Study Abroad Handbook for Postgraduate students

Lancaster Environment Centre

You can study at Lancaster for:

- Michaelmas term (October - December)
- Lent & Summer terms (January - June)
- Summer term (April – June) **Only for selected partners and previously agreed with Lancaster*
- Michaelmas & Lent term (October – March)

You are required to take:

- 24-30 ECTS credits during the Michaelmas term or Lent term
- 32-40 ECTS credits during Lent & Summer terms
- 48 ECTS credits during Michaelmas & Lent term

Modules available to Erasmus+ students

Although we make every effort to ensure the accuracy of information about modules, there may be some unavoidable changes. At the stage of the application, you are only completing a provisional study plan and it will only be confirmed when you arrive in Lancaster. We recommend you to have a strong list of back-up options in case you need to make changes to your provisional study plan.

Please note that you can change your mind if you need to and switch modules during your first week at Lancaster.

LEC.400: RESEARCH METHODS IN THE SOCIAL SCIENCES

- **Terms Taught:** Michaelmas Term Only
- **ECTS Credits:** 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module is designed to provide students with a critical understanding of the research process and the main approaches, methods and techniques which are typically used for research. The module is intended to enable students to undertake their own independent research as part of their Masters degree and to provide a solid foundation for PhD research.

Educational Aims

The module provides methods related knowledge and understanding applicable to social science at postgraduate level generally. In addition, the module provides training on communicating research outcomes.

On successful completion of this module, students should be able to:

- Situate decisions about methods through reference to the way science philosophies and existing literatures shape research design;
- Explain a range of ethical issues and dilemmas associated with research and ways of managing these issues and dilemmas;
- Use secondary data to develop original research;
- Describe the pros and cons of a range of methods for data collection and data analysis respectively
- Choose between a range of qualitative and quantitative research methods, when designing research, in a way that results in aims and objectives being effectively fulfilled.
- Write a research proposal;
- Communicate research to different audiences.

Outline Syllabus

- **Formulating a research project**
    - What is social science research?
    - How does ethics matter?
    - Positioning research in the literature.
    - How to write a research proposal.
    - How to plan a research project.
- **Choosing and engaging with methods**
    - Collecting data by asking questions or observing.
    - Analysing data quantitatively or qualitatively.
- **Working on individual research proposals**
- **Communicating research**

Assessment Proportions

- 100% Coursework

LEC.401/ LEC.401B: PERSPECTIVES ON ENVIRONMENT AND DEVELOPMENT

- Terms Taught: Michaelmas Term Only
- ECTS Credits: 7.5 ECTS Credits / 10 ECTS credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- Some experience of social science, human geography or development studies
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module aims to provide a theoretical foundation for the study of development and the environment from a geographical perspective. As such, it will focus on understanding the ways in which scholars have brought together development theory with the analysis of nature-society relations in the majority (i.e. 'developing') world. The intent of the module is to provide students with a critical understanding of the evolution of contemporary development discourses, and new ways of thinking about the relationships between environment and development. Some of the key topics that will be discussed are: theories of development, indigenous knowledge and development, biotechnology and food security, the political economy of natural resources.

Educational Aims

The module aims to enhance students' academic skills in developing reasoned arguments through the analysis, interpretation and critical appraisal of complex evidence. The module is also built to deepen students' understanding of the relationship between theory and practice. The module is also built to strengthen students' skills in oral presentation and academic writing.

On successful completion of the module, students should be familiar with:

- A range of theoretical arguments about development, from modernisation theory to sustainable development to post-development
- Geographical approaches to the study of nature and society, including cultural ecology and political ecology
- Contemporary themes, considerations and case-studies in geographies of development

Outline Syllabus

The module comprises of seminars (i.e. interactive lectures including structured discussions and other activities) and five fornightly workshops (i.e. student-led sessions based on group work). Seminars delve into the following themes/topics (subject to small changes):

1. An intro to Sustainable Development
2. Politics of the Earth? Mapping Green Discourses
3. (Post)Development
4. Environmental Justice and Social Movements
5. Climate Change and Development
6. Food: from Colonial Biopolitics to Global Biotechnologies
7. Ecosystem Services: Neoliberal Natures and Green Governmentality in the Global South?
8. Indigenous knowledges in the Anthropocene
9. A Digital Turn in Environmental Governance?
10. Final Discussion and Student Presentations.

