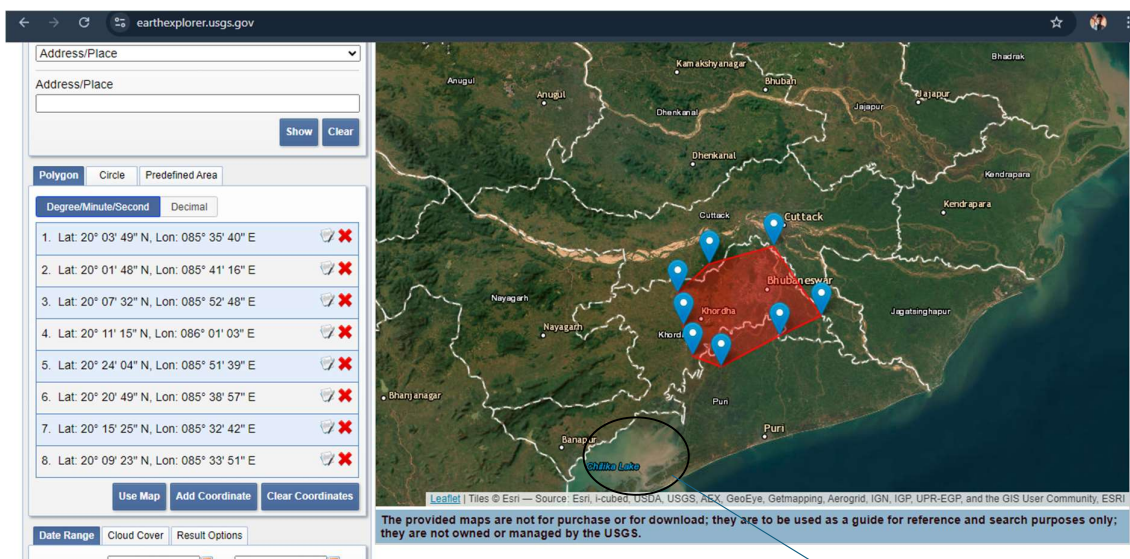
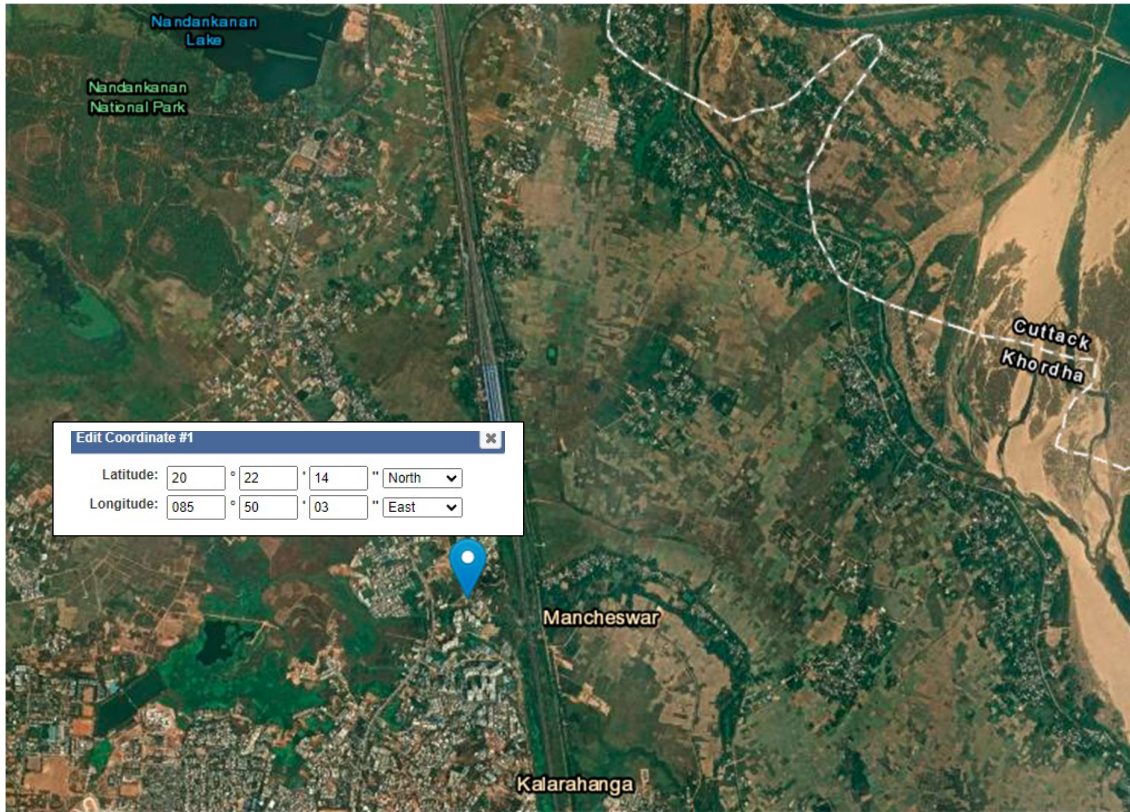


