# Syllabus

*Course Title*

**Кліматична продукція (кліматичні та соціально-економічні показники для кліматичних послуг)**

*General Information*

*General description of the required education/training, outlining the main objectives and explaining the necessity of the education/training at the organizational/country/regional level*

Course “Climate Products (climate and socio-economic indicators for climate services)” is one of the core components of the professional cycle of disciplines for master’s training within the “Climate Services” program.

The main objective is to train specialists who, using all modern tools and techniques for providing high-quality information adapted to user needs, including explanations of its possible applications, are able to create and interpret various climate products for different geographic regions and time periods.

Intensive economic activity by humans leads to a sharp global change in the circulation of substances in the biosphere, which has been formed over thousands of years. With climate change, natural resources are also changing, and this includes not only purely climatic resources but also those that are to some extent dependent on climate conditions. Consideration of climate-related natural resources has always been of great importance in those sectors of the economy that are closely connected with weather and climate conditions.

First of all, this is the agro-industrial complex, where production costs of agricultural products are determined by the corresponding set of climate-related natural resources. Next is the fuel sector, where thermal resources of a territory are particularly important, determining heating regimes, operation of ventilation systems, and refrigeration equipment. Climate-related natural resources also play a significant role in the energy sector, determining components such as hydropower resources, wind and solar energy resources.

An important role is assigned to the environmental component of climate-related natural resources, which reflects the part that affects human health and, conversely, risks of disease incidence. Water resources should also be mentioned, as well as the consideration of natural resources in construction, planning and operation of transport networks, tourism, and recreational use of territories, among others.

Scientific and technological progress, and above all the rapid growth of the energy capacity of civilization, generates numerous problems that require assessment, analysis, and in-depth study. Understanding this situation demonstrates the need to address the problem of observation, research, analysis, and forecasting of changes in climate-related natural resources in connection with climate change.

## *Audience*

*The main target audience of the course and any secondary audience, if it may influence decisions regarding the structure or content of the course*

*Expected level of knowledge and skills of the main audience (current or minimally required), as well as other factors (for example, cultural characteristics, level of technical training, access to the Internet) that should be considered when planning the course, as they may affect the choice of teaching methods, materials, and approaches to interaction with the audience*

Main audience – master's students of higher education institutions in Ukraine pursuing education in the field of climate services. The course may also partially be used as a professional development course for specialists in meteorology and climatology, as well as for specialists in other fields where decision-making based on climate information is required.

**Level of knowledge and skills of the main audience:**

*Fundamental knowledge:*

The audience should have basic knowledge in the natural sciences, particularly in geography and climatology, to understand climate processes and their impact on socio-economic systems.

*Analytical preparation:*

articipants should possess basic statistical analysis methods, including working with large datasets and their interpretation.

*Technical preparation:*

Participants should have basic computer and internet skills, as well as be familiar with tools used to access interactive learning platforms (for example, Moodle). It is desirable that learners have basic data analysis skills, experience working with presentations, and skills in using analytical tools such as Excel.

*English language proficiency:*

An intermediate level of English (B1 or higher) is recommended for working with international research, reports, and economic models.

**Other factors:**

*Inclusiveness and accessibility:*

During teaching, various methods of presenting material will be used (text, audio, video, interactive tasks). Learning materials will be provided in accessible formats, such as large-print text, audio files, or files compatible with screen-reading software.

Learners will be offered a choice of learning methods that best meet their needs.

*Internet access:*

The course includes online components, but all materials will be available for download and offline use due to possible limitations in internet access.

## *Competencies*

*Training needs at the individual or organization/country/regional level, as well as a description of how these needs were identified and recognized as relevant.*

*Competencies targeted by the training.*

C3. Create and interpret various climate products for different geographic regions and time periods, using all modern tools and techniques to provide high-quality information adapted to user needs, including explanations of their possible applications.

C5. Ensure continuous and effective communication with end users/stakeholders to identify and select the best solutions for the economy and society as a whole.

