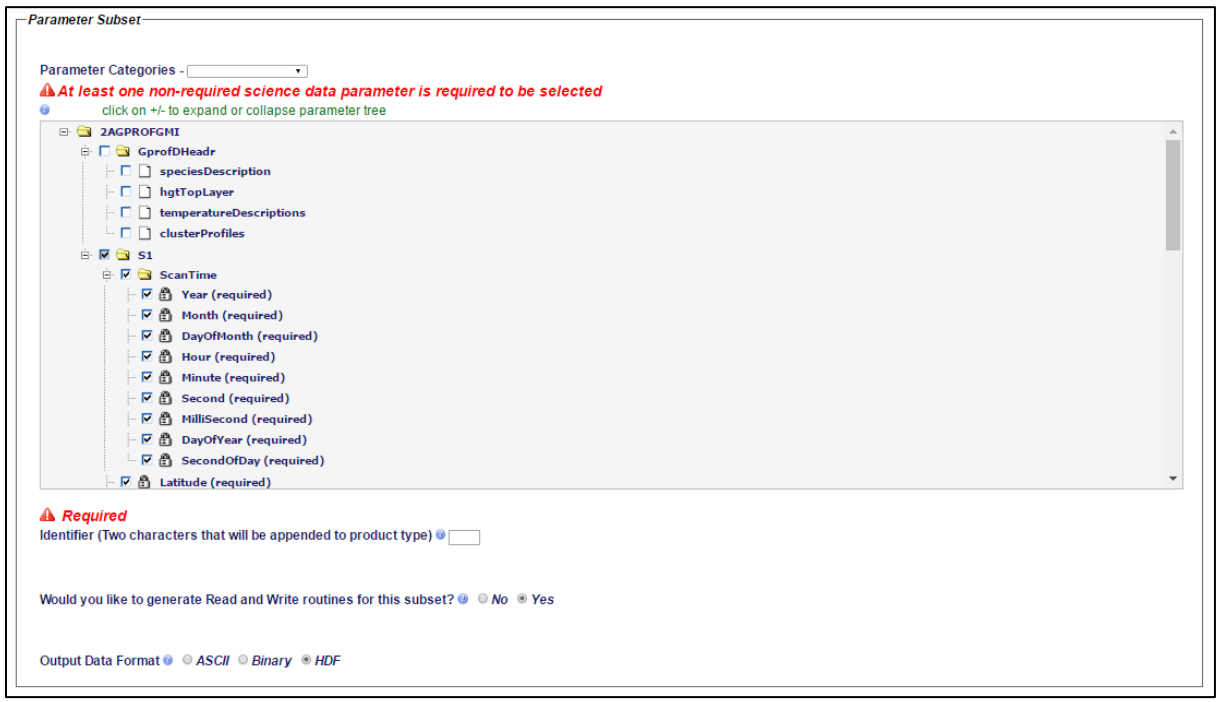
When the Parameter Subset option is selected, you can only include products associated with one algorithm per order. By selecting a radio button next to an algorithm, you can select all the product types associated with that algorithm. You may exclude some of them by unchecking a checkbox associated with a specific Frequency/Satellite/Instrument combination that defines a product. You may view the product types associated with an algorithm by clicking on "+" next to an algorithm and selecting individual products using checkboxes.

See Section 2.1.1.2.2 for information on sorting columns, filtering products, hiding/showing columns, and viewing descriptions and full documentation for an algorithm.

2.2.2.2.3 Select Temporal Criteria

See Section 2.1.1.2.3.

2.2.2.2.4 Select Science Parameters



Select the science parameters to be included in result granules. Some parameters are mandatory.

2.2.2.2.5 Provide an Identifier

This suffix will be used as a part of the name for the output file to distinguish subsets from full products (e.g., 1C_AC.F16, 1C_Qt.F16, etc.).

2.2.2.2.6 Request Read and Write Routines for the Subset

If you select Parameter Subsetting and request the read and write routines for the subsetted product, you will get a requestedCode.tar file along with your subsetted product files.

The requestedCode.tar file contains the PPS Science Algorithm Input/Output Toolkit (TKIO) read routine, write routine, header file, and config files needed for you to read and/or write this subsetted product with the TKIO toolkit.

For example, if you ordered a parameter subsetted 2AGPROFGMI product and given the suffix 'z1' you will get a product file and requestedCode.2AGPROFGMI_z1.tar file. After you untar the requestedCode tar file, you will see the following files:

TK_2AGPROFGMIz1_hdf5.h
TKrHDF5_L2AGPROFGMIz1_S1.c
TKrHDF5_L2AGPROFGMIz1_S1.h
TKwHDF5_L2AGPROFGMIz1_S1.c
TKwHDF5_L2AGPROFGMIz1_S1.h
2AGPROFGMIz1_aa.metadata.cfg
2AGPROFGMIz1_hdf5.data.cfg

Then you can use these routines in your read program and link with TKIO to read your subsetted product. You can download TKIO from the Tools page in STORM.

2.2.2.2.7 Select Output Data Format

This is the output format of your subsetted product; it is available only for products originally produced in HDF5 format. Subsetted granules for products in HDF4 are produced in HDF4.

While all subset products can be output in ASCII or Binary, only certain variables of certain products can be output in GeoTIFF. These variables include latitude/longitude two-dimensional fields within gridded products. If the user attempts to choose GeoTIFF as a format without having checked any variables to be output that are able to be GeoTIFF'ed, they will be given an alert and their order will not be processed.

2.2.2.3 View Granules in Search Results; Select Granules To Include in Your Order

See Section 2.1.1.3. Note that only full granules can be viewed with THOR Online and in Browse images. Subset granules cannot be downloaded immediately, and an order must be placed to obtain the result files.

2.2.2.4 Order Submission and Fulfillment

See Section 2.1.1.4.

