

Using LiDAR ALS data as a supplement to existing cave registry data: an example from NW Gorski kotar, Croatia

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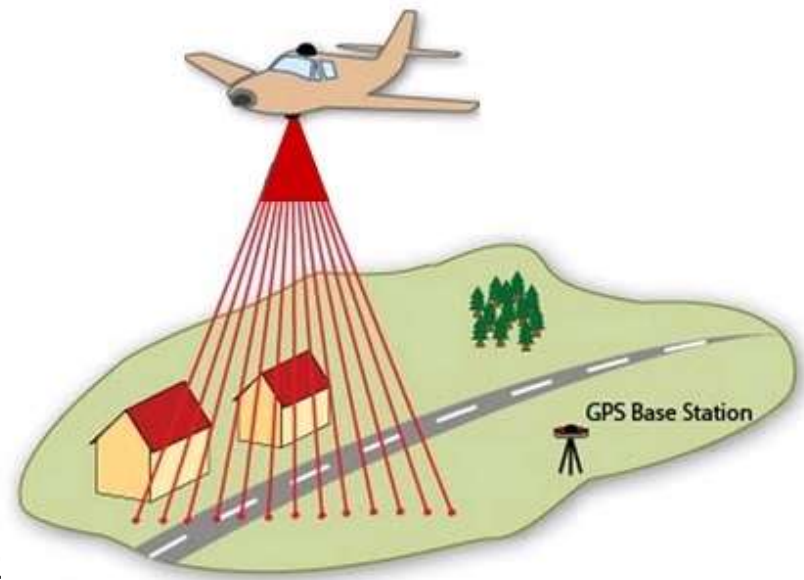
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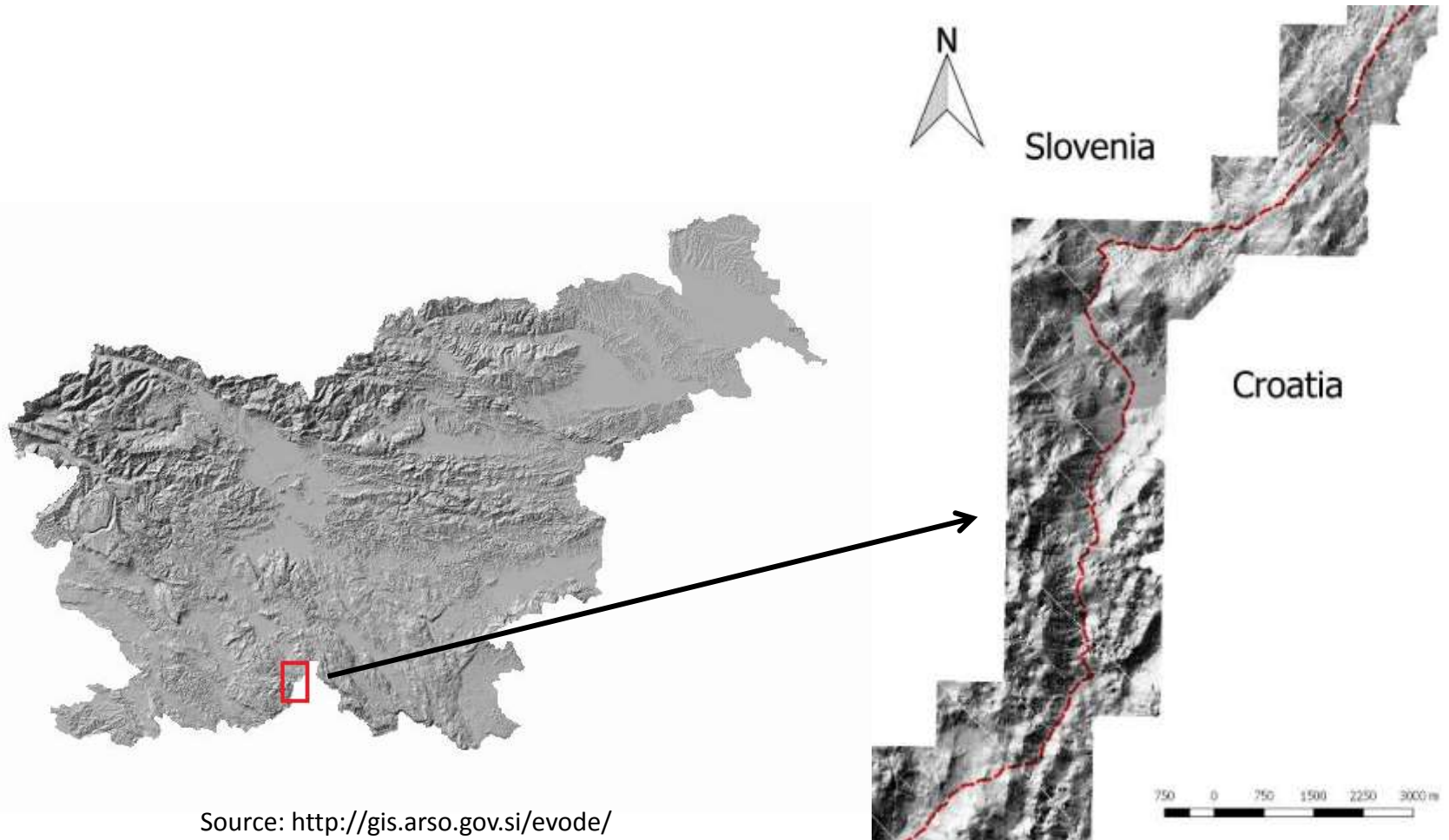
1. Introduction

- LiDAR
 - From the 1960s
 - Lidar uses light to image objects
- ALS
 - Fast
 - Accurate
 - Point density 0-100 pt/m²
 - Can „see” through canopy



