Philippines Project Documentation

This document is accompanied by a folder upload and python files which can be found on my GitHub. Further analysis can be found as comments and markdown cells in the python code or on presentations within the presentation folder

Code

https://github.com/Arron33/BioPlusMine-Project

There are 5 Files: 1. Time Series Generation, 2. Seasonal Graphs, 3. Meta Data Graphs, 4. Visualisations, 5. Training_Data.csv

1. Contains the code to generate quarterly median composites and create a time series of pixel values
2. Contains some code to graph this seasonal data
3. Contains some graphs generated from the drone image metadata including GSD distributions
4. Contains code to visualise the phantom 4 ortho mosaics in Google Earth Engine, as well as an unsupervised classifier and my attempts at a supervised classifier
5. Is a training dataset for the classifier I generated, it contains spectral bands from the Phantom 4 as the feature vector and 8 classes as the target

All other documentation and comments are in the python file as comments or markdown cells.

GSD Guide

Guide to the analysis of drone image locations and GSD in the Field:

1. Extract metadata from drone images, this can be done using EXIF Tool in the command line or using the metadata extractor program that Shuaib wrote.
2. This will output a .csv of all the metadata in the images with each image being a row.
3. Load this as a delimited text layer in QGIS, (make sure that the correct columns are selected for Lat and Lon).
4. Using the 'point sampling tool' plugin for QGIS, sample a DSM (one is provided in the files I've uploaded).
5. Once this is done and added as a column in the delimited text layer (metadata) navigate to the symbology of the layer and select graduated.
6. Use this formula for P4 imagery in the value box:

$$\frac{(GPS\ Altitude - DSM\ Elevation) \times Sensor\ Height}{Focal\ Length\ \times\ Image\ Height}$$

7. Now decide on a colour scheme for the GSD resolutions you would like to show.
8. Additionally, instead of steps 6 and 7, you can use the style file I've uploaded for GSD

Visualisations

The RGB 531 NDVI NDRE NDWI figures can be generated using the code ‘Visualisations’ or but adding the ortho mosaic in QGIS and using the symbology tab to select which bands to view and using an index formula. I've also uploaded some QGIS Geo-packages with these visualisations.

Excel Spread Sheets and Graphs

The Excel Spreadsheet in 89-22 Time Series Analysis contains the spectral data for points generated in the Time Series Generation code along with a couple of graphs of NDVI over time.

The graphs for seasonal variability and metadata GSD can be seen in the ‘Seasonal Graphs’ and ‘Meta Data Graphs’ python files accordingly. Comments on the graphs can be found in the python codes comments and mark-up cells.

Raw Data

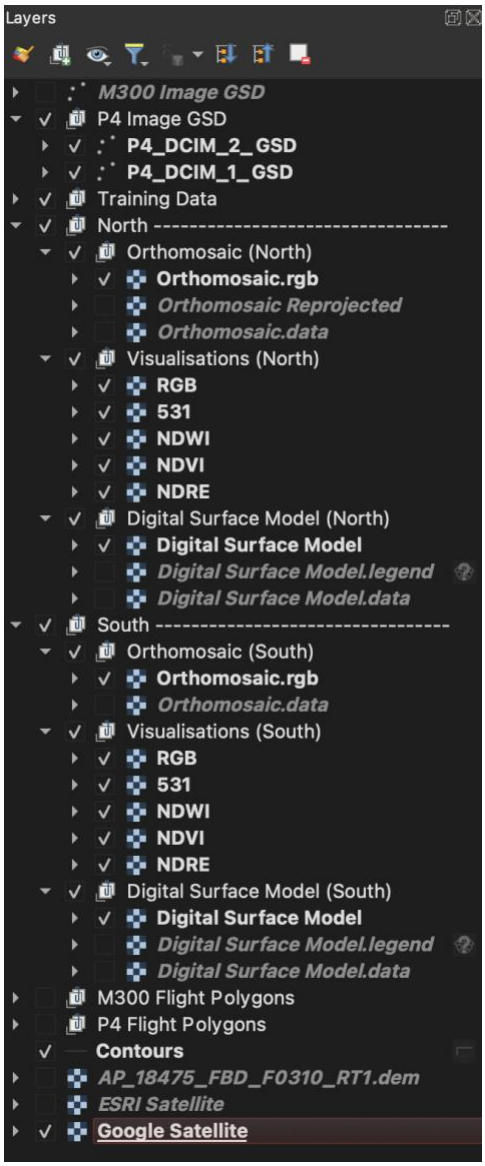
The ‘Pix4D Fields Export’ folder contains the processed ortho mosaics that I generated in Jan 2023. These don’t contain all of the data only what I had access to at the time, the full dataset and processed images are available on the remote desktop PC (the images are still processing at the moment) I recommend using the Northern area as a starting point for any classifiers as the ability of the trained classifier to generalise well can be tested on the southern area which is a lower quality and more varied dataset. This folder also contains the high-resolution DSMs generated during the processing. For this processing, I used low settings to process the data quickly however the full processed data should be of higher quality and coverage.

Processing Guide

I recommend using the collages educational licence of Pix4D Mapper. There is an excellent guide on how to process drone data using this software at this link: https://www.youtube.com/watch?v=n3af0I_QYxA&t=390s&ab_channel=TravisParker .
The software corrects for the sun's luminance, the multiband cameras' parallax and a bunch of other things. The processing can be very slow so is not recommended for use in the field. For this DJI Terra might be the better software.
The outputs of this processing will be a multiband ortho mosaic and a DSM however other products are available such as coloured point clouds or 3D mesh.

GIS Files

In the upload is a copy of some useful GIS files that can be imported into QGIS, follow the GSD guide on how to visualise the metadata. Visualisations are included as well as the DSM I've used, the training data I generated, and some other files including a style file for GSD. Below is an example of the layers I was using and had set up in my QGIS project.

