Cloud Masking and NDVI Analysis Using NOAA VIIRS Data (2022 – 2023)

Google Earth Engine and Xarray Approach for Vegetation Monitoring

INTRODUCTION

NDVI (Normalized Difference Vegetation Index) is a measure of vegetation health derived from satellite reflectance data. However, cloud contamination can distort NDVI signals, making cloud masking a crucial preprocessing step. This study uses National Oceanic and Atmospheric Administration – Visible Infrared Imaging Radiometer Suite (NOAA - VIIRS) NDVI (2022–2023) data, processed in Google Colab with Google Earth Engine (GEE) and Xarray, to analyze vegetation dynamics after removing cloud and shadow interference.

MATERIALS AND METHODS

Data Source: NOAA CDR VIIRS NDVI (V1)

Platform: Google Earth Engine (Python API)

Tools Used: Google Colab, geemap, xarray, matplotlib, MS Word, Canva

Temporal Coverage: 2022–2023

Spatial Resolution: 0.05° (~5 km)

Workflow Summary

Load VIIRS NDVI collection in GEE → Apply bitwise QA cloud and shadow mask → Export to Xarray for time-series analysis → Apply 10-step rolling mean to smooth data → Visualize monthly NDVI composites and point trends

STUDY AREA

The analysis focused on a region within Southwestern Nigeria, encompassing parts of Lagos, Ogun, Oyo, Ondo, and Osun States. This area lies between approximately latitude 6°N to 8°N and longitude 3°E to 6°E, extending inland from the Atlantic coast. The region is characterized by a humid tropical climate, with annual rainfall exceeding 1,500 mm, and supports a mosaic of lowland rainforests, derived savannahs, and coastal wetlands.

SCAN ME

Link to Code

RESULTS

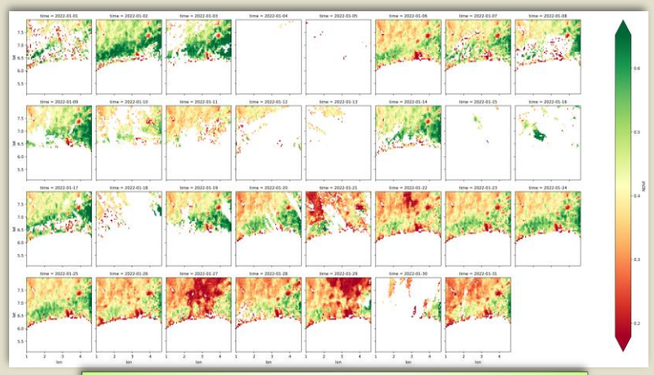

Figure 1: NDVI composites before masking

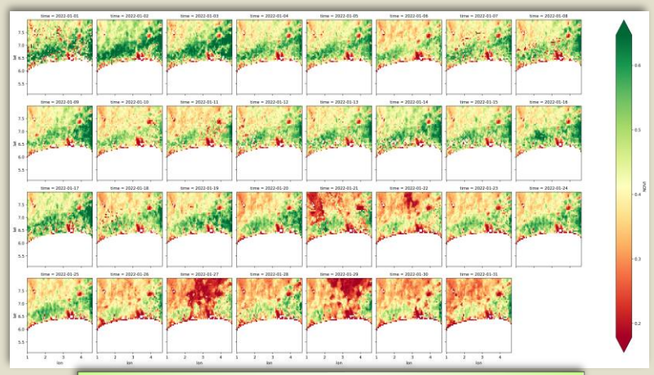

Figure 2: NDVI composites after masking

Green areas indicate healthy vegetation, while brown/yellow represent degraded or sparse vegetation. The rolling mean highlights temporal stability and recovery trends after cloud filtering.

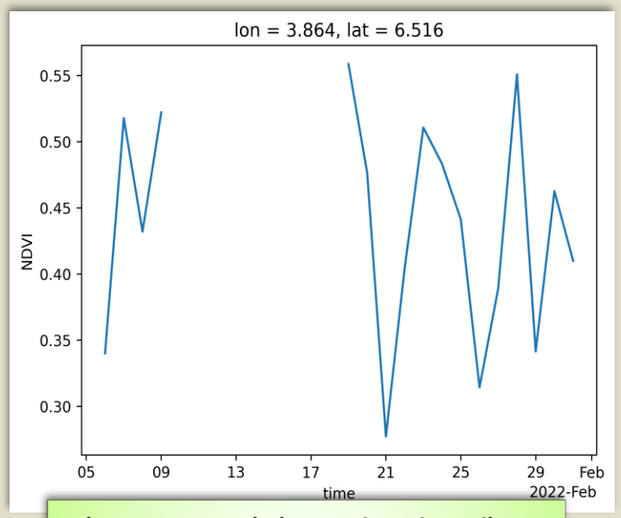

Figure 3: NDVI variation at selected coordinate before masking (6.51°N, 3.86°E)

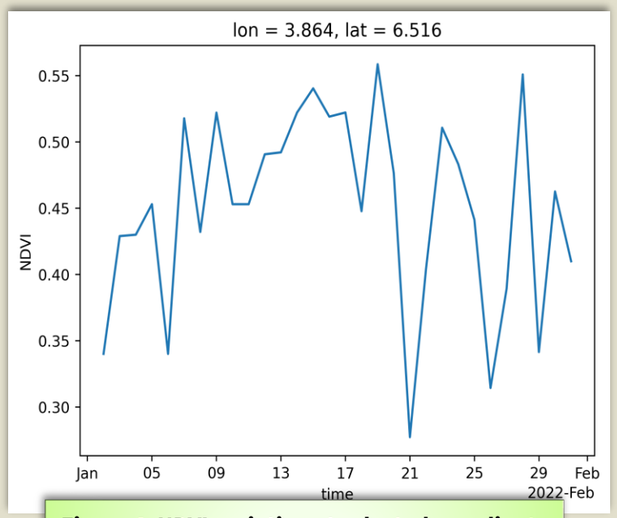

Figure 4: NDVI variation at selected coordinate after masking (6.51°N, 3.86°E)

CONCLUSION

Cloud masking effectively enhanced NDVI data quality, revealing clearer vegetation trends across time. The integration of GEE and Xarray provides a powerful workflow for reproducible environmental analyses, allowing spatiotemporal insight into vegetation dynamics.

REFERENCES

- NOAA CDR VIIRS NDVI V1 Dataset ([https://doi.org/10.7289/V5ZG6QH9])
- Google Earth Engine Python API Documentation
- Xarray Developers Team ([https://docs.xarray.dev])

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