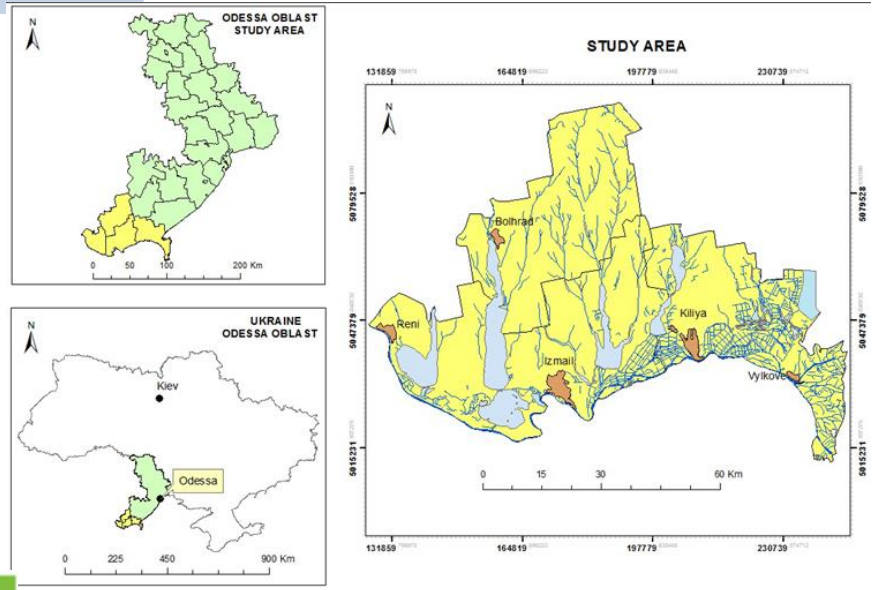
Group Project: Water Management

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

Group C11

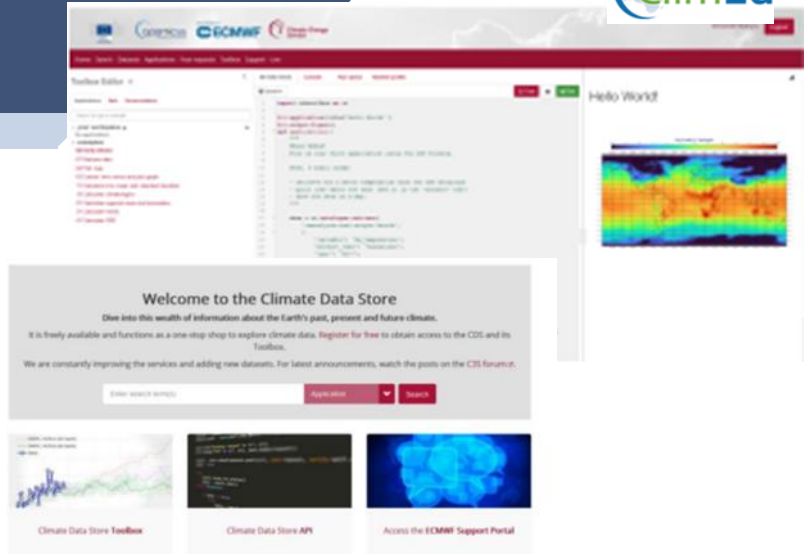
Object of study

- **The object of study** - the lakes Kugurluy and Yalpug and their basins, the rivers flowing directly into the lakes, and the Danube as the main source of water exchange in these lakes.
- **The problem is** changes in the hydrological and hydrochemical regime of the lake. Kugurlui - Yalpug: decrease in water levels and increase in mineralization above 1.5 g / dm^3 in Bolgrad.
- **The main objective of the study is** to analyze the observational material of climatic parameters affecting the hydrochemical regime of the lakes.
- **UN SDGs**



Danube basin of Ukraine

Analysis of climatic characteristics



The water balance of the Kugurlui-Yalpug reservoirs is mainly determined by the inflow of water due to precipitation, evaporation from the water surface and water exchange with the Danube. In order to study the impact of climate change on the water balance of water bodies, we analyzed the following long-term indicators:

- air temperature;
- precipitation;
- soil mjisture

Digital tools and Datasets:

ERA 5 Dataset

ERA5 Explorer

CDS – Climate Data Store

CDS Toolbox Editor

Anaconda

Python

ArcGIS

Analyzed Datasets:

Retrieve surface temperature data between 1979 and 2018

ERA5 monthly averaged data on single levels from 1979 to present

ERA5 hourly data on single levels from 1979 to present

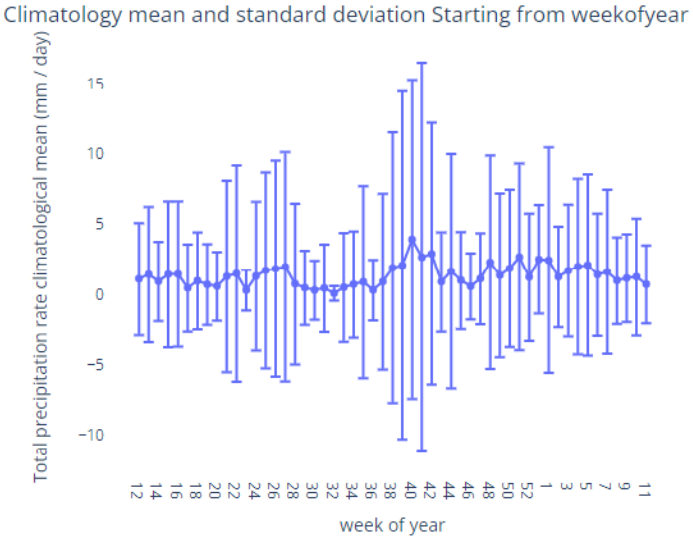
Water sector indicators of hydrological change across Europe from 2011 to 2095 derived from climate simulations

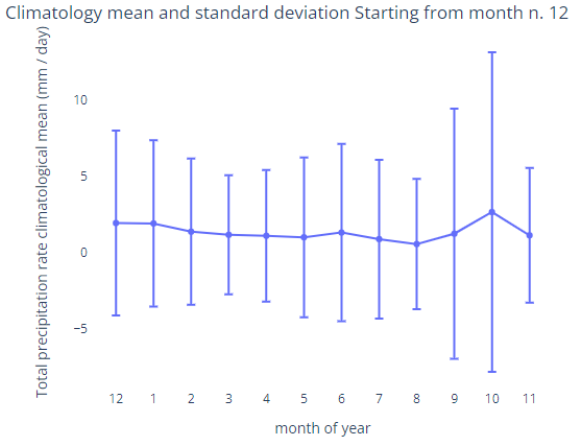
Soil moisture gridded data from 1978 to present

Global bioclimatic indicators from 1950 to 2100 derived from climate projections

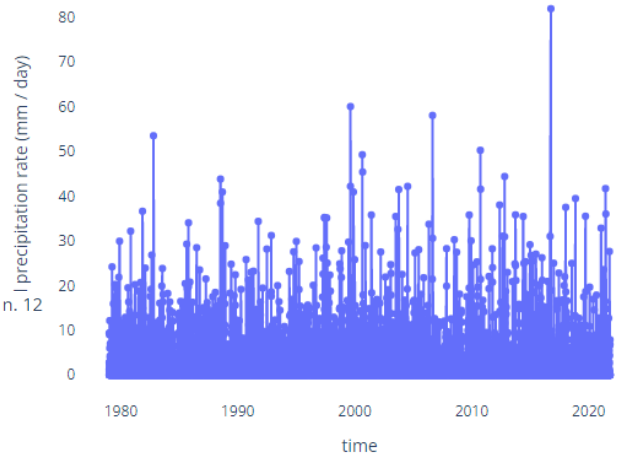
Precipitation

- Analysis of atmospheric precipitation: daily, weekly, monthly (for example, the city of Bolgrad).

