



UNICA

UNIVERSITÀ
DEGLI STUDI
DI CAGLIARI



PAVOL JOZEF ŠAFÁRIK
UNIVERSITY
IN KOŠICE



ÚSTAV GEOGRAFIE
Prírodovedecká fakulta UPJŠ v Košiciach

INTERNATIONAL REMOTE SENSING SUMMER SCHOOL

Experiencing Remote Sensing on Sardinia inland site: Advanced summer school
on instruments and methodology for a CAL/VAL site for Optical data

SAN VERO MILIS | ITALY | 21 - 25 JULY 2025

Introducing the IRSSS teams

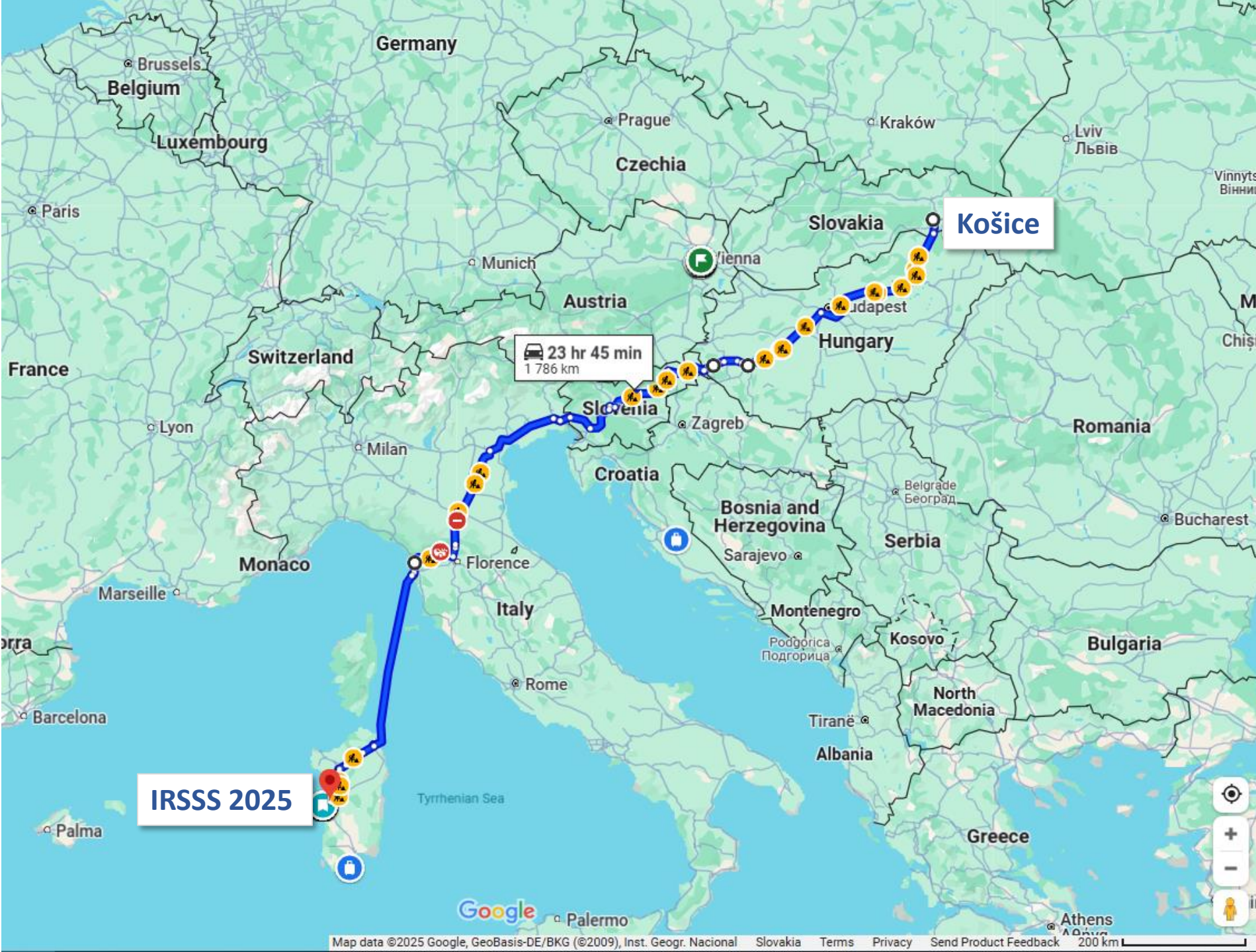
Michal Gallay, Katarína Onačillová, Ján Šašak



INSTITUTE OF GEOGRAPHY, FACULTY OF SCIENCE,
PAVOL JOZEF ŠAFÁRIK UNIVERSITY IN KOŠICE, SLOVAKIA

geografia.science.upjs.sk
michal.gallay@upjs.sk





- 220 000 people
- 3 universities
- 20 000 students



**PAVOL JOZEF ŠAFÁRIK
UNIVERSITY
IN KOŠICE**

UPJŠ

- 7000 students / 1500 foreign
- medicine, law, arts, science, public admin
- We are from:
The Faculty of Science
Institute of Geography