2.3 CREATE A SUBSCRIPTION

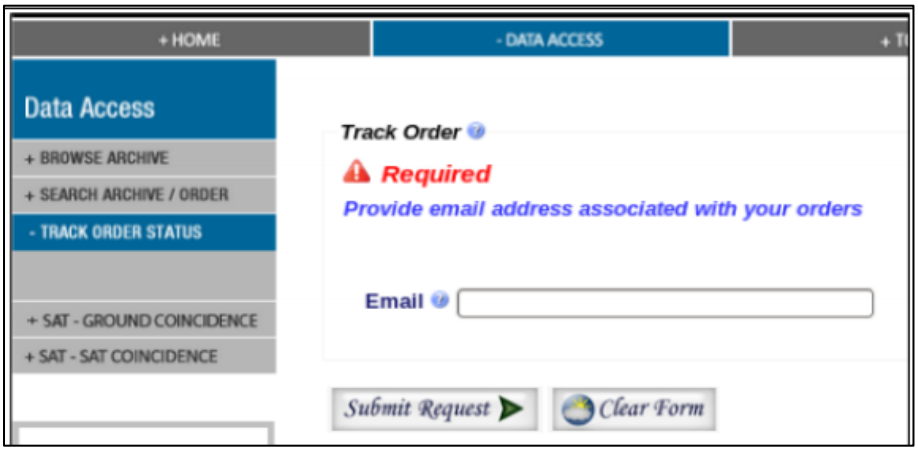
By default, Standalone Order is selected. A standalone order can be placed for data products that are already produced that you want to obtain on a one-time basis. Instead of or in addition to a standalone order, you can select a Subscription option.

A Subscription Order is submitted for a product that has not yet been produced and is being requested for an extended period of time. Subscription Orders are processed daily or are filled as the files are produced and archived (i.e., monthly for certain Level 3 products, etc.).

For a Subscription Order for standard products, the user will receive regular e-mails with a list of links to retrieve the new data files from the public archive. For a Subscription Order for subset products, the user will receive regular e-mails with a list of new data files to retrieve from the user FTP area. Subscriptions can be canceled; see Section 2.4.2.3.2.2.

2.4 VIEW ORDER STATUS

2.4.1 Request a Link To Track the Order Status Page



When you submit an order, a confirmation page will be displayed with your order number and a link to track your order. The system also sends you a confirmation e-mail that contains a temporary link to the Track Order Status page. If the link is expired or the confirmation e-mail is lost, you can request a new link by clicking on Track Order Status on the left. You will be prompted to provide an e-mail address associated with your orders.

2.4.2 Track Order Status Page

2.4.2.1 Overview

The top portion of the page, Filter Requests, contains the criteria to filter orders. The bottom portion, View Requests, is used to display the orders based on selected criteria.

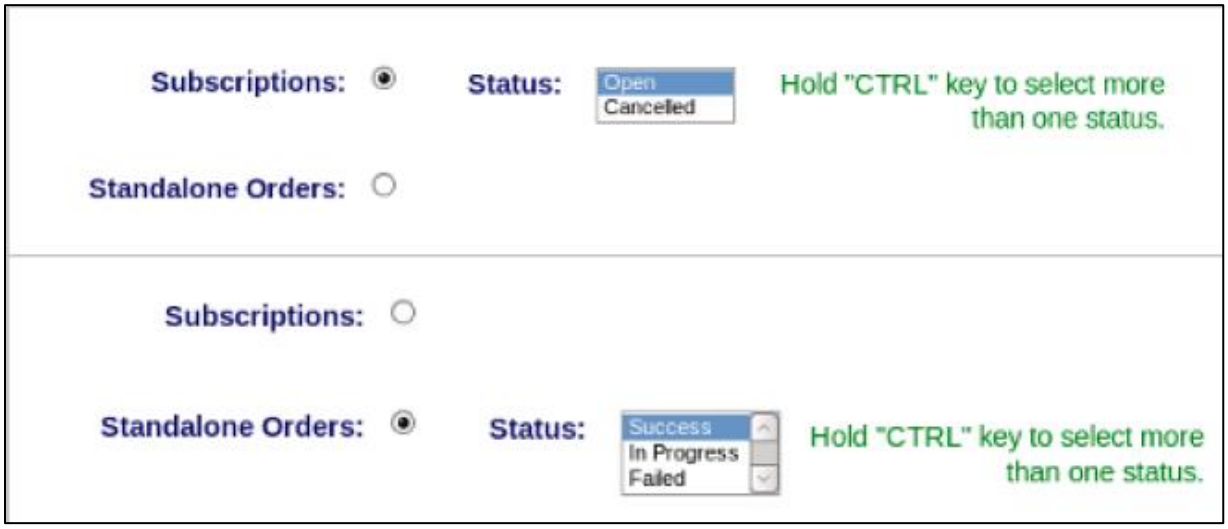
2.4.2.2 Select Filters

2.4.2.2.1 Select Subscriptions or Standalone Orders

By default, the Subscriptions option is selected. A Standalone Order is an order placed for data products that have been produced already that you are obtaining on a one-time basis. A Standalone Order is the order created by default for standard products or custom subsets. A Subscription is an option available for custom subsets only, and is created for a product that has not yet been produced and is being requested for an extended period of time. Subscription orders are processed daily or are filled as the files are produced and archived (i.e., monthly for certain Level 3 products, etc.).

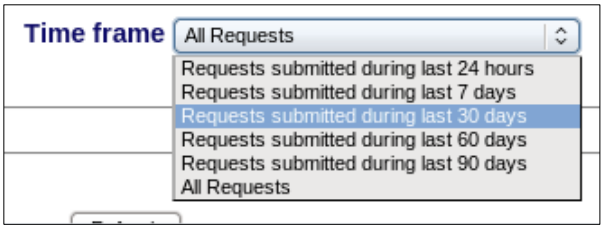
2.4.2.2.2 Select Status

The values for status selection change depending on the selected order type.



2.4.2.2.3 Select Time Frame

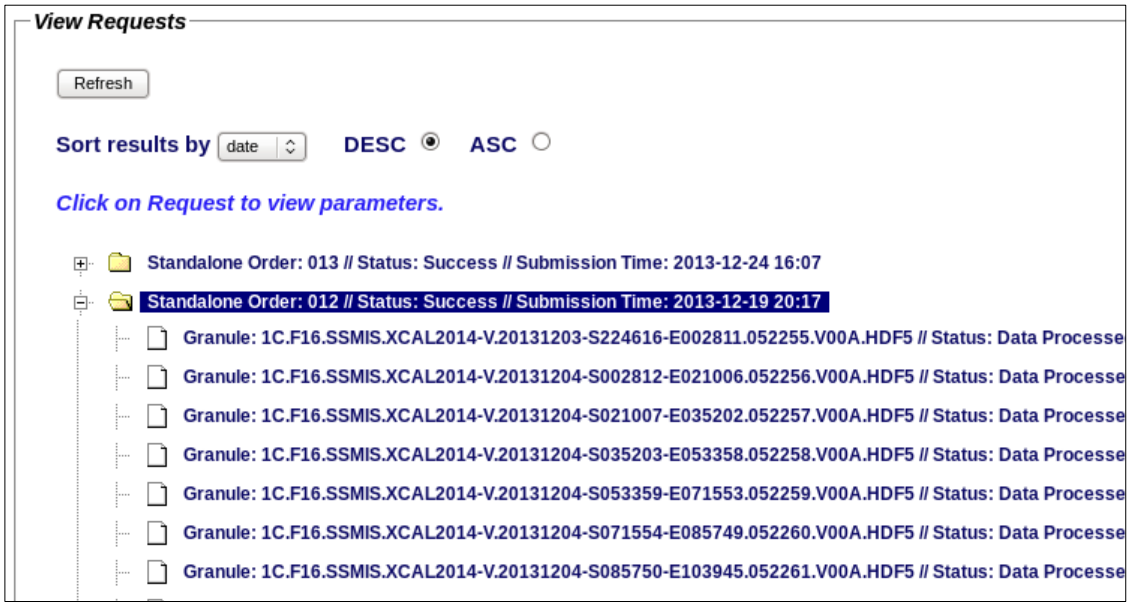
This allows you to narrow down the orders displayed by the time frame when it was submitted. The default selection is "Requests submitted during last 24 hours."



