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The proceedings of the international research-to-practice conference on 'Climate Services: Science and Education' are presented in the collected volume. The reports cover the principle results of researches in the field of issues of climate services in the climate-sensitive economic sectors; education in climate services; climate risks and adaptation to climate change on regional and local levels.

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Section III. Climate Risks and Adaptation to Climate Change on Regional and Local Levels

USING ENSEMBLE OF REGIONAL CLIMATE MODELS FOR ASSESSMENT OF FUTURE CLIMATE IN NORTH-WESTERN COAST OF BLACK SEA

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Future climate change is one of the greatest challenges facing humanity in the current century. The need for information on climate change is necessary for an assessment of their impact on human wellbeing and natural systems in order to develop appropriate adaptation approaches and strategies to mitigate the negative effects of climate change at the national and regional levels. The main tool for future climate change assessment is global climate models. These models calculate future climatic regimes using the scenarios of anthropogenic impact on the global climatic system – so-called Representative Concentration Pathways – and are resulting in future coarse-scale spatial fields of hydrometeorological parameters. In order to obtain hydrometeorological fields with a horizontal resolution of several kilometers, regional climate models (RCMs) are used.

The framework for the impact of the climate-induced changes in meteorological parameters on hydrological and, consequently, hydroecological behaviors of "choked" lagoons in the north-western Black Sea coast is as follows: global warming leads to increased aridity of the regional climate, to increased evaporation from the catchment and/or lagoon surface (together with decreasing total precipitation), and reducing the inflow from rivers and streams into lagoons. This is resulting in an increasing deficit of annual freshwater balance.

This study aims to develop a methodology allowing determining the optimal simulation from the RCMS ensemble relatively to the north-western coast of the Black Sea. At the first stage, the CORDEX dataset was used to obtain future changes in temperature and precipitation.

Next, a database of meteorological parameters (monthly temperature, precipitation, relative humidity, wind speed, cloudiness) for the period 2021-2050 was created for 24 stations located in the north-western Black Sea coast and Moldova at the catchments of small rivers inflowing into the lagoons of the north-western Black Sea coast. The database consists of the outcomes from the 14 runs of different models for climate change scenarios RCP 4.5 and RCP 8.5 (Table 1).

A single simulation was selected, which best reproduces the annual course of temperature, precipitation and evaporation for each grid point and scenario from the ensemble in comparison with the ensemble mean values. The procedure for selecting the "best" run for each node and scenario is as follows:

Table 1. RCMs used in the study.

Run	Institution	RCM	Global model
CLMcom1	Climate Limited-area Modelling Community	CLMcom-CCLM4-8-17	CNRM-CM5
CLMcom2			ICHEC-EC-EARTH
CLMcom3			MOHC-HadGEM2-ES
CLMcom4			MPI-ESM-LR
DMI1	Danish Meteorological Institute	DMI-HIRHAM5	ICHEC-EC-EARTH
DMI2			NCC-NorESM1-M
KNMI1	Royal Netherlands Meteorological Institute	KNMI-RACMO22E	ICHEC-EC-EARTH
KNMI2			MOHC-HadGEM2-ES
MPI	Max Planck Institute for Meteorology	MPI-CSC-REMO2009	MPI-ESM-LR
SMHI1	Swedish Meteorological and Hydrological Institute	SMHI-RCA4	CNRM-CM5
SMHI2			ICHEC-EC-EARTH
SMHI3			IPSL-CM5A-MR
SMHI4			MOHC-HadGEM2-ES
SMHI5			MPI-ESM-LR

(i) for each month of the year, the ensemble mean is calculated as the average for the 30-year period;

(ii) absolute deviations for each run are calculated for each month of the year;

(iii) maximum values of absolute deviations are determined and relative deviations are calculated;

(iv) for each run, the sum of the average annual deviations for the temperature, precipitation and evaporation is calculated;

(v) the run with the minimum value of that sum is considered the best.

After the above mentioned procedure, the CLMcom4 run was be found as the best runs and it's outcomes are recommended as input parameters for modeling the hydrological and hydroecological regimes of lagoons in the north-western Black Sea coast and their catchments in the near future. Analysis of the expected changes showed that the trends observed during the current climate period will continue in the next 30 years.

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