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3rd ClimEd Online Training on "Digital Tools and Datasets for Climate Change Education"

26 October – 12 November 2021

Hosts: University of Helsinki (UHEL, Helsinki, Finland) & Odessa State Environmental University (OSENU, Odessa, Ukraine)

Group A5:

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Kushchenko Liliia - *Odessa State Environmental University* ,

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GROUP HWA

ClimEd Main Themes for HWAs/Group Projects **A5**

Water Management climate info: air temperature; precipitation; duration of rainless periods; hydro info: maximum river flow; water temperature; minimum river flow; forecast info: heavy rain; extreme high and low temperatures; *& other.*

- **geographical region/ domain/ country of interest** –

Europe / Ukraine / Kherson & Odessa & Kyiv

- **existing or possible problem of concern/ interest -** Integrated water resources management is one of the items of the State Sustainable Development Strategy, in accordance with EU requirements. Therefore, a reliable quantitative assessment of the water fund will provide the basis for making the right decisions in water management.

A sound rationale for the relationship between runoff and climatic characteristics makes it possible to model and forecast the state of water resources in the future and not lead to their destruction, timely response and rational decision-making. According to the forecasts of domestic and foreign scientists, river runoff, especially in the south of Ukraine, may undergo significant changes, the manifestation of which is already observed in the absence of spring floods in recent years.

- **main aim and specific objectives of group project –** Using the database, analyze the spatio-temporal distribution of climatic characteristics of indicator cities, to use them in assessing the impact of climate change on water resources of Ukraine on the basis of models “climate-runoff”

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➢ objectives

- ✓ Create an array of climate data for different time periods and intervals for 2 cities in southern Ukraine (Odessa, Kherson) to solve the problem of the project and the city of Kyiv to compare the dynamics of possible climate change in southern Ukraine in relation to northern Ukraine.
- ✓ Visualize changes and trends in key climatic characteristics
- ✓ Construct the observed values of air temperature, precipitation per year for 3 cities.
- ✓ Visualize the simulated values of annual values of air temperature, precipitation for Ukraine up to 2100.

➢ UN SDGs results of group project might correspond

GOAL 13:
TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS

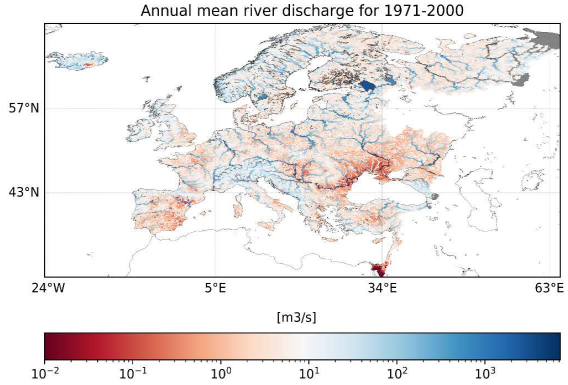
GOAL 6:
ENSURE ACCESS TO WATER AND SANITATION FOR ALL

➢ variables/ parametrs which will be analysed

air temperature; precipitation and humidity;
warming stripes for the extended period 1979-2018;
the amount of runoff in 2021

