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178. Curriculum for the Master's Degree Programme in "Copernicus Master in Digital Earth"
(Curriculum 2025)

Table of Contents

In its session on 17.06.2025 the Academic Senate of the Paris Lodron University of Salzburg enacted the curriculum for the English Master's degree programme "Copernicus Master in Digital Earth (CDE)" formally approved by the curriculum commission "Geoinformatik" of the University of Salzburg in its session on 02.06.2025 in the following version.

The legal basis for the curriculum is the Federal Act on the Organisation of Universities and their Studies (Universities Act 2002 – UG), Federal Law Gazette I No. 120/2002, as well as the section of the Statutes of the University of Salzburg pertaining to university studies, in the applicable version.

§ 1 General provisions

(1) The total number of ECTS credit points necessary to complete a degree in the Master's programme Copernicus Master in Digital Earth is 120. This corresponds to four semesters of study.

(2) Graduates of the Erasmus Mundus Joint Master programme Copernicus Master in Digital Earth will be awarded the academic title "Master of Science", abbreviated "MSc", issued by University of Salzburg (PLUS), Austria. The specialization track at UPOL (Palacký University Olomouc, Czech Republic) or UBS (University of South Brittany, France), in accordance with the joint curriculum, will be listed on the graduation documents. The joint Master's programme includes an international study experience by design and is aligning with the criteria of a European Degree in collaboration with partner universities.

(3) The precondition for the admission to the Master's degree programme Copernicus Master in Digital Earth is the completion of a relevant Bachelor's degree programme or of another relevant degree programme of at least the same higher educational level at a recognised domestic or foreign post-secondary institute of education (cf. § 64 para. 3 UG).

(4) The selection of candidates for the Master's programme CDE is made based on the application supporting documents. A detailed description of the process can be found in the Annex III. Application procedure.

(5) To compensate for significant subject-related differences in equivalency the students may be required to complete supplementary examinations worth up to 45 ECTS credit points; these supplementary examinations must be completed by the end of the second semester of the Master's programme. Only the Rectorate or a member of staff of the University of Salzburg designated by the Rectorate is authorised to decide on whether there are significant subject-related differences in equivalency.

(6) Each academic achievement to be fulfilled by students has been assigned ECTS credit points. One ECTS credit point equals 25 hours of study, which corresponds to the average number of hours required to achieve the expected learning objectives. An academic year consists of 1500 full hours corresponding to 60 ECTS credit points.

(7) Students with disabilities and / or chronic illnesses must not be subject to any form of discrimination in their studies. The guiding principles of the UN Convention on the Rights of Persons with Disabilities, the Austrian Federal Equal Treatment Act as well as the principles of compensation of disadvantage apply.

§ 2 Subject of the degree programme and qualification profile

(1) Subject of the degree programme

The Master's programme is carried out as an Erasmus Mundus Joint Master's programme coordinated by University of Salzburg, Department of Geoinformatics, Austria (PLUS), together with Palacký University Olomouc, Czech Republic (UPOL), and University of South Brittany, France (UBS), referred to as the Consortium.

Copernicus is the European Union's Earth Observation programme, looking at our planet and its environment for the ultimate benefit of all European citizens. It offers information services based on satellite Earth Observation and in situ (non-space) data. Copernicus is attributed to the discipline of Earth Observation and Geoinformatics (EO*GI), which offers highly sought-after qualifications well founded in concepts and technologies of geospatial computing, tied into inter- and multidisciplinary application domains.

The knowledge and skills acquired throughout the programme's modules are based on the common grounding of spatial sciences and a "Digital Earth" perspective, based on concepts typically acquired during undergraduate Geography, Surveying, Environmental Studies, Cartography or Planning programmes.

The Master's programme CDE aims at building advanced competences in geospatial data acquisition and data management, data analytics and simulation as well as interactive communication. Graduates are expected to interface with different spatially oriented application domains, contribute to solving problems across societies, economies, and environments as well as leading teams assigned pertinent tasks.

Graduates in particular will be qualified to work in the domains of Copernicus services and related emerging application fields in the context of monitoring and observing the atmosphere, the marine environment, the land surface, climate change and its impact, emergency response and societal security.

(2) Professional skills and competences (learning outcomes)

Geoinformatics and spatial information management have been established as a methodology-oriented, cross-disciplinary subject based on spatial concepts and approaches. Such "spatial view" competences for representing our world as a "Digital Earth" are invaluable within any subject-specific context whilst widely applicable across domains such as planning, resource management, logistics, mobility, marketing, nature and environmental protection, and security.

Graduates of this programme will be confident in using key technologies pertinent to spatial information handling and upcoming trends in the field of Copernicus, Earth Observation, Geoinformatics and Digital Earth. Graduates with a CDE Master's degree are able to answer research questions, including the development of hypotheses, definition of objectives, selection of methods, implementation of workflows, collection, analysis and interpretation of data as well as a written and oral communication and interpretation of outcomes in a decision support context.

The study programme provides application-oriented knowledge based on relevant theories and methods. Blended learning methods for critical thinking, practicing language and inter-cultural skills are an integrative part of the study programme. Discipline-specific ways of thinking in space-related research and spatial thinking, analytical skills and techniques as well as problem-solving competences are developed in core areas of Copernicus Master in Digital Earth, especially in:

- Geospatial data acquisition and spatial representations across scales;
- Advanced visualisation methods and cartographic communication;
- Data modelling and spatial data management;

- Data analytics across the spectrum of Geoinformatics and Earth Observation: georeferenced data and data streams; in-situ, remote and mobile sensing; statistics; machine learning and knowledge-based systems;
- Spatial analysis, system understanding and dynamic system simulation;
- Information extraction routines from imagery and continuous observations including cloud processing;
- Development of geospatial applications.

Graduates of the CDE programme will be able to independently plan and manage complex projects and applications in EO*GI as well as to cooperate on projects in spatial data infrastructures. The aim is to support and enhance decision-making in all application domains of Copernicus.

The study programme is challenge- and research-driven, provides a broad range of academic analysis and scientific methods, and prepares students for a doctoral degree programme. It corresponds to International Standard Classification of Education (ISCED 2011): level 7, European Qualification Framework (EQF), and National Qualification Framework (NQR): level 7.

(3) Importance and relevance of the degree for the scientific community, society, and the labour market

Graduates of the Copernicus Master in Digital Earth programme develop a focus on methodological and technical areas of expertise, thus emphasizing career perspectives in public administration (e.g., spatial data management and EO*GI services and application development, as well as in application domains such as in spatial planning, regional management, mobility, environment and nature conservation) and in business across a broad spectrum of industries. The study programme covers all areas of EO and geospatial data collection and data management, spatial analytics, communication of results and spatial decision support, interaction with stakeholders, as well as transversal aspects of project management. Graduates have special career opportunities through compulsory work placements, and an increased awareness of novel application areas in the emerging EO*GI sector.

Graduates of the Master's programme Copernicus Master in Digital Earth often pursue careers in the following occupational fields:

- Geospatial (EO*GI) technology companies: Working as Geographic Information Systems or Remote Sensing Data Engineer, EO Data Scientist, Geospatial Developer, Remote Sensing Analyst, GIS Specialist, EO*GI Research Software Engineer, Cartographer, etc.
- Public administration: Positions in (geo)spatial data management, Earth Observation or Geographic Information Systems & Science.
- Non-profit sector: Working for NGOs or international organisations [e.g. Médecins Sans Frontières (MSF) for Geohumanitarian actions, Geospatial Information Systems consultant for United Nations Development Programme (UNDP), UN World Food Programme (WFP) Remote Sensing expert for forest monitoring tasks, etc.
- Policy consulting: Advising on policies related to (geo)spatial data, GeoAI and Big Earth Data, data privacy and sharing, market research, or contributing to Sustainable Development Goals (SDG), etc.
- Consultancy: (Geo)spatial data expert in BIG Earth Data, Surveying, GIS, Construction, Property, Urban and Regional Planning or natural hazard, GIS solutions for sustainable urban development, etc.
- Start-up or SME: (Geo)spatial startups and SME's which contribute to construction of innovative economies and stimulate economic growth in the field.