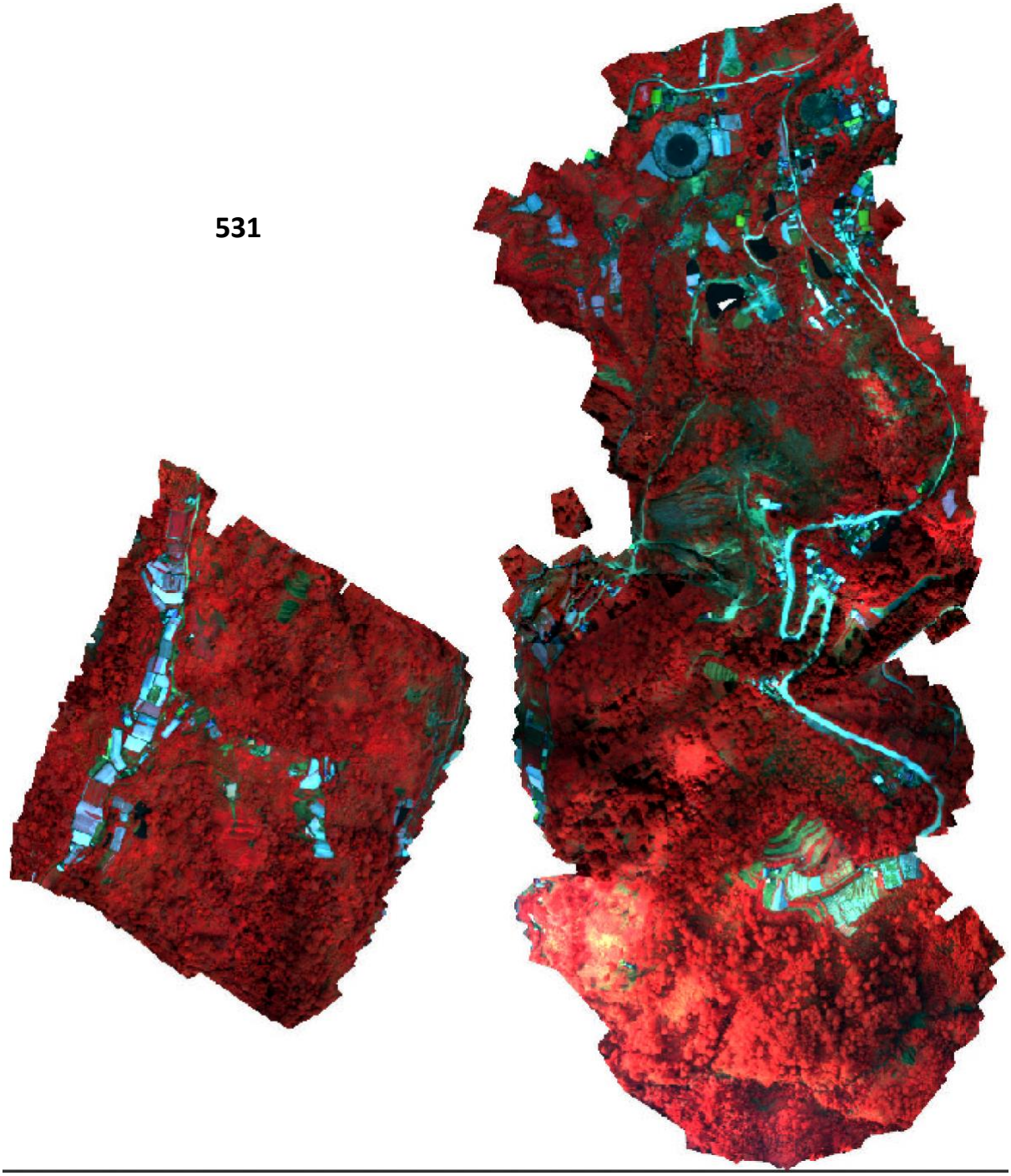


Below is a collection of useful figures that can be found with further comments in the python code or in presentations