## *Learning outcomes and performance criteria*

*Learning outcomes and performance criteria formulated with regard to the knowledge and skills to be acquired during the training process.*

***Performance criterion:***
PC1. Calculate sectoral climate indices and obtain other sector-oriented climate products.

PC2. Apply statistical and geostatistical analysis to monitor the spatial distribution and temporal dynamics of climate.

PC3. Develop climate products for specific sectors such as agriculture and food security, disaster risk reduction, energy, health, and water resources.

***Learning outcomes:***
LO1. Adapt climate data and information to meet the specific needs of different end users, such as policymakers, scientists, and sector professionals, ensuring the relevance and usefulness of the provided information.

LO2. Use climate data, climate indices, and other climate information, as well as sectoral data, to create climate products.

LO3. Identify the impact of climate on strategic sectors, particularly those defined by GFCS impact areas: agriculture and food security, disaster risk reduction, energy, health, and water.

LO4. Create synthesized reports, including textual, graphical, and cartographic information, to transform climate products into climate services and communicate them to users.

## *Course Content*

*Provide a content outline that corresponds to the learning objectives and outcomes. This may be a course outline as it will be presented to students, but not necessarily a complete curriculum.*

*Include a general list of all topics that you consider necessary to cover. If you believe it would help clarify the scope, indicate what will NOT be covered.*

**Module 1: Climate Product Generation.** Climate data, climate indices, other climate information, and sectoral data used for creating climate products.

**Module 2: Assessment of Climate Impacts on Key Sectors.** Climate impacts on strategic sectors, particularly the GFCS priority areas: agriculture and food security, disaster risk reduction, energy, health, and water.

**Module 3: Adaptation of Climate Information for Different End Users.** Adaptation of climate data and information to meet the specific needs of different end users, such as policymakers, scientists, and sector professionals, ensuring the relevance and usefulness of the provided information.

**Module 4: Delivery of Climate Services through Synthesized Reports.** Creation of synthesized reports, including textual, graphical, and cartographic information, to transform climate products into climate services and communicate them to users.

## *Learning Solutions and Methods of Implementation*

*List the learning solutions (teaching methods) that will be used and explain why they were chosen. For example: classroom learning, online learning, blended learning, workplace learning, online resources for self-study, coaching or mentoring, etc.*


Co-funded by the Erasmus+ Programme of the European Union

For master's students, blended learning should preferably be chosen whenever possible. Considering practical criteria, it can be concluded that with this approach, online learning allows this group of learners to manage their study time more easily. Based on educational needs, it can be assumed that master's students are prepared for online learning, as they already possess sufficiently developed self-learning skills, time management skills, and high motivation. However, since complex and comprehensive learning outcomes must be achieved, it is desirable that learning is accompanied by direct practical consolidation of acquired knowledge, which is best achieved in an offline format.

Master's students are encouraged to meet with the instructor offline 1–2 times per week to discuss knowledge gained from video lectures and other learning materials, as well as to consolidate and refine their skills and competencies. Online learning, which will predominantly take place in an asynchronous mode, will be monitored by the instructor through forums to enable more in-depth discussion of questions arising during the learning process.

Upon completion of the course, a final assessment of learning outcomes will be conducted.

Given the current challenging conditions in Ukraine, groups of master's students may be offered asynchronous online learning with the possibility of synchronous sessions.

In the case of online learning, the educational needs of master's students can be addressed more effectively than in offline settings, as it becomes possible to involve more experts in relevant fields who might otherwise be unavailable due to workload constraints, which positively contributes to learning effectiveness. In this context, it is particularly important to ensure frequent and purposeful communication between the instructor and students, as a deep understanding of various aspects (climatic, economic, etc.) of emerging issues can only be achieved through close interaction.

## *Learning Strategies*

*Consider which learning strategies you will use. Provide justification for why you intend to apply them, including reasons why they will help participants achieve the planned learning outcomes.*

*Combine different learning strategies to create a diverse learning environment that accommodates different learning styles of participants. This will increase the effectiveness of learning and help achieve the planned learning outcomes. This section does not require a detailed description of specific activities.*

During the course delivery, the following learning strategies are planned to be used.

Discussion strategy – will allow participants to develop practical experience in jointly discussing and solving theoretical and practical problems.