§ 3 Structure of the programme

The Master's programme Copernicus Master in Digital Earth comprises 7 modules with a total number of 75 or 81 ECTS credit points. In addition, 6 or 12 ECTS credit points are assigned for free elective courses (FEC) and 12 or 18 ECTS credit points for an obligatory work placement. The Master's thesis is worth 18 ECTS credit points, and the Master's exam 3 ECTS credit points. A research-based Master's thesis can be chosen in the context of a collaborative research work placement at a consortium partner or at any institution worldwide. The Master's thesis is completed in collaboration with partner universities.

The first academic year at PLUS includes the modules B1-B5, with a total of 42 ECTS credit points. These modules provide profound EO*GI application-oriented expertise based on relevant theories and methods. The Orientation Project (B1, 6 ECTS credit points) offers courses from Copernicus in Digital Earth, spatial thinking, scientific writing to ePortfolio and career development. The two major modules B3 and B5 (12 ECTS credit points each) focus on Digital Earth Observation and Technologies (B3); Integrated Applications (B5), deepens software and application development expertise and enhances skills in project management.

Short Intensive Programmes (B6, 9 or 3 ECTS credit points), such as blended learning courses, international summer schools, conferences, or workshops integrate the student cohort across partners and offers placement options beyond the consortium.

Alternative specialization tracks (GeoData Science vs. Geovisualisation and Geocommunication) with 30 ECTS credit points are completed at one of the designated partner universities in semester 3, typically leading to a Master's thesis in line with the respective track and co-supervised at this partner university. Geovisualisation and Geocommunication (GeoVIS) specializes in geovisualisation, geocommunication and application development, including cartography and design in geovisualisation, web and cognitive cartography, 3D visualisation, and advanced visualisation methods at Palacký University Olomouc (Czech Republic), Faculty of Science, Department of Geoinformatics. GeoData Science (GeoDSc) and Artificial Intelligence (AI) for EO specializes in Computer Science / Data Science including computer vision, machine learning and big data with a focus on data analytics for Earth Observation at the University of South Brittany (France), Computer Science Department, OBELIX team of IRISA (Institute for Research in Computer Science and Random Systems), France.

The obligatory skills-based internship typically is conducted in blocked mode (1 or 2 periods) outside of course (semester) periods but also can be completed as equivalent part-time activity. A research-based Master's thesis chosen in the context of a collaborative research / work placement at a consortium partner or at any institution worldwide including non-academic organisations must be confirmed by the Programme Board until the end of the first semester. Throughout the programme a personal portfolio (ePortfolio) has to be maintained. It contains individual presentations of materials resulting from coursework and work placements. The portfolio is developed in a suitable digital online format, e.g., as a website, blog or storymap.

	Modules	**ECTS**
B1	Orientation Project	6
B2	Space-Time Models & Representations	6
B3	Digital Earth Observation & Technologies	12
B4	Spatial Image Analysis	6
B5	Integrated Applications	12
B6	SIP - Short Intensive Programmes	9 | 3

GeoVIS	at UPOL: Geovisualisation and Geocommunication[(i)]	30
GeoDSc	at UBS: GeoData Science[(i)]	
FEC	Free Elective Courses[(i)]	6 | 12
	Master's Thesis (incl. Master's Exam)	21
WorkPl	Work Placements[(i)]	12 | 18
	Total	**120**

[(i)] § 5

§ 4 Types of courses

The programme comprises the following types of courses:

Lecture courses (VO) provide an overview of a subject or one of its sections and its theoretical approaches and present different doctrines and methods. Contents are primarily presented in the style of a speech. A lecture course is not continuously assessed, attendance is not compulsory.

Tutorial courses (UE) aim to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. A tutorial course is a continuous assessment course, attendance is compulsory.

Field trip courses (EX) are intended to promote and exemplify specialised knowledge beyond the classroom. A field trip course is a continuous assessment course, attendance is compulsory.

Interdisciplinary project courses (IP) utilise approaches and methods from different disciplines, linking thematic areas and combining theoretical and practical aspects. An interdisciplinary project course is a continuous assessment course, attendance is compulsory.

Introductory seminar courses (PS) are research-oriented courses constituting the pre-stage to seminars. Students actively participate in practical and theoretical work to acquire basic knowledge and skills in academic research. An introductory seminar course is a continuous assessment course, attendance is compulsory.

Seminar courses (SE) are advanced academic courses to acquire more in-depth knowledge, to discuss and reflect academic issues through active participation on the part of the students. A seminar course is a continuous assessment course, attendance is compulsory.

Different focal points of seminar courses are stated in the course description (e.g. supervision seminar, empirical seminar, project seminar, interdisciplinary seminar, …).

§ 5 Programme content and schedule of study

(1) The following contains a list of modules and courses of the Master's programme Copernicus Master in Digital Earth. The attribution to semesters serves as a recommendation designed to ensure that the order in which the courses are taken is optimally built on previous knowledge and that the workload of 60 ECTS credit points within an academic year is not exceeded. However, modules and courses can be taken in a different order if there are no preconditions according to § 12. Detailed descriptions of the modules including the knowledge, methods, and skills to be imparted can be found in Annex I: Description of modules.

(2) Study options: For curricular fulfilments, the number of credit points for SIP - Short Intensive Programmes, Free electives courses (FEC) and Work placements (WorkPl) together require a total of 27 ECTS credit points. For module B6 (SIP) either 9 or 3 ECTS credits points can be selected. Students who choose 9 ECTS credit points for SIP must complete 6 ECTS credit points for FEC and 12 ECTS credit points for work placement. Students who choose 3 ECTS credits points for SIP must complete either 12 ECTS credit points for FEC and 12 ECTS credit points for work placement, or 6 ECTS credit points for FEC and 18 ECTS credit points for work placement, respectively.

Master's Degree Programme Erasmus Mundus Joint Master's Programme "Copernicus Master in Digital Earth"								
Module	**Course**	**SHrs**	**Type**	**ECTS**	**Semester with ECTS**			
					I	**II**	**III**	**IV**
(1) COMPULSORY MODULES								
B1 – Orientation Project (6 ECTS)								
Copernicus in Digital Earth (EO*GI)		1	UE	1	1			
Spatial Thinking & Modelling		1	UE	2	2			
Career Development & e-Portfolio		1	UE	1	1			
Scientific Methods and Writing		1	UE	2		2		
Subtotal B1		4		6	4	2		
B2 – Space-Time Models & Representations (6 ECTS) Students have to choose courses totalling 6 ECTS								
Cartographic Design & Geomedia		2	PS	3	3			
Advanced Cartography		2	PS	3	3			
Systems Thinking in Spatial Representations		2	VO	3	3			
Design of Geospatial Data Models		2	VO	3	3			
Additional options identified by RB[i]								
Subtotal B2				6	6			
B3 – Digital Earth Observation & Technologies (12 ECTS)								
Advanced Remote Sensing		4	PS	6	6			
Copernicus Hubs and Institutions		1	SE | EX	3		3		
Digital Earth: Big Earth Data Concepts		2	UE	3	3			
Subtotal B3		7		12	9	3		
B4 – Spatial Image Analysis (6 ECTS)								
Object-Based Image Analysis		2	UE	3	3			
Analysis and Modelling (Remote Sensing)		2	SE	3		3		
Subtotal B4		4		6	3	3		
B5 – Integrated Applications (12 ECTS)								
Project Management		2	UE	3		3		
Practice Software Development		2	PS	3		3		
Application Development (Earth Observation)		3	IP	6		6		
Subtotal B5		7		12		12		