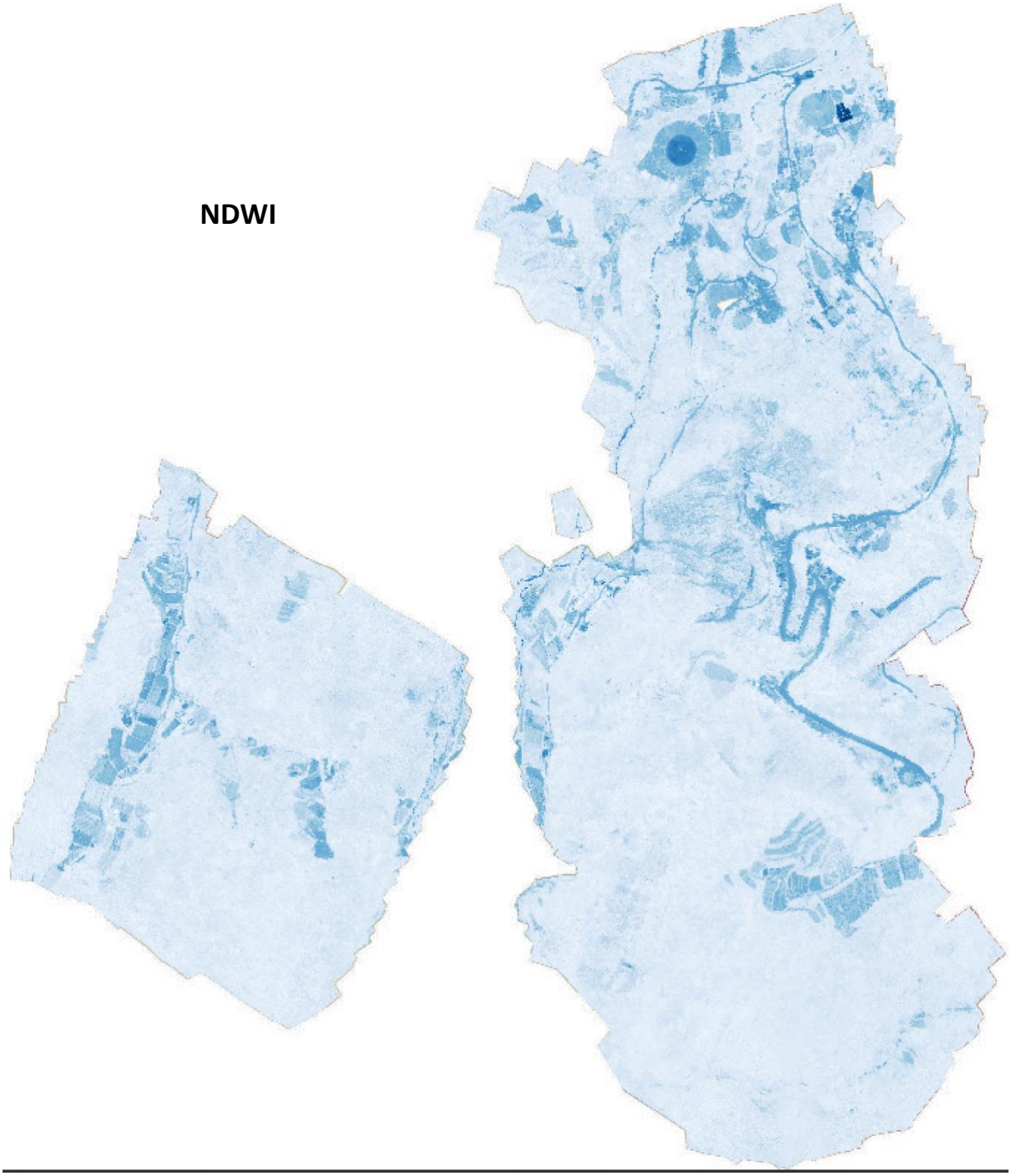
Screenshots of Drone Data

RGB

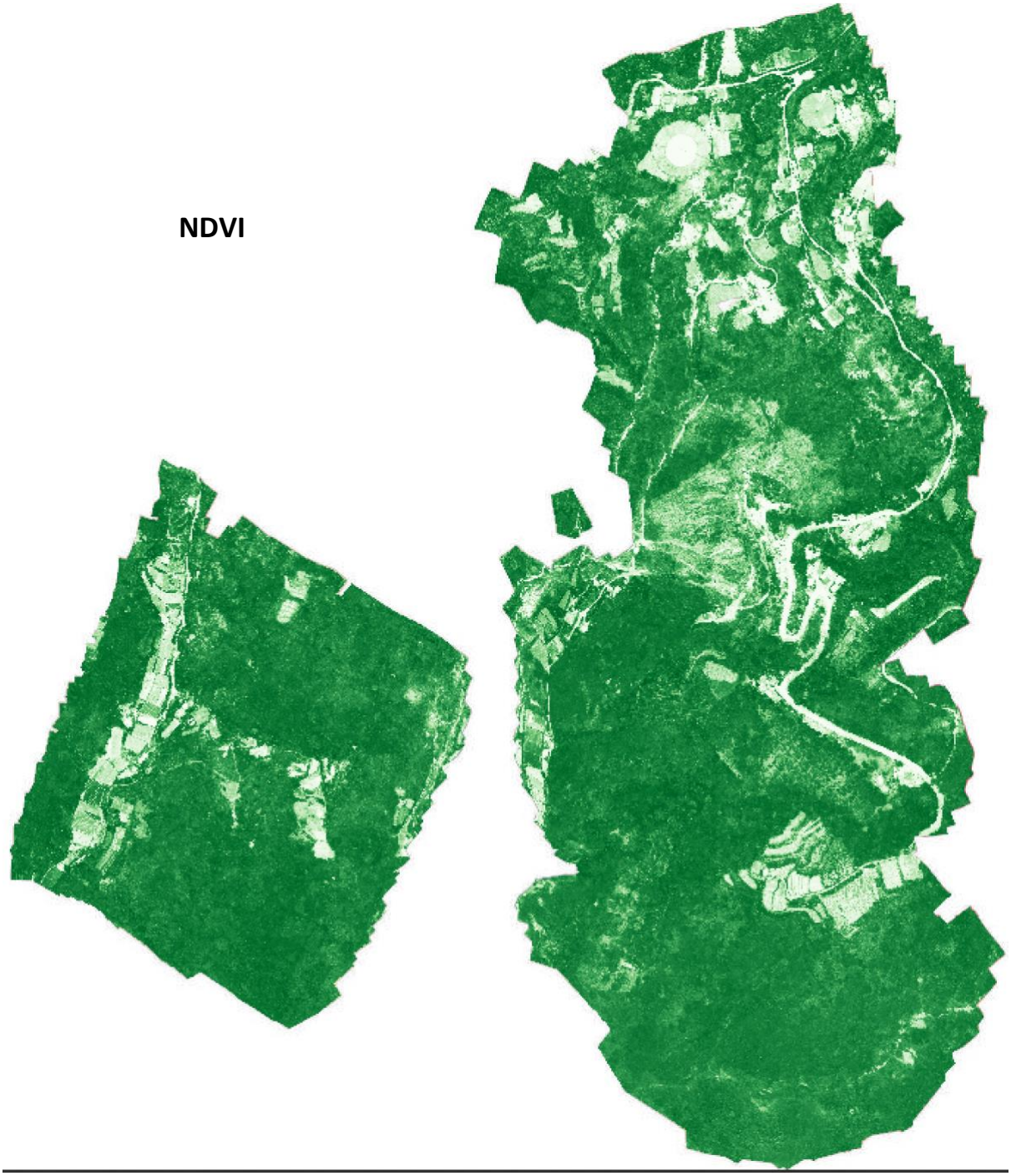
531



NDWI

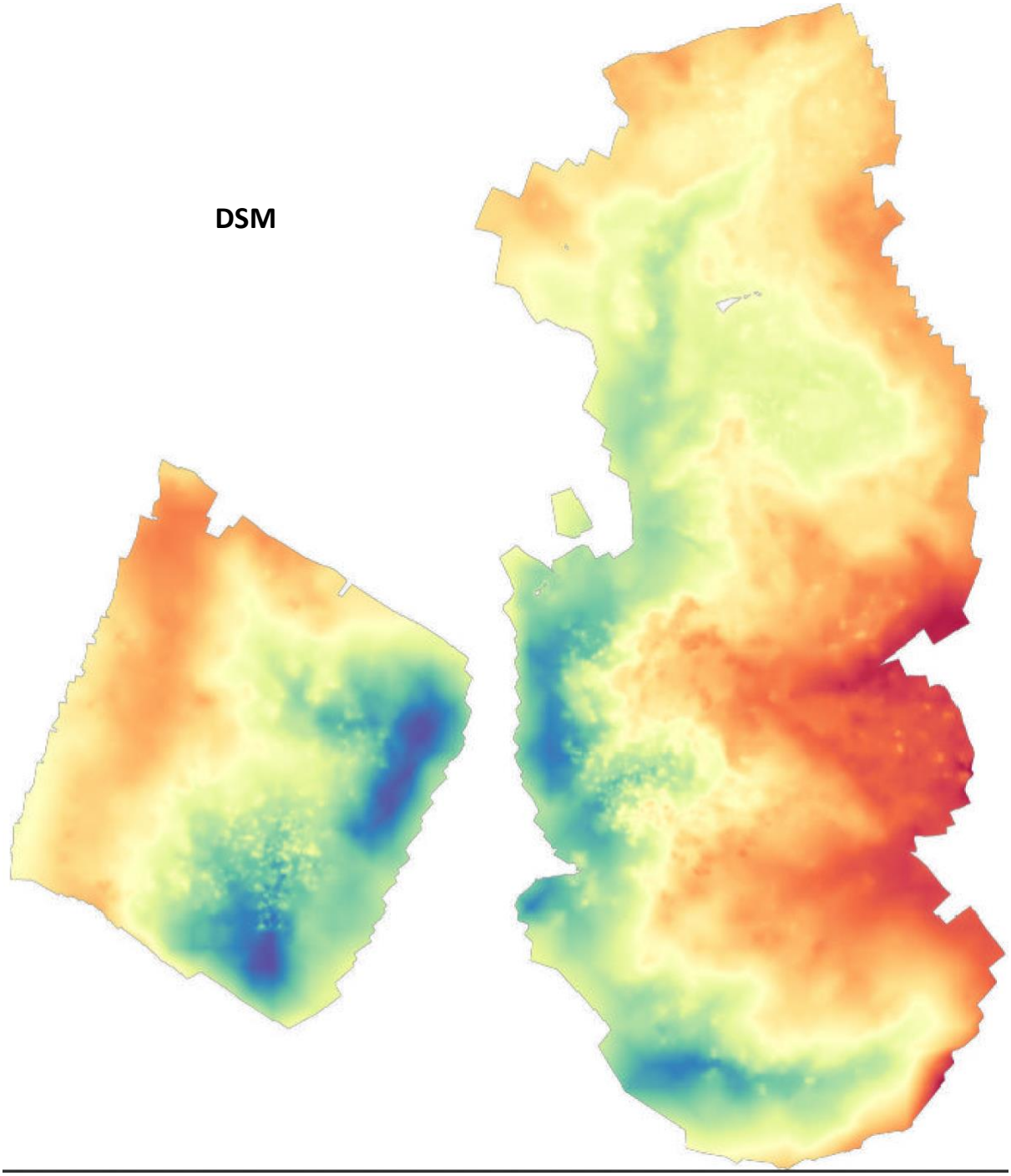


NDVI

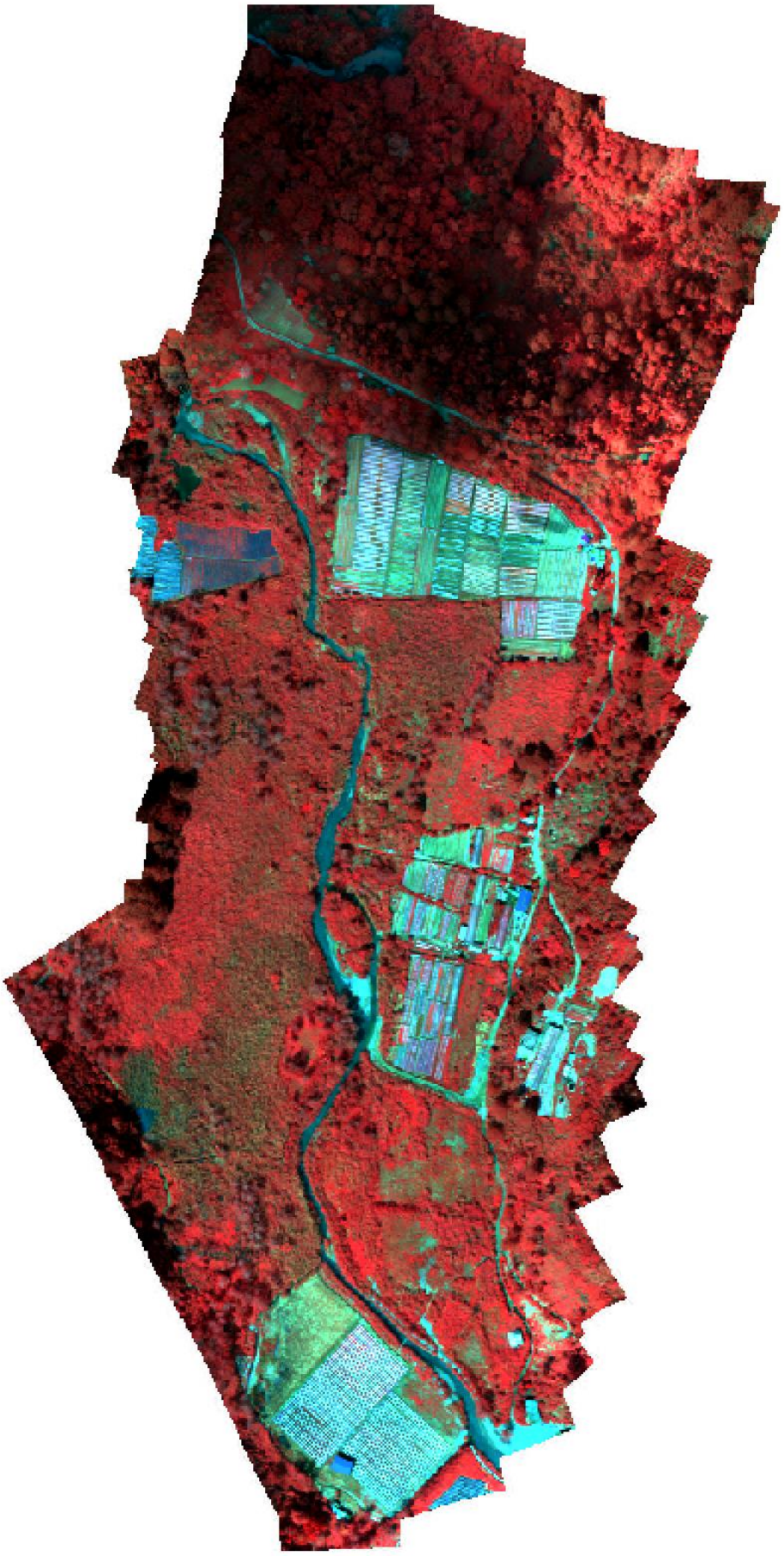


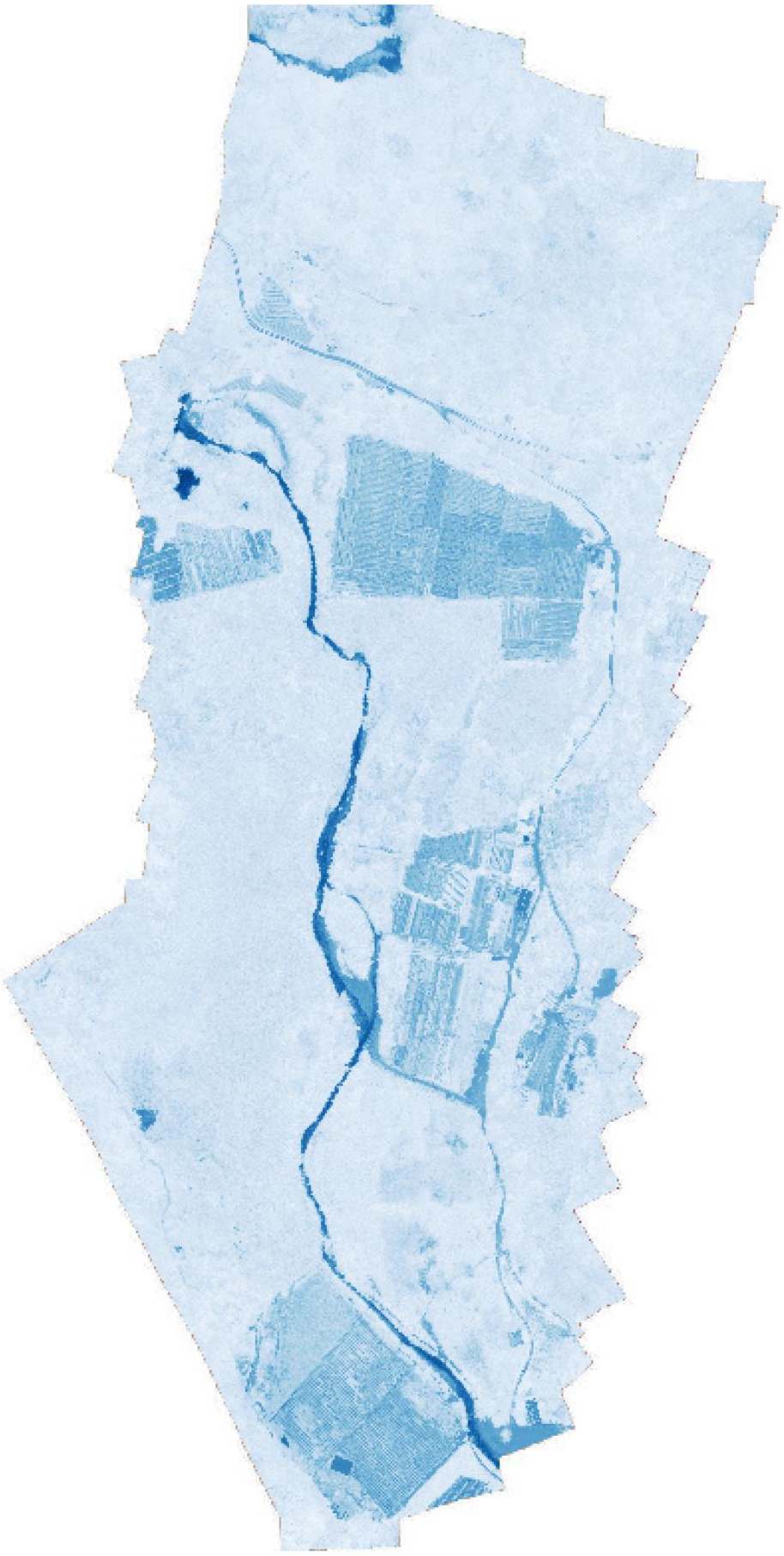
NDRE

DSM



RGB

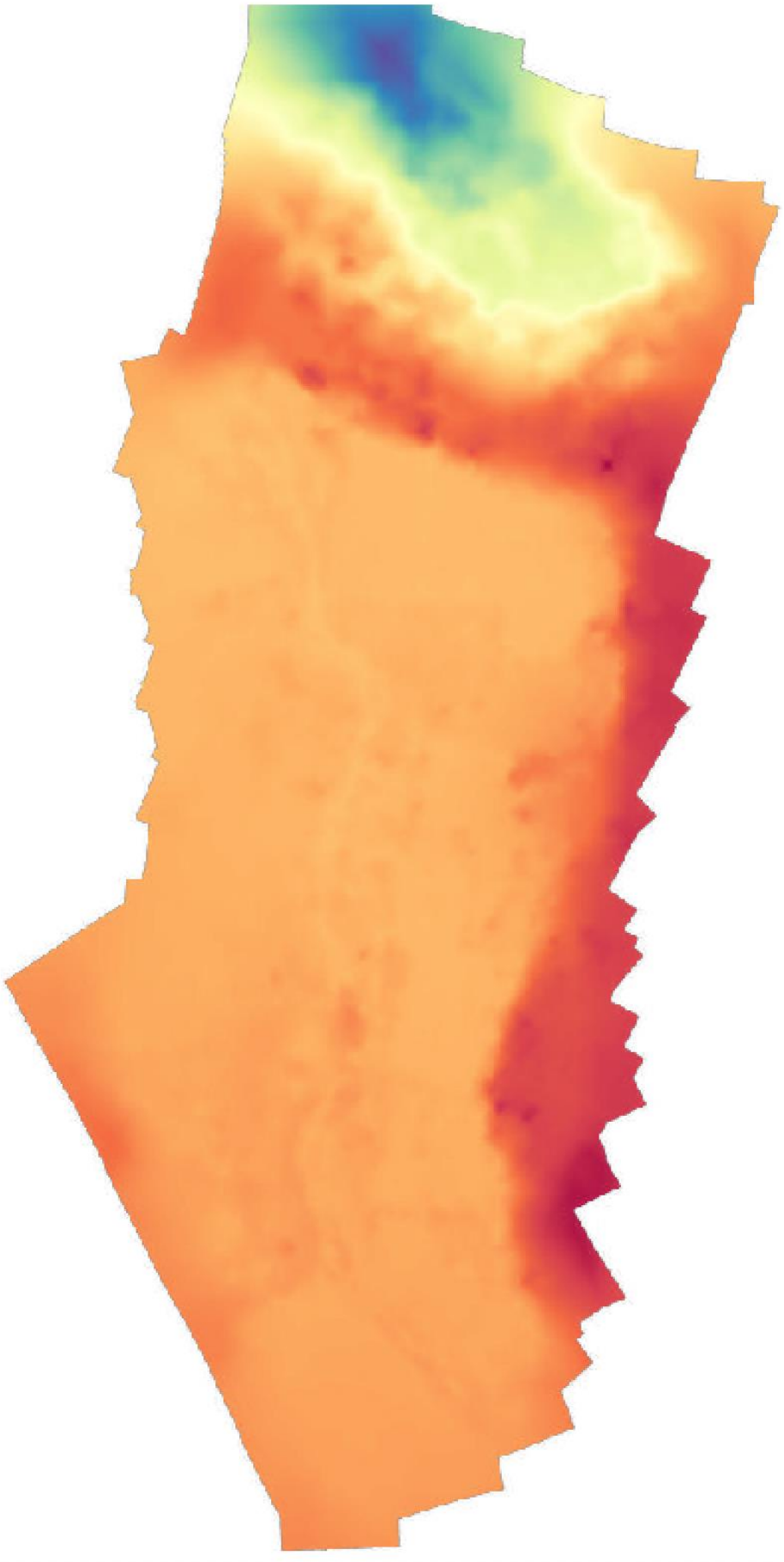




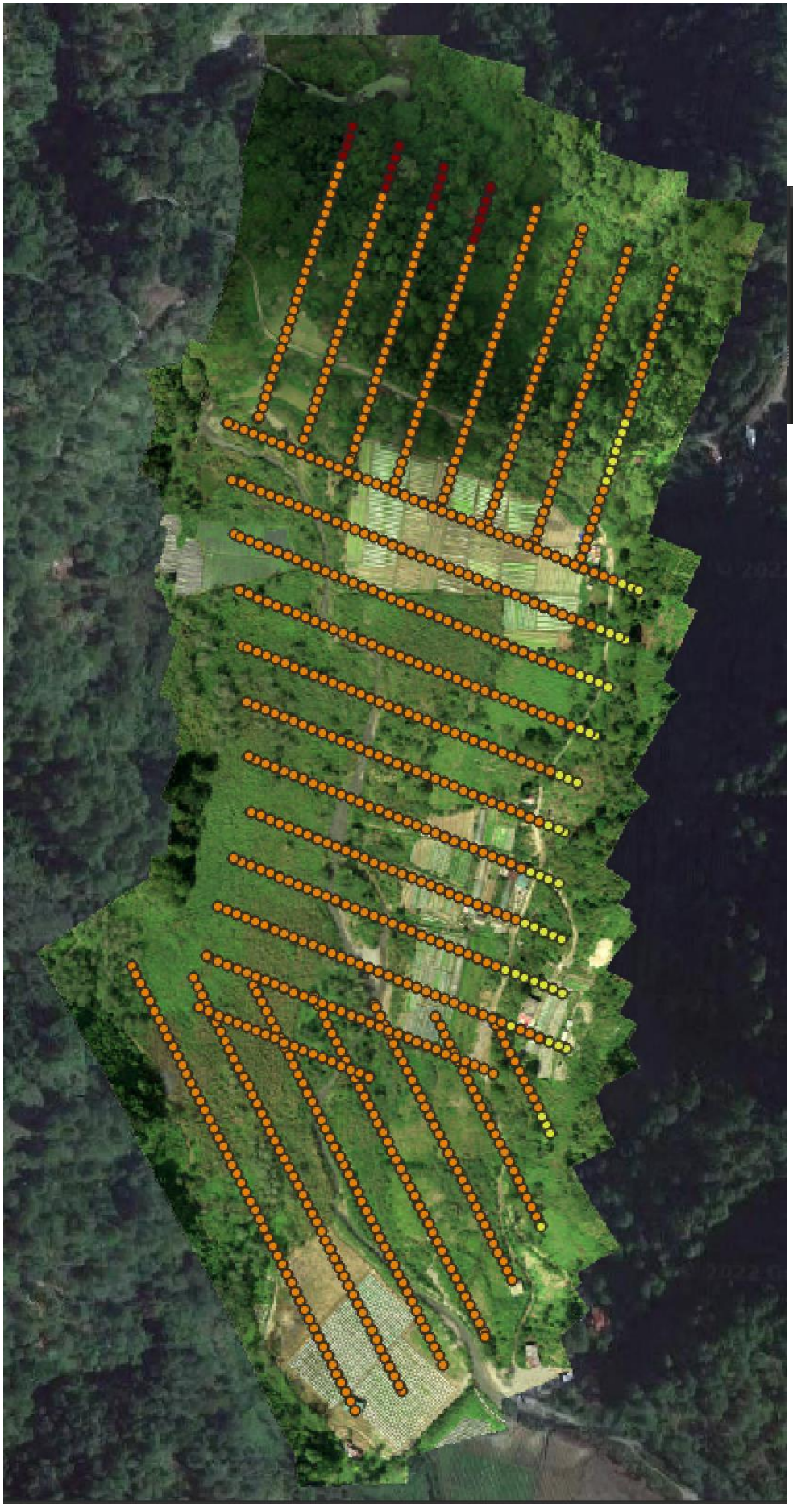
