IP: Application Development (OBIA)

Creating Ruleset and GUI for Landslide Mapping in eCognition Software

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Project Purpose

- Developing a ruleset for mapping landslides based on the paper from Karantanellis et. al (2020)
- Creating a graphical user interface (GUI) based on the previously developed ruleset that should make it easier for other users to apply the methodology to other cases.

Data

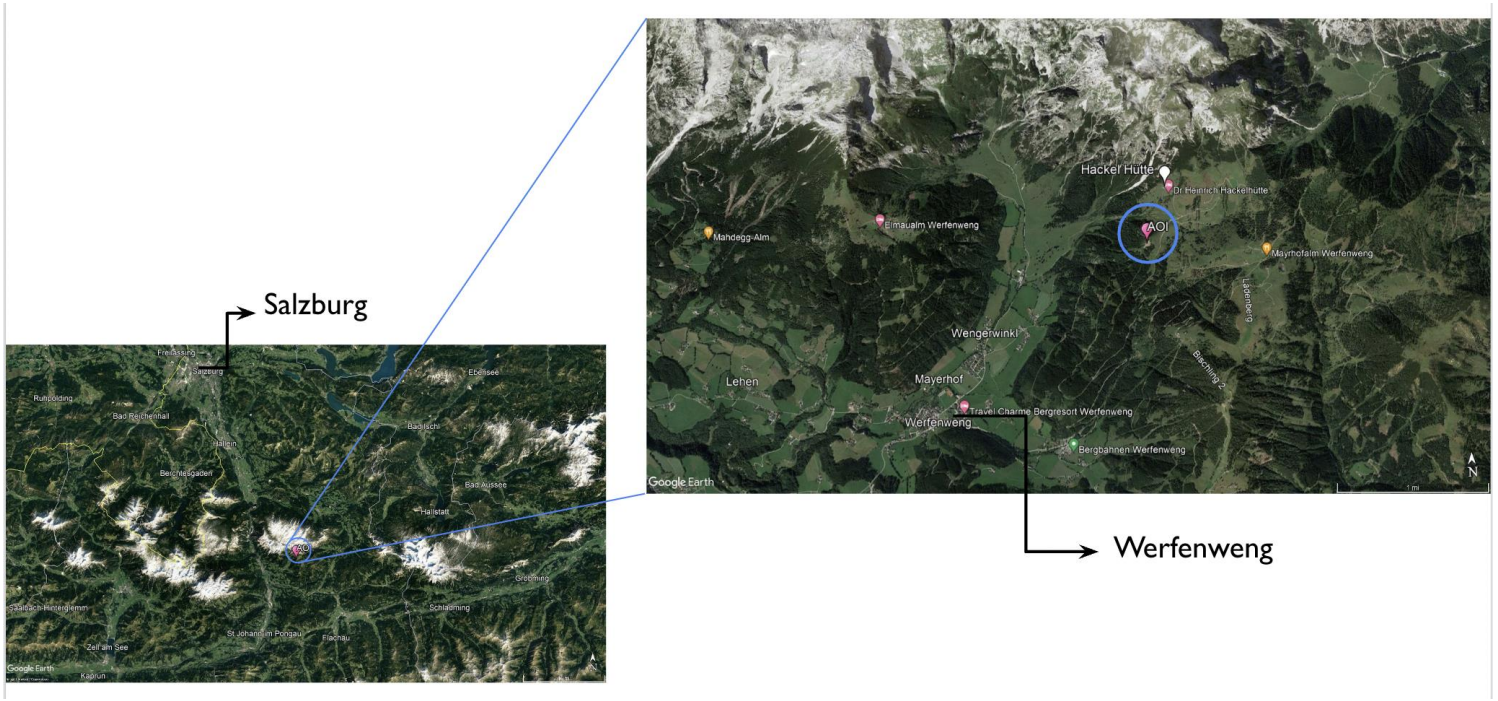
- UAV orthophoto at 1 cm/pixel, resampled to 1 m/pixel
- DSM derived from UAV data at 4 cm/pixel, resampled to 1 m/pixel

All data can be found here: data

The folder includes the original UAV data in higher resolution and without geographic coordinate system and the transformed images at lower resolution to decrease the computation time.

