

International Remote Sensing Summer School 2026 (IRSSS 2026)

Erasmus+ Blended Intensive Programme (BIP identification number: 2025-1-SK01-KA131-HED-000324321-2)

Mountain river systems dynamics from a multisensor and multiscale perspective

Venue: Stará Lesná, Tatry Mountains, Slovakia

Date: 19. 7. 2026 - 24. 7. 2026



IRSSS 2026 programme

The International Remote Sensing Summer School 2026 focuses on the dynamics of mountain river systems using remote sensing, field observation, UAV mapping, LiDAR, hyperspectral data, Structure-from-Motion photogrammetry, hydrological modelling in GIS and cloud-based satellite monitoring using Copernicus Services.

The programme combines an online preparatory session with an intensive on-site week in Stará Lesná in the High Tatras, Slovakia (<https://uge.science.upjs.sk/irsss2026>). It is organised as an Erasmus+ Blended Intensive Programme and brings together students, lecturers and experts from partner universities, scientific institutions, professional organisations and selected self-funded participants from abroad.

The summer school is designed to provide participants with practical experience in multisensor and multiscale environmental analysis, with emphasis on mountain river corridors, geomorphic processes, vegetation structure, spectral information, surface modelling and satellite-based monitoring.

Institutional Participation and Teaching Team

The International Remote Sensing Summer School 2026 is organised as an Erasmus+ Blended Intensive Programme coordinated by Pavol Jozef Šafárik University in Košice. The programme brings together students, lecturers and experts from partner universities, collaborating organisations and selected self-funded participants from institutions outside the formal Erasmus+ BIP partnership.

Erasmus+ BIP Partner and Participating Student Institutions

Institution	Country	Number of participants
Babeş-Bolyai University	Romania	7
Palacký University Olomouc	Czechia	6
Czech University of Life Sciences Prague	Czechia	4
Charles University	Czechia	4
University of Cagliari	Italy	3
University of Ostrava	Czechia	2
Ştefan cel Mare University of Suceava	Romania	2



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Self-Funded Participant Institutions

Institution	Country	Number of participants
Korea Environment Institute	South Korea	1
University of Siena	Italy	1

The summer school includes 30 participants from 9 institutions and 5 countries. Most participants are represented through institutions involved in the Erasmus+ Blended Intensive Programme framework. In addition, participants from the Korea Environment Institute and the University of Siena take part as self-funded participants. Their participation broadens the international profile of the summer school but does not change the formal Erasmus+ BIP partnership structure.

Lecturers and Teaching Team

The IRSSS 2026 programme will be delivered by an international teaching team representing the partner institutions of the Erasmus+ Blended Intensive Programme.

assoc. prof. Michal Gallay - Pavol Jozef Šafárik University in Košice, Slovakia

Programme coordinator

Michal specialises in GIS, remote sensing, UAV mapping, LiDAR and high-resolution spatial analysis of landscape processes. In the summer school, he coordinates the programme and contributes to the integration of field observations, UAV data, LiDAR, hyperspectral data and GIS-based analysis.

Dr. Katarína Onačillová - Pavol Jozef Šafárik University in Košice, Slovakia

Katarína focuses on remote sensing, hyperspectral data processing and environmental applications of geospatial technologies. Her contribution to the programme is linked mainly to UAV hyperspectral data processing and image classification.

Dr. Michaela Nováková - Pavol Jozef Šafárik University in Košice, Slovakia

Michaela works in geoinformatics and remote sensing, with experience in LiDAR point cloud processing and spatial data analysis. In the programme, she supports practical sessions focused on geospatial data processing, visualisation and interpretation.

Dr. Ján Šašák - Pavol Jozef Šafárik University in Košice, Slovakia

Ján specialises in high-resolution 3D mapping using terrestrial laser scanning, UAV photogrammetry and LiDAR-based methods. His expertise supports the programme components focused on point clouds, terrain modelling and detailed spatial analysis.

prof. Jaroslav Hofierka - Pavol Jozef Šafárik University in Košice, Slovakia

Jaroslav is an expert in GIS, geospatial modelling, terrain analysis and open-source GIS, including GRASS GIS. In the summer school, he leads the hydrological modelling component focused on surface runoff simulation using r.sim.water.

