Geophysical Research Abstracts
Vol. 20, EGU2018-14622, 2018
EGU General Assembly 2018

How accurately do global climate models reproduce hydrometeorological conditions in the river basins of Siberia and the Far East?

Andrey Kalugin
Water Problems Institute of Russian Academy of Sciences, Moscow, Russian Federation (kalugin-andrei@mail.ru)

To obtain reliable results of calculations of possible climatically conditioned changes in the water regime of rivers, it is necessary previously estimate the accuracy of reproduction of climatic and hydrological characteristics over the period of the availability of observation data. Numerical experiments were conducted with regional hydrological and global climate models. In this study, physically-based distributed models of runoff formation have been developed for the Amur River (1.85 mln. km2), the Lena River (2.5 mln. km2) and the Selenga River (0.45 mln. km2). The models are based on the ECOMAG hydrological modeling platform and describe of the hydrological cycle processes of river basins with a daily time step. Most of the spatially distributed parameters were given from the global databases on the DEM HYDRO1k, Harmonized World Soil Database, and USGS Global Land Cover Characteristics taking into account flow regulation by reservoirs and lakes. Some of model parameters were calibrated according to discharge data in different gages located on the mainstream and its tributaries. The meteorological database for the Amur and Lena rivers includes daily time series of air temperature and humidity, precipitation measured at meteostations. Due to lack of daily meteodata for the Mongolian part of the Selenga basin, the EWEMBI reanalysis data were used as the model input. The models demonstrated satisfactory performance in terms of Nash-Sutcliffe efficiency (NSE>0.70) and percent bias (PBIAS<15%) for different gages.
To carry out climate experiments, a database of global climate models was prepared based on ISI-MIP2 Project (Inter-Sectoral Impact Model Intercomparison Project Phase 2). The input data of models from the CMIP5 project were interpolated on a regular grid 0.5°, and bias-correction procedure was implemented for the observation period. An analysis of the reproduction of long-term variations in the water regime characteristics was conducted for historical period, using as boundary conditions in the hydrological models of the ensemble data of global climate models in the study watersheds, i.e. in regional scale. Statistical estimation of the efficiency of calculating the mean annual runoff, seasonal runoff, the variability of the water regime (variance, variation coefficient) for study river basins with different physically geographical and climatic conditions of runoff formation showed satisfactory results. The averaging of the hydrological modeling results in the ensemble of climatic models significantly improves the results of calculating the climatic norms of annual and seasonal runoff by filtering the errors of individual models (an error of $\pm$15%). As a result, the developed hydrological models can be applied to calculations for the actual climate projections for the 21st century taking into account the strategic objective of the retention of global average temperature growth by the end of the 21st century within lower than 1.5°C relative to pre-industrial indicators.
This study was carried out at the expense of the grant of the Russian Science Foundation (project No. 17-77-10129).