CE671A Lab 2

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1 Introduction

To complete this task, start working with QGIS and MATLAB software. Starting with QGIS, you must install the software, import an image using the "Add Raster Layer" option, and set the coordinate system “WGS84/UTM 44 N”. Explore the image properties to gain insights into aspects such as pyramids, metadata, and transparency. Additionally, learn about metadata in general, including key image parameters like bands, wavelength, and size. Export the image in "geotiff" format, exploring available options, and noting any missing features. Moving to MATLAB, read and view LISS-IV IRS images, using the "imread" function. Analyze the image in terms of its dimensions, explore different plotting commands, and use the data cursor tool to identify and understand anomalies within the image, including RGB values in specific areas. The task combines practical skills in both QGIS and MATLAB, emphasizing the importance of proper image handling and analysis in geospatial studies.

2 Methodology

2.1 Procedure-

Procedure for Working with QGIS

- Open QGIS after installation.
- Navigate to the “Layer” menu at the top of the QGIS interface.
- Select the “Add Raster Layer” option.
- Navigate to the directory where the PRODUCT1 folder is located. Select the file named “Imagery.L-4” and click “Open.”
- A dialog box will pop up asking for the coordinate system. Select “WGS84/UTM 44 N” as the coordinate system.
- If the image appears very small, use the zoom tools to adjust the view.
- Right-click on the “Imagery.L-4” layer in the “Layers” panel.
- Select “Properties” from the context menu.
- Explore the following tabs in the Properties window:
  - Pyramids
  - Metadata
  - Transparency
- Right-click on the “Imagery.L-4” layer in the “Layers” panel.
- Select the “Export” option from the context menu, then click “Save As.”
- Choose “GeoTIFF” as the file format for exporting the image.

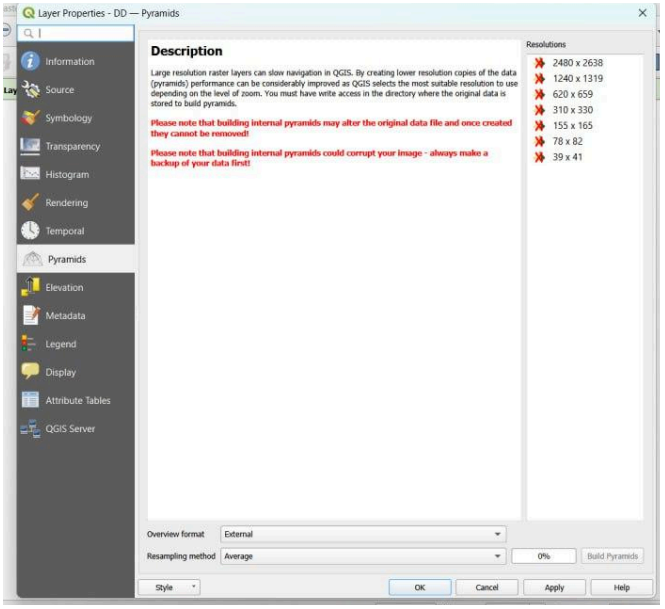
Procedure for Working with MATLAB

- Open MATLAB. Create New Script and Save it.
- Read image files using imread Function. Use the `imread` function to load the image files (in TIFF format) provided in the L4_tiff Folder.
- Save each band of the image into separate variables (e.g., `band1`, `band2`, `band3`).
- After reading the image, observe the variable in the MATLAB workspace.
- Click on the "Plots" tab in the MATLAB interface.
- Use the `help` command to explore different plotting functions, such as `imagesc`, `imshow`, etc.
- Write these plotting commands into your script to display the image.
- After displaying the image in a figure window, use the "Data Cursor" tool to inspect the image.
- Click on different areas of the image to view the RGB values.
- Identify any anomalies (such as unexpected colors or patterns) and define them. Compare the RGB values of the anomaly with other areas and interpret what these values indicate about the image.

