UNIVERSITÄT HOHENHEIM

Modulhandbuch

für den Studiengang

Master of Science

Earth and Climate System Science

Stand Oktober 2019

Studiengang: Earth and Climate System Science (Master)

Modul: Agricultural and Forest Meteorology (1201-590)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	Basic understanding about atmospheric processes, basic modules of the first semester of the master course.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Active participation in both parts of the module
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 124h independent study = 180 h
Fachkompetenzen / Lern- und Qualifikationsziele	The students develop a basic understanding for questions and methods used in agricultural and forest meteorology. They know the relationships between weather and climate on the one hand side and the different types of land surface on the other side and are capable to use this knowledge to solve interdisciplinary questions in applied meteorology.
Schlüsselkompetenzen	The students are capable to combine the competences learned in this module with their knowledge learned in the basis lectures of earth sys-tem sciences to work on interdisciplinary questions in agriculture and forestry.
Anmerkungen	Maximum number of participants: 10

Agricultural and Forest Meteorology, Lecture (1201-591)

Person(en) verantwortlich	Maike Schumacher
Person(en) begleitend	Dr. rer. nat. Hans-Stefan Bauer
Lehrform	Vorlesung
SWS	2
Inhalt	In the first part of the module, the basic understanding of atmospheric processes developed in earlier modules of the master course is briefly repeated and then complemented by details about the relationships between the atmosphere and the underlying land surface. Then the questions answered in agriculture and forest meteorology are presented to develop an understanding of the interrelation between weather and climate on the one side and agriculture, forests and forestry on the other side.

Agricultural and Forest Meteorology, Exercise and Practical (1201-592)	
Person(en) verantwortlich	Maike Schumacher
Person(en) begleitend	Dr. rer. nat. Hans-Stefan Bauer
Lehrform	Übung mit Praktikum
SWS	2
Inhalt	The students solve exercises as preparation for the written examination as well as for deepening the material discussed in the lecture. Furthermore, this part of the module contains practical work with tools used in Agriculture and Forest Meteorology to deepen the understanding of the applied methodologies.

Modul: Applied Limnology (3201-640)

Modulverantwortung	Prof. Dr. Klaus Schmieder
Bezug zu anderen Modulen	This module complements the other modules in the field of limnology Inland Water Ecosystems (3004-410) und Spezielle Limnologie (3201-450)
Teilnahmevoraussetzungen	keine
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	written papers in the form of an exercises report and of an excursion report (50%)
Prüfungsleistung	written exam (50%)
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Vermittelt werden theoretische Inhalte der Angewandten Limnologie sowie im Gelände praktische Fähigkeiten in der physikalischen, chemischen und biologischen Untersuchung und Beurteilung von Still- und Fließgewässern.
Schlüsselkompetenzen	Die Studierenden erwerben zu den genannten Fachkompetenzen weitere Kompetenzen in den Bereichen Organisation von Messkampagnen, der kritischen Auseinandersetzung mit den

	erhobenen Daten sowie Fähigkeiten in der mündlichen und schriftlichen Präsentation wissenschaftlicher Ergebnisse.
Anmerkungen	Anmeldung über ILIAS.
Applied Limnology (3201-641)	
Person(en) verantwortlich	Prof. Dr. Klaus Schmieder
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	Structural impairments and renaturation Organic and chemical impairments: Saprobisation, Eutrophication and solutions Water Organisms: Phytoplankton, Zooplankton Water Organisms: Makro-Invertebrates, Vertebrates Water Organisms: Macrophytes Limnology of artificial water bodies Assessment of ecological state: WFD Lake restoration The course includes also practicals and 3 excursions to different of the above topics.
Literatur	Schwoerbel, Brendelberger: Einführung in die Limnologie
Anmerkungen	Anmeldung über ILIAS

Modul: Astrobiology (1301-400)

Modulverantwortung	Prof. Dr. rer. nat. Henry Strasdeit
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Regular attendance, excursion, preparing and presenting a report
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h attendance + 124 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students understand how laboratory experiments, field studies, astronomical observations and space missions expand our knowledge about the origin and evolution of life. They realize that life on Earth is and always was strongly influenced by cosmic phenomena and that life itself could be a cosmic phenomenon, that

	is life may also exists on other planets and moons. The students know how to access the diverse astrobiological literature and to present and discuss results from relevant publications. During an excursion, they acquire practical skills in recognizing the traces of an ancient asteroid impact.
Schlüsselkompetenzen	After having completed the module, the students should be able to deal with highly interdisciplinary problems by combining the methods and ways of thinking of various scientific disciplines.
Anmerkungen	Places available: 14 Registration via ILIAS starting in January/February for the following summer semesterrn Places are assigned by the order of incoming registrations.
Introduction to Astrobiology (1301-401)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit
Person(en) begleitend	Dr. rer. nat. Stefan Fox
Lehrform	Vorlesung mit Exkursion
SWS	2
Inhalt	The lecture includes the following topics: astronomical basics, Drake equation and SETI, chemical evolution from the interstellar medium to planetary systems, the early Earth, asteroid impacts, primordial volcanic islands, black smokers, past and present environmental conditions on Mars, the search for life on Mars, ExoMars mission, lithopanspermia, survival of microorganisms in space, origin of biological homochirality, protocells and protometabolism, minerals and salts and the origin of life, planetary field analogues, oldest traces of life. The excursion leads to the impact crater Nördlinger Ries. It includes field trips and a visit to the Ries museum.
Literatur	Plaxco, K. W., Gross, M.: Astrobiology - A Brief Introduction, 2nd edition, Johns Hopkins University Press, Baltimore, 2011. Rothery, D. A., Gilmour, I., Sephton, M. A. (eds.): An Introduction to Astrobiology, revised edition, Cambridge University Press, Cambridge, UK, 2011. Sullivan III, W. T., Baross, J. A. (eds.): Planets and Life - The Emerging Science of Astrobiology, Cambridge University Press, Cambridge, UK, 2007. Pösges, G., Schieber, M.: Das Rieskrater-Museum Nördlingen, 3. Auflage, Pfeil, München, 2009; The Ries Crater Museum Nördlingen, Pfeil, München, 1997.
Key Experiments in Astrobiology (1301-402)	
Person(en) verantwortlich	Dr. rer. nat. Stefan Fox
Lehrform	Vorlesung
SWS	1
Inhalt	This lecture gives an overview about seminal experiments in different fields of astrobiological research. Findings from laboratory

	and field studies, space missions, and astronomical and astrochemical observations will be presented. A focus will be on the practical aspects of simulation experiments, space missions, and chemical analyses. Some examples of topics covered are “studies on the interstellar medium, exoplanets, and small celestial bodies (comets, asteroids, meteorites)”, “experimental prebiotic chemistry: amino acids, Miller-type experiments, the formose reaction, protein and RNA world hypothesis”, “field studies at volcanic locations (hot-volcanic-coast scenario)”, and “analytical methods”.
Literatur	Plaxco, K. W., Gross, M.: Astrobiology - A Brief Introduction, 2nd edition, Johns Hopkins University Press, Baltimore, 2011. Rothery, D. A., Gilmour, I., Sephton, M. A. (eds.): An Introduction to Astrobiology, revised edition, Cambridge University Press, Cambridge, UK, 2011. Sullivan III, W. T., Baross, J. A. (eds.): Planets and Life - The Emerging Science of Astrobiology, Cambridge University Press, Cambridge, UK, 2007.
Anmerkungen	The topics covered in this lecture are partly aligned to the contents of the “Practical course in chemical evolution”.
Seminar on Astrobiology (1301-403)	
Person(en) verantwortlich	Dr. rer. nat. Stefan Fox
Person(en) begleitend	Prof. Dr. rer. nat. Henry Strasdeit
Lehrform	Seminar
SWS	1
Inhalt	In this seminar, each student selects an astrobiological topic and presents it in a talk of 15 to 20 minutes (e. g. as a PowerPoint presentation). A list of topics to choose from will be provided. After each talk, one of the students will chair the following discussion. Topics for the seminar are, for example, the early Earth environment, the concept of habitability, earliest records of life, and lithopanspermia.
Literatur	Journal articles and book chapters on which the seminar talks are based.

Modul: Aufbaumodul Sustainability (5206-270)

Modulverantwortung	Prof. Dr. Michael Ahlheim
Bezug zu anderen Modulen	AVWL1
Teilnahmevoraussetzungen	(weitgehend) abgeschlossenes Grundstudium
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS

Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Studienleistung	Klausur
Prüfungsdauer	120 Minuten
Arbeitsaufwand	180 Stunden: 42 Stunden Präsenzstudium 136 Stunden Selbststudium / Vor- und Nachbereitung 2 Stunden Klausur
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden haben vertiefte Kenntnisse in den ökonomischen Instrumenten, die bei diversen Umweltschäden und umweltpolitischen Problemlagen Einsatz finden können. Sie kennen und verstehen neben dem Spektrum an umweltökonomischen Instrumenten zudem die theoretischen und praktischen Grundzüge verschiedenartiger Umweltbewertungsmethoden. Ferner besitzen die Studierenden Wissen über die Nutzung erneuerbarer und nicht-erneuerbarer Ressourcen. Sie sind in der Lage, umweltpolitische Instrumente, umweltökonomische Bewertungsmethoden und intertemporalen Ressourcenverbrauch aus der Perspektive verschiedener Nachhaltigkeitsansätze zu analysieren und zu bewerten. Vorlesung und Übung sind anwendungsorientierte Veranstaltungen, die im theoretischen Bereich vor allem auf ein mikroökonomisch-mathematisches Grundwissen zurück greifen und dieses bei den Studierenden weiter ausbauen.
Sustainability and Environmental Economics (5206-272)	
Person(en) verantwortlich	Prof. Dr. Michael Ahlheim
Lehrform	Vorlesung mit Übung
SWS	3
Inhalt	In the first part of this lecture course different concepts of sustainability are introduced to students. The next part deals with government's responsibility for the environment and with optimal government policies to cope with market failure in the environmental sector of the economy. These policies focus on an overall efficient use of the scarce resources of an economy. The next part focusses on environmental cost-benefit analysis and different techniques of preference assessment. In the final part of this lecture course which focusses on the basic concepts of resource economics students learn about the optimal extraction of nonrenewable resources like crude oil or natural gas over time. The main topics of this lecture course are: - The concept of sustainability and its different interpretations - The responsibility of government for the environment - Market failure and the economic causes of environmental problems - Instruments of environmental policy - The economic assessment of environmental values

	- Basic concepts of resource economics
Literatur	AHLHEIM, M. (1998), Measures of economic welfare, in: Barbera, S., Hammond, P. J., Seidl, C. (eds), Handbock of utility theory, Vol. 1: Principles, Kluwer Academic Publishers, Dordrecht, 483-568. AHLHEIM, M., EKASINGH, B., FRÖR, 0 ., KITCHAICHAROEN, J., NEEF, A. , SANGKAPITUX, C., SINPHURMSUKSKUL, N. (2010), Better than their reputation: enhancing the validity of contingent valuation mail survey results through citizen expert groups. Journal of Environmental Planning and Management 53(2), 163-182. AHLHEIM, M., FRÖR, 0 ., SINPHURMSUKSKUL, N. (2006), Economic valuation of environmental benefits in developing and ernerging countries: theoretical considerations and practical evidence from Thailand and the Philippines, Quarterly Journal of International Agriculture 45 (4): 397-419.

Modul: Biological Pest Control (3603-490)

Modulverantwortung	Prof. Dr. Dr. Claus P. W. Zebitz
Bezug zu anderen Modulen	This module is a good combination with the module "Exercises in Biological Pest Control" (3603-500) (limited number of participants!)
Teilnahmevoraussetzungen	Vorkenntnisse allgemeiner Pflanzenschutz einschließlich Grundlagen des biologischen Pflanzenschutzes (Modul "Pflanzenschutz" 3603-210 oder äquivalente Veranstaltung(en) anderer Universitäten)
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Written paper in groups (30 %)
Prüfungsleistung	Written exam (70 %)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completing this module, students understand in depth the potential of the respective antagonist groups, the biology of antagonists and their use in practice. Students are able to identify biocontrol relevant processes in ecosystems, to analyse their interactions and to estimate positive and negative consequences of biological pest control. They are proficient in drawing the necessary information for benefit-risk-analyses from the available literature and

	integrate this information into strategy models. Students are finally aware of the limits and risks of biological pest control.
Schlüsselkompetenzen	During preparation for the exam, while preparing and following up on lectures and with the compilation of a written scientific paper (in groups), students practice self-reliance, time management and team work. They practice both critical and analytical thinking and reading of scientific literature and they improve their capability of exploring and articulating a scientific issue. In case studies they learn to define scientific problems and design consistent research and development plans in biological pest control.
Anmerkungen	Das Modul deckt ausschließlich die biologische Bekämpfung von Schadinsekten und -milben ab.
Biological Pest Control (3603-491)	
Person(en) verantwortlich	Prof. Dr. Dr. Claus P. W. Zebitz
Lehrform	Vorlesung
SWS	4
Inhalt	1. Introduction Aims, scopes and target groups of biological pest control, suitable natural antagonists; strategies of biological pest control, short and long-term effects. 2. Biology of natural antagonists of pest arthropods Entomopathogenic Viruses: Overview on entomopathogenic viruses; pathogenesis and specificy; persistence in the environment; formulation and synergisation of viruses; production of viruses; application and application technique; examples of successful control using viruses, limitation of entomopathogenic viruses Entomopathogenic Bacteria: Overview on entomopathogenic bacteria with emphasis on Bacillus thuringiensis, B. popilliae, B. sphaericus ; pathogenesis and specificy of entomopathogenic bacteria; persistence in the environment formulation and synergisation of bacteria, application and application technique; examples of successful control and limitations of using entomopathogenic bacteria. Protozoans: Short overview on successful control, risks and limitations of entomopathogenic protozoans Entomopathogenic fungi: Overview on entomopathogenic fungi; infection biologye, pathogenesis and specificy of entomopathogenic fungi; morphological and mol.-biol. characterisation of specific strains of selected fungal species (e.g. Metarhizium anisopliae, Beauveria brongniartii, B. bassiana, Verticillium lecanii, Paecilomyces fumosoroseus); persistence in the environment; application and application technique and specific uses; examples of successful control and limitations of using entomopathogenic fungi. Nematodes:

	Overview on entomopathogenic nematodes; infection biology; production, application and use. Arthropods: Short overview of predacious and parasitoid life forms; antagonist spectrum of a (pest)species; selection of suitable antagonists (type, species, adaptation to prey or host, resp., ecotypes, specificy, prey/host preferences); importance of additional (pollen, carbohydrates) and alternative food; describing antagonistic performance under controlled conditions and in practice; impact of other crop protection measures; lab-to-land-transfer of results (i), into different crops (ii); into different agroecosystems (iii) (climate, crop, frame conditions); successful and failing biocontrol using predators and parasitoids with causal analysis; risks of biocontrol using arthropods. 3. Economical importance of biolocical pest control. 4. Perspectives of biolocical pest control.
Literatur	Das Skript ist auf der ILIAS-Plattform erhältlich und umfaßt die Vorlesungspräsentationen, ergänzende und weiterführende Original-Literatur.