SRIMAYA MOHAPATRA ,244104010

## LAB 2 ASSIGNMENT

### CE 593 ADVANCED REMOTE SENSING

#### Earth Explorer USGS



Chilika Lake

## 4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Browse/Footprint Controls

Show Result Controls

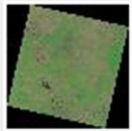
Data Set

[Click here to export your results »](#)

Landsat 8-9 OLI/TIRS C2 L1

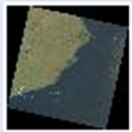
« First < Previous 1 of 1 Next > Last »

Displaying 1 - 7 of 7

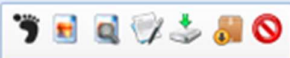


ID:  
LC09\_L1TP\_140045\_20240610\_20240610\_02\_T1  
Date Acquired: 2024/06/10  
Path: 140  
Row: 045

Download the Data



ID:  
LC09\_L1TP\_139046\_20240502\_20240502\_02\_T1  
Date Acquired: 2024/05/02  
Path: 139  
Row: 046



ID:  
LC08\_L1TP\_140045\_20240501\_20240511\_02\_T1

USGS EarthExplorer - To search and download satellite imagery and other geospatial data

### Geographic Location:

- **Country:** India
- **State:** Odisha
- **Region:** The area highlighted is in the eastern part of Odisha, around the cities of Bhubaneswar and Cuttack.

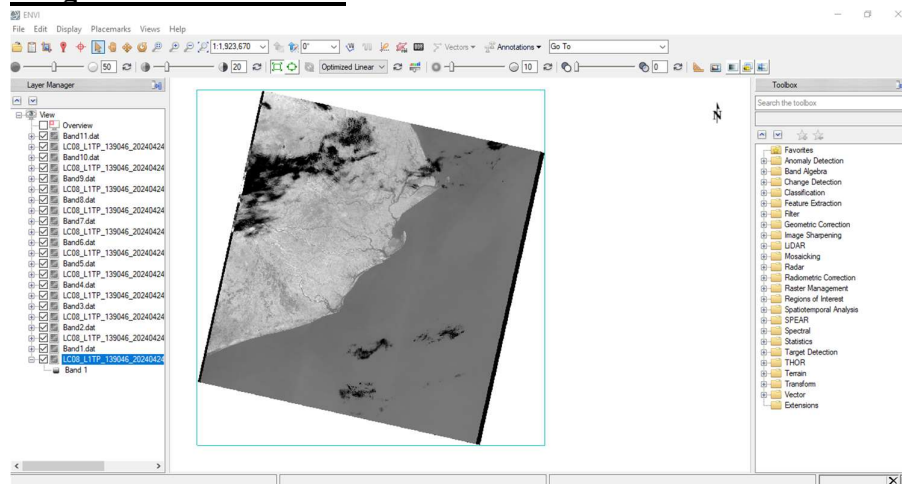
### Polygon Details:

The polygon drawn on the map marks a specific area of interest, mainly to download satellite imagery or other geospatial data. The coordinates listed on the left side define the boundaries of this polygon.

