

Cartographic Model of River Basins of European Russia

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Abstract—An analysis made of the worldwide existing geoinformation systems (HydroSHEDS, CCM, Ecrins, WBD, etc.) suggests that there are as yet no models of adequate quality for the basin boundaries of small rivers in the European part of Russia. For the territory of the European part of Russia with a total area of more than 4 mln. km² the GIS technology tools were used to construct the electron vector map of river basins and their interbasin spaces. The map thus obtained displays the basins of first-order rivers for a given level of generalization (sc 1:1 000 000). The GMTED2010 model was used as the digital elevation model. A total of 63 553 basin geosystems were identified on the map, averaging 68 km² in area. Accuracy verification of identifying the basin boundaries showed a good agreement of areal and geometric characteristics of the method used with expert approach. In test areas, the mean difference of the indicators of the area of the basins identified automatically and by use of the expert approach made up 3.6%. For areas with weakly dissected lowland topography this error does not exceed 5% while it is about 2% in areas with relatively dissected elevated topography. The basin geosystems thus identified are operational-territorial units with respect to which the geospatial data base is generated to characterize the natural-resource potential of the European territory of Russia. An example is provided for the generation of the geospatial database containing hydrological information covering 1763 hydrological stations collecting streamflow data.

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FORMULATION OF THE PROBLEM

The territory of European Russia (ER), a large geographical region (about 4 mln. km²), is dissected by a dense network of rivers. The bulk of the population and the major percentage of the industrial and agricultural potential of Russia are concentrated in the region. Its basin geosystems are experiencing a significant anthropogenic load, which triggers a great variety of negative processes (erosion-channel processes, changes in the streamflow regime, shortages of drink water resources, etc.). The status of geosystems of small river basins, and the causes and intensity of the ongoing changes across such a vast territory can only be assessed on the basis of a comprehensive spatiotemporal analysis of long-term monitoring data, cartographic products of State surveying and widespread use of Earth's remote sensing. On the other hand, such an analysis can only be accomplished on the basis of generating the problem-oriented geoinformation system, and implementing cutting-edge geoinformation technologies and mathematical/statistical methods. The basis for such a GIS must be provided by the electronic map (layer)

for the river basins of the study territory, while the river basins themselves are the basic operational-territorial units for collection and summarization of diverse natural and anthropogenic information as well as for the conduct of a spatial analysis.

The goal of this study is to generate the electronic map for the river basins of the European territory of Russia (ETR). This map can serve as the basis for determining the dependencies of the formation and functioning of small river systems and their catchments on the landscape-geographical conditions of the territory as well as for mapping the regularities of streamflows, determining the degree of anthropogenic load on the basins and for making an integral quantitative assessment of their geoeccological status.

AN OVERVIEW OF INTERNATIONAL AND RUSSIAN MODELS OF RIVER BASINS

Nowadays, there are a large number of publicly available cartographic products in the form of models for catchments (a network of river basins) of some territorial coverage. Such products can differ in their