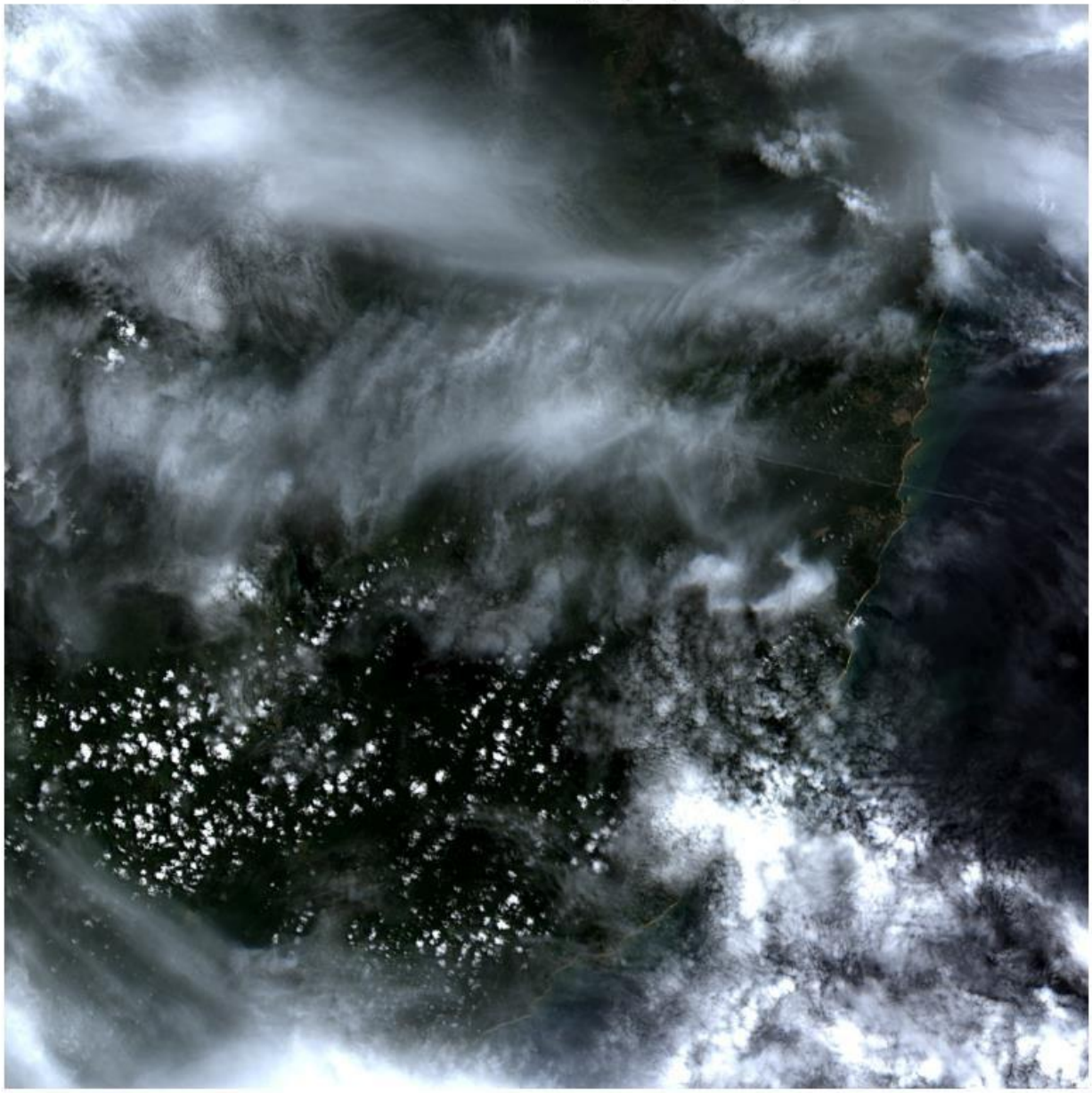
Exploring and analyzing sentinel 2 dataset and visualize the true colour image for a selected region

```
# Mount Google Drive from
google.colab import drive
drive.mount('/content/drive')
 import os import rasterio
import numpy as np import
matplotlib.pyplot as plt

# Base path to Google Drive base_path
= '/content/drive/MyDrive'

# OPTIONAL: View folders in Drive print("Root folders
in Drive:", os.listdir(base_path))

# Define path to Sentinel-2 data folder  data_path
= os.path.join(base_path,
"test/S2B_MSIL2A_20250501T050609_N0511_R076_T44NNN_20250501T070700.SAFE/S2
B_MSIL2A_20250501T050609_N0511_R076_T44NNN_20250501T070700.SAFE")
# Navigate to the IMG_DATA/R10m folder granule_dir =
os.path.join(data_path, "GRANULE") granule_subdir =
os.listdir(granule_dir)[0] img_data_dir = os.path.join(granule_dir,
granule_subdir, "IMG_DATA") r10m_dir = os.path.join(img_data_dir,
"R10m")

# Check available band files
print("R10m Band files:", os.listdir(r10m_dir))

# Define paths to RGB bands band_paths
= {
    'B04': os.path.join(r10m_dir, [f for f in os.listdir(r10m_dir) if
'B04_10m' in f][0]),  # Red
    'B03': os.path.join(r10m_dir, [f for f in os.listdir(r10m_dir) if
'B03_10m' in f][0]),  # Green
    'B02': os.path.join(r10m_dir, [f for f in os.listdir(r10m_dir) if
'B02_10m' in f][0]),  # Blue
}
```

```