## Metadata of the Downloaded File

```
LC08_L1TP_139046_20240424_20240430_02_T1_MTL - Notepad
File Edit Format View Help
GROUP = LANDSAT_METADATA_FILE
GROUP = PRODUCT_CONTENTS
ORIGIN = "Image courtesy of the U.S. Geological Survey"
DIGITAL_OBJECT_IDENTIFIER = "https://doi.org/10.5066/P975CC98"
LANDSAT_PRODUCT_ID = "LC08_L1TP_139046_20240424_20240430_02_T1"
PROCESSING_LEVEL = "L1TP"
COLLECTION_NUMBER = 02
COLLECTION_CATEGORY = "T1"
OUTPUT_FORMAT = "GEOTIFF"
FILE_NAME_BAND_1 = "LC08_L1TP_139046_20240424_20240430_02_T1_B1.TIF"
FILE_NAME_BAND_2 = "LC08_L1TP_139046_20240424_20240430_02_T1_B2.TIF"
FILE_NAME_BAND_3 = "LC08_L1TP_139046_20240424_20240430_02_T1_B3.TIF"
FILE_NAME_BAND_4 = "LC08_L1TP_139046_20240424_20240430_02_T1_B4.TIF"
FILE_NAME_BAND_5 = "LC08_L1TP_139046_20240424_20240430_02_T1_B5.TIF"
FILE_NAME_BAND_6 = "LC08_L1TP_139046_20240424_20240430_02_T1_B6.TIF"
FILE_NAME_BAND_7 = "LC08_L1TP_139046_20240424_20240430_02_T1_B7.TIF"
FILE_NAME_BAND_8 = "LC08_L1TP_139046_20240424_20240430_02_T1_B8.TIF"
FILE_NAME_BAND_9 = "LC08_L1TP_139046_20240424_20240430_02_T1_B9.TIF"
FILE_NAME_BAND_10 = "LC08_L1TP_139046_20240424_20240430_02_T1_B10.TIF"
FILE_NAME_BAND_11 = "LC08_L1TP_139046_20240424_20240430_02_T1_B11.TIF"
FILE_NAME_QUALITY_L1_PIXEL = "LC08_L1TP_139046_20240424_20240430_02_T1_QA_PIXEL.TIF"
FILE_NAME_QUALITY_L1_RADIOMETRIC_SATURATION = "LC08_L1TP_139046_20240424_20240430_02_T1_QA_RADSAT.TIF"
FILE_NAME_ANGLE_COEFFICIENT = "LC08_L1TP_139046_20240424_20240430_02_T1_ANG.txt"
FILE_NAME_ANGLE_COEFFICIENT_BAND_4 = "LC08_L1TP_139046_20240424_20240430_02_T1_ANG_TTF"
Ln 229, Col 38 100% Unix (LF) UTF-8
```