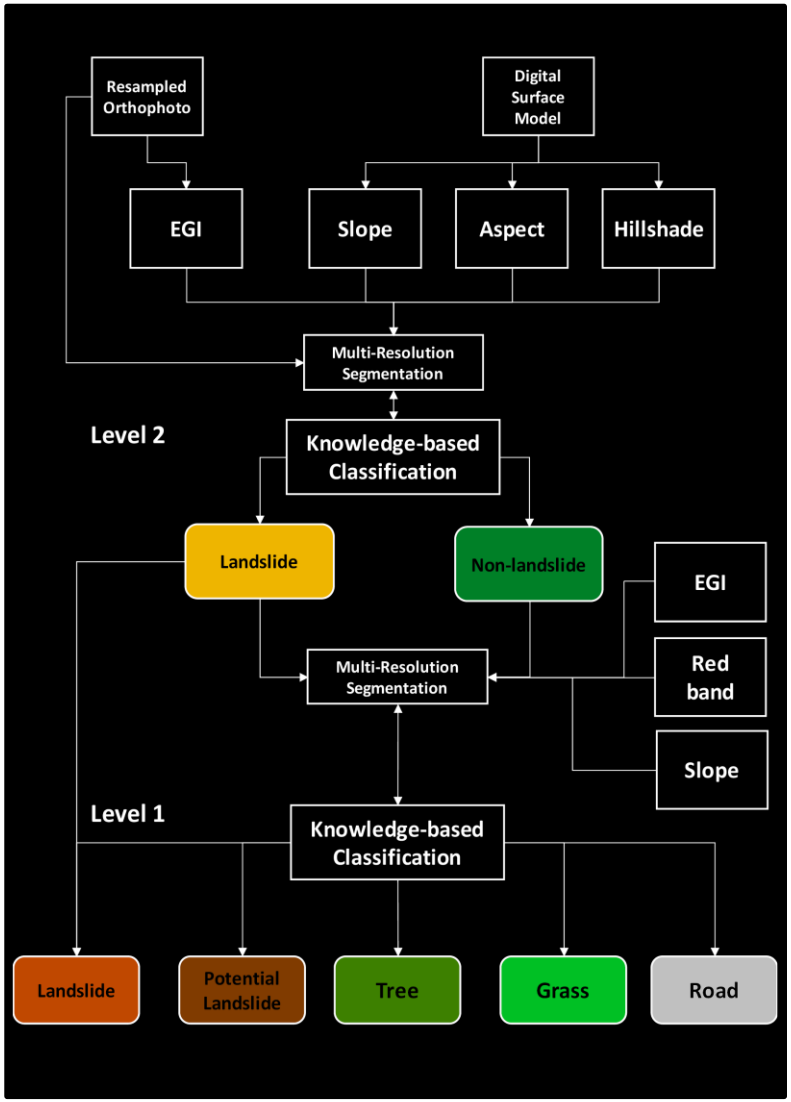
Method

The study area consist of a landslide in Werfenweg, a community located 40 min from the city of Salzburg. During July 3, 2022, drone flights were performed in the study area with a DJI Mavic Pro, flying at an altitude of 50 m above the surface, which produced an Orthoimage of 1 cm/pixel and a Digital Surface Model (DSM) of 4 cm/pixel. Due to processing time, the imagery was resampled to 1 m/pixel.



Method

A complex rule set was created for the specific case of landslide mapping in Werfenweng, which was then modified to create the graphical user interface where the user can apply the rule set to other study cases. The following figure gives an overview of the body and structure of the ruleset and the GUI.



