

STUDY GUIDE

CLIMATE-RESILIENT INFRASTRUCTURE: RISK, ADAPTATION AND DECISION-MAKING

Organised by

**University of Cantabria (UC) /
IHCantabria**

1. IDENTIFYING DATA.		
• Course Name.	Climate-Resilient Infrastructure: Risk Assessment, Adaptation and Decision-Making	
• Coordinating University.	University of Cantabria (UC)	
• Partners Involved.	IHCantabria - Environmental Hydraulics Institute of the University of Cantabria (applied case studies and technical materials). No EUNICE partner university faculty is included in this edition.	
• Course Field(s).	Engineering & Built Environment; Civil and Environmental Engineering; Climate Change Adaptation and Infrastructure Resilience	
• Related Study Programme.	N/A - stand-alone lifelong-learning microcredential	
• ISCED Code.	ISCED-F 2013: 0732 - Building and civil engineering	
• SDG.	SDG 9 - Industry, Innovation and Infrastructure; SDG 11 - Sustainable Cities and Communities; SDG 13 - Climate Action	
• Study Level.	N/A - continuing education / postgraduate and professional level	
• EUNICE Key Competencies	Problem solving	Green - strongly
	Teamworking	Red - partially
	Communication	Orange - moderately
	Self-management	Green - strongly
	Cognitive flexibility	Green - strongly
	Digital competence	Orange - moderately
	Technical competence	Green - strongly
	Global intercultural competence	Orange - moderately

• Number of ECTS credits allocated.	1 ECTS (25 hours of total student workload)
• Mode of Delivery.	Online self-study, asynchronous
• Language of Instruction.	English
• Course Dates.	19 October 2026 – 18 December 2026
• Precise Schedule of the Lectures.	Self-paced delivery during the course access period. The 18 hours of guided module content and the associated quizzes and applied activities will be available asynchronously. No compulsory live sessions are planned.

• Number of ECTS credits allocated.	1 ECTS (25 hours of total student workload)
• Key Words.	Climate-resilient infrastructure; climate risk; hazard; exposure; vulnerability; critical infrastructure; interdependencies; cascading impacts; adaptation; resilience; decision-making
• Catchy Phrase.	Turn climate information into safer, more resilient infrastructure decisions
• Main Targeted Audience.	Engineers, infrastructure owners and operators, consultants, public administrations, planners, asset managers, researchers and postgraduate students working in civil, environmental, coastal, transport, energy, water or urban infrastructure.

• Prerequisites and co-requisites.	A bachelor's degree or equivalent professional experience in engineering, environmental sciences, geography, architecture, urban planning or a related field is recommended. No previous specialist training in climate risk is required. English level B2 or equivalent is recommended. Suitable for master's and doctoral students and for professionals.
• Number of students that can attend the Course.	30 participants

2. CONTACT DETAILS.

• Department.	Department of Water and Environmental Science and Technology, University of Cantabria / IHCantabria
• Name of Lecturer.	Javier López Lara
• E-mail.	jav.lopez@unican.es
• Other Lecturers.	Íñigo J. Losada Rodríguez; María Fuentes Álvarez de Eulate; David Lucio Fernández

3. COURSE CONTENT.

This microcredential provides an applied introduction to assessing climate-related risks and strengthening the resilience of infrastructure systems. It covers climate change observations and projections; the IPCC concepts of hazard, exposure, vulnerability, risk and resilience; infrastructure inventories, physical vulnerability and interdependencies; climate information and uncertainty; qualitative, semi-quantitative and quantitative risk assessment methods; and the appraisal of structural, non-structural and nature-based adaptation measures. Real examples from coastal, transport, water and other critical infrastructure systems are used to connect scientific concepts with engineering and management decisions.

4. LEARNING OUTCOMES.

- Explain the main climate hazards and long-term changes affecting infrastructure systems.
- Apply the concepts of hazard, exposure, vulnerability, risk, adaptive capacity and resilience using the IPCC risk framework.
- Identify direct, indirect, compound and cascading impacts on critical and interconnected infrastructure systems.
- Characterise infrastructure exposure, physical vulnerability, condition, redundancy and interdependencies using available data sources.
- Interpret climate observations, projections, scenarios and uncertainty for engineering applications.
- Distinguish and apply basic qualitative, semi-quantitative and quantitative climate-risk assessment approaches.
- Compare structural, non-structural and nature-based adaptation measures and adaptation pathways.
- Support transparent, climate-informed prioritisation and decision-making for infrastructure planning, operation, maintenance and investment.

