Acquisition, Analysis and Documentation of Data with the Zambia Ground Receiver Station (GRS)

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AfAS 2026 Conference Poster

Abstract

The Zambia Ground Receiving Station (GRS) is the country's first satellite data acquisition facility, established on a 7.3■m antenna platform to strengthen national Earth observation infrastructure. The system is engineered to track and receive data from low-Earth-orbit satellites, including TERRA/AQUA, MODIS, Landsat 8, and Landsat 9, through dedicated S-band and X-band subsystems. The S-band operates at 2025–2120 MHz with selectable LHCP/RHCP polarization, while the X-band subsystem (7450–9000 MHz) provides simultaneous dual-polarization capability for high-throughput data reception. The station supports multiple tracking modes: auto-monopulse, manual, and program tracking, ensuring robust and reliable satellite acquisition.

Aim

To develop documentation and data acquisition protocols for the Zambia Ground Receiver Station, enabling the National Remote Sensing Centre (NRSC) to procure and utilise satellite imagery efficiently.

Objectives

- To establish and implement best practices for documenting satellite data acquired by the GRS.
- To evaluate software tools for processing satellite data to enhance GRS operational efficiency.
- To make recommendations for the operational efficiency and utilisation of the GRS.

Introduction

Satellite data reception plays a vital role in environmental monitoring, disaster management, agriculture, and infrastructure development. Ground Receiving Stations (GRS) capture, process, and distribute satellite data — including imagery and weather reports — directly to end users in real time. Zambia's GRS project, anchored by the National Remote Sensing Centre (NRSC), provides this capability to government departments, private firms, and educational institutions across the country.

Methods

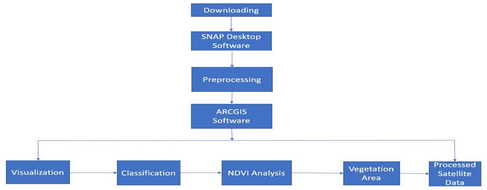

Figure 1: Data Processing and Analysis Algorithm

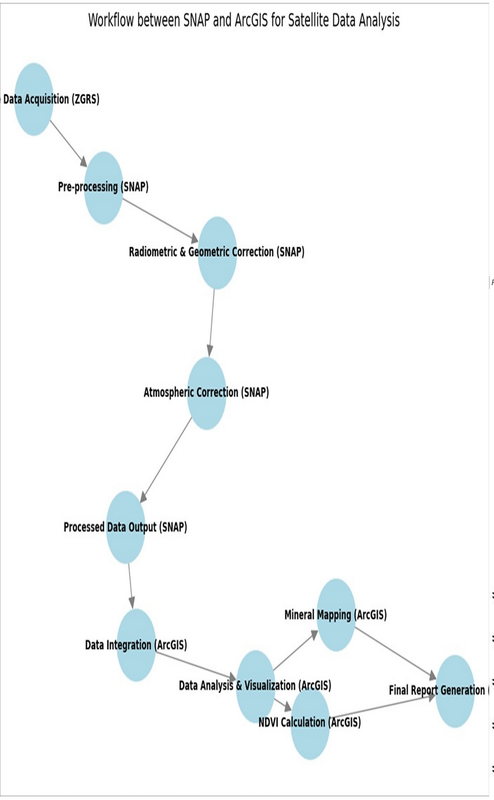

Figure 2: Workflow between SNAP and ArcGIS Software for Satellite Data Analysis

References

Ahern, F. J., Leckie, D. G., & Werle, D. (1993). Applications of RADARSAT SAR Data in Forested Environments. *Canadian Journal of Remote Sensing*, 19(4), 330–337. https://doi.org/10.1080/07038992.1993.10874568

