Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Subdivided Module Catalogue

for the Subject

# Applied Earth Observation and Geoanalysis (EAGLE)

as a Master's with 1 major

with the degree "Master of Science"

(120 ECTS credits)

Examination regulations version: 2016
Responsible: Faculty of Arts, Historical, Philological, Cultural and Geographical Studies
Responsible: Institute of Geography and Geology

# Learning Outcomes

German contents and learning outcome available but not translated yet.

**Wissenschaftliche Befähigung**

- Das Master#Studium der Applied Earth Observation and Geoanalysis (EAGLE) vertieft die Lehr# und Forschungsinhalte der geographischen Fernerkundung. Der Studiengang ist in einen Pflicht#, Wahlpflichtbereich untergliedert und bereitet auf eine qualifizierte Erwerbstätigkeit vor. Das Ziel der Ausbildung ist es, den Studierenden fundierte und detaillierte Kenntnisse aus den wichtigsten Teilgebieten der geographischen Fernerkundung zu vermitteln und sie mit modernen Methoden des geographischen und fernerkundlichen Denkens und Arbeitens vertraut zu machen. Deshalb wird auf das Verständnis der fundamentalen geographischen Begriffe und Theorien sowie auf einige grundlegende Methodenkenntnisse und die Entwicklung typischer Denkstrukturen besonderer Wert gelegt. Zentrales Lernziel ist somit der Erwerb der Fähigkeit, räumliche Strukturen und Entwicklungsprozesse zielgerichtet zu analysieren, zu dokumentieren und zu bewerten. Auch die Fähigkeit zum selbständigen wissenschaftlichen Arbeiten soll massiv gefördert werden.
- Der anwendungsbezogene englischsprachige Masterstudiengang bietet Möglichkeiten der Vertiefung und Spezialisierung und bereitet auf eine hoch qualifizierte Berufstätigkeit im akademischen oder im angewandten Bereich vor.
- Vertiefung des im Rahmen des ersten berufsbefähigenden Studiums erworbenen geo# und raumwissenschaftliches Fachwissens und Erweiterung des methodischen und analytischen Ansatzes; Vertiefung der Kenntnisse über die Zusammenhänge innerhalb der eigenen Disziplin und mit benachbarten Disziplinen, Befähigung komplexe, insbesondere interdisziplinäre, Probleme und Aufgabenstellungen im Umweltbereich zu erkennen und zu analysieren, zu formulieren und – unter Zuhilfenahme von selbst recherchierter Fachliteratur – zu lösen; Vertiefung und Erweiterung der Befähigung, über geographische, geo# und raumwissenschaftliche Inhalte und Probleme sowohl mit Fachkollegen und # kolleginnen als auch mit einer breiteren Öffentlichkeit zu kommunizieren; Vertiefung und Erweiterung der Befähigung, sowohl einzeln als auch als Mitglied internationaler Gruppen zu arbeiten und Projekte effektiv zu organisieren und durchzuführen sowie in eine entsprechende Führungsverantwortung hineinzuwachsen;
- Befähigung, zukünftige Probleme, Technologien und wissenschaftliche Entwicklungen in den Geo# und Raumwissenschaften zu erkennen und entsprechend in die Arbeit einzubeziehen; durch die Vertiefung wissenschaftlicher, technischer und sozialer Kompetenz (u.a. Abstraktionsvermögen, Team# und Kommunikationsfähigkeit) auf die Übernahme von Führungsverantwortung vorbereitet zu sein.

**Befähigung zur Aufnahme einer Erwerbstätigkeit**

- Definition, Reflexion und Bewertung von Zielen für Lern# und Arbeitsprozesse sowie eigenständige und nachhaltige Gestaltung von Lern# und Arbeitsprozessen: Praxisbezug: Studierende sind in der Lage, theoretisches Wissen in der Praxis anzuwenden
- Problemlösungskompetenz: Absolventen/innen können mit wissenschaftlichen Methoden auch unbekannte Herausforderungen zu analysieren und zielgerichtet zu bearbeiten.
- Teamfähigkeit / Konfliktkompetenz: Absolventen /innen sind in der Lage, konstruktiv und zielorientiert in einem heterogenen, teilweise internationalem, Team zusammenzuarbeiten, unterschiedliche Ansichten produktiv zur Zielerreichung zu nutzen und mögliche Konflikte zu bearbeiten.
- Zeitmanagement: Absolventen/innen können unterschiedliche Aufgaben parallel und unter Zeit# und Erfolgsdruck auch bei widrigen Rahmenbedingungen erfolgreich bearbeiten.

