

## Appendix 1.

### New Multi-band satellite imagery subsystem. Specs and screenshots. Y3 of MRI CNS-2018611

#### 1. Multi-band Satellite Imagery Management System

This system is designed to handle the challenge of storing and querying massive amounts of Multi-band Satellite Imagery data. It is comprised of three components:

- a hybrid database that is specifically designed to store massive multi-band satellite imagery data and their corresponding geospatial metadata for fast data search and retrieval
- a dataset batch-loading program that can load large amounts of satellite images into the hybrid database
- a RESTful API that enables querying the database with flexible searching criteria

#### RESTful API Details:

This RESTful API accepts the following input parameters:

Input Parameter	Required	Description
NamePattern	No	If this parameter is not supplied, all datasets will be returned. Otherwise, the names of the returned datasets must match the pattern specified. Wildcard character ‘%’ can be used to match any string of zero or more characters.
StartDate	No	If this parameter is not supplied, datasets of all dates will be returned. Otherwise, only datasets equal to or newer than this date will be returned.
EndDate	No	If this parameter is not supplied, datasets of all dates will be returned. Otherwise, only datasets equal to or older than this date will be returned.
Bbox	No	If this parameter is supplied, only datasets that overlap with this bounding box will be returned. The value of Bbox must be specified in this format: minx,miny,maxx,maxy. It’s also possible to search for datasets that overlap with a point location by setting maxx = minx and maxy = miny.

The output of the API will be a list of datasets that matches the search criteria in JSON format.

## 2. Multi-band Satellite Imagery Rendering Service and API

This service can render any multi-band satellite images that are already loaded in the system. The API provided allows advanced users to integrate this service into their programs and scripts, creating more powerful applications.

The API is hosted at this endpoint: <http://midway.cs.fiu.edu/TerraGISMapService/cgi-bin/mapserv>

It accepts the following input parameters and will output an image as specified by these parameters:

Input Parameter	Required	Description
format	Yes	Format of the image output. Supported formats: image/png, image/jpeg.
width	Yes	Width of the image output, in pixels.
height	Yes	Height of the image output, in pixels.
bbox	Yes	Bounding box for image extent. Value is minx,miny,maxx,maxy in units of the SRS.
crs	Yes	Spatial Reference System for image output. Value is in the form of "EPSG:nnn".
layer_bands	Yes	A comma-separated list of bands that will be used to render the R,G,B channels. Example: 4,3,2
layer_data	Yes	Name of the satellite imageset to be rendered
layer_lut1	Yes	Lookup table for rendering the red channel, in the format of: [in_value:out_value]*
layer_lut2	Yes	Lookup table for rendering the green channel.
layer_lut3	Yes	Lookup table for rendering the blue channel.
transparent	No	Whether the map background should be transparent, values are true or false. The default is false.

