COURSE DESCRIPTION

Drone Applications in Geosciences

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	**Babeş-Bolyai University**
1.2. Faculty	**Biology and Geology**
1.3. Doctoral Shool	**Theoretical and Applied Geology**
1.4. Field of study	**Geology**
1.5. Level of study	**Doctoral**

2. Course-related data

2.1. Course title	**Drone Applications in Geosciences**			Course code	**SDG10**
2.2. Course coordinator	Şef lucr. dr. habil. Dan Mircea Tămaş				
2.3. Seminar coordinator	Şef lucr. dr. habil. Dan Mircea Tămaş				
2.4. Year of study	1	2.5. Semester	2	2.6. Type of assessment	Progress check
2.7. Course status	Optional			2.8. Course type	Core subject

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	**4**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**2**
3.4. Total of hours in the curriculum	**48**	of which: 3.5. course	**24**	3.6. seminar/ laboratory	**24**
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					25
Additional research in the library, on subject-specific electronic platforms, and on-site					20
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					13
Tutoring (professional guidance)					2
Examinations					3
Other activities: two-way communication with the course coordinator					2
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**65**	
3.8. Total hours per semester				**113**	
3.9. Number of credits				**10**	

4. Prerequisites (where applicable)

4.1. curriculum-related	
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	Classroom equipped with a video projector, internet access, and specialized software.
5.2. seminar/laboratory-related	Computer laboratory; flight simulation software; drones and photogrammetric, LiDAR, and thermal sensors.

6. Subject-specific learning outcomes

Knowledge
1. Understands advanced concepts, theories, and models in the field of remote sensing.
2. Understands the scientific methodology applied to UAV remote sensing (photogrammetry, LiDAR, multispectral, etc.).

3. Understands monitoring and reporting tools.
4. Knows emerging research techniques and solutions.
5. Knows standards for scientific documentation.
6. Knows international academic terminology.
7. Knows digital tools and advanced AI applications.
8. Knows the principles of risk and crisis management.
Skills
1. Integrates theoretical and practical concepts to develop innovative geospatial solutions.
2. Uses data processing and interpretation techniques.
3. Applies risk assessment techniques and performance optimization strategies.
4. Applies new methods and solutions to complex problems.
5. Documents and synthesizes relevant scientific information.
6. Writes and formulates complex ideas in international contexts.
7. Uses digital tools and AI for analysis and modeling.
8. Evaluates risks in projects and research activities.
Responsibility and autonomy
1. Works autonomously in investigating and expanding knowledge.
2. Takes responsibility for the accuracy of applied procedures.
3. Takes responsibility for the success of the project.
4. Takes responsibility for decisions related to the implementation of new solutions.
5. Takes responsibility for the accuracy of information.
6. Works autonomously in international academic communication.
7. Works autonomously in applying digital technologies.
8. Takes responsibility for decisions regarding risk management.

7. Contents

7.1. Course	**Teaching and learning methods**	**Remarks[1]**
Introduction to the use of drones in Geosciences.	Lectures combined with active-participatory methods; debate.	4 hours
Drone construction and sensor integration.		2 hours
Characteristics of unmanned aerial vehicles (UAVs).		2 hours
Legislation and certification in Romania and the European Union; ethics and GDPR.		2 hours
Flight safety and LiPo battery management.		2 hours

[1] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

Acquisition and processing of photogrammetric data.		5 hours
Acquisition and processing of LiDAR data.		5 hours
The future of UAV technologies in Geosciences.		2 hours

