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A method for comparison of regional climate model compliance with observations

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The main goal of this work was to identify the regional climate model (RCM) which provides the best climate time series for the further hydrological modeling of the Latvian rivers drainage area. The selected area is located in the eastern Baltic region and covers territory of several countries: Estonia, Latvia, Lithuania, Russia and Belarus. The main forcing parameters for hydrological modelling are temperature and precipitation time series. Our approach of an estimation of RCM accuracy was based on statistical analysis of these time series. The set of 21 RCM from PRUDENCE project was used. We used calculations for reference period (daily data). The RCM reference data for the contemporary climate (1961-1990) was statistically compared to the measured weather stations data of the same period. We used measured data series from the National Climatic Data Center (www.ncdc.noaa.gov), RIHMI-WDC (meteo.ru) and the Latvian Environment, Geology, and Meteorology Agency. The area covered by these stations is approximately 400 thousand square kilometers. For the time series comparison model data was interpolated to the observation location from each model's grid.

The penalty function describing the deviation of each RCM from the meteorological observations was constructed. We aimed for the evaluation of model accuracy in terms of temperature, precipitation, their monthly and interannual variation, and spatial distribution. Therefore we used four parameters for construction of penalty function: monthly mean temperatures, monthly net precipitation and standard deviation of monthly mean temperature and precipitation during the reference 30-year period at all stations. All parameters were normalised to equal their weights.

Results of the comparison show that considered parameters of modeled data set (monthly mean temperatures, monthly net precipitation, standard deviation of temperature and precipitation) for the present-day climate noticeably differs from the measured data. Although different models indicate different statistical deviation from the observation, one may find the common deviation patterns: (1) underestimated winter precipitation, (2) increased winter temperature, (3) rather poor reflection of the annual cycle of precipitation. Obviously, direct use of RCM climatic data for hydrological modelling without modification is not desirable. There differences between model and observation data during winter period have strong influence on Latvian rivers hydrological regime because of snow accumulation and snowmelt in the spring.