B6 – SIP - Short Intensive Programmes (9 or 3 ECTS, see § 5 para. 2) Students have to choose courses totalling 9 or 3 ECTS depending on WorkPl and FEC							
International Summer School I	1	IP | EX	3		3		
International Summer School II	1	IP | EX	3		3		
Blended Intensive Programme I (BIP)	1	UE | VO	6		6		
Blended Intensive Programme II (BIP)	1	UE | VO	3		3		
Blended Intensive Programme III (BIP)	1	UE | VO	3		3		
Subtotal B6			9 | 3		9 | 3		
SPECIALIZATION TRACKS (30 ECTS)							
GeoVIS – Geovisualisation and Geocommunication (UPOL)							
GeoV – Module Geovisualisation							
Systematic Geovisualisation		PS	6			6	
Advanced Methods of Geovisualisation		SE	6			6	
Design in Geovisualisation		UE	3			3	
Subtotal GeoV			15			15	
GeoC – Module Geocommunication							
Cognitive Cartography		UE	3			3	
Web Cartography		UE	6				6
Subtotal GeoC			9			3	6
UPOL – UPOL electives (6 out of 9 ECTS)							
3D Visualisation[ii]		UE	3			3	
Cartographic Project[iii]		UE	3			3	
Desktop Publishing in Cartography[iii]		UE	3			3	
Subtotal UPOL			12			12	
Subtotal GeoVIS			30			24	6
GeoDSc – GeoData Science (UBS)							
Data – Module Fundamentals of Data Science							
Machine Learning		UE	6			6	
Foundations of Deep Learning		UE	3			3	
Big Data		UE	6			6	
Subtotal Data			15			15	
AI – Module Artificial Intelligence for Earth Observation							
Efficient Remote Sensing Image Processing		UE	6			6	
Deep Learning for Computer Vision		UE	3			3	
Geospatial Data Analytics Project		IP	6			6	
Subtotal AI			15			15	
Subtotal GeoDSc			30			30	
Total for compulsory modules[iv]			75 | 81				

(2) Free Elective Courses, cf § 7[iv]	6 | 12	3	3		6
(3) Work Placements (12 or 18 ECTS, see § 9)[iv]					
Skills-Based Internship					12
Collaborative Research Work Placement		6			12
Subtotal Work Placements	12 | 18				
(4) Master's Thesis	18				18
(5) Master's Exam	3				3
Total Sum	**120**	**60**		**60**	

[i]RB = responsible body
[ii]UPOL elective in Geovisualisation, [iii]UPOL elective in Geocommunication
[iv]See § 5 para. 2 for different study options concerning SIP, Free Elective Courses and Work Placements

§ 6 Elective modules

Elective modules in this Erasmus Mundus Joint Master programme have been designed as specialization track courses during semester 3 in the total amount of 30 ECTS credit points. This planned mobility to specialization track partner universities either in France (UBS) or Czech Republic (UPOL) must be completed during the second academic year. Further requirements are outlined in §§ 3, 5 and 10.

§ 7 Free elective courses

(1) In the Master's programme Copernicus Master in Digital Earth students are to complete free elective courses totalling 6 ECTS credit points or 12 ECTS credit points (cf. § 5 para. 2). These free elective courses can be selected from the range of courses offered by all recognised post-secondary educational institutions without restriction and are designed to further the acquisition of additional professional skills and to strengthen individual areas of focus within a student's course of study. Students are particularly encouraged to take courses recommended by the Programme Board.

(2) Free elective courses can be completed at any time throughout the programme. However, note that depending on the individual study options chosen according to § 5 para. 2 and the chosen specialization track, it may be advisable to complete free elective courses during different semesters in order to avoid exceeding a total workload of 30 ECTS credit points per semester.

(3) If the courses chosen are closely subject-related to amount of 12 ECTS credit points, the free elective courses can constitute a supplementary note in the Master‘s certificate as “elective course module”.

§ 8 Master's thesis

(1) The Master's thesis serves to demonstrate that the students have acquired the capability to independently perform academic research in the field of Copernicus, Earth Observation, Geoinformatics and Digital Earth according to current academic research methods and standards.

(2) The topic of the Master's thesis should be chosen in such a way that it is reasonable and appropriate to complete the thesis within six months (cf. § 81 para. 2 UG).

(3) The topic of the Master's thesis shall relate to the selected specialization track of the student. The student is entitled to suggest a topic or to choose the topic from a number of topics proposed by the available thesis advisors.

(4) The Master's thesis is worth 18 ECTS credit points.

(5) It is to be noted that both the student's work on the topic and the advisor's work with the student are subject to the Austrian Copyright Act, Federal Law Gazette No. 111/1936 (cf. § 80 para. 2 UG).

(6) The Master's thesis is co-supervised by two faculty members from the Consortium, one from University of Salzburg and one from the university representing the chosen specialization track selected by the student. These faculty members supervising the thesis must be qualified according to the regulations of their own institution.

(7) If agreed by the Programme Board and conforming with institutional regulations at the degree awarding partner institutions, the Master's thesis can be also produced with the support of one or more experts from an associated partner institution of the Consortium.

(8) The Master's thesis has to be submitted in English language.

(9) Due to the joint degree character of this programme, the thesis is submitted in identical form at two partner institutions as a graduation requirement.

§ 9 Work placements

(1) As part of the Master's degree programme Copernicus Master in Digital Earth, students must complete a compulsory skills-based internship related to the programme comprising, or equivalent to, 8 weeks of full-time employment (this corresponds to 12 ECTS credit points). The skills-based internship should enable students to use the knowledge and skills they have gained during their studies so far.

(2) The skills-based internship is generally to be completed outside of the university in institutions pre-approved by the governing body responsible for study matters. Prior to starting work the responsible governing body must be informed of the internship and the selected institution, and both must be approved by the responsible governing body.

(3) Alternatively, a collaborative research work placement (18 ECTS credit points) is to be completed at a consortium partner or at any institution worldwide. Collaborative research work placements at non-academic partners are encouraged. It must be confirmed by the responsible body. The research-based Master's thesis shall lead to a joint publication after graduation. Further requirements are outlined in § 8.

(4) Should it not be possible to complete the work placement outside the university in justified cases, students may complete a work placement by participating in research projects at the university, as far as this is possible at the university and as far as this is approved by the responsible governing body.

(5) Students with disabilities and / or chronic illnesses will be supported by the university as far as work placements are concerned. If it is not possible to obtain a work placement at possible institutions due to inadequate infrastructure (physical as well as infrastructural accessibility), students with disabilities and / or chronic illnesses will be given another opportunity to fulfil this part of the curriculum.

(6) A certificate issued by the host institution and serving as a basis for recognizing the completion of this requirement must document these items:

a. Institution and location where the work placement has been completed.
b. Timeframe / duration and workload (hours per week) of the work placement.
c. Description of assigned tasks and responsibilities.
d. Written assessment of work placement by supervisor at host institution.

In the course of a skills-based internship or collaborative research work placement the following qualifications can be acquired (among others:)

- Ability to apply the acquired subject-specific competences in a professional context.
- Acquaintance with different application scenarios of subject-specific concepts.
- Acquisition of soft skills (e.g., teamwork, communication competences, planning competences) in a professional context.
- Ability to put the theoretical knowledge acquired in the field of study into practice in a professional context.
- Acquaintance with different scenarios in which theoretical concepts can be used.
- Acquisition of business-related and entrepreneurial skills.
- Familiarity with professional environments of Earth Observation and Geoinformatics applications.

§ 10 International mobility

The Erasmus Mundus Joint Master's programme includes an international study experience by design, students pursue a joint master's degree by studying at two or more universities in different countries, within Europe and beyond.

Students of the Master's degree programme spend at least one semester of study abroad according to their chosen specialization track. The semesters three to four are particularly suited for this study abroad. The recognition of courses and other academic achievements completed during the study abroad is conducted by the governing body responsible for study matters. The documents required for the assessment are to be provided by the student.