# Read each band using rasterio with
rasterio.open(band_paths['B04']) as red_src:
    red = red_src.read(1).astype('float32')
     with rasterio.open(band_paths['B03']) as
green_src:
    green = green_src.read(1).astype('float32')
     with rasterio.open(band_paths['B02']) as
blue_src:
    blue = blue_src.read(1).astype('float32')

# Stack into RGB and normalize for display rgb =
np.dstack((red, green, blue)) rgb_min = np.percentile(rgb,
2) rgb_max = np.percentile(rgb, 98) rgb = np.clip((rgb -
rgb_min) / (rgb_max - rgb_min), 0, 1)
# Display image plt.figure(figsize=(10, 10))
plt.imshow(rgb) plt.title("Sentinel-2 True Color Image
(B04, B03, B02)") plt.axis('off') plt.show()
```

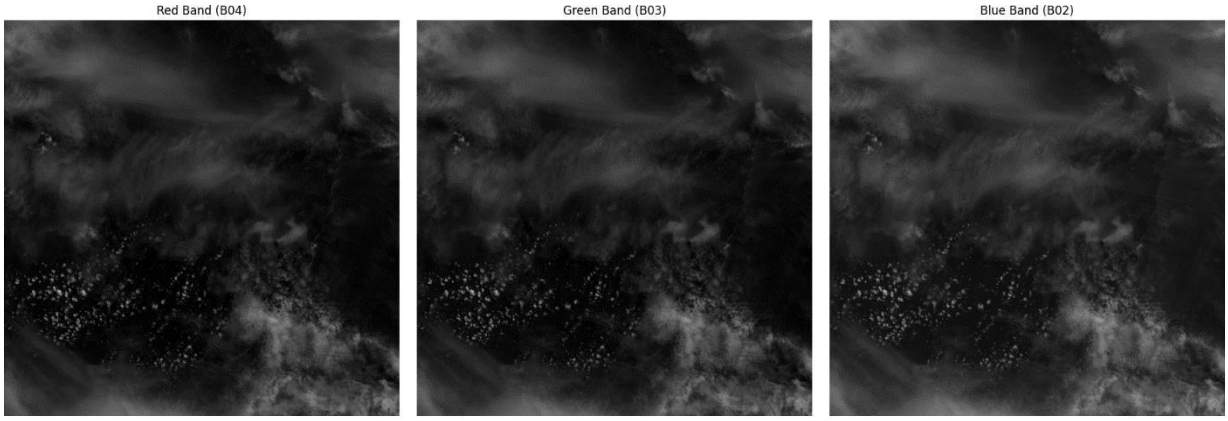
Sentinel-2 True Color Image (B04, B03, B02)



VISUALIZE EACH BANDS

```
#Mount Google Drive from
google.colab import drive
drive.mount('/content/drive')

#Import required libraries
import os import rasterio
import numpy as np import
matplotlib.pyplot as plt

#Set the correct path to your R10m folder data_path
=
"/content/drive/MyDrive/test/S2B_MSIL2A_20250501T050609_N0511_R076_T44NNN_
20250501T070700.SAFE/S2B_MSIL2A_20250501T050609_N0511_R076_T44NNN_20250501
T070700.SAFE" granule_dir = os.path.join(data_path, "GRANULE")
granule_subdir = os.listdir(granule_dir)[0] r10m_dir =
os.path.join(granule_dir, granule_subdir, "IMG_DATA", "R10m")
#Define band file paths (Red, Green, Blue) band_paths