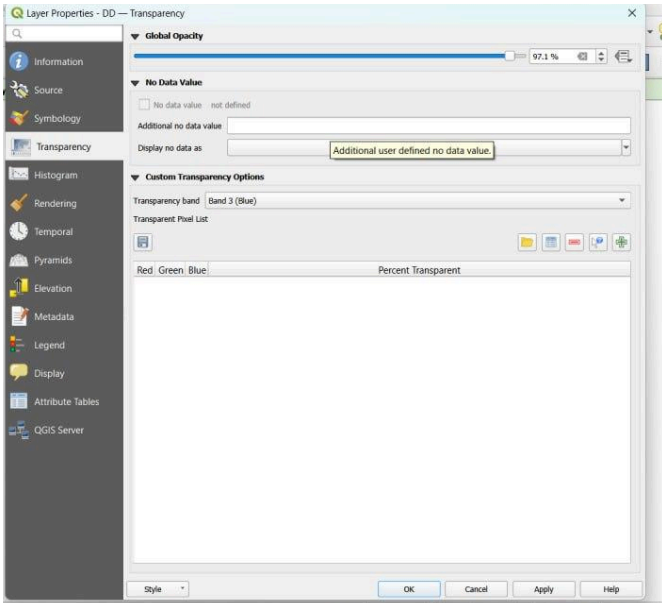
2.2 Results-

1) c)

Pyramids-

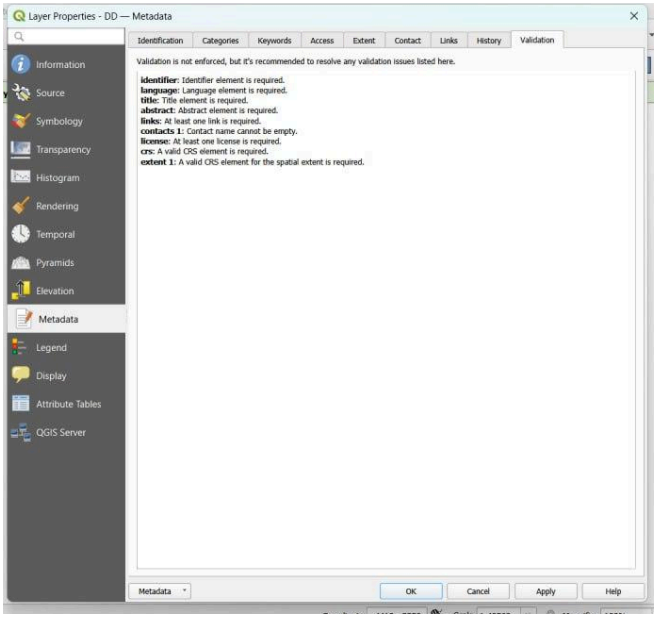


Allows you to build pyramids, which improve performance by generating lower-resolution copies of the image for faster viewing at different zoom levels.



Transparency-

Lets you set transparency levels for the image, which is useful when overlaying multiple layers.



Metadata-
Provides detailed information about the image, including the number of bands, wavelength, size, and other parameters.

What is Metadata?

Metadata is essentially "data about data." In the context of geospatial imagery and other digital files, metadata provides comprehensive information that describes the content, quality, condition, and other characteristics of the data. It serves as a guide for users to understand the origin, structure, and purpose of the data, making it easier to manage, interpret, and utilize effectively.

Metadata is crucial in ensuring that the data can be reused, shared, and understood by different users over time. It often follows specific standards, such as ISO 19115 for geographic information, which helps in maintaining consistency and interoperability across different platforms and applications.

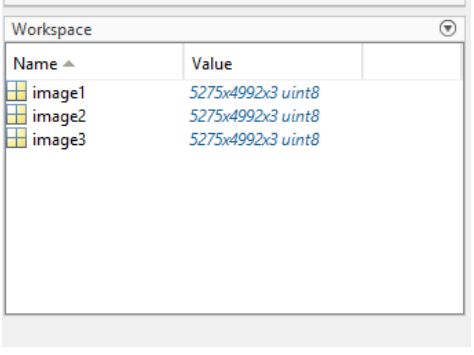
- **Number of Bands:** Refers to the different spectral layers captured by the sensor.
- **Wavelength:** Indicates the specific range of light or electromagnetic radiation each band represents.
- **Image Size:** Specifies the dimensions of the image in pixels, which can affect the level of detail visible.
- **Coordinate System:** Defines the spatial reference used for the image, ensuring it aligns correctly with other geospatial data.
- **Capture Date:** The date and time when the image was captured, important for temporal analysis.
- **Sensor Information:** Details about the sensor or satellite that captured the image, which can affect the image's quality and resolution.

The features which might be missing in this window-

Advanced Color Management: Options for managing color profiles and transformations might be limited.

Layer Styling Export: The ability to export layer styling and symbology along with the image could be missing.