Assessment Proportions

- 100% Coursework

LEC.402: GEOINFORMATICS

- Terms Taught: Lent Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This course introduces students to the fundamental principles of GIS, remote sensing and simulation modelling and explores how these complimentary technologies may be used to capture, manipulate, analyse and display different forms of spatially referenced environmental data. This is a highly vocational module with lectures complimented by computer-based practicals (using state-of-the-art software such as ArcGIS and ERDAS Imagine) on related themes. At the end of the module students are required to complete a project in which a functioning analytical environmental information system is generated for a given area from a variety of primary and secondary sources of data.

Educational Aims

- On successful completion of this module a student will gain:
- An understanding of the fundamental principles and applications of GIS and Remote Sensing
- An appreciation of the strong linkages between these disciplines and their fusion to create meaningful spatially-referenced environmental information
- A critical appreciation of current and future potential applications
- Training in the use of advanced software packages including ArcGIS and ERDAS Imagine
- Project management skills through completion of a geoinformatics project

Outline Syllabus

This module provides an introduction to the field of Geoinformatics, encompassing aspects of Geographical Information Systems (GIS), Remote Sensing for Earth Observation and Spatial Modelling.

The following topics will be covered in lectures:

Introduction to Geoinformatics; Sources and Characteristics of Spatial Data; Principles of Remote Sensing for Earth Observation; Sensors, Platforms and Systems; Multispectral Image Classification; Applications of Remote Sensing; Principles of GIS; Vector (object-based) GIS; Raster (field-based) GIS; Spatial Modelling; Effective Cartography; Geoinformatics in Academic Research.

The following topics will be covered in practicals:

Introduction to ArcGIS Pro; Image Processing; Image Classification; Change Detection; Vector Geoprocessing; Simple and Weighted Map Overlay; Effective Cartography; Sourcing Geospatial Data.

Assessment Proportions

- 100% Coursework

LEC.403/LEC.403B: ENVIRONMENTAL GOVERNANCE AND MANAGEMENT

- Term taught: Michaelmas
- ECTS Credits: 7.5 ECTS Credits / 10 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module provides students with a critical perspective on the underlying principles, approaches, tools and techniques associated with the management of natural resources and the environment. Particular attention is given to the challenges of dealing with change, complexity, uncertainty and conflict in the environment and the different strategies which can be deployed.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

This module provides students with a critical perspective on the underlying principles, approaches, tools and techniques associated with the management of natural resources and the environment. Particular attention is given to the challenges of dealing with change, complexity, uncertainty and conflict in the environment and the different strategies which can be deployed.

Educational Aims: General: Knowledge, Understanding and Skills

This module will enable students to examine and interpret contemporary environmental problems from academic and policy perspectives, evaluate and critique arguments and evidence related to environmental problems, demonstrate advanced understanding of alternative management concepts and approach and demonstrate their knowledge and learning both in academic and policy-relevant writing, and verbal contributions to discussions and debates with other students and module tutors.

Learning Outcomes: Subject Specific: Knowledge, Understanding and Skills

On successful completion of this module students will be able to:

1. Have a critical appreciation of the debates regarding the nature of resource and environmental management;

2. Have a critically awareness of the underlying characteristics of contemporary environmental problems, their challenges and management implications;
3. Have in-depth knowledge of a range of different approaches and strategies available for managing natural resources and the environment;
4. Assess selected environmental problems and policies responses for them, and develop constructive arguments in support of alternative policy proposals.

Learning Outcomes: General: Knowledge, Understanding and Skills

On successful completion of this module students will be able to:

1. examine and interpret contemporary environmental problems from academic and policy perspectives
2. evaluate and critique arguments and evidence related to environmental problems
3. demonstrate advanced understanding of alternative management concepts and approach
4. demonstrate their knowledge and learning both in academic and policy-relevant writing, and verbal contributions to discussions and debates with other students and module tutors.