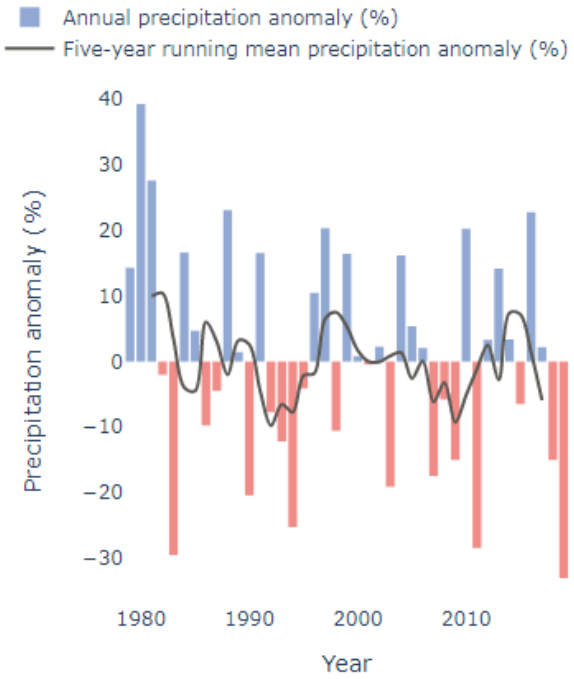




Extract a time series and plot graph

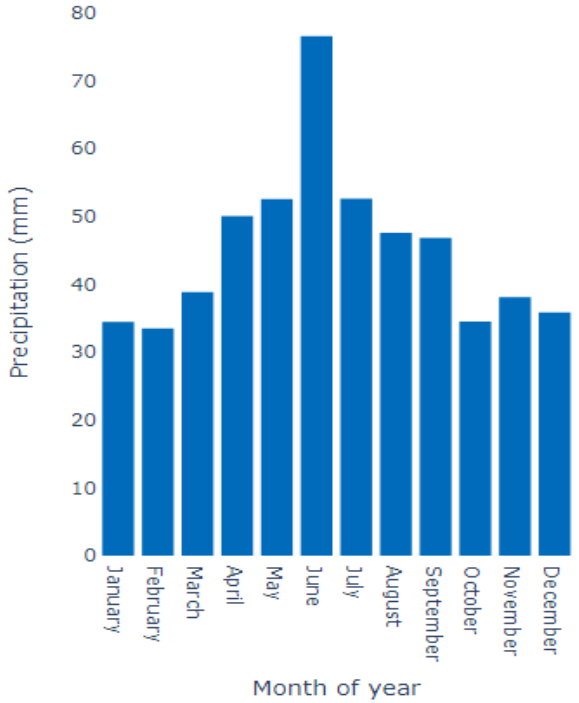


Analysis of Precipitation Patterns



The plot below shows the precipitation anomaly for each year in the 1979-2020 period, or how much more (blue) or less (red) precipitation fell each year as a percentage relative to the long-term reference period of 1981-2010.

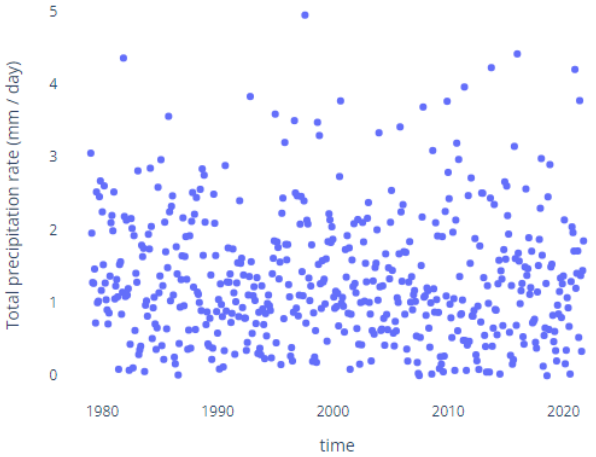
For the 1981-2010 reference period, the mean annual total precipitation in Bolhrad was 541.6 mm.
Monthly average precipitation ranged from 33.5 mm (February) to 76.6 mm (June).