2) d) Size of the image-



5275 x 4992 x 3

This variable have 3 dimensions because -

- ➔ **Height (rows):** The number of rows of pixels in the image.
- ➔ **Width (columns):** The number of columns of pixels in the image.
- ➔ **Color Channels (depth):** The third dimension represents the color channels. In an RGB image, there are three color channels:
- **Red (R)**
- **Green (G)**
- **Blue (B)**

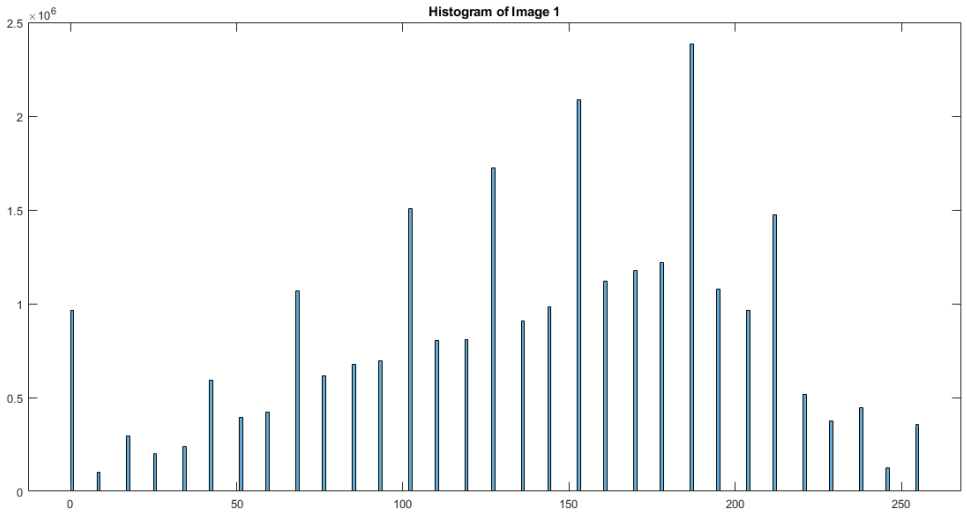
e) Plot options-

- **Histogram-**

In the context of image processing, a histogram typically represents the distribution of pixel intensities (gray levels) in an image. For color images, histograms can be created for each color channel (Red, Green, Blue) individually.

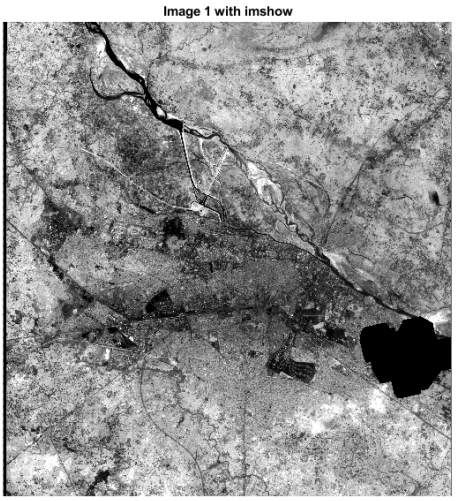
Understanding Histograms:

- X-axis: Represents the range of pixel intensity values. For an 8-bit grayscale image, the intensity values range from 0 to 255.
- Y-axis: Represents the frequency (or count) of each intensity value. It shows how many pixels in the image have each intensity value.



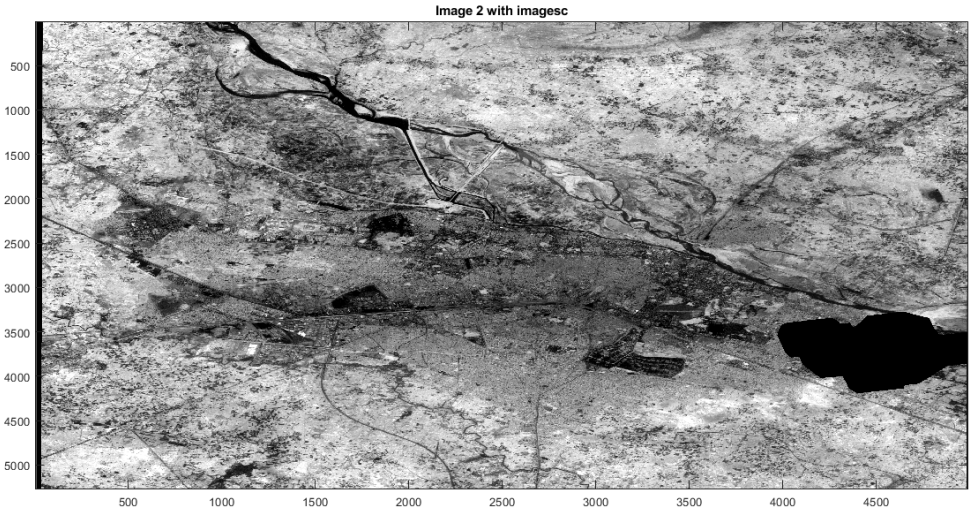
- **Imshow-**

The imshow function is used to display an image in a figure window. It is one of the most commonly used functions in image processing to visualize images.