Source: <http://stormwise.uconn.edu/lidar/>

1. Introduction



Source: <http://gis.arso.gov.si/evode/>
Made with Qgis 2.18

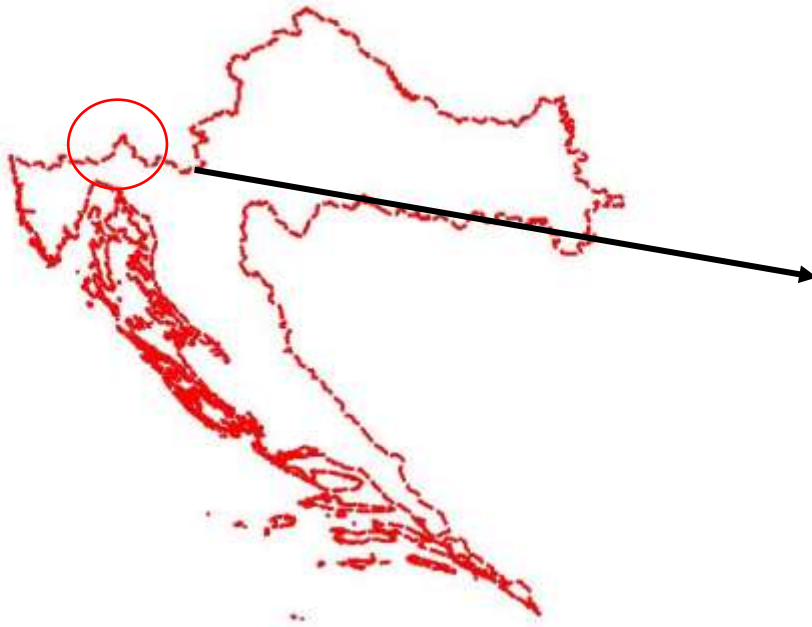


Made with Qgis 2.18

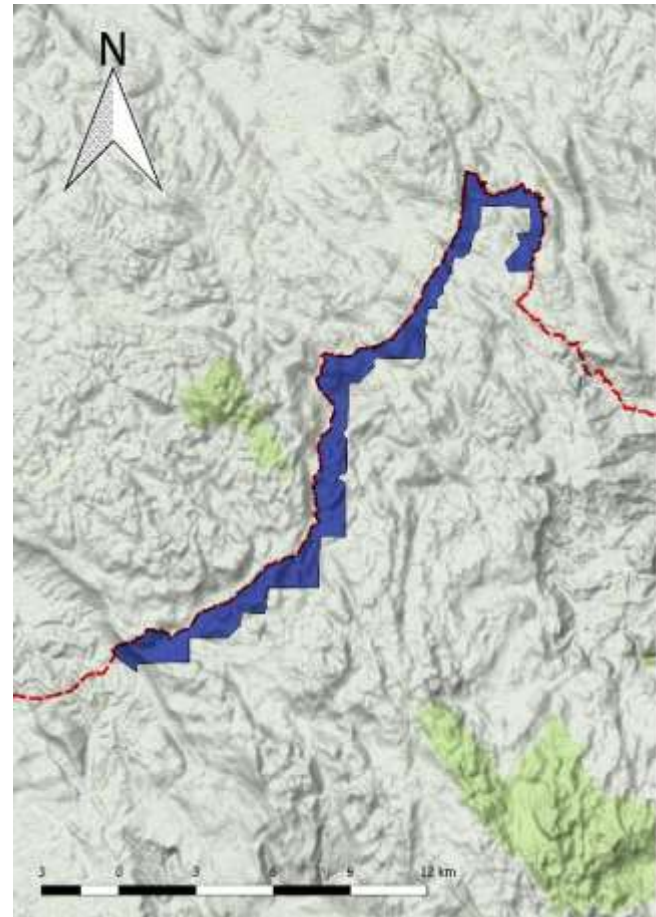


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Made with Qgis 2.18

2. Study area



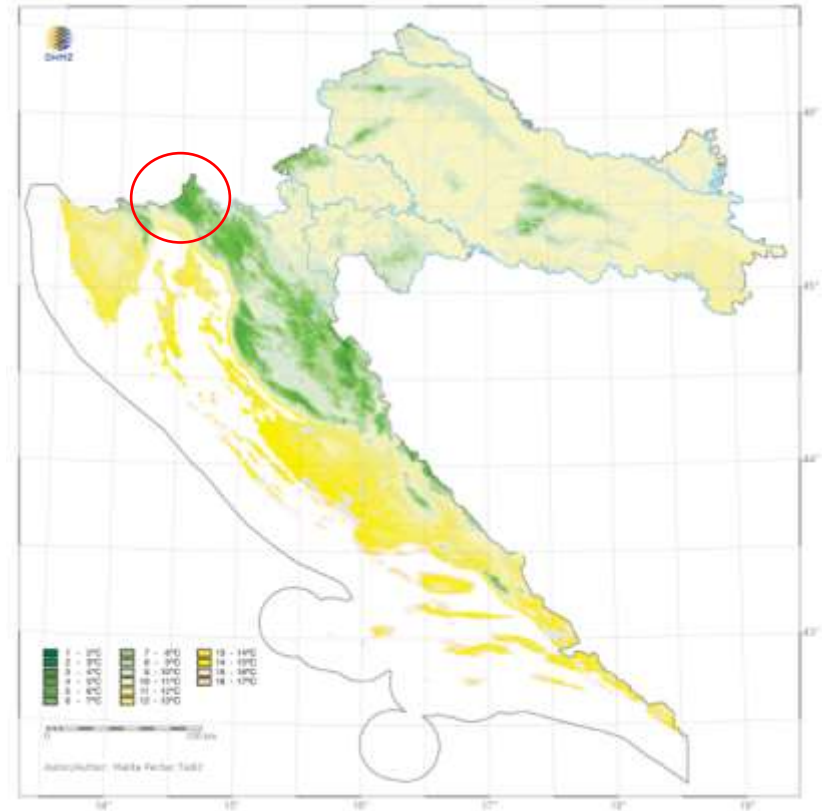
Made with Qgis 2.18



Source: Google physical map WMS
Made with Qgis 2.18

2. Study area

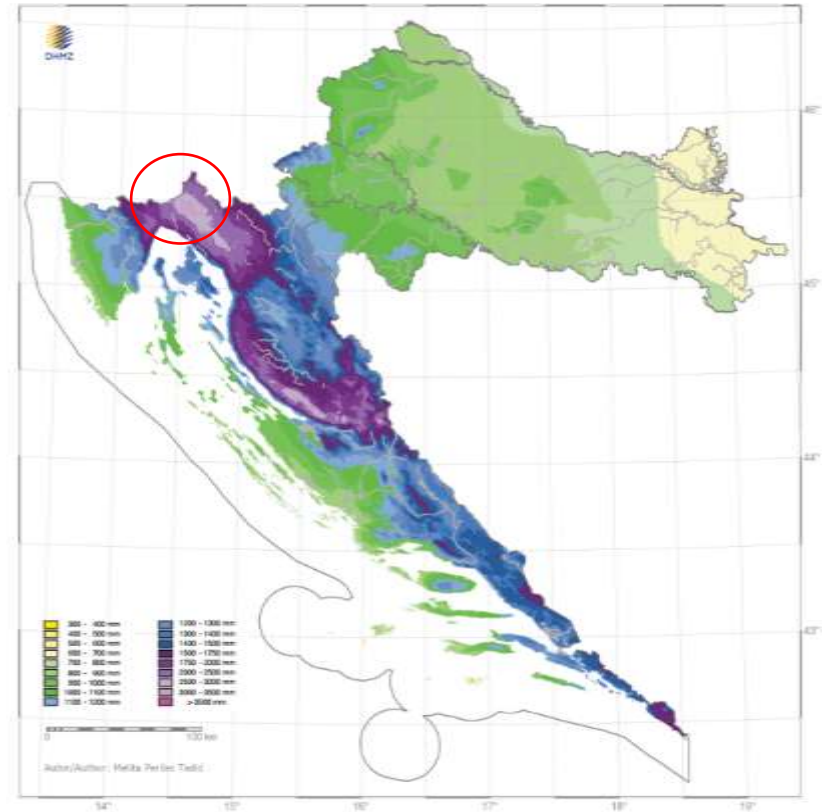
- Remote and hard to reach
- Low average annual temperatures



Source: Zaninović et al. (2008)

2. Study area

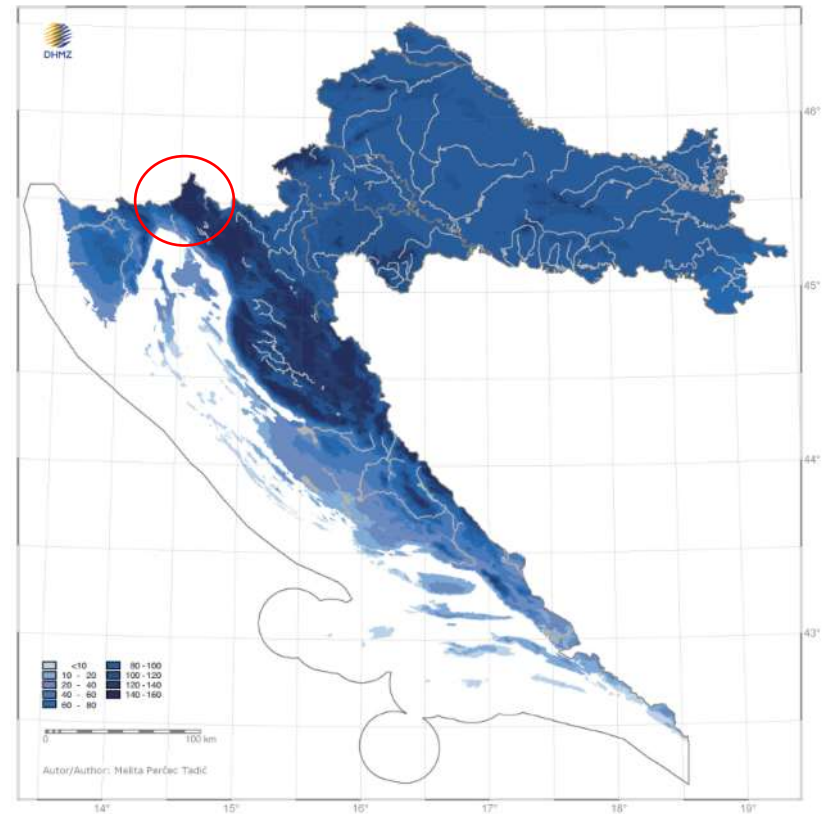
- Remote and hard to reach
- Low average annual temperatures
- High amount of annual precipitation



Source: Zaninović et al. (2008)

2. Study area

- Remote and hard to reach
- Low average annual temperatures
- High amount of annual precipitation
- Many days with snow



Source: Zaninović et al. (2008)