FACULTY OF SCIENCE
PAVOL JOZEF ŠAFÁRIK UNIVERSITY
IN KOŠICE

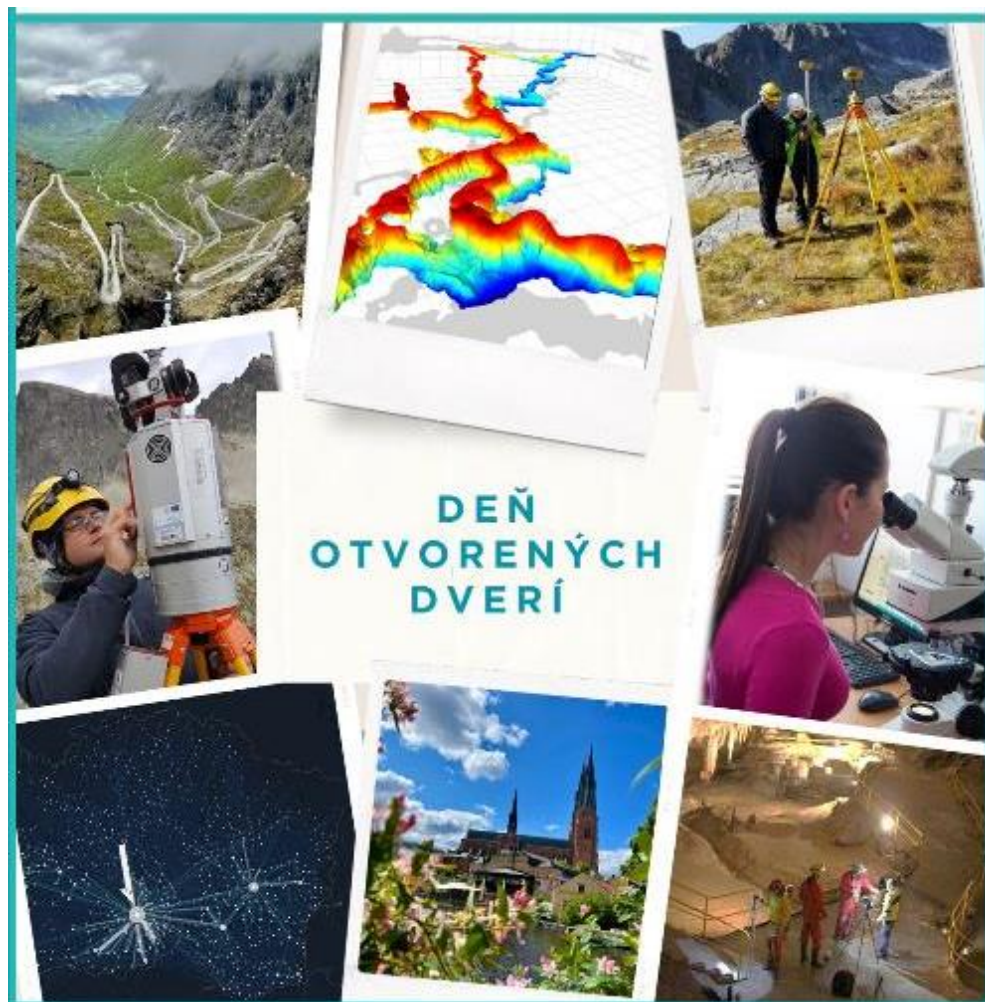
INSTITUTE OF GEOGRAPHY

48.728725° N, 21.248469°E

- **17 academic staff** (1 prof., 5 assoc.prof., 3 res. assist., 7 researchers) + 1 admin. support staff
- **3 departments**
 - Department of Geoinformatics
 - Department of Physical Geography
 - Department of Human Geography
- **4 laboratories**



We are a small but active research group in Eastern Slovakia



INSTITUTE OF GEOGRAPHY

Education profile

Single degree study

- BSc. Geography and Geoinformatics
- MSc. Geography and Geoinformatics
- PhD. Geoinformatics and Remote Sensing

Joint degree study

- BSc., Geography with other Science Discipline (e.g. Mathematics, Computer Science, Physics, Biology, Chemistry, Slovak, German, English language, History)
- Msc. Geography teaching
- <https://studijne-programy.upjs.sk/en/faculty/PF>