Bibliography

Bond, C.E., Cawood, A.J. 2021. A role for virtual outcrop models in blended learning – improved 3D thinking and positive perceptions of learning, Geosci. Commun., 4, 233–244, https://doi.org/10.5194/gc-4-233-2021
Hodgetts, D., 2013. Laser scanning and digital outcrop geology in the petroleum industry: A review. Marine and Petroleum Geology, v. 46, p. 335-354. https://doi.org/10.1016/j.marpetgeo.2013.02.014
Jones, R.R., McCaffrey, K.J.W., Wilson, R.W., Holdsworth, R.E., 2004, Digital field data acquisition: towards increased quantification of uncertainty during geological mapping: Geological Society, London, Special Publications, v. 239, p. 43-56, https://doi.org/10.1144/GSL.SP.2004.239.01.04
Tamas, D. M., Tamas, A., Barabasch, J., Rowan, M. G., Schleder, Z., Krézsek, C., Urai, J. L. 2021. Low-angle shear within the exposed Mânzălești diapir, Romania: Salt decapitation in the Eastern Carpathians fold-and-thrust belt. Tectonics, 40, e2021TC006850, https://doi.org/10.1029/2021TC006850
Tamas, A., Holdsworth, R, Tamas, D.M., Dempsey, E., Hardman, K., Bird, A., Underhill, J.R., McCarthy, D., McCaffrey, K.J.W. and Selby, D., 2023, Using UAV-Based Photogrammetry Coupled with In Situ Fieldwork and U-Pb Geochronology to Decipher Multi-Phase Deformation Processes: A Case Study from Sarclet, Inner Moray Firth Basin, UK. Remote Sensing, 15, 695, 1-22. https://doi.org/10.3390/rs15030695
Tavani, S., Corradetti, A., Mercuri, M., Seers, T. 2024. Virtual outcrop models of geological structures. From the construction of photogrammetric 3D models to their application towards the analysis of geological structures. Società Geologica Italiana, Roma, 92 p. ISBN 978-88-944844-6-5, https://doi.org/10.3301/MON.2024.01
https://www.easa.europa.eu/en/domains/civil-drones
https://www.caa.ro/ro/pages/drone

7.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
Flight simulators and UAV mission planning.	Practical work, discussions, and exercises.	4 hours
Exercises for A1/A3 and A2 certifications.		3 hours
Acquisition of photogrammetric data in the field / indoors.		5 hours
Data processing and generation of digital models.		3 hours
Acquisition and processing of LiDAR data.		5 hours
Use of specialized sensors (multispectral, thermal, etc.).		4 hours

Bibliography

Bond, C.E., Cawood, A.J. 2021. A role for virtual outcrop models in blended learning – improved 3D thinking and positive perceptions of learning, Geosci. Commun., 4, 233–244, https://doi.org/10.5194/gc-4-233-2021
Hodgetts, D., 2013. Laser scanning and digital outcrop geology in the petroleum industry: A review. Marine and Petroleum Geology, v. 46, p. 335-354. https://doi.org/10.1016/j.marpetgeo.2013.02.014
Jones, R.R., McCaffrey, K.J.W., Wilson, R.W., Holdsworth, R.E., 2004, Digital field data acquisition: towards increased quantification of uncertainty during geological mapping: Geological Society, London, Special Publications, v. 239, p. 43-56, https://doi.org/10.1144/GSL.SP.2004.239.01.04
Tamas, D. M., Tamas, A., Barabasch, J., Rowan, M. G., Schleder, Z., Krézsek, C., Urai, J. L. 2021. Low-angle shear within the exposed Mânzălești diapir, Romania: Salt decapitation in the Eastern Carpathians fold-and-thrust belt. Tectonics, 40, e2021TC006850, https://doi.org/10.1029/2021TC006850
Tamas, A., Holdsworth, R, Tamas, D.M., Dempsey, E., Hardman, K., Bird, A., Underhill, J.R., McCarthy, D., McCaffrey, K.J.W. and Selby, D., 2023, Using UAV-Based Photogrammetry Coupled with In Situ Fieldwork and U-Pb Geochronology to Decipher Multi-Phase Deformation Processes: A Case Study from Sarclet, Inner Moray Firth Basin, UK. Remote Sensing, 15, 695, 1-22. https://doi.org/10.3390/rs15030695
Tavani, S., Corradetti, A., Mercuri, M., Seers, T. 2024. Virtual outcrop models of geological structures. From the construction of photogrammetric 3D models to their application towards the analysis of geological structures. Società Geologica Italiana, Roma, 92 p. ISBN 978-88-944844-6-5, https://doi.org/10.3301/MON.2024.01
https://www.easa.europa.eu/en/domains/civil-drones
https://www.caa.ro/ro/pages/drone

8. Evaluation

Type of activity	8.1 Evaluation criteria[2]	8.2 Evaluation methods[3]	8.3 Percentage in the final grade
8.4. Course	Accuracy of UAV mission planning Quality of data processing and interpretation Compliance with safety and ethical standards Quality of the final project	Assessment of the applied project	60%
8.5. Seminar/ laboratory		Continuous laboratory assessment	40%
8.6 Minimum standard for passing			
Participation in and completion of practical laboratory activities, as well as the development of a final applied project.			

9. SDG labels (Sustainable Development Goals)[4]

	○	Sustainable Development Generic Label

								
○	○	○	○	○	○	○	○	●
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
11.05.2026

Signature of course coordinator

.....

Signature of seminar coordinator

.....

Date of approval in the department:
...

Signature of the head of department

.....

[2] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[3] Both final evaluation methods and ongoing evaluation strategies should be established.

[4] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*