Dr. Jozef Šupinský - Pavol Jozef Šafárik University in Košice, Slovakia

Jozef is a research assistant at UPJŠ with expertise in terrestrial LiDAR mapping of caves, 3D speleology and environmental 3D modelling. In the summer school, he will support hydrological modelling

component, especially the practical work with high-resolution terrain data and GIS-based runoff simulation.

prof. Maria Teresa Melis - University of Cagliari / UNICA, Italy

Maria Teresa is a geomatics and remote sensing expert with experience in environmental monitoring, satellite data analysis and thematic information extraction. Her contribution focuses on Sentinel-2 applications, GIS-based image interpretation and remote sensing workflows for environmental analysis.

Dr. Massimo Musacchio - Istituto Nazionale di Geofisica e Vulcanologia / INGV, Italy

Massimo works in remote sensing for environmental and geological applications, with expertise in field spectroscopy, multispectral and hyperspectral data, and geophysical contexts. In the programme, he contributes to hyperspectral remote sensing, radiometric calibration and field spectrometry.

Dr. Federico Rabuffi - Istituto Nazionale di Geofisica e Vulcanologia / INGV, Italy

Federico specialises in Earth Observation and the processing of multi- and hyperspectral and thermal data for geological and environmental applications. His teaching contribution focuses on hyperspectral satellite data analysis and remote sensing workflows for geological applications.

Dr. Miloš Rusnák - Institute of Geography, Slovak Academy of Sciences, Slovakia

Miloš is a fluvial geomorphologist specialising in river-channel dynamics, UAV-based mapping, Structure-from-Motion photogrammetry and GIS analysis of river systems. In the programme, he contributes to the study-area interpretation, river morphology fieldwork and UAV-SfM processing.

Dr. Lukáš Michaleje - Institute of Geography, Slovak Academy of Sciences, Slovakia

Lukáš works in physical geography and geomorphology, with expertise relevant to river systems, field documentation and spatial analysis of geomorphic processes. In the summer school, he contributes to UAV-SfM processing, river morphology analysis and sediment-related interpretation.

assoc. prof. Ján Kaňuk - PHOTOMAP, s.r.o., Slovakia

Ján specialises in professional geospatial data acquisition, UAV and airborne LiDAR mapping, photogrammetry and high-resolution 3D landscape modelling. His contribution links academic training with professional mapping workflows, including flight planning, LiDAR acquisition, quality control and geodata products.

Dr. Daniel Paluba - Charles University, Czechia

Daniel specialises in Earth Observation, satellite image time series, SAR data, machine learning and forest change detection. In the programme, he leads the cloud-based satellite monitoring component using platforms such as Google Earth Engine and Copernicus data services.

What to Bring

Most of the IRSSS 2026 programme will take place indoors at the hotel, including lectures, hands-on exercises and data processing sessions. However, the programme also includes short outdoor field activities near the river and along field roads. Participants should therefore be prepared for changing mountain weather conditions.

Participants are advised to bring:

- **Comfortable outdoor shoes** suitable for approximately two hours of walking on field roads and near a river. Mountain hiking boots are not required, but shoes should be stable and suitable for uneven or wet ground.
- **Weather-appropriate outdoor clothing**, as conditions may change quickly during the day.
- **Rain jacket or rain cover**, especially for outdoor sessions and field demonstrations.
- **Sun protection**, including sunscreen and sunglasses.
- **Head cover**, such as a cap or hat, for sun, wind or light rain.
- **Warm layer**, as temperatures may drop to around **10°C**, especially in the morning or during bad weather.
- **Light summer clothing**, as temperatures may also reach around **30°C**.
- **Reusable water bottle** for field activities and indoor sessions.

Participants should be prepared for a combination of **sun, wind, rain and rapid temperature changes**. The outdoor activities are not planned as demanding mountain hikes, but basic field readiness is necessary.