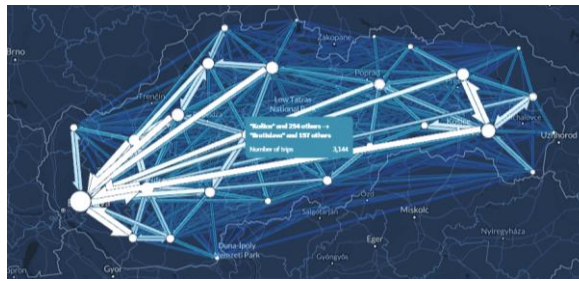
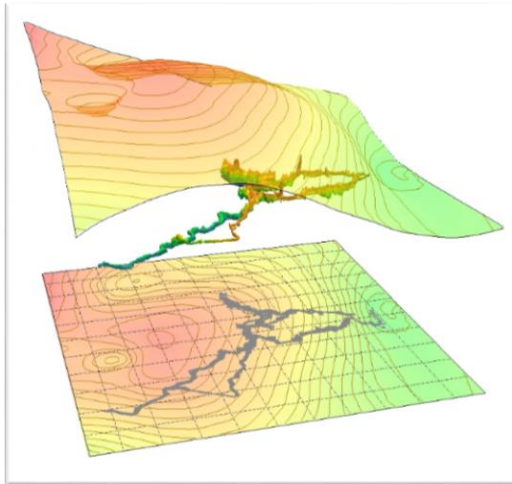
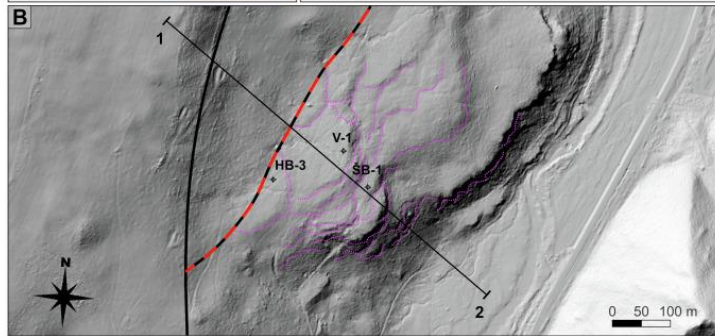
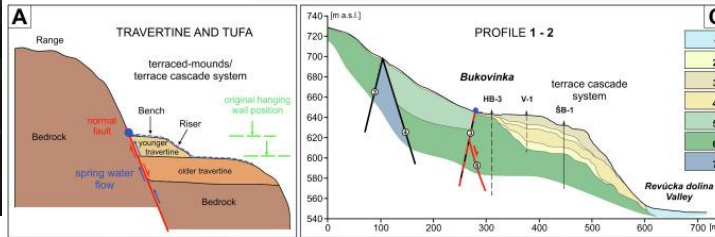
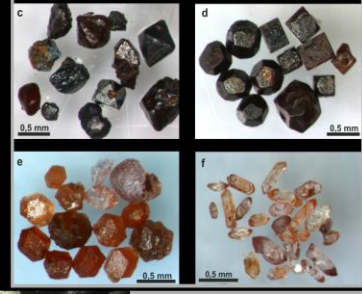
Our ERASMUS+ partners



- Over 170 for the science disciplines
- 34 related to the Institute of Geography UPJŠ
- Visiting students mostly from Turkey, Germany, Ukraine, Uzbekistan, Spain
- Our students in Spain, Greece, Germany, Estonia, Finland, Poland



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INSTITUTE OF GEOGRAPHY

Research focus

- **Geoinformatics & Remote Sensing:** UAV-based LiDAR and hyperspectral mapping, solar radiation modelling, urban heat and land surface temperature analysis, flood simulation, UAV topo-bathymetry, and GRASS GIS applications.
- **Physical Geography:** Karst and flysch landscape evolution, fluvial and alpine geomorphology, cave and drainage mapping, sediment analysis, palaeogeography, and tectonic landform studies using ALS and SfM.
- **Human Geography:** Migration patterns, micromobility, demographic and ethnic change, regional disparities, urban transformation, and spatial planning in marginalised areas.
- **Geography Education:** Tangible GIS, geovisual storytelling, sketchnoting, and use of 3D printing and GIS in geography education at schools and universities.



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International research projects: Earth Observation Research & Education, Regional Monitoring & GIS Applications