Implementation

First, the user can load an orthophoto and a DSM of his choice. In the next step, the input alias names must be adjusted as follows:

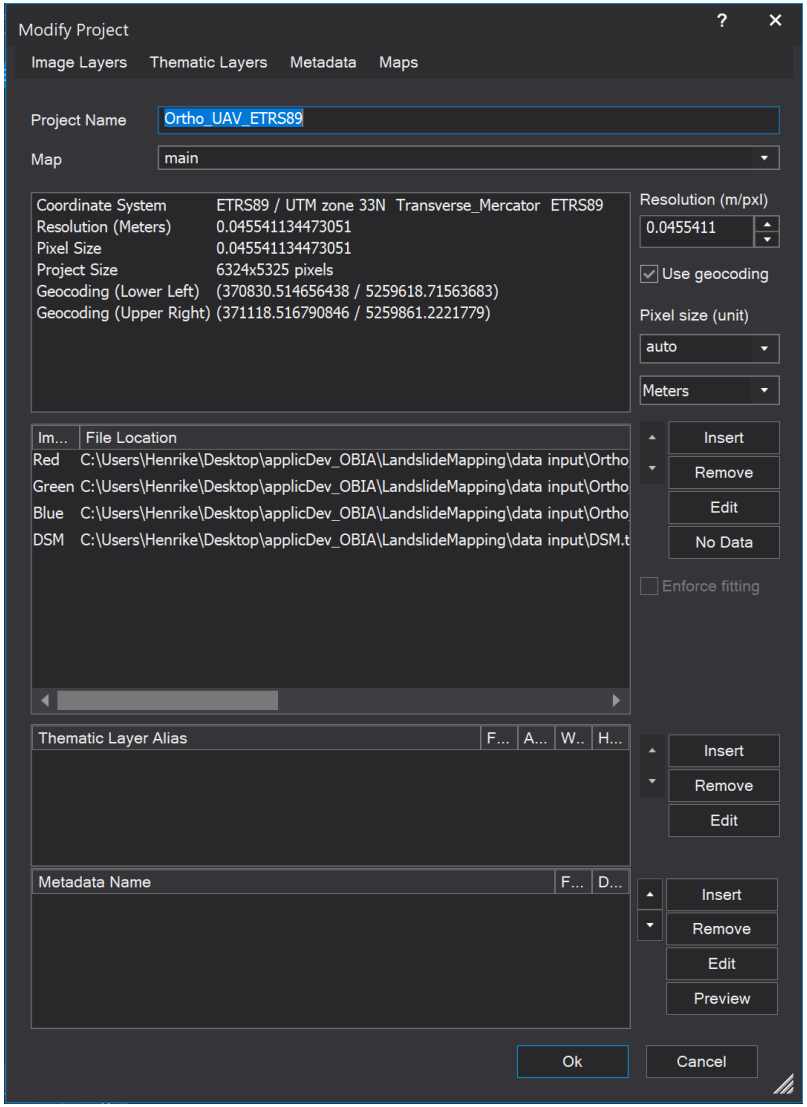
Layer1: Red

Layer2: Green

Layer3: Blue

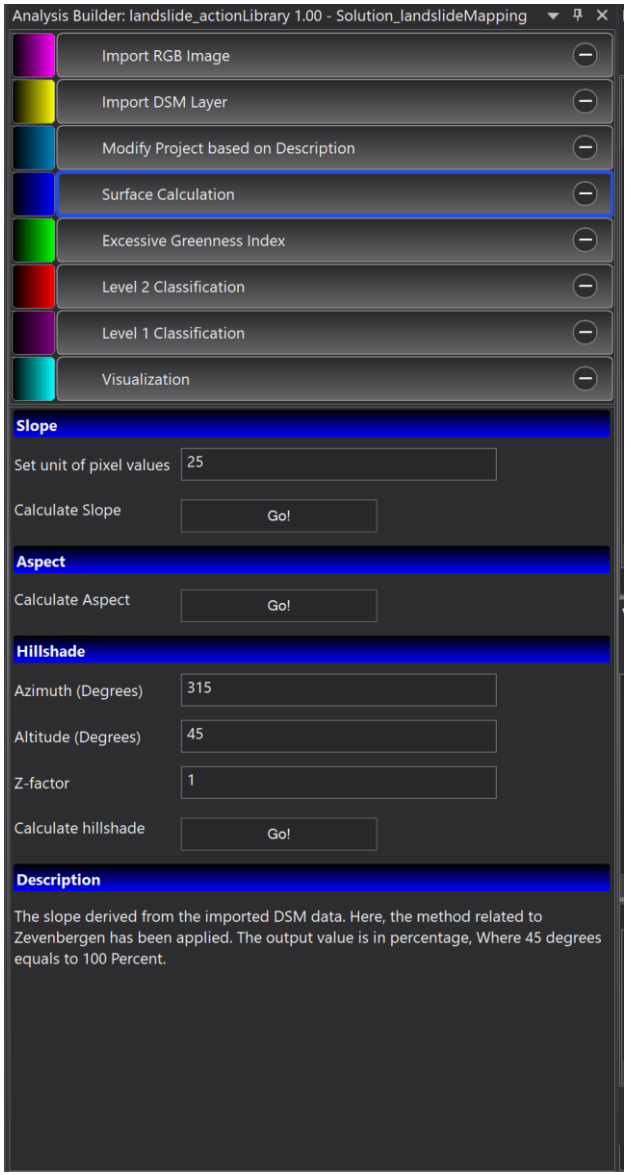
Layer5: DSM

Layer 4 can be removed from the project, because it is not needed in the further calculations.



Implementation

If everything is set, the user can start to calculate the slope, aspect and hillshade based on the DSM using the panel "Surface Calculation". Slope