Situational analysis strategy – is an important element in the preparation of future climate managers.

Simulation strategy – interactive models of climate products focused on specific sectors of the national economy, which in their internal characteristics are as close as possible to real climate conditions.

## *Learning Activities*

*Describe the main learning activities that will be included, such as lectures, readings, case studies, discussions, exercises, practical assignments, simulations, role-playing games, etc.*

*Also describe the roles of instructors and students during these activities.*

he course includes lectures and practical classes (40% of the total course hours) and independent student work (60% of the total course hours). For contact hours, 12 academic hours are allocated for each module, while 18 hours are allocated for independent student work. Thus, contact hours consist of 1–3 lectures and practical classes, to which the remaining time is allocated.

The main organizational form of learning is the lecture, which is the starting point for studying the course. From the first lecture, students are introduced to the instructors, the objectives and structure of the course; the connection between the theoretical content of the course and practical tasks is explained; a list of educational and scientific sources for studying the course is provided, and the conditions for current and final assessment are communicated.

The main requirements for lectures are scientific rigor and informativeness; justification and the presence of a sufficient number of scientific foundations, facts, documents, vivid and convincing examples; activation of students' thinking through reflective questions; a clear structure and logical progression of material; methodological processing of educational content, explanation of new terms, highlighting of key ideas, provisions and conclusions, and repetition of conclusions in different formulations, etc.

The final lecture provides a brief overview of the studied material, as well as systematization of knowledge with mandatory clarification of the most complex examination questions.

The learning process also includes practical classes. They provide students with the opportunity for deeper study of the course and play an important role in developing master's students' skills in applying theoretical knowledge to practical tasks. Practical classes allow the instructor to develop and monitor students' mastery of the course material. They may take the form of assignments, exercises, situational problem solving, and the development of teamwork skills through research and analysis of results.

Independent work of master's students is a significant part of the learning process. The effectiveness of classroom learning depends on students' self-preparation. Effective independent work requires planning and monitoring by the instructor, as well as planning its volume within the curriculum. Independent work is carried out not only to master the course but also to develop general skills of independent work in academic, scientific, and professional activities, as well as the ability to take responsibility, independently solve problems, find constructive solutions, and respond to crisis situations.

Independent student work includes preparation for lectures, practical classes, and assessment activities, as well as completion of part of the practical assignments.

The role of the instructor during lectures is to provide overall control of the learning process and selection of learning activities and strategies. During practical classes, the instructor acts as an instructor or supervisor, defining the direction of practical tasks. Throughout the course, the instructor provides support to students through scheduled and unscheduled consultations.

The role of the student is to acquire knowledge, skills, and practical competencies in professional activity and teamwork while completing tasks provided by the instructor, thereby preparing for future professional practice.

## *Assessment of Learning*

*Describe the assessment plan for participants before, during, and/or after the course, including tests, exercises, activities, and projects that will be assessed. Indicate whether self-assessment or peer assessment will be used. Explain how the assessment is linked to the learning outcomes.*


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Before the start of the course, an initial assessment of master's students' knowledge is conducted – an entry test. Its purpose is to determine the learners' level of preparation and knowledge of the basic component required for studying this course. This method of assessment is considered necessary for the instructor to understand the educational needs of each master's student and may be conducted in a distance format using the e-learning platform.

For the assessment of master's students' knowledge, a modular form of control is used. The basis of the modular assessment system is the division of the course program into separate logically connected blocks – modules (in the form of tests of different types). The integrated assessment of students' acquisition of theoretical knowledge and skills in the course consists of the grades obtained for each of these modules (3 theoretical modules with a maximum score of 8, 12, and 4 points respectively). At the same time, the integrated grade includes points for each module, which reflect the significance of the module in terms of students' acquisition of basic knowledge and skills, as well as rhythm – completion of assessment activities within the timeframe established by the course syllabus.

Tests are conducted in a distance format using the e-learning platform. Testing allows the instructor to assess the degree of students' mastery of the theoretical material. Theoretical tests consist of at least 20 questions. Correct answers to 50–74% of questions correspond to a satisfactory (minimum) level, 75–89% to a good level, and 90–100% to an excellent level of mastery.