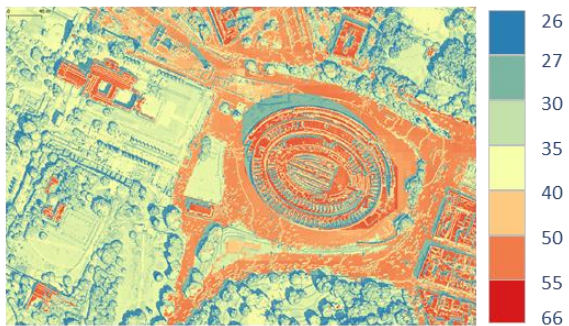
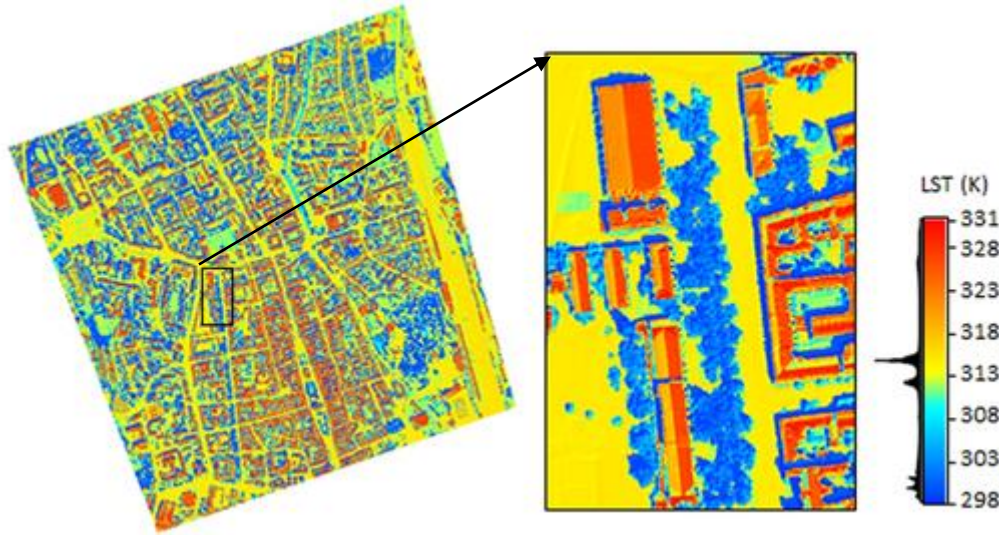
ESA – European Space Agency Projects

- URBANA (2023 – 24) Development and verification of urban analytics (in collaboration with Geomatics, Italy).
- ENEUM (2023 – 24) Enhancing Earth observation curriculum with a focus on ESA sensors.
- SURGE (2016 – 18) Simulating the cooling effect of urban greenery using a new generation of ESA sensors.

INTERREG Projects (Cross-border Cooperation)

- GEOSSES (2019 – 22) - Space Emergency Protection System Monitoring hazardous natural and anthropogenic geoprocesses in the HU-SK-RO-UA region.
- TOKAJGIS (2017 – 20) Development of a webGIS platform using big geodata for the Tokaj Wine Region to foster cross-border collaboration.

<https://www.uge.science.upjs.sk/projekty>



Modelled land surface temperature (°C)
Resolution: 0.5 m

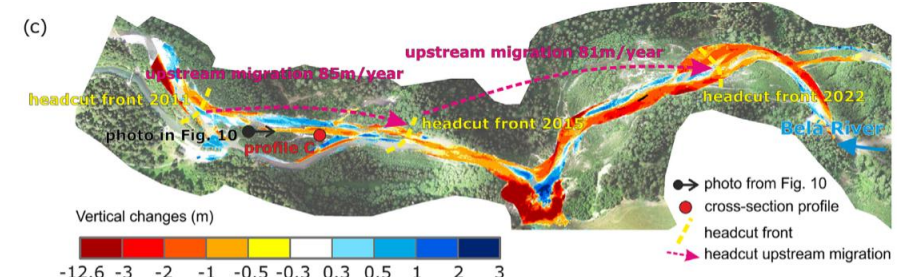
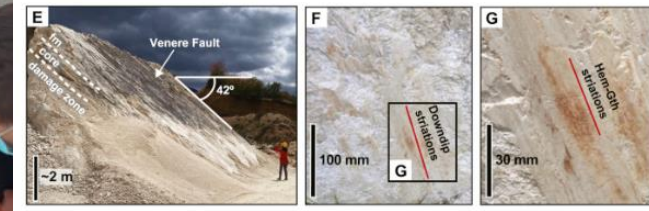
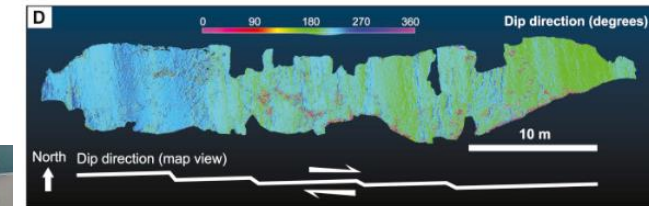
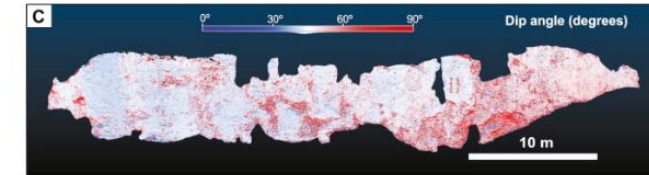
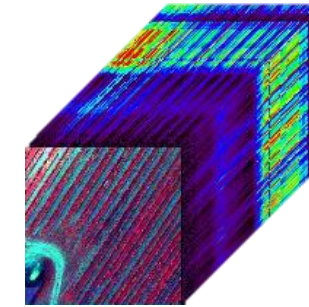
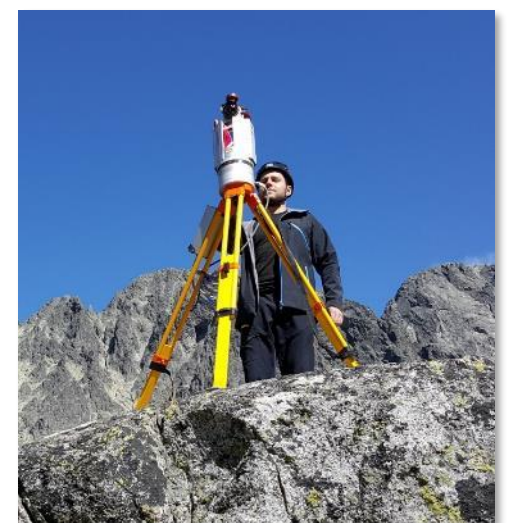




