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# Introduction to Climate Change

## Group B02:

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# THE TDP PROJECT

## Overview

Climate change is one of the deepest and most complex issues affecting our society and economy today. Scientific developments continue to increase the scope of the concern and suggest that the problem of climate change may turn out to be even more serious than previously thought.

Despite the continuing uncertainty about the detailed relationships, extreme weather events are increasingly associated with human intervention, and there is growing emphasis on the need to prepare for and adapt to climate change. To gain an understanding of the impacts of climate change, it is important to identify the vulnerabilities and opportunities for the region of interest.

## Audience Description

This course will be of interest to all staff in meteorological services organizations, especially managers and line managers who are responsible for understanding the challenges of climate change, its impact on the environment and its associated risks. Government officials, civil society wishing to learn about the issue of climate change were also welcomed.

## Training Goals

The aim of this course is to educate meteorological professionals, senior and mid-level meteorological leaders, and empower them to gain a deeper understanding of climate change processes for forecast and warning services in a way that will allow users to fully understand the impact of hazardous extreme weather events as well possible adoption of appropriate mitigation measures.

## Learning Needs

1. Analyze causes and effects of climate change
2. Use knowledge about the physical mechanisms of climate system formation and scenarios of its development to assess the possible consequences of climate change.
3. Use research databases on climate time series.
4. Provide consumers with information on hazardous weather conditions and risk factors for decision-making

# Learning Outcomes

## ***Demonstrate Knowledge:***

- Describe the current state of knowledge on climate change
- Describe the components, drivers and interactions of climate
- Analyze causes and effects of climate change
- Interpretation of climate products and model output to determine significance of trends and indicators.
- Describe the basic concepts involved in the economic control of climate change
- Possible climate change adaptation and mitigation strategies in societies in different cultural and economic settings.

## ***Demonstrate Skills:***

- Identify and analyse climate change related problems, using methods from a wide range of disciplines
- Exploratory data analysis over climate time series, including the computation of climate normals, anomalies and indices

Present the results of an analysis in a well-structured, logical coherent scientifically correct form, applying scientific terminology, written as well as orally.

- Explore climate change scenarios in the future for global and regional climate

# Content Scope

## 1.1. Introduction to Climate Science and Climate Change

- The climate system and its components.
- The Carbon cycle.
- Climate variability and climate change.
- Climate change scenarios and pathways.*
- Trends in global and regional climate.

## 1.2. Causes of Climate Changes and Intensification

- Past climate investigations and tools to detect its change over time
- Natural causes and factors contributing to climate change.
- Human activities contributing to climate change.
- Climate Intensification: floods, droughts, heat waves, rainfalls ets.

## 1.3. Impacts of Climate Change on People and Environment

- Adaptation to climate change at various levels.
- Climate change and biodiversity.
- Climate change and agriculture.
- The economics of climate change.
- IPCC Assessment Reports and mitigation strategies.

# Learning Solutions and Delivery Modes

Classroom course is for the main topics of lectures and practices. Some of the practical exercises the students may do at home or in groups in the classrooms helping each other. Reading materials will be distributed online and the lecturer will be available online at the dedicated time to answer questions and consultation.

## Learning Strategies

**Discussion strategies**

**Inquiry strategies**

# Learning Activities

Learning activities will mainly consist of **theoretical lectures** (in group, may be online) **and classroom practice exercises and case studies** that will be done individually or as a group study.

Case studies will be used past, real-time and future time series to let the students get the spatiotemporal distribution on climate indicators to analyze the climate extremes and climate changes.

Practice exercises will be suggest to retrieve climate data from different sources and generate special purpose time series (e.g. using Climate Explorer database). Main tasks in exercises will be devoted to computation of the basic climate products, such as normals, anomalies and climate Indices, such as those defined by the WMO. Students will be use the software applications for produce graphics, maps and reports based on the climate forecasts and projections.

## **The roles of the trainers during the training:**

- Introduce the learners to (and guide them through) each subject and make sure the students understand what and why they are doing as they do.
- Give feedback.
- Be sure that teaching becomes learning.

## **The roles of learners during the training:**

- Read and review content resources to gain the necessary knowledge.
- Actively participate in learning activities to practice and learn.
- Seek guidance and feedback from trainers to improve on their competences.
- Engage themselves in-group work to help each other out.

## 1.1. Introduction to Climate Science and Climate Change

- The climate system and its components.
- The Carbon cycle.
- Climate variability and climate change.
- Climate change scenarios and pathways.
- Trends in global and regional climate.

Your progress?

