International Cartographic Association
Association Cartographique Internationale

Mapping climate zones change for the territory of Kazakhstan

Kalamkas Yessimkhanova [a,*], Mátyás Gede [a]

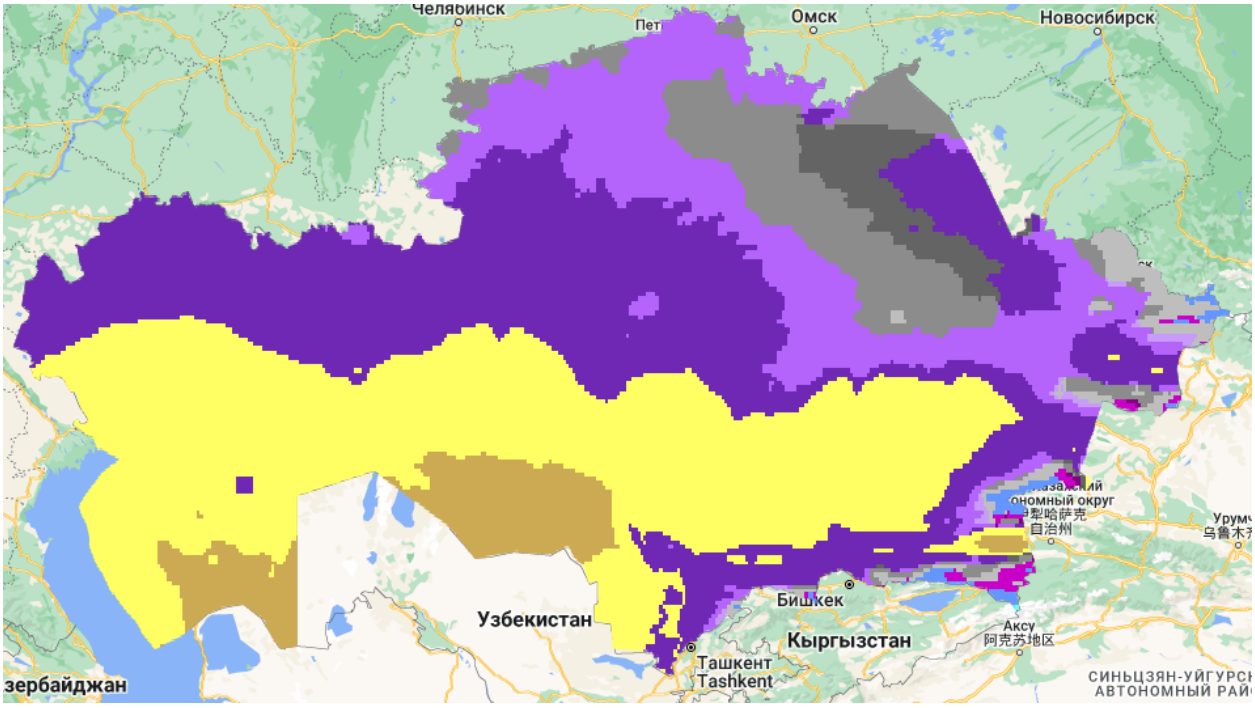
[a] *ELTE Eötvös Loránd University, 1st Author – kalamkasyessimkhanova@gmail.com, 2nd Author - saman@inf.elte.hu*