National research projects: Landscape, Urban Climate & AI Integration

- Lidar and Hyperspectral Fusion for Land Cover Classification (2024 – 26)
- Physical Geomorphometry for Geographic Research (2023 – 27) (with Comenius University, Bratislava).
- Urban Heat Island Modelling using Geospatial Tools (2023 - 25)
- Palaeogeographic Interpretation of Detrital Minerals (2023 – 25)
- Multi-scale assessment of spatial variability of socio-economic stratification of the population (2024 - 26)
- 3D technologies and machine learning methods for environmental monitoring of rivers (2024 - 27)

<https://www.uge.science.upjs.sk/projekty>

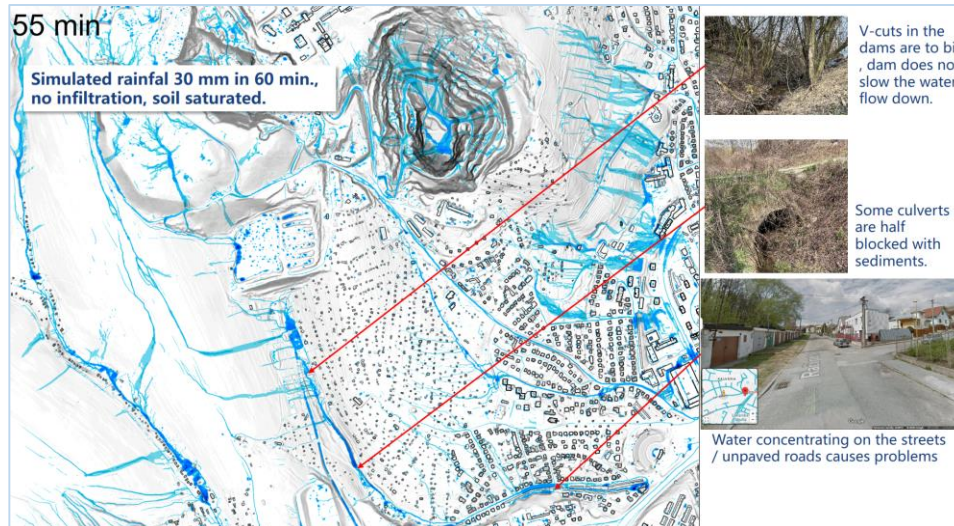
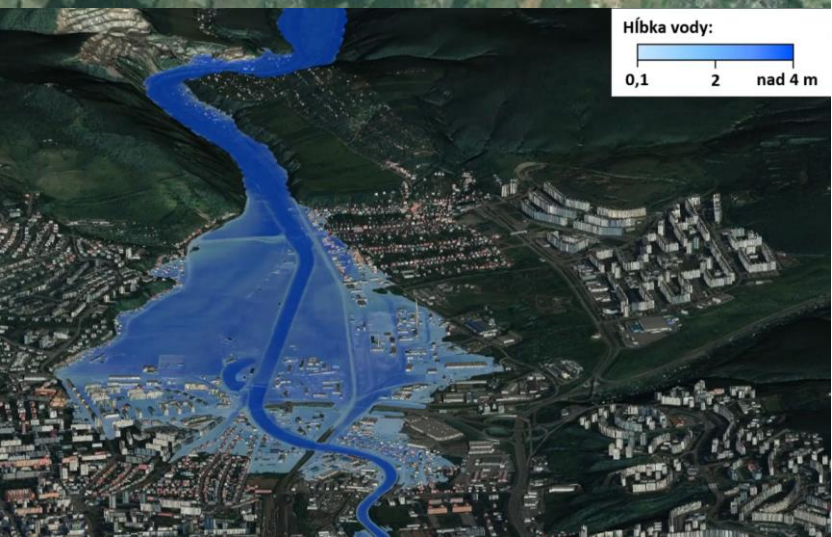




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Consultancy projects

- Simulating the flooding after water dam breaching, and flash floods for Košice city civil protection
- Carbon emission strategy for Košice city
- Renewable energy potential
- Training in GIS for Košice self-government region, Deutsche Telekom IT Solutions Slovakia