Students may also independently monitor their level of theoretical understanding using self-assessment tests prepared for each section of the course and available on the e-learning platform. This type of control is aimed at deeper mastery of the theoretical part of the course and error correction.

Practical classes are conducted under the supervision of the instructor during contact hours, the number of which is defined in this syllabus. Assignments and source materials for completing practical tasks are provided on the e-learning platform. The completed practical assignment is uploaded by the student to the platform for evaluation and feedback from the instructor. Correctly completed practical assignments are assessed according to the achievement of learning outcomes and the quality of performance. During the course, seven practical assignments are proposed. The points for practical work are distributed as follows: Practical work 1.1 – 10 points, Practical work 1.2 – 10 points; Practical work 2.1 – 10 points, Practical work 2.2 – 10 points, Practical work 2.3 – 6 points; Practical work 3 (essay) – 10 points; Practical work 4 (synthesized report) – 20 points.

Practical assignments are evaluated as follows: excellent level – the student completed all tasks of the practical assignment independently (80% of the total score for the practical work), presented results in the form of a presentation (20% of the total score for the practical work), and answered the instructor's questions during the presentation; good level – the student completed all tasks independently without a presentation; satisfactory level – the student completed all tasks together with the instructor (60% of the total score for the practical work).

The integrated course grade is calculated as the arithmetic sum of points for the semester modules (grades for theoretical modules and practical work), i.e., the cumulative total accumulated during the semester, which represents the final grade for course completion.

## *Storyboard of Learning (Learning Storyboard)*

*Use this to create a visual scenario of your blended learning activity*

Acquisition

Learning through acquisition is what master's students do when they listen to lectures or podcasts, read books or websites, and watch demonstrations or videos:

• reading books, articles (reading digital books, articles, multimedia, websites, documents, and resources);

• listening to instructors' presentations, lectures (listening to podcasts, webcasts);

• watching demonstrations, master classes (watching animations, videos, demonstrations, master classes);

• question and answer forum.

## *Learning Resources and Tools*

*List the available resources you will use for different types of learning activities and recommend to students.*

*Describe the technologies that will be used to implement the learning solutions, including learning technologies and operational equipment (hardware, software, collaborative tools).*

Learning Resources and Tools


1. Alberdi et al., 1998 Alberdi JC et al. (1998). Daily mortality in Madrid Community (Spain) 1986–1991: relationship with atmospheric variables. *European Journal of Epidemiology*, 14. P. 571-578.
2. Balabukh V. O. et al. Extreme weather events in Ukraine: occurrence and changes. Extreme Weather / Edited by P. J. Sallis. London, UK: Intech Open, 2018. Pp. 85-106
3. Climate Assessment & Dataset (ECA&D). Project team ECA&D : Royal Netherlands Meteorological Institute KNMI: December 9, 2021, Version: 11, 53 P.
https://knmi-ecad-assets-prd.s3.amazonaws.com/documents/atbd.pdf
4. Crespi A., Terzi S., Cocuccioni S., Zebisch M., Berckmans J., Füssel H-M (2020) "Climate-related hazard indices for Europe". European Topic Centre on Climate Change impacts, Vulnerability and Adaptation (ETC/CCA) Technical Paper 2020/1.
DOI: 10.25424/cmcc/climate_related_hazard_indices_europe_2020
5. Diaz J et al. (2002). Heat waves in Madrid, 1986–1997: effects on the health of the elderly. International Archives of Occupational and Environmental Health, 75. P. 163–170.
6. Diaz J, Lopez Santiago C (2003). Health impact of thermal extremes in Iberia: analysis and trends. cCASHh Workshop on Vulnerability to Thermal Stresses, 5–7 May, Freiburg, Germany.
7. Environmental management. Quantitative environmental information. Guidelines and examples iTeh STANDARD PREVIEW (standards.iteh.ai) ISO 14033:2019.
https://standards.iteh.ai/catalog/standards/sist/f25668cb-8886-4d8d-bc34-f9710b91e57f/iso-14033-2019
8. European Topic Centre on Climate Change impacts, Vulnerability and Adaptation (ETC/CCA) Technical Paper 2020/1. 64 P.
DOI: 10.25424/cmcc/climate_related_hazard_indices_europe_2020
9. INVS (Impact sanitaire de la vague de chaleur d'aout 2003 en France. Bilan et perpectives), 2003. Health impact of the heat wave in August 2003 in France. Institut de Veille Sanitaire, Saint-Maurice, 120 p.
10. Kalkstein L. S., Smoyer K. E. The impact of climate change on human health: Some international implications // Experiencia. 1993. № 49. P. 469-479.
11. McGeehin M. A., Mirabelli M. The potential impacts of climate variability and change on temperature_related morbidity and mortality in the United States//Environmental Health Perspectives. 2001. Vol. 109. Suppl. 2. P. 185-189.
12. Plan Canicule. Dossier de presentation. Ministere de la Sante et de la protection sociale, 2004. 46 p.
13. Revich B., Shaposhnikov D. High Summer Temperatures and Environmental Health, Tver Case_Study//The Future for Our Children: ISEE Meeting. Hungary, 2003. P. 40.
14. Smoyer K. E. A comparative analysis of heat waves and associated mortality in St. Louis, Missouri, 1980 and 1995, Int. J. Biometeorol., 1998. No. 1, pp. 44-50.

