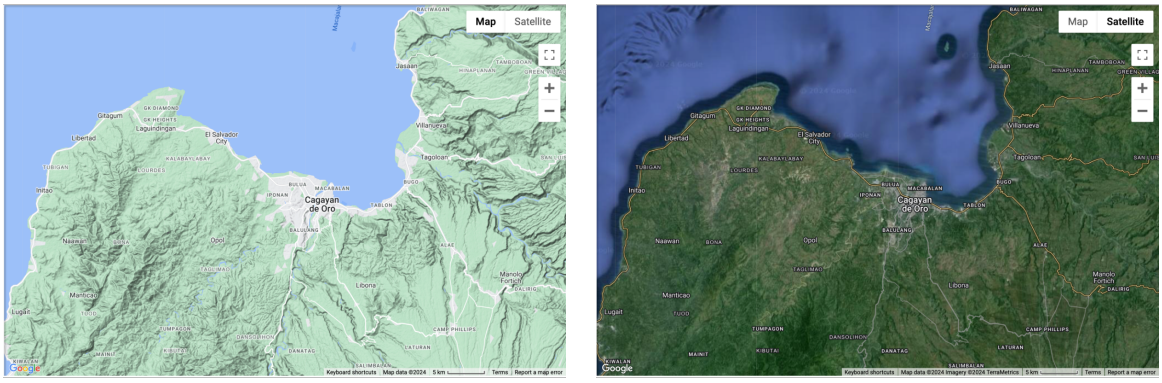
1 Introduction to Google Earth Engine Explorer

MCD43A4.061 MODIS Nadir BRDF-Adjusted Reflectance Daily 500m
`https://doi.org/10.5067/MODIS/MCD43A4.061`

- **Dataset Availability**: 24 Feb 2000 - 11 Feb 2024
- **Bands**:
  - `Nadir_Reflectance_Band1`: 620-670 nm
  - `Nadir_Reflectance_Band2`: 841-876 nm
  - `Nadir_Reflectance_Band3`: 459-479 nm
  - `Nadir_Reflectance_Band4`: 545-565 nm
  - `Nadir_Reflectance_Band5`: 1230-1250 nm
  - `Nadir_Reflectance_Band6`: 1628-1652 nm
  - `Nadir_Reflectance_Band7`: 2105-2155 nm
- **Resolution**: 500 meters

In this activity, we explored a MODIS dataset measuring daily ground reflectance via the Google Earth Engine Explorer (GEE Explorer). The dataset encompasses seven bands covering electromagnetic wavelength ranges from 459 nm to 2155 nm, each associated with a bitmask quality flag. It became available on Feb 24, 2000, with the latest data accessible as of Feb 11, 2024.



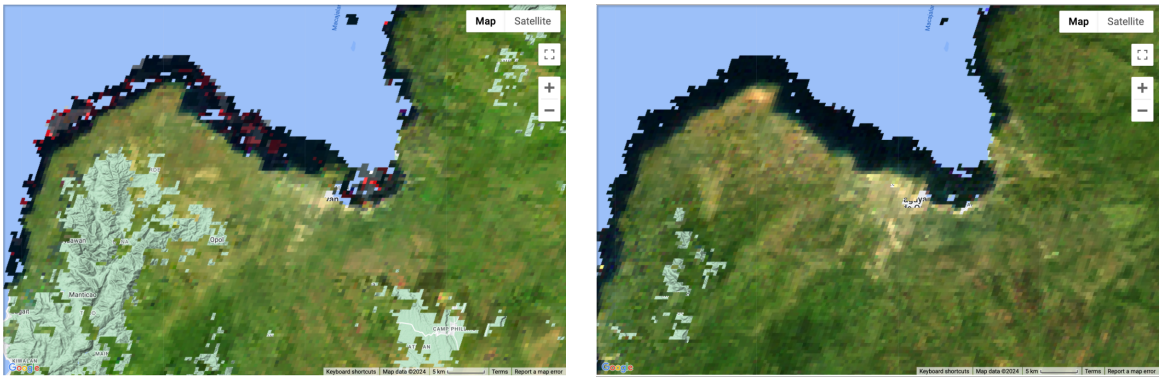
(a) Map view of my hometown

(b) Satellite view of my hometown

Figure 1: GEE Basemaps of Cagayan de Oro.

For this exercise, our goal was to visualize MODIS images centered around my hometown in Cagayan de Oro, as depicted in Figure 1. I chose the dates 25 March 2000 (a year after my birthdate) and the latest available date to compare the changes over 14 years.

To generate an RGB image, we composited true color images using the MODIS bands corresponding to the red, green, and blue channels. Specifically, RED: `Nadir_Reflectance_Band_1`, GREEN: `Nadir_Reflectance_Band_4`, and BLUE: `Nadir_Reflectance_Band_3`. Figure 2 showcases the MODIS RGB composites for the selected dates.