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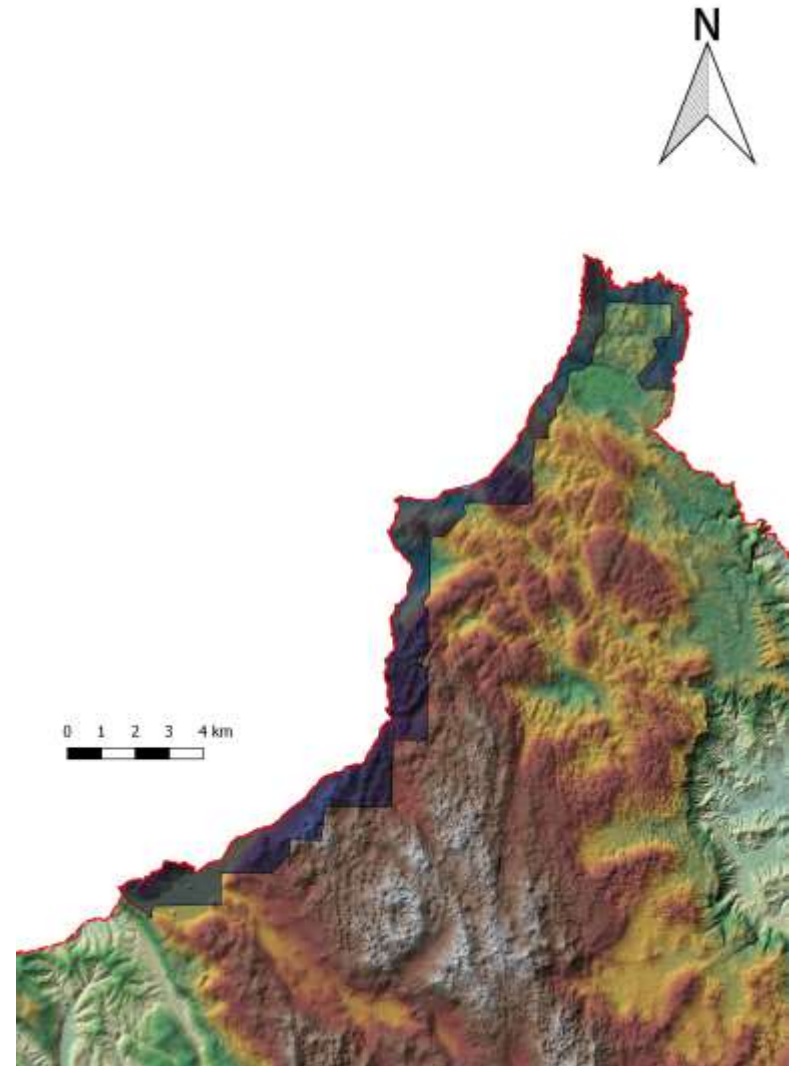
- Remote and hard to reach
- Low average annual temperatures
- High amount of annual precipitation
- Many days with snow
- Very limited time gap suitable for scouting new cave entrances



Foto: Dino Grozić

2. Study area

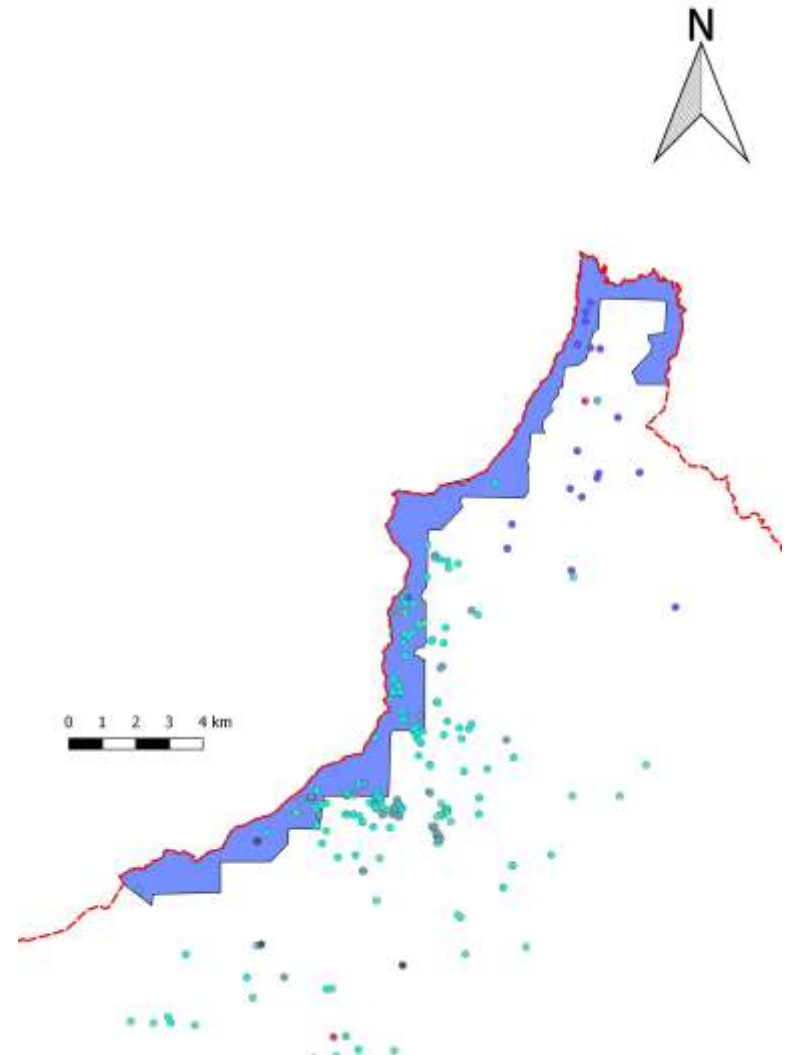
- Complex karst terrain with Jurassic and Cretaceous bedrock
- Glacio-karst features



Made with Qgis 2.18

2. Study area

- Complex karst terrain with Jurassic and Cretaceous bedrock
- Glacio-karst features
- History of systematic cave exploration
 - Excellent cave register