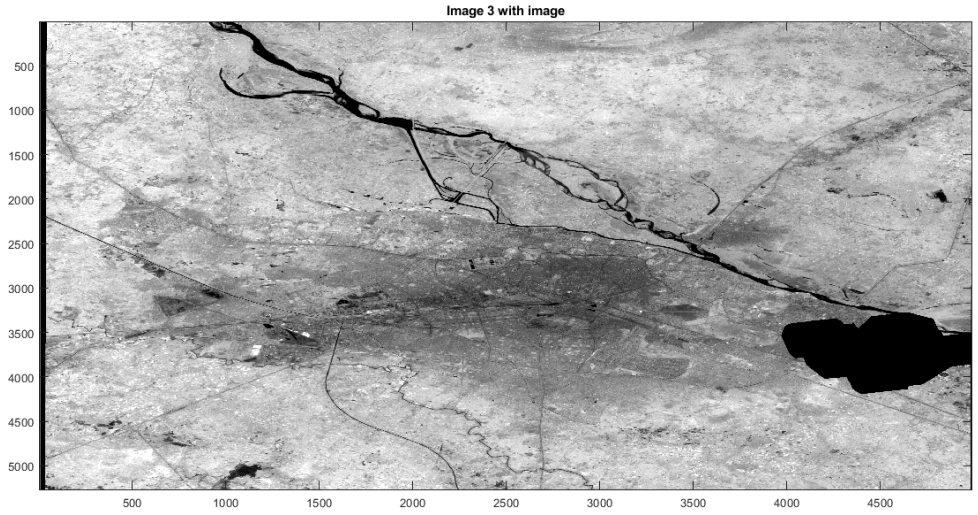
- **Imagesc-**

It is used to display a scaled version of an image or matrix as a color-coded image. Unlike imshow, which directly displays image data, imagesc scales the data values in the matrix to use the full range of the colormap, making it particularly useful for visualizing matrices or images where the range of values might not naturally span the full range of intensities or colors.



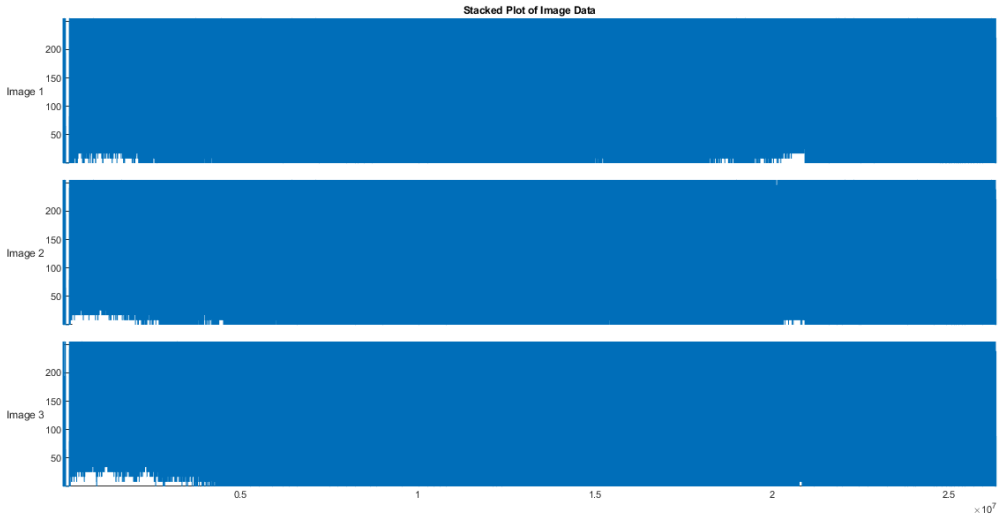
- **Image-**

The image function is used to display a matrix as an image. Each element of the matrix corresponds to a pixel in the image, and the value of that element determines the color of the pixel according to a colormap.