Modul: Bodenwissenschaftliches Experiment (3102-420)

Modulverantwortung	Prof. Dr. Ellen Kandeler
Bezug zu anderen Modulen	This module helps to deepen your interest in soil science and will help to focus your interest on a topic you want to choose for your master thesis and/or PhD.
Teilnahmevoraussetzungen	Basic and advanced knowledge in soil science is necessary!
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Prüfungsleistung	schriftliche Ausarbeitung in Form eines Laborprotokolls (75%) und Präsentation mit Diskussion (25%)
Prüfungsdauer	30 Minuten
Arbeitsaufwand	70 h Präsenz + 130 h Eigenanteil + Prüfung = 200 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Nach erfolgreichem Abschluss dieses Moduls haben die Studierenden einen Einblick in die Themen der modernen Bodenwissenschaften. Sie können Böden analysieren und Ergebnisse mündlich präsentieren.

Schlüsselkompetenzen	Durch die Vorlesungsvor- und Nachbereitung sowie durch die Prüfungsvorbereitung erlernen und trainieren die Studierenden selbstständiges Arbeiten und kritisches, analytisches Denken.
Anmerkungen	Jeder Student kann wählen ob er die Laborarbeit mit Bericht und den Vortrag auf englisch oder deutsch machen möchte.
Bodenwissenschaftliches Experiment (3102-421)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Thilo Streck, Prof. Dr. Ellen Kandeler, Prof. Dr. rer. nat. Thilo Rennert
Lehrform	Seminar
SWS	4
Inhalt	Entsprechend Ihres Interesses können Sie ein Projekt unter Anleitung von: Biogeophysik (Prof. Streck) Bodenchemie (Prof. Rennert) Bodenbiologie (Prof. Kandeler) durchführen. In Zusammenarbeit mit einem Post Doc oder einem Doktoranden beteiligen Sie sich aktiv an neuen Forschungsfragen. Sie analysieren Bodenproben, werten ihre Ergebnisse aus und präsentieren sie in einem Seminar. Für weitere Informationen bezüglich der Inhalte dieser Veranstaltung wenden Sie sich bitte an Prof. Kandeler: Tel. 0711/4592-4220.
Literatur	Der Betreuer stellt Ihnen aktuelle Literatur zu Ihrem gewählten Thema zur Verfügung.
Anmerkungen	Es handelt sich um ein Seminar mit Übungen! Das Projekt kann nach Absprache mit dem Betreuer jederzeit begonnen werden. Dauer: 2-3 Wochen im Institut nach Vereinbarung

Modul: Chemistry of the Earth System & Pollution (1301-470)

Modulverantwortung	Prof. Dr. rer. nat. Henry Strasdeit
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht

Studienleistung	Regular attendance
Modulprüfung	Written examination
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 112h independent study = 168 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students are familiar with the most important substances and compound classes of the Earth system and their relevant reactions. The students understand the underlying chemical concepts and know how to apply them. They comprehend the chemical aspects of the Earth system on a global scale as well as on the molecular level. The students acquire a differentiated view of anthropogenic impacts.
Anmerkungen	Registration for the module: In person with the professor (this only applies to students of other Master's programmes)
Organic Substances in the Earth System (1301-471)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Uwe Beifuß
Lehrform	Vorlesung
SWS	1
Inhalt	Initially, some important functional groups and reactions that are crucial for a proper understanding of organic chemistry will be repeated. This is followed by presentation and discussion of the most important classes of organic substances as well as selected compounds of the Earth system. Their formation, properties, and (degradation) reactions will be discussed as far as they are relevant to the Earth system.
Literatur	- D. Hart, C.M. Hadad, L.E. Craine, H. Hart, Organic Chemistry: A Short Course, Brooks/Cole, Belmont, 2012. - or any other textbook of organic chemistry.
Inorganic Chemistry of the Earth's Surface (1301-472)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit
Lehrform	Vorlesung
SWS	1
Inhalt	The lecture is based on an integrative concept. The focus is on the chemical principles that can equally be applied to the description of the Earth's solid surface and the bodies of water. Key issues of the lecture are: general chemical description of the Earth's surface; mineral classes; rocks; weathering; solubility; mobilisation and immobilisation of metal ions; metal complex formation; ion exchange; adsorption; acid-base reactions; redox reactions; acidity; salt content; substances and their transport in the hydrosphere; anthropogenic impacts.

Anmerkungen	- C.V.A. Duke, C.D. Williams, Chemistry for Environmental and Earth Sciences, CRC, Boca Raton, 2008. - J.E. Andrews. P. Brimblecombe, T.D. Jickells, P.S. Liss, B.J. Reid, An Introduction to Environmental Chemistry, Blackwell, Oxford, 2004. - G.W. vanLoon, S.J. Duffy, Environmental Chemistry - A Global Per-spective, Oxford University Press, Oxford, 2011. - Textbooks of general and inorganic chemistry (the most recent edi-tions).
Chemistry of the Atmosphere (1301-473)	
Person(en) verantwortlich	Prof. Dr. Cosima Stubenrauch
Lehrform	Vorlesung
SWS	2
Inhalt	Structure of the atmosphere; radiation balance of the Earth; glob-al balances of trace gases; chemical degradation mechanisms; stratospheric chemistry, ozone hole; tropospheric chemistry, pho-tochemical smog; greenhouse effect, climate; spatial distribution of air pollutants in urban and rural areas; temporal variation and trends in air quality; meteorological influences.
Literatur	- D.J. Jacob, Introduction to Atmospheric Chemistry, Princeton University Press, Princeton, 1999. - R. Zellner, Global Aspects of Atmospheric Chemistry, Steinkopff Verlag, Darmstadt, 1999. - P. Warneck, Chemistry of the Natural Atmosphere, Academic Press, San Diego, 2nd edition, 2000. - G. Baumbach, Air Quality Control, Springer Verlag, Berlin, 1996.
Anmerkungen	The graduates of the module understand the basic physical and chemical processes in the tropo- and the stratosphere. The influ-ence of air pollutants in the ambient air and on a global scale can be explained, which, in turn, allows classifying and assessing the air quality in a defined area.

Modul: Climate Change, Risks and Challenges (1201-400)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	2
Angebotshäufigkeit	jedes Semester
Semesterlage	3. Semester
Dauer des Moduls	1 Semester

Verbindlichkeit	Wahlpflicht
Modulprüfung	Einreichen der Teilnahmebescheinigung
Arbeitsaufwand	60 h Eigenanteil
Fachkompetenzen / Lern- und Qualifikationsziele	Basic knowledge of - the climate system - climate models and scenarios - climate history - impacts of climate change - climate change as a societal challenge - climate change in politics and economy
Schlüsselkompetenzen	- Transfer of knowledge in natural and applied sciences - Teamwork and communication - Critical and analytical thinking - Interdisciplinary thinking and its applications to problems in earth sciences
Anmerkungen	Ergänzendes Modul für ECSS und ESS Studierende mit Studienbeginn vor WS 2018/19
Climate Change, Risks and Challenges, MOOC (1201-401)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	E-Learning
SWS	2
Inhalt	Die Lehrveranstaltung vermittelt die für das Verständnis des Klimasystems und extremer Ereignisse wichtigen naturwissenschaftlichen Grundlagen: Energie- und Wasserhaushalt, allgemeine Zirkulation sowie Rückkopplungsprozesse im Klimasystem. Darauf aufbau-end werden natürliche Klimavariabilität und anthropogener Klimawandel vorgestellt. Klimamodelle und Emissionsszenarien werden erklärt und diskutiert. Zuletzt beschäftigt sich die Lehrveranstaltung mit den erwarteten Klimaänderungen, möglichen Folgen sowie Vermeidungs- und Anpassungsstrategien. Im Rahmen von interaktiven Elementen, Diskussionen und Übungen wird Gelerntes re-flektiert und angewendet.
Literatur	Intergovernmental Panel on Climate Change (IPCC)-Reports: www.ipcc.ch and http://www.de-ipcc.de IGBP Reports

Modul: Climate History and Evolution of the Earth System (1201-560)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	-

Sprache	englisch
ECTS	4
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Arbeitsaufwand	42 h attendance + 78 h independent study = 120 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students learn to think in larger spatial and longer temporal scales and recognize evolution as a universal phenomenon. They understand how climate and chemistry of the Earth system developed over long time scales and that it will further change in the future. In addition, the students can distinguish between natural and anthropogenic influences on the Earth system.
Anmerkungen	Maximum number of participants: 15
Chemical Evolution (1201-561)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit
Lehrform	Vorlesung
SWS	1
Inhalt	The students are introduced to the chemical and biological evolution as well as its complexity and emergence. They learn how chemical aspects determined the development of our solar system and about the chemical and physical conditions on the young planet Earth. In addition, prebiotic chemistry and the theories for the development of life on the planet are introduced and the development of the Earth is explained from a chemical point of view. Finally, today's chemical industry and the anthropogenic chemical evolution are considered.
Literatur	H. Rauchfuß: "Chemische Evolution und der Ursprung des Lebens", Springer, Berlin.
Climate History (1201-562)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Vorlesung
SWS	1
Inhalt	The students perform a journey through the 4.5 billion years of Earth and climate History. They learn about the governing natural forcing mechanisms like the Milankovich cycles or the influence of plate tectonics and today's anthropogenic influences on the climate system. The development of the atmosphere and the sequence of cold and warm episodes is described in detail including the development of the biosphere and its influence on climate. Finally, the radiation balance, the greenhouse effect and future climate scenarios are discussed

Literatur	Publications of the International Geosphere Biosphere Program
Climate History and Evolution of the Earth System (1201-563)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit, Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Übung
SWS	1
Inhalt	Exercise to deepen the content of the lecture „Climate History“. The students select a subject and prepare a seminar talk. This talk is given to the whole group followed by a discussion.

Modul: Debate Seminar (1201-570)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	2
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Modulprüfung	Presentation
Arbeitsaufwand	27 h attendance + 25 h independent study = 52 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students learn the standard formats of debates such as the British and Open Parliamentary Styles. They elaborate their own speeches based on rhetorical tools. Standard knowledge about the structure of speeches is acquired as well. By practical debates, they examine their skills to appear convincingly in discussions about topics in Earth System Science such as global and climate change.
Anmerkungen	Maximum number of participants: 10 Registration via ILIAS. Registration is open from the end of the summer semester until the beginning of the winter semester.
Debate Seminar (1201-571)	
Lehrform	Seminar
SWS	2
Inhalt	In this seminar, the students learn to prepare and to perform a debate. Generally, the debate is performed based on the style of the "Open Parlamentary Debate".

	After the definition of a debate, the main ingredients of a good speech are presented based on the well-known and still applicable introductions of Aristotle. Then, the preparation, organization, and performance of a high-quality speech is trained including a good behavior of the speaker. One week in advance, a topic of the debate is formulated by the students, which relates to the contents of this class and is matter of a controversial discussion among experts and/or in the public. By a draw it is selected whether the students belong to the government, the opposition or to the free speakers in the debate. These groups perform the final preparation of he debate together and independently, i.e., they allocate arguments and arrange their appearance in the debate. In the debate, the speakers of these parties present their arguments within a prescribed time schedule. The lecture is closed with an open discussion between the audience and all students.
Literatur	The specific rules are handed out and explained to students in written form during a preliminary meeting.

Modul: Ecology and Agroecosystems (4906-410)

Modulverantwortung	PD Dr. Frank Rasche
Bezug zu anderen Modulen	This module will link-up knowledge from different subject areas in order to enable students to interpret reactions within agroecosystems coherently.
Teilnahmevoraussetzungen	Basic knowledge of farming and/or closely related topics. This module is designed to accommodate a range of experience and knowledge levels in both ecology and agriculture. Students with only basic knowledge in ecology and biology should enlarge them before starting in this module. To maintain the high quality of this module and due to time and space constraints in planned group work, seminar presentations, and excursions we only accept a maximum of 50 students. Access is on a "first come first serve" basis, allowing students for which the module is compulsory, semi-elective, and, thereafter, elective to enter the course.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Presentation in groups (20 %) with handout (5 %) and discussion (5 %)
Prüfungsleistung	Written exam (70 %)
Prüfungsdauer	120 Minuten

Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the module, students are able to explain the principles of ecological agents that regulate the functioning of natural and agricultural ecosystems and to demonstrate the complex biotic interactions in natural landscapes and agro-ecosystems. Further, they are able to explain how to apply ecological concepts and principles to design and manage sustainable agro-ecosystems with improved long-term reliability in agricultural production.
Schlüsselkompetenzen	During preparation for the exam, while preparing and following up on lectures and while preparing the seminar, students practice self-reliance, time management, personal responsibility and cooperation. They hereby also adopt needful skills in fields, also including communication skills and (foreign) language proficiency. Students learn and practice both critical and analytical thinking and reading of scientific literature in the seminar and their ability to explore a scientific issue. Through the seminar presentation, students improve their oral articulateness and their ability to discuss scientific matters. Finally, students acquire expertise to permit the competent application of technical knowledge and are of use in the solution of practical problems.
Anmerkungen	Please register online via ILIAS as the module is restricted to 40 participants. The registration will be open until the last week before the module starts. Thereafter, no more registration will be possible, but a waiting lsit will be maintained and implemented on the first day of the course. You will receive an electronic confirmation once you have been accepted into the module.
Ecology and Agroecosystems (4906-411)	
Person(en) verantwortlich	PD Dr. Frank Rasche
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	-Ecology - outline -Climatically caused diversity of tropical and subtropical ecozones -Agro-ecological zoning system -Plants and environmental factors -Interaction between agriculture and natural ecosystems -Principles of ecosystem functions -Interactions in agroecosystems: Species interactions -Agroecosystems of the tropics and subtropics -Wildlife and rangeland ecology -Practical methods in agroecology
Literatur	Martin, K. und J. Sauerborn; 2006: Agrarökologie, Verlag Eugen Ulmer, Stuttgart.
Anmerkungen	Teaching strategies: -Lectures - to provide fundamental knowledge relevant to agro-ecosystems

	- Group assignment - to encourage broader interdisciplinary thinking and design in a group context - Examination - the final test of competency Assessment: written exam 70%; seminar presentation 30%

Modul: Economics and Environmental Policy (4902-440)

Modulverantwortung	Dr. Kirsten Boysen-Urban
Bezug zu anderen Modulen	Due to its introductory character, this module is a basis for more advanced economic modules such as "Microeconomics", "Agricultural and Food Policy" or "Environmental and Resource Economics".
Teilnahmevoraussetzungen	This is an introductory module without any specific prerequisites.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	Written exam (100 %)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completing this module, students are able to explain basic principles and concepts of microeconomics, environmental economics and environmental policy. In addition, students are able to translate these concepts into complex real world situations (market imperfections, policy design, policy distortions, linkage between agriculture and the environment). Students can further comparatively assess different policy options to address environmental problems/resource use. Finally, students are proficient in analysing the limits of economic concepts and their relevance in policy design.
Schlüsselkompetenzen	During preparation for the exam and while preparing and following up on lectures, students practice time management and self-reliance. They learn and practice critical and analytical thinking and learn to apply sound economic reasoning.
Anmerkungen	Learning objectives are enhanced by the distribution of exercises and solutions, as well as a voluntary tutorial in order to support students in the application of economic concepts to real world problems.
Basic Microeconomics (4902-441)	

Person(en) verantwortlich	Dr. Kirsten Boysen-Urban
Lehrform	Vorlesung
SWS	2
Inhalt	This lecture comprises the basic microeconomic concepts of household theory, theory of the firm, and the theory of markets under perfect and imperfect competition, as well as the economics of the public sector (public goods, externalities). These concepts are applied in many examples to the agricultural and food sector of developing and developed economies with a focus on interactions between agriculture and the environment. It will be shown how to apply microeconomic concepts to real world situations and policy challenges. This lecture is enhanced by the distribution of exercises and solutions, as well as a voluntary tutorial in order to support students in the application of microeconomic concepts.
Literatur	The lecture is organized along the microeconomic part of "Principles of Economics" by Gregory Mankiw. The textbook "Economics" by Samuelson/Nordhaus has a similar content. The mathematical concepts used (differential and integral calculus) are well explained in "Fundamental Methods of Mathematical Economics" by Alpha C. Chiang.
Anmerkungen	This lecture is offered in the first half of the semester (4 hours per week). We offer an additional voluntary tutorial to support students in working on distributed exercises. This module is strongly recommended for first semester AgEcon students who find their background in economics weak.