2.4.2.3 View Requests

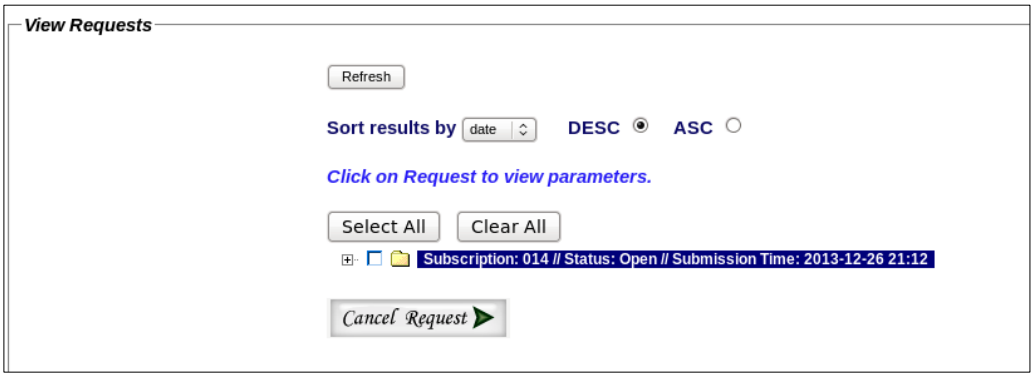
2.4.2.3.1 View Standalone Orders

By clicking on the "+" sign next to an order with status Success, you can view the list of files delivered with the order.

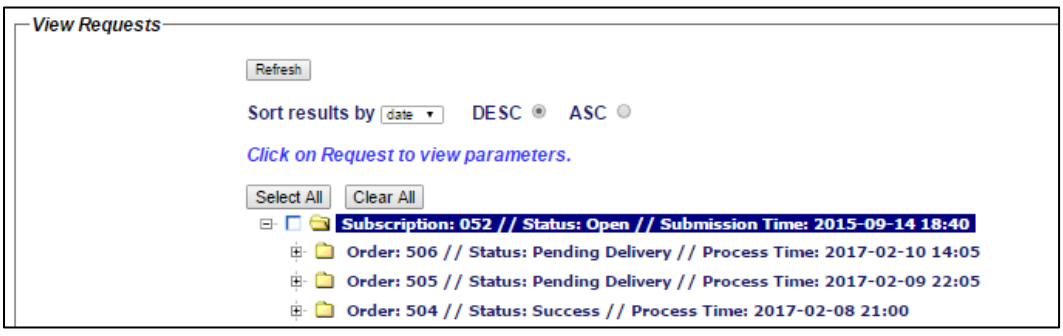


2.4.2.3.2 Track Status of Subscriptions

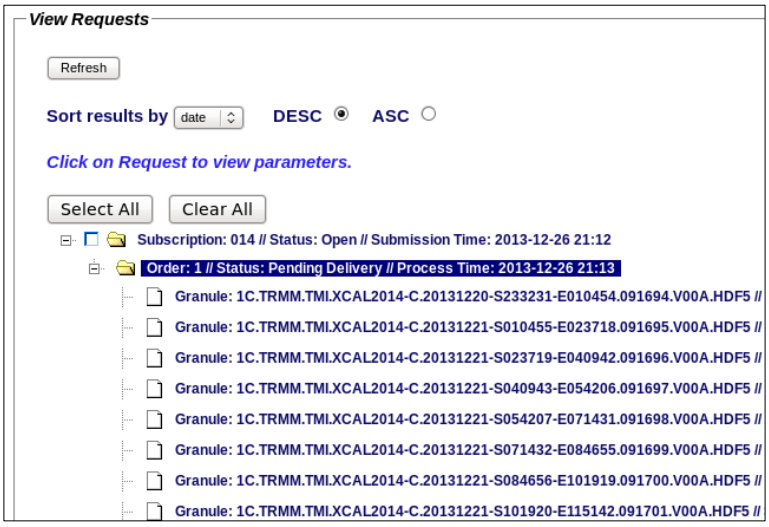
2.4.2.3.2.1 View Subscription



By clicking on the "+" next to a subscription, you may view a list of orders associated with this subscription.



By clicking on the "+" next to an order associated with a subscription, you can view a list of files delivered with that order.

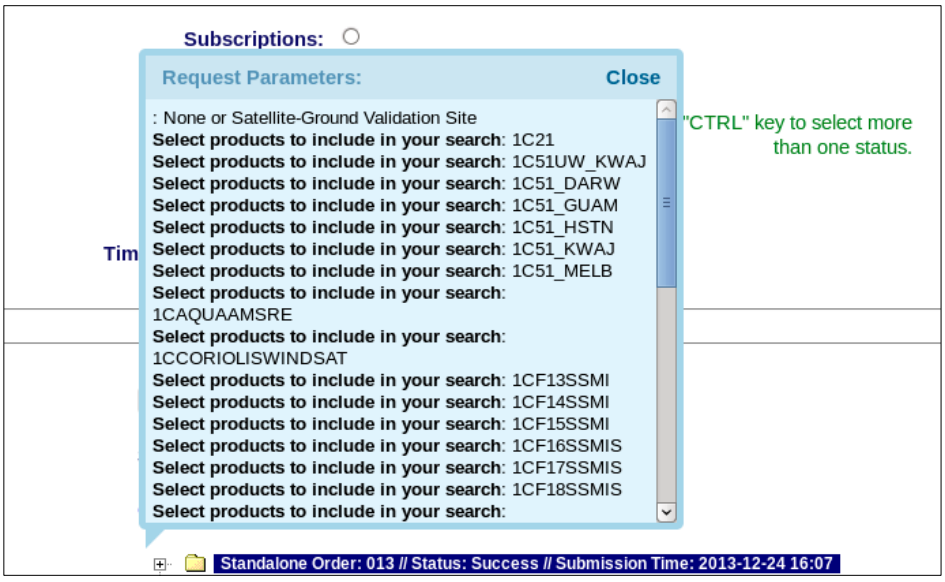


2.4.2.3.2.2 Cancel Subscription

You can cancel subscriptions by selecting the checkboxes associated with the subscriptions and clicking on the Cancel Request button at the bottom of the page. A confirmation box will appear. Click OK to delete the subscription.