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Public outreach & education

Summer schools

- UAV hyperspectral and laser scanning, geospatial modelling, drones, river mapping
- Int. Rem. Sens. Summer School, Univ. Cagliari (07/2023, 04/2024, 09/2024, 07/2025)
- Workshop on Lidar mapping/Sentinel 3 Odra river, Univ. Wroclaw (10/2023)
- Exploring the landscape with dynamic visualization, tangible interaction, and UAV-lidar (07/2019)



https://youtu.be/AjdV_UFaelo



<https://youtu.be/NlzdYtPF0a8>





IRSSS : Our contribution

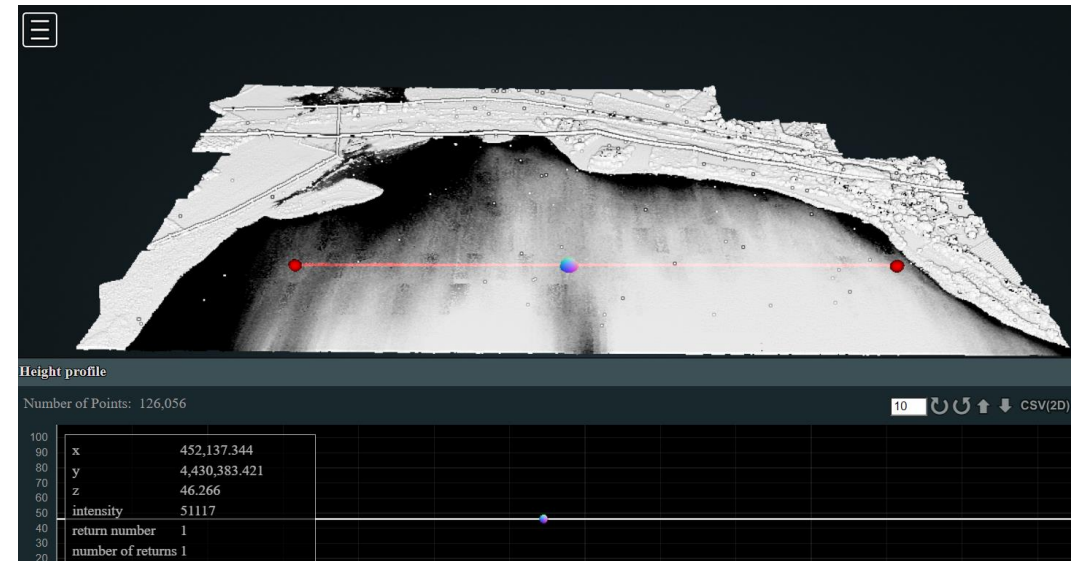
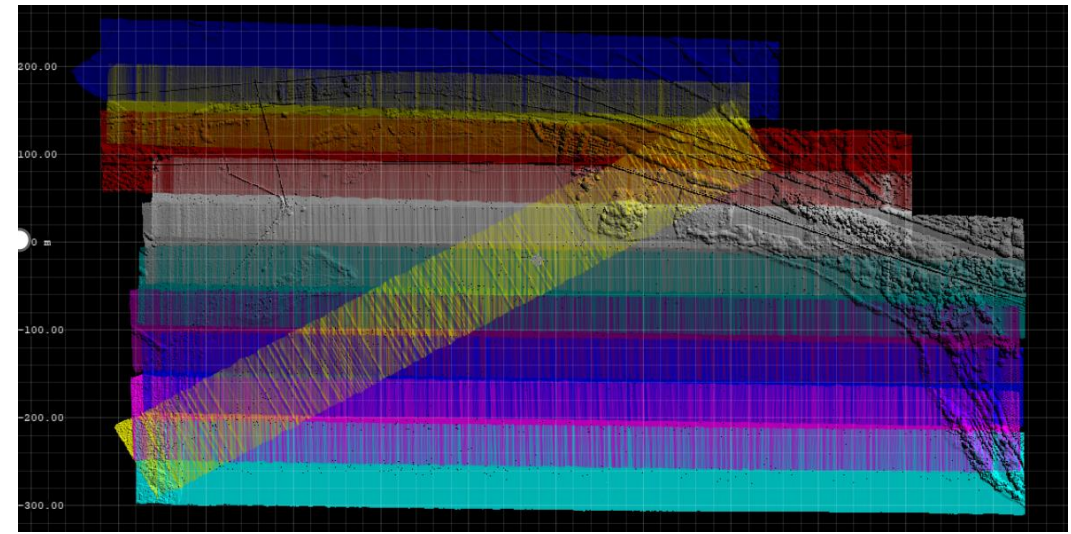
- UAV data collection & processing
- Customized DJI AGRAS T30 multicopter.
- Laser scanning (lidar) and hyperspectral imaging payloads
- GNSS / tacheometry ground control,
- 3D point clouds, HS image data cube
- For accurate and detailed characterisation of the salty pond





IRSSS : Our contribution

- UAV LiDAR scanning for mapping topography
- RIEGL VUX-1 scanner with OXTS GPS/INS
- Digital Terrain Models (DTMs) of 0.2 m cell size for flatness assessment.
- High-precision processing ensures minimal errors (standard deviation of 0.004 m).