Environmental Policy (4902-442)

Person(en) verantwortlich	Prof. Dr. Christian Lippert
Lehrform	Vorlesung
SWS	2
Inhalt	In the light of applied economic theory current resource use problems will be analysed. The lecture introduces to basic concepts of environmental and natural resource economics, cost-benefit analysis with respect to environmental resources, the concept of sustainable resource use, as well as to the theory of optimal resource extraction. Moreover, the most important environmental policy instruments will be presented and discussed.
Literatur	Perman, R., Ma, Y., McGilvray, J. and M. Common (2007): Natural Resource and Environmental Economics. 3rd Edition, Pearson Education. Tietenberg, T. (2003): Environmental and Natural Resource Economics. 6th Edition. Addison Wesley. Tietenberg, T. (2007): Environmental economics and policy. 5th Edition. Addison Wesley.

Anmerkungen	This lecture takes place in the second half of the semester (4 hours per week). A voluntary tutorial is offered.
Exercises to Basic Microeconomics (freiwillig) (4902-443)	
Person(en) verantwortlich	Dr. Kirsten Boysen-Urban
Lehrform	Übung
SWS	1
Inhalt	.
Anmerkungen	First half of semester
Exercises to Environmental Policy (freiwillig) (4902-444)	
Person(en) verantwortlich	Prof. Dr. Christian Lippert
Lehrform	Übung
SWS	1
Inhalt	.
Anmerkungen	Second half of semester

Modul: Ecosystems and Biodiversity (2101-510)

Modulverantwortung	N.N.
Teilnahmevoraussetzungen	Good knowledge of general biology, in particular of botany, at least high school level.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Arbeitsaufwand	56 h attendance + 112 h independent study = 168 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students get an overall view of the earth's vegetation (zonobiomes, orobiomes, and pedobiomes) against the background of solar and climatic zones and basic soil properties. They get to know the basics and methods of biodiversity research and its applications as well as dendrochronological, palynological, and archaeobotanical work for reconstructions of historical climate, vegetational history, and archaeology.
Zonobiomes of the Earth and Plant Geography (2101-511)	

Person(en) verantwortlich	Prof. Dr. Manfred Küppers
Lehrform	Vorlesung
SWS	2
Inhalt	- Presentation of earth vegetation in the interaction with the determining environmental factors their zonobiomes: tundra, taiga, deciduous mixed forest, evergreen sclerophyllous forest, steppe, semi-desert and desert, savannah, tropical rainforest, special type dry forest, mountain biomes (colline to alpine altitude), mountainous tundras, Páramo, pedobiomes - Ecosystems and fundamental biogeochemical cycles - Causes of Biodiversity - Fire as global ecological factor
Literatur	S-W. Breckle, Walter's Vegetation of the Earth: The Ecological Systems of the Geo-Biosphere. Springer, 2008 R. Pott & J. Hüppe, Spezielle Geobotanik: Pflanze - Klima - Boden. Springer, 2007
Exercise on Vegetation and Climate History (2101-512)	
Person(en) verantwortlich	N.N.
Person(en) begleitend	Dr. rer. nat. Alexander Land
Lehrform	Übung
SWS	2
Inhalt	- Learning the techniques in the areas of Tree-Ring Dating, Dendroecology, and Dendroclimatology - Microscopic investigation of wood structure and on the identification of wood species - Learning the working methods of archaeobotany - Learning the measurement and working techniques of pollen analysis
Literatur	H.-J. Beug, Leitfaden der Pollenbestimmung, Pfeil Verlag, München, 2004 E. R. Cook, Methods of Dendrochronology: Applications in the Environmental Sciences. Springer, 2010 S. Jacomet & A. Kreuz, Archäobotanik, Ulmer Verlag, Stuttgart, 1999 F. H. Schweingruber & H.C. Wolf, Tree Rings: Basics and Applications of Dendrochronology. Springer, 1991 D. Zohary & M. Hopf, Domestication of Plants in the Old World, Oxford University Press, Oxford, 2000

Modul: Energy and Water Regime at the Land Surface (3103-500)

Modulverantwortung	Prof. Dr. rer. nat. Thilo Streck

Teilnahmevoraussetzungen	Students should have completed the module Physics of the Earth System and the module Biology of the Earth System and Biodiversity.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Modulprüfung	Klausur
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 112 h Eigenanteil + Prüfung = 168 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	This interdisciplinary module gives insight into the fundamental properties of and processes at the land surface. This lays the foundation for successfully dealing with numerous problems from the local over the regional to the global scale. After completion of the module, the students have good knowledge of the basic processes in the soil-plant-atmosphere system, which control the water and energy exchange at the land surface, and their representation through the most important governing equations.
Schlüsselkompetenzen	Students learn to integrate new information with knowledge from the prior modules Physics and Biology of the Earth System. They learn how to apply problem solving strategies independently and in a different situation.
Energy and Water Regime at the Land Surface, Lecture (3103-501)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Thilo Streck
Person(en) begleitend	Dr. rer. nat. Joachim Ingwersen, Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Vorlesung
SWS	2
Inhalt	1. Radiation processes at the land surface (long and shortwave radation, albedo, photosynthetically active radiation) 2. Energy partitioning at the land surface (fluxes of latent and sensible heat, ground heat flux, photosynthesis) 3. Transport of energy and water in soil (1D, 3D; Fourier's law, Richards equation, material functions, infiltration) 4. Landscape hydrology (processes at the watershed scale, linear models, lumped models, semi-distributed models, 3D models) 5. Evapotranspiration (Penman equation) 6. Land surface models (NOAH-MP) 7. Crop models (assimilation, root growth, biological time, stress) 8. Turbulent fluxes (basics, Monin-Obhukov theory)

Literatur	Bonan, G.B. Ecological Climatology: Concepts and Applications. Cambridge University Press, 2008. Jury, W.A., Horton, R.H. Soil Physics. John Wiley & Sons, 2004. Hillel, D. Introduction to Environmental Soil Physics: The State and the Transport of Matter and Energy in the Soil-Plant-Atmosphere Continuum. Academic Press, 2003. Campbell, G.S., Norman, J.M. An Introduction to Environmental Biophysics. Springer, 2000.
Energy and Water Regime at the Land Surface, Computer exercises (3103-502)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Thilo Streck, Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Joachim Ingwersen, Dr. rer. nat. Ralph Gäbler
Lehrform	Übung
SWS	2
Inhalt	- Energy partitioning at the land surface - Physical interaction between atmosphere and radiation - Modeling thermal conduction in soil (with Berkeley Madonna) - Modeling water infiltration in soils with Hydrus 2D/3D (with case studies) - Land surface modeling with NOAH-MP - Turbulence and the eddy-covariance technique - Similarity relations including Monin-Obukov Theory

Modul: Environmental and Resource Economics (4101-410)

Modulverantwortung	Prof. Dr. Christian Lippert
Teilnahmevoraussetzungen	Knowledge of basic concepts from economic theory (e.g. demand function and its determinants), from investment appraisal (e.g. calculating net present values) and from Environmental Economics (e.g. externalities) as taught in the module Economics and Environmental Policy (4201-440)
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	in-class presentation and short seminar paper (25%)
Modulprüfung	written (75%)
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload

Fachkompetenzen / Lern- und Qualifikationsziele	Applying the relevant microeconomic theory students should be enabled to analyse current problems of resource use and agricultural production.
Schlüsselkompetenzen	Critical analytical thinking; communication and oral presentation; applying economic reasoning
Environmental and Resource Economics (4101-411)	
Person(en) verantwortlich	Prof. Dr. Christian Lippert
Person(en) begleitend	Dr. Tatjana Krimly, M.Sc. Manuel Narjes
Lehrform	Seminar
SWS	4
Inhalt	Fundamental concepts of Environmental and Natural Resource Economics are introduced and broadly discussed; In the light of applied microeconomic theory current problems of resource use and agricultural production will be analysed; special attention is given to combined economic and ecological models.
Literatur	Perman, R., Yue, M., McGilvray, J. and M. Common (2003): Natural Resource and Environmental Economics; Third Edition. Munich, Pearson.
Anmerkungen	Seminar and accompanying computer exercises; contributions by the students; lecture notes are available at the 'ASta Skriptenverkauf'. Further course material will be uploaded during the course to https://ilias.uni-hohenheim.de.

Modul: Environmental Microbiology (3102-410)

Modulverantwortung	Prof. Dr. Ellen Kandeler
Bezug zu anderen Modulen	This module gives a basis for advanced studies in environmental microbiology and soil sciences (e.g. modul 3102-420 Project in Soil Science, Molecular Soil Ecology 3102-450)
Teilnahmevoraussetzungen	Basics in microbiology, chemistry and biochemistry
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Presentation with discussion (40 %) and extended abstract (10 %)

Prüfungsleistung	Written exam (50 %)
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h presence + 104 h preparation at home + exam = 160 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After successfully completing the module, students generally have a better understanding for ecological systems and understand the role and function of microorganisms in different habitats in particular. Students can specify interactions of microorganisms and soils, plants as well as animals. In addition, they are familiar with different aspects of biotechnology and ecotoxicology of microorganisms and can outline the rapid development of new methods in environmental microbiology (e.g. metagenomics and proteomics).
Schlüsselkompetenzen	While preparing and following up on lectures and while working on their seminar presentation including a written paper in the form of a review of a paper (extended abstract), students practice time management and enhance their self-reliance, organizational, cooperation and communication skills. They learn and practice both critical and analytical thinking and reading of scientific literature in the lecture and when preparing the seminar, while generally improving their ability of exploring a scientific subject. During preparation of the seminar, students improve their scientific articulateness, i.e. oral expression skills and presentation techniques. Students are prepared for compiling their own scientific work and for contributing to international conferences.
Anmerkungen	The lecture starts at the 20th of October 2016 (8.30 a.m.)
Environmental Microbiology (3102-411)	
Person(en) verantwortlich	Prof. Dr. Ellen Kandeler, Prof. Dr. Günter Neumann, Prof. Dr. Julia Fritz-Steuber, Jun.-Prof. Dr. Jana Seifert
Person(en) begleitend	Dr. sc. agr. Eva Weiß, Dr. agr. Maren Witzig
Lehrform	Vorlesung
SWS	2
Inhalt	Environmental microbiology of terrestrial ecosystems: Microbial degradation of organic pollutants in soils, soil microorganisms and heavy metals, overview of bacteria and fungi, regulation of metabolism, ecological functions of rhizodeposition, rumen microbiota, intestinal microbiota of pigs, microbial interactions in the gastrointestinal tract of animals and humans (metagenomics and metaproteomics)
Literatur	Madigan M.T., Martinko J.M. (2006) Brock Mikrobiologie. Pearson Studium, München.
Seminar on Environmental Microbiology (3102-412)	
Person(en) verantwortlich	Prof. Dr. Ellen Kandeler, Prof. Dr. Günter Neumann, Jun.-Prof. Dr. Jana Seifert
Person(en) begleitend	Dr. sc. agr. Eva Weiß, Dr. agr. Maren Witzig

Lehrform	Seminar
SWS	2
Inhalt	Students select topics for seminars based on recommendations of the lecturers. They can choose topics of microbiota living in different environenment (e.g. soil, rhizosphere, rumen microbiota). One to two original papers give the basis for literature reserach of students. Students give presentations of 20 minutes followec by discussion (10 min). In addition, students prepare a extended abstract of four pages summing up the most important findings of the selected topic.
Literatur	

Modul: Ethical Reflection on Food and Agriculture (4302-420)