Assessment Proportions

- 100% Coursework

LEC.406/LEC.406b: CLIMATE CHANGE AND SOCIETY

- Term taught: Lent
- ECTS Credits: 7.5 ECTS Credits / 10 ECTS credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module aims to explore and reconfigure the ways in which climate change is understood through a focus on the social, rather than the scientific-environmental discourses that have dominated the policy and politics of climate change. This module offers students a wide-ranging and intensive introduction to the politics, cultures and theories of climate change research in the social sciences and humanities.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

This module aims to explore and reconfigure the ways in which climate change is understood through a focus on the social, rather than the scientific-environmental discourses that have dominated the policy and politics of climate change. This module offers students a wide-ranging and intensive introduction to the politics, cultures and theories of climate change research in the social sciences and humanities.

Educational Aims: General: Knowledge, Understanding and Skills

Students will be able to critically evaluate different theoretical perspectives on a range of climate change debates and present alternative arguments.

Outline Syllabus

1. Introduction: Is it too late to stop dangerous climate change?
2. Thinking critically about energy and climate
3. Social constructions of climate change
4. Climate change and development
5. Climate mobilities
6. (Socio-) technical responses to climate change
7. Politics in times of climate change
8. Imagining the Earth, governing the planet
9. Influencing policy, negotiating climate change
10. Summary and synthesis: Climate change at the threshold

Assessment Proportions

- 80% Essay(s)
- 20% Presentation (Assessed)

LEC.421: FOOD SECURITY, AGRICULTURE AND CLIMATE CHANGE

- Terms Taught: Michaelmas Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

Food security is achieved when all people have access to an adequate supply of safe and nutritious food. Currently there are almost one billion people who are inadequately fed, while a similar number suffer from diet-related illnesses caused by over-consumption! We consider the requirements of a healthy diet and ways in which those in the developing world can access sufficient nutrients (e.g. fish consumption, crop biofortification). We address issues contributing to variation in food availability driven by local and global factors, the access that people have to food and the different ways in which food is utilised. The impact of the food production system on the environment is considered, along with the tensions arising from our quest for food security, energy security and water security. The approach to the study of these

issues is interdisciplinary in nature. The course takes an international perspective on GFS (Global Food Security).

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

We consider the sensitivity of food production processes (crop photosynthesis and reproductive development) to environmental variables associated with climate change (increased severity / frequency of droughts and high/low temperature events, and changes in atmospheric composition including elevated CO_2 concentrations and air pollutants such as ozone) and how these affect the quality and quantity of food produced.

Educational Aims: General: Knowledge, Understanding and Skills

Food security is achieved when all people have access to an adequate supply of safe and nutritious food. Currently there are almost one billion people who are inadequately fed, while a similar number suffer from diet-related illnesses caused by over-consumption! We consider the requirements of a healthy diet and ways in which those in the developing world can access sufficient nutrients (e.g. fish consumption, crop biofortification). We address issues contributing to variation in food availability driven by local and global factors, the access that people have to food and the different ways in which food is utilised. The impact of the food production system on the environment (and vice versa) is considered, along with the tensions arising from our quest for food security, energy security and water security. The approach to the study of these issues is interdisciplinary in nature. The course takes both local and international perspective on GFS (Global Food Security).

We explore the case study of the River Wye catchment, and the tensions between local and national stakeholders that have arisen from food system challenges and a declining river ecosystem.

Outline syllabus

Example topics include:

- Food Insecurity, Food Production & Climate Change
- What is a healthy and sustainable diet?
- The contribution of fisheries to food and nutritional security
- Biofortification for improved human nutrition
- Food Production & Water Availability
- Food versus Energy Production
- Food Production and Air Pollution
- Multi-functional landscapes for food security?
- Local food system challenges
- Stakeholder driven solutions

Assessment Proportions

- 50% Coursework
- 50% Reflective report

LEC.424: USING THE NATIONAL VEGETATION CLASSIFICATION

- Terms Taught: Summer Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module aims to provide a thorough grounding in the principles and practice of the vegetation survey including Phase 1 Survey and National Vegetation Classification (NVC). The module will consider the use of NVC for the description and understanding of plant communities and its application for vegetation survey, assessment and monitoring. The module is taught intensively

within one week.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

This module aims to provide a thorough grounding in the principles and practice of the vegetation survey includingUK HAB Survey and National Vegetation Classification (NVC). The module will consider the use of NVC for the description and understanding of plant communities and its application for vegetation survey, assessment and monitoring. The module is taught intensively within one week.