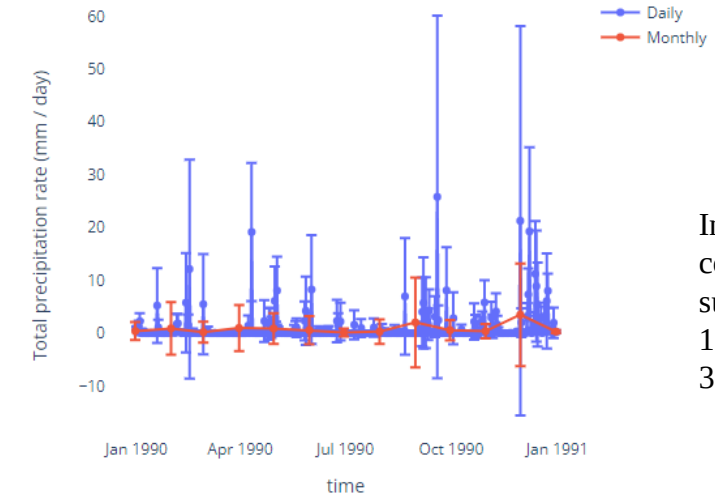
Precipitation

Extract a time series and plot graph

The highest monthly mean values of the filling volume of the Danube lakes due to atmospheric precipitation and runoff from the Danube occur in spring. During this period, desalination of the lakes takes place. In autumn, on the other hand, the filling of the reservoirs with river water is practically not carried out. This leads to an increase in mineralization.

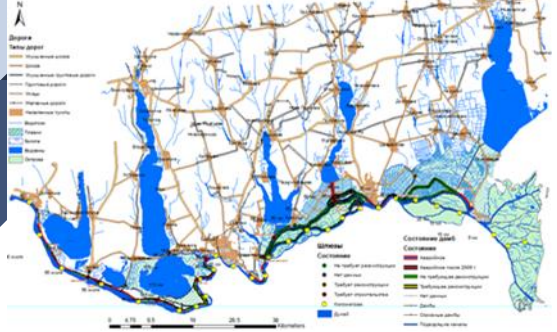


Monthly/Daily mean with standard deviation



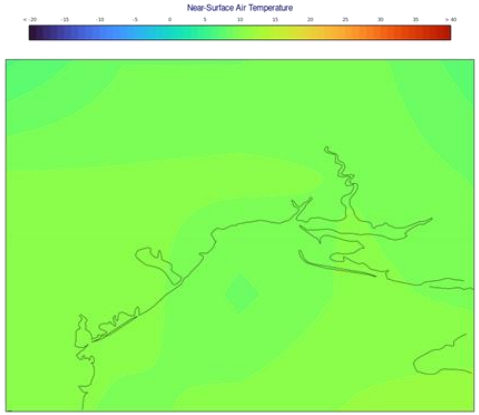
In dry years, the salinity of the water in the Danube lakes can increase considerably. In such times the water of the lake. Yalpug-Kugurluy may not be suitable for drinking and irrigation purposes. According to long-term observations, 1990-1995 were such dry years. Annual precipitation for 1994 was not more than 336 mm. In the future, you need to consider such scenarios.

Temperature



Danube basin of Ukraine

Near surface air temperature



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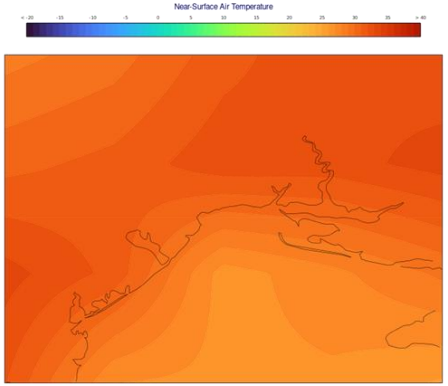