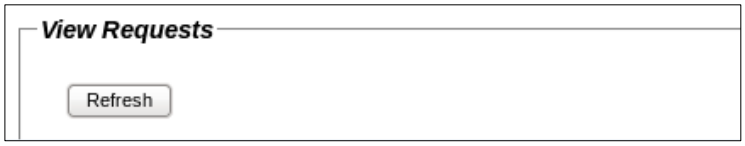
2.4.2.4 View Order Information

By clicking on the order, you can view the search criteria and order options selected when the order was submitted.



2.4.2.5 Refresh Results

To refresh the list of orders displayed, click on the Refresh button at the top of the View Requests section of the page.



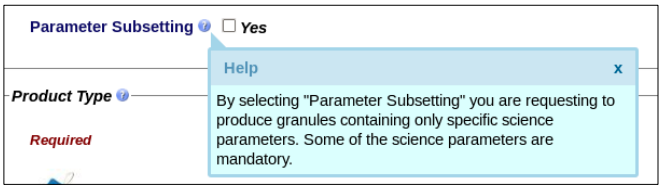
2.4.2.6 Sorting Results

To sort the list of orders in ascending or descending order, use the pull-down and Desc/Asc radio button under the Refresh button. Orders can be sorted by submission date and status.

2.5 GETTING HELP

2.5.1 Context-Specific Help

There are icons throughout the Web site to provide you with context-specific help. When you click on this icon, a pop-up appears with some useful information.

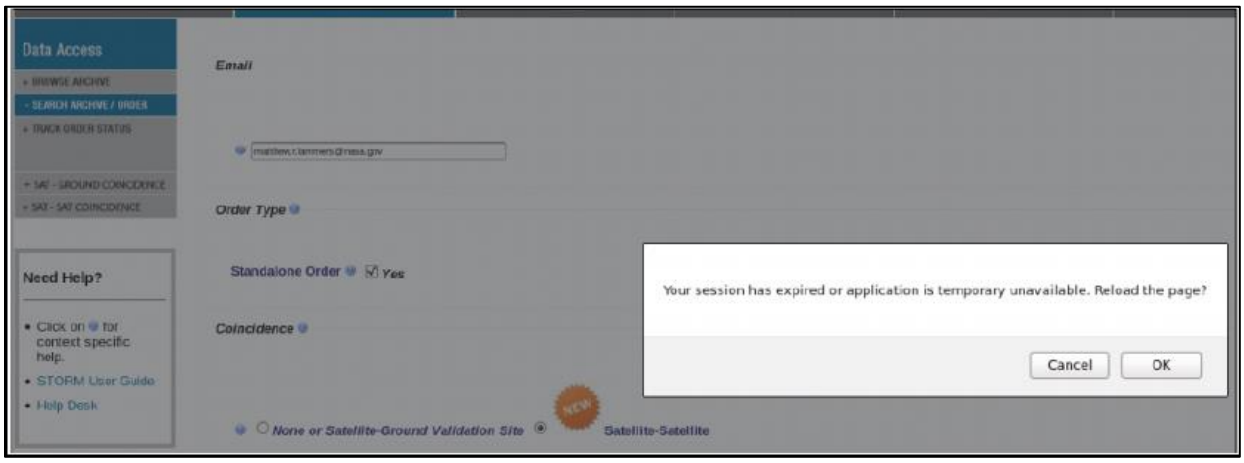


2.5.2 E-mail PPS Helpdesk

A link to send an e-mail to the PPS Helpdesk is located on the left of every page.

2.6 SESSION EXPIRATION

If you start using the Search Archive/Order page, leave it for more than 2 hours, and then attempt to continue using it, the following message will appear: "Your session has expired or application is temporarily unavailable. Reload the page?"

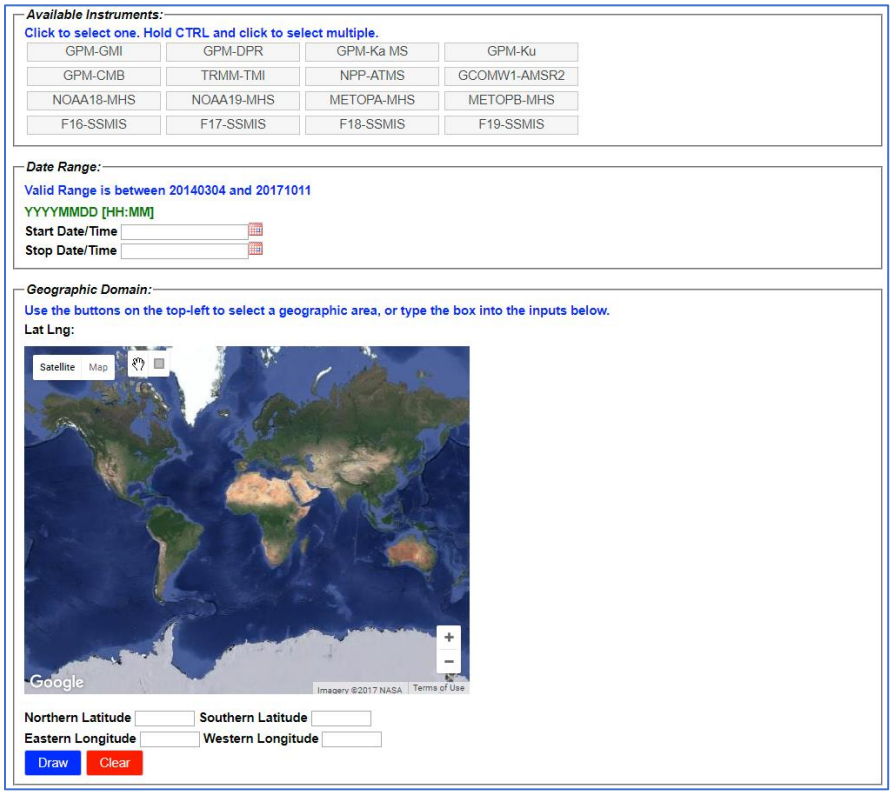


After clicking OK, you can reload the page by either using the Browser Reload button or by clicking on the Clear Form button at the bottom of the page. The search criteria/order options previously selected will be lost.