Source: Caving society Estavela
Made with Qgis 2.18

2. Study area

- Complex karst terrain with Jurassic and Cretaceous bedrock
- Glacio-karst features
- History of systematic cave exploration
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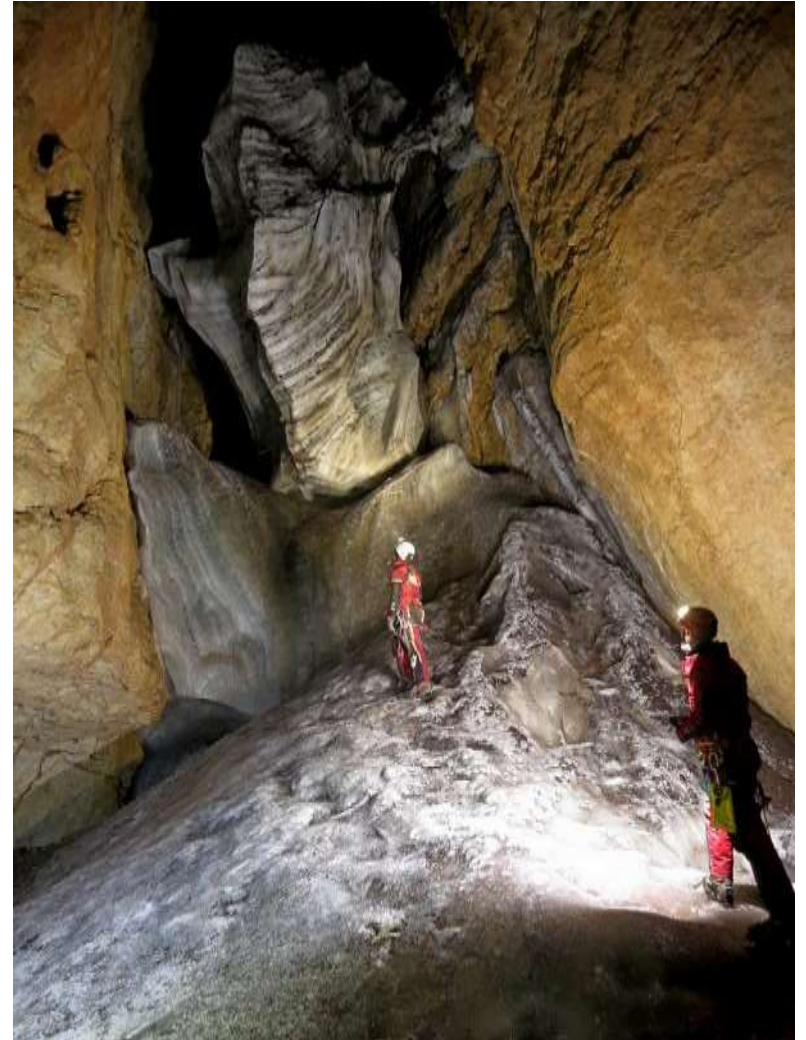
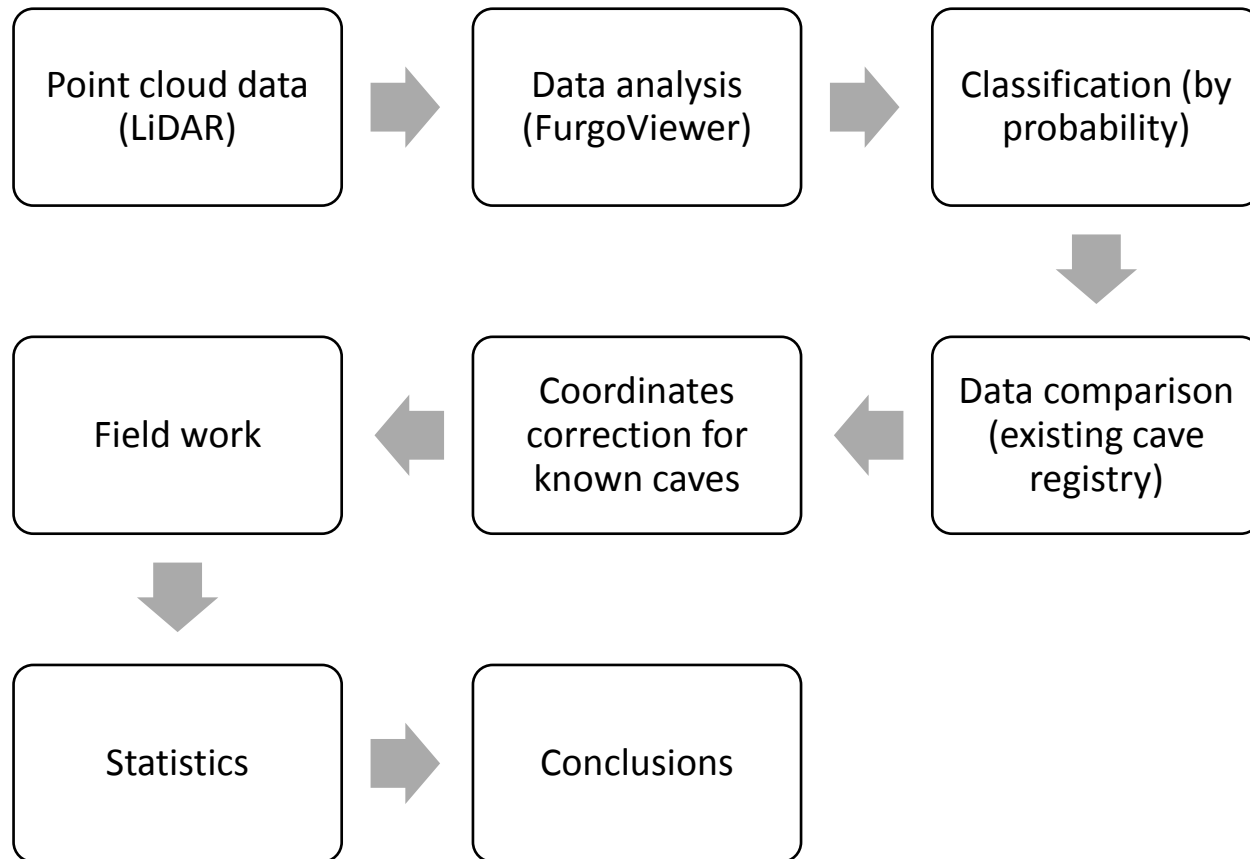
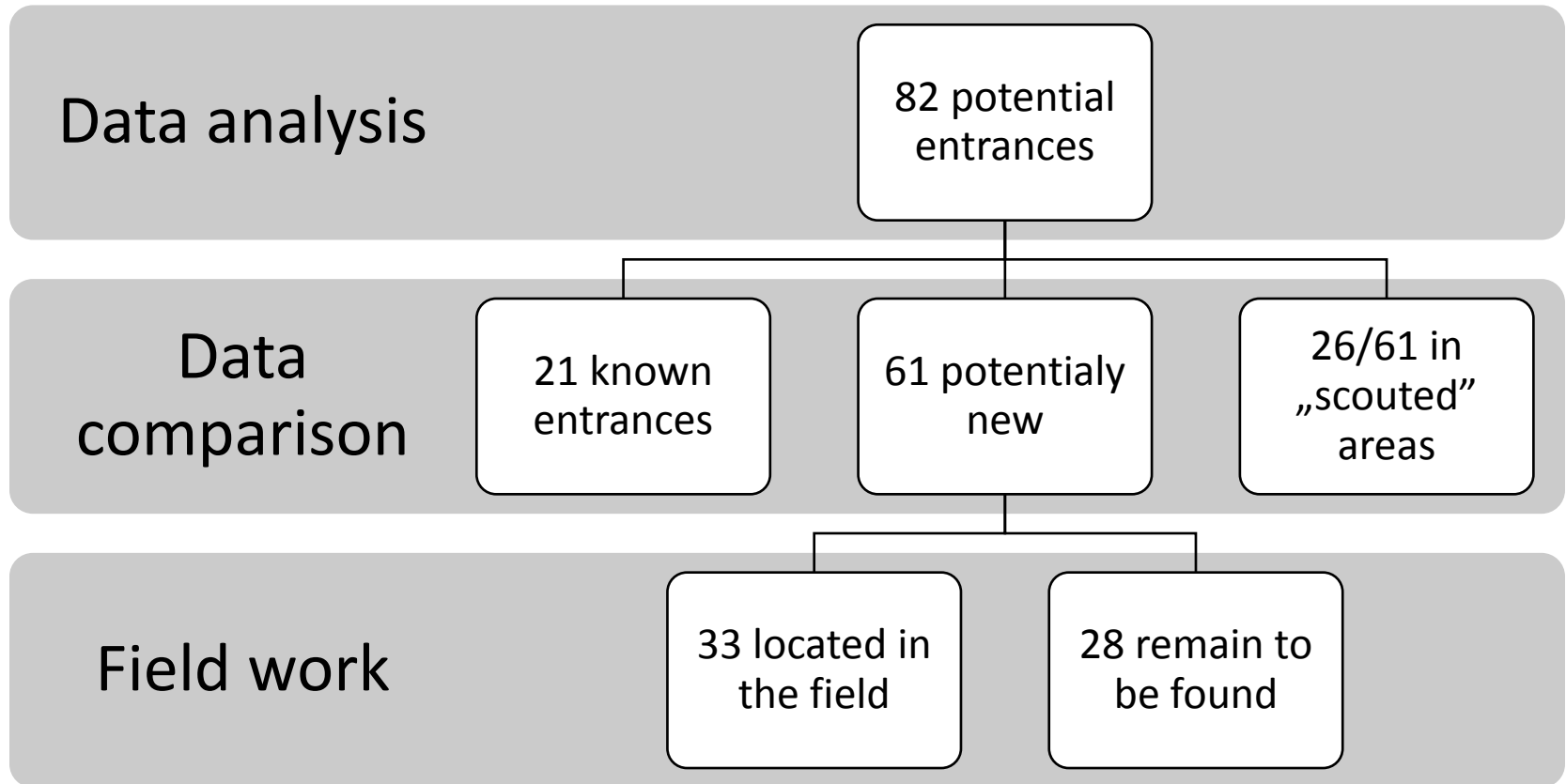


