

Extreme low flow period in the Don River Basin 2007-2015: the reasons and effects

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The Don River Basin is located in the south of the European part of Russia and covers an area of 422,000 km², with more than 29 million inhabitants. The Don and its tributaries are the main source of fresh water for population and industry needs. This research was devoted to extreme low flow period in Don River basin, which takes place from 2007 till now. The main goal of the study is complex analysis of this hazard and their influence on the river system.

The basic task is the assessment of the anthropogenic and natural input in process of extreme low flow formation. Successful solution allows determining the reasons of water scarcity period; draw up the recommendations how to minimize environmental and economic damage and fined the way for entrance from the crisis. For climate anomalies analysis spatial data of reanalysis was used. The absolute values of the air temperature, monthly precipitation, soil moisture and snow cover depth were explored in details. Moreover, spatial and temporal anomalies of the parameters were analyzed. Data on the water use and water release was the main information for human activity assessment. The remote sensing data and GIS were used to identify the land cover changes in Don River region. The lack of field verification led to necessity to combine different schemes in process of detection. This is the novelty of used method. Sources for calibration were taken from free web sources (). After accounting the areas, which are covered by different agriculture activities, crop irrigation requirements were estimated. All calculations made for 4 periods that were characterized by various levels of economic development. The results were compared with river flow. It gives an opportunity to find the links between low flow values and the anthropogenic factor.

The second important task was evaluation of spatial-temporal flow distribution during the drought period. Revealing the parts of the basin that give major contribution in the process of the drought formation can help redistribute human activity more effectively. A range of 45 maps were made by R programming language. It shows the distribution of annual and seasonal flow probability. It was shown that:

- there are an increasing of flow probability from Upper Don to the downstream
- the alternation of the years with relatively high and low water content was observed during the drought
- the rotation of flow probability was asynchronous for the eastern and western parts of basin

Detection of flow redistribution during the year is very important result too. The role of spring flood is reduced, at the same time the mean water flow during winter is increased.

The drought greatly affected on the river ecosystems. There is dramatic rise of phytoplankton concentration during this water scarcity period. The class of water quality transfer from oligotrophic in 2004-2006 to eutrophic in last years. The drought influence on fish fauna is ambiguous. For the most species reduce of reproducing ability was distinctive.

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