



Module name: Earth System

Academic year: 2019/2020 Code: ZSDA-3-0147-s ECTS credits: 4

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr inż. Wachniew Przemysław (wachniew@agh.edu.pl)

### Module summary

This multidisciplinary course provides an introduction to the entire Earth's environment as composed of closely interrelated elements (spheres) and processes (cycles). An emphasis is put on the role of humans in the global environment. The lecture provides the basic conceptual framework, while the further understanding is derived from discussions and simple modelling exercises.

### Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Skills: he can			
M_U001	Ability to build a simple mathematical model of energy/matter fluxes in the global environment or its selected compartment.	SDA3A_U07, SDA3A_U03	Project
M_U002	Ability to find, integrate and communicate scientific knowledge on Earth System functioning	SDA3A_U07, SDA3A_U03, SDA3A_U02, SDA3A_U05, SDA3A_U04	Presentation
M_U003	Ability to critically evaluate and respond to claims in popular media related to the environmental change.	SDA3A_U02, SDA3A_U05, SDA3A_U04	Participation in a discussion
Knowledge: he knows and understands			
M_W001	Understanding of a particular environmental compartment/process in the context of the entire Earth System.	SDA3A_W02, SDA3A_W05	Presentation

M_W002	Understanding of fundamental concepts related to Earth systems science, and the holistic comprehension of the interactions between Earth system elements.	SDA3A_W02, SDA3A_W01, SDA3A_W05	Project, Presentation, Participation in a discussion
M_W003	Understanding the nature and extent of environmental change.	SDA3A_W05	Project, Presentation, Participation in a discussion

## Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
45	15	0	0	15	0	15	0	0	0	0	0

## FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Skills: he can												
M_U001	Ability to build a simple mathematical model of energy/matter fluxes in the global environment or its selected compartment.	-	-	-	+	-	-	-	-	-	-	-
M_U002	Ability to find, integrate and communicate scientific knowledge on Earth System functioning	-	-	-	-	-	+	-	-	-	-	-
M_U003	Ability to critically evaluate and respond to claims in popular media related to the environmental change.	-	-	-	-	-	+	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Understanding of a particular environmental compartment/process in the context of the entire Earth System.	-	-	-	-	-	+	-	-	-	-	-

M_W002	Understanding of fundamental concepts related to Earth systems science, and the holistic comprehension of the interactions between Earth system elements.	+	-	-	-	-	-	-	-	-	-	-
M_W003	Understanding the nature and extent of environmental change.	+	-	-	-	-	-	-	-	-	-	-

## Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	45 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	30 h
Contact hours	5 h
Summary student workload	80 h
Module ECTS credits	4 ECTS

## Additional information

### Module content

#### Lectures

-

#### Project classes

-

#### Seminar classes

-

### Teaching methods and techniques:

Lectures: Nie określono

Project classes: Nie określono

Seminar classes: Classes have a form of seminar where presentations prepared by students are presented and discussed.

### Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

Warunki i sposób zaliczania zostaną określone na pierwszych zajęciach.

### Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: No

- Participation rules in classes: Nie określono

Project classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Participation is compulsory

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: Participation is compulsory

### **Method of calculating the final grade**

The final grade is calculated as the arithmetic mean of the seminar presentation and project grades.

### **Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:**

Sposób i tryb wyrównywania zaległości zostaną określone na pierwszych zajęciach.

### **Prerequisites and additional requirements**

Prerequisites and additional requirements not specified

### **Recommended literature and teaching resources**

ARCHER, David. The global carbon cycle. Princeton University Press, 2010.

BUTZ, Stephen D. Science of earth systems. Cengage Learning, 2004.

CONDIE, Kent C. Earth as an evolving planetary system. Academic Press, 2015.

HORNBORG, Alf; CRUMLEY, Carole L. The World System and the Earth System: global socioenvironmental change and sustainability since the Neolithic. Routledge, 2016.

JACOBSON, Michael, et al. Earth System Science: from biogeochemical cycles to global changes. Academic Press, 2000.

KASIBHATLA, Prasad, et al. (ed.). Inverse methods in global biogeochemical cycles. American Geophysical Union, 2000.

KRAPIVIN, Vladimir F. Biogeochemical cycles in globalization and sustainable development. Springer Science & Business Media, 2008.

KUMP, Lee R., et al. The earth system. Upper Saddle River, NJ: Pearson Prentice Hall, 2004.

PATWARDHAN, A. M. The dynamic earth system. PHI Learning Pvt. Ltd., 2012.

ROLLINSON, Hugh R. Early Earth systems: a geochemical approach. John Wiley & Sons, 2009.

SLINGERLAND, Rudy; KUMP, Lee. Mathematical Modeling of Earth's Dynamical Systems: A Primer. Princeton University Press, 2011.

### **Scientific publications of module course instructors related to the topic of the module**

HØJBERG, Anker Lajer, et al. Review and assessment of nitrate reduction in groundwater in the Baltic Sea Basin. Journal of Hydrology: Regional Studies, 2017, 12: 50-68.

KLØVE, Bjørn, et al. Groundwater dependent ecosystems. Part I: Hydroecological status and trends. Environmental Science & Policy, 2011, 14.7: 770-781.

SØVIK, A. K., et al. Emission of the greenhouse gases nitrous oxide and methane from constructed wetlands in Europe. Journal of environmental quality, 2006, 35.6: 2360-2373.

WACHNIEW, Przemysław. Isotopic composition of dissolved inorganic carbon in a large polluted river: The Vistula, Poland. Chemical Geology, 2006, 233.3-4: 293-308.

### **Additional information**

None