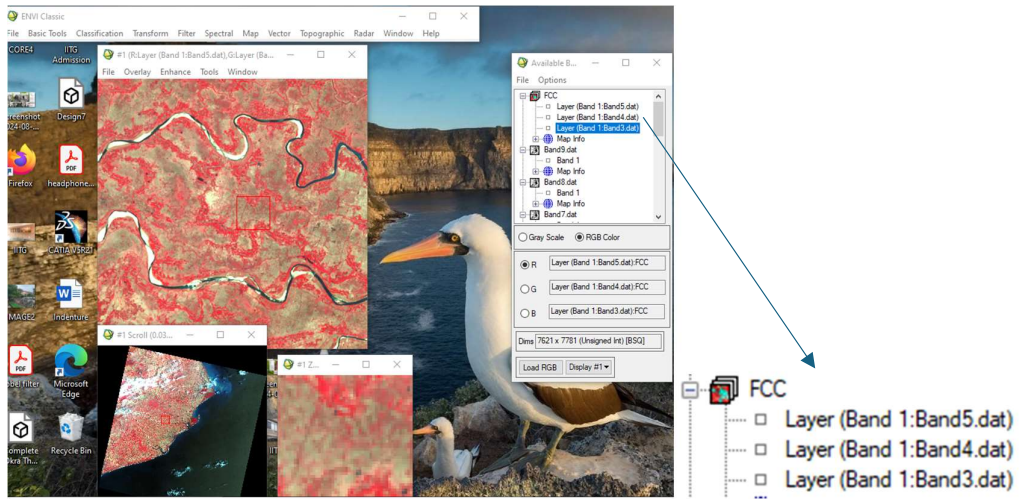
## Image Conversion to Envi





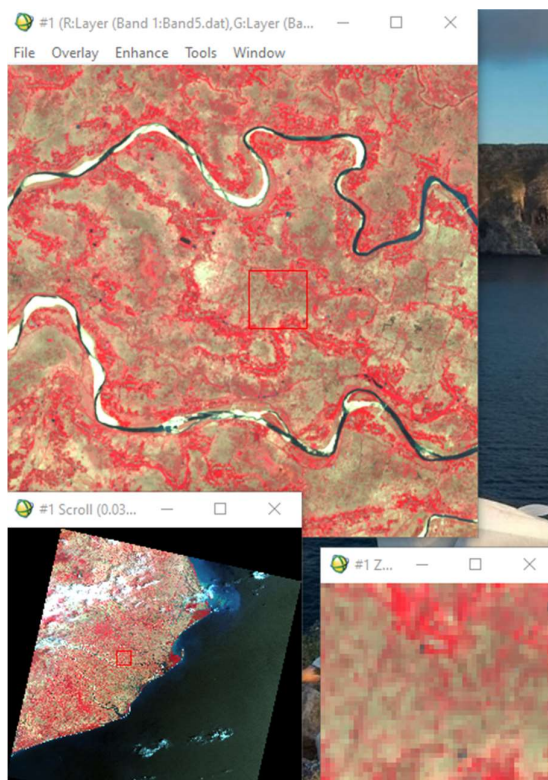
## Layer Stacking for FCC Band

11 bands are loaded, and FCC image stacked into single file



- For (FCC) image - bands 5, 4, and 3:
  - Red (R): Band 5 (NIR)
  - Green (G): Band 4 (Red)
  - Blue (B): Band 3 (Green)
- Stack the bands in the order of R-G-B

## **FCC IMAGE RESULT AND INFORMATION**



**1. General Information**

- Product ID: LC08\_L1TP\_139046\_20240424\_20240430\_02\_T1
- Date Acquired: 2024-04-24
- Processing Level: L1TP (Precision Terrain)
- Output Format: GeoTIFF

**2. Image Attributes**

- Spacecraft ID: LANDSAT\_8
- Cloud Cover: 6.06%
- Cloud Cover over Land: 11.07%
- Sun Azimuth: 104.04°
- Sun Elevation: 66.33°

**3. Projection Attributes**

- Map Projection: UTM
- Datum/Ellipsoid: WGS84
- UTM Zone: 45
- Grid Cell Size:
  - Panchromatic: 15 meters
  - Reflective/Thermal: 30 meters

**4. Geometric Attributes**

- Upper Left Corner (Lat, Lon): (21.27384, 85.49441)
- Upper Right Corner (Lat, Lon): (21.27913, 87.69792)
- Lower Left Corner (Lat, Lon): (19.16546, 85.51457)
- Lower Right Corner (Lat, Lon): (19.17018, 87.68858)

**Band Math Calculation**

**Digital Number to Reflectance**

$$P_{\lambda} = (M_{\rho} + Q(cal) + A_{\rho}) / \sin(\theta_{se})$$

$P_{\lambda}$  = Reflectance

$M_{\rho}$ =Band – specific rescaling factor from the metadata (Reflectance)