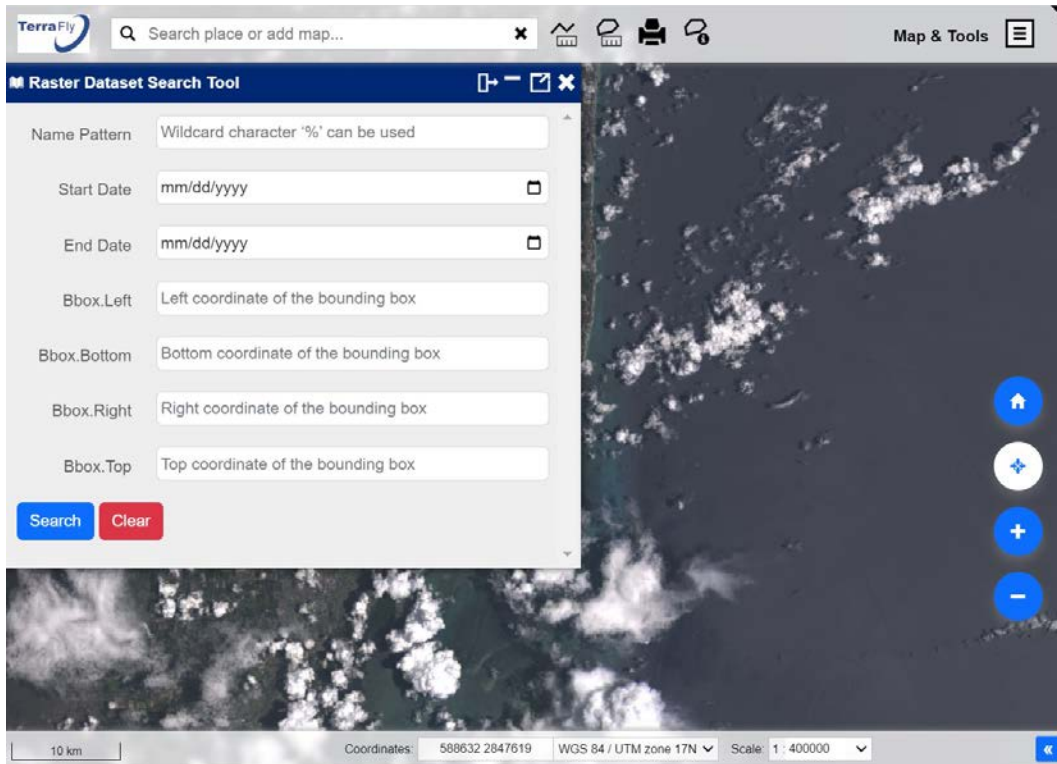
The output is an image that is rendered by the server according to the requested input parameters.

### **3. Multi-band Satellite Imagery Querying Tool**

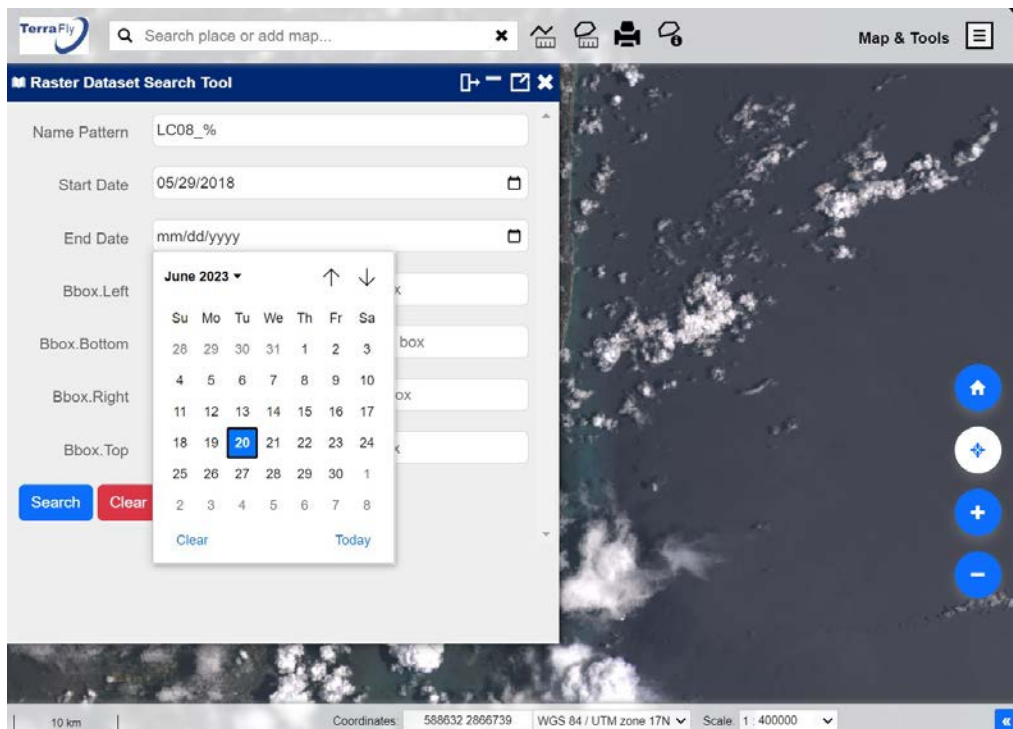
This web-based, user-friendly tool enables the fast search of satellite image datasets within the system. Users can specify the following search criteria:

- Name Pattern: optional; if specified, the name of the searched datasets must match the pattern. Wildcard character ‘%’ can be used to match any string of zero or more characters. Example: LC\_%\_T1.
- Start Date: optional; if specified, only search for datasets newer than this date. Example: 20190101.
- End Date: optional; if specified, only search for datasets older than this date. Example: 20231231.
- Bbox: optional, if specified, only search for datasets that overlap with this bounding box. Example: -82.97,27.48,-82.71,27.53.

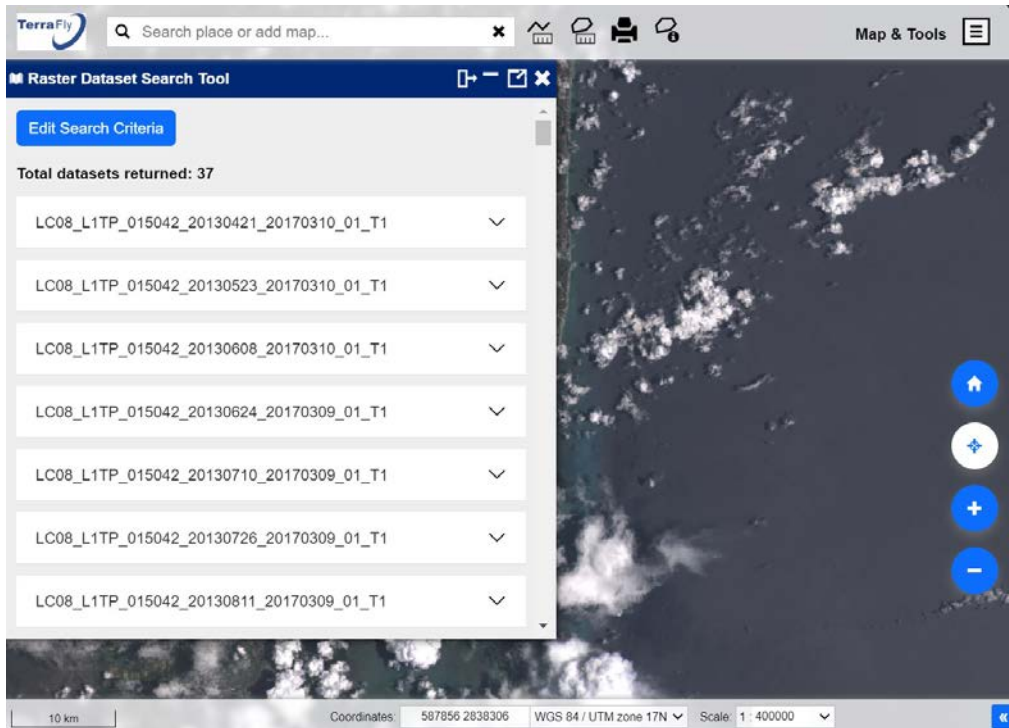
Upon opening the dataset search tool, the user will be presented with multiple search criteria which they can use to filter out exactly what they want from the millions of datasets available in the TerraGIS database.



The user can then fill in the search form with their desired filtering criteria.



After clicking the search button, a list of datasets matching the search criteria will be displayed, for which the user can then choose any to customize and add to the map as a raster layer.