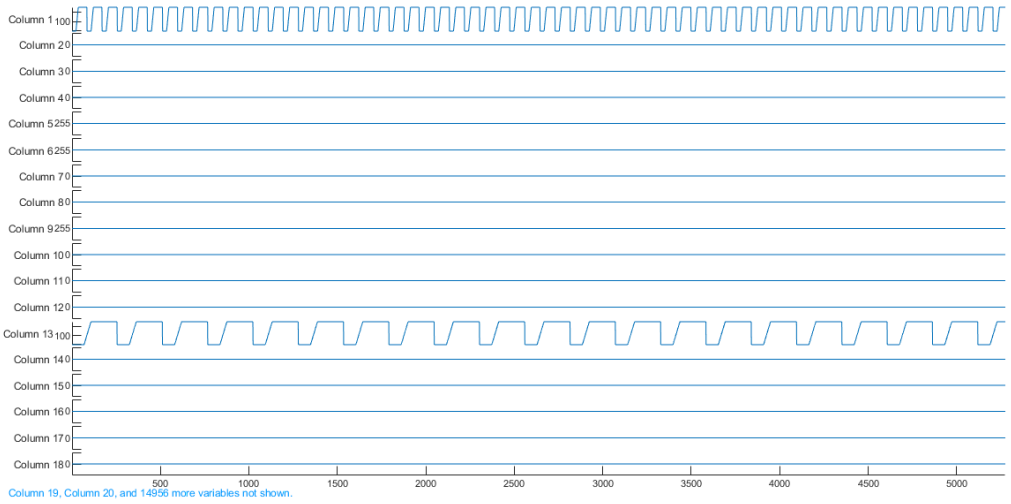


- Stackedplot(all three)

It displays multiple variables or columns of data in a vertically stacked format. Each variable is plotted in its own axes, one above the other, making it easy to compare trends across different variables simultaneously. The x-axis is shared across all the plots, and each variable has its own y-axis.



- Stackedplot(image1)



Differences Between image, imshow, and imagesc:

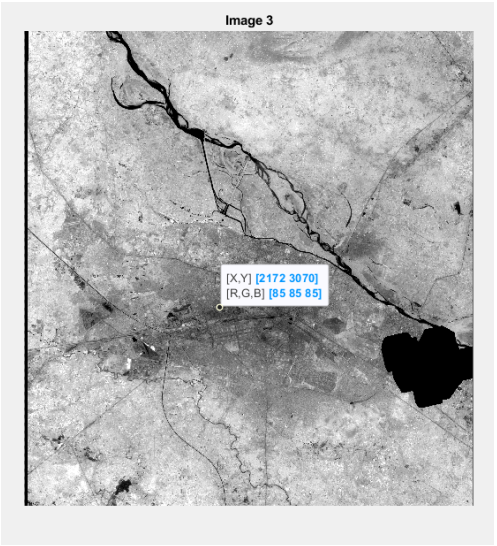
- image: Displays a matrix as an image with values mapped directly to the colormap. Ideal for displaying indexed images or matrices with specific colormap indexing.

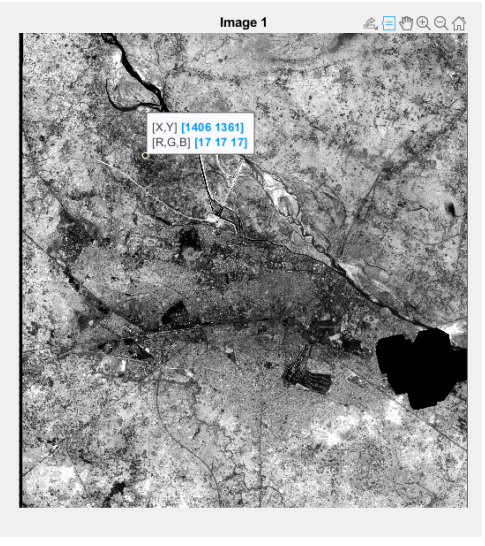
- imshow: Displays images without altering the data. It is often used for viewing images with their actual intensity values, particularly for grayscale or color images.

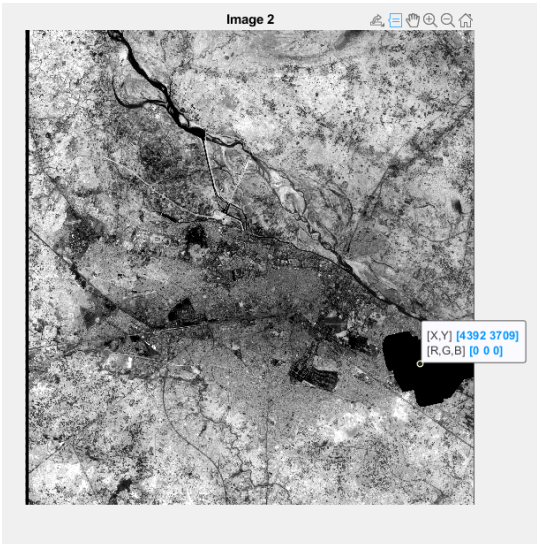
- imagesc: Scales the matrix values to the full range of the colormap and then displays the image. Useful for visualizing data that spans a wide range or when the data range doesn't naturally fit the colormap.