Educational Aims: General: Knowledge, Understanding and Skills

This module will provide basic information on plant species identification.

Outline syllabus

Lectures/workshops

- Plant species identification – Using vegetation keys to identify plant species.
- Phase 1 habitat survey – conducting phase1 habitat surveys and mapping vegetation types
- Introduction to the National Vegetation Classification – An outline of the origin and purpose of the NVC as a systematic and comprehensive survey of the plant communities of natural, semi-natural and major artificial habitats in Britain.

- The NVC survey methodology – Basic technique of recognising boundaries and homogeneous strands, of locating sample quadrats and recording essential features of the composition and structure of the vegetation and its relationship to the habitat.
- Using keys to identify plant communities – Assembling field data into floristic tables, understanding the concepts of frequency and abundance to identify plant communities encountered in the field.
- Understanding floristic tables of vegetation data – Using these results to understand the basic style of phytosociological floristic tables; the concepts of communities and sub-communities; constant, associate, differential and preferential species.
- Applications of the NVC for vegetation monitoring and management – Using the data and results from the above in case studies to demonstrate descriptive and predictive applications of the NVC for vegetation monitoring, management and landscape design.

Several of the above sessions include practical field exercises involving data collection from a range of vegetation types with subsequent analysis, evaluation and interpretation.

Assessment Proportions

- 100% Coursework

LEC.425: HABITAT MANAGEMENT

- Terms Taught: Lent Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module aims to develop students' understanding of the ecological principles of habitat management for biodiversity conservation, and how these can be applied for effective management of a range of priority habitat types in the UK. The module will also critically examine the construction of habitat management plans.

Students will gain experience in writing such a plan, in which conservation objectives are specified, threats identified, and management actions defined, taking into account the dynamic nature of ecosystems and conflicts of interest in land use. The course is taught by a mix of Lancaster staff and external lecturers who are directly involved in the application of ecological principles to habitat management. Much of the module is field-based, with excursions designed to exemplify the material presented in class.

Outline syllabus

The module will include a range of lectures, field excursions and workshops delivered by the module convenor and external contributors. Lectures will cover the ecological principles underlying habitat management for biological conservation and focus on a range of UK habitats including grassland, wetland and woodland as well as management of farmland and uplands in the wider countryside. Workshops will look at construction of conservation management plans

and the application of ecological principles. The lecture and workshop content will be supported by excursions to several nature reserves, in which reserve managers will demonstrate how they manage habitats to deliver conservation priorities.

Assessment Proportions

- 100% Coursework

LEC.428: WILDLIFE MONITORING TECHNIQUES

- Terms Taught: Michaelmas Term only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

Fieldwork skills are essential for ecologists and conservation biologist in both research and applied contexts. The module will teach a range of taxonomically-based field skills that will combine identification, sampling and other methods used to quantitatively monitor or assess populations. Components will include sessions on birds, mammals and invertebrates.

Educational Aims

The module will provide students with a range of generic skills such as team working, report writing, critical observation and accurate data recording and interpretation.

On completion of this module a student will be able to:

- Demonstrate identification skills with the key taxa used on the module
- Identify appropriate sampling methods and apply them in the field
- Outline the fundamentals of sampling bias and distinguish how they are associated with different trapping, recording and sampling methods
- Explain how surveys are used at different scales

Outline Syllabus

The module will have five sections, each delivered with one or two lectures and including a field component in campus or away. Section content will be determined by staff skills and may vary from year to year in relation to availability, but examples of key components include:

- Bird census techniques. Identification of key groups, such as waders or woodland birds using plumage and song.
- Terrestrial Invertebrate sampling methods. Identification of key taxa to various levels of detail, trapping methods (e.g. pitfall, sweep netting, suction sampling).
- Woodland sampling techniques. Measuring woodland structural complexity.