Foto: Lovel Kukuljan

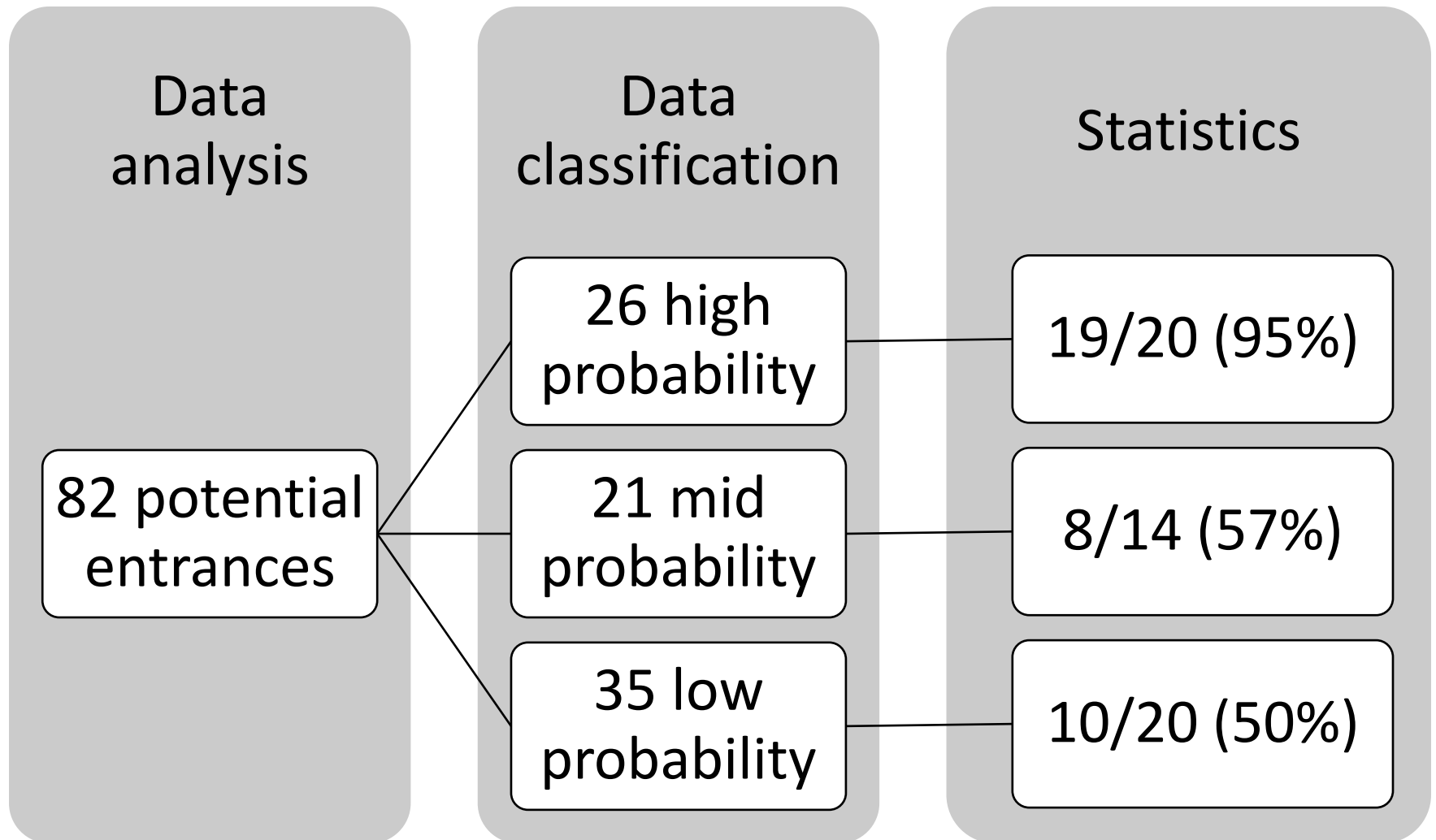
3. Methods



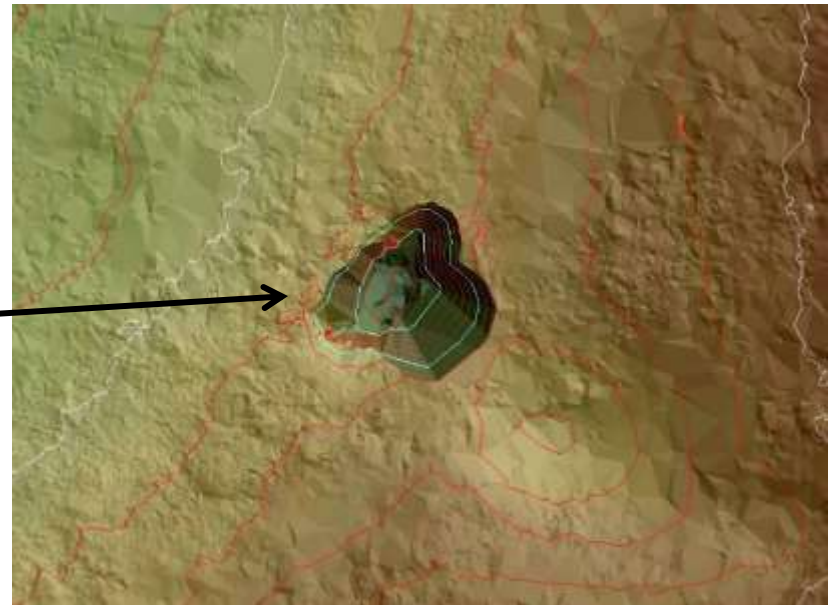
4. Results



4. Results



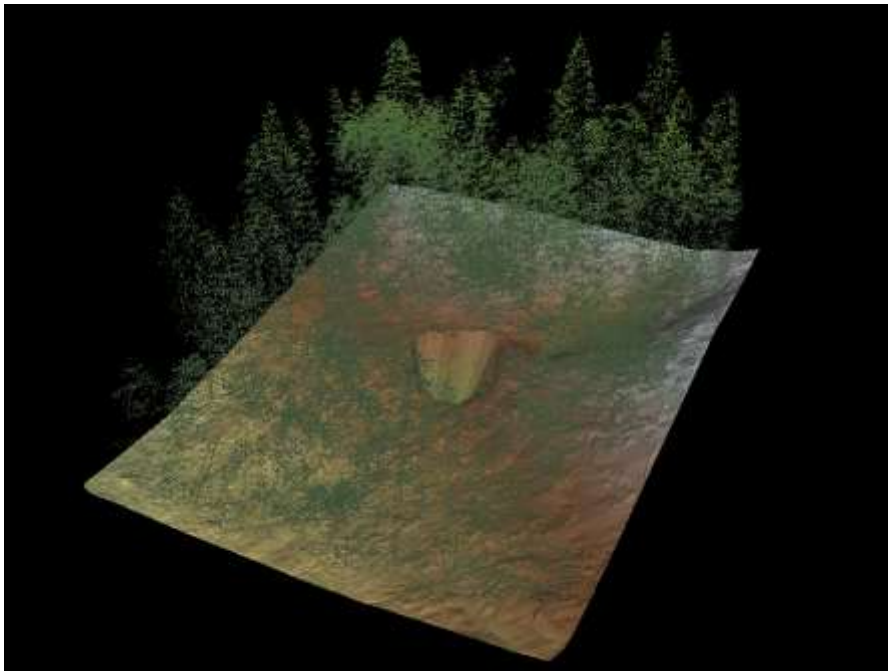
Jamica u Praprotnoj dragi



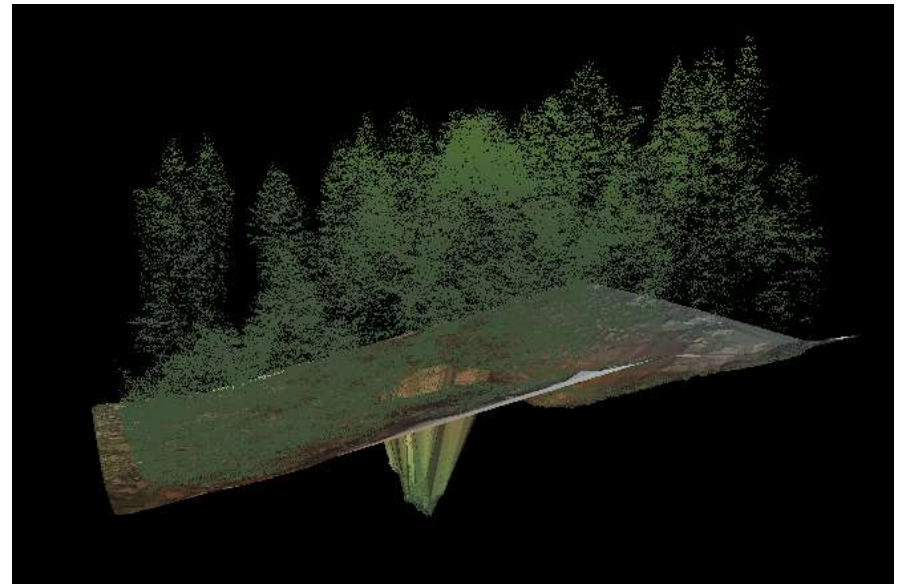
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Made with Furgoviewer Ver. 2.2.