Software and Online Account Requirements

Participants are required to bring their own laptop and install the necessary software before the start of the on-site programme. Some tools will be used during hands-on exercises; therefore, participants should install and test them before travelling to Stará Lesná. **Windows-based laptops are recommended for smooth completion of all tasks.**

Software to install before the summer school

Agisoft Metashape Trial Version - Required for UAV-SfM photogrammetry processing. Please install it before Sunday, 19 July 2026. <https://www.agisoft.com/downloads/installer/>: Windows installer: https://download.agisoft.com/metashape_2_3_1_x64.msi

QGIS - Required for GIS data visualisation, satellite image exploration, and selected hands-on remote sensing exercises. <https://www.qgis.org/download/>
Windows installer: <https://download.qgis.org/downloads/QGIS-OSGeo4W-3.44.11-1.msi>

GRASS GIS - Required for hydrological simulation, including the use of r.sim.water. GRASS 8.5.0 (current): <https://grass.osgeo.org/download/windows/>,
Windows installer: <https://download.osgeo.org/osgeo4w/v2/osgeo4w-setup.exe>

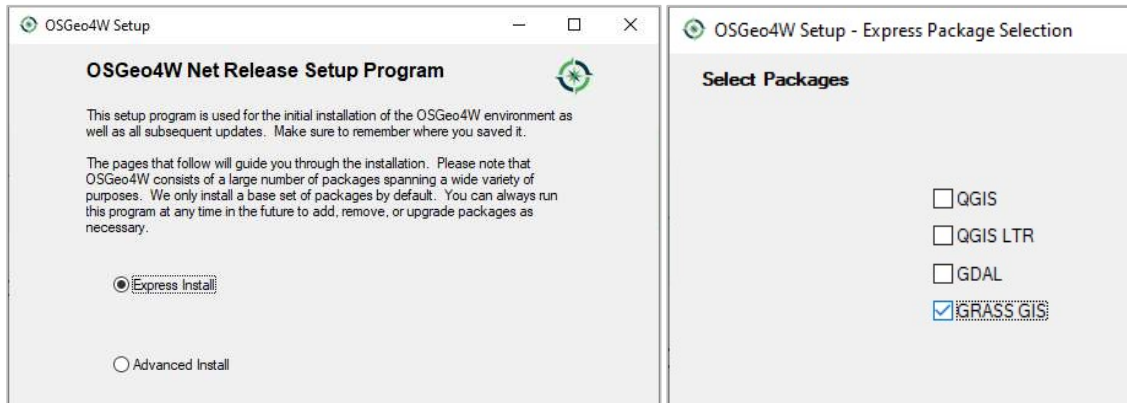
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LAStools - Required for selected LiDAR point cloud processing tasks, including classification and derivation of DTM, DSM and CHM products. Please download LAStools from <https://downloads.rapidlasso.de/LAStools.zip> and unzip it to C:\LAStools. (or D:\LAStools). No standard installation is required. LAStools can be used from the command line and, if needed, through the QGIS Processing toolbox: <https://rapidlasso.de/lastools-as-qgis-plugin/>

MultiSpec - Required for multispectral and hyperspectral image classification exercises.

https://engineering.purdue.edu/~biehl/MultiSpec_Apps/MultiSpecWin64wxz.exe

Online accounts to create before the summer school

Google Earth Engine - Please register for Earth Engine access, open the Code Editor and check that your account works. If requested, create or link a Google Cloud project.

<https://earthengine.google.com/signup/> or <https://console.cloud.google.com/earth-engine/welcome>

Copernicus Browser / Copernicus Data Space Ecosystem

Please create an account, verify it by email, log in and check that you can search for Sentinel-1 or Sentinel-2 data. <https://browser.dataspace.copernicus.eu/> (click login – register)

These accounts will be required for the practical exercises on cloud-based satellite monitoring and Copernicus data access. Please complete this task before arrival and bring your login credentials with you.