- Measuring and representing species diversity (computer based session using RStudio).
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Assessment Proportions

- 100% Coursework

LEC.462: DATA ASSIMILATION AND INTEGRATION

- Terms Taught: Michaelmas Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline
- College-level Maths or equivalent
- Familiarity with Microsoft Excel

Module Description

This module provides extensive hands-on experience in accessing and combining diverse data types for addressing challenges across the environmental sciences. Sessions are dominated by computer practicals, which cover a wide range of topic areas such as flooding, coastal processes, geoscience and ecology, to develop different digital data analysis skills. The module introduces the use of software such as ArcGIS and Matlab for data integration, analysis and visualisation tasks, and provides direct experience in accessing internationally available datasets (e.g. from national databases). Key themes, such as documenting data collection, the advantages of combining different data types, and considering uncertainty in data, run throughout the module. These lead to developing a critical approach for digital data use, from which robust methods can provide confidence in analysis results. The module can provide valuable digital skills for dissertation projects and includes the use of remote sensing data, time-series analysis, databases and data mining and diverse ground-based sensor data. The potential for advancing research through using historical and other data sources, such as citizen-science, is also explored.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

Making cutting-edge advances in the environmental sciences increasingly involves using a wide variety of data, collected using different sensors or instruments. Successful integration of such large and diverse data sets is facilitated by modern digital techniques, but must be underpinned by rigorous scientific methodologies. This module aims to instill the necessary critical approach for appropriate analysis of diverse digital data. The fundamentals of accessing, annotating, processing and interpreting heterogeneous datasets are taught, whilst considering the potential errors and pitfalls involved. Everyday problems in data collection, both avoidable and unavoidable will be demonstrated, together with techniques that minimise their impact. Underlying concepts such as identifying errors, dealing with missing data and data visualisation run throughout the module. These theoretical concepts are explored using a practical, hands-

on approach to develop data manipulation and visualisation skills with a variety of sources and software. Specialist software, such as ArcGIS and Matlab, will be introduced and an awareness of available tools to maximise the data utility will be developed. Datasets from across the environmental sciences will be used and the techniques and benefits of integrating different data streams illustrated.

Educational Aims: General: Knowledge, Understanding and Skills

The module develops widely applicable skills in data collection, handling, manipulation and integration that frequently underpin dissertation work. The module reinforces the use of rigorous scientific approaches in a digital environment and advances practical skills in the awareness and use of software. Students are shown how to consider data in a broad integrated approach and apply common sense in analyses and interpretation.

Outline Syllabus

- Remote sensing and metadata (I): data availability, source system properties, measurement trade-offs, analysis tools, processing multi/hyperspectral products, visualisation, data users
- Time series: tools and techniques for collection, analysis, visualisation and interpretation of time series data, issues requiring annotation, including non-stationarity, long range dependency, missing data
- Ground-based techniques: transducers, sensors and wireless sensor networks, cost versus accuracy, analysis and manipulation tools, geo-referencing and co-ordinate systems
- Databases, data mining and metadata (II): large data volumes and use of databases for storage, access and analysis; concepts behind data mining and metadata for disparate sources and observation types
- Historical and other data sources: historical data and non-conventional sources, accuracy and annotation issues, citizen-science and multi-scale integration

Assessment Proportions

- 100% Coursework

LEC.474: GEOLOGICAL HAZARDS

- Terms Taught: Lent Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline

Module Description

This module takes a broad look at geological hazards, covering contemporary events, to those that have shaped the Earth over geological time. Specific hazards addressed are: 1) earthquakes and tsunamis, 2) terrestrial and sub-marine landslides at a variety of differing scales, landslide triggering and principles of run-out, 3) volcanic hazards (eruption styles, plumes and pyroclastic flows) and 4) extreme events which civilisation has yet to witness. The module explores in depth the fundamental processes involved, and to what extent events can be predicted, and how they might be predicted. Case histories of national and international disasters will be used to illustrate these hazards, with the inherent risks and potential mitigation measures discussed. More numerate skills are a key focus. The module develops a sense of human-place in the geological world, promoting an understanding of how the geological world impacts human society, and what can be done to limit that impact.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

Geological hazards are considered over a range of magnitudes and timescales, from contemporary and historical events to those that have shaped the Earth over geological time.