**Persönlichkeitsentwicklung**

- Diskussionskultur und Teamfähigkeit: Entwicklung der Diskussionsbereitschaft und Befähigung zur Teamarbeit.
- Interkulturelle Kompetenz: Die Absolventen /innen können ihre erworbenen Kompetenzen in unterschiedlichen interkulturellen Kontexten anwenden.
- Die Absolventen /innen können sich sicher in einem heterogenen Umfeld bewegen und andere Meinungen konstruktiv auf ein gemeinsames Ziel einbinden. Sie sind kritikfähig.

**Befähigung zum gesellschaftlichen Engagement**

- Ethisches Handeln: Die Absolventen /innen können gesellschaftliche, naturwissenschaftliche, kulturelle wie auch wirtschaftliche Entwicklungen vergleichen, kritisch reflektieren und begründet eigene Positionen beziehen. Sie haben die Fähigkeit entwickelt, ihre Kompetenzen in partizipative Prozesse einzubringen.

# Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **V** = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

# Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

# Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

# In accordance with

the general regulations governing the degree subject described in this module catalogue:

**ASPO2015**

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

**01-Jun-2016 (2016-79)**

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.

# The subject is divided into

| Abbreviation | Module title | ECTS credits | Method of grading | page |
|---|---|---|---|---|
| **Compulsory Courses (55 ECTS credits)** | | | | |
| **Theoretical Basics (10 ECTS credits)** | | | | |
| 04-GEO-TB1-162-m01 | Introduction to Remote Sensing and Geoanalysis | 5 | NUM | 25 |
| 04-GEO-TB2-162-m01 | Applications of Earth Observation | 5 | NUM | 26 |
| **Methodological Basics (15 ECTS credits)** | | | | |
| 04-GEO-MB1-162-m01 | Digital Image Analysis and GIS | 5 | NUM | 13 |
| 04-GEO-MB2-162-m01 | Introduction to Programming and Geostatistics | 5 | NUM | 14 |
| 04-GEO-MB3-162-m01 | From Field Measurements to Geoinformation | 5 | NUM | 15 |
| **Internship (15 ECTS credits)** | | | | |
| 04-GEO-INT-162-m01 | Internship | 15 | B/NB | 10 |
| **Step towards Master Thesis (15 ECTS credits)** | | | | |
| 04-GEO-TMT1-162-m01 | Innovation Laboratory | 10 | NUM | 27 |
| 04-GEO-TMT2-162-m01 | Project Seminar | 5 | B/NB | 28 |
| **Compulsory Electives (35 ECTS credits)** | | | | |
| **Applications of Earth Observation (10-15 ECTS credits)** | | | | |
| 04-GEO-APP1-162-m01 | Land Surface Dynamics | 5 | NUM | 6 |
| 04-GEO-APP2-162-m01 | Land and Water Management | 5 | NUM | 7 |
| 04-GEO-APP3-162-m01 | Exploration of Mineral Deposits | 5 | NUM | 8 |
| 04-GEO-APP4-162-m01 | Selected Applications | 5 | NUM | 9 |
| **Advanced Methods and Modeling (5-10 ECTS credits)** | | | | |
| 04-GEO-MET1-162-m01 | Spatial Modeling and Prediction | 5 | NUM | 16 |
| 04-GEO-MET2-162-m01 | Advanced Spatial Analysis for Geoscientists | 5 | NUM | 17 |
| 04-GEO-MET3-162-m01 | Special Methodological Issues | 5 | NUM | 18 |
| **Resources and Environment (5-10 ECTS credits)** | | | | |
| 04-GEO-RE1-162-m01 | Selected Topics in Geography I | 5 | NUM | 19 |
| 04-GEO-RE2-162-m01 | Selected Topics in Geography II | 5 | NUM | 20 |
| 04-GEO-RE3-162-m01 | Mineral Resources in Space and Time | 5 | NUM | 21 |
| **Soft Skills (5 ECTS credits)** | | | | |
| 04-GEO-SOS1-162-m01 | Advanced applied Project management / Scientific presentation / Scientific Writing | 5 | B/NB | 22 |
| 04-GEO-SOS2-162-m01 | Advanced skills on the Master's level | 5 | B/NB | 23 |
| 04-GEO-SOS3-162-m01 | Advanced Instructions on Scientific Working | 5 | B/NB | 24 |
| **Thesis (30 ECTS credits)** | | | | |
| 04-GEO-MA1-162-m01 | Master-Thesis EAGLE | 28 | NUM | 11 |
| 04-GEO-MA2-162-m01 | Final Colloquium on Master Thesis | 2 | NUM | 12 |