NDWI

NDVI

NDRE

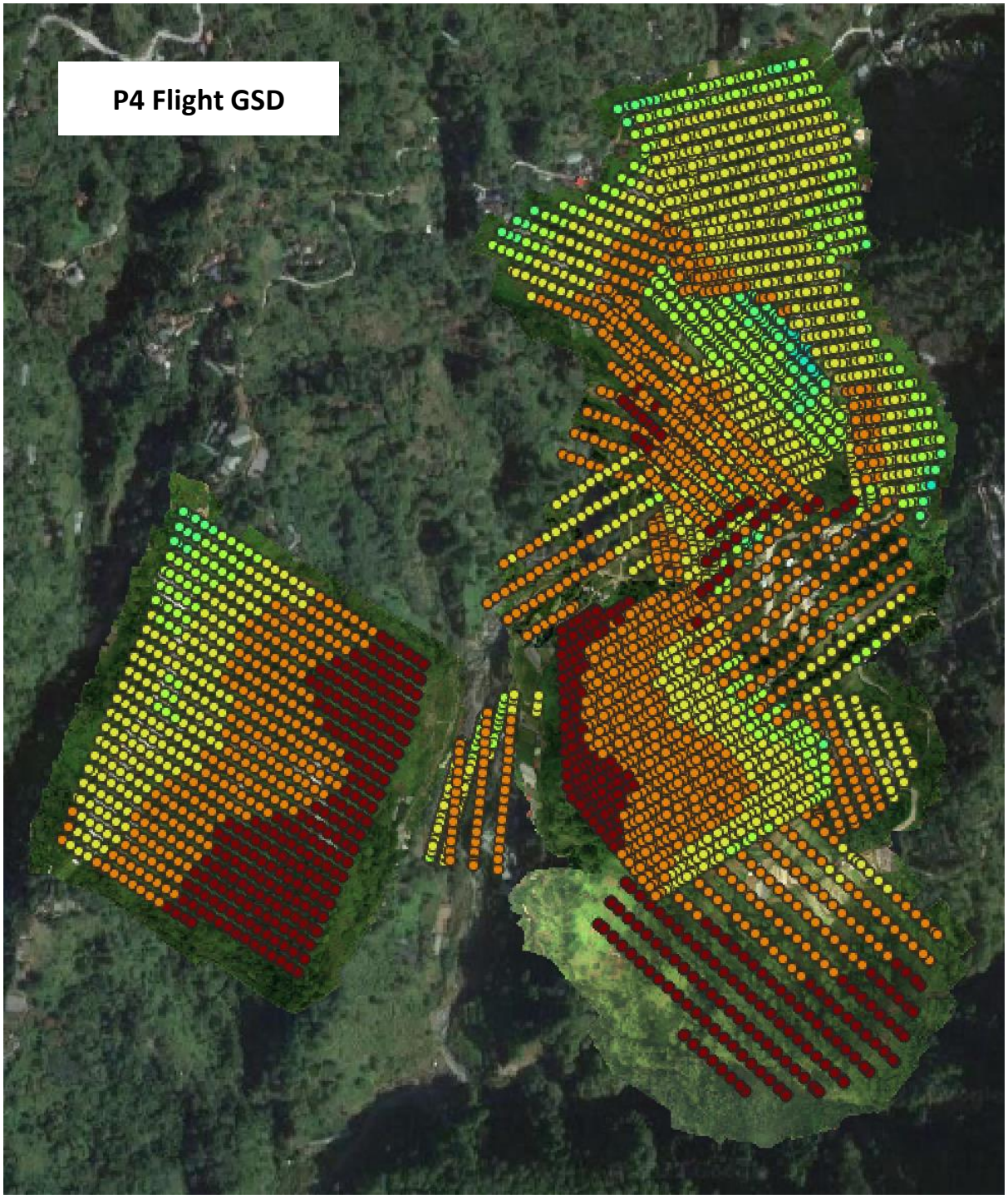


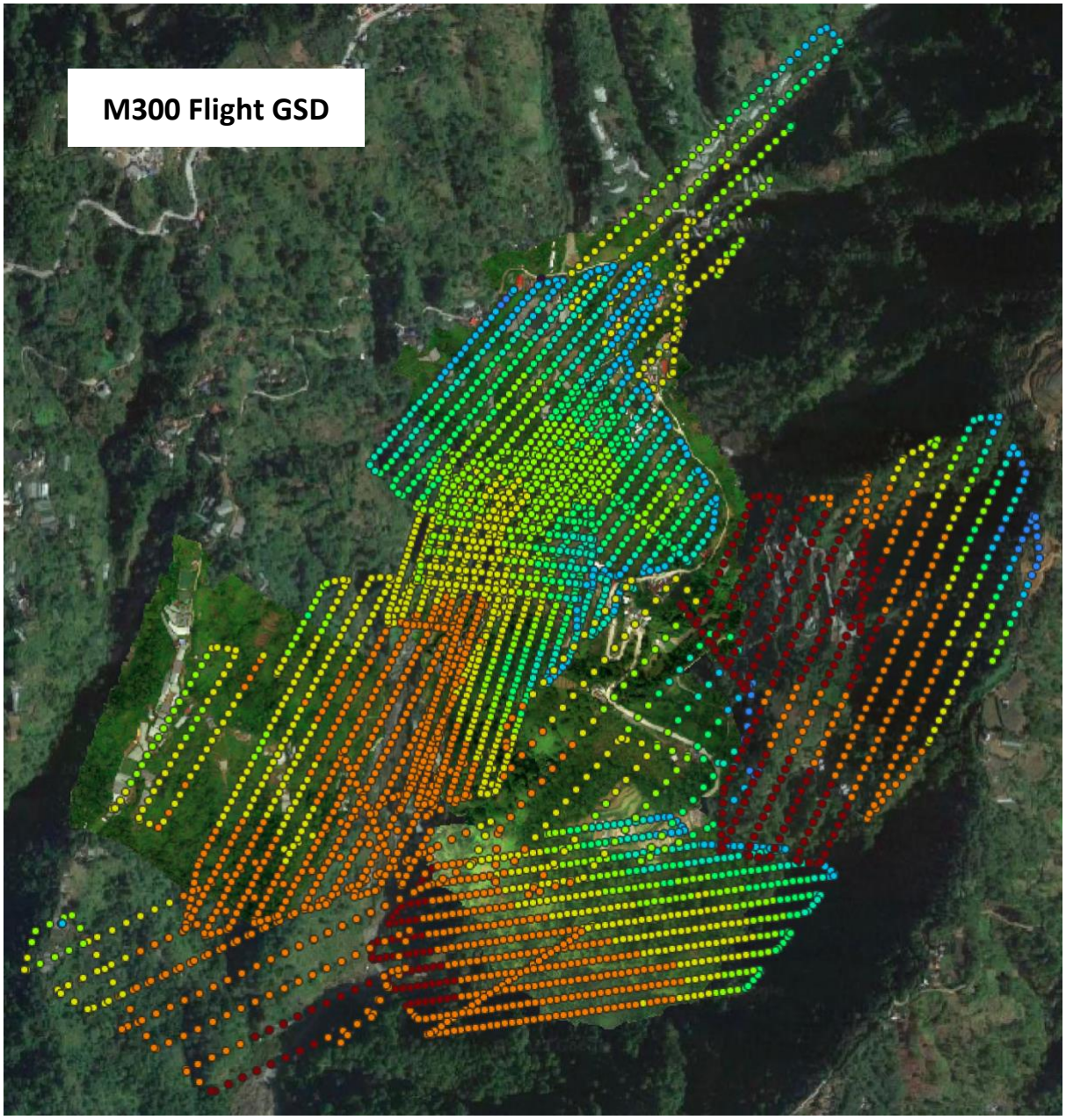
DSM



P4 Flight GSD

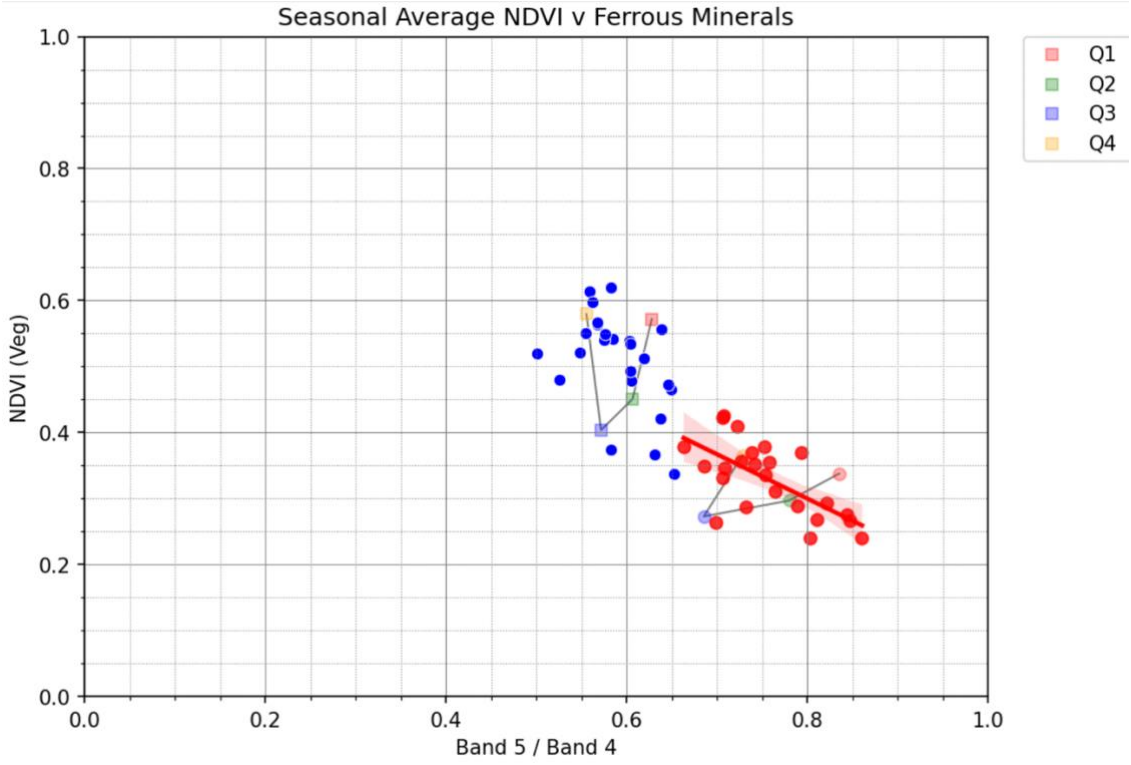
M300 Flight GSD


P4 Flight GSD

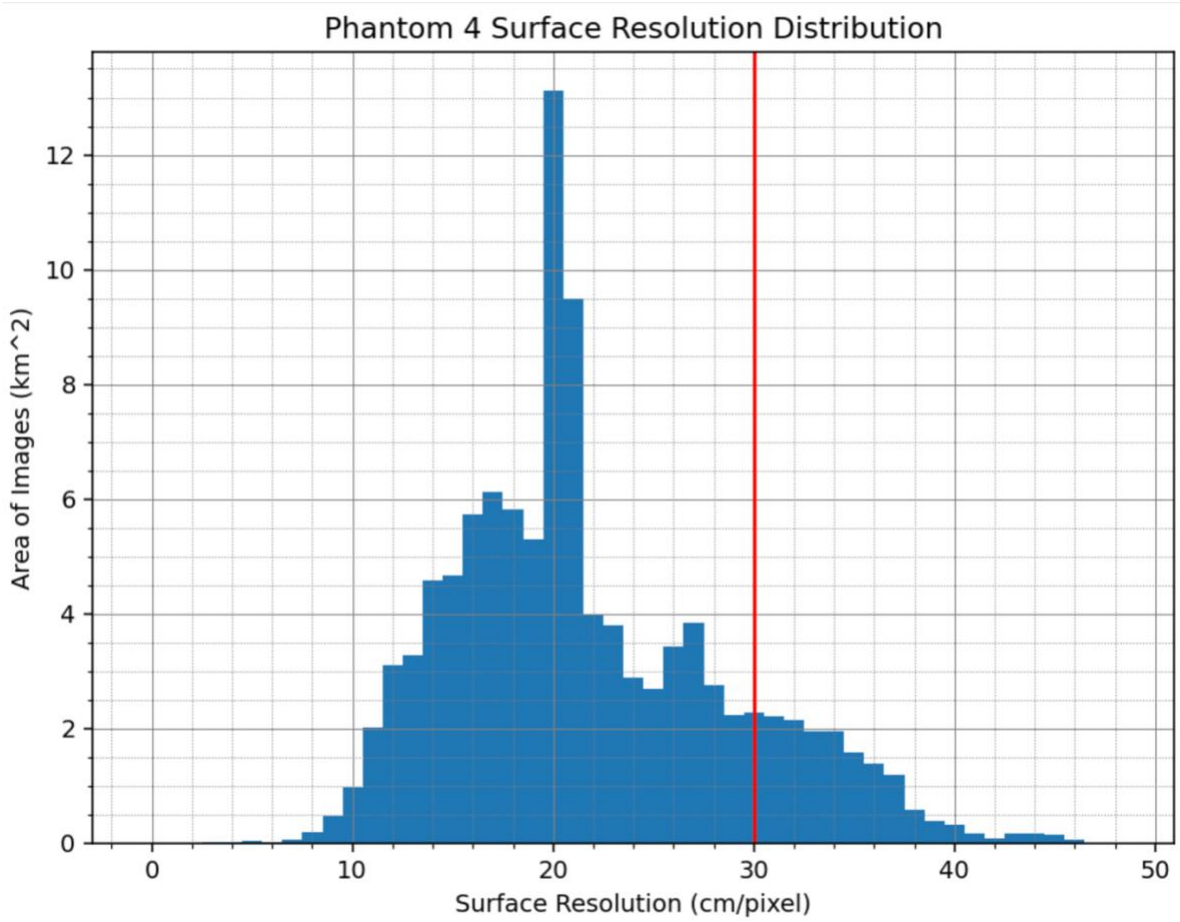

M300 Flight GSD

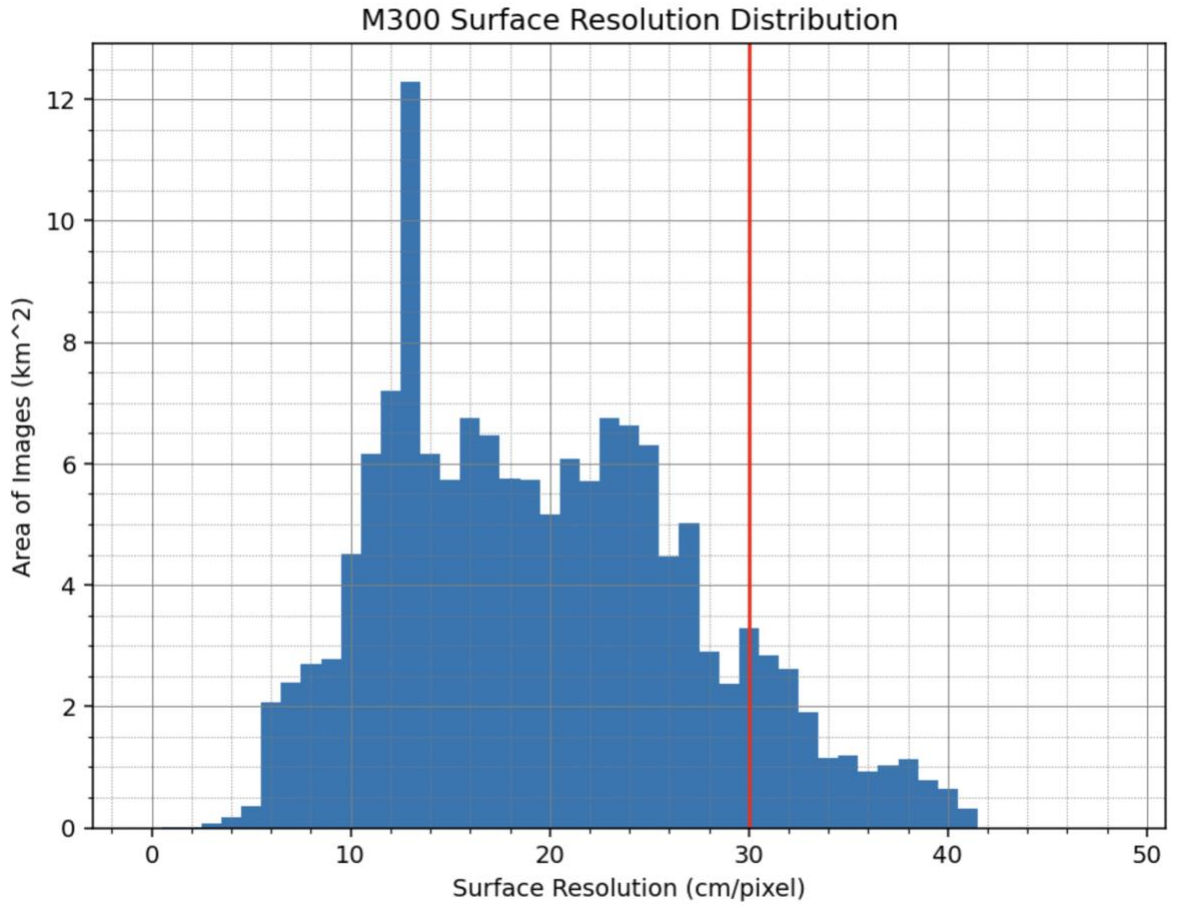
	Mine	Natural	Other	Class Corr
B2	0.124360	-0.133767	0.002790	-4.641635e-05