= {
    'B04': os.path.join(r10m_dir,
'T44NNN_20250501T050609_B04_10m.jp2'),  # Red
    'B03': os.path.join(r10m_dir,
'T44NNN_20250501T050609_B03_10m.jp2'),  # Green
    'B02': os.path.join(r10m_dir,
'T44NNN_20250501T050609_B02_10m.jp2'),  # Blue
}

#Load bands into a dictionary bands = {} for
b in band_paths:     with
rasterio.open(band_paths[b]) as src:
        bands[b] = src.read(1).astype(np.float32)

#Normalize for visualization def
normalize(array):
    return (array - array.min()) / (array.max() - array.min())
#Plot each band individually fig, axs =
plt.subplots(1, 3, figsize=(18, 6))
 axs[0].imshow(normalize(bands['B04']),
cmap='gray')
```

```
axs[0].set_title('Red Band (B04)') axs[0].axis('off')
 axs[1].imshow(normalize(bands['B03']),
cmap='gray') axs[1].set_title('Green Band (B03)')
axs[1].axis('off')
 axs[2].imshow(normalize(bands['B02']),
cmap='gray') axs[2].set_title('Blue Band (B02)')
axs[2].axis('off')
 plt.tight_layout()
plt.show()
```

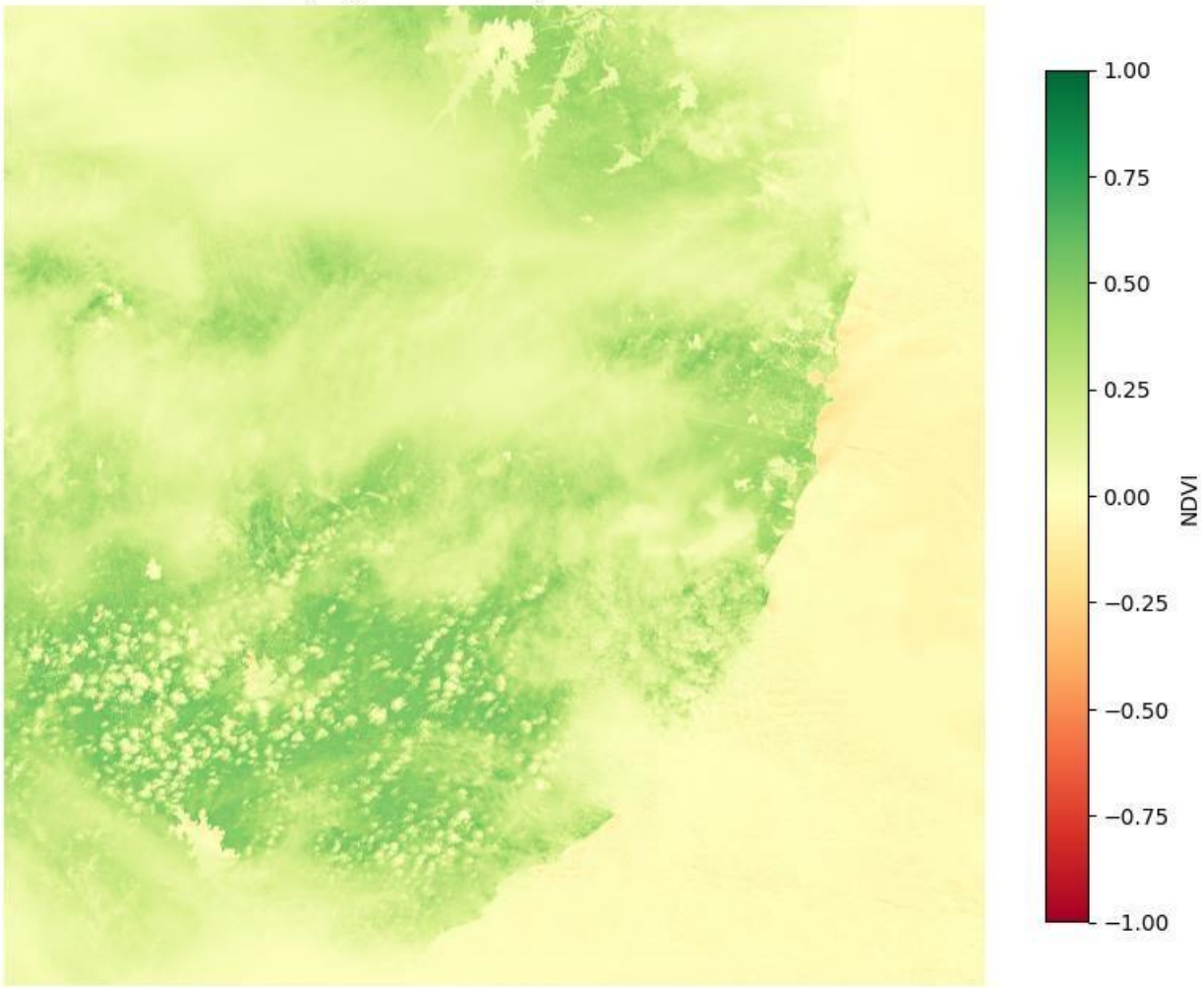


Normalized Difference Vegetation Index

$$\text{NDVI} = \frac{B08 - B04}{B08 + B04}$$

```
# Mount Google Drive from google.colab import drive
drive.mount('/content/drive')

#Import libraries import os import rasterio import
numpy as np import matplotlib.pyplot as plt
```

```
#Set the correct path to the R10m directory data_path
=