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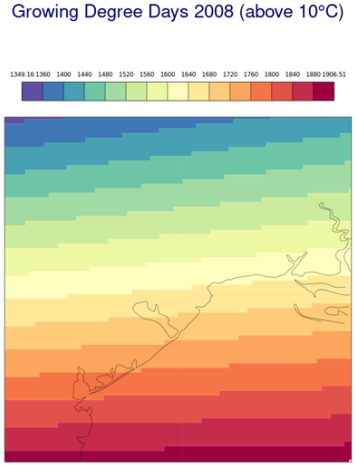
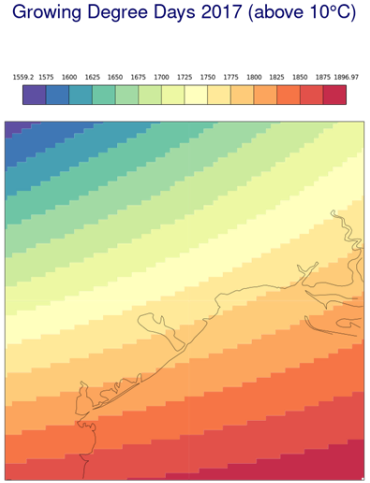
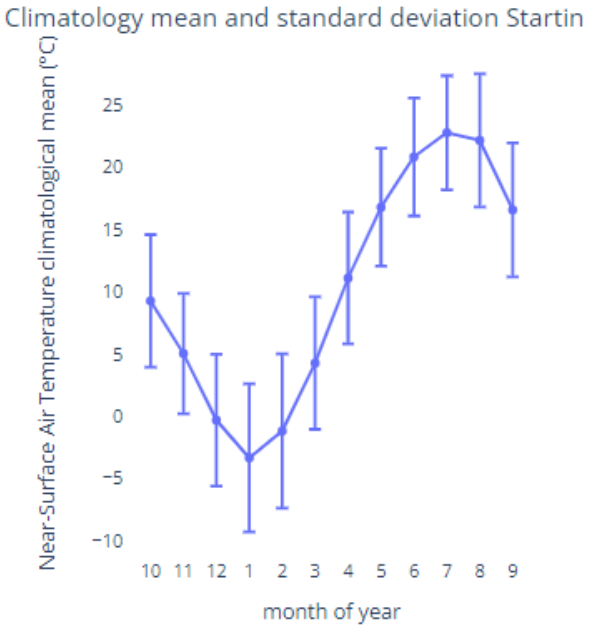
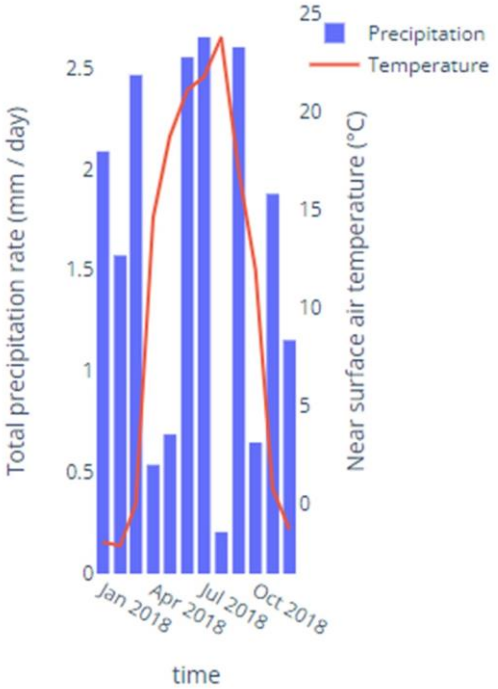


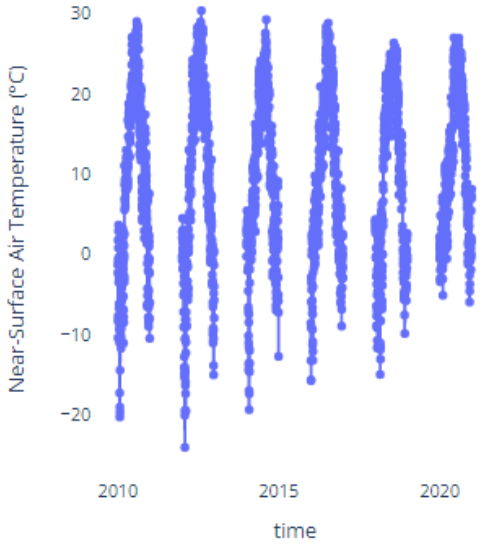


Temperature

Analysis of temperature: monthly and for the year (for example, the city of Bolgrad).