Results

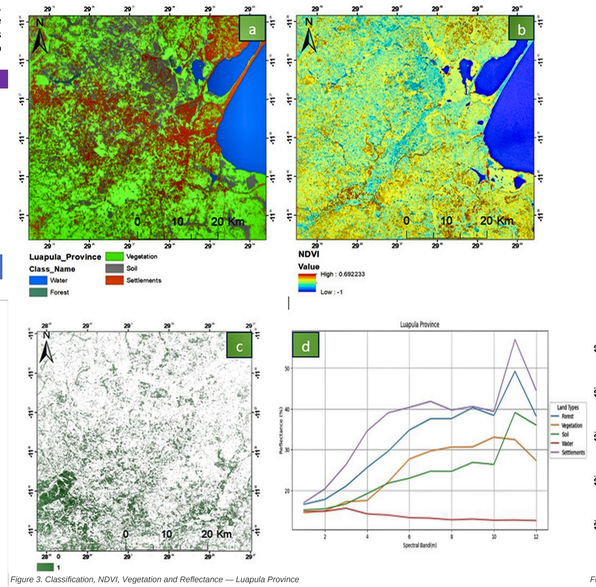

Figure 3. Classification, NDVI, Vegetation and Reflectance — Luapula Province

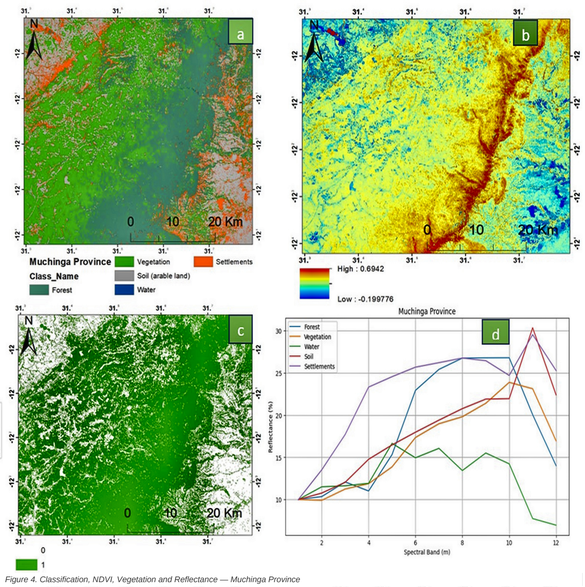

Figure 4. Classification, NDVI, Vegetation and Reflectance — Muchinga Province

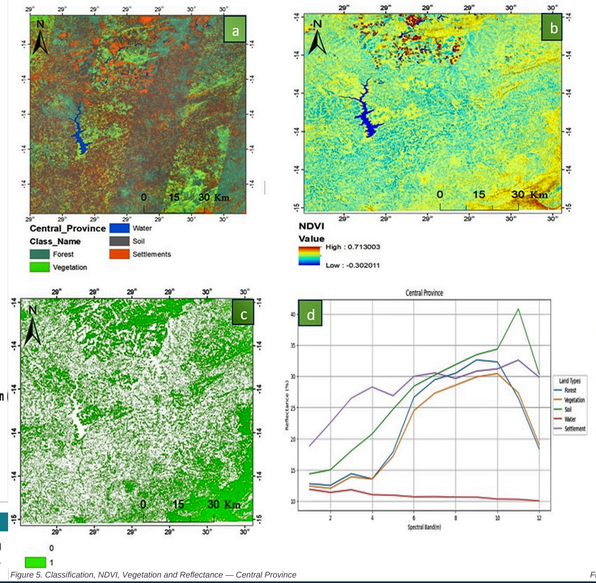

Figure 5. Classification, NDVI, Vegetation and Reflectance — Central Province

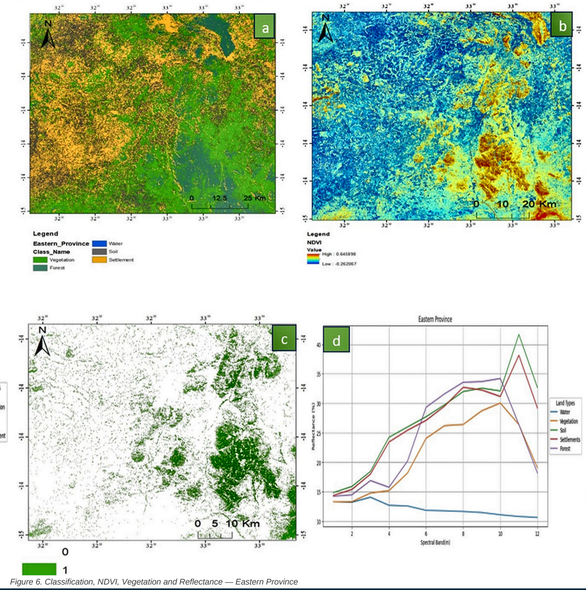

Figure 6. Classification, NDVI, Vegetation and Reflectance — Eastern Province

Results (cont.)