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Monday 6 July 2026 18:00-20:00	Virtual Component – Online session Duration: 2 hours Led by Michal Gallay and the UPJŠ team
Time	Programme item
0:00–0:10	Welcome, online connection and technical check
0:10–0:25	Introduction to IRSSS 2026: aims, topic and structure
0:25–0:45	Scientific background: mountain river systems from a multisensor and multiscale perspective
0:45–1:05	Overview of methods and data sources used during the summer school
1:05–1:20	Study area, fieldwork concept and planned on-site workflow
1:20–1:40	Practical preparation: software, laptops, datasets, field equipment, accommodation and transportation
1:40–1:50	Assignment, attendance and 3 ECTS requirements
1:50–2:00	Q&A and next steps before arrival in Stará Lesná



IRSSS 2026 physical component programme 19-24 July 2026

Sunday 19 July 2026 Starting at 17:00		Arrival and Orientation, IRSSS 2026 on-site programme opening
Time	Programme item	Responsible persons
15:00–17:00	Arrival, check-in and registration of participants	UPJŠ organising team
17:00–17:10	Welcome and opening of the on-site part of IRSSS 2026	Michal Gallay / UPJŠ
17:10–17:30	Introduction to IRSSS 2026: aims, structure of the week and expected outcomes	Michal Gallay
17:30 –18:50	Partner institution introductions (10 min each + 5 min each partner for individual introduction of lecturers and organising team (15 min x 5 partners)	UPJŠ, UNICA, INGV, GÚ SAV, Photomap + all lecturers and organisers
18:50–19:00	Practical information: accommodation, meals, rooms, communication, contacts, safety basics and next-day arrangements	UPJŠ organising team
19:00–19:10	Welcome drink and formation of quiz groups	UPJŠ organising team
19:10–19:55	Ice-breaker quiz in mixed participant groups Quiz answers, short wrap-up	UPJŠ organising team
20:15–21:00	Welcome dinner	all
after 21:00	Informal networking	optional



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Monday, 20 July 2026		
Study Area and Remote Sensing Context		
Lead institution(s): UPJŠ / GÚ SAV / INGV / UNICA		
Time	Programme item	Lecturer(s) / Institution
7:00-8:00	Breakfast	
08:30 – 8:40	Opening of the first working day and field plan	Michal Gallay / UPJŠ
08:40–09:20	Participant introductions	all participants
09:20–9:50	Study area introduction: High Tatras and mountain river systems	Miloš Rusnák / GÚ SAV + UPJŠ
9:50–10:00	Field trip briefing: route, safety and organisation	UPJŠ + GÚ SAV
10:15–13:15	Field trip: river morphology, riparian zones, river study section and High Tatras landscape context Field task for organisers: collect suitable rock or plant-surface samples larger than 3 × 3 cm, preferably with a smooth surface, for spectral measurements.	GÚ SAV + UPJŠ
13:15–15:00	Lunch break rest	all
15:00–16:00	Basics of remote sensing: principles, platforms, sensors, resolution and environmental applications	Massimo Musacchio / INGV
16:00–16:15	Coffee break	all
16:15–17:30	Sentinel-2 applications for river corridors or forest fire pre-/post-event management: lecture and QGIS hands-on exercise	Maria Teresa Melis / UNICA
17:30–18:00	Preview of working datasets, from field trip observations to remote sensing interpretation (optional if there is time)	Michal Gallay
18:00–18:30	Wrap-up and preparation for Tuesday	UPJŠ organising team
19:00–20:00	Dinner	all
19:30–20:15 20:15–21:00	Optional visit of the Astronomical Institute (5 min walk) - telescope and meteorological station, two groups max. 20 people each group.	Astronomical Institute SAS



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Tuesday, 21 July 2026	Hyperspectral Remote Sensing and Field Spectrometry	
	Lead institution(s): INGV / UPJŠ	
Time	Programme item	Lecturer(s) / Institution
07:00–08:30	Breakfast	all
08:45–09:00	Opening of the day and explanation of group rotation	UPJŠ team
09:00–10:00	Introduction to hyperspectral remote sensing , field spectroscopy, from DN to reflectance: radiometric calibration, types of atmospheric correction, HS geological applications	Massimo Musacchio / INGV + Federico Rabuffi / INGV
10:00–12:15	Group A: Field spectrometry exercise (outdoor) : spectral measurements, targets, reference spectra and field protocols	Massimo Musacchio / INGV
10:00–12:15	Group B: Hyperspectral satellite data exercise : Remote Sensing for Geological Applications	Federico Rabuffi / INGV
12:30–13:30	Lunch break	all
14:00–16:15	Group A: Hyperspectral satellite data exercise : Remote Sensing for Geological Applications	Federico Rabuffi / INGV
14:00–16:15	Group B: Field spectrometry exercise (outdoor) : spectral measurements, targets, reference spectra and field protocols	Massimo Musacchio / INGV
16:15–16:30	Coffee break	all
16:30–17:30	UAV hyperspectral data processing and simple classification in MultiSpec	Katarína Onáčillová / UPJŠ
17:30–18:00	Joint wrap-up: from field spectra to spectral library and hyperspectral image classification	Massimo Musacchio + Federico Rabuffi / INGV
18:00–18:30	Wrap-up and preparation for Wednesday	Michal Gallay / UPJŠ
19:00–20:00	Dinner	All