3.0 SWATH ANALYSIS TOOL

The Swath Analysis Tool, found at https://storm.pps.eosdis.nasa.gov/storm/Analysis.jsp, gives users the ability to generate time series of basic statistics from Level 2 products for any geographic domain. The available statistical properties for the variable "Surface Precipitation" include mean, conditional mean, median, maximum, standard deviation, percent of pixels with precipitation, and total swath pixels in domain. The chart generated is fully interactive and contains the ability to jump from a data point to the STORM Virtual Globe visualization of the product. It can be exported as an image, and the data can be exported as a CSV file, either all of the data or just what are visible in the chart.

3.1 SETTING UP A QUERY



When you start on the page, three boxes will be visible: Available Instruments, Date Range, and Geographic Domain. Values for all of these fields must be input before performing a query by clicking the Get Granules for Chart button.

3.1.1 Instruments

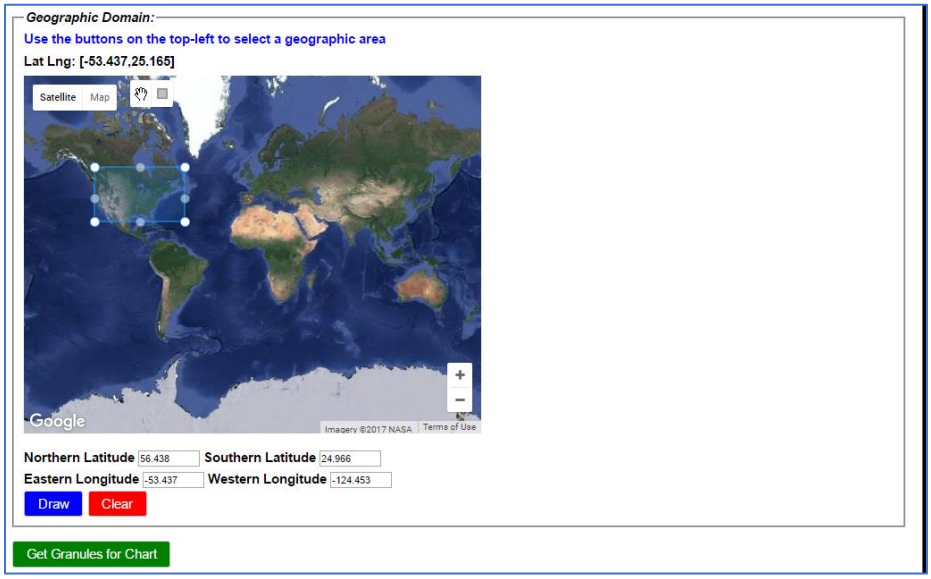
Available for selection are all of the instruments for which we have Level 2 swath data. These include both GMI and DPR from GPM, as well as the microwave instruments from TRMM and the partner satellites. These can be selected one at a time, or in a group. To select multiple instruments, either click and drag the cursor over a cluster, or hold the CTRL button while clicking. As many instruments can be selected as you would like, but only six of them will be represented in the chart at a time.

3.1.2 Date Range

The Date Range field will provide a range starting with the first granule in the STORM archive and ending two days prior to the current date. The Start Date/Time must be prior to the Stop Date/Time for the query to complete successfully. You can select down to the minute the interval in which you are interested, although if only dates are selected, Start Date/Time defaults to 00:00, and End Date/Time defaults to 23:59.

3.1.3 Geographic Domain

There are multiple ways to select a rectangular region. One way is to click the button containing a shaded square at the top of the map. This will change a click-and-drag from moving the map to drawing a box. Note that it is possible to draw a box across the International Date Line, but this will not result in a successful query currently. The box will auto-populate the Latitude and Longitude fields.



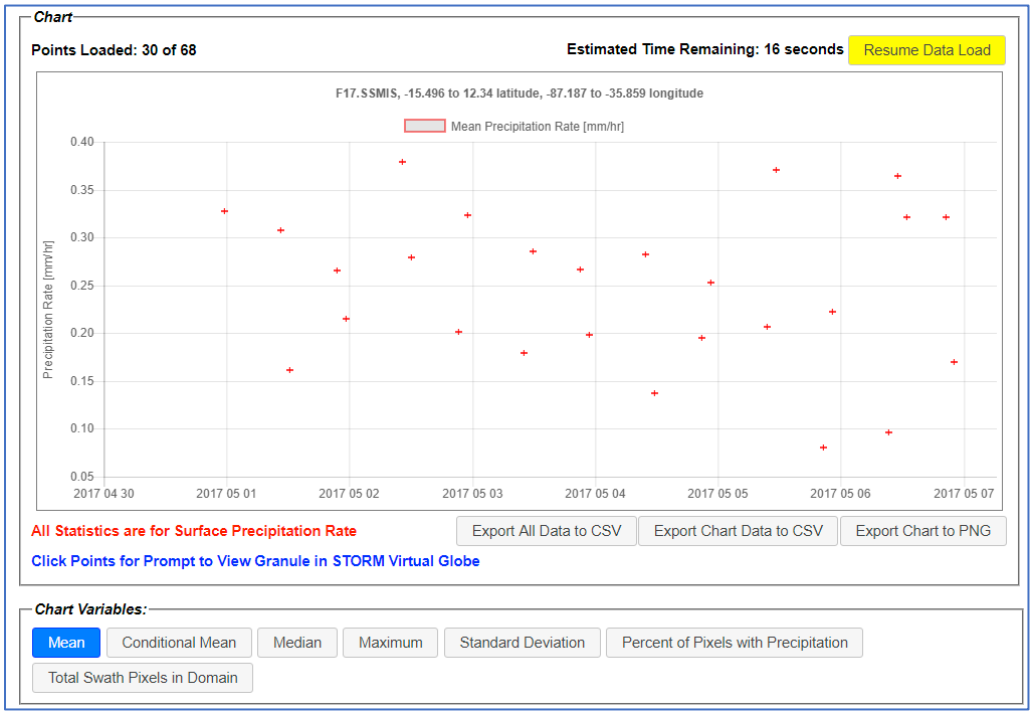
The other way to draw a box is to put values into the Latitude and Longitude fields and click the Draw button. This will generate a box in the map representing the corners you input. Pressing the Clear button will remove the box from the map and clear the Latitude and Longitude input fields. One final feature of this interface is that the Lat Lng field above the map will give you the Latitude and Longitude coordinates beneath your cursor if it is over the map area.