$A_{\rho}$ =Band - specific additive rescaling factor from the metadata

$Q(cal)$  – Quantized and calibrated standard product pixel value (DN)

$\theta_{se}$ - Local sun elevation angle, provided in the metadata

Parameter	Band 3	Band 4	Band 5
$M_\rho$	2.0000E-05	2.0000E-05	2.0000E-05
$A_\rho$	-0.100000	-0.100000	-0.100000
$\theta_{se}$	66.32614072	66.32614072	66.32614072

$((0.00002*B3)-0.1)/0.915845$   
 $((0.00002*B4)-0.1)/0.915845$   
 $((0.00002*B5)-0.1)/0.915845$

### Digital Number to Radiance

$$P_\lambda = (M_\rho + Q(cal) + A_\rho$$

$P_\lambda$  = Radiance

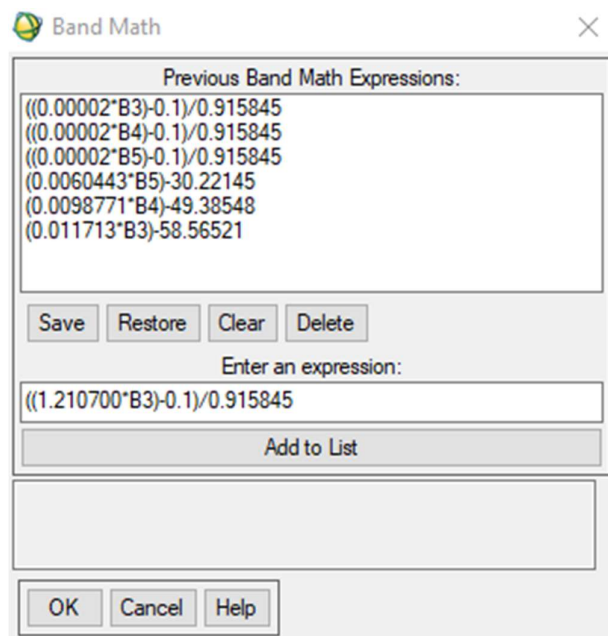
$M_\rho$ =Band – specific rescaling factor from the metadata (Radiance)