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Wednesday, 22 July 2026	UAV Photogrammetry (SfM), LiDAR, Hyperspectral Mapping	
	Lead institution(s): UPJŠ / PHOTOMAP / GÚ SAV	
Time	Programme item	Lecturer(s) / Institution
07:00–08:30	Breakfast	all
08:30–09:00	Lecture: UAV hyperspectral mapping system: DJI Agras T30, SPECIM camera, flight planning, spectral/spatial binning, IMU, calibration and image rectification, UAV lidar Riegl VUX-1	UPJŠ team
09:00–09:30	Lecture: UAV LiDAR mapping system: DJI L2 workflow, RTK/GNSS, IMU, trajectory, scan geometry, flight planning and expected products	Ján Kaňuk / Photomap
9:30–10:00	Lecture: UAV-SfM mapping workflow and field demonstration briefing: image acquisition strategy, safety, group rotation, equipment logistics and walk to the meadow site	GÚ SAV team + Photomap
10:00–10:20	Lecture: Joint safety briefing at the meadow: flight area, participant observation zone, no-go zone, pilot roles and emergency procedure	UPJŠ team + Photomap
10:20 – 10:30	Walk to the demonstration site	all
10:30–10:50	Joint UAV-SfM flight demonstration in the field	Photomap or GÚ SAV
10:50–11:10	Joint UAV LiDAR DJI L2 flight demonstration in the field	Photomap
11:10–11:30	Joint UAV DJI Agras T30 hyperspectral flight demonstration	UPJŠ team
11:30–11:40	Short break and division into three rotating groups to explain details of the UAV missions and sensors in the field	all
11:40–12:10	Rotation 1: Group A – LiDAR station; Group B – hyperspectral station; Group C – SfM station	UPJŠ team / Photomap / GÚ SAV
12:10–12:40	Rotation 2: Group A – hyperspectral station; Group B – SfM station; Group C – LiDAR station	UPJŠ team / Photomap / GÚ SAV

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Wednesday, 22 July 2026			UAV Photogrammetry (SfM), LiDAR, Hyperspectral Mapping Lead institution(s): UPJŠ / PHOTOMAP / GÚ SAV
Time	Programme item	Lecturer(s) / Institution	
12:40–13:10	Rotation 3: Group A – SfM station; Group B – LiDAR station; Group C – hyperspectral station	UPJŠ team / Photomap / GÚ SAV	
13:10–13:20	Return to Hotel Academia	all	
13:20–14:00	Lunch break	all	
14:00–15:45	Hands-on LiDAR processing in LAsTools and QGIS: point cloud classification, DTM, DSM, CHM and terrain/river-corridor visualisation, geomorphometry	UPJŠ team	
15:45–16:00	Coffee break	all	
16:00–17:00	Professional LiDAR mapping workflow: flight strips, strip adjustment, accuracy control and large-area mapping campaigns	Ján Kaňuk / Photomap	
17:00–17:40	Commercial airborne and satellite geodata products: sensors, acquisition planning, product levels and use cases	Ján Kaňuk / Photomap	
17:40–18:00	Wrap-up: from UAV field demonstration to professional mapping workflows and preparation for Thursday	UPJŠ organising team / Photomap	
19:00–20:00	Dinner	all	