3.2 THE GRAPH INTERFACE

Upon pressing the Get Granules for Chart button, the site will immediately search for the list of granule files and start to process them. Processing grabs all of the statistical values for each granule for each product, and selected fields are visualized on the chart. Changing between statistics and products is seamless because all values are pulled in on initial load. The chart and values within it can be exported as an image or csv file.

3.2.1 While Data Are Loading

When the button, Get Granules for Chart is pressed, a list of granules in the date/time and geographic domain is generated and the code begins to loop through those granules to extract the statistical values for the chart. Values are added to the chart in groups of five, allowing for parallel processing without overloading the server. The first time that statistical values are loaded, the first product is automatically selected, and the mean values are displayed.

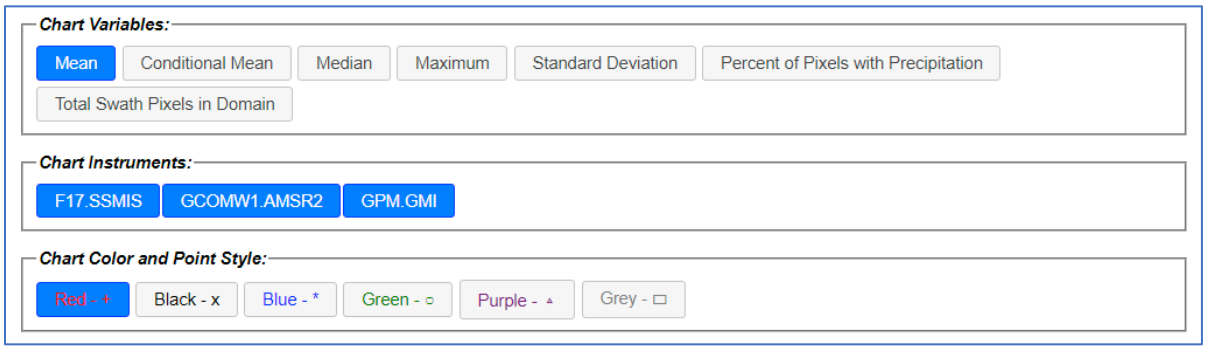


As values come in, the Points Loaded field updates continuously. Each time a group of five is added to the chart, the Estimated Time Remaining changes to reflect a rolling average of the time that the previous sets of granules took to process extrapolated for the number of remaining granules.

While the data continue to load, the user can click the Pause Data Load button, which will suspend processing of further granules once the latest set of five granules arrives. Pressing this will allow interaction with the values that have been received on the chart. It will also enable changing the visible variable(s), product(s), and color(s). Data loading can resume by pressing the same button, for which the text has been updated to Resume Data Load.

3.2.2 Changing the Chart

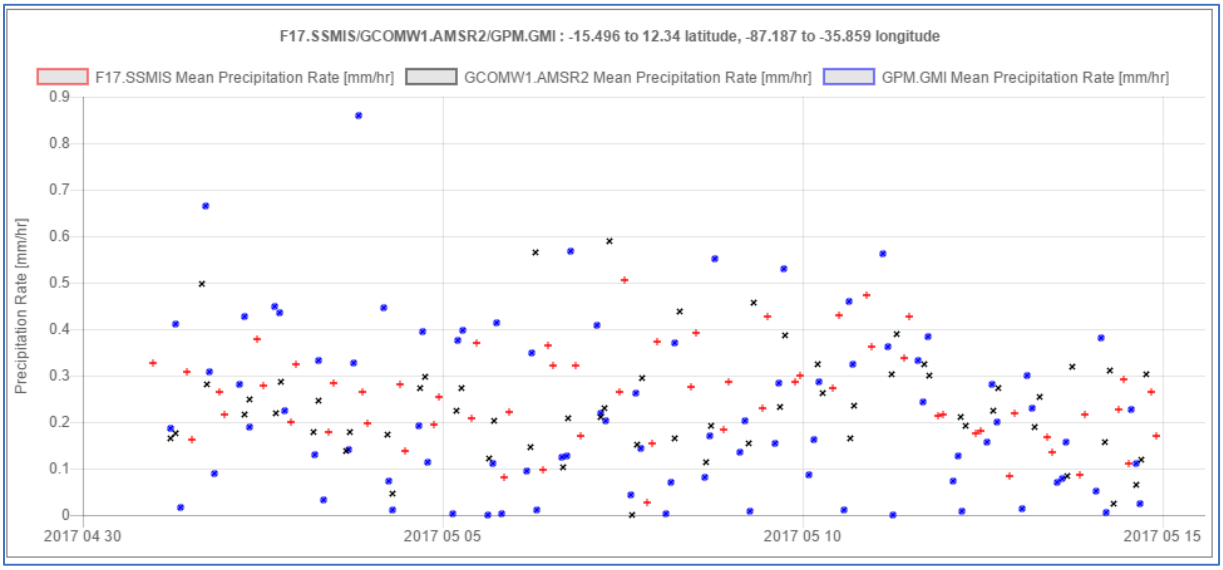
Once the data have loaded (or data load has been paused), the user can change what is visible on the chart. The three selector fields below the chart control what is visualized: Chart Variables, Chart Instruments, and Chart Color and Point Style. The first two fields are interrelated – when multiple Chart Instruments are selected, only one Chart Variable can be selected. If only one Chart Instrument is selected, up to six Chart Variables can be visualized.