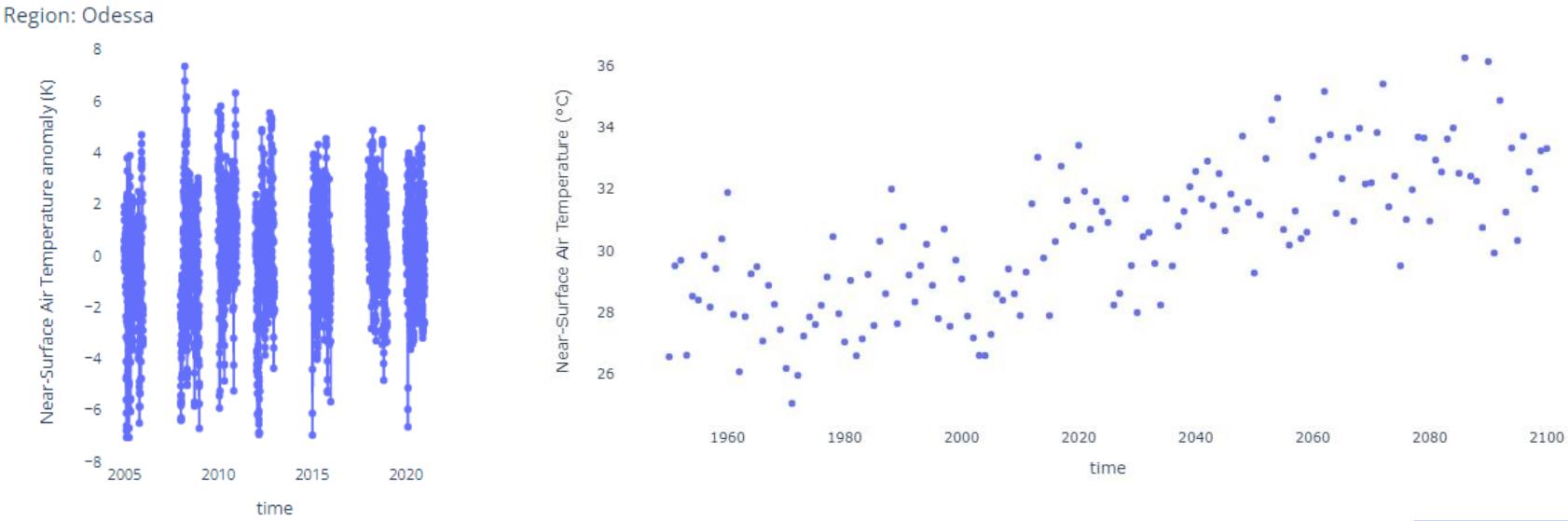






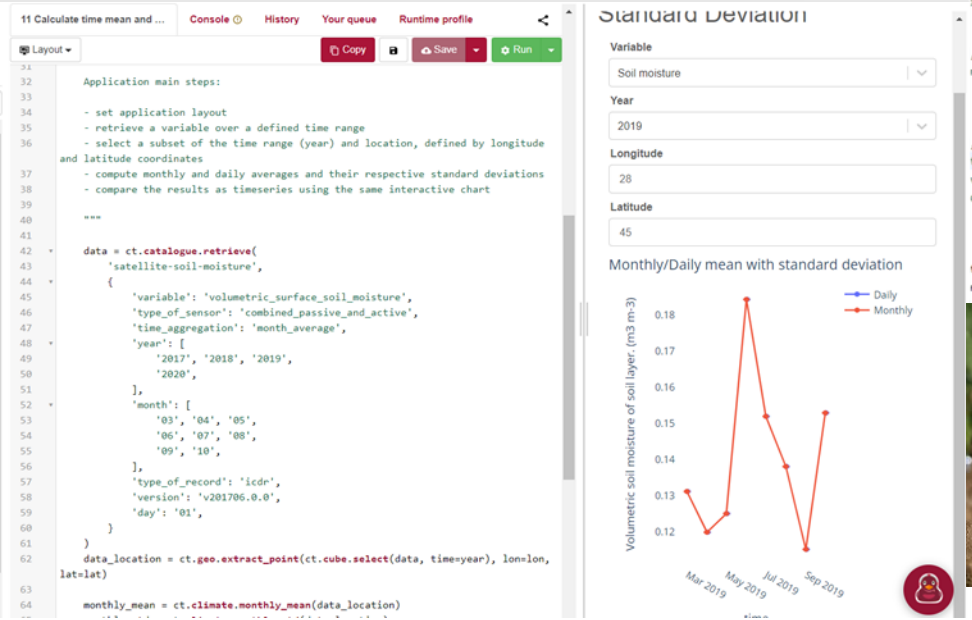
Temperature

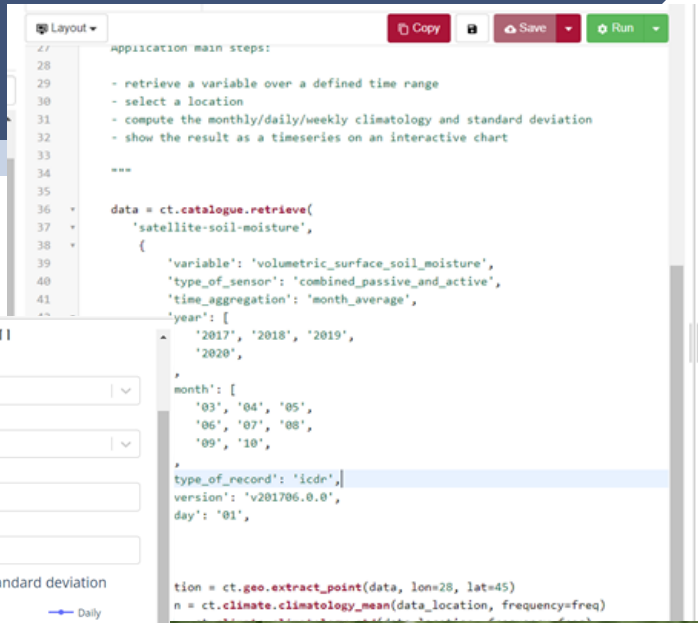
Present values and forecast of maximum temperature of the warmest month on RCP4.5

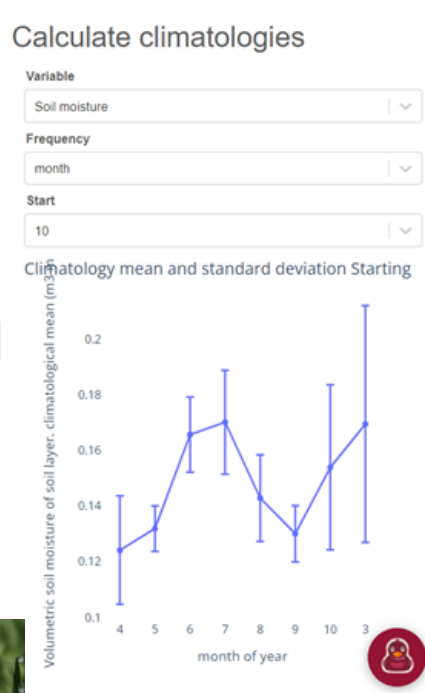


Soil moisture

Reserves of soil moisture during the growing season (April-October) decrease from July onwards