➢ approach(s) and tools for visualisation and data analysis

histograms, point areas, surface areas, parallel coordinated areas



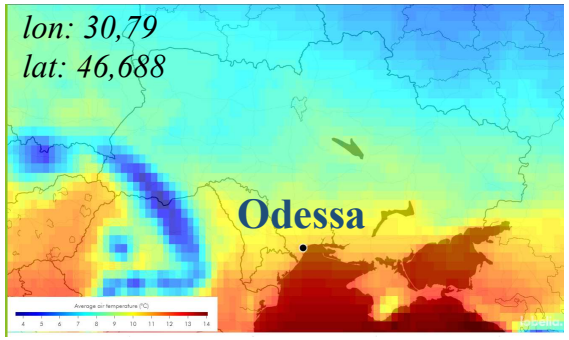
GROUP HWA

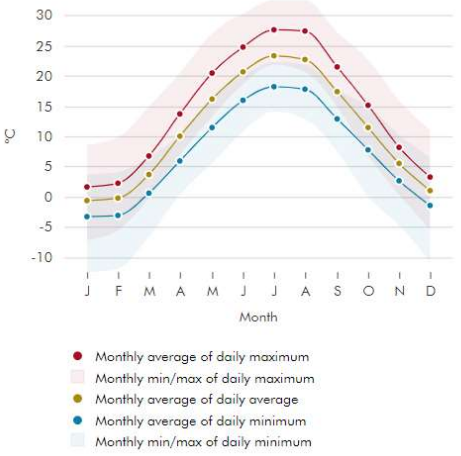
➢ results

- ✓ As a result of work on the project, the climatic characteristics of 3 indicator cities (Odessa, Kherson and Kyiv) were analyzed. The average annual air temperature for Odessa and Kherson is 11 degrees Celsius, and for Kyiv - 8 degrees Celsius. The amplitude of oscillations is about 24 degrees.
- ✓ Warming stripes for the extended period 1979-2018 for Odessa are typical at the level of 8.5 - 12.5 degrees, for Kherson - 8.0-11.9 degrees and for Kyiv - 5.8-9.9 degrees. You can note positive trends in the data series.
- ✓ The average annual rainfall in Odessa is 455 mm, in Kherson 476 mm and in Kyiv 709 mm.
- ✓ The average annual humidity is 72-73% for Odessa and Kherson and 77% for Kyiv.
- ✓ The graphs based on data from Copernicus show a low runoff in 2021 in both the south and north of Ukraine
- ✓ The trend of surface air temperature in 3 cities is at the level of 0.06-0.08.
- ✓ With the help of Climate Explorer, the possible values of air temperature and precipitation were modeled in two scenarios. The average annual air temperature in the rcp 2.6 scenario will increase by 1 degree, and in the rcp 4.6 scenario by 2 degrees. And no precipitation data are available for our indicator cities.

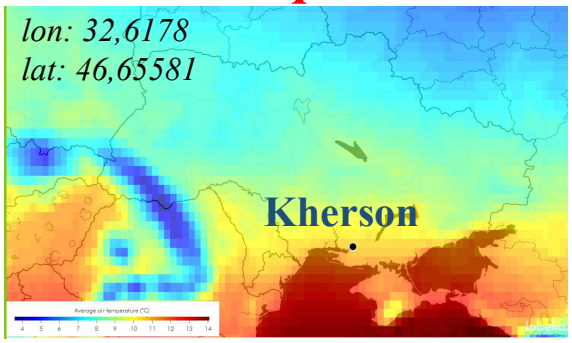
Climatic data make it possible to model the possible state of rivers in the future according to different models and scenarios. Examples can be seen on the slide. Also having data of climatic characteristics can be defined Streamflow drought index (SDI) Standardized precipitation index (SPI) Agricultural Standardised Precipitation Index (aSPI)

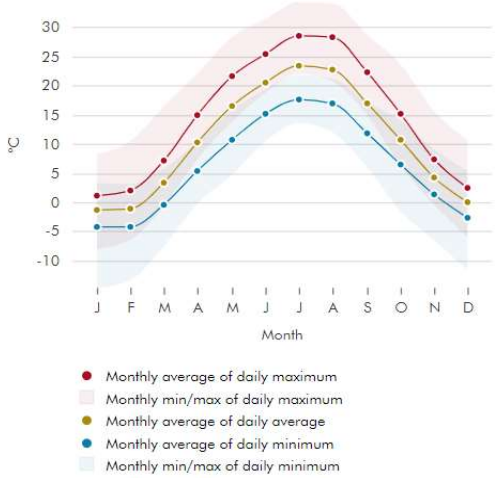
Air temperature



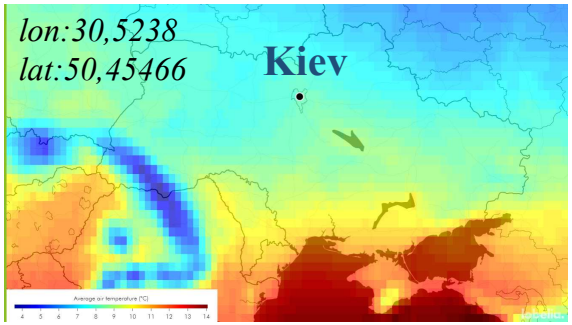


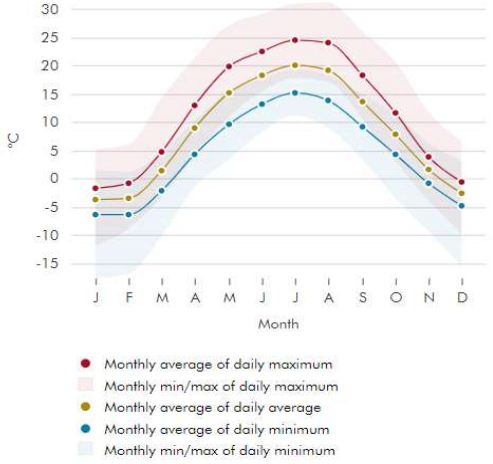
Monthly average temperatures range from -0.7 °C (January) to 23 °C (July). Yearly average temperature is 11 °C.