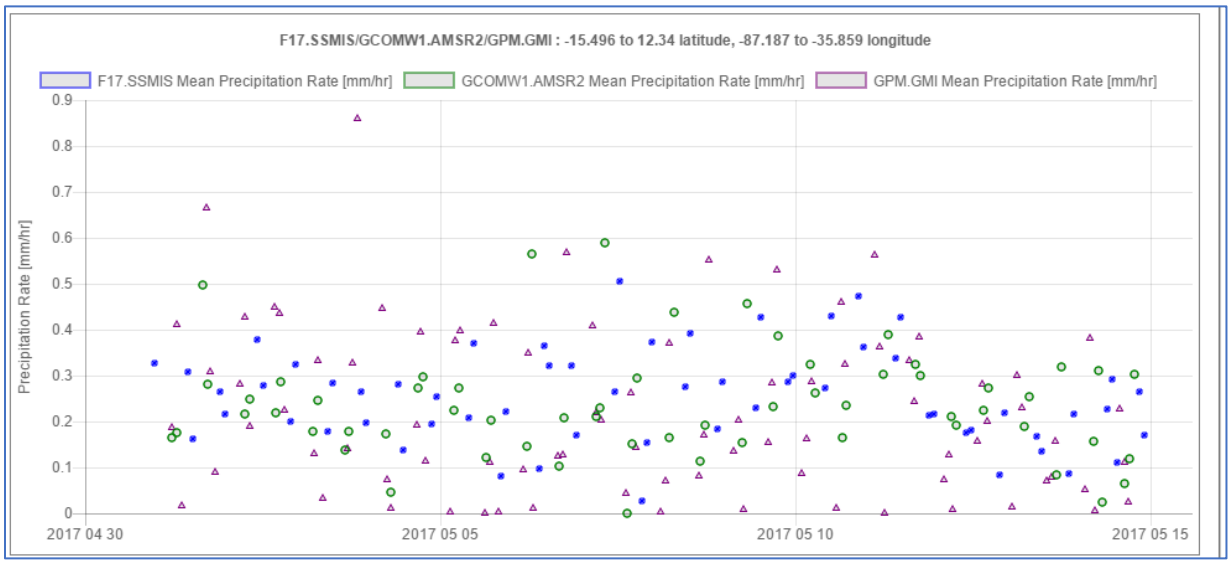


Some of the Chart Variables fields are self-explanatory: mean, median, and standard deviation. Conditional Mean is the average of all points where there is observed precipitation (whereas Mean is simply the average of all points, precipitation or not). Maximum refers to the highest precipitation rate pixel value within the domain. Percent of Pixels with Precipitation is the number of pixels with surface precipitation values greater than 0.5 mm/hr divided by the total number of pixels within the domain for the granule (multiplied by 100). Total Swath Pixels in Domain gives the number of pixels within the domain, which gives the user a sense of whether the swath simply grazed the domain or went completely over it.

Chart Instruments are ordered based when their first swath's information comes into the browser, so the ordering can change from query to query. Due to technical issues, this set of buttons is regenerated for each query, so values selected to appear on the chart will not carry over, instead the first instrument will be selected by default. As with Chart Variables, a maximum of six instruments can be selected at any one time.

Chart Color and Point Style features a rotating set of different colors and icons for the chart. If more than one variable or instrument is selected, the first set of values will be denoted with the color/style selected, and subsequent sets of values will appear in the color(s)/style(s) after, going from left-to-right and wrapping around if necessary. In the first chart below, the three fields are shown with red, black, and blue colors respectively. When the button for Blue-* is selected, the fields then change to blue, green, and purple colors/styles, shown in the second chart.



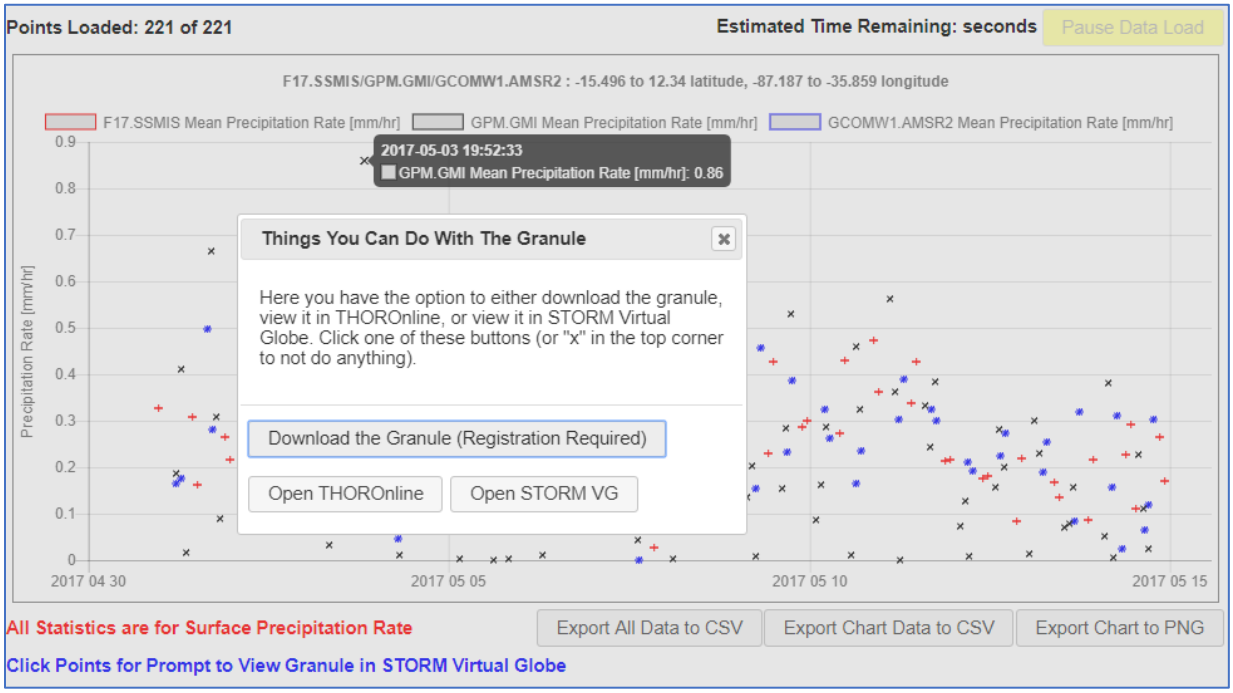


3.2.3 Interacting with the Chart

Beyond a flexible and visually compelling appearance, the chart is quite powerful from an interactivity perspective. One thing to note first, however, is that while data are loading, the chart is not interactive – it will not respond to mouseover or on-click events. If the data load is paused, then interactivity will return.

The two primary modes of interaction are mouseover and on-click. The former displays a tooltip that contains the specific date/time of the overflight and the raw value for the selected field. If more than one variable or product are selected, the tooltip will display all of the simultaneous values, whether that's multiple variables for a single granule, or multiple instruments for a single platform.

The latter connects the Analysis tool with visualization tools and the data file itself. When a point is clicked, the window below pops up, asking if you would like to download the granule, open a THOROnline window, or be taken to the STORM VG visualization of the selected granule. Note that as is typical of STORM VG, if GPM GMI or GPM DPR are selected, both will be displayed simultaneously.



3.2.4 Exporting Data

The Analysis tool offers three different things that can be exported in two different formats. The primary thing for export is the chart itself, which can be saved as a PNG file. The filename attempts to represent the statistic(s) visualized, the geographic domain, and the instrument(s) displayed.