Lidar flight lines and final point cloud in a perspective view towards north with a profile line. The grey tones represent elevation between 46.18 and 46.40 meters above sea level of the lake salt pan/bottom. The lidar data help to characterise the surface inclination which is were mild within the range¹ of 0.2 m.

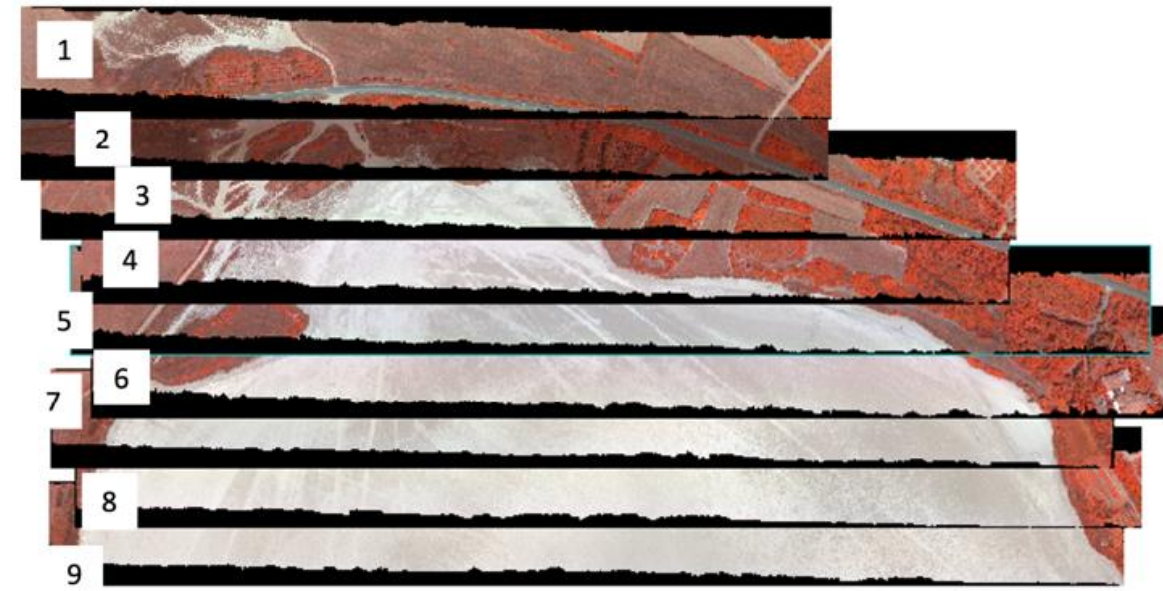


IRSSS : Our contribution

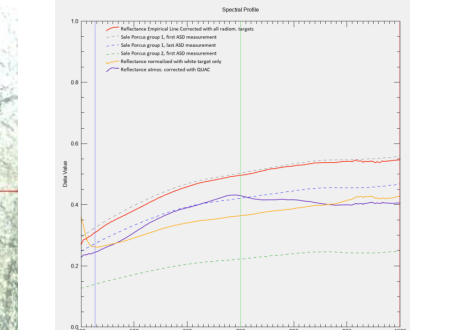
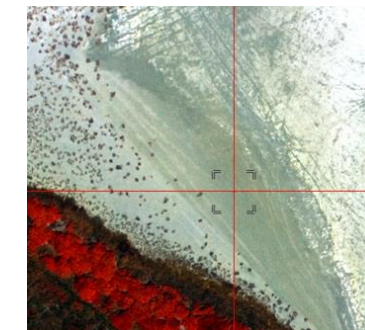
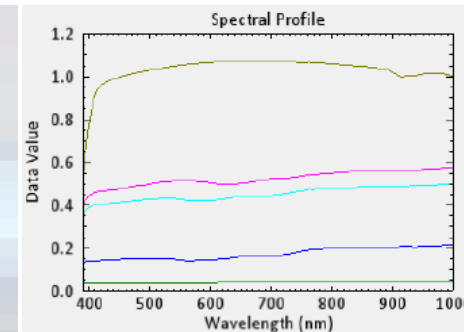
- Hyperspectral characterisation
- Hyperspectral imaging with a linear (push-broom) AISA Kestrel 10 camera by SPECIM in 380-1000 nm range.
- UAV flights 120 minutes with 8 cm pixel resolution from 80 meters.
- Radiometric calibration using ASD FieldSpec and Empirical Line Correction with the reference radiometric targets.