The Erasmus Mundus Joint Master's programme offers the following structure of integrated international mobility:

- All students spend the first academic year at the University of Salzburg to acquire a set of core EO*GI Earth Observation and Geoinformatics competences.
- At the time of application for admission, candidates select and prioritize at least one specialization track offered by the Consortium. The assigned specialization can be changed until the end of the first semester with the agreement of the Programme Board.
- Students will move to the selected joint programme specialization track partner for the second academic year.
- Students may move to an industry / SME, higher education or research partner for their Master's thesis (collaborative research work placements) as outlined in § 9.
- The Programme Board can identify and define additional focus subjects based on demand and according to available course offerings.

It is ensured that semesters abroad are possible without causing a delay in a student's course of study if the following conditions are met:

- During each semester abroad courses and other academic achievements totalling at least 30 ECTS credit points are completed.

- The courses and other academic achievements completed during the study abroad are not identical to the content of courses and academic achievements already completed at the University of Salzburg.
- Before starting the semester abroad, it is stated by means of an official order which of the planned examinations will be recognised for the examinations stipulated in the curriculum.

In addition to subject-specific competences students can acquire the following qualifications by studying abroad:

- Acquisition and deepening of subject-specific knowledge of a foreign language.
- Acquisition and deepening of general foreign-language skills (comprehension, conversation, …)
- Acquisition and deepening of organisational skills by independently planning the day-to-day study life in international administrative and university structures.
- Familiarising with and studying in international university systems as well as broadening the individual perspectives in the student's own field of study.
- Acquisition and deepening of intercultural competences.

Students with disabilities and/or chronic illnesses will be actively assisted by the university in searching for an opportunity to study abroad and in planning the semester abroad.

§ 11 Allocation of study places in courses with a limited number of participants

(1) For the admission to and priorities in all individual courses, the admission regulations of the institution hosting the course are applied.

(2) All applicable prerequisites for prioritizing the admission to courses will be made available to students at the beginning of the programme at each host university.

(3) At the University of Salzburg, for the following types of course the number of participants in the Master's programme Copernicus Master in Digital Earth is limited as follows:

Lecture (VO)	no limit
Introductory seminar course (PS), Tutorial course (UE)	25 participants (or adjusted to number of available workplaces / instruments)
Seminar course (SE), Interdisciplinary project courses (IP)	25 participants
Field trip courses (EX)	30 participants

(4) At the University of Salzburg, if the maximum number of participants is exceeded by the number of enrolments for courses with a limited number of participants, those students for whom this course is part of their curriculum will be given priority.

(5) At the University of Salzburg, study places will be allocated in the order specified in the Statutes of the University of Salzburg.

(6) At the University of Salzburg, for students participating in international exchange programmes, additional study places constituting at least ten percent of the maximum number of participants on each course will be available. These study places will be allocated by lot.

§ 12 Admission requirements for exams

(1) For the admission to all course exams, the admission regulations of the institution hosting the respective course are applied. At the University of Salzburg, no exam admission requirements beyond the assessment and attendance rules specified in § 4 are applicable.

(2) All requirements for the admission to exams will be made available to the students at the beginning of the respective course.

§ 13 Examination regulations

The following forms of performance assessment are possible for modules:

(1) All courses except for type VO require course attendance and are continuously assessed. Lectures (VO) are assessed based on a single written or oral exam at the end of the course.

(2) Assessment within a module / course-oriented assessment: all courses in the module are marked individually based on the module objectives.

(3) For students with disabilities and / or chronic illnesses, alternative examination regulations suitable for each individual case will be offered in cooperation with the Service Facility for Family, Gender, Disability & Diversity.

§ 14 Master's examination before an examining committee

(1) The Master's programme Copernicus Master in Digital Earth is concluded with a Master's examination before an examining committee worth 3 ECTS credit points.

(2) Taking the Master's examination before an examining committee requires proof of successful completion of all prescribed examinations, the compulsory work placement and positive assessment of the Master's thesis.

(3) The Master examination before an examining committee consists of:

- a presentation of the Master's thesis by the person taking the examination (approx. 15 minutes),
- questions on the topic of the Master's thesis by the members of the examining committee,
- questions on two separate topics different from the topic of the Master's thesis proposed by the candidate from the modules B1-B5 and specialization track courses defined in the Master's programme in accordance with § 8 para. 3.

§ 15 Effective date

The curriculum will become effective on 1 October 2025.

§ 16 Transitional provisions

(1) Students of the Master's programme Copernicus Master in Digital Earth who are subject to the Curriculum 2019, as published in the version 2019, Bulletin No 88 of March 15, 2019, at the time of the entry into force of this curriculum, are entitled to complete their studies until 30.09.2026 according to the provisions of the Curriculum Version 2019. If they do not complete their studies by 30.09.2026, they are subject to the curriculum in its current version.

(2) Students of the Master's programme Copernicus Master in Digital Earth who are subject to the Curriculum 2023, as published in the version 2023, Bulletin No 92 of May 5, 2023 at the time of the entry into force of this curriculum, are entitled to complete their studies until 30.09.2027 according to the provisions of the Curriculum Version 2023. If they do not complete their studies by 30.09.2027, they are subject to the curriculum in its current version.

(3) Students who are registered for the Copernicus Master in Digital Earth (CDE) at the University of Salzburg (Version 2019, Bulletin No 88 of March 15, 2019, or Version 2023, Bulletin No 92 of May 5, 2023) at the time of entry into force of this curriculum shall be entitled to voluntarily

transfer to this curriculum specified in this document at any time within the admission deadlines. A written, binding declaration specifying their intention to transfer to the new curriculum shall be addressed to the Admissions Office.

Course equivalency lists can be found in Annex II.

Annex I: Description of modules

Module name	ORIENTATION PROJECT
Module code	B1
Total workload	6 ECTS
Learning outcomes	Students are building adequate expectations and adjusting to the requirements of the MSc programme depending on their respective (and different) first degrees. Based on admission interviews, students receive recommendations to compensate any deficiencies from their undergraduate studies, particularly in the areas of Earth observation and Geoinformation (EO*GI) skills, basic spatial literacy and cartographic competences, fundamental understanding of spatial sciences and general digital and analytical methods. In addition, students enhance their general orientation in scientific methods and scientific writing in a dedicated set of classes, as a preparation for supervised and independent work in advanced classes. Students apply the acquired knowledge and write a scientific report or article. This module guides students towards establishing their individual ePortfolio and career development skills. Coursework aiming at adjusting prerequisites will secure coverage of knowledge according to: EO4GEO BoK *Remote sensing data and imagery & Data formats* (https://bok.eo4geo.eu/PS3-6) - Discuss the purposes of obtaining remote sensing data. - Discuss how remote sensing data is organized and stored. EO4GEO BoK *Organizational and Institutional Aspects* (https://bok.eo4geo.eu/OI) - List and explain relevant organizational and institutional aspects related to GIS&T. EO4GEO BoK *Spatial Thinking* (https://bok.eo4geo.eu/CV6-6) - Arrange previously observed objects in a place. - Recognize spatial schemes like patterns and shapes. - Represent an object or a scene from different viewpoints. EO4GEO BoK *GI and Society* (https://bok.eo4geo.eu/GS) - List and explain the different societal aspects that are important in dealing with geospatial information. GIS&T Body of Knowledge (https://www.ucgis.org/assets/docs/gist_body_of_knowledge.pdf) - Foundations of Geoinformatics: CF3, CF4, CF5-1,4,5, DA4, DM1-4, GD12, OI51-2, GS3. Cartography and Visualisation: GD1-5, GD10, CV2, CV3, CV4-1, CV6-1-3, DN2 Regarding socio-economic questions, students - are able to assess arguments and develop rationales applicable to social challenges inequality and diversity.
Module content	Orientation regarding structure of entire curriculum, the scope of the emerging fields of Earth observation and geoinformation (EO*GI), and student life at partner universities. Integration with student cohort. Planning and design of one's individual course of study, including specific methodology and / or domain.