Modulverantwortung	Prof. Dr. Claudia Bieling
Bezug zu anderen Modulen	Sustainability Discourses and Environmental Sociology; Global Agri-food Systems; Gender, Nutrition and Right to Food; and other modules that deal with interdisciplinary aspects of food and agriculture
Teilnahmevoraussetzungen	Since the number of participants is limited to 20, students are asked to submit a short letter of motivation to participate in the module. Applications for participation in WS 2019/20 should be submitted from September 30 to October 13, 2019. Please send your letter of motivation to claudia.bieling@uni-hohenheim.de stating the following: 1. Your name 2. Your nationality 3. Your study programme 4. Study programme level (M.Sc./B.Sc./Ph.D.) 5. Statement of motivation: I want to take the course 'Ethical Reflection on Food and Agriculture' because... (max. 150 words) The decision about participation will be communicated to applicants by October 14, 2019.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Presentation in groups (40 %), participation in class (10 %)
Prüfungsleistung	Written paper in the form of an individual learner’s journal (50 %)
Arbeitsaufwand	56 h presence + 104 h preparation (individually and in groups) = 160 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completing this module, students have basic knowledge of ethical theory and frameworks for ethical analysis, as well as of their application to the field of contemporary food and agricultural research and practice. Furthermore, course participants are familiar

	with identifying ethical issues and their underlying moral principles, and with ethical reasoning and evidence-based argumentation with respect to the multi-functionality of agriculture. Drawing on teaching methods that combine theory and on-the-ground experiences from lecturers and guest speakers, this module creates a space to critically discuss current ethical issues related to food and agriculture. Following an interactive didactic approach, students learn to identify the impact of concurrent global challenges on the different members of society (small and large scale farmers, consumers, civil society organizations, industry and retailers, the public sector, and scientists) and the environment, as well as define the roles and responsibilities of the various actors in meeting these challenges.
Schlüsselkompetenzen	Engaging participants in discussions with lecturers and guest speakers, and comprising a group work assignment that includes independent literature research, classification/prioritization of evidence and information, oral presentations and argumentation in plenary debates, as well as an individual journal exercise, this module enables students to further develop the following soft skills: - communication skills - logical and analytical abilities - critical and analytical reading of scientific literature - evidence-based argumentation - teamwork capacity - intercultural competence - scientific journal-based literature research - scientific writing skills - (media-supported) presentation skills - organization and time management skills
Anmerkungen	Please note that the number of participants is limited to 20 (we will give priority to Master level students). Therefore, students are asked to submit a short letter of motivation to participate in the module (see above). Applications can be submitted from September 30 to October 13, 2019. Registration in ILIAS will only be possible after the selection process.
Ethical Reflection on Food and Agriculture (4302-421)	
Person(en) verantwortlich	Prof. Dr. Claudia Bieling
Lehrform	Seminar mit Übung
SWS	4
Inhalt	The module is broadly structured in two parts: Part I is dedicated to the theoretical foundations of ethical thinking. Under the guidance of an ethicist from the International Center of Ethics in the Sciences and Humanities (IZEW, University of Tübingen), students will become acquainted with basic knowledge of ethical theory and tools for ethical analysis and argumentation, including: - prudence, justice and the good life as principles for ethical assessment - from fact to values and norms: how to build an argument - the role of emotions in public discourses and conflicts. In parallel to the lectures of the first part, students will practice the application of these theories and tools by elaborating case studies

	(group work) on an ethical issue of their choice (e.g. animal welfare, GMOs, biofuels). In Part II, students will further enhance their capacity to identify ethical issues related to the field of food and agriculture and critically reflect on them. For this, guest speakers are invited to share their experiences and perspectives, e.g. as an ethicist working in science or on providing food aid to developing countries. A particular emphasis will be on “solutions” or ways forward for reducing ethical problems and conflicts. As part of this, we will for instance explore the potential of taxation as a means for including ethical concerns in policy as well as alternative economic models that call for a more just economic order.
Literatur	Readings will be provided via ILIAS.
Anmerkungen	Please note that this module is limited to 20 students and can be taken only after applying with a motivation letter! See module description for further information.

Modul: Food Tech Transition - Summer School 2019 (4302-490)

Modulverantwortung	Prof. Dr. Claudia Bieling
Teilnahmevoraussetzungen	Acceptance into one of the above programs or basic knowledge and/or strong interest in social sciences and crop science. Interested students need to apply for participation via ILIAS. The application must include the curriculum attended so far and a one page motivation letter.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	geblockt (n. V.)
Verbindlichkeit	Wahl
Prüfungsleistung	Scientific presentation with discussion of about 20 min (50%) and written report of 10 to 15 pages (50%)
Arbeitsaufwand	60 h presence + 100 h home work+ exam = 160 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	This summer school has been designed to provide a comprehensive overview on food technology transitions and paradigmatic shifts within the agrifood branch. It will integrate knowledge about the production side with social sciences and a wider social perspective. It focuses on the impact of food technology implies, the disruption potential of production and consumption logics; nutrition patterns; agronomic practices; available raw materials and human as well as environmental and animal ethics associated. At the end of the summer school, students will have a thorough understanding of food technology transitions. The summer school sections provides for many

	competences development: in the introduction section, a socio-historical overview allows student to understand the factors that enhance or restraint transitions and what costs or benefits; in the sustainability section, a theory-based assessment of sustainability allows students to position the current socio-technical challenges in a wider context; in the crop-science section, a natural science perspective allows student to specify and understand issues related to the production side, what resources and materials are currently and will be in the future available that allows or constraint transitions, and trends in nutrition and food waste; in the management section, a practical perspective on everyday practice allows students to develop management perspectives on food technology and develop strategies for corporate responsibility and regulation; in the business section, an empirical approach allows students to develop business models that address impact and sustainability evaluation, and communication strategy with industry partners and tech investors.
Schlüsselkompetenzen	At the end of the summer school, students will acquire multiple and interactive skills. Thanks to the summer school format, both oral and written skills are developed. During preparation for the written report and while preparing and following up on lectures, students practice critical thinking, self-reliance, time management, interpersonal communication and cooperation.
Anmerkungen	Block (29.07.-09.08.2019) with a further period of home work from 09.08.2019 to 23.08.2019. Because of limited space available, interested students must apply to this module by registering in the ILIAS course (https://openilias.uni-hohenheim.de/goto.php?target=cat_35230&client_id=UHOH2). Registration is open from 15 April to 13 May 2019. Students will be then selected based on the curriculum attended so far and the motivation letter. The written exam is a report. The deadline for the submission of the report is 23.08.2019. Only offered in summer 2019! Any inquire should be addressed to Dr. Cinzia Piatti.
Food Tech Transition - Summer School 2019 (4302-491)	
Person(en) verantwortlich	Prof. Dr. agr. Simone Graeff-Hönninger
Person(en) begleitend	Forough Khajehei, Dr. Cinzia Piatti
Lehrform	Vorlesung mit Übung und Exkursion
SWS	4
Inhalt	There are four main sections in this course: • Introduction section: food systems (brief historical overview, current configuration, main actors, consumption politics and trends); food tech (food technologies and the industry, related and residual issues for adoption, transition); sustainability and transition (basics of sustainability, basics of transition and transition theories; socio-cultural issues related to sustainability). • Crop science section: crop science and food tech in the age of transition (resources and material currently available and in the next future, issues related to the production-in the field issues); superfoods, small grains and food waste (trends in nutrition and in nutrition consumption; focus on food waste and role of technology to avoid it).

	• Management section: Nutrition and safety concerns in the use of food technology; management perspectives on food technology and future challenges; corporate responsibility and regulation. • Business section: Business Model Development; impact and sustainability evaluation; Communication strategy with industry partners and investors.

Modul: Forschungspraktikum Chemische Evolution (1301-430)

Modulverantwortung	Prof. Dr. rer. nat. Henry Strasdeit
Teilnahmevoraussetzungen	Chemiekenntnisse auf dem Niveau eines naturwissenschaftlichen Bachelor-Studiengangs.
Sprache	deutsch/englisch
ECTS	6
Angebotshäufigkeit	jedes Semester
Semesterlage	3. Semester
Dauer des Moduls	geblockt (n. V.)
Verbindlichkeit	Wahl
Modulprüfung	Klausur
Prüfungsdauer	60 Minuten
Arbeitsaufwand	98 h Präsenz + 82 h Eigenanteil = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden kennen die Leistungsfähigkeit und Grenzen der experimentellen Simulation präbiotisch-chemischer Prozesse und verstehen den zu Grunde liegenden interdisziplinären Ansatz. Sie erkennen, dass die experimentelle Simulation erst durch die zeitliche und räumliche Universalität naturwissenschaftlicher Gesetzmäßigkeiten sinnvoll wird. Die Studierenden erwerben praktische Fähigkeiten im Umgang mit chemischen Stoffen und in der Nutzung moderner chemisch-analytischer Großgeräte.
Schlüsselkompetenzen	Die Studierenden sollen nach Abschluss des Moduls in der Lage sein, ihre Arbeit im Labor selbstständig zu organisieren und Theorie und Praxis miteinander zu verknüpfen.
Anmerkungen	Das Modul wird mehrfach im Jahr für jeweils max. 5 Studierende angeboten. Anmeldung zur Teilnahme am Modul: Jederzeit persönlich bei Herrn Prof. Dr. Strasdeit oder Herrn Dr. Fox.
Forschungspraktikum Chemische Evolution (1301-431)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit
Person(en) begleitend	Dr. rer. nat. Stefan Fox
Lehrform	Praktikum

SWS	7
Inhalt	Praktikum: - Modellierung physikalischer und chemischer Aspekte des frühen Erdsystems im Labor - plausible Reaktionen organischer Stoffe unter simulierten Bedingungen der frühen Erde - Bedeutung der anorganischen Umwelt (Atmosphäre, Minerale, Meersalz u. a.) für die präbiotisch-chemische Evolution - kombinierter Einsatz verschiedener Synthese-, Trenn- und Analyseverfahren Übung: Aufgaben zu den Themen des Praktikums; Auswertung und Diskussion der Versuchsergebnisse

Modul: Global Agri-food Systems: Conventional, Organic, and Beyond (4302-460)

Modulverantwortung	Prof. Dr. Claudia Bieling
Bezug zu anderen Modulen	This module is of particular interest for students who intend to choose the modules "Ethical Reflection on Food and Agriculture" and "Gender, Nutrition and Right to Food".
Teilnahmevoraussetzungen	Acceptance into the above programme or basic knowledge and/or strong interest in social sciences
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Written paper (50 %)
Prüfungsleistung	Oral exam (50 %)
Prüfungsdauer	20 Minuten
Arbeitsaufwand	56 h presence + 104 h preparation at home + exam = 160 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completing this course, students have a comprehensive understanding of agri-food systems and the paradigmatic shifts within. Students are in particular able to specify the diverse motivations and politics that have led farmers, consumers, and policy makers toward (or away from) more sustainable agri-food systems. They are familiar with the geographical, sociological, historical, political, legal, and economic aspects of how and why individuals, groups, and industries make (or are involved in) certain

	choices about food throughout the food chain (production, processing, trade, consumption). To make sense of global agri-food systems, students are introduced to a theoretical framework that helps understand changes in food provisioning: In the 19th century, the bases of contemporary agri-food systems were established, but it is in the 20th century that they changed again; agri-food systems underwent a further period of transformation as the industrial processing of food, the emergence of large food transnational corporations and the integration of ever widening portions of the globe into the world food system restructured world food relationships. These series of changes have had dramatic consequences on agriculture and land use; it is from this that alternative forms of agriculture emerged and the organic movement blossomed, for instance. Factoring in an increasing array of ecological shocks and threats like climate change and peak oil, and dramatically changing cultural and political dynamics around food, agriculture and land use, the next turn to "local" and "traditional" gives a perspective of the big changes food systems underwent. Students are hereafter aware of the possible outcomes of the current developments in organic and sustainable agriculture. In this course, students are provided with the conceptual tools to understand the sociological bases around which a future world of agriculture, food and land use will possibly take shape. Students have an insight into the political and social importance of food and agriculture and are able to identify different kinds of politics around agriculture and food production and consumption. Finally, they are able to explain basic concepts and theories related to organic agriculture and sustainability and have an understanding for the complexity of agriculture and food as it relates –among others– to the politics of resources, the environment and social justice.
Schlüsselkompetenzen	During preparation for the exam, while writing their essay (written paper) and preparing and following up on the seminar, students practice self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature. Writing the essay enhances their scientific articulateness. During discussions in class, students practice and improve their capability of exploring a scientific issue and of orally presenting an academic argument. With the help of dedicated tutorials, students are further supported with creating an essay plan and essay writing, quoting, referencing, and using academic and non-academic sources (therefore avoiding plagiarism).
Anmerkungen	The written paper (compulsory assignment) comprises an essay on topics related to course contents, to be submitted during the course. This course is taught by Dr. Cinzia Piatti.

Global Agri-food Systems: Conventional, Organic, and Beyond (4302-461)

Person(en) verantwortlich	Prof. Dr. Claudia Bieling
Person(en) begleitend	Dr. Cinzia Piatti
Lehrform	Seminar
SWS	4

Inhalt	This course has been designed to provide a comprehensive understanding of agri-food systems and make sense of paradigmatic shifts within. There are four main sections in this course: • Understanding the background • Understanding the contemporary paradigm • Understanding the emergence of alternatives • Adapting to transition These sections will unfold in order to make sense of the global agri-food systems and make sense of the social conditions that permitted the emergence of organic and sustainable agriculture, exploring the background and explaining the relationships between developed and developing countries, and conversely between global and local. Specific case studies relating to the course contents and from various geographic regions reinforce the learning process through enhanced discussions and critical reflection. Preparatory reading of selected literature and introduction to academic journal-based literature research and scientific writing complete the academic picture.
Literatur	Course-relevant readings will be made available or uploaded in ILIAS if possible.
Anmerkungen	Because of limited space available (70 students), students must register via ILIAS; registration is open from 25 September to 30 October 2017. A waiting list will be available if the number of registrations will exceed expectations. This course is taught by Dr. Cinzia Piatti.
Tutorial Global Agri-food Systems: Conventional, Organic, and Beyond (freiwillig) (4302-462)	
Person(en) verantwortlich	Prof. Dr. Claudia Bieling
Person(en) begleitend	Dr. Cinzia Piatti
Lehrform	Tutorium
SWS	2
Inhalt	-

Modul: Global Change Issues (3202-420)

Modulverantwortung	Prof. Dr. rer. nat. Andreas Fangmeier
Teilnahmevoraussetzungen	Extremely important: you have to be present on the first day of the module (i.e. 18 October 2018 at 14:00 in lecture hall 20) in order to be enroled for the module. This is mandatory because of organisational reasons. We will not accept any student for the module who is not present on 18 October 2018. General requirements: Ability to think in an interdisciplinary way, background knowledge in natural sciences at least at Bachelor level, basic

	knowledge and interest in social sciences and economy, readiness for active contribution of knowledge from the students home countries.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	written exam
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	The aim of the module is to give a solid understanding of global change with focus on global climate change, its impacts on ecosystems and ecosystem services, and the consequences for the human society. We would like to emphasize that this module deals with the natural science aspect of global change and global climate change rather than with economic issues related to climate change. Nevertheless, mitigation and adaptation strategies as well as current approaches in international treaties are taught. After completing the course the student should be able to: Knowledge: The students know the drivers of global change, in particular global climate change. They understand the perturbations of the global carbon, nitrogen, and water cycles and can distinguish between natural and human impact. The students understand the effects of climate change on natural and anthropogenic (mainly agricultural) ecosystems and the most important feedbacks between ecosystem traits and climatic conditions and the threat to ecosystems services and the potential impacts on the human society. The students know the international treaties to combat climate change and understand mitigation and adaptation options to climate change. The students are aware about the methodological tools in investigate global change and its impacts and feedbacks. Skills: The students can combine knowledge from different disciplines to analyse the extent and the consequences of climate change. They can think across scales both in time and space to valuate global change issues. They can judge about the severity of climate change and its effects compared to other drivers of ecosystem performance and services. The students are able to perform experimental research on climate change impacts. They are able to acquire, evaluate and summarize information from scientific literature and to combine information from different sources, they can prepare and give scientific presentations.

