Internship Report

Earth Observation and GIS Applications for Landslide Research

Title Page

Title: Internship Report – Earth Observation and GIS Applications for Landslide Research
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Student ID: 12517720
Degree Programme: Erasmus Mundus Joint Master in Copernicus Master in Digital Earth (CDE)
Host Institution: Department of Geoinformatics – Z_GIS Paris Lodron University Salzburg
Supervisor: Dr. Daniel Hölbling
Internship Period: 4 May 2026 – 10 July 2026
Internship Duration: 320 hours / 12 ECTS

Declaration

I hereby declare that this internship report is my original work and has been prepared based on the activities, analyses, and experiences undertaken during my research internship. The report has not been submitted elsewhere for academic assessment.

1. Internship Overview

The internship focused on the application of Earth Observation (EO) and Geographic Information Systems (GIS) to landslide research and mapping. The main objective was to gain practical experience in identifying suitable geospatial datasets, processing satellite imagery, conducting pre- and post-event comparisons, and evaluating different Earth Observation datasets for landslide-related applications.

The work included literature research, landslide inventory investigation, satellite data acquisition, optical and radar image processing, change detection, and visual interpretation. Landslide events in Colombia, including Mocoa, Salgar, Medellín/Granizal, and Mesetas, were investigated during the internship.

Different data sources were explored, including Sentinel-1, Sentinel-2, Landsat-8, Planet imagery, the SIMMA landslide database, and the Universal Global Landslide Catalog (UGLC). QGIS and SNAP were the main software environments used for geospatial analysis and satellite image processing.

2. Tasks and Project Activities

The main activities carried out during the internship included identifying landslide events suitable for Earth Observation analysis, searching for appropriate satellite imagery, processing optical and radar data, and comparing conditions before and after landslide events.

For optical data, Sentinel-2 imagery was used to investigate pre- and post-event conditions. Different approaches, including NDVI, NBR, red-band differencing, thresholding, and visual interpretation, were explored to identify changes related to landslide-affected areas.

The internship also included working with Sentinel-1 SAR data for the Mocoa debris flow event of 31 March 2017. Sentinel-1B SLC images from 20 March 2017 and 1 April 2017 were processed in SNAP. The preprocessing workflow included the necessary steps to prepare the radar data for comparison, and final terrain-corrected Sigma0 VV products were generated and exported.

The resulting maps, satellite imagery, processing steps, and observations were documented throughout the internship.

Detailed Internship Documentation

More detailed documentation of the internship activities, including weekly progress, processing steps, maps, satellite imagery, and other visual outputs, is available in the ArcGIS StoryMap prepared during the internship.

ArcGIS StoryMap: https://arcg.is/1a1X0e6

3. Tools, Data, and Outcomes

The internship involved the use of several Earth Observation datasets and geospatial tools. Sentinel-1 and Sentinel-2 were the main satellite datasets used for image analysis, while Landsat-8 and Planet imagery were also investigated. Landslide information was obtained from sources including the SIMMA landslide database and the Universal Global Landslide Catalog.

QGIS was used for geospatial data visualization and analysis, while SNAP was used for Sentinel-1 SAR preprocessing.

The main outcomes of the internship included processed pre- and post-event satellite imagery, thematic visualizations, change-detection experiments, and final Sentinel-1 Sigma0 VV products for the Mocoa case study. These outputs were also documented visually in the ArcGIS StoryMap.

4. Learning Objectives and Professional Development

The internship provided practical experience in applying Earth Observation and GIS methods to real landslide events. One of the main learning objectives was to improve the ability to identify appropriate satellite datasets according to event date, location, spatial resolution, and data availability.

The internship also improved practical skills in optical and SAR image processing. In particular, working with Sentinel-1 SLC data provided experience with radar preprocessing in SNAP, while the optical analyses strengthened skills in pre- and post-event comparison and change detection.

Overall, the internship helped connect theoretical remote sensing knowledge with practical geospatial analysis and strengthened skills in QGIS, SNAP, satellite data interpretation, and scientific documentation.

5. Challenges and Lessons Learned

One of the main challenges during the internship was finding suitable satellite imagery for specific landslide events. Cloud cover, image acquisition dates, spatial resolution, and data availability sometimes limited the possibilities for analysis.

Another challenge was interpreting changes in complex environments, particularly where vegetation, urban areas, terrain conditions, and other surface changes could influence satellite observations.

These challenges demonstrated the importance of carefully selecting datasets and considering the limitations of each sensor before carrying out landslide analysis. The internship also showed the value of combining different Earth Observation datasets rather than relying on a single data source.

6. Self-Evaluation and Reflection

The internship was valuable for developing practical skills in Earth Observation and GIS. It provided an opportunity to work independently with different satellite datasets and to evaluate which approaches were suitable for landslide-related applications.

A particularly useful part of the internship was gaining experience with both optical and SAR imagery. The work strengthened my understanding of satellite image processing and helped me become more confident in selecting, processing, interpreting, and documenting geospatial data.

Overall, the internship contributed positively to my academic and professional development in the fields of Earth Observation and geospatial analysis.

7. Recommendations for Future Interns

Future interns working on similar topics should begin by carefully checking the availability and quality of satellite imagery before selecting a landslide event for detailed analysis. Factors such as cloud cover, acquisition dates, spatial resolution, and sensor characteristics can strongly influence the analysis.

It is also recommended to document processing steps and results throughout the internship. Maintaining clear documentation, including maps and visual outputs, can make it easier to evaluate different approaches and prepare the final report.

8. Conclusion

The internship provided practical experience in using Earth Observation and GIS for landslide research. Different optical and radar datasets were investigated, processed, and evaluated through several landslide case studies.

The work strengthened practical skills in satellite data acquisition, image processing, pre- and post-event comparison, change detection, visual interpretation, and scientific documentation. Overall, the internship provided useful experience in applying remote sensing methods to real-world landslide events and contributed to further professional development in Earth Observation and GIS.

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Internship confirmation for Janeda Baysal

I hereby confirm that Janeda Baysal conducted an internship at the Risk, Hazard & Climate Lab at the Department of Geoinformatics – Z_GIS, University of Salzburg, Austria. Her internship was carried out in the research project LEONA and focussed on landslide mapping and assessment using Earth observation and geospatial data. The internship took place from 04 May 2026 to 10 July 2026, comprising a total of 320 hours.

The main tasks included:

- Acquire and process Sentinel-1 and Sentinel-2 satellite imagery for landslide monitoring and analysis.
- Conduct pre- and post-event comparisons to identify and assess changes associated with landslide events.
- Generate thematic maps and visualizations to support the interpretation of landslide impacts.
- Integrate and analyze geospatial datasets using GIS and Earth Observation techniques.
- Document the research workflow, interpret the results, and prepare a short scientific report summarizing the findings.

I wish her all the best for the future.

With best regards,

Daniel Hölbling

Dr. Daniel Hölbling