	Review basic concepts of spatial orientation and geospatial thinking. Practice and apply spatial thinking through online platforms. Perspectives on professional outlook and career development for informed career choices. Comprehend professional development as a continuous and dynamic process including importance of strengthening the network within the geospatial community. Personal SWOT analysis and translation of outcomes into action. Written communication in science. Structuring of documents according to media and target audience. Scientific writing in English language. Adequate use and referencing of sources, empirical evidence and pertinent tools. Elementary research design. Professional ethics.
Courses	All courses are taught as tutorial courses fostering problem-oriented and experiential learning through individual or group assignments. - UE Copernicus in Digital Earth (EO*GI) - UE Spatial Thinking & Modelling - UE Career Development & ePortfolio - UE Scientific Methods and Writing
Type of exam	Course-oriented type of exam. Submission of several individual and group mini projects aiming at orientation, social environments and use of geomedia / geospatial communication. These projects serve as assignments graded from a combination of peer and teacher assessment.

Module name	SPACE-TIME MODELS & REPRESENTATIONS
Module code	B2
Total workload	6 ECTS
Learning outcomes	Students will be able to apply the selected methods in project-oriented work and take methodological responsibilities in working groups and complex workflows. Coursework will secure coverage of knowledge according to: EO4GEO BoK *Cartography and Visualisation* (https://bok.eo4geo.eu/CV)[i] - Choose from different options to create a map. - Explain the importance of visualisation of cartographic materials over time. - Relate the science and technology of graphical representation of geographic data. - Are able to question societal developments and analyse and classify them in relation to socio-ecological challenges for cartographic visualisation. EO4GEO BoK *Data Modeling, Storage and Exploitation / Standards for Spatial Data Modeling* (https://bok.eo4geo.eu/DM)[ii] - Knowledge and skills to read and implement geospatial data models based on standardized techniques. Model geospatial data. - Determine the standards that are essential for geospatial data modelling. EO4GEO BoK *Design and Setup of Geographic Information Systems* (https://bok.eo4geo.eu/DA)[ii]

	- Design databases for spatial data management. - Design workflows, procedures, and customized software tools for using geospatial technologies and methods. - Develop effective mathematical and other models of spatial situations and processes. - Understand spatial data models and structures. - Can design innovative spatial data strategies that will contribute to finding solutions to socio-ecological problems. - Understand the connections between cause and effect of issues with socio-ecological implications. GIS&T Body of Knowledge (https://www.ucgis.org/assets/docs/gist_body_of_knowledge.pdf)[i] - Design and implement advanced geovisualisation interfaces for use-case oriented media, devices and user experiences [DM5-3, DN2-4, GS3-3]. - Acquire knowledge and skills in thematic cartography, including overview on current research. [i]course: Geovisualisation and Advanced Cartography [ii]courses: Systems Thinking in Spatial Representations & Design of Geospatial Data Models
Module content	Courses introduce theory of cartographic communication, principles of map design, methods for preparing thematic maps, and examples for the application of thematic cartography in various subject areas. Geospatial data models as the foundation of efficient geospatial data processing impacting service interfaces, performance and the ability to flexibly exchange data. Systems thinking as a transversal concept for space-time representation. Hierarchical or ontological organisation of natural and technical systems. Systems theory foundations of spatial science, modelling and simulation.
Courses	Courses are taught as introductory seminar course (PS) which are research-oriented courses constituting the pre-stage to seminars. Students actively participate in practical and theoretical work to acquire basic knowledge and skills in academic research. Lecture courses (VO) provide an overview of system thinking in spatial representations and design of geospatial data models, its theoretical approaches and present different doctrines and methods. - PS Cartographic Design & Geomedia - PS Advanced Cartography - VO Systems Thinking in Spatial Representations - VO Design of Geospatial Data Models - Additional options identified by RB
Type of exam	Course-oriented type of exam. Introductory seminar courses are continuous assessment courses, attendance is compulsory. Submission of several individual and group mini projects aiming at orientation, social environments and use of geomedia / geospatial communication. These projects serve as assignments graded from a combination of peer and teacher assessment.

Module name	DIGITAL EARTH OBSERVATION & TECHNOLOGIES
Module code	B3
Total workload	12 ECTS

Learning outcomes	This core module of the Copernicus in Digital Earth study programme builds advanced translation skills from application domain problems towards conceptual reframing and structuring, towards analytical methods and toolsets of EO*GI. Utilising operational methods and tools, complete workflows representing complex processes are modelled in structured frameworks to support spatial decisions across domains. Students will acquire knowledge according to: EO4GEO BoK *Remote Sensing* (https://bok.eo4geo.eu/GD2-2) - Explain which types of geospatial data are collected through satellite remote sensing. - Understand the larger space policy context of satellite Earth observation with a particular focus on the Copernicus programme. - Familiarise with advanced methods, tools and techniques of remotely sensed imagery. - Master image analysis tools and methods to a degree to be confident in tackling 'real-world' application scenarios. - Apply specific image acquisition techniques (VHR optical data, Radar data, Lidar, UAV). - Perform image pre-processing (calibration, filtering, and pre-classification). - Conduct spatial image analysis using image segmentation, advanced classifiers (both physical-model based and statistical) and assess the quality of the results. EO4GEO BoK *EO services and applications* (https://bok.eo4geo.eu/TA13) - Designing the description of a service for the need of a particular user of EO information. - Having in-depth knowledge on Copernicus-relevant topics such as land monitoring, emergency response including (geo-) humanitarian action, and climate change. EO4GEO BoK *Earth Observation Big Data* (https://bok.eo4geo.eu/PS3-2-4) - Explain and discuss the concept of big data in the field of Earth observation. - Understand current trends of big data in remote sensing and its background as well as applying new concepts and approaches. GIS&T Body of Knowledge (https://www.ucgis.org/assets/docs/gist_body_of_knowledge.pdf) - Design, implement and validate complex workflows and process models built from individual methods and operations. [AM5-6,78]. - Move from data analysis to generation of context-specific information and the creation of higher-level domain knowledge. [AM1-1,2]. - Choose and apply spatial- and geo-statistical methods to analyse multidimensional and multivariate data sets to explain and model complex relations and processes [CF6, AM7, AM8, AM9-2,4, GC2-4]. - Manage information extraction from large (‘big’) data sets, including flow of data, DBMS aspects and pattern analysis [AM10].

Module content	Automated image analysis of remotely sensed data covering the full workflow from image acquisition (new sensor types and devices), over advanced pre-processing and pre-classification techniques, and object-based image understanding including quality assessment. Opportunities and trends of the European Union's Earth observation programme – Copernicus, including topics such as the (emerging) Copernicus service portfolio, data and information access services, user appraisal and uptake, “Women in Copernicus”, specific challenges of the service domains (climate change, security, etc.). Recent trends in Earth observation referred to "big Earth data" including topics such as accessing and processing of massive amount of big data online, building and exploiting data cubes, utilizing cloud-based data processing and related application areas for continental- or global-scale remote sensing image processing. In a mixture of theoretical and hands-on sessions students will learn to understand current trends and challenges as well as applying new concepts and approaches in remote sensing.
Courses	Through a combination of an introductory seminar course students actively participate in practical and theoretical work to acquire basic knowledge and skills in academic research. A tutorial class includes extensive lab components with an advanced seminar, students develop broad competences across the spectrum of analytical methods (optionally including spatial statistical and remote sensing methods), as well as a deeper understanding and critical appreciation of results through application experience of selected methods and their parameterization contexts. - PS Advanced Remote Sensing - SE | EX Copernicus Hubs and Institutions - UE Digital Earth: Big Earth Data Concepts
Type of exam	Course-oriented type of exam. Assessment of individual lab assignments plus overview test. Hands-on exercises and assignments using relevant software packages. Presentation of seminar (project) paper with peer and teacher assessment.

