International Cartographic Association
Association Cartographique Internationale

Visualising spatial data of different origin and resolution in diverse terrain: St. Ana in Slovenia

Klemen Kozmus Trajkovski [a,*]

[a] *University of Ljubljana, Faculty of Civil and Geodetic Engineering, Jamova 2, SI-1000 Ljubljana, Slovenia*

* Corresponding author

Keywords: UAV, DTM, Lidar, global DEM, orthophoto, visualization

Abstract:

The research deals with the use of different elevation data for 3D visualizations. In addition to UAV (Unmanned Aerial Vehicle) derived DEM (Digital Elevation Model) and imagery, national LiDAR (Light Detection And Ranging) data and global DEM and imagery were examined, compared and used for various visualizations.

The area of the church of St. Ana and its surroundings south of Ljubljana was surveyed with a UAV DJI Matrice M300 RTK with two payloads: Lidar L1 and photogrammetric camera P1 with 35 mm lens. In addition to the point cloud, the RGB data from L1 was also used to create an orthophoto with a resolution of 2 cm. The point cloud from L1 was classified using the Flai classification service. A DTM (Digital Terrain Model) with 5 cm resolution was created from the ground points. The UAV with P1 was flown in a so-called Smart Oblique mission, which is very practical for the creation of 3D models.

The UAV solutions were compared with other publicly available spatial data. On the one hand, this involves data at the national level, orthophotos with a resolution of 0.5 m and the 1-meter DTM from Laser Scanning of Slovenia (LSS, 2025). Global DEMs ASTER (ASTER GDEM, 2025), SRTM (SRTM, 2025) and Copernicus (Copernicus DEM, 2025) with a resolution of 1 arc second as well as satellite images from ESRI and Google (downloaded via the QuickMapServices plugin for QGIS) were used for comparison.

In a diverse terrain, the low-resolution DEMs cannot capture micro-topographic details such as local peaks and depressions. In the study area of about 400 x 300 m, the DoD (DEM of Difference) between the UAV-derived DEM and the global Aster DEM is between -13 meters and 24 meters. However, the national 1-meter DEM differs only slightly from the UAV DEM. Both can be seen in Figure 1.

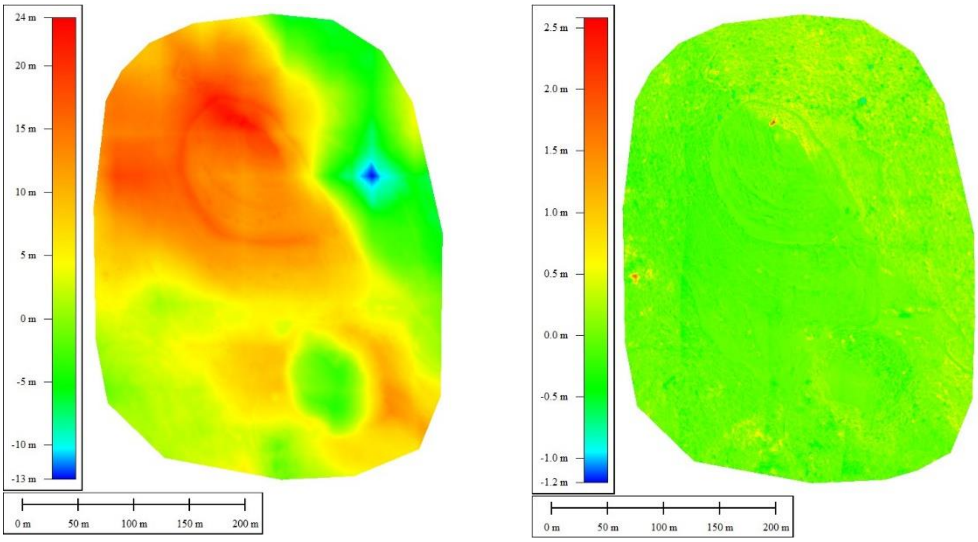

Figure 1. DoD between L1 derived DEM and Aster DEM (left), between L1 DEM and LSS DEM (right).

The difference between high and low DEM resolution becomes even clearer in the perspective view, as can be seen in Figure 2. The church appears to be positioned downhill on the global DEM, while it is correctly positioned on the top on the fine DEM.

https://doi.org/10.5194/ica-abs-10-154-2025 © Author(s) 2025. CC BY 4.0 License.