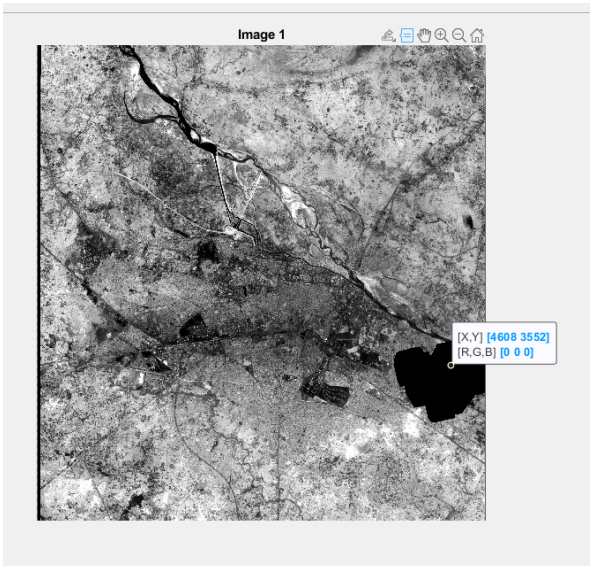
g) Anomaly -

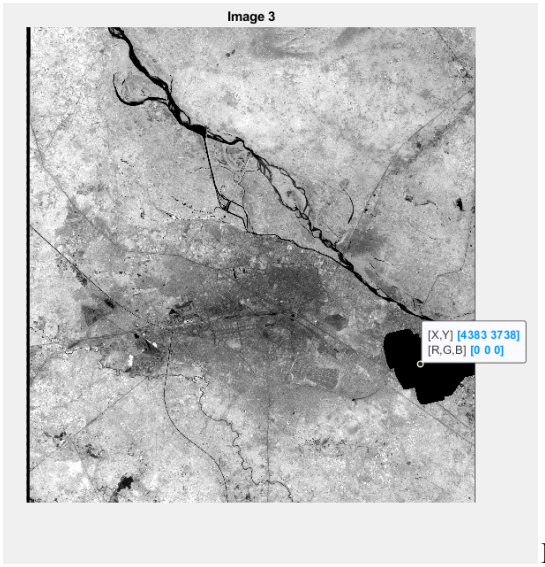
There appears to be a kind of blank area in all the images near the bottom right corner. It appears that this anomaly is due to either some object kept at the top of this map or some error in either downloading or this map has been created by merging lot of images because of which this kind of black area is formed.











RGB of this black area is (0,0,0) while the the RGB of all other areas has some value like (85,85,85). We notice that RGB all the values are same. If the RGB values of the anomalous area are significantly different from surrounding areas, it could indicate a color shift or artifact in that region. A large difference in the RGB values may suggest that the anomaly is caused by a sudden change in intensity, perhaps due to a shadow, bright spot, or sensor error.

3 Discussion

This assignment helped me develop a solid understanding of GIS and image analysis. Using QGIS, I learned to import and manage raster images, adjust coordinate systems, and explore image properties like metadata. In MATLAB, I utilized functions like `imshow`, `imagesc`, `image`, and `stackedplot` to visualize and analyze image data, including detecting anomalies. The Data Cursor tool helped identify RGB value discrepancies, providing insights into potential sensor artifacts or processing errors.

4 Conclusion

This assignment focused on using QGIS and MATLAB for GIS and image analysis. We imported and analyzed raster images in QGIS, explored metadata, and exported files. We visualized image data, identified anomalies using RGB values, and understood their potential causes. The results highlighted the importance of accurate data handling and interpretation.

5 References

https://gis.stackexchange.com/questions/347041/viewing-metadata-in-qgis
https://gis.stackexchange.com/questions/433514/create-pyramids-for-geotiff-files-from-qgis
https://in.mathworks.com/help/matlab/ref/matlab.graphics.chart.primitive.histogram.html
https://in.mathworks.com/help/matlab/ref/stackedplot.html