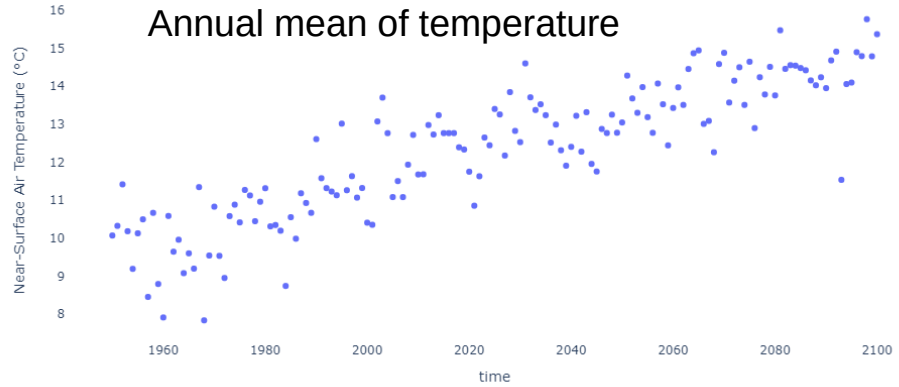




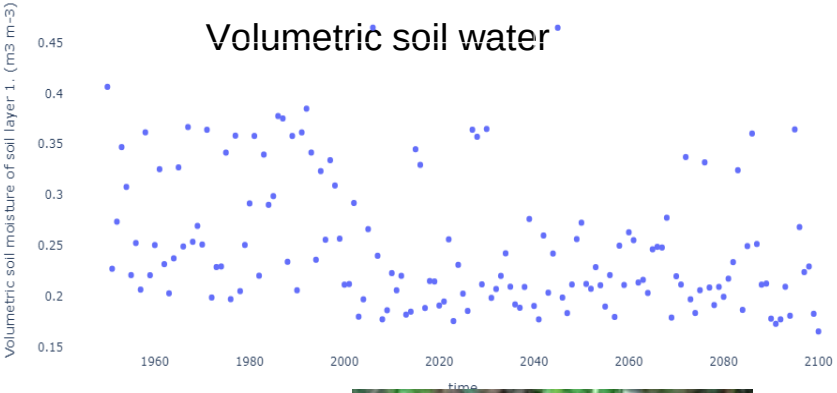


Results derived from climate projections (from 1950 to 2100) RCP 4.5

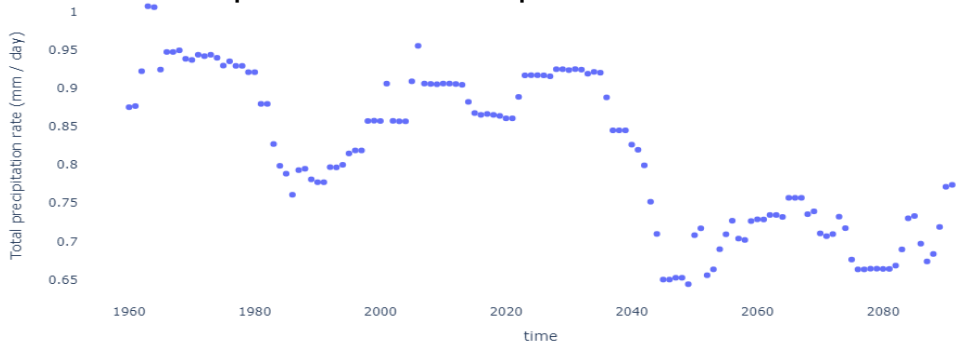
Annual mean of temperature



Volumetric soil water



Precipitation of driest quarter



Vulnerability to climate change and adaptation

possible impacts on centralized drinking water supply to settlements (using Bolgrad as an example)

- deterioration of water quality
- increasing costs for water preparation and treatment

the prospects for water supply to industrial and municipal enterprises (using Bolgrad as an example)

- increasing levels of water consumption and simultaneous deterioration of water quality
- reducing wastewater dilution

conditions for agriculture (crop production);

- the need for irrigation increases

- Integrated monitoring of water quality and quantity
- Modernization of treatment systems and application of natural based technologies
- Implementation of innovative water treatment technologies (natural based technologies)
- Finding sources of alternative water supply
- Quality control and application of innovative technologies to improve irrigation water
- Implementation of modern resource, energy efficient and environmentally friendly irrigation methods

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THANKS!