Monthly average temperatures range from -1.4 °C (January) to 23 °C (July). Yearly average temperature is 11 °C.





Monthly average temperatures range from -3.8 °C (January) to 20 °C (July). Yearly average temperature is 8 °C.

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RESULTS

Warming stripes for the extended period 1979-2018

Odessa

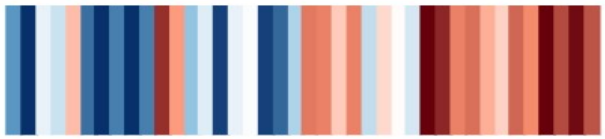
Trend equation

y = 0,0595x - 107,86
R^2 = 0,4904

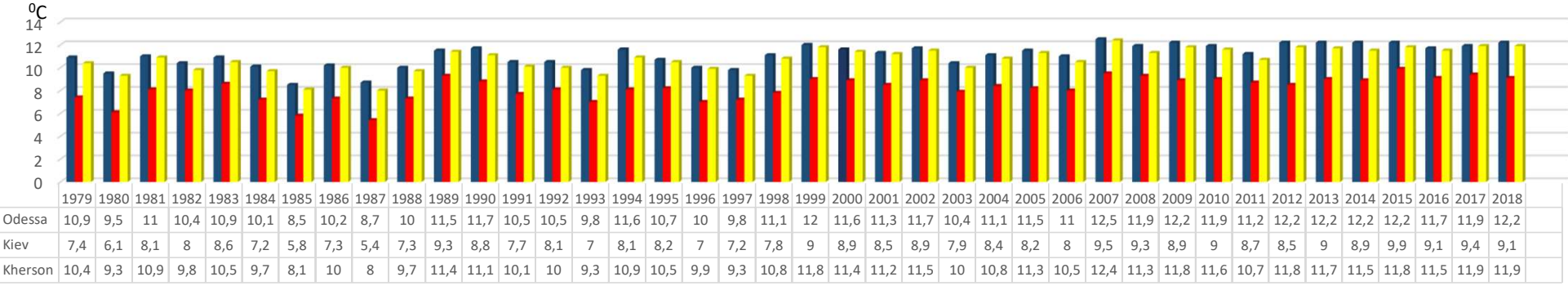
Kherson

y = 0,0607x - 110,65
R^2 = 0,4683

Kiev



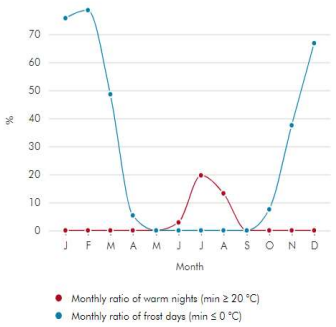
y = 0,0583x - 108,4
R^2 = 0,4459



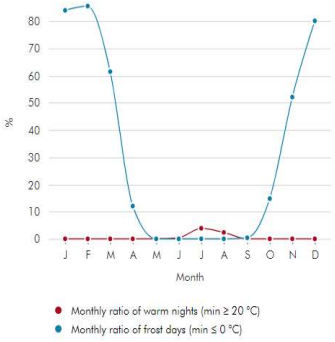
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Odessa	10,9	9,5	11	10,4	10,9	10,1	8,5	10,2	8,7	10	11,5	11,7	10,5	10,5	9,8	11,6	10,7	10	9,8	11,1	12	11,6	11,3	11,7	10,4	11,1	11,5	11	12,5	11,9	12,2	11,9	11,2	12,2	12,2	12,2	12,2	11,7	11,9	12,2
Kiev	7,4	6,1	8,1	8	8,6	7,2	5,8	7,3	5,4	7,3	9,3	8,8	7,7	8,1	7	8,1	8,2	7	7,2	7,8	9	8,9	8,5	8,9	7,9	8,4	8,2	8	9,5	9,3	8,9	9	8,7	8,5	9	8,9	9,9	9,1	9,4	9,1
Kherson	10,4	9,3	10,9	9,8	10,5	9,7	8,1	10	8	9,7	11,4	11,1	10,1	10	9,3	10,9	10,5	9,9	9,3	10,8	11,8	11,4	11,2	11,5	10	10,8	11,3	10,5	12,4	11,3	11,8	11,6	10,7	11,8	11,7	11,5	11,8	11,5	11,9	11,9

Odessa Kiev Kherson

Warm nights (night temperature ≥ 20 °C) occur 4.3% of the year.
Frost days (night temperature ≤ 0 °C) occur 23% of the year.



