Experiment_5b

April 27, 2025

[61]:

```python
import numpy as np
import re
import rasterio
import matplotlib.pyplot as plt
```

[62]:

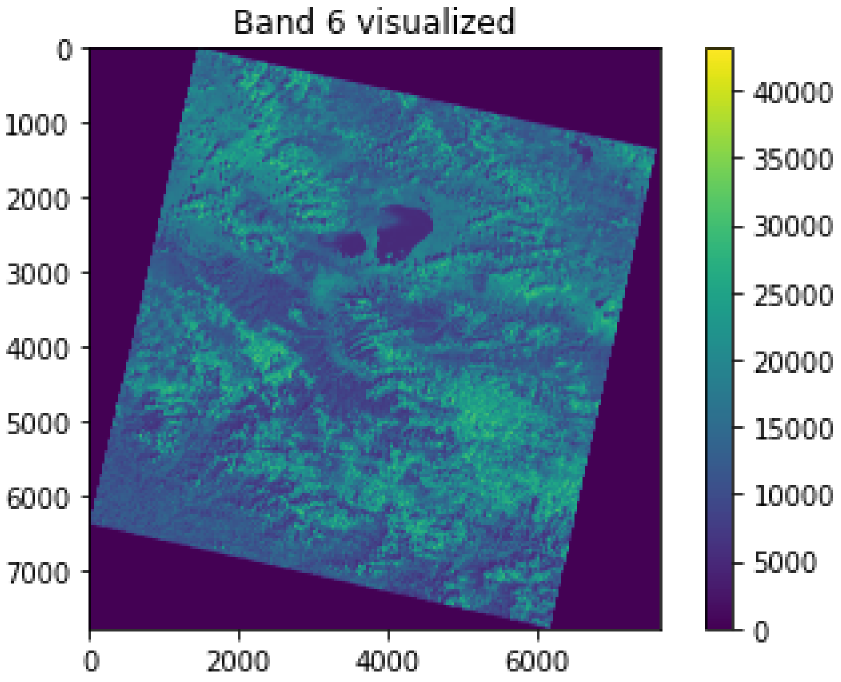
```python
band_number = int(input("Enter the band number (e.g., 1-9): "))
```

[63]:

```python
path = "./LC08_L1TP_144039_20250313_20250313_02_RT/"
meta_file = f"{path}LC08_L1TP_144039_20250313_20250313_02_RT_MTL.txt"
band_file = f"{path}LC08_L1TP_144039_20250313_20250313_02_RT_B{band_number}.TIF"

with rasterio.open(f"{band_file}") as src:
    gray_image = src.read(1)

plt.title(f"Band {band_number} visualized")
plt.imshow(gray_image)
plt.colorbar()
plt.show()
```



[64]:

```
keys = {
    f"RADIANCE_MULT_BAND_{band_number}": None,
    f"RADIANCE_ADD_BAND_{band_number}": None,
    f"REFLECTANCE_MULT_BAND_{band_number}": None,
    f"REFLECTANCE_ADD_BAND_{band_number}": None,
    "SUN_ELEVATION": None
}
pattern = re.compile(r"(\w+)\s=\s([-]?\d+\.?\d*)")
```

[65]:

```
with open(meta_file, 'r') as f:
    for line in f:
        match = pattern.search(line)
        if match:
            key, value = match.groups()
            if key in keys:
                keys[key] = float(value)

print(keys)  # Output the extracted parameters
```

```
{'RADIANCE_MULT_BAND_6': 1.5392, 'RADIANCE_ADD_BAND_6': -7.69583,
'REFLECTANCE_MULT_BAND_6': 2.0, 'REFLECTANCE_ADD_BAND_6': -0.1, 'SUN_ELEVATION':
49.42483267}
```

[66]:

```
sun_elevation = keys["SUN_ELEVATION"]
solar_zenith = 90 - sun_elevation
```

```
print(f"Solar Zenith Angle: {solar_zenith:.2f}°")
```

```
Solar Zenith Angle: 40.58°
```

[67]:

```
with rasterio.open(band_file) as src:
    dn_image = src.read(1).astype(float)
```

[68]:

```
radiance_mult = keys[f"RADIANCE_MULT_BAND_{band_number}"]
radiance_add = keys[f"RADIANCE_ADD_BAND_{band_number}"]
radiance = radiance_mult * dn_image + radiance_add

reflectance_mult = keys[f"REFLECTANCE_MULT_BAND_{band_number}"]
reflectance_add = keys[f"REFLECTANCE_ADD_BAND_{band_number}"]
reflectance = reflectance_mult * dn_image + reflectance_add
```