Schlüsselkompetenzen	The structure of the module provides the following competences: The students are able to discuss ecological, social, political and economic aspects of global change. They are able to develop and communicate mitigation and adaptation strategies. They are able to co-operate and to work independently. They can evaluate regulatory measures and treaties and suggest improvements. The students acquire intercultural competence by working in groups with international students.
Anmerkungen	Module is expected to be offered again in WS 2020/21
Introduction to Global Change (3202-421)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Fangmeier
Person(en) begleitend	Dr. Jürgen Franzaring, Dr. rer. nat. Andreas Klumpp, PD Dr. rer. nat. Petra Högy, Dr. Iris Schmid, Dr. Olga-Christina Calvo-Weimar
Lehrform	Vorlesung
SWS	2
Inhalt	Introduction to Global Change is a lecture introducing to the students the most important current knowledge on global change. The focus is on global climate change, its causes and consequences with more emphasis on natural science than on social science and economy. Contents of the lectures cover: - Introduction and structure of the module - Human population - Land-use change - Greenhouse gas emissions - The concept of radiative forcing - Global warming !? - Sea level rise - Global water cycling and future projections - Effects on ecosystems - Effects on agriculture - Health impacts - Mitigation options - International legislation - Emission trading
Literatur	Literature on global change is numerous and almost immediately outdated when recommendations are written down somewhere. Nevertheless, as basic literature for understanding the current state of the art in science and recommendations to policy makers the latest reports of the IPCC are recommended (download at http://ipcc.ch/). Further literature is provided on the ILIAS e-learning platform
Anmerkungen	Course material is provided via the ILIAS e-learning platform.

Seminar on Global Change (3202-422)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Fangmeier
Person(en) begleitend	Dr. Jürgen Franzaring, PD Dr. rer. nat. Petra Högy, Dr. Iris Schmid, Dr. Olga-Christina Calvo-Weimar
Lehrform	Seminar
SWS	1
Inhalt	This seminar is thought to complement the lecture "Introduction to Global Change" with some most recent findings from current publications in the scientific literature. The actual content will vary from year to year but may cover issues such as the latest findings on disturbance of the global carbon cycle and its implications for climate, ecological footprints, state of international negotiations, case studies on climate change effects on selected ecosystems, ecosystem services, habitats etc. The students will prepare a powerpoint presentation including a handout on one topic, they will present and discuss it and get feed-back not only on the scientific content but also on the didactics of their presentation.
Literatur	ever changing and updated; students are assisted to find relevant literature and other sources; sources will be made available via the ILIAS e-learning platform.
Anmerkungen	Course material is provided via the ILIAS e-learning platform.
Experiments on Global Change (3202-423)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Andreas Fangmeier
Person(en) begleitend	Dr. Jürgen Franzaring, PD Dr. rer. nat. Petra Högy, Dr. Iris Schmid
Lehrform	Praktikum
SWS	1
Inhalt	Experiments on Global Change is covered by a small but nice greenhouse experiment in which one of the most important resources to plant growth - water - is manipulated. At the same time, water shortage is one of the major expected side effects of climate change in many areas and therefore represents a nice example to study climate change effects. The students will analyse the response of C3 and C4 species to water shortage and learn about water cycling, water use efficiency and physiological adaptation of vegetation to resource deficiency. Furthermore, they will do cuvette experiments with increasing atmospheric CO2 concentrations to evaluate primary plant responses to elevated CO2.
Anmerkungen	Information, manuals, and the results of the experiments (students' presentations) are made available via the e-learning platform ILIAS

Modul: Land Use Economics (4904-430)

Modulverantwortung	Prof. Dr. Thomas Berger
Bezug zu anderen Modulen	Dieses Modul vertieft Kenntnisse im Bereich Modellierung von Landnutzung und speziellen Multi-Agentensystemen
Teilnahmevoraussetzungen	Grundkenntnisse der Mathematischen Programmierung (Lehrbuch: Ragsdale, C.T., 2004. Spreadsheet Modeling & Decision Analysis, Kap. 1-4)
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1. Semesterhälfte
Verbindlichkeit	Wahl
Modulprüfung	schriftlich
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studierenden kennen die relevanten Größen und Prozesse der Landnutzungsökonomik und sind mit deren Abbildung durch räumlich explizite Modellansätze vertraut. Sie sind fähig, je nach Fragestellung geeignete Modellansätze zu spezifizieren, um angewandte Probleme der Landnutzung eigenständig zu bearbeiten. Sie kennen die Prinzipien der agentenbasierten Modellbildung und besitzen das grundlegende Verständnis komplexer Systeme, das benötigt wird, um Landnutzungsentscheidungen und damit zusammenhängende biophysikalische und sozioökonomische Prozesse zu modellieren. Des Weiteren verfügen sie über die Kompetenz, Modellergebnisse kritisch zu hinterfragen und Lösungsansätze für landnutzungsbezogene Fragen zu diskutieren.
Schlüsselkompetenzen	Analytical thinking, oral presentation, scientific reading, data handling, processing and analysis
Anmerkungen	Laptop wird für Computer-Übungen benötigt
Land Use Economics - Lecture (4904-431)	
Person(en) verantwortlich	Prof. Dr. Thomas Berger
Lehrform	Vorlesung
SWS	2
Inhalt	Land-use economics: basic concepts and research questions Land-use modeling: model classes and cases of application Irrigation as a special land-use problem Land-use modeling at watershed level (case study) Land-use modeling with CA and MAS
Land Use Economics - Case Study (4904-432)	
Person(en) verantwortlich	Prof. Dr. Thomas Berger

Lehrform	Praktikum
SWS	2
Inhalt	Cases of application for land-use modeling

Modul: Lecture Series Earth System Science (1201-550)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	2
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Arbeitsaufwand	28 h attendance + 28 h independent study = 56 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students get a general idea of the key aspects of Earth System Science as well as the definition and the research approach of system science. The interaction of the compartments of the Earth system is demonstrated by a series of lectures focusing on different aspects such as climate change, land use, vegetation and biogeochemical cycles. The contents of the lecture series is set up in each semester according to brand-new topics, e.g. extracted from the media. The predictability of Earth system pro-cesses and the chaotic nature of weather and climate are dis-cussed as well.
Lecture Series Earth System Science (1201-551)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Henry Strasdeit, Prof. Dr. rer. nat. Volker Wulfmeyer, Prof. Dr. rer. nat. Uwe Beifuß, Prof. Dr. Philipp Kügler, N.N.
Lehrform	Ringvorlesung
SWS	2
Inhalt	- Compartments of the Earth System - Condition and interactions of components of the energy, water, and matter cycles across the compartments - Impact of human being to the Earth system, the anthroposphere - System theory - nonlinear coupled systems and chaotic systems Furthermore the students meet in person the representatives of the profession Earth System Science at the University of Hohenheim. The students meet the experts of different aspects in Earth System Science at the University.

Anmerkungen	Steffen et al.: "Global Change and the Earth System - A Planet under Pressure", Springer, ISBN 3-540-40800-2

Modul: Massive Open Online Course on Climate Change, Risks and Challenges (1201-410)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Bezug zu anderen Modulen	-
Teilnahmevoraussetzungen	Mandatory modules of M.Sc. ECSS
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes Semester
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Attendance sheet of online course
Prüfungsleistung	Klausur
Modulprüfung	Klausur
Prüfungsdauer	120 Minuten
Arbeitsaufwand	6 Online course 28 Seminar and exercieses 2 Exam In total: 36 Präsenzzeit, 130 Eigenanteil, 166 Arbeitsaufwand
Fachkompetenzen / Lern- und Qualifikationsziele	Basic knowledge of - the climate system - climate models and scenarios - climate history - impacts of climate change - climate change as a societal challenge - climate change in politics and economy
Schlüsselkompetenzen	- Transfer of knowledge in natural and applied sciences - Teamwork and communication - Critical and analytical thinking - Interdisciplinary thinking and its applications to problems in earth sciences
Anmerkungen	Number of participants: 20 Application period: Until 2 weeks before start of lectures Criteria of assignment: grades of mandatory modules For the Online course please register via this link: https://www.oncampus.de/weiterbildung/moocs/klima-mooc. After completing the course you will have to hand in an atterdance certificate.
Klimawandel und extreme Ereignisse (1201-411)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer

Person(en) begleitend	Dr. rer. nat. Kirsten Warrach-Sagi
Lehrform	Praktikum mit Übungen
SWS	4
Inhalt	Die Lehrveranstaltung vermittelt die für das Verständnis des Klimasystems und extremer Ereignisse wichtigen naturwissenschaftlichen Grundlagen: Energie- und Wasserhaushalt, allgemeine Zirkulation sowie Rückkopplungsprozesse im Klimasystem. Darauf aufbauend werden natürliche Klimavariabilität und anthropogener Klimawandel vorgestellt. Klimamodelle und Emissionsszenarien werden erklärt und diskutiert. Zuletzt beschäftigt sich die Lehrveranstaltung mit den erwarteten Klimaänderungen, möglichen Folgen sowie Vermeidungs- und Anpassungsstrategien. Im Rahmen von interaktiven Elementen, Diskussionen und Übungen wird Gelerntes reflektiert und angewendet.
Literatur	Intergovernmental Panel on Climate Change (IPCC)-Reports: www.ipcc.ch and http://www.de-ipcc.de IGBP Reports

Modul: Master’s Thesis Earth System Science (1200-500)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	Successful completion of modules in the amount of 78 credits.
Sprache	englisch
ECTS	30
Angebotshäufigkeit	jedes Semester
Semesterlage	4. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Modulprüfung	Master's thesis
Arbeitsaufwand	900 h
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the master thesis the students understand sub-components of the Earth system by inter- or transdisciplinary research, e.g., from atmospheric, agricultural, economic or social sciences. The studied interactions and feedbacks in these components either by measurements and their analyses, coupled modeling or data assimilation or combinations of these. They are able to understand the key processes in these systems and their interactions. They are able to present and to discuss their results at scientific conferences and in the public.

Schlüsselkompetenzen	- System analysis - System observations by synergies of instruments - System modeling - Competence to present their work in a comprehensive and concise manner.

Modul: Mathematics and Computational Sciences of the Earth System (1102-400)

Modulverantwortung	apl. Prof. Dr. Georg Zimmermann
Bezug zu anderen Modulen	Mathematische Grundlagen für das Modul 1102-410.
Teilnahmevoraussetzungen	Solide Grundkenntnisse in Mathematik wie sie in einem typischen B.Sc.-Programm behandelt werden.
Sprache	englisch
ECTS	4
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Studienleistung	50 % der Punkte von den Hausübungen
Prüfungsleistung	Klausur
Modulprüfung	Klausur
Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h Präsenzzeit, 64 h Eigenanteil, 120 h Arbeitsaufwand.
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel diese Moduls ist es, dass die studentes die mathematischen Werkzeuge aus Analysis und Linearer Algebra beherrschen, die für gewöhnliche und partielle Differentialgleichungen benötigt werden. Darüberhinaus lernen sie, einfache Computerprogramme zu schreiben, um sowohl verwandte mathematische Probleme lösen als auch Daten analysieren zu können.
Schlüsselkompetenzen	Ziel diese Moduls ist es, dass die studentes genügend Routine in den oben genannten Bereichen erlangen, um sich bei der Lösung von Differentialgleichungen auf deren Methodik konzentrieren zu können. Darüberhinaus erlangen sie Grundfertigkeiten im Programmieren und in der Datenanalyse.
Anmerkungen	Teilnehmerzahl: Unbeschränkt.
Applied Mathematics for Earth and Climate System Science (1102-401)	
Person(en) verantwortlich	apl. Prof. Dr. Georg Zimmermann
Lehrform	Vorlesung
SWS	2

Inhalt	Linear algebra: matrices and linear mappings, eigenvalues and eigenvectors, quadratic forms and definiteness. Differentiation: ordinary and partial derivatives, gradient, divergence and curl, Laplacian operator. Integration: indefinite and definite integrals, curves and line integrals, conservative vec-tor fields, surfaces and surface integrals, integral theorems by Gauß and Stokes.
Literatur	Any standard book on mathematics for physicists or engineers. in English: basic (undergraduate level): M.L. Boas, Mathematical Methods in the Physical Sciences advanced (graduate level): G. B. Arfken, Mathematical Methods for Physicists in German: H. Fischer / H. Kaul, Mathematik für Physiker 1 & 2
Computer Exercises for Earth and Climate System Science (1102-402)	
Person(en) begleitend	Dr. rer. nat. Andreas Behrendt
Lehrform	Übung
SWS	2
Inhalt	Exercises to the topics of Applied Mathematics for Earth and Climate System Science using the programming environment Mathematica. Analysis and visualization of earth system observations and climate data using Mathematica.