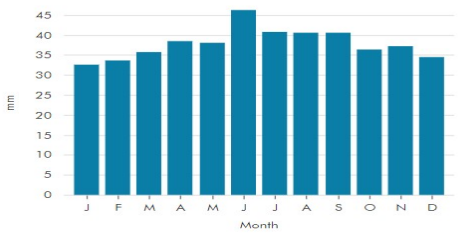
Warm nights (night temperature ≥ 20 °C) occur 3% of the year.
Frost days (night temperature ≤ 0 °C) occur 27% of the year.



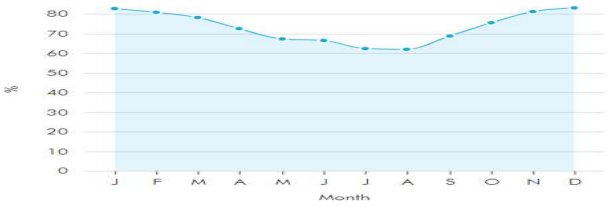
Warm nights (night temperature ≥ 20 °C) occur 0.5% of the year.
Frost days (night temperature ≤ 0 °C) occur 33% of the year.

Precipitation and humidity

Odessa



Monthly precipitation values range from 33 mm (January) to 46 mm (June).
Average yearly precipitation is 455 mm.



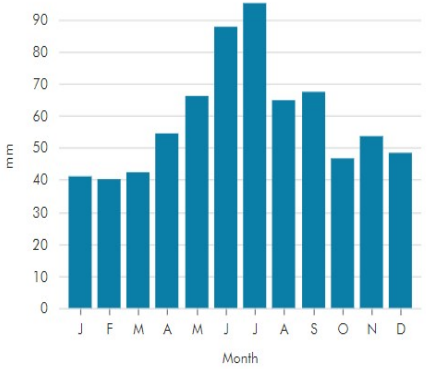
Relative humidity ranges from 62% (August) to 83% (December) (monthly average).
Yearly average humidity is 73%.

Kherson

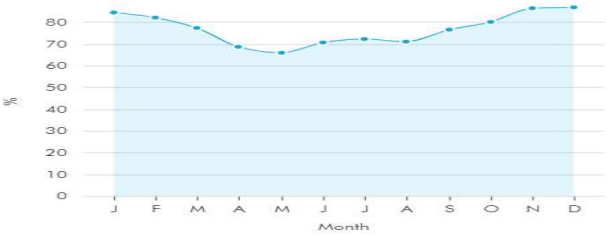
Monthly precipitation values range from 31 mm (October) to 55 mm (June).
Average yearly precipitation is 476 mm.

Relative humidity ranges from 59% (August) to 85% (December) (monthly average).
Yearly average humidity is 72%.

Kiev



Monthly precipitation values range from 40 mm (February) to 95 mm (July).
Average yearly precipitation is 709 mm.



Relative humidity ranges from 66% (May) to 87% (December) (monthly average).
Yearly average humidity is 77%.