Module name	SPATIAL IMAGE ANALYSIS
Module code	B4
Total workload	6 ECTS
Learning outcomes	Students will be able to apply the selected methods in project-oriented work and take methodological responsibilities in working groups and complex workflows. Students will have acquired the following competences: EO4GEO BoK *Foundations of analytical methods* (https://bok.eo4geo.eu/AM1) - Apply analytical methods to solve spatial problems. - Understand current trends of big data in remote sensing and its background as well as applying new concepts and approaches. EO4GEO BoK *Object-based image analysis (OBIA)* (https://bok.eo4geo.eu/IP3-7) - Apply object-based classification methods for classifying very high-resolution satellite images. - Apply object-based image analysis methods for extracting information from optical imagery.

	- Compare pixel-based image classification methods with object-based techniques. - Describe the main advantages of object-based image analysis methods. - Develop and implement an object-based image analysis workflow for a specific application context. - Overall understanding of object-based image analysis as an advanced image understanding strategy. - Apply spatial concepts in image analysis, such as geometrical, form-related, context-related properties of objects. - Handling basic technical principles of image segmentation and object-based classification and validation. GIS&T Body of Knowledge (https://www.ucgis.org/assets/docs/gist_body_of_knowledge.pdf) - Decide on adequate Remote Sensing data sources and workflows across available passive and active sensors. - Apply the Object-Based Image Analysis (OBIA) paradigm to the extraction of features and monitoring of change across remote sensing application domains. - Select and implement advanced geodata acquisition processes using e.g. photogrammetry, LiDAR, in-situ and mobile sensors, crowdsourcing and UAV platforms, including real-time data streams [DN1-6, components from GD]. Prepare and support decisions through (geo-)simulation [DA5-3,4, GC]. Regarding socio-ecological challenges, students - understand the connections between cause and effect of issues with socio-ecological implications. - are able to question societal developments and analyse and classify them in relation to socio-ecological challenges. - can design strategies that will contribute to finding solutions to socio-ecological challenges.
Module content	Students are offered a selection of core EO*GI on advanced geospatial data analysis using mixed input data and analytical methods. Object-based image analysis (OBIA) providing methods and tools for multi-scale representation and class modelling by integrating spatial concepts and knowledge-based strategies for advanced image understanding. At the interface between GIS and remote sensing technologies, OBIA offers a powerful approach for utilizing image information for various application fields. Advanced spatial analysis techniques with a particular focus on remote sensing applications and image analysis. Addressing both, GI methods with a particular flavour in EO image analysis, e.g., filters and advanced classifiers. Comprehending and applying techniques of hybrid AI and EO analytics for complex data-driven and/or knowledge driven image understanding. Combining rule-based analysis techniques with deep learning.
Courses	All courses have a strong practice orientation, combining conceptual foundations with a view towards applications. Participants familiarize with spatial analysis by conducting small hands-on experiments or comparative methodological studies. Tutorial courses (UE) aim to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. Seminar courses (SE) are advanced academic courses to acquire more in-depth knowledge, to

	discuss and reflect academic issues through active participation on the part of the students. - UE Object-Based Image Analysis - SE Analysis and Modelling (Remote Sensing)
Type of exam	Course-oriented type of exam. Assessment of individual lab assignments plus overview test. Hands-on exercises and assignments using relevant software packages. Presentation of seminar (project) paper with peer and teacher assessment.

Module name	INTEGRATED APPLICATIONS
Module code	B5
Total workload	12 ECTS
Learning outcomes	Students will gain a well-structured understanding of software development from a combined problem-solving and software engineering perspective, enabling them to work as geospatial experts in technical teams and to successfully communicate with software developers. Students are enabled to translate from Copernicus thematic applications to software solutions via use cases. Based on the foundations of programming and application development, students acquire competences in at least two development environments and languages, enabling them to design simple software programmes, to customize existing applications, and to automate basic workflows. This includes practical skills in geo-application development in the areas of web applications, mobile applications, or desktop analytical applications. Having completed this module, students are able to carry out basic development tasks on a variety of platforms and architectures with an emphasis on understanding and translating demands from typical EO*GI domains. This key competence is developed and verified through a development project in one IP. Students will be able to: EO4GEO BoK *Project management* (https://bok.eo4geo.eu/DA2-1) - Explain what a project is, and the difference between a project, programme, and product. - Illustrate each of the project management areas with an example of a technique or tool used. - List the key elements of a project management. - List the phases of a project management life cycle. - Select the most appropriate techniques for a EO*GI project. EO4GEO BoK *System design* (https://bok.eo4geo.eu/DA1) - Analyse suitability of a network. - Demonstrate why the system design is important in any GIS implementation. - Identify data center platform tier configuration and identify platform selection for each tier. - Identify platform assignment for each workflow software component peak transaction processing load. - Identify user locations, network connectivity, and data center server locations. - Interpret business needs and translate them to IT needs.

	- Interpret user needs as an input for the design process. - Model project workflows. GIS&T Body of Knowledge (https://www.ucgis.org/assets/docs/gist_body_of_knowledge.pdf) - Design and carry out software projects in accordance with standardized and structured SWE processes [DA7-1, DA7-2, DA6-1, DA6-3]. - Select the appropriate programming or scripting language according to the specific goals of a software project [DA5-4 , DA6-3 , DA7-1, DA2-4]. - Apply their basic knowledge of modeling software systems for communication between different stakeholders in a SWE project [DA1-2, DA1-5, DA2-4, DA6-2]. - Programmatically access external code libraries and Application Programming Interfaces (APIs) of commercial off-the-shelf (COTS) and open-source software in their own programs to achieve their goals [DA7-2, DA1-5, DA6-3]. - Develop software programs to pre-process and analyse spatial data (read, manipulate, store, visualize, classify) that are available in a variety of formats (CSV, ShapeFiles, GML, KML, raster formats etc.) [DA7-1, DM1-2]. - Integrate data from service-oriented architectures (SOA), including OGC Web Services (OWS) into their software programs through service-based data access [DA7-2]. - Read and understand the documentation of software libraries. - Create user interface components in selected development environments [DA6-2]. - Batch analysis tasks in the application domains of GIS and remote sensing [DA6-3]. - Develop geo-applications for different platforms (desktop, web, mobile) and application domains (GIS, remote sensing) [DA7-2, CV5-1, CV4-5].
Module content	Project management techniques and tools combined with fundamental management skills and principles. Introduction to leadership competences e.g., critical thinking, effective listening, taking initiative and motivating, and conflict management. Understanding and translating user requirements into software solutions via design thinking and use cases. Strong link to an applied research framework. Principles of software engineering. Procedural and object-oriented programming principles. Approaches to modelling software systems using UML. Service-oriented Architectures. OGC Web Services (OWS) and OGC API. Client-side and server-side scripting languages (e.g., JavaScript, Python, or similar). Object-oriented programming vs. scripting. Server-side OO programming and scripting (e.g., JSP, Python, PHP, or similar). Programmatic database access. Program development for spatial data pre-processing. APIs in commercial off-the-shelf (COTS) and/or open-source software. Web Mapping. Web GIS. Batch processing for GIS and remote sensing analysis and classification tasks. Basic GUI design. Deeper understanding of Application Development using Cognition Network Language (CNL) in an OBIA software environment. CNL language (using varia-

	bles, loops/branching, arrays etc.). Realise selected applications within the context of applied research and elaborate on more advanced OBIA concepts using CNL as a programming language; applications development.
Courses	Through a combination of an introductory seminar course and a tutorial course as well as an interdisciplinary project course (IP) courses include extensive practical components, students develop broad competences across the spectrum of application development methods on different platforms and programming languages (at least two) as well as different application domains. Interdisciplinary project courses (IP) utilise approaches and methods from different disciplines, linking thematic areas and combining theoretical and practical aspects. - UE Project Management - PS Practice Software Development - IP Application Development (Earth Observation)
Type of exam	Course-oriented type of exam. Assessment of individual lab assignments plus overview test. Presentation of focus topic with peer and teacher assessment. IP: hands-on project work with strong motivation from real world problems; detailed documentation according to corresponding standards. Evaluation of the approach to challenge during the project as well as final results.