and hillshade can be modified by the user, whereas the aspect is automatically calculated using Horn's method.

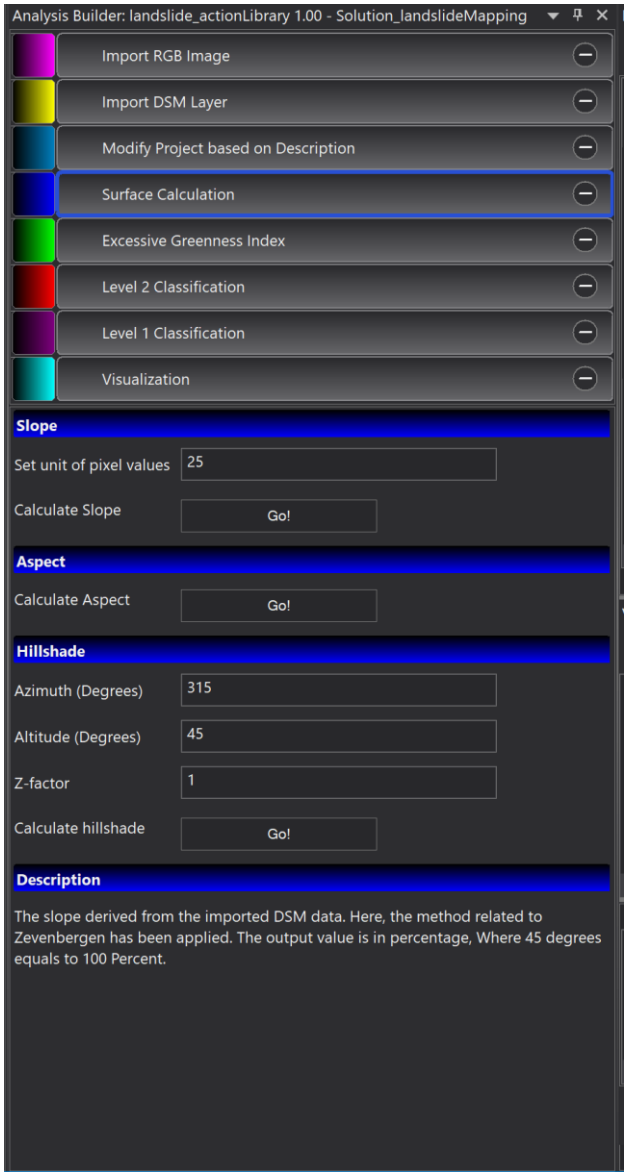


Implementation

In the next step, the Excessive Greenness Index (EGI) is calculated as:

EGI = (2 * Green) - (Red + Blue)

The EGI contrasts the green portion of the spectrum against red and blue to distinguish vegetation from soil and has shown good results in our study area. And is used to distinguish Landslide from Non-slide areas on level 2 and Tree and Grass on level 1.