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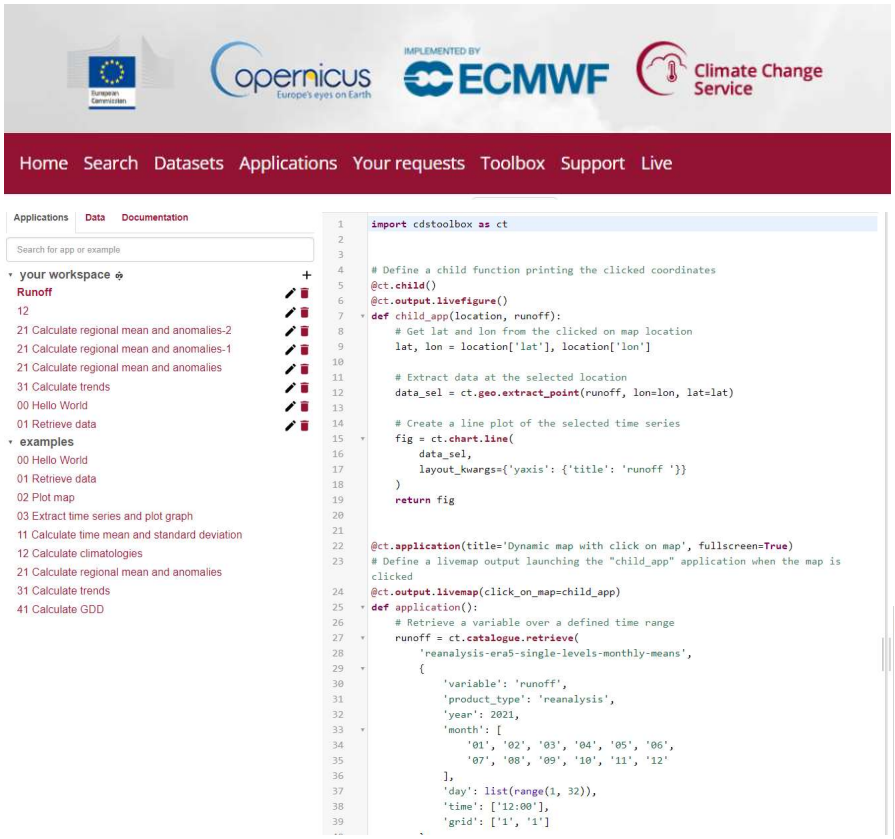
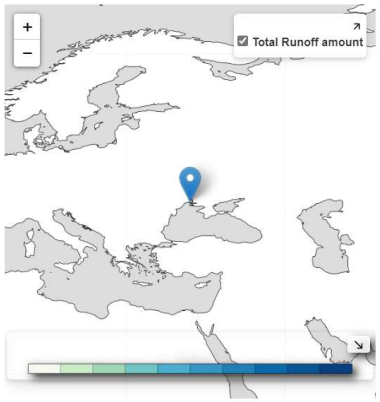
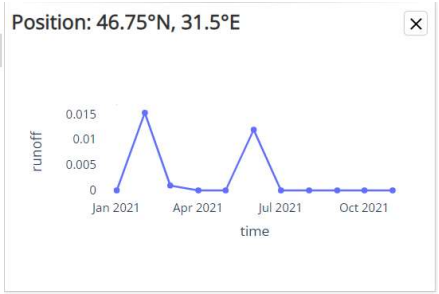
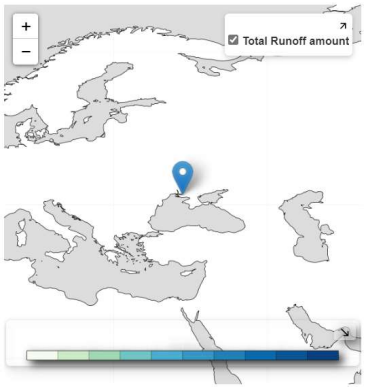


