Paris Lodron University Salzburg

EO Browser

Digital Earth
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Landslides Script

This script actively detects local soil mass movement, enabling disaster management and hazard detection by obtaining the shape of landslides and their movement vectors. The logic behind the algorithm utilizes Sentinel-2 L2 imagery, specifically analyzing NDWI, NDVI, and B11 values for discriminating between vegetated areas, built-up zones and water with traces of sediment. The output obtained exposes the following attributes:

Color	***Meaning***	***Pixel Value***
	Landslides and Barrel Soil	B11 < 0.88 or NDVI > 0.15
	Built-up Zones	B11 > 0.88 or 0.25>NDVI>0.15
	Vegetation and Other Covers	NDVI > 0.25
	Water	NDWI > 0.15

Figure 1. Table of attributes for Landslide Script.

It should be emphasized that the script incorporates a Cloud Mask[1], returning the RGB and CLM bands in this order, along with the fraction of cloudy pixels.

Area of Study

The area selected for applying the script was *Kaprun,* in the region of Salzburg, where significant landslides were reported following massive rainfall in August 2024. Several households were significantly affected by the extreme weather, with many properties compromised by the mudslide.

Figure 2. Houses on the Schaufelberg affected by the landslides (Tilly, 2024).

[1] Cloud probabilities form s2cloudless

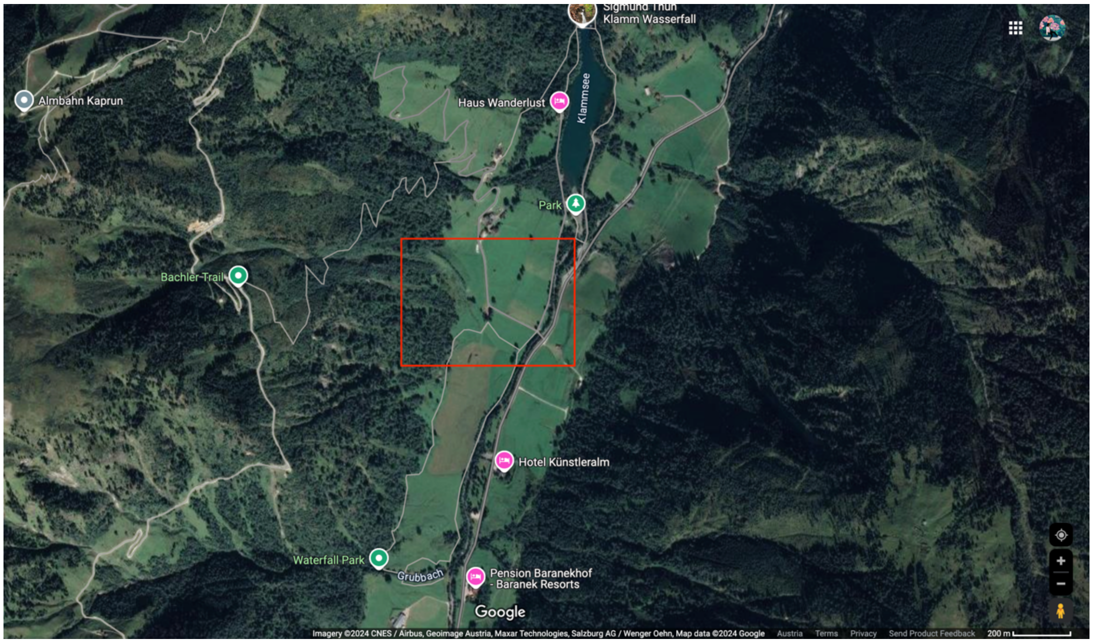

Figure 3. Satellite image of the specific study area in Kaprun.

Analysis

Given that the disaster was reported on August 18, 2024, it is essential to analyze satellite imagery from before that date, using both in True Color imaging and the Landslide Script or a comprehensive assessment.

August 10, 2024

The images obtained on August 10 reveal typical vegetation, built-up areas, and bodies of water. After applying the Landslide Script in Sentinel Hub, these attributes are more clearly defined following the standards outlined in *Figure 1.* At this point no signs of landslides are evident in the imagery.

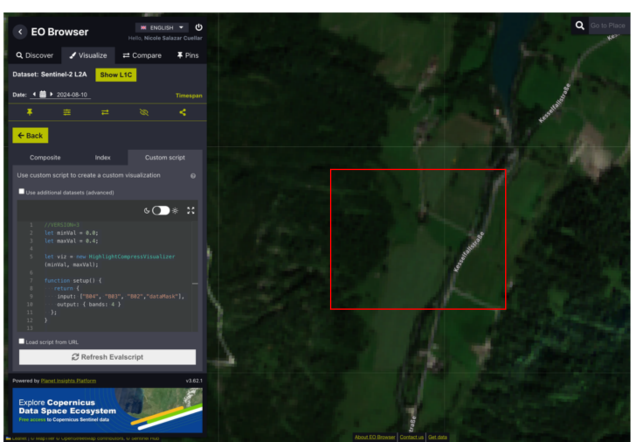

Figure 4. Study Area in True Color days before the disaster.

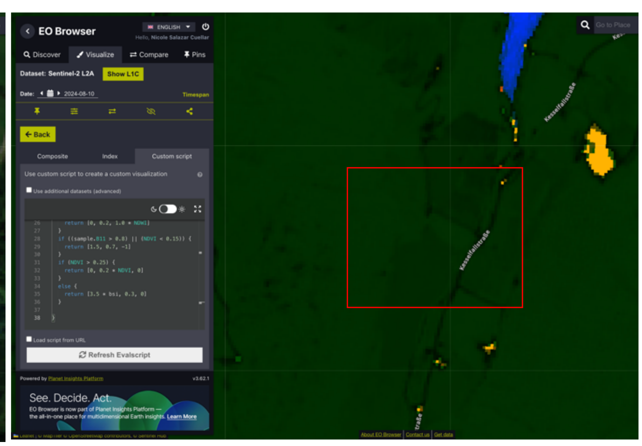

Figure 5. Study Area with the Landslide detector applied days before the disaster.