"/content/drive/MyDrive/test/S2B_MSIL2A_20250501T050609_N0511_R076_T44NNN_
20250501T070700.SAFE/S2B_MSIL2A_20250501T050609_N0511_R076_T44NNN_20250501
T070700.SAFE" granule_dir = os.path.join(data_path, "GRANULE")
granule_subdir = os.listdir(granule_dir)[0] r10m_dir =
os.path.join(granule_dir, granule_subdir, "IMG_DATA", "R10m")
#Define file paths for Red (B04) and NIR (B08) band_paths
= {
    'B04': os.path.join(r10m_dir,
'T44NNN_20250501T050609_B04_10m.jp2'),  # Red
    'B08': os.path.join(r10m_dir,
'T44NNN_20250501T050609_B08_10m.jp2')   # NIR
}

#Read the bands using rasterio with
rasterio.open(band_paths['B04']) as red_src:
    red = red_src.read(1).astype(np.float32)
 with rasterio.open(band_paths['B08']) as
nir_src:
    nir = nir_src.read(1).astype(np.float32)

#Calculate NDVI = (NIR - Red) / (NIR + Red) ndvi_numerator = nir - red
ndvi_denominator = nir + red ndvi_denominator[ndvi_denominator == 0] =
0.01  # Avoid division by zero ndvi = ndvi_numerator / ndvi_denominator

#Clip values to range -1 to 1 for visualization ndvi
= np.clip(ndvi, -1, 1)

#Plot the NDVI image plt.figure(figsize=(10, 10)) ndvi_plot
= plt.imshow(ndvi, cmap='RdYlGn', vmin=-1, vmax=1)
plt.colorbar(ndvi_plot, shrink=0.7, label='NDVI')
plt.title("NDVI (Vegetation Index) from Sentinel-2")
plt.axis('off') plt.show()
```


NDVI (Vegetation Index) from Sentinel-2
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
NDVI