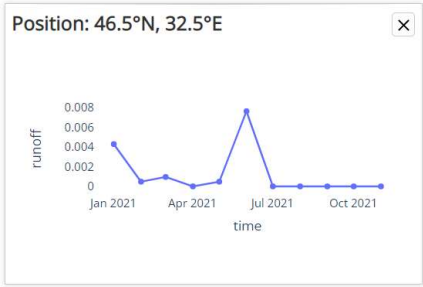
Odessa



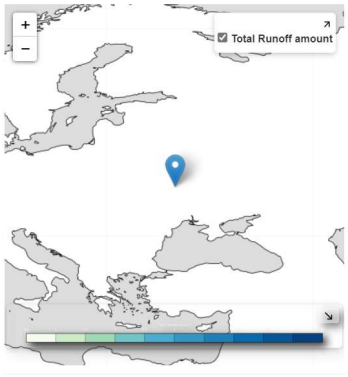


Kherson





Kiev



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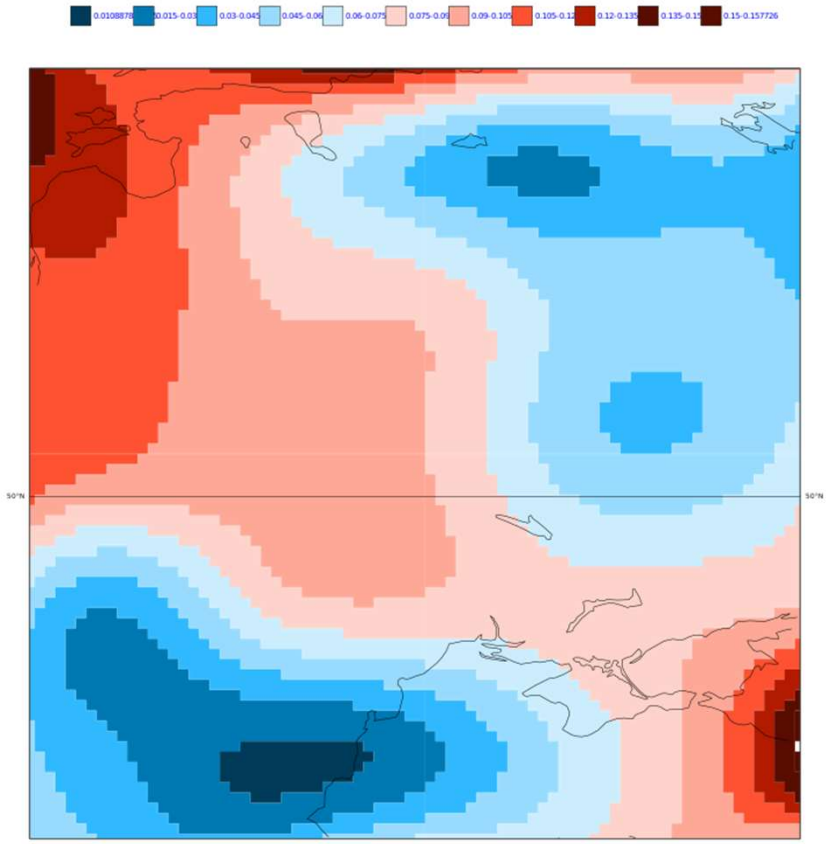
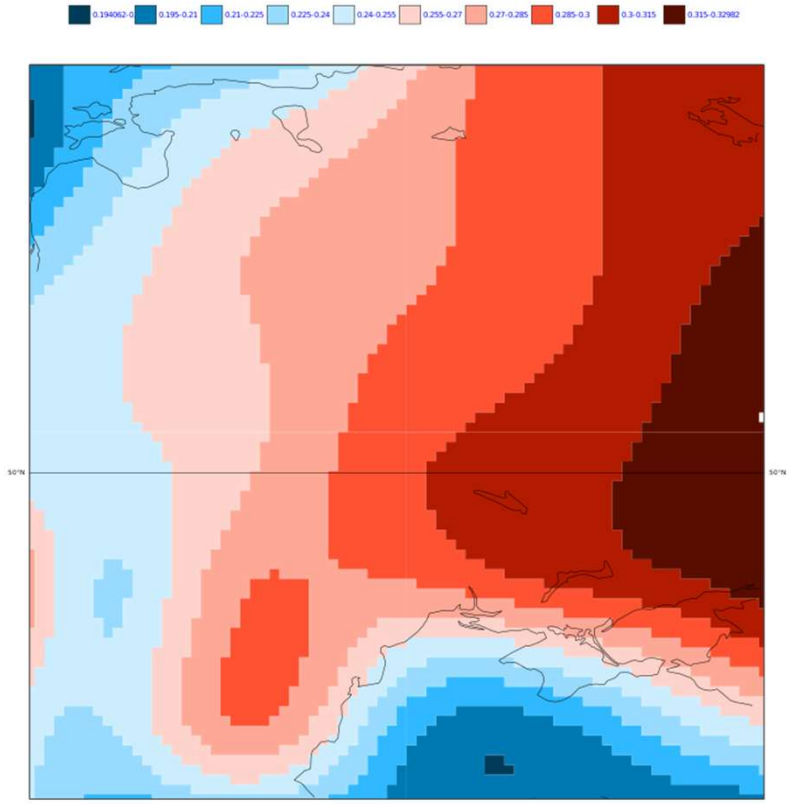
RESULTS

urface air temperature trend (K



temperature trend standard dev



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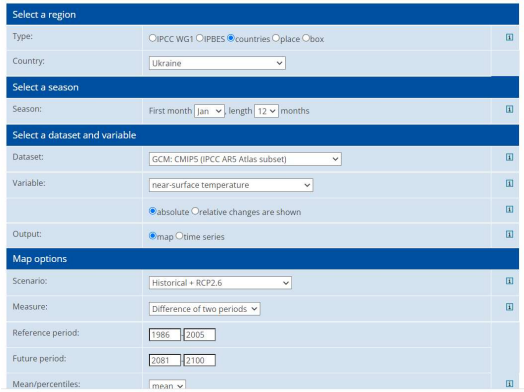