| Module title | | | Abbreviation |
|---|---|---|---|
| **Land Surface Dynamics** | | | 04-GEO-APP1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Topics cover most aspects of remote sensing based assessment of Land Surface Dynamics. Topics such as snow cover dynamics, water body dynamics, forest cover and further vegetation dynamics, urbanization dynamics, coastal dynamics, or dynamics of geophysical parameters such as land surface temperature or selected indices will be addressed. In these contexts we look at opportunities arising from optical-, multi-spectral- and radar sensors, as well as thermal imagery. Data availability and access, as well as typical software tools for handling of multispectral data or time series analyses will be addressed as well.

**Intended learning outcomes**

Participants will gain a thorough and comprehensive overview and understanding of dynamic processes on the land surface that can be monitored using remote sensing imagery. Seminar papers or oral presentations will provide first experiences in scientific writing and presentation.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Land and Water Management** | | | 04-GEO-APP2-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

A general introduction on the land and water management and its demand for integrative knowledge in numerous fields of environmental and social sciences is given. The students select topics in which remote sensing and geoanalysis can significantly contribute parameters for answering relevant management questions. The topics include the derivation and use of parameters for monitoring land and/or water resources and examples how to use them in analytical or predictive models, or in indicator systems.

**Intended learning outcomes**

Participants will increase their knowledge about remote sensing approaches and geoanalytical methods which support different fields of land and water management. The students will gain practical experiences in selected examples.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Exploration of Mineral Deposits** | | | 04-GEO-APP3-162-m01 |
| **Module coordinator** | | | **Module offered by** |
| holder of the Professorship of Geodynamics and Geomaterials Research | | | Institute of Geography and Geology |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The examples may include the management of the resources in rangelands, croplands, irrigation and drainage systems, river catchments, urban areas, or others. Focus may be set on special geographical settings. Depending on the selected topics and scale relevant Earth Observation parameters can include land cover and land use mapping, biophysical variables (LAI/FPAR/Chlorophyll, evapotranspiration, etc.), biomass or crop yields, soil moisture, phenological metrics and other dynamic parameters.

**Intended learning outcomes**

Application of Remote Sensing in Mineral Deposit research

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Selected Applications** | | | 04-GEO-APP4-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The module focuses on remote sensing applications relevant for spatial and environmental planning, resource management, ecology and conservation, or disaster management. Among others, e.g. (urban) land use / land cover mapping and spatial modeling, or environmental modeling e.g. in geography, geology, ecology and biodiversity research, climatology, hydrology, soil sciences, geomorphology or forestry can be subject of the module. All topics covered ought to be in direct relation to remote sensing and geoanalysis.

**Intended learning outcomes**

The participants gain theoretical and methodological knowledge on the use of remote sensing in selected fields of environmental sciences and studies.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Internship** | | | 04-GEO-INT-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 15 | (not) successfully completed | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The background of the research idea, the methodological background hosting institution as well as the aim of the internship will be presented. The work during the internship as well as the outcome should be covered by this presentation. Moreover the students are encouraged to provide valuable insights into the respective research in order to help fellow students to gain a better understanding of the value of each approach.

**Intended learning outcomes**

The presentation of the internship for the whole EAGLE students and lecturer

**Courses** (type, number of weekly contact hours, language — if other than German)

P (0)
Module taught in: English or German

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

report in the form of a presentation (approx. 15 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

Additional information on module duration: 8 weeks.