B3	0.146141	-0.174941	0.027712	-7.084858e-04
B4	-0.147910	0.165139	-0.011635	2.841990e-04
B5	-0.014427	0.011717	0.004910	-8.299350e-07
B7	0.089583	-0.114609	0.027138	-2.786277e-04
B1	0.100744	-0.107969	0.001715	-1.865673e-05
B2_Q2	0.027347	-0.027946	-0.001410	1.077317e-06
B3_Q2	0.051868	-0.051045	-0.005372	1.422357e-05
B4_Q2	-0.046389	0.052778	-0.005006	1.225666e-05
B5_Q2	0.124668	-0.114402	-0.024321	3.468785e-04
B7_Q2	0.122372	-0.077342	-0.072001	6.814537e-04
B1_Q2	0.029196	-0.030798	-0.000181	1.626801e-07
B2_Q3	0.018562	-0.005295	-0.019785	1.944367e-06
B3_Q3	0.029669	-0.016614	-0.020400	1.005549e-05
B4_Q3	-0.076882	0.081211	0.000322	-2.012833e-06
B5_Q3	-0.044245	0.021387	0.035088	-3.320227e-05
B7_Q3	0.015167	-0.046073	0.041315	-2.887027e-05
B1_Q3	0.025047	-0.000912	-0.035278	8.054851e-07
B2_Q4	0.152640	-0.154386	-0.010776	2.539293e-04
B3_Q4	0.216299	-0.230620	0.000742	-3.700266e-05
B4_Q4	-0.273470	0.268657	0.030039	-2.206938e-03
B5_Q4	-0.011305	0.006419	0.007577	-5.498780e-07
B7_Q4	0.197114	-0.214127	0.006030	-2.545038e-04
B1_Q4	0.131820	-0.139250	-0.001301	2.388724e-05

Quarterly Bands
Correlation with Classes



Natural vs Mine Waste Vegetation


Phantom 4 Surface Resolution Distribution
Area of Images (km^2)
Surface Resolution (cm/pixel)
0
2
4
6
8
10
12
0
10
20
30
40
50


M300 Surface Resolution Distribution
Area of Images (km^2)
Surface Resolution (cm/pixel)
0
2
4
6
8
10
12
0
10
20
30
40
50

Index Time Series Graphs