Online test input control 1.1

Done

Lecture notes\_1.1

Done

Climate indicators and variables. Explore the IPCC WGI Interactive Atlas.

Opened: Monday, 16 August 2021, 12:00 AM

Due: Monday, 23 August 2021, 12:00 AM

Done

### 1.1. Climate indicators and variables. Explore the IPCC WGI Interactive Atlas. (4)

- 1) Introduction in Interactive Atlas (<https://interactive-atlas.ipcc.ch>) (1 h)
- 2) Investigation of global distribution of climate variables and indicators (1 h)
- 3) Comparative analysis of regional time series of climate variables (2 h)

Outcomes: discussion and presentation results of the analysis spatiotemporal distribution of the main climate variables in the specific region.

IPCC WGI Interactive Atlas

Done

control test 1.1

Done

Course Evaluation Questionnaire 1.1

Done

## Exercise 1.1. Climate indicators and variables. Explore the IPCC WGI Interactive Atlas. (4 h)

- 1) Introduction in Interactive Atlas (<https://interactive-atlas.ipcc.ch>) (1 h)
- 2) Investigation of global distribution of climate variables and indicators (1 h)
- 3) Comparative analysis of regional time series of climate variables (2 h)

Outcomes: discussion and presentation results of the analysis spatiotemporal distribution of the main climate variables in the specific region.



ipcc  
INTERGOVERNMENTAL PANEL ON  
climate change

IPCC Working Group I (WGI): Sixth Assessment Report

### IPCC WGI Interactive Atlas

A novel tool for flexible spatial and temporal analyses of much of the observed and projected climate change information underpinning the Working Group I contribution to the Sixth Assessment Report, including regional synthesis for Climatic Impact-Drivers (CIDs).

OUR POSSIBLE CLIMATE FUTURES

+1.5°C  
+2°C  
+3°C  
+4°C

Temperature  
Precipitation

Participate in the user testing survey  
Errata and problem reporting

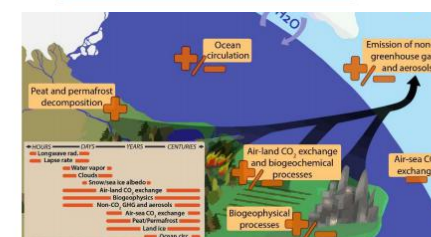


Figure 1.2 | Climate feedbacks and timescales. The climate feedbacks related to increasing CO<sub>2</sub> and rising temperature include negative feedbacks (-) such as LWR, lapse rate (see Glossary in Annex III), and air-sea carbon exchange and positive feedbacks (+) such as water vapour and snow/ice albedo feedbacks. Some feedbacks may be positive or negative (±): clouds, ocean circulation changes, air-land CO<sub>2</sub> exchange, and emissions of non-GHGs and aerosols from natural systems. In the smaller box, the large difference in timescales for the various feedbacks is highlighted.



## 1.2. Causes of Climate Changes and Intensification

- Past climate investigations and tools to detect its change over time
- Natural causes and factors contributing to climate change.
- Human activities contributing to climate change.
- Climate Intensification: floods, droughts, heat waves, rainfalls etc.

Your progress

Online test input control 1.2

Done

Lecture notes\_1.2

Done

Investigation of climate changes in Ukraine

Opened: Monday, 16 August 2021, 12:00 AM

Due: Monday, 23 August 2021, 12:00 AM

Done

### 1.2 Investigation of climate changes in Ukraine. (5 h)

- 1) Introduction in KNMI Climate Change Atlas ([http://climexp.knmi.nl/plot\\_atlas\\_form.py](http://climexp.knmi.nl/plot_atlas_form.py)) (1 h)
- 2) Past trends in climate variables (at the area, local point of interest) (2 h).
- 3) Future trends and spatial distribution in climate variables under different RCP scenarios (2 h).

**Outcomes:** preparation of the public presentation and report (e.g. to journalists) on past, current and future trends of the main climate variables in the specific region.

KNMI Climate Change Atlas

Done

control test 1.2

Done

Course Evaluation Questionnaire 1.2

Done

## Exercise 1.2 Investigation of climate changes in Ukraine. (5 h)

- 1) Introduction in KNMI Climate Change Atlas ([http://climexp.knmi.nl/plot\\_atlas\\_form.py](http://climexp.knmi.nl/plot_atlas_form.py)) (1 h)
- 2) Past trends in climate variables (at the area, local point of interest) (2 h).
- 3) Future trends and spatial distribution in climate variables under different RCP scenarios (2 h).