**Workload**

450 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Master-Thesis EAGLE** | | | 04-GEO-MA1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 28 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The student should show within the Msc thesis that he/she is capable of working scientifically without major supervision. Defining the aim, the hypothesis and structuring a research topic is the main first content followed by the actual analysis of spatial data (Earth Observation mainly satellite remote sensing but also airborne data or auxiliary data). Defining the methods and describing these including the results and discuss the outcome critically. Moreover an appropriate visual presentation (typesetting and graphics, as well as maps) and writing is expected. The Msc thesis is graded on the difficulty of the topic, on the amount of needed supervision (independent work is expected as well as regular meetings with the supervisors), the writing and especially the discussion of the Msc thesis. The thesis structure can comply to a standard scientific article but should exceed 50 pages.

**Intended learning outcomes**

Conducting an independent research topic within 6 months

**Courses** (type, number of weekly contact hours, language — if other than German)

No courses assigned to module

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Master's thesis (approx. 60 pages)
Language of assessment: English

**Allocation of places**

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**Additional information**

Time to complete: 6 months.

**Workload**

840 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Final Colloquium on Master Thesis** | | | 04-GEO-MA2-162-m01 |
| **Module coordinator** | | | **Module offered by** |
| holder of the Professorship of Remote Sensing | | | Institute of Geography and Geology |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 2 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| | graduate | -- | |

**Contents**

The final colloquium aims to present the aim and results of the Msc thesis to a scientific audience (EAGLE lecturer and students) who are all allowed to ask questions and discuss the outcome critically. The presentation ought to follow scientific standards and should take 20mins. The presentation is not graded but is needed to finish the Msc.

**Intended learning outcomes**

Presentation of the final Msc thesis

**Courses** (type, number of weekly contact hours, language — if other than German)

K (0)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

talk (approx. 30 minutes) with subsequent discussion (approx. 15 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

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**Workload**

60 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Digital Image Analysis and GIS** | | | 04-GEO-MB1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The module comprises the following practical topics: Managing and geoprocessing of raster and vector data including digitization and analysis/ visualization of geodata / preprocessing of optical remote sensing data (geometric and atmospheric corrections, dimension reduction) / different approaches, algorithms, sampling and validation strategies for validation / change detection, vegetation indices / basics in the derivation of geophysical and biophysical parameters (e.g. LAI, FAPAR, Chlorophyll content of leafs, Land Surface Temperature, Surface Albedo

**Intended learning outcomes**

The seminar aims at improving the methodological skills of the participants in digital image processing and the use of Geographical Information Systems.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Introduction to Programming and Geostatistics** | | | 04-GEO-MB2-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Theoretical basics and practical examples of programming and geostatistics focused on application within Remote Sensing and GIS are provided. Basic functionality such as script structure, implementation, functions, loops as well as programming syntax using the R language are introduced. Moreover, statistical basics related to environmental analysis are covered such as Random Forest or spatial queries.

**Intended learning outcomes**

Introduction to programming and geostatistics for environmental data analysis.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **From Field Measurements to Geoinformation** | | | 04-GEO-MB3-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

This module sets a strong focus on field methods and data integration for selected types of land mapping. The contents of the course comprises the preparation of field campaigns, i.e. the selection of sampling schemes and methods appropriate for the subsequent analysis. A broad sequence of field devices will be introduced to the students. The field data collection can focus on different fields of environmental mapping, e.g. land use or vegetation, climate soil, geology, and others. Depending of the special focus of course, spatial integration and interpolation methods are presented.

**Intended learning outcomes**

The students will gain knowledge in how to collect field data for the purposes of training and validation land cover maps and geo-/biophysical parameters.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Spatial Modeling and Prediction** | | | 04-GEO-MET1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Different statistical methods will be applied for analysing spatial point patterns, such as vegetation samples or biodiversity related information. These results will be statistically predicted using methods such as GLM, GAM, Random Forest or MaxEnt. Implications of spatial point patterns as well as chosen environmental parameters will be discussed. All methods will be practically applied during the course using the programming language R

**Intended learning outcomes**

Within this course different methods to analyse point pattern statistically and conduct a spatial prediction are covered. Students will learn how to design such analysis, how to avoid caveats, troubleshoot errors and interpret the results.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Advanced Spatial Analysis for Geoscientists** | | | 04-GEO-MET2-162-m01 |
| **Module coordinator** | | | **Module offered by** |
| holder of the Professorship of Soil Science | | | Institute of Geography and Geology |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

No information on contents available.