Modul: Mathematics and Computational Sciences of the Earth System II (1102-410)

Modulverantwortung	apl. Prof. Dr. Georg Zimmermann
Bezug zu anderen Modulen	Fortsetzung des Moduls 1102-400.
Teilnahmevoraussetzungen	Erfolgreicher Abschluss des Moduls 1102-400.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	50 % der Punkte von den Hausübungen
Prüfungsleistung	Klausur
Modulprüfung	Klausur

Prüfungsdauer	90 Minuten
Arbeitsaufwand	56 h Präsenzzeit, 124 h Eigenanteil, 180 h Arbeitsaufwand.
Fachkompetenzen / Lern- und Qualifikationsziele	Ziel diese Modul ist es, dass die studentes gewöhnliche und partielle Differentialgleichungen als solche und auch einige spezielle Typen erkennen können. Sie wissen, wie bestimmte Typen von Differentialgleichungen gelöst werden können, einige explizit, andere numerisch. Sie können autonome Systeme erkennen, stationäre Lösungen finden und deren Stabilitätseigenschaften bestimmen.
Schlüsselkompetenzen	Ziel dieses Modul ist es, dass die studentes Differentialgleichungen verstehen können in dem Sinne, dass sie erkennen, welche Effekte durch die einzelnen Terme modelliert werden. Sie kennen Stabilitätseigenschaften und wie sie zu bestimmen sind.
Anmerkungen	Teilnehmerzahl: Unbeschränkt. Anmeldung: Beim Dozenten zu Beginn des Semesters.
Mathematics and Computational Sciences of the Earth System II (1102-411)	
Person(en) verantwortlich	apl. Prof. Dr. Georg Zimmermann
Lehrform	Vorlesung mit Übung
SWS	4
Inhalt	Ordinary differential equations: numerical methods, autonomous systems and the stability of their stationary solutions. Partial Differential equations: wave equation, heat equation, numerical methods
Literatur	Lecture notes provided by the lecturer. Additional, if so desired: Any standard book on mathematics for physicists or engineers. in English: basic (undergraduate level): M.L. Boas, Mathematical Methods in the Physical Sciences advanced (graduate level): G. B. Arfken, Mathematical Methods for Physicists in German: H. Fischer / H. Kaul, Mathematik für Physiker 1 & 2

Modul: Measurement, Modeling and Data Assimilation I (1201-520)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	Recommended requirements: modules of the first semester, good computer skills, e.g. word processing and spreadsheets.
Sprache	englisch

ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Studienleistung	Active participation in the practical parts of the module and the lectures.
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	84 attendance +96 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students can install and operate observing systems in the field. They know how to archive, visualize and analyze the data and are aware of the importance of observations for driving, ini-tialization, calibration and validation of numerical models. In addition, practical work with the Weather Research and Forecasting model (WRF) will be carried out and the students learn how to visualize, interpret and document their results.
Anmerkungen	Independent study consists of 2 hours of preparation and review for each session of the lecture, 1 hour review per session of the Exercise and 5 days for the independent composition of a written report on the field course.
Measurement, Modeling and Data Assimilation I, Lecture (1201-521)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Thomas Schwitalla, Priv. Doz. Dr. rer. nat. Hans-Dieter Wizemann, Dr. rer. nat. Andreas Behrendt, Dr. rer. nat. Hans-Stefan Bauer, Dr. rer. nat. Ralph Gäbler
Lehrform	Vorlesung
SWS	2
Inhalt	The lecture introduces several observing systems ranging from meteorological in-situ sensors for the different variables, instruments applied in soil sciences and biology, eddy-covariance measurements as well as remote sensing techniques. Apart from the description of the instruments itself, methods to analyze the collected data are introduced. Following the instrumental part, the meteorological workstation NinJo is introduced. It was developed to facilitate the work with huge data sets in operational meteorological forecasting. Then, the transfer to modeling is carried out with the introduction of data analysis techniques to convert point measurements to spatially resolved information. The third part of the lecture introduces the basic concept of mod-eling. What models are available? How important are observa-tions for modeling? In which areas are models applied, what their

	performance is and what methods are applied to judge the model performance.
Measurement, Modeling and Data Assimilation I, Exercise (1201-522)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Thomas Schwitalla, Priv. Doz. Dr. rer. nat. Hans-Dieter Wizemann, Dr. rer. nat. Andreas Behrendt, Dr. rer. nat. Hans-Stefan Bauer, Dr. rer. nat. Ralph Gäbler
Lehrform	Übung
SWS	2
Inhalt	In the exercise sessions, the students will solve problems adjust-ed to the subjects they learned in the lectures. These range from arithmetic problems to the analysis and visualization of observed data and model results.
Measurement, Modeling and Data Assimilation I, Practical (1201-523)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Thomas Schwitalla, Priv. Doz. Dr. rer. nat. Hans-Dieter Wizemann, Dr. rer. nat. Andreas Behrendt, Dr. rer. nat. Hans-Stefan Bauer, Dr. rer. nat. Ralph Gäbler
Lehrform	Praktikum
SWS	2
Inhalt	In the practical sessions, the students learn how to set up instru-ments in the field and how the observational data is gathered, archived and analyzed. Here, they work with data from different instruments introduced during the lecture. After the introduction of basic concepts of modeling, practical work is done to set up and run the Weather Research and Fore-casting model (WRF) on a Linux PC including the analysis and visualization of the results.

Modul: Measurement, Modeling and Data Assimilation II (1201-530)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	Recommended requirements: Participation in the first module “Measurement, Modeling, Data Assimilation I, Computer practice (e.g. word processing, spreadsheet, basic knowledge with Linux)
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS

Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Active participation in the practical parts of the module and the lectures
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 124h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students learn the basics of model development, programming and data assimilation. They understand fundamentals of microeconomics for the representation of production processes, are able to solve first practical decision problems with the aid of spreadsheet programs and solvers, and can discuss their results. In addition, they deepen their knowledge about models for plant development, weather and climate and are able to critically judge their performances with the aid of observational data. Further-more, a theoretical introduction into data assimilation techniques is given.
Schlüsselkompetenzen	With this knowledge, competence to estimate the future development of the earth system is developed. Furthermore, the students are capable to independently analyze and solve problems related to the earth system.
Anmerkungen	Maximum number of participants: 10 Application to participate in the module: End of summer term until beginning of winter term using the ILIAS system.
Measurement, Modelling and Data Assimilation II, Lecture (1201-531)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Andreas Behrendt, Dr. rer. nat. Hans-Stefan Bauer
Lehrform	Vorlesung
SWS	1
Inhalt	The students learn the basics of model development, program-ming and data assimilation. They deepen their knowledge about models for plant development, weather and climate and are able to critically judge their performances with the aid of observational data. Furthermore, a theoretical introduction into data assimilation techniques is given.
Literatur	Kalnay, E.: Atmospheric Modeling, Data Assimilation and Predictability, Cambridge University Press, 2003. Evensen, G.: Data Assimilation, Springer, 2nd edition 2009
Measurement, Modelling and Data Assimilation II, Exercise (1201-532)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer

Person(en) begleitend	Dr. rer. nat. Andreas Behrendt, Dr. rer. nat. Hans-Stefan Bauer
Lehrform	Übung
SWS	1
Inhalt	In the practical part, the students deepen their knowledge gained during the lecture with modeling and data assimilation exercises. As in the first part of the module, the Weather Research and Forecasting model (WRF) is applied.
Literatur	Kalnay, E.: Atmospheric Modeling, Data Assimilation and Predictability, Cambridge University Press, 2003. Evensen, G.: Data Assimilation, Springer, 2nd edition 2009
Modelling of Land Use Decisions with Mathematical Programming (4904-462)	
Person(en) verantwortlich	Prof. Dr. Thomas Berger
Lehrform	Übung
SWS	2
Inhalt	Modelling of land use decisions with mathematical programming.

Modul: Microbiological Safety within the Feed and Food Production Chain (4605-430)

Modulverantwortung	Prof. Dr. med. vet. Ludwig E. Hölzle
Bezug zu anderen Modulen	The knowledge gained by this basic module may be completed in several other more specific modules, especially 4602-430 "Project in advanced Environmental- and Animal Hygiene", 4602-440 "Laboratory Course in Advanced Environmental- and Animal Hygiene".
Teilnahmevoraussetzungen	Students shall have basic knowledge in the biochemistry of carbohydrates, fats and proteins as well as in biology and genetics. For better preparation of the students, an introductory lecture is given for those participants who like to fresh up their knowledge before the module starts.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	oral exam
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload

Fachkompetenzen / Lern- und Qualifikationsziele	Students are able to understand and analyse the complex ecologic and microbial systems in soil, air and water as potential epidemiological niches for plant and animal pathogens and zoonotic agents. In addition, students are enabled to perform hygienic risk assessment during microbiocidal biotechnical processes, i.e. composting, anaerobic treatment and waste water treatment. In the group with international students they experience the cultural differences in risk assessment and can develop their intercultural competence in this module. Based on these skills and knowledge absolvents are capable to play an important role as advisors in international consultant teams regarding the hygiene of biotechnical processes.
Schlüsselkompetenzen	critical, analytical thinking , (foreign) language skills
Microbiological Safety within the Feed and Food Production Chain (4605-431)	
Person(en) verantwortlich	PD Dr. med. vet. habil. Wolfgang Beyer, Prof. Dr. med. vet. Ludwig E. Hölzle
Lehrform	Vorlesung
SWS	4
Inhalt	Principles of microbial morphology and physiology (bacteria, fungi, viruses), life cycles of parasites, microbiology and parasitology of vertebrates, plants, soils, water, and air; survival and inactivation of organisms; techniques for isolation and identification of organisms from soil, water and air. A set of questions will help in exam preparation.
Literatur	Brock : Biology of Microorganisms, Pearson Education International, Upper Saddle River,NJ07458Hurst, Crawford, Knudsen, McInerney, Stetzenbach: Manual of Environmental Microbiology, ASM Press, Washington, DCBush, Fernandez, Esch, Seed: Parasitism, Cambridge University Press, Cambridge

Modul: Natural Resource Use and Conservation in the Tropics and Subtropics (4907-410)

Modulverantwortung	Prof. Dr. Folkard Asch
Bezug zu anderen Modulen	This module is directly linked to all other compulsory modules in AgriTropics.
Teilnahmevoraussetzungen	.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester

Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	Written exam (100 %)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h presence + 120 h preparation at home + exam = 1178 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	Students acquire basic knowledge on resource use, requirements, and conservation as linked to tropical agricultural production. They learn to define and evaluate the different abiotic and biotic resources and their relevance for sustainable agricultural production systems. The are able to recognize and define disciplinary and systemic interactions of resource use and conservation and can apply this knowledge in concepts of sustainable agricultural production.
Natural Resource Use and Conservation in the Tropics and Subtropics (4907-411)	
Person(en) verantwortlich	Prof. Dr. Folkard Asch, apl. Prof. Dr. Bettina Haussmann, Prof. Dr. Uta Dickhöfer
Person(en) begleitend	Dr. agr. Thomas H. Hilger, Dr. sc. agr. Willmar L. Leiser, PD Dr. Ludger Herrmann
Lehrform	Vorlesung
SWS	4
Inhalt	1.) Introduction - module requirements - module links within the compulsory moduls - Ilias - exam mode and requirements - expectations 2.) Systems thinking - multidisciplinary approaches - Resources - functions - links between resources - concepts of use and conservation 3.) Weather - Climate - global circulation - wind systems - ocean currents - global energy distribution - precipitation patterns - agro-ecolgical zoning - agri-ecological zones -examples 4.) Precipitation patterns - agro-ecological zoning - agri-ecological zones -definitions- Length of growing period - Köppen-Geiger-vegetation zones -examples 5.) Global water cycle - precipitation - evaporation - transpiration - run-off - surface pools - kondesation - movement - immobilisation - water table recharge - drainage - percolation 6.) Water as a resource - global water issues- virtual water - Green - Blue -Grey - Water Concepts - rain water harvesting - field water management - water and soil -soil degradation and withering - tropical soils = problem soils

	7.) General definitions, soil functions and global soil degradation 8.) Soil description and systematics 9.) Soil diversity at variable scales 10.) Problem soils and their management 11.) Exercise: Calculation of site characteristics 12.) Soil management in Sahelian subsistence farming systems 13.) Major land usetypes of the tropics and subtropics and ecosystems services 14.) Crop production systems, crop management and resource use in the tropics and subtopics: Potentials and constriants 15.) Land use change, LUC assessement: tools and approaches 16.) Matter flows in landscapes, interconnectivity of landscapes 17.) Land degradation: types, extent, human impact, consequences and mitigation options at landscape level 18.) Global diversity of vascular plants, Role of the tropics and subtopics: origin of most food crops, Agricultural threats to biodiversity 19.) Natural resource use in tropical livestock systems: - System classifications - Resource use by livestock - efficiency of nutrient and water conversion - examples 20.) Tropical feed resources: - Feed evaluation systems - Nutritional value of tropical feed resources 21.) Tropical feed resources: - Nutritional value of tropical feed resources (cont.) - Feed management and conservation - examples of livestock feeding in different production systems 22.) Grassland-based livestock production: - Grassland ecotypes - Spatio-temporal availability in resource availability - Pastoral livestock systems 23.) Grassland-based livestock production: - Grassland degradation processes -

	24.) Grassland-based livestock production: Rangeland concepts - Management strategies 25.) Plant Genetic Resources (PGR), Roles and functions of crop and varietal diversity in the production system (including linkage with nutrition), PGR conservation (ex situ, in situ - farmer management of diversity), Use of PGR : legal framework (CBD, ITPGRFA, SMTA, benefit sharing) 26.) Use of PGR and crop improvement targeting sustainable production systems and sustainable use of natural resources (P, N efficiency) 27.) Use of PGR and crop improvement to cope with climate variability and change 28.) Use and breeding of minor crops

Modul: Plant and Crop Modeling (3103-410)

Modulverantwortung	Hon.-Prof. Eckart Priesack
Teilnahmevoraussetzungen	Basic knowledge of mathematics will be helpful (esp. calculus; ordinary differential equations).
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Prüfungsleistung	Oral exam (100 %)
Prüfungsdauer	30 Minuten
Arbeitsaufwand	56 h Präsenz + 112 h Eigenanteil + Prüfung = 168 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After successfully completing the module, students understand the important role of models of plant and crop growth in many disciplines (e.g. agricultural sciences, agricultural economics, bioeconomics, hydrology, earth system science, environmental physics and meteorology). They can specify the general concepts currently used in modelling the processes determining plant and crop growth. Students have a good understanding of the concepts and modelling approaches required for the development of crop growth models appropriate for various environmental situations from the local to the regional scale. They are finally able to work with and further develop basic plant growth models which integrate knowledge from different disciplines at the interface between biogeophysics, plant physiology and agricultural sciences, in

	particular models of phenological development, biological switches, light transmission in canopies, leaf gas exchange, photosynthesis, growth and respiration, transport processes and assimilate partitioning in plants and water and nutrient uptake by plants. Students are ultimately proficient in respective biochemical approaches and plant morphology.
Schlüsselkompetenzen	Students enhance their organizational skills, self-reliance, time management and team work abilities while preparing and following up on lectures and during the exercises and while preparing for the exam. They learn and practice critical and analytical thinking in the lectures and the exercises, improve their ability of integrating knowledge from different disciplines, and gain experience in approaching complex scientific subjects.
Plant and Crop Modeling (3103-411)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Thilo Streck
Person(en) begleitend	Dr. rer. nat. Sebastian Gayler
Lehrform	Vorlesung
SWS	2
Inhalt	.
Computer Exercises in Plant and Crop Modeling (3103-412)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Thilo Streck
Person(en) begleitend	Dr. rer. nat. Sebastian Gayler
Lehrform	Übung
SWS	2
Inhalt	.