**Outcomes:** preparation of the public presentation and report (e.g. to journalists) on past, current and future trends of the main climate variables in the specific region.

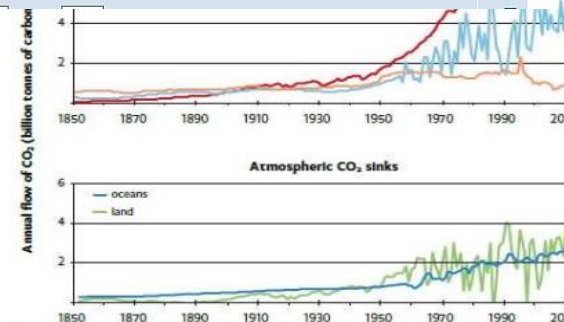
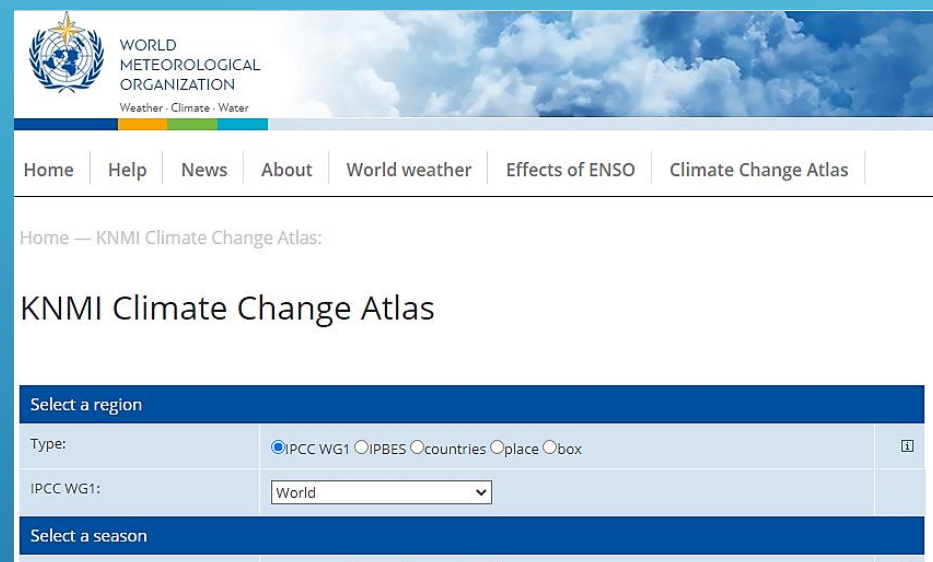


figure 3.2: An 'atmospheric CO<sub>2</sub> budget' reveals the amount of carbon in the net amounts of CO<sub>2</sub> entering, leaving and accumulating in the atmosphere. The upper panel shows the inflows of CO<sub>2</sub> to the atmosphere from fossil fuel emissions (red) and net land use change (orange), together with the net annual CO<sub>2</sub> accumulation in the atmosphere (pale blue). The lower panel shows the outflows of CO<sub>2</sub> from the atmosphere to the ocean (dark blue) and to plants on land (green). The accumulation in the atmosphere is the

### 1.3. Impacts of Climate Change on People and Environment

- Adaptation to climate change at various levels.
- Climate change and biodiversity.
- Climate change and agriculture.
- The economics of climate change.
- IPCC Assessment Reports and mitigation strategies.

Your progress ?

Online test input control 1.3

Done

Lecture notes\_1.3

Done

Economic activity and climate change

Opened: Monday, 16 August 2021, 12:00 AM

Due: Monday, 23 August 2021, 12:00 AM

Done

#### 1.3 Economic activity and climate change. (3 h)

1. Introduction in Climate Change Indicators Dashboard (<https://climatedata.imf.org/>) (1 h)

2. Analyze the statistics on impact of economic activity on climate change and government efforts to mitigating these impacts (on the example of Ukraine or other country). (2 h)

Outcomes: preparation of the public report on impact of economic activity on climate change at the country level.

### Exercise 1.3 Economic activity and climate change. (3 h)

- 1) Introduction in Climate Change Indicators Dashboard (<https://climatedata.imf.org/>) (1 h)
- 2) Analyze the statistics on impact of economic activity on climate change and government efforts to mitigating these impacts (on the example of Ukraine or other country). (2 h)

Outcomes: preparation of the public report on impact of economic activity on climate change at the country level.

Please provide any feedback you might have using this [survey](#).