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Jamica u Praprotnoj dragi

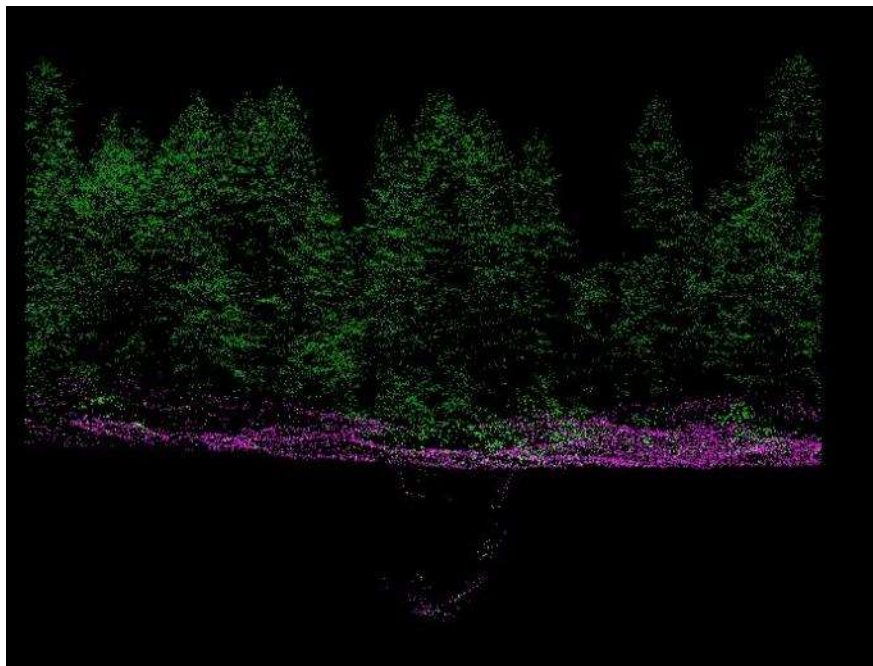


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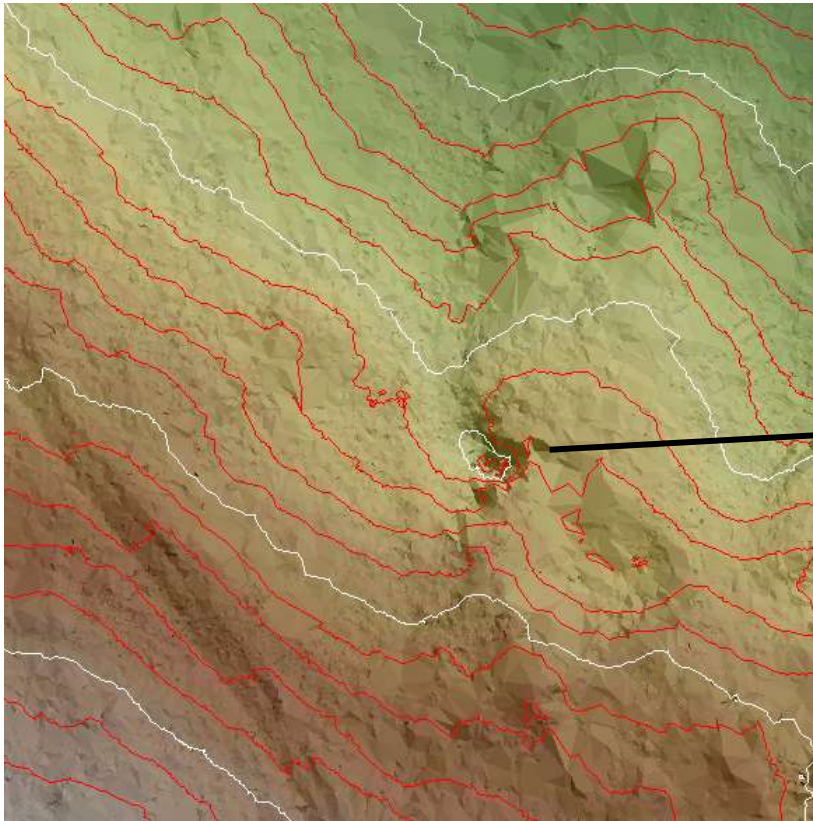


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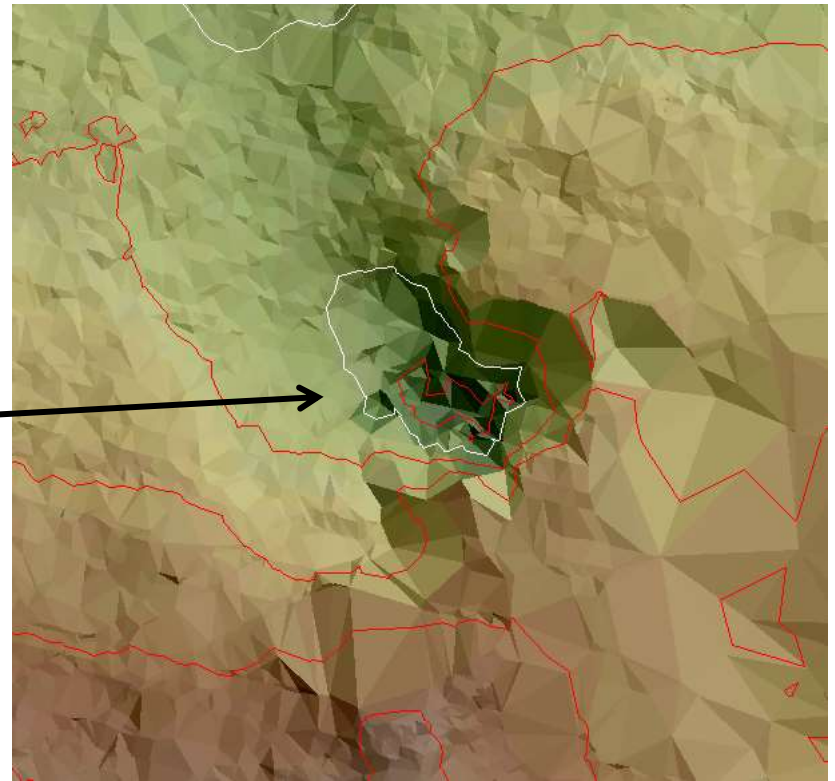