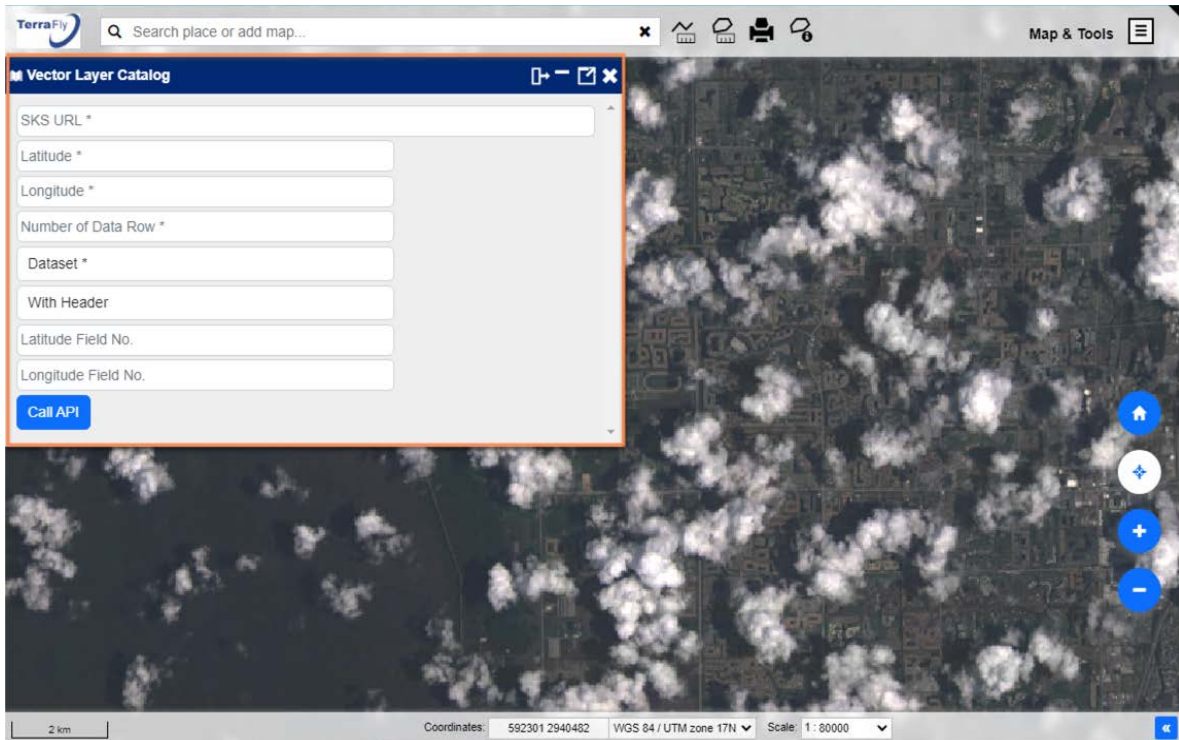
## 4. Vector Dataset Rendering Tool

This front-end-based rendering tool can fetch vector data from the TerraFly SKS system and render the returned vector features on the map. Users can then click any point to view the detailed properties of the vector record.

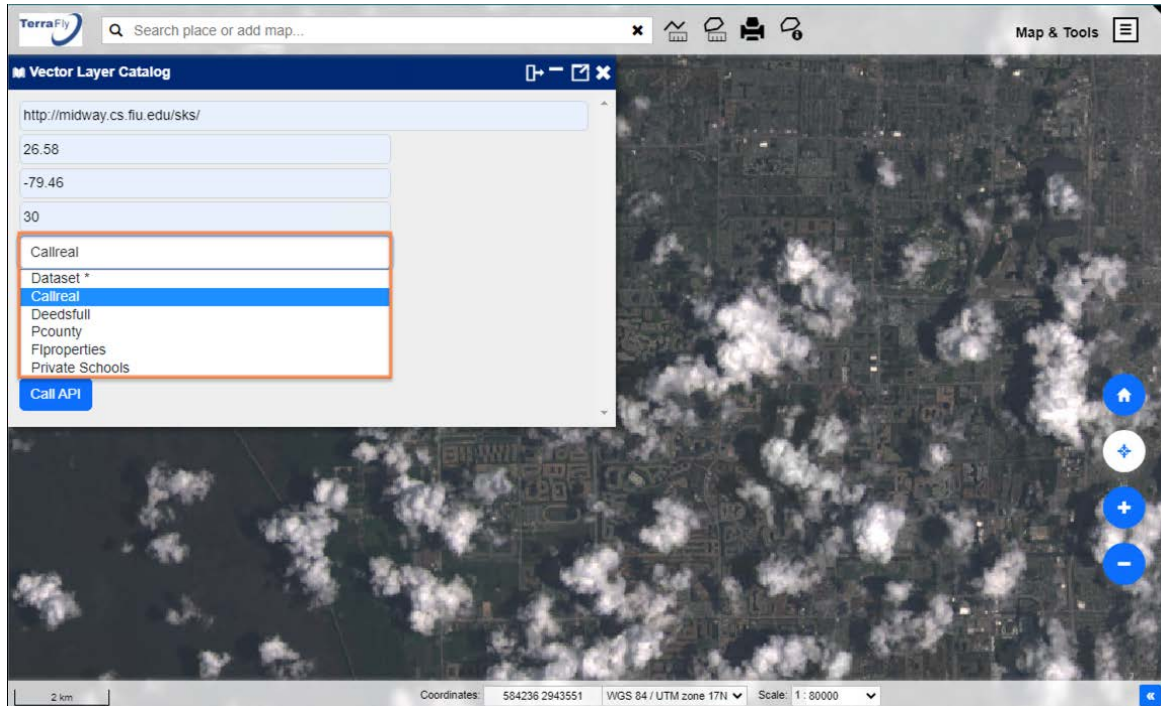
The TerraFly SKS system stores multi-billion vector records amounting to close to 1 TB. This tool enables a quick and easy way for the user to utilize data from this geospatial database to their own advantage.