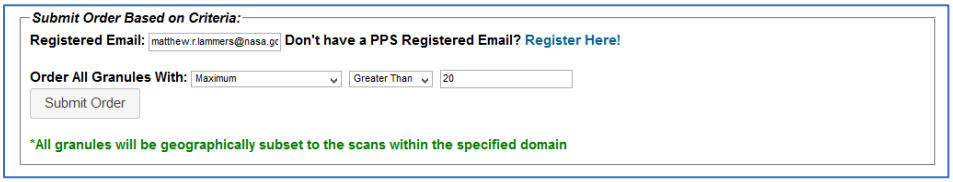
The other two exports are in .csv format (comma-separated value). The user can either export the data visible on the chart currently, or all of the data gathered when the request was performed. The difference is that the former is likely significantly smaller, but better if you are only interested in the specific variable(s) or instrument(s) visualized. The latter includes all six variables and all of the products queried initially. An example of this is shown below.

METOPB.MHS_GCOMW1.AMSR2_GPM.GMI_GPM.DPR_GCOMW1.AMSR2_GPM.GMI_GPM.DPR_F18.SSMIS_F18.SSMIS_F18.SSMIS_METOPB.MHS_METOPB.MHS_GCOMW1.AMSR2_MET

```
date/time,mean[mm/hr],median[mm/hr],max[mm/hr],std[mm/hr],var[mm/hr],perc[%],count[number],platform
2017-04-30 22:54:36,0.032,0.0,0.76,0.119,0.014,8.51,505,METOPB.MHS
2017-04-30 23:56:43,0.037,0.0,18.96,0.39,0.152,3.02,66860,GCOMW1.AMSR2
2017-05-01 00:26:29,0.112,0.0,7.93,0.381,0.145,15.63,44763,GPM.GMI
2017-05-01 00:27:41,0.13,0.0,16.31,0.521,0.271,12.5,35140,GPM.DPR
2017-05-01 01:35:05,0.064,0.0,11.81,0.355,0.126,7.51,137258,GCOMW1.AMSR2
2017-05-01 02:03:38,0.02,0.0,1.13,0.081,0.007,7.33,17521,GPM.GMI
2017-05-01 02:05:15,0.0,0.0,1.58,0.016,0.0,0.07,13005,GPM.DPR
2017-05-01 04:13:17,0.0,0.0,0.0,0.0,0.0,0.0,7,F18.SSMIS
2017-05-01 05:45:59,0.025,0.0,2.74,0.141,0.02,5.17,36169,F18.SSMIS
2017-05-01 07:27:55,0.057,0.0,4.16,0.18,0.032,14.27,41141,F18.SSMIS
2017-05-01 07:45:50,0.012,0.0,3.35,0.1,0.01,2.74,4958,METOPB.MHS
2017-05-01 09:25:56,0.042,0.0,6.71,0.261,0.068,6.14,14601,METOPB.MHS
2017-05-01 11:05:30,0.02,0.0,23.92,0.297,0.088,1.8,94260,GCOMW1.AMSR2
2017-05-01 11:06:43,0.072,0.0,2.68,0.243,0.059,13.09,9307,METOPB.MHS
2017-05-01 12:44:22,0.076,0.0,7.22,0.336,0.113,11.61,135999,GCOMW1.AMSR2
2017-05-01 14:01:59,0.103,0.0,15.8,0.656,0.43,5.71,11120,GPM.GMI
2017-05-01 14:03:06,0.115,0.0,39.5,0.764,0.584,8.15,8567,GPM.DPR
2017-05-01 14:23:15,0.017,0.0,1.95,0.073,0.005,7.33,45623,GCOMW1.AMSR2
2017-05-01 15:34:34,0.073,0.0,52.11,0.533,0.284,7.45,42910,GPM.GMI
2017-05-01 15:35:41,0.113,0.0,60.81,0.701,0.491,8.66,33440,GPM.DPR
2017-05-01 17:07:35,0.039,0.0,4.4,0.249,0.062,6.15,43039,GPM.GMI
2017-05-01 17:08:45,0.01,0.0,4.67,0.108,0.012,1.47,32694,GPM.DPR
2017-05-01 17:16:13,0.045,0.0,7.87,0.219,0.048,8.99,41527,F18.SSMIS
2017-05-01 18:46:56,0.047,0.0,1.41,0.155,0.024,12.59,8472,GPM.GMI
2017-05-01 18:48:12,0.057,0.0,2.0,0.226,0.051,7.49,5034,GPM.DPR
2017-05-01 18:58:10,0.024,0.0,1.17,0.088,0.008,8.0,23565,F18.SSMIS
2017-05-01 19:11:15,0.03,0.0,3.3,0.173,0.03,5.05,11934,METOPB.MHS
2017-05-01 20:23:33,0.14,0.0,5.82,0.478,0.229,13.72,2136,GPM.GMI
2017-05-01 20:52:16,0.051,0.0,2.64,0.21,0.044,9.29,14258,METOPB.MHS
```

3.2.5 Ordering Data

Below the chart customization fields is a box that contains inputs and dropdowns for ordering geographically subset granules that have values beyond some threshold in the chart. The first thing required is a PPS registered email address, which gives access to ordering files and will serve as your login to the ftp page where you can access those files. Next, the user selects a variable by which to filter, which includes all of the Chart Variables. Then, they select whether they want the granule to have a variable value greater than or less than the number they are putting in the next input field. Finally, they input a threshold number. If the user wants all files, simply leave the variable as mean, the direction as “greater than,” and set the value to -1.



Once all of these fields are set, they can press the Submit Order button, which will submit the order to PPS to be processed. Once accepted, an alert window will pop up with the order number, and once completed, the user will receive an email at their registered address. Below is an example of what the interface looks like when filled out.

APPENDIX A. ACRONYMS AND ABBREVIATIONS

CMB	Combined Data Product
CSV	Comma-Separated Value
DPR	Dual-Frequency Precipitation Radar
GMI	GPM Microwave Imager
GPM	Global Precipitation Measurement
GPROF	GPM Profiling Algorithm
GRIB	Gridded Binary
GV	Ground Validation
HDF	Hierarchical Data Format
IMERG	Integrated Multi-Satellite Retrievals for GPM
L1B	Level 1B
PMM	Precipitation Measurement Missions
PPS	Precipitation Processing System
THOR	Tool for High-Resolution Observation Review
TKIO	PPS Science Algorithm Input/Output Toolkit
TLE	Two-Line Element
TRMM	Tropical Rainfall Measuring Mission
VIRS	Visible and Infrared Sensor