Foto: Lovel Kukuljan

Lidar 5

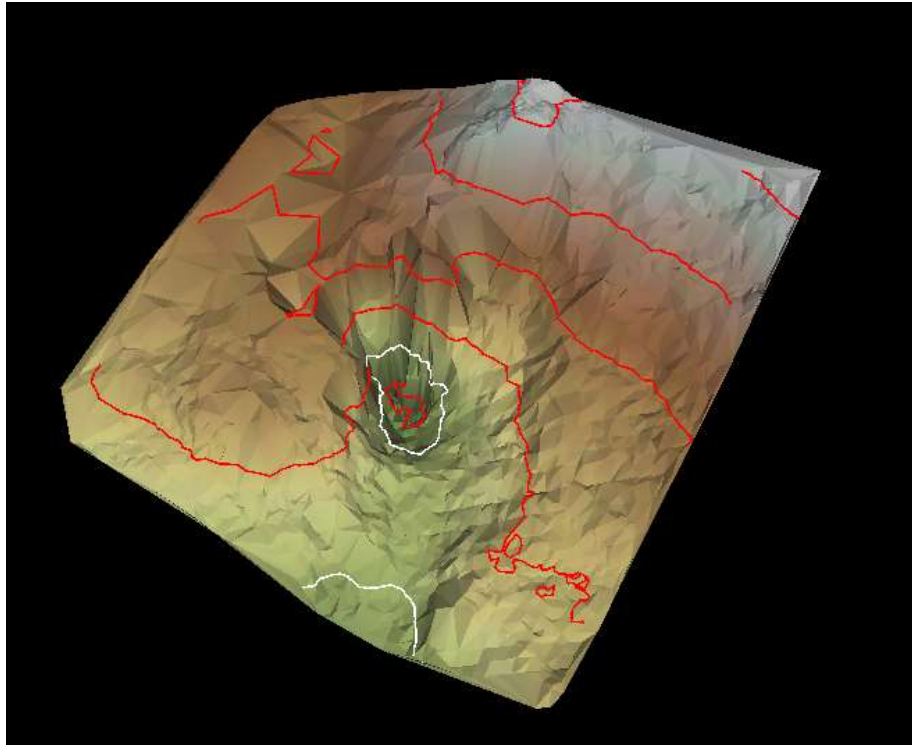


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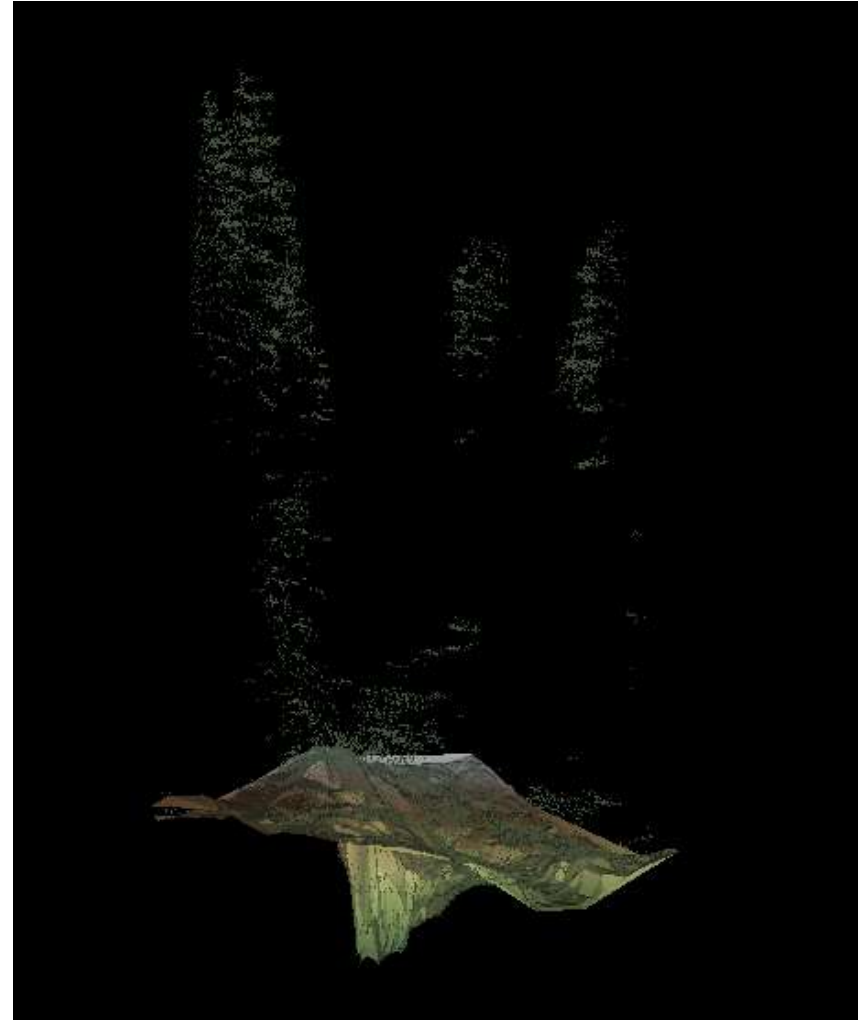


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Lidar 5

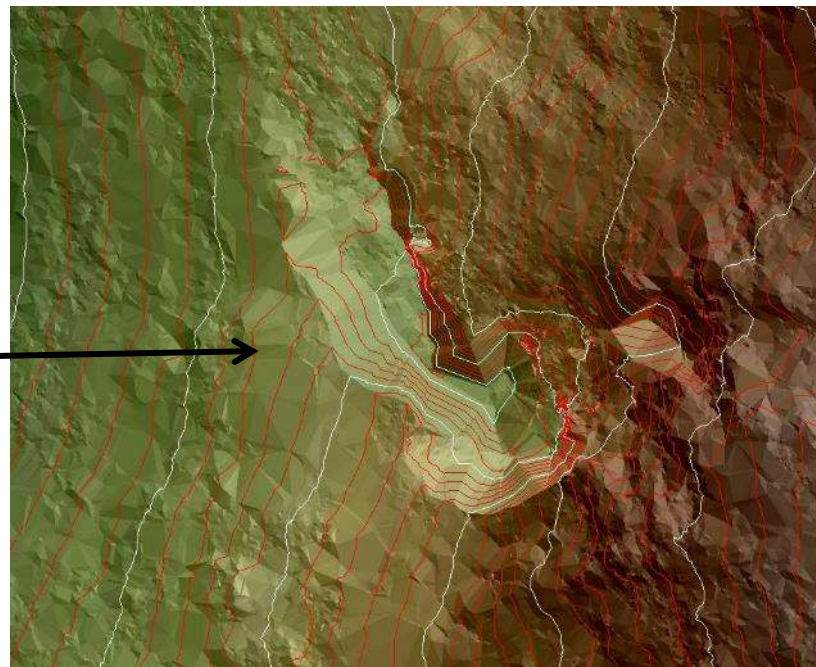
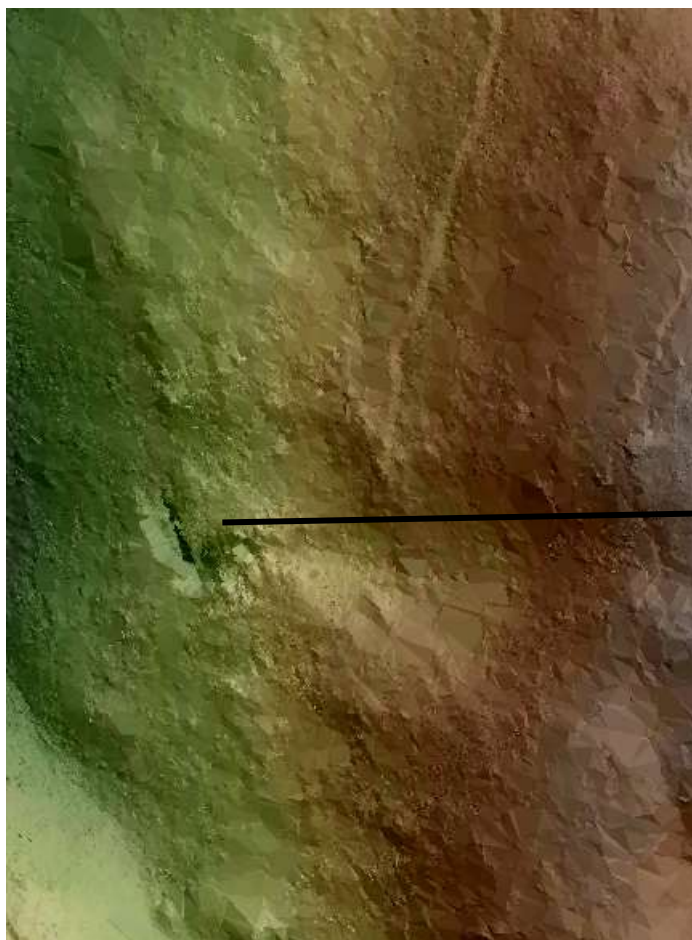


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Source: <http://gis.arso.gov.si/evode/>
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Jamica pod Mirakulom



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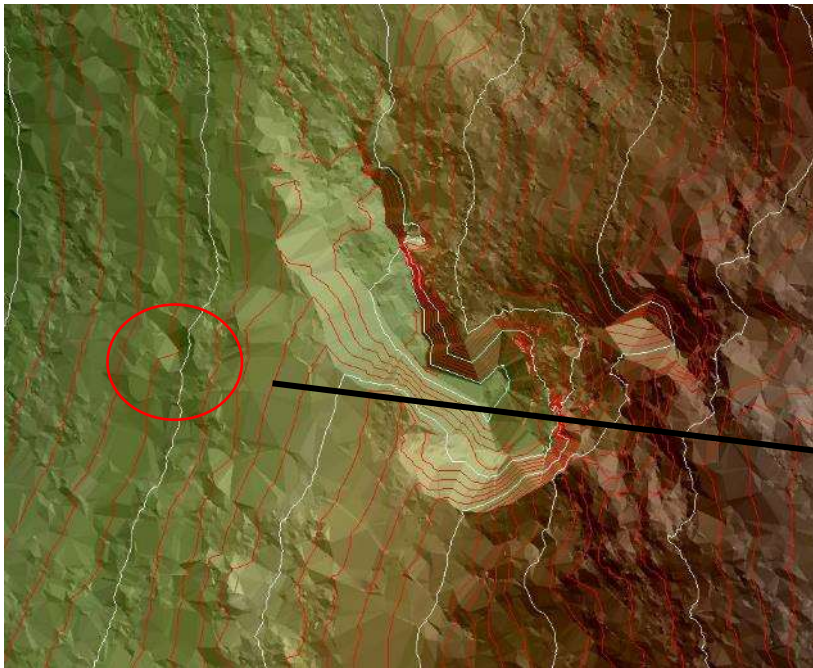