15. State of the Climate in Europe - State of the Climate in Europe 2022. WMO-No. 1320. 2022. 40 p.
16. The Role of Climatological Normals in a Changing Climate. WCDMP-No. 61 WMO-TD No. 1377 World Meteorological Organization, 2007 -P.46. - The role of climatological normals in a changing climate. WHO, 2007
17. World map of the Köppen-Geiger climate classification - https://koeppen-geiger.vu-wien.ac.at/present.htm
18. www.rnw.nl/eglish/bulletin/heatwave-causes-500-extra-deaths.
19. Адаменко В.Н., Хайруллин К.Ш. Оценка пребывания человека на открытом воздухе зимой с учётом микроклимата застройки. Тр. ГГО, вып. 248, 1969. С. 74-81.
20. Адаптація до зміни клімату: короткий путівник для громад Рівне 2023, 38.с. State of climate services. FIVE-YEAR PROGRESS REPORT (2019–2024). WMO-No. 1363. ISBN 978-92-63-11363-4
21. Атлас «Агрокліматичні ресурси України» / за ред. Т. І. Адаменко, М. І.Кульбіди, А. Л. Прокопенка. Київ, 2016. – 113 с.
22. Вплив змін клімату в Україні / Wilson, L., New, S., Daron, J., Golding, N. (2021). Climate Change Impacts for Ukraine. Met Office., 2021, 34 с. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/services/government/met-office_climate-change-impacts-for-ukraine_report_12dec2021_ukrainian.pdf
23. Врублевська О.О., Катеруша Г.П., Гончарова Л.Д. Кліматологія. Підручник. Одеса: Екологія, 2013. – 344 с.
24. Врублевська О.О., Катеруша Г.П., Миротворська Н.К. Кліматологічна обробка окремих метеорологічних величин. Навчальний посібник. Одеса «ТЕС», 2004. – 150 с.
25. Врублевська О.О., Катеруша Г.П. (2012). Клімат України та прикладні аспекти його використання. Навчальний посібник. Одеса: ТЭС, 180 с. http://eprints.library.odeku.edu.ua/id/eprint/378
26. Врублевська О.О., Катеруша Г.П. Прикладна кліматологія. Конспект лекцій. Дніпропетровськ: Економіка, 2005. – 131 с.
27. Глобальні стандартні кліматичні норми (1991-2020 рр.) / Український гідрометеорологічний центр ДСНС України. Київ, 2021. [Електронний ресурс].
28. Зміна клімату: наслідки та заходи адаптації: аналітична доповідь / [С.П. Іванюта, О. О. Коломієць, О. А. Малиновська, Л. М. Якушенко]; за ред. С. П. Іванюти. – К. : НІСД, 2020. – 110 с. ISBN 966-554-344-2)
29. Изменения климата и здоровье человека: угрозы и ответные меры. Резюме. ВОЗ, ВМО, ЮНЕП, 2003.
30. Кліматичний кадастр України (стандартні кліматичні норми за період 1961–1990 рр.)/ Державна гідрометеорологічна служба та ін. УНДГМІ ЦГО, Київ, 2006. [Електронний ресурс]
31. Клімат України // За ред. В.М. Ліпінського, В.А. Дячука, В.М. Бабіченко. – К.: Вид. Раєвського, 2003. – 343 с.
32. Кліматичні зміни та їх вплив на сфери економіки України: монографія (2015) / за ред. С.М. Степаненка, А.М. Польового. Одеса: ТЕС, 520 с. http://eprints.library.odeku.edu.ua/id/eprint/2269
33. Кліматичні ризики функціонування галузей економіки України в умовах зміни клімату: монографія / за ред. С. М. Степаненка, А. М. Польового. Одеський державний екологічний університет. Одеса: ТЕС, 2018. 548 с. http://eprints.library.odeku.edu.ua/id/eprint/4916/
34. Лялько В. І., Єлістратова Л .О., Апостолов О. А. Дослідження проблем посушливості на території України з використанням наземної та супутникової інформації. Український журнал дистанційного зондування Землі. – 2014, Вип.2 – С.18–28.
35. Настанова з метеорологічного прогнозування. Український гідрометеорологічний центр. Київ, 2019. 35 с. Режим доступу: https://www.meteo.gov.ua/f/pro_nas/normatuvni_akt/Nastanova%20z%20meteoprognozuvannia.pdf.
36. Недострелова Л.В. Вплив кліматичних змін на галузі економіки України. Частина ІІІ. Конспект лекцій. Одеса, 2021. 112 с. http://eprints.library.odeku.edu.ua/id/eprint/7925
37. Обиход А. Человек и жара: оптимизация взаимодействия «Зеркало недели. Украина» №26, 3 августа 2012.
38. Осадчий В.І., Бабіченко В.М. Динаміка стихійних метеорологічний явищ в Україні. Український географічний журнал - 2012, № 4. С. 8-14.
39. Оцінка впливу кліматичних змін на галузі економіки України (2011) / За редакцією Степаненка С.М., Польового А.М. Одеса: Екологія, 694 с. http://eprints.library.odeku.edu.ua/id/eprint/2252