$A_\rho$ =Band - specific additive rescaling factor from the metadata

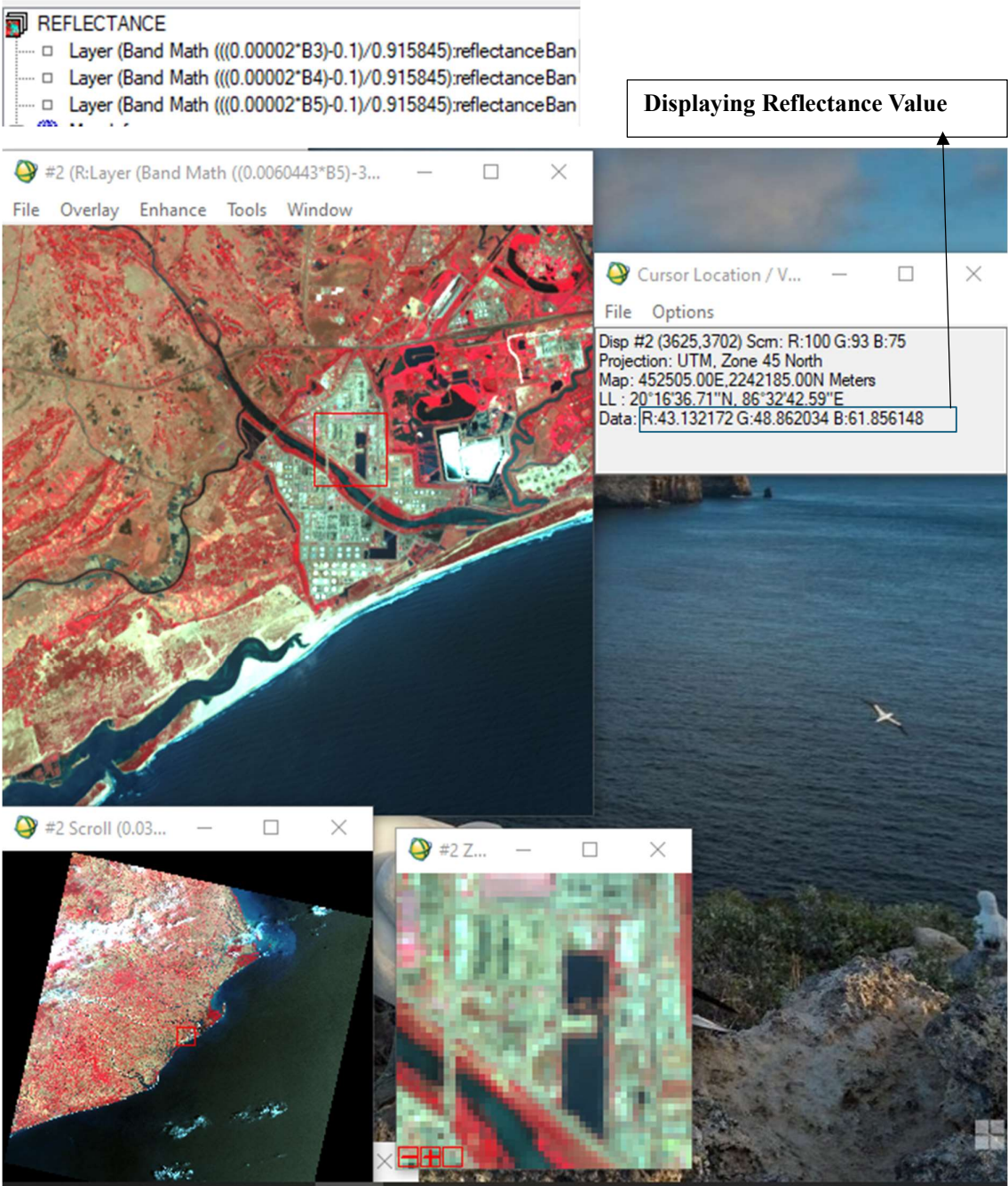
$Q(cal)$  – Quantized and calibrated standard product pixel value (DN)

Parameter	Band 3	Band 4	Band 5
$M_\rho$	1.1713E-02	9.8771E-03	6.0443E-03
$A_\rho$	-0.100000	-0.100000	-0.100000

$((0.0060443*B5)-30.22145$   
 $(0.0098771*B4)-49.38548$   
 $(0.011713*B3)-58.56521$



Reflectance Value



## Available Bands List

File Options

REFLECTANCE

- ☐ Layer (Band Math (((0.00002\*B3)-0.1)/0.915845):reflectanceBand3)
- ☐ Layer (Band Math (((0.00002\*B4)-0.1)/0.915845):reflectanceBand4)
- ☐ Layer (Band Math (((0.00002\*B5)-0.1)/0.915845):reflectanceBand5)
- ☒ Map Info
- ☐ reflectanceBand3
  - ☐ Band Math (((0.00002\*B3)-0.1)/0.915845)
  - ☒ Map Info
- ☐ reflectanceBand4
  - ☐ Band Math (((0.00002\*B4)-0.1)/0.915845)
  - ☒ Map Info
- ☐ reflectanceBand5

☐ Gray Scale ☒ RGB Color

☒ R Layer (Band Math (((0.00002\*B5)-0.1)/0.915845):reflectanceBand5):REFLECTANCE

☐ G Layer (Band Math (((0.00002\*B4)-0.1)/0.915845):reflectanceBand4):REFLECTANCE

☐ B Layer (Band Math (((0.00002\*B3)-0.1)/0.915845):reflectanceBand3):REFLECTANCE

Dims 7621 x 7781 (Floating Point) [BSQ]

Load RGB Display #3 ▾



## Radiance Value