Modul: Plant Quality (3302-460)

Modulverantwortung	Prof. Dr. Uwe Ludewig
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Studienleistung	Presentation (25 %) with extended abstract (5 %)
Prüfungsleistung	Written exam (70 %)

Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After successfully completing the module, students are able to describe the main requirements for the external appearance and physical composition of plant products (food, feed and other biobased products) from the perspective of the processor, marketer, consumer and legislator. They can specify means of influencing the quality by plant mineral nutrition (external quality, content and storage of value-adding ingredients; suppression of unwanted plant compounds) and can evaluate the possibilities of influencing the quality by mineral nutrition in comparison with other means, such as breeding (eg. genetically modified crops) and plant cultivation strategies. Students are familiar with quality concepts and the quality of the product beyond (eg. production quality). Students acquire these abilities in the lecture (2 SWS). In the accompanying seminar, students present and discuss original work from the literature and current aspects of plant quality in short lectures. A one-day excursion to LUFA Speyer gives an insight into the practice of the official quality control of agricultural products.
Schlüsselkompetenzen	During preparation for the exam, while preparing and following up on lectures and while preparing the seminar, students enhance their organizational skills, self-reliance, time management and team work. They learn and practice both critical and analytical thinking and reading of scientific literature in the seminar, while generally improving their ability of exploring a scientific subject. While preparing the seminar, students improve their scientific articulateness and further improve their oral communication skills, presentation techniques and discourse capacities through presenting their work.
Plant Quality (3302-461)	
Person(en) verantwortlich	Prof. Dr. Günter Neumann, apl. Prof. Dr. Franz Wiesler, Prof. Dr. Uwe Ludewig
Lehrform	Vorlesung mit Seminar
SWS	4
Inhalt	Gliederung 1. Definition, Bewertung und Beeinflussung der Pflanzenqualität 2. Die äußere Qualität von Pflanzen 3. Die stoffliche Zusammensetzung von Pflanzen 3.1 Anorganische Inhaltsstoffe (ess. Mineralstoffe, Nitrat, Schwermetalle) 3.2 Organische Stickstoffverbindungen 3.3 Kohlenhydrate 3.4 Lipide 3.5 Organische Säuren

	3.6 Vitamine 3.7 Bioaktive Substanzen 3.8 Rückstände und Kontaminanten 4. Spezielle Qualitätsfragen 4.1 Pflanzenernährung und Kartoffelqualität, Zuckerrübenqualität, Obstqualität, Gemüsequalität, Weinqualität 4.2 Pflanzenernährung und Qualität im konventionellen, integrierten oder alternativen Anbau 5. Biotechnologische Methoden der Qualitätsverbesserung
Literatur	Aktuelle Literatur Marschner's Mineral Nutrition of Higher Plants (2011, Academic Press)

Modul: Portfolio-Modul (Master) (3000-410)

Modulverantwortung	Prof. Dr. sc. agr. Michael Kruse
Teilnahmevoraussetzungen	Pro Studiengang kann nur ein Portfolio Modul belegt werden.
Sprache	deutsch/englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	n. V.
Verbindlichkeit	Wahl
Studienleistung	In dem Portfoliomodul können mit einer oder mehreren Studienleistungen insgesamt zwischen 1,0 und 7,5 ECTS credit erworben werden. Als Studienleistungen werden mit ECTS credits anerkannt (Richtlinie 25 - 30 h = 1 ECTS credit): - ein Industrie-/Behörden-/Firmenpraktikum in vor- und nachgelagerten Bereichen (einschließlich Werkstudierenden-Tätigkeit). Hierbei ergeben 20 Arbeitstage mit 20 seitigem Bericht = 6 ECTS credits. Für andere credit Anzahlen wird linear angepasst (z.B. 10 Tage + 10 Seiten Bericht = 3 credits oder 25 Tage + 25 Seiten Bericht = 7,5 credits). Eine Genehmigung des Praktikums oder des Betriebes ist nicht erforderlich. Das Praktikum kann auch vor dem Studium abgelegt worden sein. Der Bericht samt Praktikumsbescheinigung ist bei einem Prüfungsberechtigten (i.d.R. Prof.) abzugeben. Dieser prüft den Bericht und bestätigt dem Studiendekan, dass der Bericht angenommen ist und schlägt die Anzahl der zu vergebenden ECTS Punkte vor. Seitens der Fakultät gibt es außer der Seitenzahl keine weiteren Vorgaben für den Bericht. Es ist ratsam, vor Erstellung des Berichts den Prüfungsberechtigten nach seinen Vorgaben zu fragen und diese zu berücksichtigen. Der Studiendekan kann eine Bestätigung darüber ausstellen, dass das Praktikum als Studienleistung anerkannt wird. Das Praktikum kann maximal einmal geteilt werden. Landwirtschaftliche Praktika selbst können im Master nicht angerechnet werden. - Individuelles Forschungspraktikum (d.h.

	der/die Studierende wird z.B. in die Bearbeitung eines wissenschaftlichen Projekts in einem Institut bzw. einer Forschungseinrichtung integriert). Beispiel für 6 ECTS credits: 20 Arbeitstage mit 20 seitigem Bericht oder Arbeitstagebuch, Projektbeschreibung mit Fragestellungen, angewendete Methoden und ggf. Teilergebnisse. Der Bericht ist bei einem Prüfungsberechtigten (i.d.R. Prof.) abzugeben. Dieser prüft den Bericht und bestätigt dem Studiendekan, dass der Bericht angenommen ist und schlägt die Anzahl der zu vergebenden ECTS Punkte vor. - Hausarbeit/Literaturarbeit über ein wissenschaftliches Thema (5 - 10 Seiten je ECTS credit). - Summerschools für postgraduierte Studierende. (ECTS nach Absprache mit einem Hochschullehrer) - Fortbildungsveranstaltungen wissenschaftlicher Gesellschaften für postgraduierte Studierende. (ECTS nach Absprache mit einem Hochschullehrer) - Fachspezifische Sprachkurse (insges. max. 2 ECTS credits). - Fortbildungen im Bereich „Soft Skills“ mit erkennbarem Bezug für das gewählte Studienfach (insges. max. 2 ECTS credits). - FIT-Tutorenausbildung (insges. max. 3 ECTS credits). Das Abhalten des Tutoriums kann nicht anerkannt werden, wenn es im Rahmen eines HiWi-Vertrags erfolgte. - Kurse zu Statistischer Programmierung oder zu Statistikprogrammen (insges. max. 2 ECTS credits). - Leistungsscheine der Virtuellen Akademie Nachhaltigkeit werden mit den darin ausgewiesen Credits anerkannt. Die Leistungsscheine werden durch eine elektronische Klausur in Hohenheim oder einer anderen Partner-Hochschule des Projektes erworben: https://www.va-bne.de/index.php/de/studierende/beteiligte-hochschulen-2 und durch Prof. Bieling bestätigt. Der Studiendekan ist bevollmächtigt, im Einzelfall und auf Antrag des/der Studierenden und mit Befürwortung eines Hochschullehrers, weitere Leistungen anzuerkennen. - Tätigkeiten in Rahmen einer Beschäftigung (HiWi) an Forschungseinrichtungen der Universität Hohenheim, werden nicht als Studienleistungen anerkannt. - In Streitfällen bzgl. der Anerkennung von Studienleistungen entscheidet der Prüfungsausschuss.
Prüfungsleistung	keine
Modulprüfung	Die ECTS werden durch den zuständigen Studiendekan Prof. Dr. Michael Kruse aufgrund der vorgelegten Bescheinigungen bzw. auf Empfehlung der betreuenden Hochschullehrer vergeben. Bitte kommen Sie hierzu in die Sprechstunde, Mo. 12 - 13 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links) und bringen Ihre Bescheinigungen mit. Die dort erhaltene Bescheinigung über die anerkannten Leistungen geben Sie dann beim Prüfungsamt ab. Das Modul kann mit 1 - 7,5 ECTS credits abgeschlossen und bestanden werden. Das Modul ist unbenotet.
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Nach Abschluss des Moduls sind die Studierenden in der Lage, - die Grundlagen wissenschaftlichen Arbeitens zu benennen. - interdisziplinäre Schnittstellen bzgl. ihres Studiengangs zu identifizieren und zu beschreiben - eigene Wissenslücken zu erkennen und selbständig zu schließen.

	- unter Anleitung ein wissenschaftliches Projekt zu planen und durchzuführen. - Ergebnisse wissenschaftlichen Arbeitens schriftlich festzuhalten und diese im Rahmen einer Präsentation wiederzugeben.
Schlüsselkompetenzen	Das Modul vermittelt Schlüsselkompetenzen in unterschiedlichen Bereichen, je nach inhaltlicher Ausrichtung. Zu nennen sind vor allem: Die Befähigung zum selbständigen (wissenschaftlichen) Arbeiten und zur effektiven Informationsbeschaffung und Informationsanalyse durch das selbstständige Erarbeiten eines Themas. Teamfähigkeit, Selbst- und Fremdorganisation und planerische Fähigkeiten durch die Arbeit in Gruppen, Forschungsteams, oder durch ein Praktikum in einem Betrieb, sowie durch die selbstständige Organisation der Tätigkeiten in diesem Modul durch die Studierenden.
Anmerkungen	Das Modul ist unbenotet. Es bleibt daher bei der Bildung des Notendurchschnitts unberücksichtigt. Eine Anmeldung zur Prüfung dieses Moduls im Prüfungsamt ist nicht erforderlich. Die vom Studiendekan ausgestellte Bescheinigung wird nach Abschluss des Moduls im Prüfungsamt abgegeben. Bei offenen Fragen kommen Sie in die offene Sprechstunde des Studiendekans montags 12:00 - 13:00 Uhr (Inst. f. Pflanzenzüchtung (350), Fruwirthstraße 21, 1. Stock, links). Schreiben Sie bitte keine e-Mails direkt an den Studiendekan!

Modul: Poverty and Development Strategies (4901-420)

Modulverantwortung	Prof. Dr. Manfred Zeller
Bezug zu anderen Modulen	Is complemented by module 4901-430 "Rural Development Policies and Institutions".
Teilnahmevoraussetzungen	keine
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	2. Semesterhälfte
Verbindlichkeit	Wahl
Modulprüfung	written
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	Die Studenten können Problemstellungen sowie Ziele in landwirtschaftlicher und ländlicher Entwicklung beschreiben. Sie können einen Überblick geben über vergangene Entwicklungstheorien und -strategien und gegenwärtige Ansätze, mit einem Fokus auf Verteilungsfragen, Armutsreduzierung, wirtschaftliches Wachstum sowie deren Wechselwirkungen.

Schlüsselkompetenzen	Selbständiges Arbeiten, kritisches, analytisches Denken, schriftliche und mündliche Ausdrucksfähigkeit,Kooperationsfähigkeit,
Anmerkungen	Once not offered in WS 19/20. Please register online via ILIAS.
Poverty and Development Strategies (4901-421)	
Person(en) verantwortlich	Prof. Dr. Manfred Zeller
Person(en) begleitend	M.Sc. Orkhan Sariyev, Bezawit Bahru
Lehrform	Vorlesung
SWS	4
Inhalt	Students learn methods/indicators to measure development, with a specific focus on agriculture, economic growth, poverty, equality, and food security. This includes indicators of development, such as the Human Development Index, and development objectives and their relationships as well as conflicts between them. Data (mainly from World Bank and UN system) are presented on selected development indicators for all developing regions. This is followed by a review of development theories (classical, balanced/unbalanced growth models, modernization theory, basic needs approach, role of transaction costs and rural institutions) and related development strategies and by a discussion of the underlying factors of development (as derived by the development theories), such as the endowment with natural resources and land, labor and population growth, and human, financial and social capital. The contributions of agriculture for overall development are presented. Students learn also about the institutional setting of development aid. This concerns national and international development institutions including non-governmental organizations (NGOs) with their structures, roles and development approaches. Finally, students are introduced to several rural and agricultural development policies, with an emphasis on the role of the state for agricultural and rural development and sectoral policy instruments related to agricultural and food markets, land and rural finance, agricultural extension, and social safety net /public works policies.
Literatur	Major literature references for the module are: TODARO, M.P. and S.C.Smith 2003. Economic Development. Harlow, UK: Pearson Education Ltd. Chenery, H. and T.N. Srinivasan (eds.). 1989. Handbook of development economics. Amsterdam, NL: Elsevier Publishers. World Bank. Annual issues of the World Development Report. New York, NY, USA: Oxford University Press.- especially Attacking Poverty. World Development Report 2000/2001. Eicher, C.K., and J.M. Staatz (eds.). 1998. International agricultural development. London, UK: Johns Hopkins University Press (especially articles 6, 7, 10, 11, 15, 17, 19, 20, 24, and 27) UNDP. Annual issues of the Human Development Report. New York, NY, USA: United Nations Development Program (UNDP).

Anmerkungen	Lecture with discussion, work in small groups, study of literature, reader/script. The reader and powerpoint slides are available in the ASTA-Skriptenbüro.
Tutorial Poverty and Development Strategies (freiwillig) (4901-422)	
Person(en) verantwortlich	Prof. Dr. Manfred Zeller
Lehrform	Tutorium
SWS	1
Inhalt	The exercise will offer students to rehearse selected topics covered in the lecture for which students demand additional opportunity for learning and rehearsal. These topics include: a) methods for measuring development in various dimensions (for example gross national product, income inequality, income poverty, purchasing power parity, human development index, food security, global hunger index); b) analytical concepts used in various development theories; and exercises regarding price/market analysis and investments in agricultural research (e.g. total factor productivity analysis).

Modul: Quantitative Methods in Economics (4901-470)

Modulverantwortung	Prof. Dr. Manfred Zeller
Bezug zu anderen Modulen	This module is considered as basic for all other modules offered to students in the Major of "Rural Development Economics" in the M.Sc. Agritropics.
Teilnahmevoraussetzungen	Bachelor-Niveaukurse in Statistik werden vorausgesetzt.
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	3. Semester
Dauer des Moduls	2. Semesterhälfte
Verbindlichkeit	Wahl
Prüfungsleistung	Written exam (100 %)
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h Präsenz + 104 h Eigenanteil + Prüfung = 160 h Workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completing this module, students: - Know the steps of preparing a field research project - Comprehend the different methods of sampling commonly used in rural areas of developing countries - Are able to utilize about best practices in questionnaire design - Are proficient in various statistical tools to address research questions and to test research hypotheses

	- Can apply these tools using Stata, a comprehensive statistics software package
Schlüsselkompetenzen	During preparation for the exam, while preparing and following up on lectures and during the exercises, students practice self-reliance and time management. They learn and practice critical and analytical thinking when challenged with statistical analysis. In the exercises, students further practice team work by working in small groups. Skills in professional statistical software such as STATA are indispensable for further scientific work. The skills and competences gained in the course facilitate students to successfully conduct fieldwork activities in rural areas with the highest scientific standard.
Anmerkungen	This module targets students from all master programs with a strong interest in empirical quantitative social science research. It is highly recommended to students in their 3rd semester who plan to conduct such research for their master thesis. A certain degree of overlap with module 4902-810 "Applied Econometrics" (compulsory for AgEcon students in their 1st semester) regarding linear regression is unavoidable because the module also targets students from other master programs who may not have chosen "Applied Econometrics" in their 1st semester. However, due to its much broader range of topics, "Quantitative Methods in Economics" is a highly recommended module also and especially for AgEcon students. Please register online via ILIAS. We only accept a maximum of 25 students.
Quantitative Methods in Economics (4901-471)	
Person(en) verantwortlich	Prof. Dr. Manfred Zeller
Person(en) begleitend	Dr. Tim K. Loos, Dr. Ling Yee Khor
Lehrform	Vorlesung
SWS	3
Inhalt	This module consists of lectures and exercises in the computer lab. Its emphasis is on the design and execution of socio-economic research that investigates issues of rural or agricultural development in developing countries. The course mainly covers quantitative research methods that are used in development economics and in applied socio-economic research in developing countries. The particular contents of the module are as follows: 1. Quantitative research designs in the social sciences 2. The sampling process (constructing sampling frames, sampling procedures, sample size) 3. The measurement of variables and questionnaire design (with group assignment) 4. Data entry and data cleaning (with computer exercises) 5. Overview of statistical instruments 6. Parametric and non-parametric tests (with computer exercises) 7. Principal component analysis (with computer exercises) 8. Linear regression (with computer exercises)

	9. Binary response models (with computer exercises) 10. Two-stage Heckman procedure for correcting sample selection bias (with computer exercises)
Literatur	Literature Black, Thomas R. (1999) Doing quantitative research in the social sciences. An Integrated approach to research design, measurement and statistics. Sage Publications, London. Field, Andy (2005) Discovering statistics using SPSS. Second Edition. Sage Publications, London. Hill, R. Carter, Griffiths, William E., and Judge, George G. (2001) Undergraduate econometrics. Second Edition. John Wiley & Sons, New York.
Exercises to Quantitative Methods in Economics (4901-472)	
Person(en) verantwortlich	Prof. Dr. Manfred Zeller
Person(en) begleitend	Dr. Tim K. Loos
Lehrform	Übung
SWS	1
Inhalt	Computer exercises to quantitative methods in economics used in socio-economic research to issues of rural or agricultural development in developing countries.