IMF

CLIMATE CHANGE  
DASHBOARD

INDICATORS

COUNTRIES

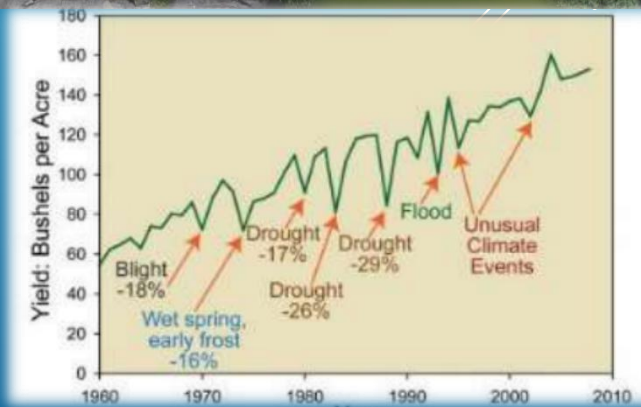
GLOSSARY

ACCESS DATA

ABOUT

## Climate Change Indicators Dashboard

A statistical tool linking climate considerations and global economic indicators



Climate Change Indicators Dashboard

Done

control test 1.3

Done

Course Evaluation Questionnaire 1.3

Done

# Learning Assessment

The total number of points that each student can get is **100%**.

Before  
(Diagnostic)

For the first entrance **Online test** input control on each topic is 10 points (30 points per course).

During  
(Formative)

**Debate** (oral questioning and discussion) of each topic: for topic 1.1 – 4 points, for topic 1.2 and 1.3 – 3 points for each (10 points per course).

Completion of **three laboratory works**–10 points for each (30 points per course).

After  
(Summative)

**Control test** at the end of the topic - 10 points (30 points per course)

# Training Evaluation

The course will be conducted by blended learning.

- Online test input control, which will be used to identify the level of participants.
- The theoretical course will be carried out online for availability of training materials and student mobility.

***Learning activities that will be included: lectures, discussions.***

- Laboratory exercises (3 exercises) and seminars will be carried out in the classroom or online conference.

***Learning activities that will be included: games, discussions, assignments.***

- Debate will be held in the classroom or in the form of online conference.
- After every topic - Course Evaluation Questionnaire
- After graduation, a Final Quiz will be conducted on all topics covered.

In order to help us better evaluate the effectiveness of the training curriculum and improve our training activities, students will invite to complete the Post-Training Questionnaire

The screenshot shows the 'Course Evaluation Questionnaire 1.3' interface on the ClimEd platform. The page title is 'Course Evaluation Questionnaire 1.3' and the mode is 'Anonymous'. The questionnaire consists of five sections, each with a radio button for 'Not selected' and four radio buttons for 'Excellent', 'Satisfactory', 'Sufficient', and 'Poor'. The 'Not selected' option is selected for all sections.

Section	Not selected	Excellent	Satisfactory	Sufficient	Poor
Session Coordination	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecture Delivery	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lecturer Qualification	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PPT Slide Design	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online Attendance Experience	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

At the bottom right, there are two red buttons: 'Submit your answers' and 'Cancel'.

# ABC LD (Arena Blended Connected Learning Design)

Module 1 / Blended Course - Introduction to Climate Change/MOOC title

Load

Date

Learner timeline

**Topic 1.1**  
Introduction to Climate Science and Climate Change

**Topic 1.2**  
Causes of Climate Changes and Intensification.

**Topic 1.3.**  
Impacts of Climate Change on People and Environment.

**Final Quiz**

**Online Learning**

**Online test input control**

Preliminary test for assessment of the training level of student

Grouping

Assessment

**Lectures**

Set of online lectures

- The climate system and its components.
- The Carbon cycle.
- Climate variability and climate change.
- Climate change scenarios and pathways.
- Trends in global and regional climate.

Assessment

**Control test**

Control test after topic 1.1

theoretical and practical questions included in the test

Assessment

**Course Evaluation Questionnaire**

In order to help better evaluate the effectiveness of the training curriculum and improve our training activities, students are invited to complete the Questionnaire

Assessment

**Online Learning**

**Online test input control**

Preliminary test for assessment of the training level of student

Grouping

Assessment

**Lectures**

Set of online lectures

- Fast climate investigations and tools to detect its change over time
- Natural causes and factors contributing to climate change.
- Human activities contributing to climate change.
- Climate intensification: floods, droughts, heat waves, sea-levels etc.