Module name	SIP - SHORT INTENSIVE PROGRAMMES
Module code	B6
Total workload	9 | 3 ECTS
Learning outcomes	As a core element in an international study programme integrating students from very diverse backgrounds and pursuing different pathways, participating in a summer school or Blended Intensive Programmes aims at several important objectives: - Social integration of student cohort through groupwork and a fulltime residential setting. - Deep dive into a specific topical domain with particular professional relevance. - Contact opportunity with practitioners from industry and application domains. - Experience with hands-on field work and data acquisition.
Module content	Depending on the chosen topic (summer schools and BIPs will be offering a variety of themes), the content will allow students to build a holistic understanding of the respective theme through an immersive experience.
Courses	International summer schools and Blended Intensive Programmes (BIPs) - IP | EX International Summer School I - IP | EX International Summer School II - UE | VO Blended Intensive Programme I (BIP) - UE | VO Blended Intensive Programme II (BIP) - UE | VO Blended Intensive Programme III (BIP)
Type of exam	Course-oriented type of exam. Integrated, continuous assessment including group work (depending on summer school theme) and individual written and optionally oral presentation of assigned topic; ePortfolio reports.

Specialization Track GeoVIS – Geovisualisation and Geocommunication at Palacký University Olomouc	
Module name	GEOVISUALISATION
Module code	GeoV
Total workload	15 ECTS
Learning outcomes	Upon completion of the module, students are able to explain the geovisualisation process. - Understand general theory of systems. - Implement geovisualisation processes using and combining spatial and non-spatial data. - Understand general theory of systems. - Implement geovisualisation processes using and combining spatial and non-spatial data. - Evaluate visualisation approaches of spatial data and build new ones upon the theoretical framework. - Design scientific atlases as products of systematic geovisualisation. - Analyse and categorize available techniques in terms of quality; efficiency, and suitability for a particular data type. - Evaluate available tools based on their functionality and apply these tools to create own geovisualisations. - Understand current issues in design in geovisualisation; - Evaluate design research approaches. - Analyse and process geodata within a geovisualisation context. - Evaluate different geovisualisation techniques, principles and methodologies according to the applicability to the intended project. EO4GEO BoK *Cartography and Visualisation* (https://bok.eo4geo.eu/CV) - Choose from different options to create a map. - Explain the importance of visualisation of cartographic materials over time. - Relate the science and technology of graphical representation of geographic data.
Module content	Through a combination of an introductory lecture and a lab exercise including extensive practical components, students develop broad competences across the scope of application development methods on different design platforms. Systematic Geovisualisation: - Fundamental geovisualisation concepts - Designing geovisualisation within theory of systems - Types of geovisualisation processes - Map and layout designing - Cartographic generalization - Map projections in geovisualisation concepts - Use and user issues in geovisualisation - Topographic and thematic mapping - Colors and labelling - Image mapping Advanced Methods in Geovisualisation:

	- Concept of thematic mapping - Composition of thematic maps - Methods for representing qualitative data - Methods for representing quantitative data - Colours in thematic maps - Digital tools for geovisualisation production - Multivariate mapping - Tactile mapping - 3D in geovisualisation Design in Geovisualisation: - Introduction to the design in geovisualisation - History of computer graphics - Fundamental principles of graphic design and principles of geo-visualisation - Map layout and map styles - Bezier curves in geodata processes - Colours and tools for colour settings - Map symbology design - Designing infographics - Designing communication-oriented geovisualisations EO4GEO BoK *Cartography and Visualisation* (https://bok.eo4geo.eu/CV) - Choose from different options to create a map. - Explain the importance of visualisation of cartographic materials over time. - Relate the science and technology of graphical representation of geographic data.
Courses	Course are fostering problem-oriented and experiential learning through individual or group assignments. Introductory seminar courses (PS) are research-oriented courses constituting the pre-stage to seminars. Students actively participate in practical and theoretical work to acquire basic knowledge and skills in academic research. Seminar courses (SE) are advanced academic courses to acquire more in-depth knowledge, to discuss and reflect academic issues through active participation on the part of the students. Tutorial courses (UE) aim to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. - PS Systematic Geovisualisation - SE Advanced Methods of Geovisualisation - UE Design in Geovisualisation
Type of exam	Course-oriented type of exam. Written and oral examination. Map assignment and paper assignment.

Specialization Track GeoVIS – Geovisualisation and Geocommunication at Palacký University Olomouc	
Module name	GEOCOMMUNICATION
Module code	GeoV
Total workload	9 ECTS
Learning outcomes	Upon completion of the module, students are able to:

	- Explain theories of perception and effective user-driven map-design. - Understand current cognitive research issues in relations to cartographic research questions. - Get acquainted with different methods of map assessment. - Learn about recording of eye-movements. - Evaluate perception of cartographic products. - Analyse and process map reading. - Evaluate different cartographic techniques, principles and methodologies according to the cognitive processes. EO4GEO BoK *Cartography and Visualisation* (https://bok.eo4geo.eu/CV) - Choose from different options to create a map. - Explain the importance of visualisation of cartographic materials over time. - Relate the science and technology of graphical representation of geographic data.
Module content	Cognitive Cartography - Cartographic communication models - Methodological aspects of empirical research in cognitive cartography - History and the present of cognitive research - Methods of cognitive cartography - Questionnaire surveys in cartography - Eye-tracking and its use in cartography - Preparing of eye-tracking experiment and testing - Analyses, visualisation and statistical evaluation of recorded data - The use of GIS tools for visual analysis of eye-tracking data - Cartography and psychology Web Cartography - WebGIS 2.0, Map Application vs. Map Server - GIS software libraries - Different GIS data formats for Web Cartography - Vector and raster tiles - Server-side data publishing - Cloud GIS - JavaScript GIS mapping libraries - GIS API - Geospatial analysis and processing - Design and styling of web maps
Courses	Tutorial courses (UE) aim to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. The courses introduce advanced cartography methods and theory. - UE Cognitive Cartography - UE Web Cartography
Type of exam	Course-oriented type of exam. Web map application and written examination.

Specialization Track GeoVIS – Geovisualisation and Geocommunication at Palacký University Olomouc

Module name	UPOL Electives
Modulecode	UPOL
Total workload	6 ECTS
Learning outcomes	Upon completion of 3D Visualisation, students are able to: - Remember advantages of applications of 3D data models. - Consider the range of 3D design options. - Choose suitable input data for 3D landscape models. - Understand necessity of quality and consistency control. - Use modelling software for own model preparation including texture. - Combine 3D content into a simple model. - Produce 3D content of moderate complexity. - Integrate 3D printing and virtual reality workflows. Upon completion of Cartographic Project, students are able to: - Understand current cartographic research issues and cartographic research questions. - Evaluate cartographic research approaches. - Combine spatial data with other non-spatial data. - Evaluate different cartographic techniques, principles and methodologies. - According to the applicability to the intended project. - Create user- and purpose-oriented results for the intended project. - Discuss and present the applied cartographic/design methodologies with/to expert. Upon completion of Desktop Publishing in Cartography, students are able to: - Understand the principles of desktop publishing in cartography as the relevant outcome of the cartographic communication process. - Analyse key criteria for the pre-print processes. - Apply the knowledge of digital typography and cartographic principles to create final maps.
Module content	The course 3D Visualisation is fostering problem-oriented and experiential learning. - 2, 2,5 and 3D concepts - 3D spatial data sources, formats and conversions - Visualisation techniques and tools for 3D visualisations - Level of Detail (LoD) - Virtual reality vs. physical reality - Tangible Landscape - Visualisation by 3D printing - Visualisation techniques over 3D physical models The course Cartographic Project is led as an interdisciplinary project integrating cartographic approaches, design concepts and geovisualisation methods for geospatial problem solving across geoinformation disciplines. It includes practical as well as conceptual synergies: Preparation of the cartographic project and compiling the individual map project. The course Desktop Publishing in Cartography applies geovisualisation methods on different platforms and cartographic styles as well as different application domains (optionally including geospatial topics).

