FORECASTS OF THE RUNOFF CHANGE OF THE SMALL RIVERS OF BELARUS

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Rational use of water resources is impossible without forecasts of fluctuations and changes of river runoff. Although the basic character of these fluctuations is determined by climatic factors, increasingly they are influenced by anthropogenic factors. The purpose of the research reported here is to estimate changes in river regimes caused by the degradation and reduction of the peatbogs as the result of drainage. We have created the automated computer program “Balance”, based on the joint solution of the surface energy and water balance equations, for calculating changes in river runoff.

Modeling the water balance of a specific river is carried out in two stages: adjustment of the general model for that river and then forecasting the runoff change. At the first stage the appropriate river-analogue is automatically selected from the built-in data base of existing hydrometeorological and river basin information. The second stage employs direct calculation of the water balance of the river of concern using the parameters derived from the appropriate analogue river. Results from a series of tests of different rivers in current conditions indicate good agreement between modeled and measured run-off values. Therefore the "Balance" program was used to forecast runoff changes as a response to both climatic and land use changes.

Drainage of the peat bogs and their subsequent use for agriculture results in the reduction of the peatbog layer. At the same time at least part of the surface will be replaced by soil with various textures (sand, sandy loam, loam, and clay) which will partly depend on the local physical geography. Both sources of change will influence evaporation and runoff. Therefore we forecast the changes associated with a variety of degrees of peat degradation and reduction. The results indicated that the greatest impact on the runoff would occur in basins where peatbog was effectively replaced by sand on 30 % of the basin area. Average annual values of runoff changed insignificantly, but there was a significant intra-annual redistribution of the runoff.

We extended the numerical experiment to include the potential effects of climate change. Without any surface changes, the results indicate that runoff is more sensitive to precipitation changes than to temperature changes. For realistic estimates of future precipitation changes, runoff changes around 10-20% of current values are typical. Adding a temperature increase and a reduction in bog area yields a decrease around 30%. At the opposite extreme, a temperature reduction combined with a bog area increase, there would be a 40% change in runoff. Within one year of the change the major adjustment would be established as occurring during the warm period of the year. The results for this joint impact of climatic and anthropogenic factors indicates that in several months of the year the runoff can change more than 2 times.