Modul: Remote Sensing of the Earth System (1201-500)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Bezug zu anderen Modulen	An advisable complement is the module 3103-440 "Spatial data analysis with GIS"
Teilnahmevoraussetzungen	Basic knowledge in mathematics and physics
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Modulprüfung	Written exam
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 124 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	After completion of the module students can describe the basic principles of remote sensing including the radiative transfer equation. They can apply and improve methods for remote sensing of land-surface properties (temperature, fluxes, vegetation), of the atmosphere (temperature and humidity profiles, clouds, and

	precipitation). Students can interpret remote sensing data from satellites (e.g. visualization of high-impact weather events such as hurricanes).
Anmerkungen	Maximum number of participants: 20
Remote Sensing of the Earth System, Lecture (1201-501)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Andreas Behrendt
Lehrform	Vorlesung
SWS	2
Inhalt	The observation of the Earth system using remote sensing has fundamental applications for everyday lives of mankind. The module introduces in the physical basis, the methods, and appli-cations of remote sensing from ground-based, airborne, and space borne platforms. The module is equipped with brand-new examples such as hurri-cane watch, wild fire observations, and sea surface temperature measurements for weather forecasting. Please contact Dr. Behrendt (andreas.behrendt@uni-hohenheim.de) or Prof. Wulfmeyer (volker.wulfmeyer@uni-hohenheim.de) for further details.
Literatur	W.G. Rees, Physical Principles of Remote Sensing* C. Elachi, J. van Zyl, Introduction to the physics and techniques of remote sensing, Wiley & Sons, 2006* (some copies of both books are available in the central library of the university).
Remote Sensing of the Earth System, Excercise (1201-502)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Person(en) begleitend	Dr. rer. nat. Andreas Behrendt
Lehrform	Übung
SWS	2
Inhalt	Exercise of the content of the lectures with interesting applica-tions of remote sensing for studying variables of the atmosphere and the land surface.

Modul: Special Topics of Earth System Science (1201-620)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Bezug zu anderen Modulen	All modules from the 1st semester
Teilnahmevoraussetzungen	Successful completion of the 1st semester

Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes SS
Semesterlage	2. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Wahl
Modulprüfung	Presentation
Prüfungsdauer	60 Minuten
Arbeitsaufwand	56 h attendance + 124 h independent study = 180 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The Students are able to apply their knowledge from natural sciences and other applied sciences for understanding and analyses of interdisciplinary compelling topics of Earth System Science
Schlüsselkompetenzen	- Analysis problems from Earth System Science with respect to the interaction between physical, chemical, biological, and economic processes - Set up of corresponding Earth system models of moderate complexity - Analyze the output of the model with respect to input variables, error analyses - Interdisciplinary thinking - Competence to present the analysis of the problem in oral and written manner
Anmerkungen	Maximum number of participants: 15 Registration is open until March 2014. Ranking according to grades in first semester, priority set to students from Earth System Science but the module is also open for other curricula.
Special Topics of Earth System Science, Seminar (1201-621)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Seminar
SWS	4
Inhalt	Current problems in Earth System Science are introduced and analyzed by the students. Examples are volcanic ash outbreaks, extreme weather events, land-surface-atmosphere exchange, geoengineering. The problems are split with respect to the representation by various disci-plines in Earth System Science and transformed into simple models with non-linear interactions between the components
Literatur	Will be presented in the seminar
Anmerkungen	Late-breaking topics in Earth System Science will be introduced and analyzed.

Modul: Spring School "Extreme Environments" (1301-410)

Modulverantwortung	Dr. rer. nat. Stefan Fox

Bezug zu anderen Modulen	Astrobiology (1301-400)rnPractical Course Chemical Evolution (1301-431) Selbstorganisation und Musterbildung in biologischen Systemen mit demrnSchwerpunkt Membranen (2302-400)
Teilnahmevoraussetzungen	Bachelor degree in einer technischen, naturwissenschaftlichen oder agrarwissenschaftlichen Disziplin sowie sehr gutes Grundwissen in Physik, Chemie und Biologie
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	geblockt
Verbindlichkeit	Wahl
Studienleistung	regular attendance, participation in three excursions
Modulprüfung	Klausur
Prüfungsdauer	90 Minuten
Arbeitsaufwand	72 h attendance + 116h independent study = 188 h workload
Fachkompetenzen / Lern- und Qualifikationsziele	The students understand how studies such as laboratory experiments, astronomical observations and space missions contribute to our knowledge about chemical evolution in extreme environments that probably led to the origin of life. They realize that life on Earth is and always was strongly influenced by cosmic phenomena. The students gain an overview about abiotic (prebiotic) chemical reactions in extreme environments and how traces of extinct and extant life can be detected on Earth and possibly on other planets (e.g. Mars) and moons (e.g. Europa, Enceladus). Extreme environments on other bodies of the Solar System are discussed as possible habitats for extraterrestrial life forms. During an excursion, the students acquire skills in recognizing the traces of an ancient asteroid impact. Students understand the technical and scientific prerequisites to study living systems under space conditions. The students know how gravity perception in general is organized in living systems.
Schlüsselkompetenzen	After having completed the module, the students should be able to deal with highly interdisciplinary problems by combining the methods and ways of thinking of various scientific disciplines. They should be able to understand the extended technical needs in the presented field of science. The students are able to convert newly gained theoretical knowledge into own experimental research. In a small experiment, students gain the ability to formulate scientific hypotheses, the design of experimental setups and the practical realization of experiments and data management and interpretation.
Anmerkungen	Anzahl Studien-/Teilnehmerplätze: 12 Anmeldung zur Teilnahme: über ILIAS ab Oktober Das Modul findet in der vorlesungsfreien Zeit vor Beginn des Sommersemesters statt.

Abiotic Molecular Evolution and Biosignatures (2302-411)	
Person(en) verantwortlich	Dr. rer. nat. Stefan Fox
Lehrform	Vorlesung
SWS	1
Inhalt	This lecture gives an overview about abiotic chemical reactions and chemical evolution in extreme environments such as the interstellar medium and planetary systems with their small celestial bodies (comets, asteroids, meteorites). Further the following topics are included: the early Earth, asteroid impacts, primordial volcanic islands, black smokers, past and present environmental conditions on Mars, the search for life on Mars (e. g. ExoMars mission), lithopanspermia, survival of microorganisms in space, homochirality, protometabolism, rocks and minerals, the origin of life, traces of life and biosignatures. The excursion leads to the Ries-Krater-Museum in Nördlingen.
Literatur	Plaxco, K. W., Gross, M.: Astrobiology - A Brief Introduction, 2nd edition, Johns Hopkins University Press, Baltimore, 2011. Rothery, D. A., Gilmour, I., Sephton, M. A. (eds.): An Introduction to Astrobiology, revised edition, Cambridge University Press, Cambridge, UK, 2011. Sullivan III, W. T., Baross, J. A. (eds.): Planets and Life - The Emerging Science of Astrobiology, Cambridge University Press, Cambridge, UK, 2007. Pösges, G., Schieber, M.: Das Rieskrater-Museum Nördlingen, 3. Auflage, Pfeil, München, 2009; The Ries Crater Museum Nördlingen, Pfeil, München, 1997.
Anmerkungen	The contents of the lecture are in part aligned to the contents of the modules "Practical Course Chemical Evolution" (1301-431) and "Astrobiology" (1301-400).
Life science under space conditions (2302-412)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Wolfgang R. L. Hanke
Person(en) begleitend	Dr. rer. nat. Florian P.M. Kohn, Dr. med. vet. Claudia Koch, apl. Prof. Dr. rer. nat. Ralf Anken
Lehrform	Vorlesung
SWS	1
Inhalt	This lecture gives an introduction to cosmology and to radiation in space. It delivers information about techniques/platforms to study live under space conditions on earth and in space missions. It also includes detailed information about gravity perception in living systems. The excursion leads to the DLR Research Center in Köln (Inst. Luft- und Raumfahrtmedizin).

Literatur	Meike Wiedemann, Florian P.M. Kohn, Harald Rösner, and Wolfgang R.L. Hanke. Self-organization and pattern-formation in neuronal systems under conditions of variable gravity. In:Springer Complexity, Springer Publishing Comp., ISBN 978-3-642-14471-4 (2011) Tipler, P.A. and Mosca, G. Physics for scientists and engineers. Freeman and Company, 2008

Modul: UNIcert III English for Scientific Purposes (1000-040)

Modulverantwortung	Prof. Dr. rer. nat. Lutz Fischer
Teilnahmevoraussetzungen	Scoring at least 85 points in the Language Center's entrance examination OR a UNIcert II certificate or equivalent proof of English language proficiency OR being enrolled in an English-language Master's program at the Faculty of Natural Sciences.
Sprache	englisch
ECTS	7,5
Angebotshäufigkeit	jedes Semester
Semesterlage	2. Semester
Dauer des Moduls	2 Semester
Verbindlichkeit	Wahl
Studienleistung	Regular attendance, active participation, other (see individual course descriptions at https://spraz.uni-hohenheim.de/kurse)
Modulprüfung	UNIcert III examination (240 minutes total): 180 minutes written exam, 30 minutes listening comprehension, 30 minutes oral exam
Arbeitsaufwand	225 h
Fachkompetenzen / Lern- und Qualifikationsziele	Upon successful completion of this module, the English language proficiency of the students corresponds to the level C1 of the Common European Framework of Reference for Languages. For details on the competencies you acquire beyond language proficiency, please read the individual course descriptions at https://spraz.uni-hohenheim.de/kurse?&L=1.
Anmerkungen	You need to register for the UNIcert III courses. Information on how to register is available at https://spraz.uni-hohenheim.de/anmeldung?&L=1.
UNIcert III English for Scientific Purposes (1000-041)	
Lehrform	Kurs
SWS	8
Inhalt	Scientific Writing (2 SWS)

	“This course focuses on written communication in the scientific world using English. The primary emphasis is on the structure and vocabulary of a scientific paper/article. Printed materials include articles and papers from each student's area of interest, as well as vocabulary, writing, and grammar exercises.” Critical Thinking (2 SWS) “This course is relevant for anyone who would like to improve the way they read and deal with academic and scientific texts. Research based reading will cover strategies for improving reading techniques and skills such as speed reading and scanning academic texts for pertinent information. It will give you the opportunity to identify text types, critically assess and analyze their content to identify their main points, and distinguish fact from opinion.” Intercultural Communication (2 SWS) “Communication between two members of the same cultural community takes place within the framework of a common language and against a common socio-cultural background. International communication may thus fail, or be less satisfactory than it could be, not only because of language problems but also because the participants have insufficient knowledge of each other's cultural background and an undeveloped awareness of what is unique to their own cultural background.” Scientific Reading and Discussion (2 SWS) “This course is particularly important for science students, as many leading textbooks and the majority of scientific research articles are written in English. Instructor feed-back will be given to each student's grammar, vocabulary, and fluency problems.”
Anmerkungen	Registration: https://spraz.uni-hohenheim.de/anmeldung

Modul: Weather and Climate Physics (1201-630)

Modulverantwortung	Prof. Dr. rer. nat. Volker Wulfmeyer
Teilnahmevoraussetzungen	-
Sprache	englisch
ECTS	6
Angebotshäufigkeit	jedes WS
Semesterlage	1. Semester
Dauer des Moduls	1 Semester
Verbindlichkeit	Pflicht
Modulprüfung	Written examination
Prüfungsdauer	120 Minuten
Arbeitsaufwand	56 h attendance + 112 h independent study = 168 h workload

Fachkompetenzen / Lern- und Qualifikationsziele	The students have knowledge of the physical variables and processes related to the earth system and are familiar with the underlying mathematical equations and formulations. They are able independently to apply these equations in order to solve physical problems. They know the principles of physical modeling and understand the content of complex equations. The students have the physical understanding required to specify the state and the ongoing processes of the earth system. They have the expertise of analytical thinking and are able to quantitatively solve problems in natural science.
Anmerkungen	Maximum number of participants: 10
Weather and Climate Physics, Lecture (1201-631)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Vorlesung
SWS	2
Inhalt	The order of the topics relates to the chain of processes of the earth system: beginning with the sources of energy, followed by the transport of energy by radiation and ending with thermody-namic processes and thereby caused mass flows. The following topics will be discussed in detail: - Nuclear physics (equivalence of energy and mass; mass defect; nuclear fusion; radioactivity; isotopes; mass spectrometry) - Physics of atoms and molecules (emission and absorption of electromagnetic waves; spectra of atoms, molecules and solid bodies; spectrum analysis) - Radiation (Planck's law of radiation; transmission; scattering) - Thermodynamics (diffusion; heat transport processes; energet-ics of phase transitions of water; sensible und latent heat; enthal-py; entropy; thermodynamic equilibrium) - Mass flows (laminar and turbulent flow; Reynolds number; Navier-Stokes-equation; flow in a moving reference system; flow in porous matter)
Weather and Climate Physics, Exercise (1201-632)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Übung
SWS	1
Inhalt	Solution of assigned physical problems related to the contents of the lecture.
Weather and Climate Phyics, Practical (1201-633)	
Person(en) verantwortlich	Prof. Dr. rer. nat. Volker Wulfmeyer
Lehrform	Praktikum
SWS	1

Inhalt	Performance and evaluation of physical experiments related to the contents of the lecture.