Upon opening the tool, the user will be presented with a list of options to customize the search and only get the desired data from the SKS database. Here is the explanation for the most important options in the search tool:

- **SKS URL:** this option is for advanced users only. If the user can construct a valid SKS URL by themselves, they can enter it here directly and avoid the hassle of having to fill in each parameter individually.
- **Latitude/Longitude:** center of the search location.
- **The number of Data Rows:** use this parameter to limit the number of returned results.
- **Dataset:** a dropdown list of available datasets in the SKS database.

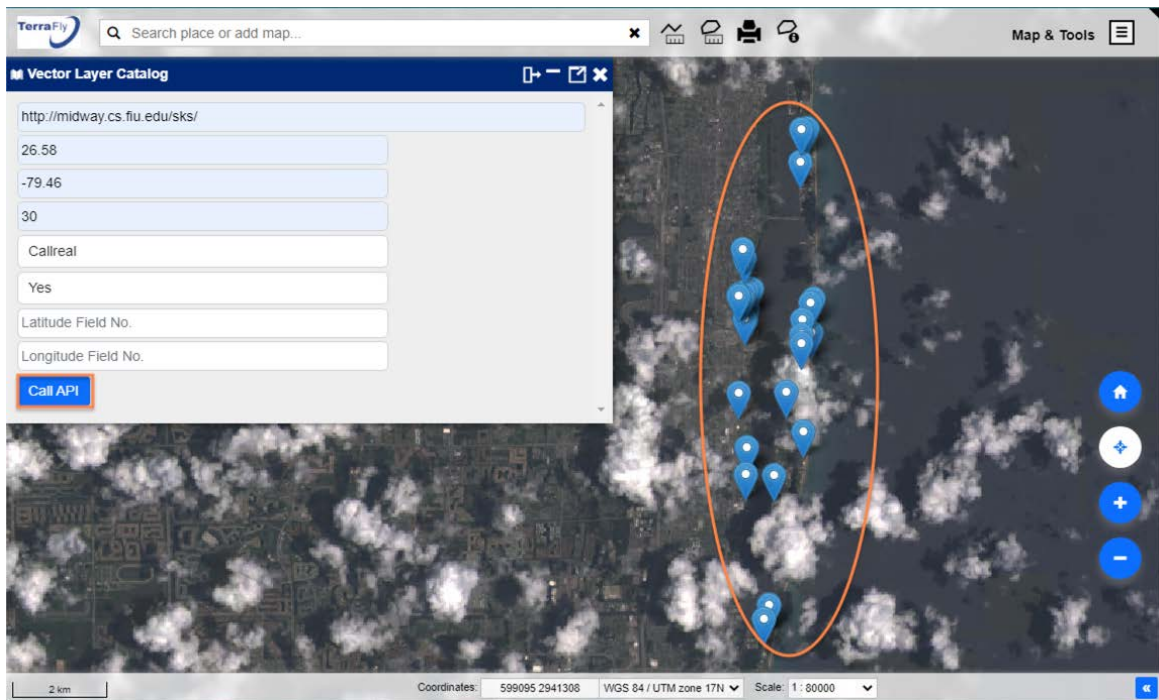


When the Dataset option is clicked, the user will be presented with a list of datasets pre-loaded and readily available in the SKS database.