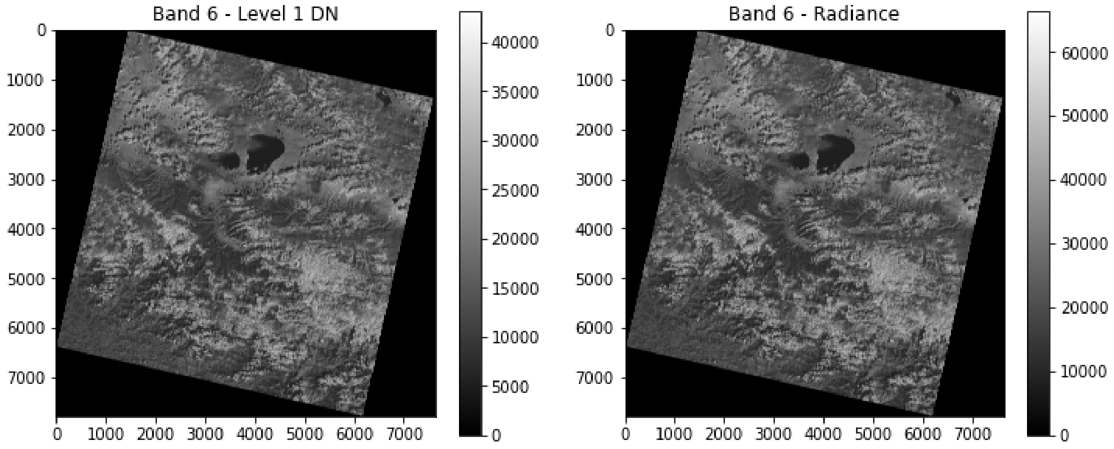
[69]:

```
plt.figure(figsize=(12, 5))

plt.subplot(1, 2, 1)
plt.title(f"Band {band_number} - Level 1 DN")
plt.imshow(dn_image, cmap='gray')
plt.colorbar()

plt.subplot(1, 2, 2)
plt.title(f"Band {band_number} - Radiance")
plt.imshow(radiance, cmap='gray')
plt.colorbar()

plt.show()
```



[70]:

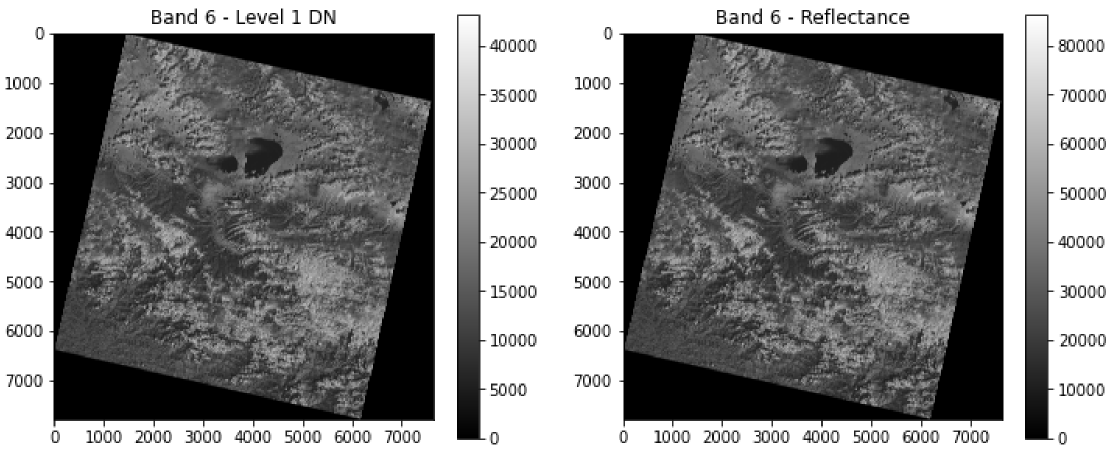
```
plt.figure(figsize=(12, 5))

plt.subplot(1, 2, 1)
```

```python
plt.title(f"Band {band_number} - Level 1 DN")
plt.imshow(dn_image, cmap='gray')
plt.colorbar()

plt.subplot(1, 2, 2)
plt.title(f"Band {band_number} - Reflectance")
plt.imshow(reflectance, cmap='gray')
plt.colorbar()

plt.show()
```


Band 6 - Level 1 DN

Band 6 - Reflectance

```python
[71]: nan_mask = np.isnan(dn_image)
      num_nan_values = np.sum(nan_mask)
      print(f"Number of NaN values in DN image: {num_nan_values}")
```

```
Number of NaN values in DN image: 0
```

```python
[72]: mid_row = dn_image.shape[0] // 2
      mid_col = dn_image.shape[1] // 2

      middle_dn = dn_image[mid_row, mid_col]

      if middle_dn == 0:
          mid_row = mid_row+1
          mid_col = mid_col

      # Compute Radiance & Reflectance for the selected pixel
      middle_radiance = radiance[mid_row, mid_col]
      middle_reflectance = reflectance[mid_row, mid_col]

      print(f"Selected Pixel (Row {mid_row}, Col {mid_col}):")
      print(f"DN Value: {middle_dn}")
      print(f"Radiance: {middle_radiance}")
      print(f"Reflectance: {middle_reflectance}")
```

```
Selected Pixel (Row 3890, Col 3820):
DN Value: 21890.0
Radiance: 33685.39217
Reflectance: 43779.9
```