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Thursday, 23 July 2026	UAV-SfM, Image-Based River Morphology Analysis and DEM-Based Runoff Modelling Lead institution(s): GÚ SAV / UPJŠ	
Time	Programme item	Lecturer(s) / Institution
07:00–08:30	Breakfast	all
09:00–09:10	Opening of the day and explanation of the programme	Michal Gallay/UPJŠ
09:10–09:40	UAV-SfM for river morphology mapping: principles, image acquisition logic, overlap, GCPs/checkpoints, accuracy and limitations.	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
09:40–10:25	Hands-on SfM processing: UAV-SfM survey of the river section – image block, GCP layout, acquisition parameters, field documentation and expected outputs – initial processing and bundle adjustment	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
10:25–10:40	Coffee break	all
10:40–12:00	Hands-on SfM processing: dense point cloud, DSM/DTM and orthomosaic generation from prepared imagery	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
12:00–13:00	Lunch break	all
13:00–13:30	Quality assessment and reproducibility: GCP residuals, checkpoints, artefacts, resolution effects, metadata and processing parameters	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
13:30–14:30	Image-based sediment analysis: sediment surface texture and grain-size extraction from photos / orthomosaic + bathymetry	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
14:30 – 15:00	SfM – open source for data processing – short example	Miloš Rusnák, Lukáš Michaleje / GÚ SAV
15:00–15:15	Coffee break	all
15:15–16:00	Application of high-resolution DEMs in GRASS GIS: surface runoff simulation using r.sim.water	Jaroslav Hofierka / UPJŠ
16:00–17:45	Hands-on exercise in GRASS: Interpretation of modelling outputs: water depth, flow velocity, accumulation patterns, terrain controls and limitations	Jaroslav Hofierka, Jozef Šupinský / UPJŠ
17:30–18:00	Final synthesis: from UAV-SfM products to sediment analysis and DEM-based hydrological modelling	GÚ SAV + UPJŠ



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	Lead institution(s): GÚ SAV / UPJŠ	
Time	Programme item	Lecturer(s) / Institution
19:00–20:00	Dinner	all
Friday, 24 July 2026	Cloud-Based Satellite Monitoring and Final Synthesis	Lecturer(s) / Institution
	Lead institution(s): Charles University / UPJŠ	
07:00–08:30	Breakfast	all
09:00–09:10	Opening of the final day: from local UAV/field workflows to landscape-scale satellite monitoring	Michal Gallay / UPJŠ
09:10–10:00	Introduction to cloud-based geospatial platforms for global remote sensing , satellite embeddings, and forest change detection in mountain environments	Daniel Paluba / Charles University
10:00–10:30	Hands-on cloud-based remote sensing: Copernicus Browser / GEE exercise: forest change detection using Sentinel-1/Sentinel-2 time series;	Daniel Paluba / Charles University
10:30–10:45	Coffee break	all
10:45–12:00	Hands-on cloud-based remote sensing: Copernicus Browser / GEE exercise: Interpretation of outputs: disturbance patterns, forest change, uncertainty and transferability	Daniel Paluba / Charles University
12:00–13:00	Lunch break	all
13:00–13:30	Final synthesis of the summer school: from field observation to UAV, LiDAR, hyperspectral, SfM, modelling and satellite workflows	Michal Gallay / UPJŠ
13:30–13:45	Individual assignment guidance: 6–8 slide PDF structure, submission and 3 ECTS requirements	UPJŠ team
13:40–14:00	Closing of IRSSS 2026	UPJŠ organising team

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Weather contingency: Field visits, UAV demonstrations and astronomical observation will take place only under suitable weather conditions. If weather conditions are not suitable, the activities will be replaced by indoor demonstrations, prepared datasets, videos, maps, sensor setup explanations and hands-on processing exercises. The final decision will be made by the organisers on the relevant day.

Original activity

Alternative in case of bad weather

Monday field trip to the river section / High Tatras landscape walk

Indoor study-area session using maps, UAV imagery, LiDAR products, photos and short interpretation exercises

Wednesday UAV flight demonstration

Indoor technical demonstration of UAV platforms, sensors, RTK base, flight plans, calibration workflow, sample trajectories and prepared datasets

Wednesday rotating field stations

Indoor rotating stations: LiDAR system, hyperspectral system, SfM workflow, using equipment setup and sample data



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