Foto: Lovel Kukuljan

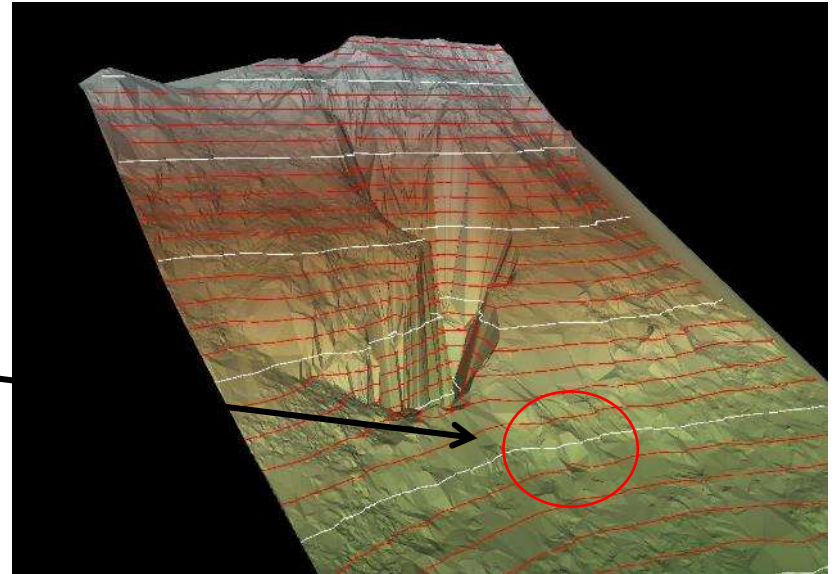


Foto: Lovel Kukuljan

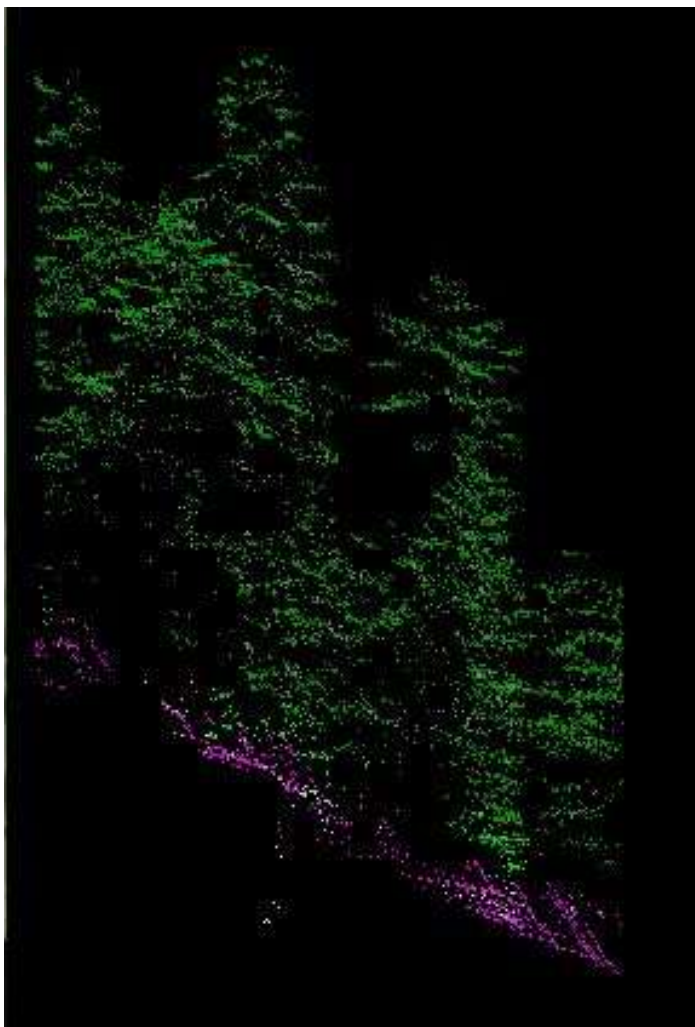
Jamica pod Mirakulom



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Foto: Dario Maršanić

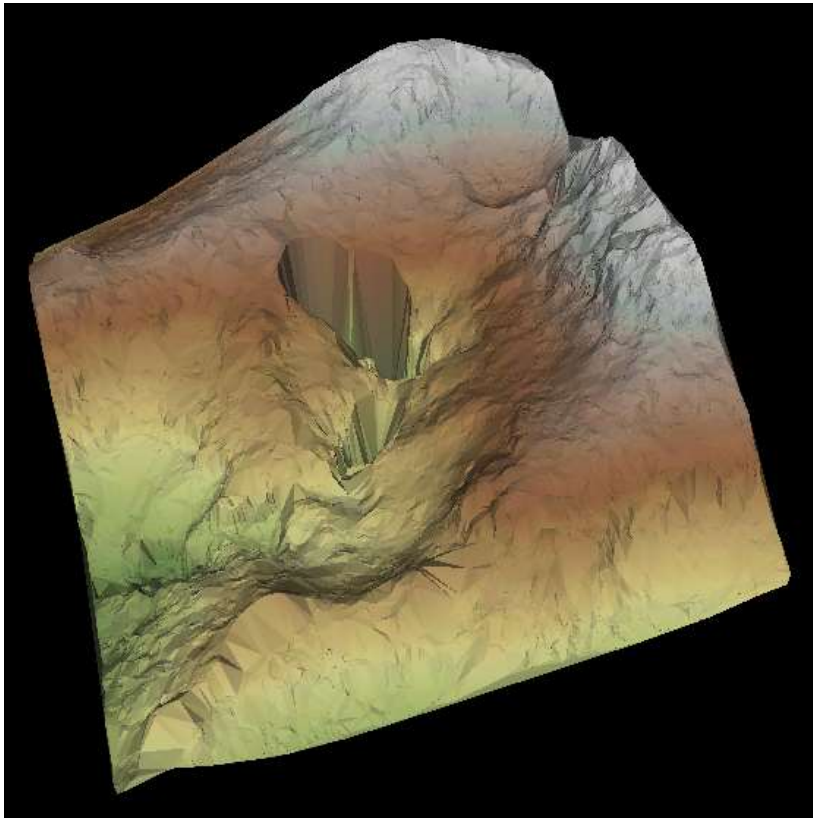
5. Conclusions

- Using ALS LiDAR data shows great potential in cave entrance identification and cave registry data correction
- This method is a great supplement to old fashioned scouting for cave entrances, not a substitution
 - Time conserving
- Ideal for identifying „anomalies” from background terrain
 - Helps decision making

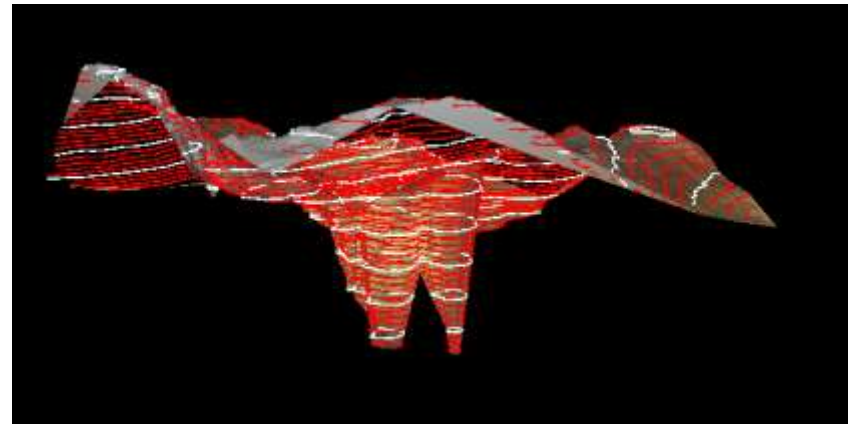
5. Conclusions

- Using 5 pt/m² point cloud ALS LiDAR data is most suitable for identifying medium and large size vertical cave entrances (>3 x 3 m)
- Successful identification greatly depends on:
 - Local point density
 - interpreter's skill to correctly identify a cave entrance from the background terrain data

Thank you for your attention



Source: <http://gis.arso.gov.si/evode/>
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Questions?