Courses	Tutorial courses (UE) aim to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. The courses introduce advanced cartography methods and theory. - UE 3D Visualisation - UE Cartographic Project - UE Desktop Publishing in Cartography
Type of exam	Course-oriented type of exam. Web map application and written examination.

Specialization Track GeoDSc – GeoData Science at University of South Brittany	
Module name	FUNDAMENTALS OF DATA SCIENCE
Module code	Data
Total workload	15 ECTS
Learning outcomes	Upon completion of the module, students will be able to: - Understand the different machine learning problems and methods. - Design for a given data analytics problem the appropriate solution to be used. - Implement deep learning models within a standard framework. - Use software framework to design, implement and deploy a solution for big data analytics. EO4GEO BoK *Machine learning* (https://bok.eo4geo.eu/IP3-4-7) - Describe the role of machine learning classifiers to find patterns in the available data. EO4GEO BoK *Deep learning* (https://bok.eo4geo.eu/IP3-4-6) - Analyse the EO Image processing tools required for preparing EO data for deep learning. - Apply deep learning methods on EO data within online processing platforms like Google Earth Engine Cloud Computing, Amazon Web Service, Microsoft Azure, or Sentinel Hub. - Apply different DL approaches in EO imagery for classification, detection, or regression. - Compare different deep learning approaches in EO image classification. - Describe how deep learning works. - Identify programming languages (like Python, R, and C++) and the main open-source libraries (like OpenCV, PyTorch, TensorFlow, Google Colab, Github, Scikit-learn) that are common for deep learning. - EO4GEO BoK *Earth Observation Big Data* (https://bok.eo4geo.eu/PS3-2-4) - Explain and discuss the concept of Big Data in the field of Earth Observation.
Module content	Machine Learning: - Principles of supervised and unsupervised learning - Data clustering - Dimension reduction and feature selection - Classification and regression algorithms - Bayesian learning

	- Time series analysis - Training strategies and evaluation protocols - Use of software libraries Foundations of Deep Learning: - Principles of neural networks - Optimization and regularization - Main architectures (CNN, RNN, AE, GAN) - Use of deep learning software frameworks Big Data: - Principles of Big Data processing and HPC - Review of main software frameworks (e.g., Hadoop stack) - GPU-based processing (CUDA, OpenCL) - Application to Earth observations with Spark and SparkML
Courses	Courses are taught as tutorial courses (UE) aiming to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. - UE Machine Learning - UE Foundations of Deep Learning - UE Big Data
Type of exam	Course-oriented type of exam. Assessment of individual lab assignments, group-projects plus written exams.

Specialization Track GeoDSc – GeoData Science at University of South Brittany	
Module name	ARTIFICIAL INTELLIGENCE FOR EARTH OBSERVATION
Module code	AI
Total workload	15 ECTS
Learning outcomes	Upon completion of the module, students will be able to: - Understand the main paradigms (both deterministic and learning-based) for image processing, and their relevance for large-scale remote sensing data. - Design and implement the appropriate computer vision solution for a given EO data analytics problem. - Solve a challenging EO task using modern AI frameworks. EO4GEO BoK *Image enhancement* (https://bok.eo4geo.eu/IP1-4) - Identify and explain methods of image enhancement. EO4GEO BoK *Image segmentation* (https://bok.eo4geo.eu/IP3-5) - Explain which principles a segmentation should follow to arrive at meaningful objects that are appropriate for a specific application. - List the main segmentation methods used to group similar pixels into homogeneous objects. EO4GEO BoK *Deep learning* (https://bok.eo4geo.eu/IP1-4) - Analyse the EO Image processing tools required for preparing EO data for deep learning. - Apply deep learning methods on EO data within online processing cloud platforms.

	- Apply different DL approaches in EO imagery for classification, detection, or regression. - Compare different deep learning approaches in EO image classification. - Describe how deep learning works. - Identify programming languages (like Python, R, and C++) and the main open-source libraries that are common for deep learning. EO4GEO BoK Computer vision in EO (https://bok.eo4geo.eu/IP3-2) - Explain how computer vision imitates the human visual system when interpreting EO images. EO4GEO BoK *Kernel analysis (convolution)* (https://bok.eo4geo.eu/IP3-6) - Calculate a set of filtered reflectance values for a given array of reflectance values and a digital image filtering algorithm. - Describe a situation in which filtered data are more useful than the original unfiltered data. - Interpret the effect of a convolution from a given mask and contained weights. EO4GEO BoK *Scale space analysis* (https://bok.eo4geo.eu/IP3-9) - Create a scale space for an image by applying multiple iterations of low-pass filtering.
Module content	Efficient Remote Sensing Image Processing: - Classical methods for image processing and study of their complexity - Graph-based image processing - Tree-based image processing Deep Learning for Computer Vision: - Scene classification - Semantic segmentation - Object detection - Other computer vision tasks (e.g., instance segmentation) - Applications to Earth Observation data (e.g., change detection, land cover mapping) Geospatial Data Analytics Projects: - Research seminars - Advanced remote sensing projects (LiDAR, SAR, time-series and/or video) - Geodata science practical workshop
Courses	Courses are taught as tutorial courses (UE) aiming to help students acquire, practice and perfect practical skills and knowledge of the subject or one of its topics. - UE Efficient Remote Sensing Image Processing - UE Deep Learning for Computer Vision - IP Geospatial Data Analytics Project
Type of exam	Course-oriented type of exam. Assessment of individual lab assignments, group-projects plus written exams.

Module name	WORK PLACEMENTS
Module code	WorkPl
Total workload	12 | 18 ECTS
Learning outcomes	Obligatory work placements during the course of studies expose students to the workforce. Aiming at several important objectives: - Secure better career opportunities for graduates through compulsory work placements. - Increased awareness on novel application areas in the emerging EO*GI sector. - Collaborative research activities in the context of projects.
Module content	The obligatory skills-based internship (12 ECTS credit points) typically is conducted in blocked mode (1 or 2 periods) outside of course (semester) periods, but also can be completed as equivalent part-time activity. Alternatively, a research-based Master's thesis can be chosen in the context of a collaborative research work placement (18 ECTS credit points) at a consortium partner or at any institution worldwide including non-academic organisations must be confirmed by the Programme Board until the end of the first semester.

Annex II: Course equivalency lists

2023 Curriculum			2025 Curriculum	
Course		ECTS	Course	ECTS
Geovisualization and Advanced Cartography		6	Cartographic Design & Geomedia Advanced Cartography	3 3

Annex III: Application procedure

The application procedure for Erasmus Mundus Joint Master's programmes consists of two phases:

Phase 1: Online application

Generally, all submitted foreign documents, including all certificates and confirmations, must be verified by the country of origin and acknowledged by the Austrian representation authorities in that country (see the university's admission department website: https://www.plus.ac.at).

Students must complete the online application form, details on requirements and application deadlines can be found on the Erasmus Mundus Joint Master's website: https://master-cde.eu/admission/. The following information must be provided:

- Completed online application form
- Bachelor's diploma, diploma supplement (including course duration, description of the content and credits) and / or transcript of records including course titles, credit hours & grades
- Copy of passport
- Proof of language proficiency (e.g., school leaving certificate "Reifeprüfungszeugnis" within the EU)

Candidates will be invited for an online interview, criteria for the interviews include:

- Key competences for the intended Master's programme.
- Subject-related English skills.
- Motivation, objectives, and expectations of the studies.
- Previous academic achievements or practical experience.

Phase 2: Preselection

The Selection Committee will decide whether applicants will be recommended for admission. The final decision is made by the University of Salzburg.

Final provisions

The present version of the curriculum builds on the curricula for the European Erasmus Mundus Joint Master's Degree "Copernicus Master in Digital Earth", a joint programme and project co-funded by the European Union. The Consortium complies fully with EACEA requirements for project implementation and university admission regulations.

Impressum
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