**Intended learning outcomes**

No information on intended learning outcomes available.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Special Methodological Issues** | | | 04-GEO-MET3-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

One special remote sensing or geoinformatics method is covered in more detail. Special courses could cover contents such as utilizing data of passive (e.g. multi-spectral, hyper-spectral, thermal) or active (e.g. SAR, LIDAR) sensors in order to provide further details for application in geography, geology, ecology or other disciplines. Moreover, detailed courses on statistics and geostatistics as well as environmental modeling could be offered. Additionally, courses on specific research questions in geographic, geological, ecological or other disciplines related to Earth Observation can be offered.

**Intended learning outcomes**

The module enables the students to improve their technical skills in remote sensing and applied geoinformatics using one out of numerous different special methods.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1) + Ü (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, summer semester
creditable for bonus

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Selected Topics in Geography I** | | | 04-GEO-RE1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Physical Geography | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The module focuses the geofactors bedrock, topography, climate, soils, water, and plants and their relevance for landscape forming processes as well as for land-use. Basic geofactors of natural landscapes related to anthropogenic impact (land-use, settlements, infrastructure, etc.) are communicated.

**Intended learning outcomes**

The students learn synthesis and integration of their knowledge on geofactors. They are able to consider natural and cultural aspects for site-specific and planning assessment.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 45 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Selected Topics in Geography II** | | | 04-GEO-RE2-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Physical Geography | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The emphasis of this course is on linking classic biogeographical theory with current research outcomes. The aim is to learn what the historical and ecological reasons are behind the geographical distributions of living organisms and their communities, and the dynamic nature of these distributions. In this course we will answer the following questions: What are the patterns of plant distribution and diversity? What mechanisms explain these patterns? What are the theoretical and technical basic principles for the modelling of species distributions? What is the aim of the study of species distributions in the context of the "biodiversity crisis" and a dramatically changing environment? How can remote sensing techniques be useful for this kind of studies? After completing the course, each student should have: Gained or developed a familiarity and functional understanding in each of the main themes outlined on the course timetable and demonstrated competence in discussing and integrating across these themes.

**Intended learning outcomes**

The module deepens student's knowledge on selected environmental theories and approaches and their relevance for applied remote sensing.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 45 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Mineral Resources in Space and Time** | | | 04-GEO-RE3-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Geodynamics and Geomaterials Research | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The course provides an overview of the multitude of mineral deposits -- essential georesources for the sustainable utilization of planet Earth. In particular, processes that can lead to the economic concentration of mineral resources will be discussed using examples of major deposit types. This includes magmatic, hydrothermal and sedimentary processes that resulted in the formation of economically viable deposits of ore minerals, solid fuels and industrial minerals.

**Intended learning outcomes**

The students obtain basic, up-to-date insights into the geology of mineral deposits on the basis of concrete examples. Furthermore they obtain the ability to classify known and new mineral deposits/occurrences in a genetic way, thus laying the foundation for optimising future exploitation and exploration strategies.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 45 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Advanced applied Project management / Scientific presentation / Scientific Writing** | | | 04-GEO-SOS1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | (not) successfully completed | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Existing presentations will be discussed and evaluated with regard to visual appearance. Moreover design and appearance of presentations and poster will be discussed and guidelines provided. Individual training of presentations will be part of it as well. Alternative presentation methods will be introduced (e.g knitr, beamer).

**Intended learning outcomes**

Presentations and articles will be discussed with regard to its scientific content and goal to ensure high quality presentations as well as articles.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages) or
d) log (2 to 3 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Advanced skills on the Master's level** | | | 04-GEO-SOS2-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | (not) successfully completed | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Moreover scientific articles will be discussed and own articles be written. The structure as well as wording will be covered. Moreover, general writing guidelines, journal guidelines etc. will be introduced.

**Intended learning outcomes**

Presentations and articles will be discussed with regard to its scientific content and goal to ensure high quality presentations as well as articles.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages) or
d) log (2 to 3 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Advanced Instructions on Scientific Working** | | | 04-GEO-SOS3-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | (not) successfully completed | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

Moreover scientific articles will be discussed and own articles be written. The structure as well as wording will be covered. Moreover, general writing guidelines, journal guidelines etc. will be introduced.

**Intended learning outcomes**

Presentations and articles will be discussed with regard to its scientific content and goal to ensure high quality presentations as well as articles.