Assessment

**Control test**

Control test after topic 1.2

theoretical and practical questions included in the test

Assessment

**Course Evaluation Questionnaire**

In order to help better evaluate the effectiveness of the training curriculum and improve our training activities, students are invited to complete the Questionnaire

Assessment

**Online Learning**

**Online test input control**

Preliminary test for assessment of the training level of student

Grouping

Assessment

**Lectures**

Set of online lectures

- Adaptation to climate change at various levels.
- Climate change and biodiversity.
- Climate change and agriculture.
- The economics of climate change.
- IPCC Assessment Reports and mitigation strategies

Assessment

**Control test**

Control test after topic 1.3

theoretical and practical questions included in the test

Assessment

**Course Evaluation Questionnaire**

In order to help better evaluate the effectiveness of the training curriculum and improve our training activities, students are invited to complete the Questionnaire

Assessment

**Online Learning**

**Final quiz**

show the degree of mastering the program of courses by students

Grouping

Assessment

**Post-training Questionnaire**

In order to help better evaluate the effectiveness of the training curriculum and improve our training activities, students are invited to complete the Questionnaire

Assessment

**Classroom**

**Laboratory exercises**

1.1 Climate indicators and variables. Explore the IPCC WGI Interactive Atlas

Assessment

**Debate**

Oral questioning and discussion

Assessment

**Laboratory exercises**

1.2 Investigation of climate changes in Ukraine

Assessment

**Debate**

Oral questioning and discussion

Assessment

**Laboratory exercises**

1.3 Economic activity and climate change

Assessment

**Debate**

Oral questioning and discussion

Assessment

Notes

## Learning Resources and Tools

Auditorium for 10 students with a projector.

1. Laptops with Internet access to use all the necessary resources.
2. Moodle website (<https://re.climed.network/course/>). There we will upload all the information for the course: goals, calendar, participants, exam information, forum, presentations, simulations, grades, any additional material.
3. Zoom for several online sessions, to connect students with the teacher.
4. Internet modules for learning, for example, conceptual models and verification.
5. Presentations and exercises created by trainers.
6. Portals of climate products; a weather portal where learners will have access to real-time data, NMP products from various centers, observational data, etc.

## Human Resources

### **Internal resources:**

**project manager**—OSENU faculty with PhD or Sc.D in Geography (Meteorology, Climatology, Agrometeorology), experienced in international project management and scientific journal publications with high citation indices

**project lead** – OSENU faculty with PhD or Sc.D in Geography, science journal publications with high citation rates and extensive experience with e-learning, leading climate change research.

**content experts, teachers(trainers)** – OSENU faculty with PhD or Sc.D in Geography, science journal publications with high citation rates and extensive experience with e-learning.

**training support, etc.** - specialists from OSENU technical departments and IT specialists with experience in technical support and software for e-learning courses

**External resources:** experts from Ukrainian Hydrometeorological Center, Ukrainian Hydrometeorological Institute and from geographical faculties of universities in Ukraine or Europe with PhD or Sc.D in Geography (Meteorology, Climatology, Agrometeorology), experienced in international project management and scientific journal publications with high citation indices.

## Constraints and Risks

### ***Constraints might include:***

- **Budget available** - The budget for the online stage should include payment for the working hours of the course instructors and external experts. The available budget for the classroom seminar should provide for the participation of up to 10 people.
- **Number and location of students** - there may be problems with recruiting the required number of students, which can change the time and form of courses (classroom or distance).
- **Facilities and technologies available** - lack of access to high-speed Internet and outdated equipment of course participants can reduce the effectiveness of training activities.

### ***Risks to the project might include:***

- Limited existing content resources
- Large scope or complexity
- Technology limitations
- Limited training staff availability
- Significant schedule constraints
- Funding risks

## Milestones and Schedule

<i>major milestones</i>	<i>timeline</i>
Project Plan completed	<i>autumn 2021</i>
Learning needs assessed	<i>autumn 2021</i>
Learning outcomes reviewed and approved	<i>autumn 2021</i>
Content outline developed	<i>December 2021</i>
Learning activities designed	<i>Dec-Feb, 2022, During the course for the next sessions</i>
Assessment plan complete	<i>Dec-Feb,2022</i>
Scheduling of all human, technical, and facility resources	<i>Dec-Feb,2022</i>
Learning resources developed or adapted	<i>March 2022</i>
Training delivered (begin date/end date)	<i>March 20-25, 2022</i>
Training evaluation complete	<i>Beginning of April 2022</i>

A 5-day course (**30 hours**) is offered. Relevant topics can be selected and adapted to meet the needs of the desired target groups, for example a short workshop (1-2 days) for civil servants at the national level.