40. Периоды сильной жары: угрозы и ответные меры. Серия «Здоровье и глобальное изменение окружающей среды» №2. ВОЗ. 2005. С. 122.

41. Про затвердження методичних рекомендацій щодо врахування кліматичного компонента в документах державного планування та під час здійснення стратегічної екологічної оцінки та оцінки впливу на довкілля. Міністерство захисту довкілля та природних ресурсів України, Наказ від 31 жовтня 2024 року N 1382. https://ips.ligazakon.net/document/FN084574

42. Светличный А. А., Ибрагимова М. С. К вопросу о современных изменениях климата Северо-Западного Причерноморья. Вісник ОНУ. Сер.: Географічні та геологічні науки. 2016. Т. 21, вип. 1. С. 22-41.

43. Семёнова И.Г. Оценка пространственно-временного распределения засух на Украине в вегетационный период. Труды ГГО им. А. И. Воейкова. – 2014, Вып 571. – С.134-146.

44. Семенова І.Г. Синоптичні та кліматичні умови формування посушливих явищ в Україні. Монографія. Харків, 2017. 236 с.

45. Справочник по показателям и индексам засушливости. ВМО-№1173, 2016 .

46. Стихійні метеорологічні явища на території України за останнє двадцятиріччя (1986-200 рр.) / За ред. В.М. Ліпінського, В.І. Осадчого, В.М. Бабіченко. – Київ: «Ніка-Центр», 2006. – 312 с.

47. Третье, четвёртое и пятое национальные сообщения Украины по вопросам изменения климата, подготовленные на выполнение статей 4 и 12 Рамочной конвенции ООН об изменении климата и статьи 7 Киотского протокола. Киев. 2009. 367 с.