5. OBJECTIVES.

- Provide a rigorous conceptual foundation for climate risk and infrastructure resilience.
- Develop the ability to translate climate information into engineering-relevant risk evidence.
- Introduce practical methods for characterising exposure, vulnerability and infrastructure interdependencies.
- Present consistent approaches for screening, assessing and prioritising climate risks.
- Enable participants to compare adaptation options and contribute to robust, climate-informed decisions.

6. COURSE ORGANISATION.

UNITS/MODULES

1.	Module 1. Climate Change and Infrastructure Challenges (2.5 h): observations and projections; infrastructure under changing conditions; direct, indirect and cascading impacts; systemic risk.
2.	Module 2. Fundamentals of Climate Risk and Resilience (2.5 h): hazard, exposure and vulnerability; risk frameworks; adaptive capacity; infrastructure resilience.
3.	Module 3. Infrastructure Characterisation: Exposure, Vulnerability and Interdependencies (3 h): assets and inventories; geospatial information; typology, age, maintenance and residual service life; redundancy; networks, dependencies and cascading effects; data sources.
4.	Module 4. Climate Hazard Assessment and Climate Information (2.5 h): observations, models, scenarios, uncertainty, extremes and engineering applications.
5.	Module 5. Climate Risk Assessment Methodologies (3 h): qualitative, semi-quantitative and quantitative approaches; prioritisation and decision support.
6.	Module 6. Adaptation and Resilience Strategies (2 h): structural and non-structural measures; nature-based solutions; adaptation pathways; robust decision-making.
7.	Module 7. Real Applications and Future Challenges (2.5 h): coastal, transport and water infrastructure; critical interdependencies; emerging challenges and future trends.

LEARNING RESOURCES AND TOOLS.

EUNICE Moodle; recorded lectures; downloadable technical notes; guided readings; climate data and scenario examples; infrastructure case studies; self-assessment question bank; discussion forum.

PLANNED LEARNING ACTIVITIES AND TEACHING METHODS.

Pre-recorded lectures; guided readings; worked examples; self-assessment quizzes; analysis of an applied infrastructure case; discussion forum; optional recorded expert seminars.

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

The course is graded. Assessment comprises five online quizzes covering Modules 1-7:

- Quiz 1 (Module 1) (12,5%)
- Quiz 2 (Module 3) (12,5%)
- Quiz 3 (Module 3) (12,5%)
- Quiz 4 (Module 4) (12,5%)
- Quiz 5 (Module 5) (12,5%)
- Quiz 6 (Module 6) (12,5%)
- Quiz 7 (Module 6) (12,5%)

Additionally, one FINAL QUIZ will be taken by the students (12,5%)

Quizzes combine concept-based and scenario-based questions explained in the videos and in the supplementary material.

To pass, participants must complete all assessment components and obtain an overall score of at least 50%.

One retake per quiz is permitted during the course access period. The highest attempt is retained.

7. ASSESSMENT METHODS, CRITERIA AND PERIOD.

OBSERVATIONS.

The proposed assessment scheme corrects the preliminary draft so that the total weighting equals 100%.

8. BIBLIOGRAPHY AND TEACHING MATERIALS.

Intergovernmental Panel on Climate Change, *Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Core Writing Team, H. Lee and J. Romero (eds), IPCC, Geneva, 2023, doi: 10.59327/IPCC/AR6-9789291691647

European Environment Agency, *European Climate Risk Assessment*, EEA Report No. 01/2024, Publications Office of the European Union, Luxembourg, 2024, ISBN 978-92-9480-627-7, available at <https://www.eea.europa.eu/en/analysis/publications/european-climate-risk-assessment>.

United Nations Office for Disaster Risk Reduction, *Principles for Resilient Infrastructure*, UNDRR, 2022, available at <https://www.undrr.org/publication/principles-resilient-infrastructure>.

Hallegatte, S., Rentschler, J. and Rozenberg, J., *Lifelines: The Resilient Infrastructure Opportunity*, Sustainable Infrastructure Series, World Bank, Washington, DC, 2019, doi: 10.1596/978-1-4648-1430-3.

Global Center on Adaptation, *Climate-Resilient Infrastructure Handbook*, Global Center on Adaptation, 2025, available at <https://gca.org/reports/climate-resilient-infrastructure-handbook>

European Commission and European Environment Agency, *Climate-ADAPT: European Climate Adaptation Platform*, available at <https://climate-adapt.eea.europa.eu>

9. OTHER COMMENTS (IF ANY).

The course is designed as an introductory microcredential.