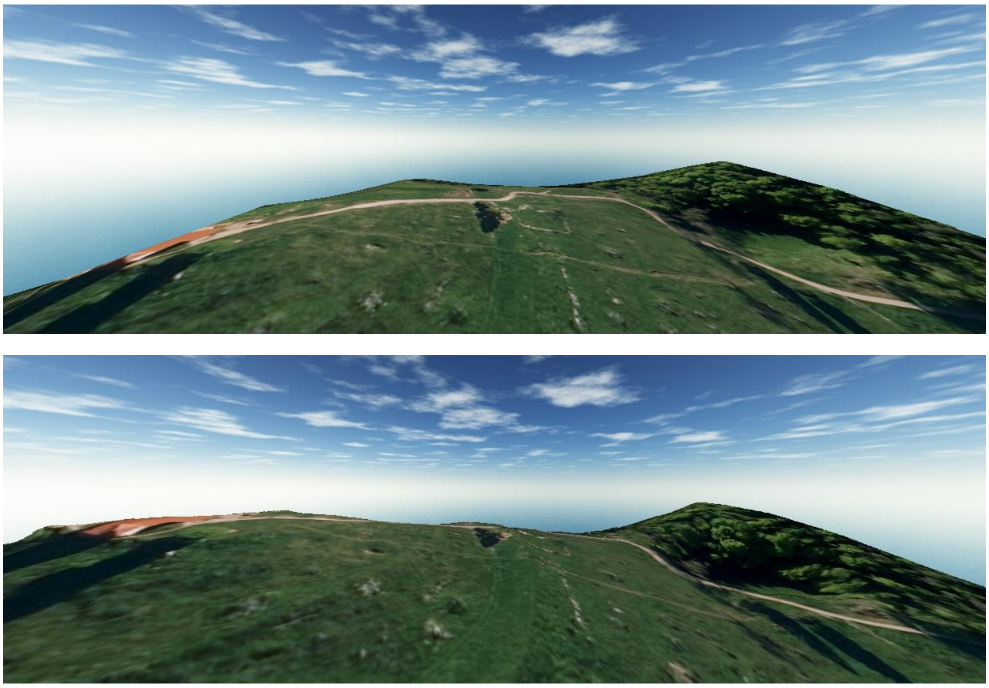

Figure 2. Perspective view of ESRI satellite imagery draped on ASTER DEM (top) and L1 DTM (bottom).

When it comes to modelling a building, a combination of nadir and oblique photogrammetry is superior to nadir Lidar, which can be clearly seen in Figure 3.

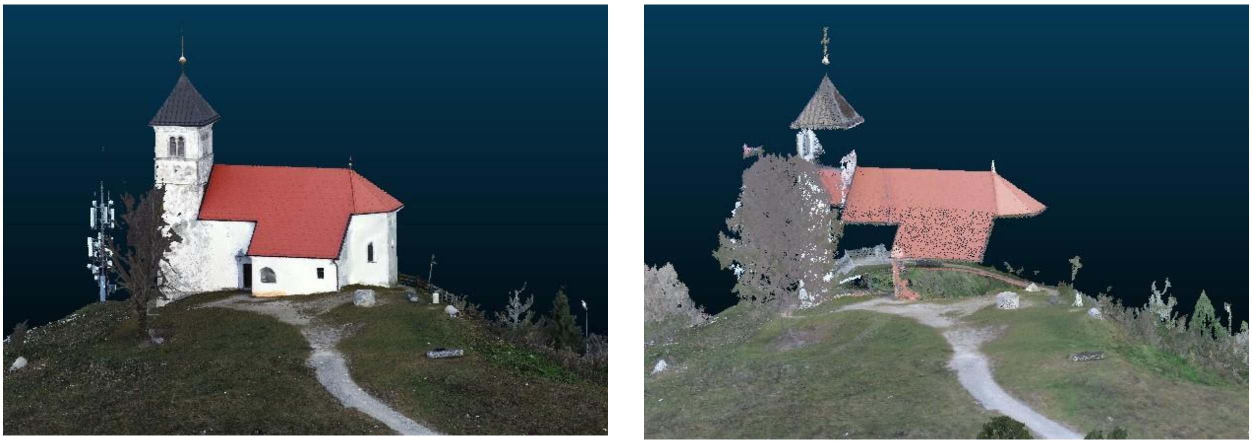

Figure 3. Perspective view of 3D model from P1 (left) and point cloud from L1 (right).

It is obvious that global DEMs have insufficient resolution for detailed visualizations such as perspective views and close-up virtual flyovers. Due to the low grid resolution, interpolation can lead to misinterpretation of slope angles in the diverse terrain. If more detailed DEM with a resolution in the meter range are available at the national level, it is very well suited for 3D representations. The use of national orthophotos depends on their resolution and the degree of proximity to the visualization.

Further comparisons and analyses of the suitability of data for different visualizations - static and dynamic - are addressed in the research.

References

ASTER GDEM, 2025. Available online: https://www.earthdata.nasa.gov/ (accessed on 10 January 2025).

Copernicus DEM, 2025. Available online: https://dataspace.copernicus.eu/ (accessed on 10 January 2025).

LSS, 2025. Available online: https://gis.arso.gov.si/evode/ (accessed on 10 January 2025).

SRTM, 2025. Available online: https://www.earthdata.nasa.gov/ (accessed on 10 January 2025).

Abstracts of the International Cartographic Association, 10, 154, 2025
32nd International Cartographic Conference (ICC 2025), 17–22 August 2025, Vancouver, Canada.
https://doi.org/10.5194/ica-abs-10-154-2025 © Author(s) 2025. CC BY 4.0 License.