Specific hazards addressed are:

1) landslide hazards (slope instability)
2) volcanic hazards (eruption styles, plumes, pyroclastic flows and lava flows)
3) seismic hazards (earthquakes and tsunamis)

The module explores in depth the fundamental processes involved, to what extent events can be predicted, and how they might be predicted. Case histories of national and international disasters will be used to illustrate these hazards, with the inherent risks and potential mitigation measures discussed.

Educational Aims: General: Knowledge, Understanding and Skills

Students will develop skills in integrating sparse quantitative measurements and qualitative observations to derive interpretations. Numeracy and use of maps and models are developed during the practicals and computer-based seminars. Environmental and geological observational skills are developed during the fieldwork. The module emphasises broad concepts such as using the past to inform the future, and environmental risk. Students acquire experience in communicating such themes through written work.

Outline Syllabus

We examine geological hazards over a wide range of timescales and magnitudes, ranging from contemporary and historical events to those that have shaped the Earth over geological time.

Specific hazards addressed are: 1) landslides, including both natural and human-triggered slope failure; 2) volcanic hazards (eruption styles, plumes and flows) and 3) earthquakes and tsunamis. The module explores in depth the fundamental geological processes involved, and examines the extent to which probabilistic forecasts, predictions or warning systems are possible or useful for different hazards.

Case histories of disasters from around the world are used to illustrate these hazards, with the inherent risks and actual or potential mitigation measures discussed.

This module is taught through lectures, practicals, seminars, and a fieldtrip to the Falls Foot landslide on Ingleborough.

Summary of contact and learning hours (Total: 150 hrs)

Total lecture + practical + seminar contact time: 38 hrs

Fieldwork contact time: 8 hrs

Reading: 70 hrs (5 hr for every hour of lectures)

Preparation of coursework: 42 hrs

Assessment Proportions

- 100% Coursework

LEC.475: DATA ANALYSIS AND PROGRAMMING SKILLS

- Terms Taught: Lent Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline
- Basic numeracy skills required (e.g. Microsoft Excel)

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

The module will introduce the skills required to explore, analyse, and visualise numerical datasets of different origins. It includes introductory elements of a modern programming language (e.g. Python) and interactive development environments (e.g. Jupyter Notebook). The module will provide students with scientific computing skills going beyond the use of spreadsheets and which are much in demand from potential employers. The module focuses on data pre-processing and quality assurance, analysis, and visualization, mainly for use with dissertation work, which provides the focus and immediate motivation. The main elements of programming are introduced, and skills are developed through exploring examples: data input, processing, output in numerical and graphical forms, programming tools and structures (e.g. arrays, loops, conditional statements, and comments).

Educational Aims: General: Knowledge, Understanding and Skills

The module aims to build confidence in handling and understanding numerical scientific data through supported exposure to real environmental data in intensive workshops. The module, while being principally a skills module, provides a pragmatic perspective on use of data and visualisation as scientists' tools, including the role of software and visualisation in scientific communication. Selected aspects of data modelling and its place within the scientific method and process are presented.

Outline Syllabus

This module serves as a foundation for environmental scientists to develop proficiency in data analysis and programming techniques. The module introduces the use of computer programming for analysis and visualisation of environmental science data. Using a modern programming language (e.g. Python) and interactive development environments (e.g. Jupyter Notebook), this module develops the skills necessary to use computer programming in conjunction with large datasets and modelling systems relevant to environmental science. The module covers the fundamental tools of basic programming: running code in interactive development environments, editing, commenting, debugging, variables, loops, conditional statements, and functions. These tools are used to develop the ability to use programming for statistical analysis, hypothesis testing, and data visualisation. The module assumes no prior experience with computer programming. The module is taught in 2-hour sessions, with each session consisting of a combination of theoretical concepts delivered in short lectures and hands-on programming exercises.

Assessment Proportions

- 50% Coursework
- 50% Test

LEC.477: GLOBAL CHANGE AND THE EARTH SYSTEM

- Terms Taught: Michaelmas Term Only
- ECTS Credits: 7.5 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline
- Previous knowledge of climate and weather; willingness to engage in some Maths, Chemistry and Physics

Module Description

The module begins with the underlying concepts that shape the Earth’s climate (energy transfer, the greenhouse effect, atmosphere and ocean circulation) before considering natural and human drivers of climate change, such as volcanoes, solar output, greenhouse gases and land use change. In addition, it will also introduce the computer models and global observation networks that scientists use to understand the Earth system as well as the IPCC process.