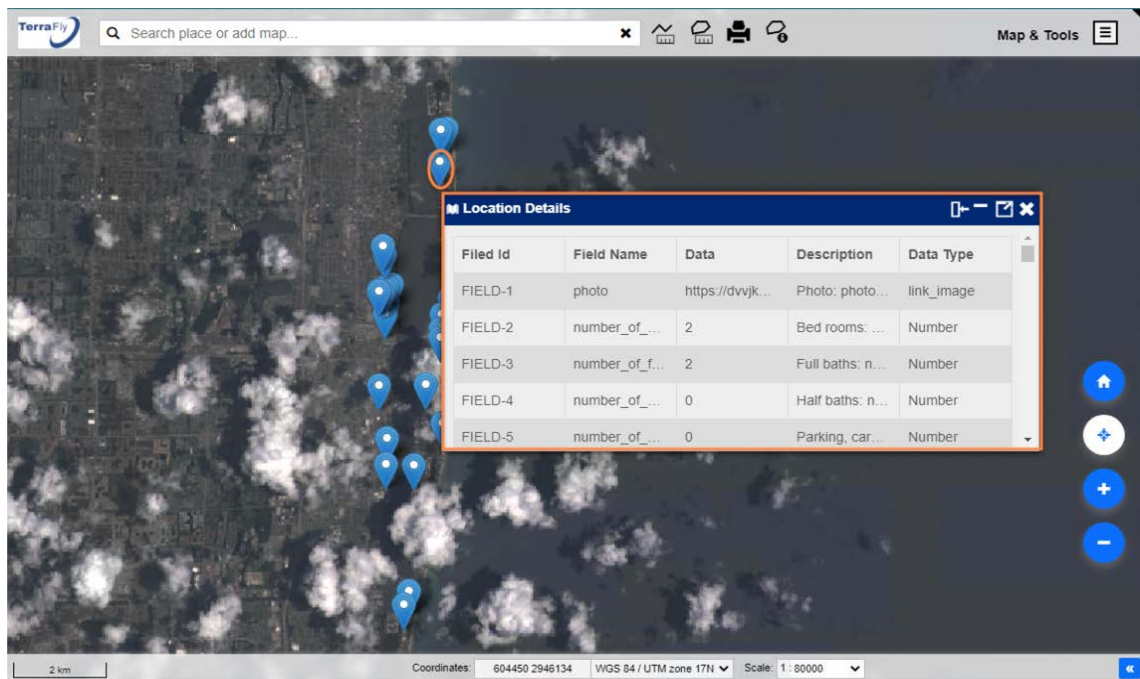




Upon submitting the search form, all the data records that match the search criteria will be shown on the map.



The user can then click any marker to check the details of the corresponding data record. Since the length of the data records varies, each column in the table has a limited width, and full details can be viewed by hovering the cursor over the field.



TerraFly

Search place or add map...

Map & Tools

Location Details

Filed Id	Field Name	Data	Description	Data Type
FIELD-1	photo	https://dvvj...	Photo: photo...	link_image
FIELD-2	number_of_...	2	Bed rooms: ...	Number
FIELD-3	number_of_f...	2	Full baths: n...	Number
FIELD-4	number_of_...	0	Half baths: n...	Number
FIELD-5	number_of_...	0	Half baths: number of half_bathrooms, i.e. without bathtub or shower	

2 km

Coordinates: 604048 2938810 WGS 84 / UTM zone 17N Scale: 1 : 80000