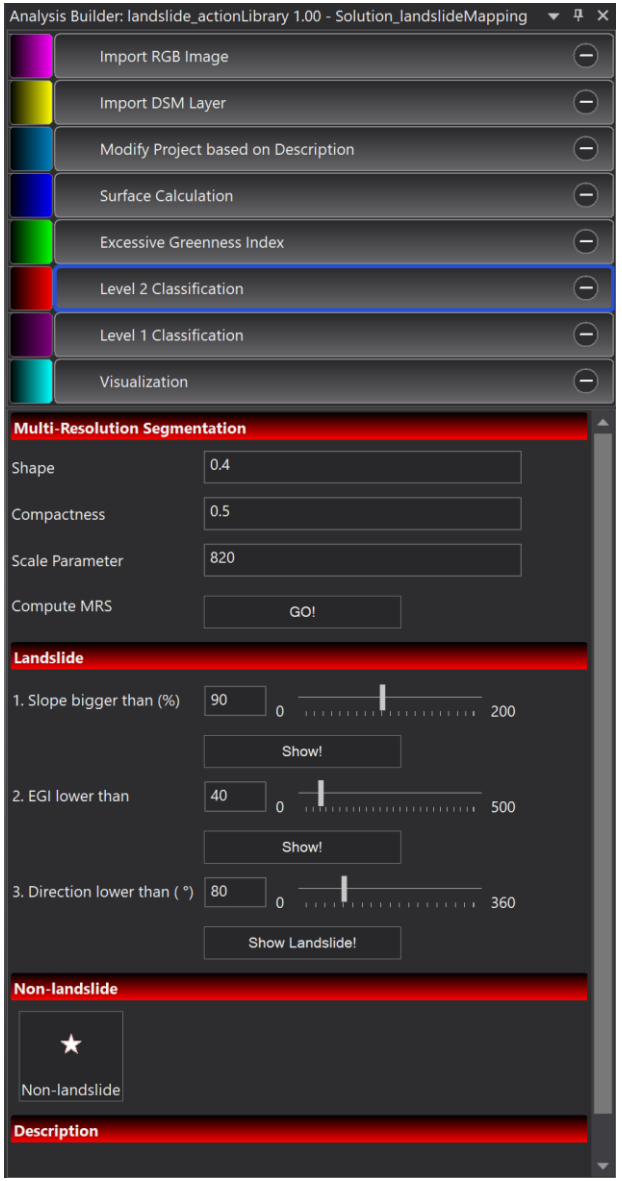


Implementation

In the next steps, the user can classify the selected study area into Landslide and Non-landslide on level 1, and Landslide (from Level 2), Tree, Potential Landslide, Grass and Road on level 1.

Level 2 Multi-Resolution Segmentation criteria for the study area is as: Scale Paramter 820, Shape 0.4, and Compactness 0.5. All the available layers have been considered for segmentation with equal weight of 1.

Level 2 classifies the area into Landslide and Non-landslide based on slope, EGI and direction.



Implementation

The default Level 1 Multi-Resolution Segmentation settings are:

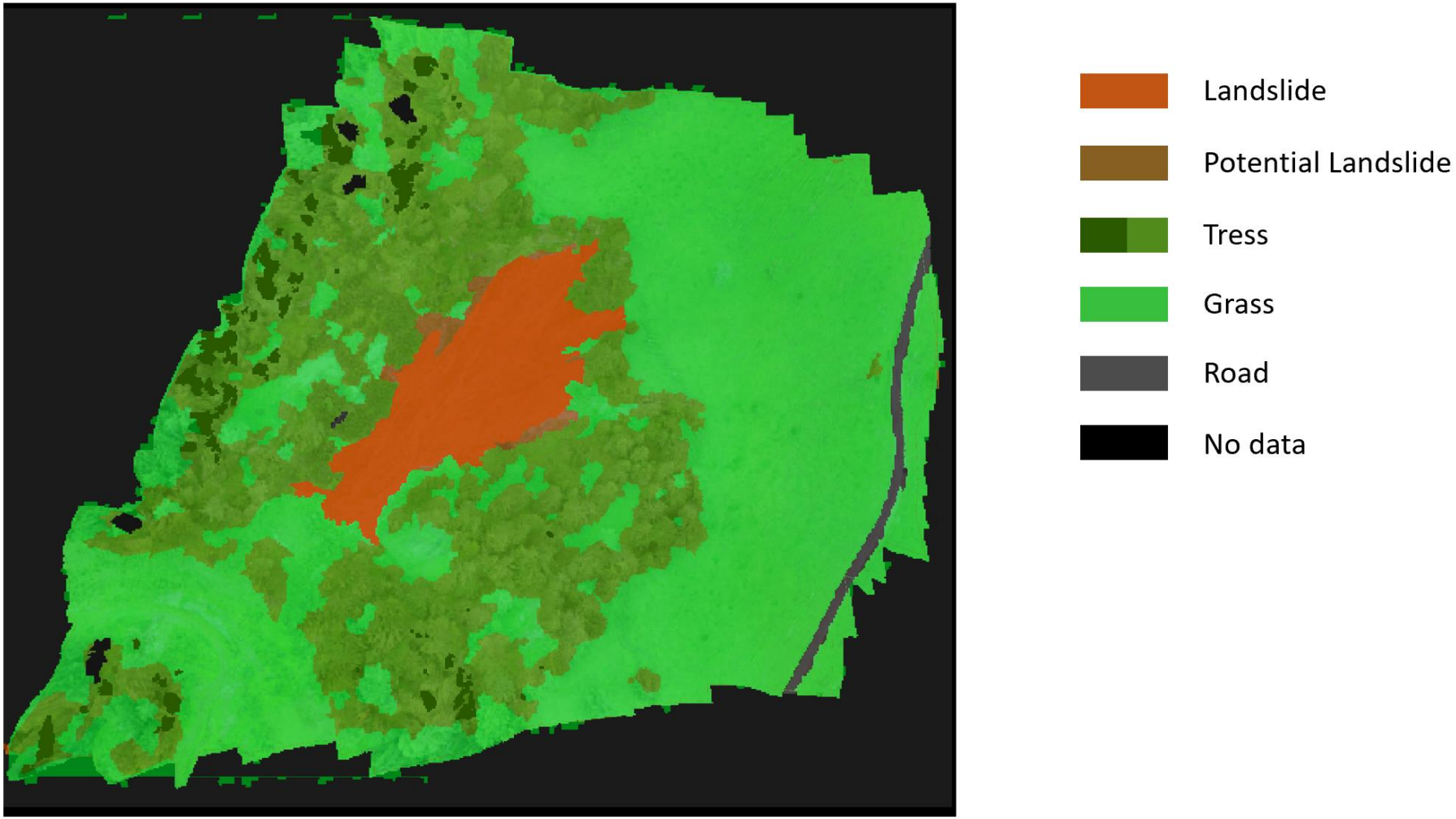
Scale Paramter 180, Shape 0.6, and Compactness 0.4.

EGI, Slope and Red reflectance value have been considered for segmentation with equal weight of 1.

Level 1 is used to go one level below the "landslide" or "non-landslide" binary classification. Here, the user can classify trees based on a lower EGI value compared to grass, a higher slope, and the red band reflectance value. Potential landslide areas are classified based on a lower EGI value and with a boundary to the already classified landslide area. Road areas are defined with a low EGI value and a low slope, and the remaining unclassified objects in our example are classified as grass.