* Corresponding author

Keywords: climate change, climate zones, time-series

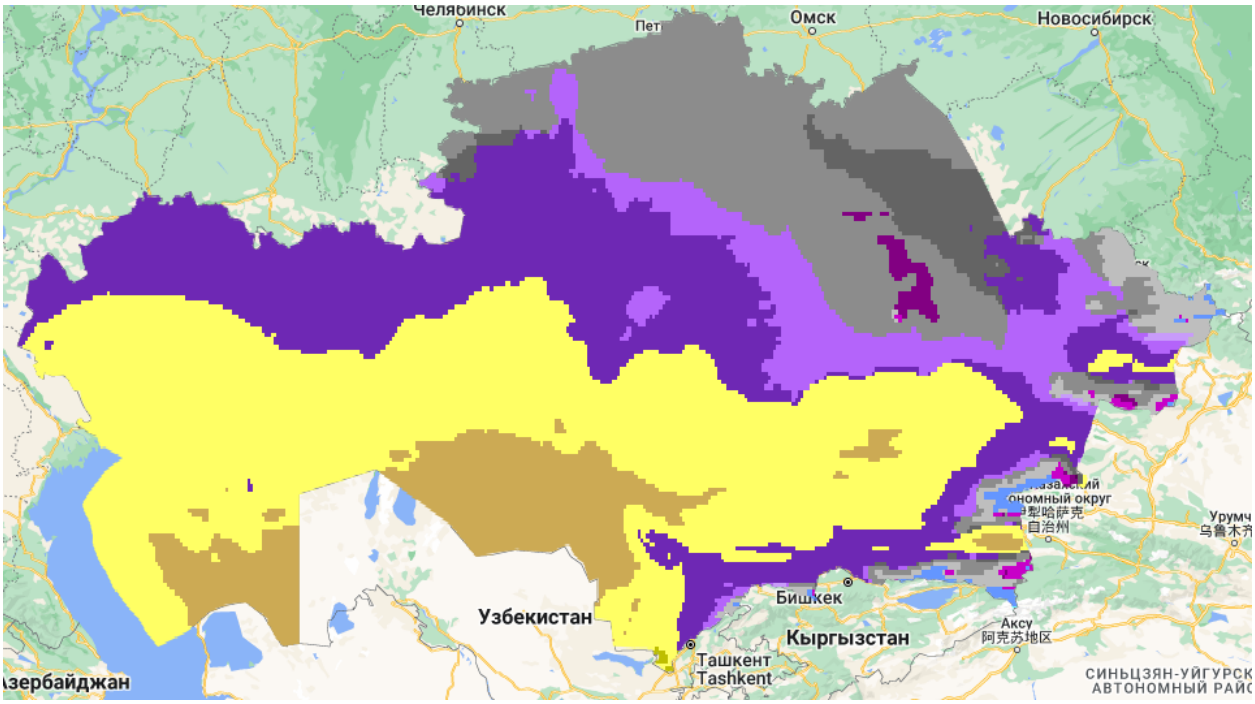
Abstract:

Climate change is one of the most challenging and important issues of the 21st century. It is a global problem that requires attention and action from the whole globe. The impact of climate change is being felt in Kazakhstan. Prominent reports indicate that the territory of Kazakhstan is experiencing environmental emergencies (heatwaves, droughts, fires, flood, mudflows in some regions). To better understand the impact of climate change in Kazakhstan, this study has significance in terms of examination and visualization the alterations in the boundaries of climatic zones in the area of Kazakhstan. The study uses the Google Earth Engine (Gorelick et al. 2017) cloud-based spatial analysis service which offers a rich database that enables the use of climate reanalysis datasets over extended periods. ERA5-Land Monthly Aggregated Data (Muñoz Sabater, 2019) by ECMWF Climate Reanalysis is the data source. Monthly mean values of temperature and precipitation are applied as an input data for classification. There are two 30-year periods that have been updated 1961-1990 and 1991-2020 to observe climate change. Although the region of interest is predominantly characterized by arid (class B) and continental (class D) climates, all major climate classes (A, B, C, D, E) and their subclasses were examined in this project. The Köppen climate classification is utilized as a reference system. The outcomes are presented as categorized maps of climate zones for the periods of 1961-1990 and 1991-2022. The maps were generated in Google Earth Engine platform and presented sequentially. Figure 1 illustrates significant changes in climatic zones across various regions of Kazakhstan. The country is located in Central Asia and it undergoes an extreme continental climate with hot summers and cold winters. Results of this research can be advantageous for other researchers studying climate change. Moreover, Kazakhstan is taking actions on implementing Sustainable Development Goals; therefore, the research results have an importance in realisation of practical ideas and decision making.



1961-1990

Abstracts of the International Cartographic Association, 6, 284, 2023.
31st International Cartographic Conference (ICC 2023), 13–18 August 2023, Cape Town, South Africa.
https://doi.org/10.5194/ica-abs-6-284-2023



1991-2020

Legend

- Cold desert climate (BWk)
- Cold semi-arid climate (BSk)
- Hot-summer humid continental climate (Dsa)
- Warm-summer humid continental climate (Dsb)
- Mediterranean-influenced subarctic climate (Dsc)
- Hot-summer humid continental climate (Dfa)
- Warm-summer humid continental climate (Dfb)
- Monsoon-influenced warm-summer humid continental climate (Dwb)
- Monsoon-influenced subarctic climate (Dwc)
- Hot-summer Mediterranean climate (Csa)
- Tundra (ET)

Figure 1. Climate classification maps of Kazakhstan (30-years mean values)

References

Gorelick, N., Hancher, M., Dixon, M., Ilyushchenko, S., Thau, D., & Moore, R. (2017). Google Earth Engine: Planetary-scale geospatial analysis for everyone. Remote Sensing of Environment.

Muñoz Sabater, J., (2019): ERA5-Land monthly averaged data from 1981 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS). (<05.05.2023>), doi:10.24381/cds.68d2bb30