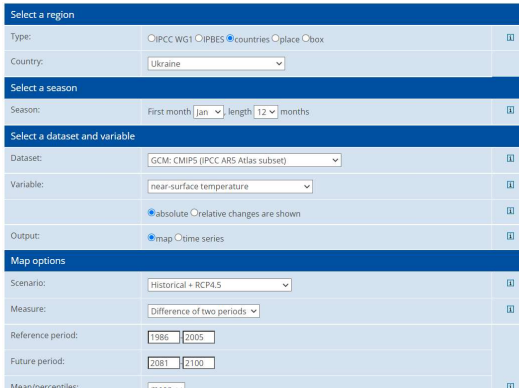

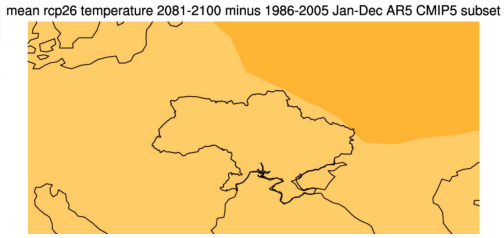

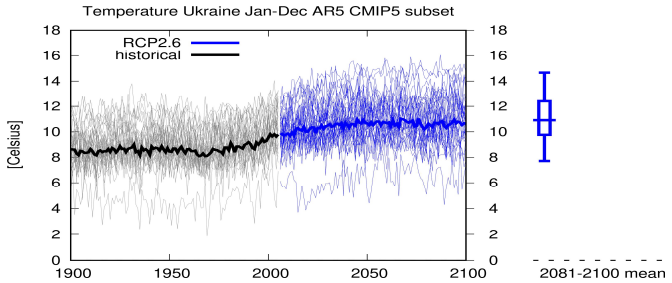

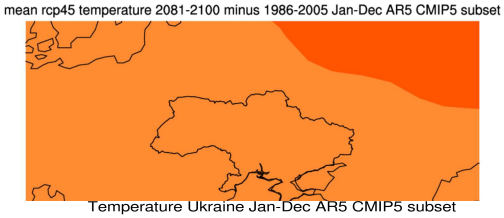

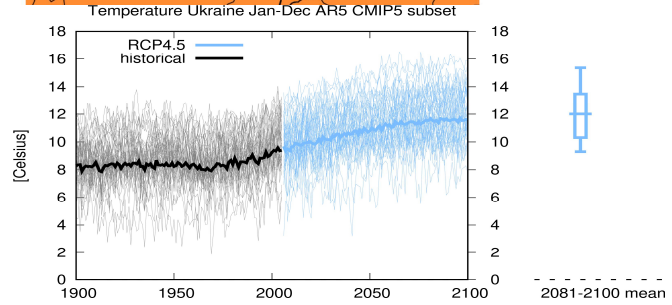

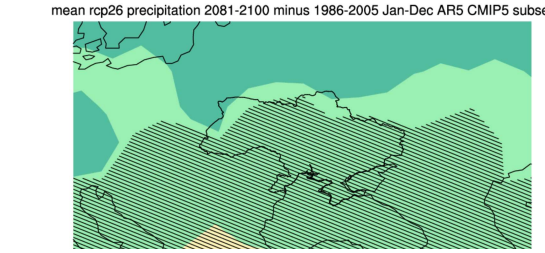

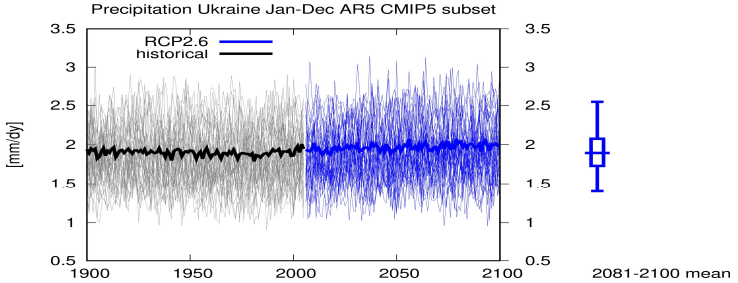

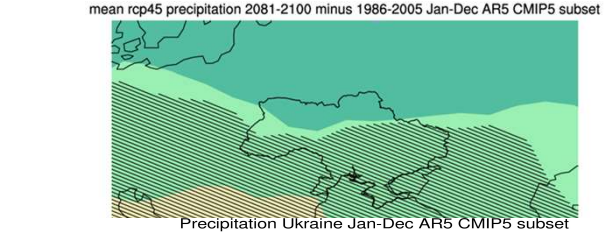

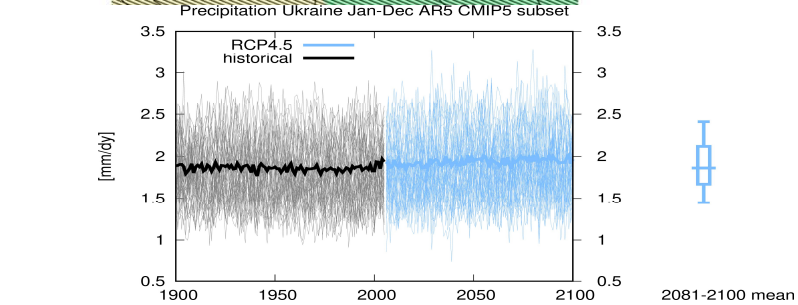

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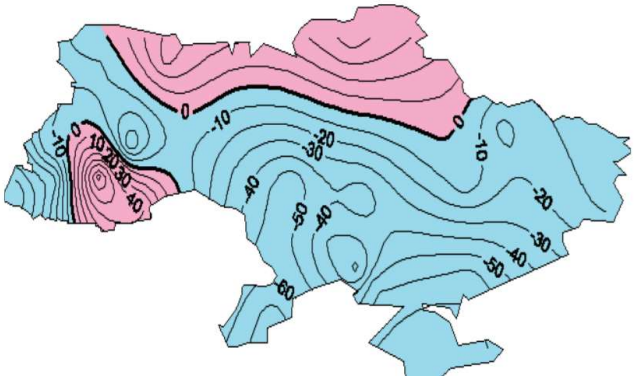
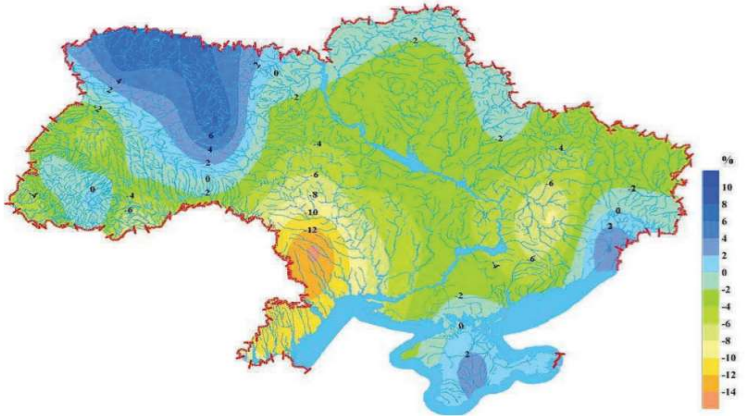
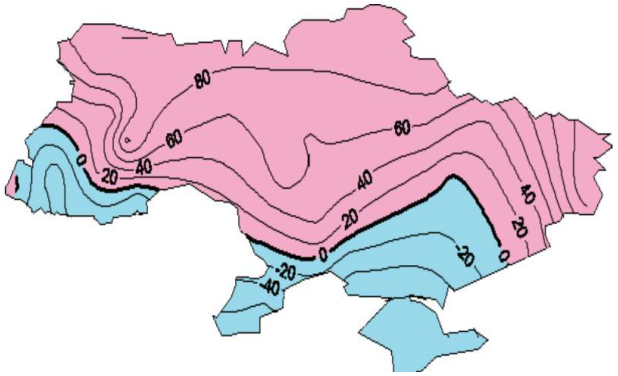
RESULTS



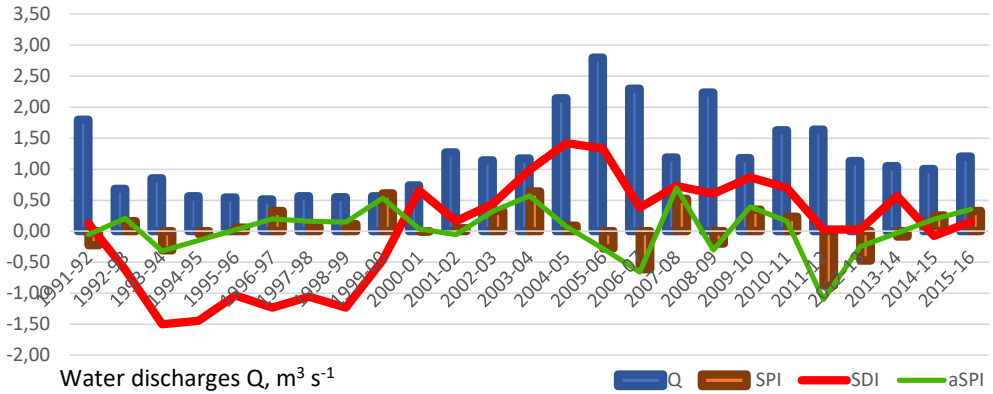
Spatial distribution of relative deviations (%) of annual climatic runoff norms for the period 2031–2050 in comparison with the data before 1989 (scenario A1B) *[Authors Loboda N.S., Bozhok Yu.V.]*



Possible future changes in the average annual water runoff (%) of rivers of Ukraine for the period 2031–2050 relative to the base period 1991–2010 according to the RCM, scenario A1B [*Author Gorbacheva L.O.*]



Spatial distribution of relative deviations (%) of annual climatic runoff norms for period 2031–2050 compared to data before 1989 (scenario A2) *[Authors Loboda N.S., Bozhok Yu.V.]*



Water discharges Q, $m^3 s^{-1}$
Streamflow drought index (SDI)
Standardized precipitation index (SPI)
Agricultural Standardised Precipitation Index (aSPI)

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