Resources:

Melis, Musacchio, Casu, Collu, Correa, Sedda, Silvestri, Buongiorno, Rabuffi, Andreucci, Kanuk, Gallay, Onacillova, Sasak, Naitza, Fantini, Dessì, Noli (2024). **First results of the spectral characterisation of a salt flat in Europe: the Sal 'e Porcus salty pond.** *ISPRS Archives*, Technical Commission III Mid-term Symposium on Remote Sensing. 4-8 November 2024, Belém, Brazil.



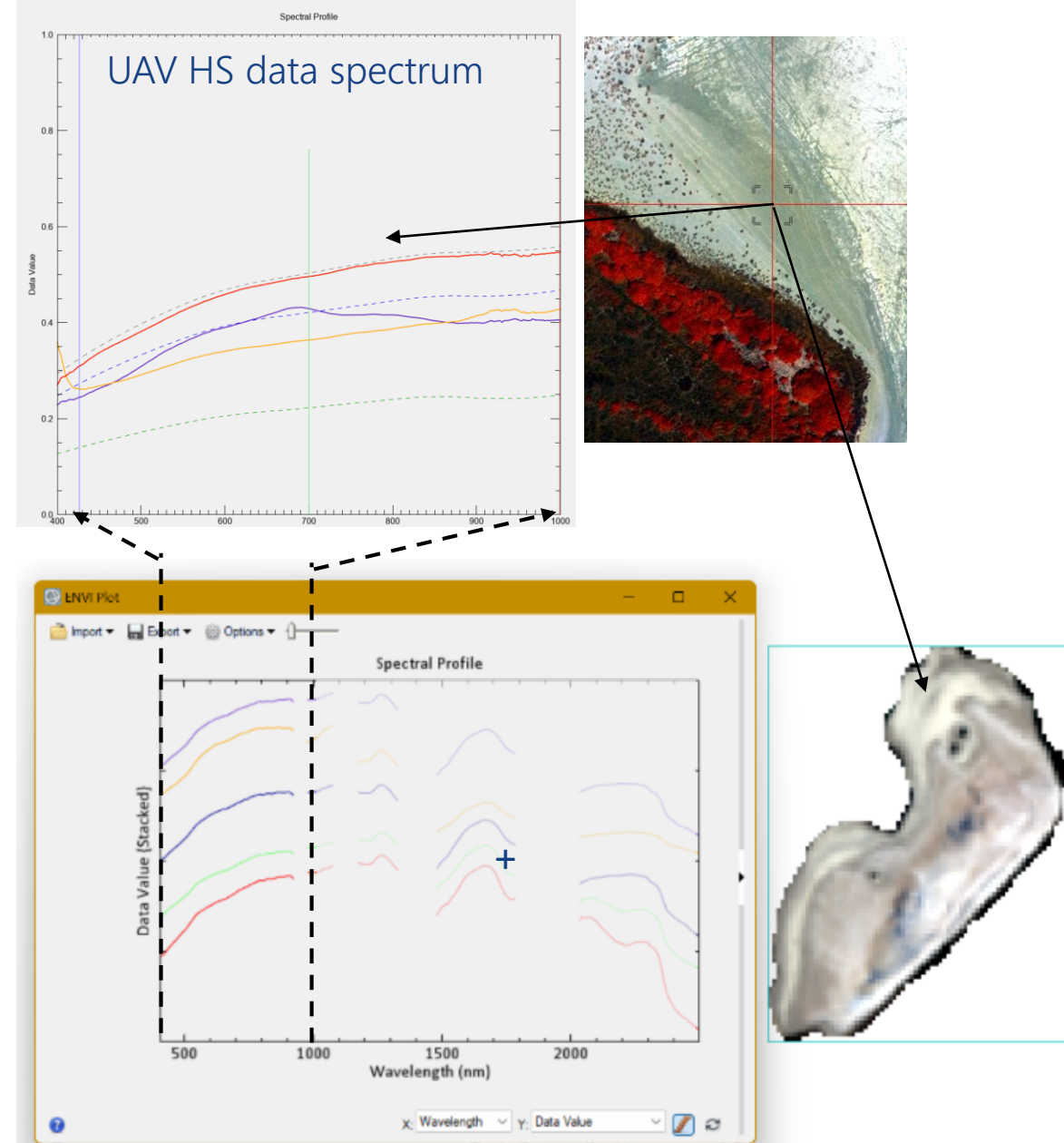
Post-processed georectified atmospherically corrected HS data. Radiance ($\text{mW} \cdot \text{cm}^{-2} \cdot \text{sr}^{-1} \cdot \mu\text{m}^{-1}$)*1000.00





Take aways

- We are a small but active research group in Eastern Slovakia
- Sal 'e Porcus is a reliable long-term calibration site.
- Flat terrain and spectral stability make the site ideal for hyperspectral calibration.
- You will get insight into UAV lidar and HS data collection
- Learn to process the airborne lidar data and classify airborne HS data



PRISMA L2D pre-processed image of the salty pond, showing different horizons

GRAZIE PER ATTENZIONE!