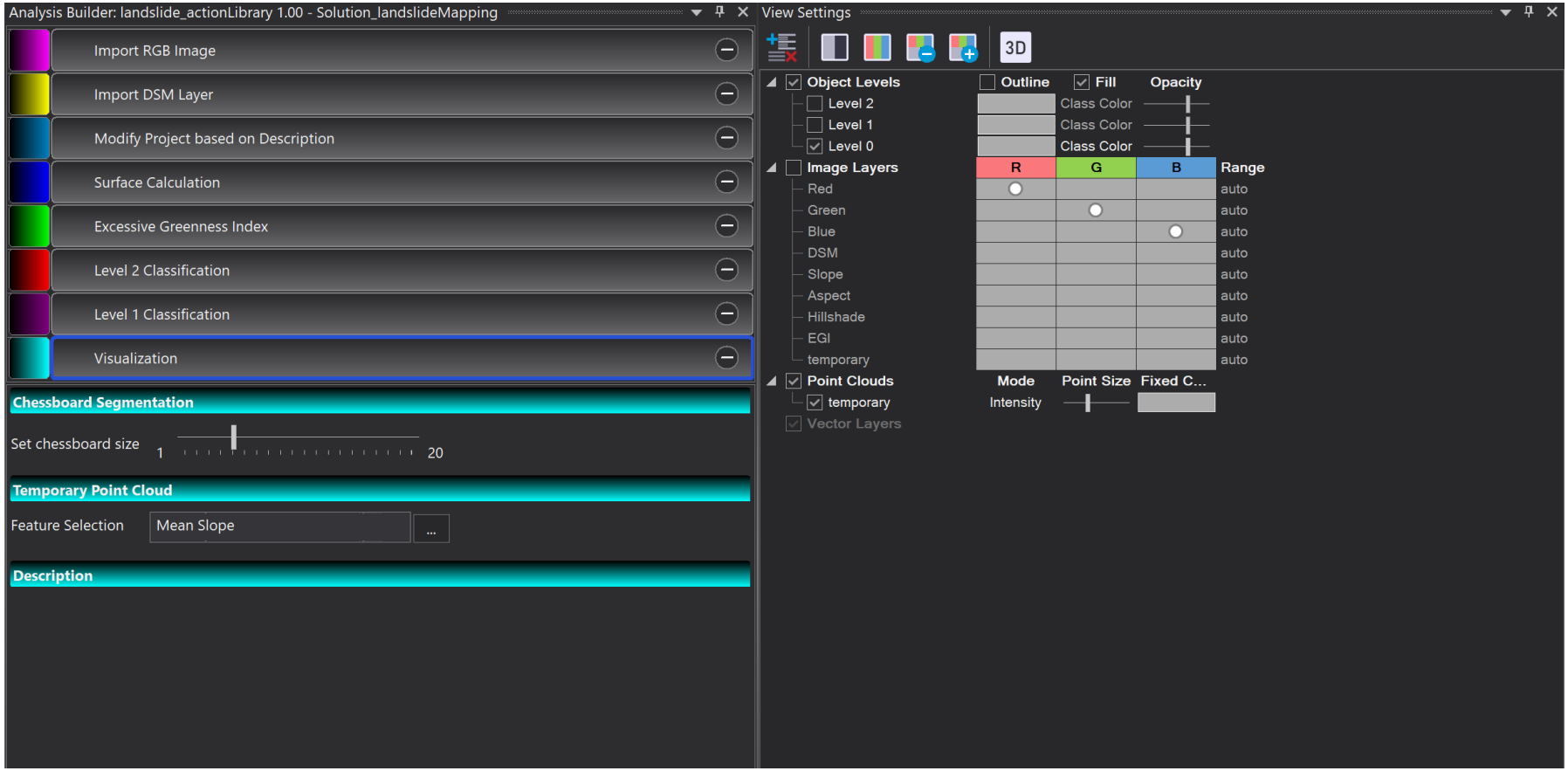
Result

The result of the present study should look like the image below:



Result

As a final clue, the user can visualize slope, hillshade or aspect as a 3D image.



Discussion

The visualization as a 3D object worked when we tried it out the last time. However, sometimes it does not work as expected and only a white surface is represented. We tried to find the error, but could not solve it properly.

Several errors mostly on the edges of ortho image exist, mainly since the data collection and processing has been performed without using Ground Control Points.

Applying the ruleset on other case studies may not accurately provide the final output, since there would be particular characteristics for landslide that demands various features to be applied.

Further work could be done in future on Landslide area in the lower level to detect Scarp zone and Deposition zone.