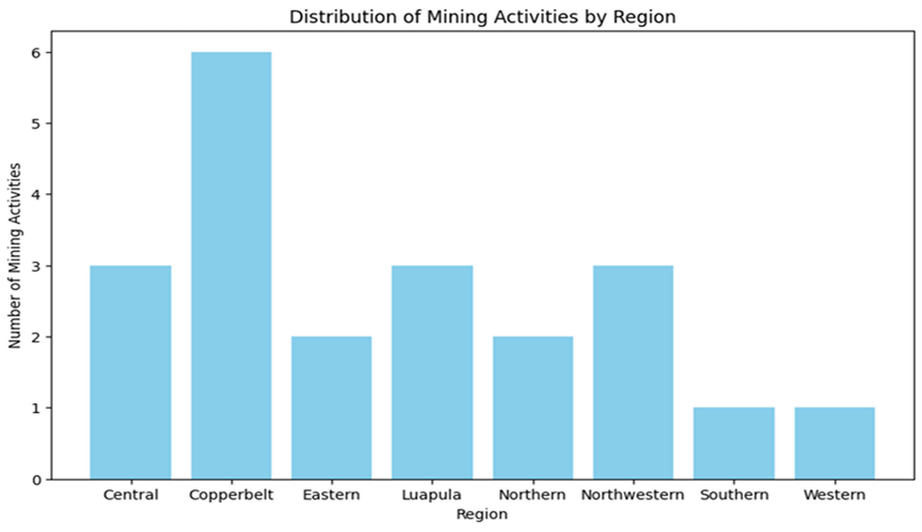

Figure 9a: Distribution of Mining Activities by Region

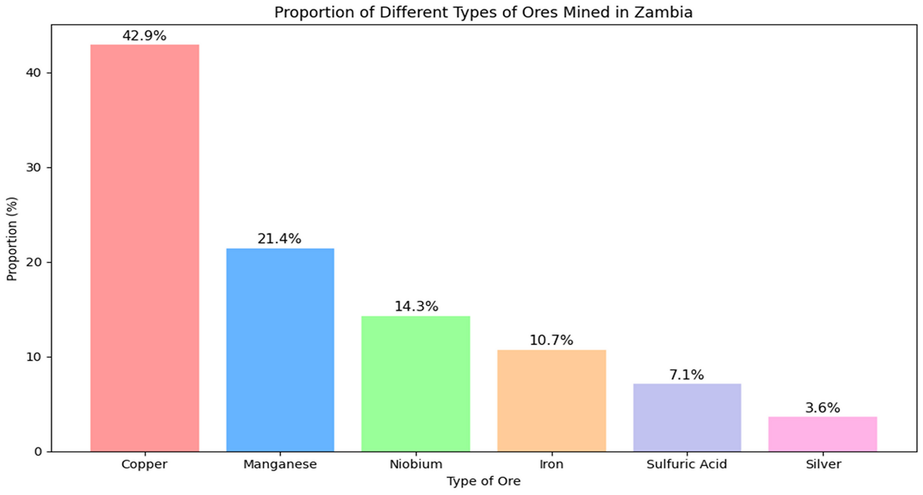

Figure 9b: Proportion of Different Types of Ores Mined in Zambia

Conclusion

The study successfully established and implemented a standardized documentation framework for the Zambia Ground Receiver Station (ZGRS). This includes clear metadata protocols, data storage procedures, and validation workflows that ensure traceability, reproducibility, and long-term accessibility of satellite data. These best practices now serve as a model for future operations and research documentation at the station.