48. Трофимова И.В., Шмурдак А.Л. Деятельность по адаптации к изменению климата в Украине. Разработка Национального плана Украины по адаптации к изменению климата: проблемы и пути их решения. Тезисы к выступлению на Пятой встрече рабочей группы проекта «Снижение уязвимости к экстремальным наводнениям и изменениям климата в бассейне реки Днестр». Кишинёв, 7 июня 2012 г.

49. Хохлов В.М. Просторово-часовий розподіл засух на території України в умовах зміни клімату. Український гідрометеорологічний журнал. 2011, № 8. - С. 38-43.

50. Шевченко О. Г Хвилі тепла та основні методологічні проблеми, що виникають при їх дослідженні /О. Г. Шевченко, С. І. Сніжко // Український гідрометеорологічний журнал. – 2012. – № 10. – С.57- 63.

51. Шестое национальное сообщение Украины по вопросам изменения климата, подготовленное на выполнение статей 4 и 12 Рамочной конвенции ООН об изменении климата и статьи 7 Киотского протокола. Киев. 2013. 342 с.

Online Resources:

1. ERA5 hourly data on single levels from 1940 to present, ECMWF -застосунок для відображення локальних кліматичних даних на порталі Climate Data Store від Європейського центру середньострокових погодних прогнозів (ECMWF).

2. http://iridl.ldeo.columbia.edu/maproom/Global/Atm_Temp/Seasonal - Місячна карта сезонна аномалія приземної температури повітря

3. http://iridl.ldeo.columbia.edu/maproom/Global/Precipitation/Seasonal - Місячна та сезонна аномалія опадів

4. http://www.ipcc.ch/index.htm Оціночні звіти із змін клімату

5. https://avs.com/2020/01/21/smartmet-software-tool-for-visualizing-and-editing-meteorological-data/ - Програмний інструмент для візуалізації та редагування метеорологічних даних

6. https://cds.climate.copernicus.eu/apps/c3s/app-era5-explorer. - Climate Data Store від Європейського центру середньострокових погодних прогнозів (ECMWF) для відображення локальних кліматичних даних.

7. https://climatecharts.net/ – ClimateCharts.net застосунок для створення метеорологічних діаграм від Технічного Університету Дрездену.

8. https://climatecharts.net/ - ClimateCharts.net. Створення метеорологічних діаграм від Технічного Університету Дрездену

9. https://climpact-sci.org/ - Climpact дозволяє обчислювати індекси, які є річною чи місячною статистикою змодельованих або спостережених кліматичних даних. Тут ви можете знайти описи та формули для кожного з індексів.

10. https://drought.emergency.copernicus.eu/tumbo/edo/map/?id=1052 - Карта поточних посух в Європі

11. https://meteopost.com/weather/archive/, https://www.ncei.noaa.gov/ - Архівні дані фактичної погоди
12. https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/ Ресурси з кліматології
13. https://rcccm.dwd.de/DWD-RCCCM/EN/products/europe/products_monthly_node.html – Поточні кліматичні характеристики та їхній розподіл по території України також можна встановлювати за даними Регіонального кліматичного центру з моніторингу клімату
14. https://wmo.int/ Всесвітня метеорологічна організація
15. https://wordpress.mediadoma.com/uk/instrumenti-vizualizacii-danih-pro-pogodu-dlja-demonstracii-statistiki-pogodi/ - Інструменти візуалізації даних про погоду для демонстрації статистики погоди
16. https://www.climatecentral.org/climate-shift-index - Climate Shift Index
17. https://www.climdex.org/learn/indices/ - дозволяє обчислювати кліматичні індекси
18. https://www.ecad.eu/dailydata/customquery.php - European Climate Assessment & Dataset project
19. https://www.meted.ucar.edu/ Ресурси з кліматології
20. https://www.npa-ua.org/climate Зміна клімату та психічне здоров'я
21. Regional Climate Centre on Climate Monitoring: Monthly, seasonal and annual products- - Регіональний кліматичний центр з моніторингу клімату (Regional Climate Centre on Climate Monitoring – RCC Node-CM), створює кліматичні карти регіону
22. World map of the Köppen-Geiger climate classification - класифікація Кеппена-Гейгера


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