Assessment of melioration impact on the maximum river runoff all over the territory of Polesye

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Yasielda is a typical small river of Polesye, which can serve as reference model for assessment of influence of large scale melioration activities on regional water regime. The basin of Yasielda River is situated in the central part of Polesye, related to East European platform. Catchment area of the river is 7,790 km^2 with flat terrain features. Elevated catchment areas have mostly sandy soils and lowland areas have peaty soils. River basin is covered with forests and swamps by 60%. Dry forest constitutes 27% of catchment area, grassy marshes cover 34-35% of catchment, forested swamps – 7% and lakes cover approximately 1% of the basin. Principal lakes of the area are Chernoe, Sporovskoe and Beloe. The largest artificial lake is Selets. The wetland watershed is ill-defined, which probably leads to water transfer into adjacent catchments in flood conditions. The high level of drainage water and rich supplies of suspended water, which are the main sources of river inflow, is a distinctive feature of the river basin.

Hydrological regime of Yasielda River catchment has its distinctive features, which are due instable weather conditions during winter and spring seasons, leading to formation of flood regime in some years and to formation of flash flood conditions in another years. Flash flood conditions are building up during warm winters with absence of stable snow cover and flash floods are caused mostly by rainfall. Spring floods are often preceded by high river water levels, and major thaws in winter are leading to flash floods, caused by intense snow cover melt.

High water levels during spring floods are largely driven by simultaneous snow melt in the river watershed accompanied by heavy rainfall with lesser influence of accumulated water content of snow cower and wetness of catchment soils during autumn season. Futhermore, maximal water discharge values are influenced by simultaneous development of maximal discharges on principal tributaries. The natural flood regime on some parts of the river is distorted by influence of hydraulic structures. Flood in the Yasielda River basin a characterized as mostly small, with the longest duration in the river Pripyat watershed (with exclusion of Pripyat itself). The warming period (starting from 1988) shifted the spring flood to more recent dates. The spring flood begins approximately at first decade of March, the early time is third decade of January and the later time is first decade of April. Flood peak occurs at last half of March. The average flood duration on Yasielda River is 45–75 days and 30–40 days on its tributaries. The flood comes to end at an average in the last days of April in the upper reach of river Yasielda and in the lower reach – at third decade of April. On the Yasielda tributaries the flood ends at an average at last half of April. The spring flood on the Yasielda and its tributaries contributes to 22–45% of annual water discharge.

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In the 1958 the highest water discharge was observed in the catchment. So, on the Yasielda River near Senin settlement the water discharge was measured as 575 m^3/s. Beginning from the 80-s of the past century the maximal values of water discharge were lower than annual average (74.7 m^3) in all years except 1981, 1996 and 1998.

The spring flood causes the river floodplain inundation and sometimes leads to lowland settlements inundation. The flood runoff depth variation coefficient value on the Yasielda River catchment is quite high: ranging from 0.60 to 0.85. The highest values of runoff depth are ranging from 92 mm (1970) to 157 mm (1958) and in the years of average water content – from 33 mm to 52 mm. The flood runoff depth value of 1 % probability exceedance is ranging from 107 mm to 161 mm, which slightly exceeds the maximal observed runoff depths. During the period of instrumental observations the exceptional spring flood inundation (P = 1 – 2%) occurred on the Yasielda River at 1999 and the major ones (P = 3 - 10%) – at 1958, 1979 and 1981.

Analysis of systematic hydrological observations over a period of more than 100 years showed up, that spring floods with high water levels are repeating in 2-3 successive years at intervals of 10 and more years.

The creation of fish farm “Selets” has exerted profound influence on the annual distribution of stream flow. By ecological considerations, the river ecosystem performance downstream the fish farm is not favorable for every year.

The dewatering of the major part of river catchment and water canalization up to the borders of wildlife reserve “Sporovsky”, building of artificial lake and fish farm “Selets” have resulted in the further changes of river Yasielda hydrological regime:

- the maximal water discharge have decreased significantly (up to 40 -70%) because of major part of spring flood discharge is consumed by filling up of the fish farm ponds, which leads to the absence of spring flood;
- the summer drought flow have increased by 30% because of water flushing from the fish farm ponds during the fish seining; and
- the major vegetal invasion into the river bed in the wildlife reserve territory because of the absence of spring flood, which recently cleaned the river bed.

Recent analysis of hydrological observations in the river Yasielda watershed has showed, that anthropogenic activities in the catchment is exerting severe influence on the water regime.

At the present time up to 30% of the river catchment is dewatered. Building and operation of the hydraulic structures in the catchment have lead to further changes:

- the density of hydrographic network has increased;
- lowering and emptying of peat deposits has made the specific mesorelief, which is changing the river flow regime and its conditions;
- the phreatic decline in the meliorated and adjacent territories has lowered the water evaporation intensity; and
- the phreatic decline in the meliorated and adjacent territories has created the water storage vessel, which decreases the water discharge.

Analysis of spatial structure of the spring flood water discharge values of the Yasielda basin river shows dissimilarity of the process over the territory, however its decrease is noticed everywhere. Such omnipresent decrease of maximal water discharge could not be explained by melioration and anthropogenic activities. In this case we see the action of

global processes, which exert influence on maximal discharge formation. For example, the increase of winter thaws frequency leads to significant expenditure of snow water content in some years which subsequently results in the increased water levels during winter drought which causes even winter floods sometimes. This process is somehow counter-balanced by building of hydraulic structures which leads to increase of maximal discharges by the cost of the increased water flow time towards the outlet. Nevertheless, the major decrease of maximal spring flood discharges is observed downstream of Selets artificial lake, because it is filling-up in the same time.

Consequently, the changes of annual and minimal spring-and-summer water discharge of the rivers in the Yasielda catchment are caused by major meliorative dewatering activities in the Polesye Region. The increase of winter drought and decrease of maximal spring flood discharges are linked. The major reason of this are global and regional climate warming processes. The creation of Selets artificial lake has exerted significant influence to the water regime change of the Yasielda River.