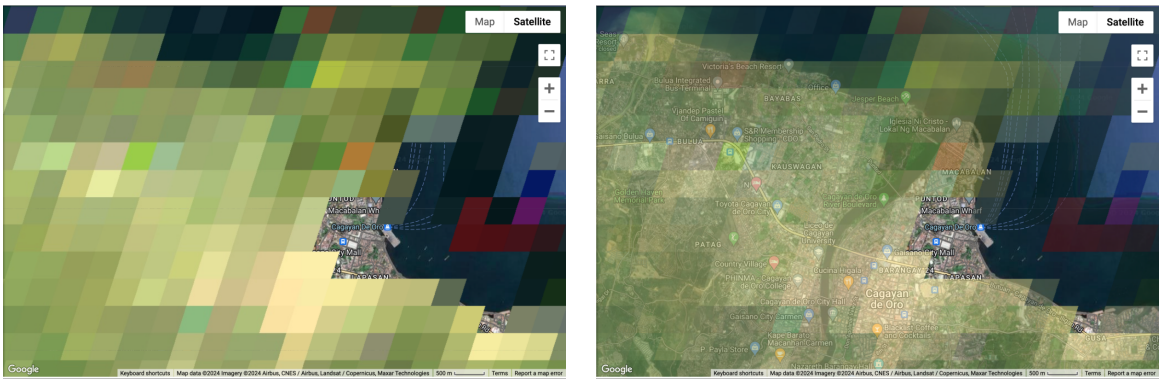


(a) 25 March 2000 (b) 11 February 2024

Figure 2: MODIS true color image displaying Nadir Band 1, Band 4, and Band 3 corresponding to RGB (true color), respectively.

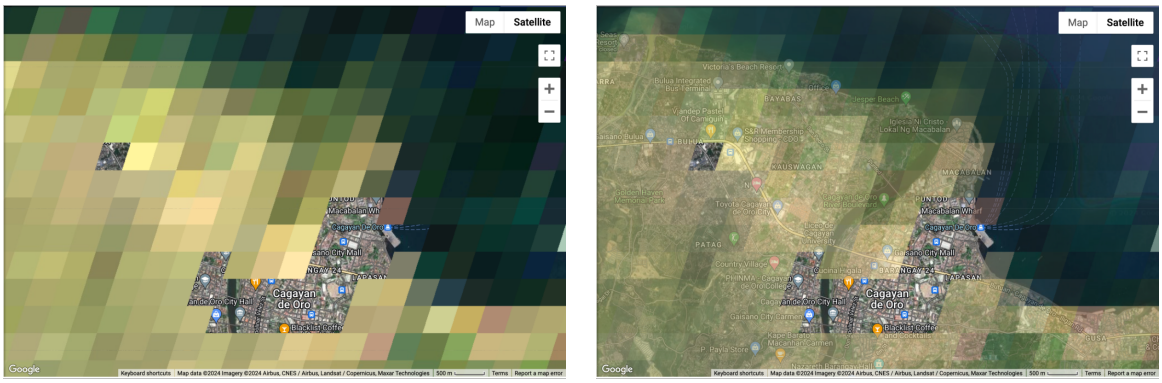
A side-by-side comparison reveals the expansion of settlements (represented by white/lighter-colored pixels), marking Cagayan de Oro's transformation into a Mega City center for Northern Mindanao, with new settlements emerging along the coastal areas.

Closer inspection in Figs. 3 & 4 reveals true color composites with adjusted transparency to view the basemap. The 2000 MODIS image shows reflectance pixels on the sea, suggesting potential changes in land mass due to coastal erosion and river meandering. In contrast, the 2024 MODIS image aligns with the basemap.



(a) True Color Composite (b) Transparency at 50%

Figure 3: MODIS true color image on 25 March 2000.

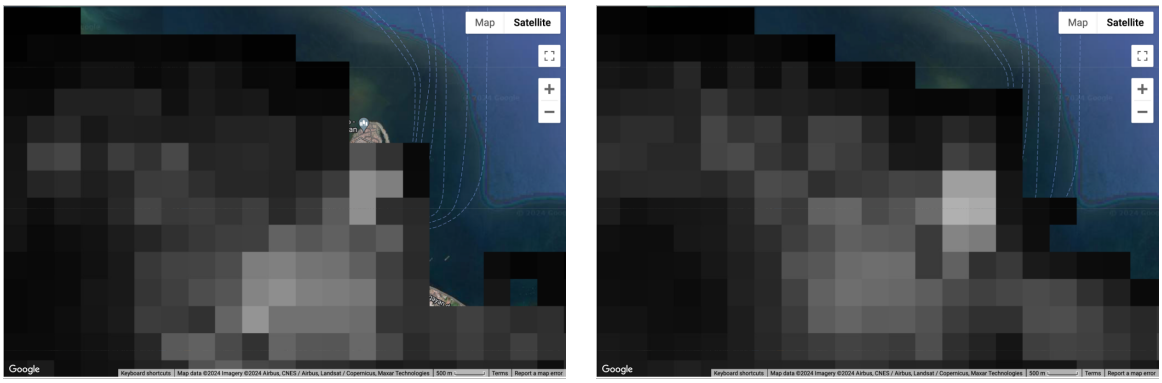


(a) True Color Composite (b) Transparency at 50%

Figure 4: MODIS true color image on 11 February 2024.

In both sets, some missing pixels indicate areas with low-quality observations, likely due to cloud obstructions. Visual inspection of MODIS provides valuable insights.

NASA's Black Marble Nighttime Lights Product Suite for daily data from 2014-2022
`https://doi.org/10.5067/VIIRS/VNP46A2.001`



(a) NTL on 25 March 2014 (b) NTL on 11 February 2024

Figure 5: Nighttime lights (NTL) visualization.

As a researcher using nighttime lights (NTL), I attempted to visualize it in Figs. 5. NTL captures human settlements' location and prominence through brightness values. Comparing 2014 with 2024, we observe spatial expansion and a shift toward the coast.

Overall, this exercise served as an excellent introduction to Google Earth Engine's capabilities for visualizing free and accessible datasets.

References:

- `https://developers.google.com/earth-engine/datasets/catalog/MODIS_061_MCD43A4#bands`
- `https://developers.google.com/earth-engine/datasets/catalog/NOAA_VIIRS_001_VNP46A2`