科目ナンバリング	U-LAS70 10002 SE50						
授業科目名 <英訳>	ILAS Seminar-E2 :Fundamentals of Earth's atmosphere dynamics and climate（地球大気の力学と気候の基礎） ILAS Seminar-E2 :Fundamentals of Earth's atmosphere dynamics and climate			担当者所属 職名・氏名	生存圏研究所 教授　　Luce，Hubert		
群	少人数群	単位数	2単位	週コマ数	1コマ	授業形態	ゼミナール（対面授業科目）
開講年度・ 開講期	2026・前期	受講定員 (1回生定員)	10 (5) 人	配当学年	主として1回生	対象学生	全学向
曜時限	金5	教室	共西22			使用言語	英語
キーワード	Atmosphere / weather / climate						

[授業の概要・目的]

This seminar provides an accessible introduction to the physical processes that govern the Earth's atmosphere and climate system. Grounded in fundamental scientific principles, it is designed for students from diverse backgrounds who wish to understand the structure, composition, and dynamics of the atmosphere and its role in shaping weather and climate.Topics include the Earth's energy balance, atmospheric circulation, cloud and precipitation formation, and extreme weather events. The seminar emphasizes conceptual understanding rather than mathematical complexity, offering students a solid foundation for interpreting climate phenomena and human impacts on the atmosphere.This seminar also supports the United Nations Sustainable Development Goal 13 (Climate Action) by equipping students with scientific literacy on climate processes and environmental change.

[到達目標]

By the end of this seminar, students will be able to:
- Describe the composition and vertical structure of the Earth's atmosphere.
- Explain the physical principles underlying energy balance, radiation, and the greenhouse effect.
- Understand the role of water in atmospheric processes, including cloud formation and precipitation.
- Identify the major atmospheric circulation patterns and their influence on global and regional climates.
- Explain the coupling between the atmosphere, oceans, and cryosphere.
- Recognize how human activities influence atmospheric dynamics and climate.

[授業計画と内容]

Weeks 1-2: Composition and Vertical Structure of the Atmosphere
- Composition and origin of atmospheric gases
- Temperature, pressure, and density variations with altitude
- Hydrostatic equilibrium and vertical stability

Weeks 3-5: Terrestrial and Solar Radiation - The Earth's Energy Balance
- Radiative balance of the Earth
- The greenhouse effect: simplified models and conceptual understanding
- Role of convection and atmospheric circulation in energy transfer
- Anthropogenic disturbances to energy balance

Weeks 6-8: The Role of Water in the Atmosphere
- Water in all its phases and transitions
- Principles of saturation and latent heat

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- Cloud formation and precipitation mechanisms
- Thermal gradient of the troposphere and atmospheric stability

Weeks 9-11: Atmospheric Circulation and Weather Systems
- Major circulation cells and prevailing wind systems
- Monsoons and trade winds
- Mid-latitude weather systems and jet streams
- Extreme weather events: cyclones, thunderstorms, and tornadoes

Weeks 12-13: Ocean-Atmosphere Coupling
- The ocean's role in global energy transport
- Case Study 1: El Nino-Southern Oscillation (ENSO)
- Case Study 2: North Atlantic Oscillation (NAO)

Week 14: Cryosphere-Atmosphere Coupling
- The role of ice and snow in the climate system
- Feedbacks between ice melt and climate dynamics
- Implications for sea-level rise and global circulation

Week 15: Final Examination

Week 16: Feedback

[履修要件]

This seminar requires a high school level science background. Although mathematical modeling is kept to a minimum, students should be familiar with the fundamentals of vector analysis and differential calculus. These tools are nonetheless provided in appendices.

[成績評価の方法・観点]

Evaluation will be:
Active participation in class: 40 pts
Assignments/projects at home: 30 pts
Final examination: 30 pts

[教科書]

There is no specific textbook for this course. Its content will be based on multiple references (books, websites) that will be mentioned during the course.

[参考書等]

（参考書）
授業中に紹介する

[授業外学修（予習・復習）等]

Materials (pdf files) will be made available before class.
Students are encouraged to study the materials before and after each class in order to assimilate technical or uncommon words.
Depending on the topic, studying the materials and preparing the report for evaluation may take several hours per week.

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[その他（オフィスアワー等）]

Materials (pdf files) are available on the Kulasis website. Email communication is available for questions outside of class time.

[主要授業科目（学部・学科名）]