August 15, 2024

On this exact date, the landslide began, which can be clearly observed in the highlighted area in both images. Traces of mod and loose soil are visible in True Color. However, when the algorithm is applied, it reveals a darker green area with a few pixels in brown and orange.

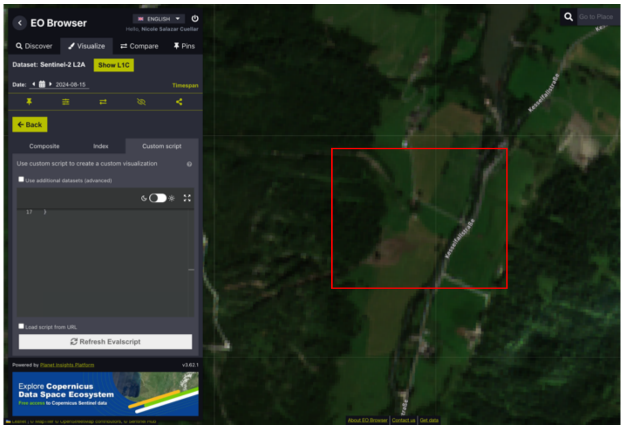

Figure 6. Study area in True Color on the date of the disaster.

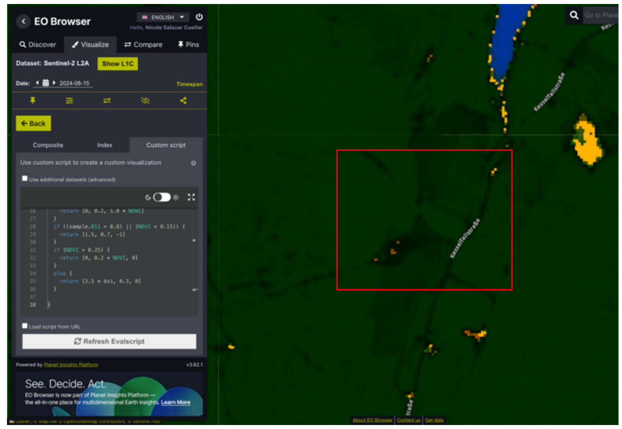

Figure 7. Study Area with the Landslide detector applied on the date of the disaster.

August 30, 2024

The landslide is even more evident in both images on this date. Some river channels have increased in width, and the brown color began to expand. In *Figure 9*, some brown pixels appear in the river channel, confirming the color and width observed in the True Color image (*Figure 8*). Additionally, pixels representing the landslide have expanded in size and intensity confirming the continuity and severity of the disaster. As the days passed, these changes became increasingly pronounced further the progression of the landslide.

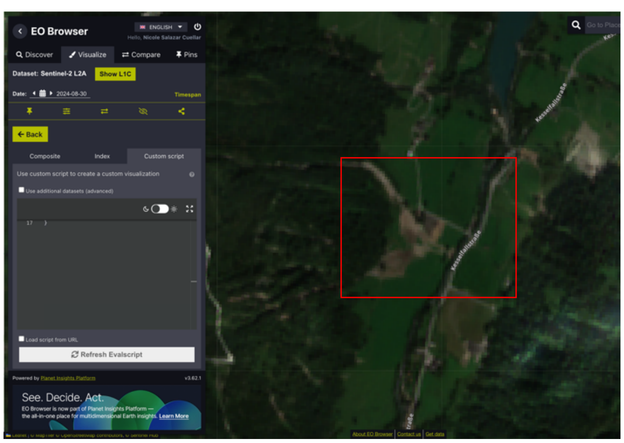

Figure 8. Study area in True Color after days the disaster began.

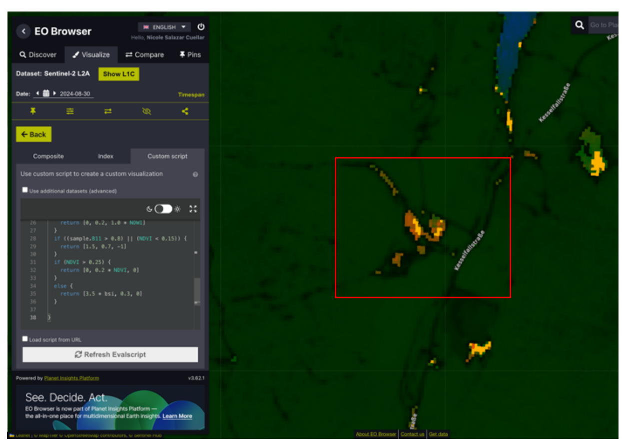

Figure 9. Study area with the Landslide detector applied after days the disaster began.

Glossary

NDWI: Normalized Difference Water Index.

NDVI: Normalized Difference Vegetation Index.

B11: Brand 11 (Short Wave Infrared).

CLM: Cloud Mask.

References

1. Viehweger, J. (n.d.). *Landslide detection rapid mapping* [custom-scripts/sentinel-2]. GitHub. Retrieved November 12, 2024, from https://github.com/sentinel-hub/custom-scripts/blob/main/sentinel-2/landslide_detection_rapid_mapping/README.md
2. Tilly, H. (2024, August 18). *The next flood threatens, destruction and devastation: Austria under water.* Kronen Zeitung. https://www.krone.at/3496636