Educational Aims

Educational Aims: Subject Specific: Knowledge, Understanding and Skills

This module is intended for students who wish to gain experience in the field of Earth system science, and to understand how scientists study this area in an era of global change.

The aim is to introduce the concept of the Earth system and how the different components (atmosphere, ocean, ice and ecosystems) interact with each other to shape the Earth's climate and control how climate changes on a range of timescales. The module begins with underlying concepts that control the Earth's energy balance (e.g. the greenhouse effect, atmosphere and ocean circulation), before considering natural and human drivers of climate change, including

volcanoes, solar output, greenhouse gas emissions and land use change. In addition, it will also introduce the computer models and global observation networks that scientists use to understand the Earth system as well as the IPCC process.

Overall, this module aims to provide students with a rounded understanding of (a) the physical processes which influence global climate change, and (b) a range of contemporary climate issues (e.g. Paris agreement, geoengineering proposals).

Educational Aims: General: Knowledge, Understanding and Skills

Though workshops, practicals and seminars students will engage with the course content more deeply, including understanding uncertainty and confidence in scientific data, and considering scientific knowledge and the scientific process at the interface with society, as well as how public/policymaker/science/interest group tensions can arise. Through the coursework assessments, students will practice researching, summarising and communicating complex concepts for both a technical audience as well as an educated, but not necessarily scientific, audience.

Outline Syllabus

This module is about how the different parts of the Earth system (atmosphere, biosphere, ocean, ice, land, etc.) interact with each other through feedback processes, and how these processes affect and are affected by climate change.

We start by covering the underlying physical, chemical and biological sciences of the Earth system in the context of Earth's climate. We consider how changes to Earth's climate are observed and modelled and how research findings are synthesised then communicated by the IPCC. In addition to studying human influences on Earth's climate in recent centuries, we cover the major natural processes that alter Earth's climate over millennia. Finally, we look at some case studies of global change and the Earth system and consider some of the most contemporary issues in climate science (e.g. proposed geoengineering approaches, uncertainty in future climate projections, the Paris Agreement).

The module is delivered through lectures and seminars. There is also a practical at the Hazelrigg weather station to determine the atmospheric radiative balance. These elements combine such that students gain an in-depth understanding of the complexity of the Earth system in relation to historical and future climate change.

Learning Outcomes

Learning Outcomes: Subject Specific: Knowledge, Understanding and Skills

On completion of this module students will be able to demonstrate subject specific knowledge, understanding and skills, having the ability to:

- Calculate a global 2-compartment radiative budget
- Discuss the major parts of the Earth system and how they interact
- Describe what an Earth system model is and explain major sources of uncertainty
- Explain the sources and sinks of long- and short-lived climate forcing agents

Learning Outcomes: General: Knowledge, Understanding and Skills

On completion of this module students will be able to:

- Prepare and deliver a short scientific report (written or oral) on a climate change topic.
- Use a range of meteorological apparatus and observations to report the detailed state of the atmosphere.
- Contribute to key debates around contemporary issues in climate science

Assessment Proportions

- 100% Coursework

LEC.500: DISSERTATION PROJECT (EXCHANGE STUDENTS)

- Terms Taught: Michaelmas, Lent or Summer terms
- ECTS Credits: 15 ECTS Credits

Pre-requisites:

- This module is only available to Postgraduate Erasmus+ students from selected partners
- You must have completed a degree and enrolled in a postgraduate programme in a related discipline
- Module Convenor approval required to undertake dissertation project

Module Description

100% on a final 5,000-word report. An academic supervisor is appointed to each project providing guidance on the definition of the research question, identification of the appropriate methodology and feedback on the Progress Report, Poster and draft sections of the thesis. The Progress Report and Posters are formative assessments because the student requires feedback but invariably the project is still evolving to such an extent that this feedback should not count toward their final mark for this element. The summative assessment is on the 5,000-word dissertation where it belongs.

Educational Aims

On successful completion of this module students will be able to develop specialised, master level knowledge and experience in a specific area of research.