**Courses** (type, number of weekly contact hours, language — if other than German)

S (2)
Module taught in: English or German

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages) or
d) log (2 to 3 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)
Assessment offered: Once a year, winter semester

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Introduction to Remote Sensing and Geoanalysis** | | | 04-GEO-TB1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The lecture "Introduction to Remote Sensing" ensures that participants will gain a solid understanding of the following topics: the role of remote sensing in nowadays world / basics of electromagnetic radiation / history of remote sensing and image acquisition platforms / satellite orbits and orbit geometry / current spaceborne sensors / impacts of the atmosphere / geocorrection of digital imagery / radiometric correction of digital images / principles of image classifications / time series and big data / geodata concepts / geodata standards / geodata visualization / the job market for remote sensing and geo IT specialists

**Intended learning outcomes**

The lecture provides participants with a solid and comprehensive theoretical background of the background and physical principles of remote sensing, gives an introduction into digital image processing, as well as geodata concepts, standards and future developments

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 45 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

--

**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Applications of Earth Observation** | | | 04-GEO-TB2-162-m01 |
| **Module coordinator** | | | **Module offered by** |
| holder of the Professorship of Remote Sensing | | | Institute of Geography and Geology |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The lecture addresses applications of remote sensing of the atmosphere, the oceans, and particularly the land surface. The presented materials include among others applications in geography, environmental planning, ecology, biology, oceanology, soil science, geology, atmospheric science, but also e.g. pollution control (monitoring) and natural resource management. Which research questions can be answered by the means of Earth Observation and geoanalysis? The lecture comprises commonly used methodological approaches for the derivation of the different parameters. The covers the issue of implementation of the remote sensing technology into practice, e.g. the implementation of information systems. It outlines at selected examples, how remote sensing based results can be transferred to the workplace of professionals also beyond science.

**Intended learning outcomes**

The lecture gives a broad overview about the applications of remote sensing. The participants will learn how the different disciplines of environmental sciences and studies utilize the potentials of active and passive sensors for quantification and assessment.

**Courses** (type, number of weekly contact hours, language — if other than German)

V (2)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 45 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Innovation Laboratory** | | | 04-GEO-TMT1-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 10 | numerical grade | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The content of the innovation laboratory can be decided by each student individually and either a research topic is offered by a lecturer or the student is proposing an own topic. Research topics need to be discussed and proposed to one EAGLE lecturer who will also be in charge of supervising and grading the students work. Topics of the innovation laboratory can cover all aspects of the EAGLE study program with a strong focus on Earth Observation such as linking spectrometer field studies to remotely sensed data or the exploration of UAV based imagery and its usefulness for remote sensing sciences.

**Intended learning outcomes**

The innovation laboratory will allow the participant to focus on one particular topic in his/her field of interest. The aim is to get an in depth practical knowledge in how to address an own research in the field of the study program. The innovation laboratory aims to provide first insights into independent research projects such as a MSc study.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (3)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) presentation (approx. 30 minutes) or
b) preparing a poster (approx. 10 hours total) or
c) term paper (approx. 15 pages)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

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**Workload**

300 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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| Module title | | | Abbreviation |
|---|---|---|---|
| **Project Seminar** | | | 04-GEO-TMT2-162-m01 |
| **Module coordinator** | | **Module offered by** | |
| holder of the Professorship of Remote Sensing | | Institute of Geography and Geology | |
| **ECTS** | **Method of grading** | **Only after succ. compl. of module(s)** | |
| 5 | (not) successfully completed | -- | |
| **Duration** | **Module level** | **Other prerequisites** | |
| 1 semester | graduate | -- | |

**Contents**

The innovation laboratory shall provide the students with the opportunity to work independently on a defined research topic and explore the potential, challenges and limits of Earth Observation in a practical approach.

**Intended learning outcomes**

The presentation of the planned Msc. thesis for the whole EAGLE students and lecturer

**Courses** (type, number of weekly contact hours, language — if other than German)

S (1)
Module taught in: English

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

presentation (approx. 30 minutes)
Language of assessment: English or German (assessment will be held in English; in addition, the examiner may, where possible, decide to hold assessment in German)

**Allocation of places**

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**Additional information**

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**Workload**

150 h

**Teaching cycle**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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