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TOPIC 1:

Endangered Danube:
What can we do?

INTEGRATED EVALUATION OF HYDROLOGIC, HYDRAULIC AND SEDIMENT PROCESSES ON THE DANUBE INFLUENCED BY THE ĐERDAP RESERVOIR, AIMING AT PROJECTION OF SYSTEM SAFETY ACCOUNTING FOR GLOBAL AND CLIMATIC CONDITIONS

Jovan DESPOTOVIĆ*, Marko IVETIĆ*,
Mihajlo GAVRIĆ*, Aleksandar ŠOTIĆ*

Abstract. – The paper gives an evaluation of the compound hydrologic, morphologic and other processes at the river Danube influenced by the Đerdap reservoir aiming at system safety, in the context of the Danube Strategy. Among other objectives, the Danube Strategy elaborates on Danube system safety, including people, nature and the overall environment. These aspects will be addressed based on the experience gained in a series of national and international studies and documents during the seventy-year cooperation among UNESCO International Hydrologic Programme National Committees.

Numerous studies have been undertaken, based on measurements and survey, monitoring and other research activities in the decades after World War II, led by the Danube Commission, and much later by the International Commission for the Protection of the Danube River (ICPDR). In addition, painstaking field, laboratory and study works have been performed by many hydro-meteorological services in countries in the Danube river basin, from its source, all along the Black Sea estuaries.

Even though none of those studies have encompassed major evaluations of the hydrologic, hydraulic and sediment processes in an integrated form, they include projections of system security and safety, including global and climate changes.

Nevertheless, the chosen major studies and references are listed below, concerning partially gained results, as well as suggestions for further work on the implementation of the EU Strategy for the Danube Region. Yet, those are not the only ones, nor the best ones, but are available and well-known. In addition, listed are certain projects carried out in the region.

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Moreover, there has been no comprehensive analysis either of the sediment or pollution processes on the Danube basin influenced by the Đerdap reservoir, upstream and downstream the dam at the Iron Gate.

It seems that a reanalysis and/or interconnections of the conducted studies, having in mind assessing the hierarchical list of major influences toward decreasing environment sustainability, could be a promising way for preventing deterioration of water regime and entire environment certain species and participants in entire environment chains in the Danube river basin.

Keywords: Danube, process, hydrologic, hydraulic, sediment, Đerdap reservoir, safety, security, changes, global, climate

INTRODUCTION

Cooperation of the countries in the Danube river basin was (re)established immediately after World Wars I and II, local civil wars, and after turbulent times in ex-Yugoslav republics during the 90s and the NATO bombing of Serbia in 1999. Yet, the damages and casualties were repaired, so the Danube is fully navigable after more than 20 years.

The bases for the Danube cooperation, projects and economy are common water resources of either the Danube or its numerous tributaries, covering the area of app. 800.000 km², shared by 15 countries. The major monograph concerning the Danube hydrology was published only once [1]. Since those days, numerous partial and smaller studies and/or projects have been undertaken. Yet, none of those is comprehensive enough so as to be taken into account for any reliable and accurate comparisons with previous works for global evaluation and/or for comprehensive discussions of climate change. Recently published was a capital study concerning the flood regime in the Danube basin in 2017, which is yet to be analyzed and implemented all along the basin [2].

Major projects on the river Danube included the erection and construction of the large dam Đerdap at the Iron Gate gorge between Serbia and Romania. Construction works started in 1967 and were completed in 1974. There were many positive but also negative impacts of construction of the dam, reservoir of app. 90 m depth, lake area of more than 250 km², and the Đerdap power plant.

In 1948, aware of the importance of the river, major countries established the Danube Commission for Navigation and Floods in Budapest, which, given its role and position, has so far been the leading commission at the basin. Much later, when water quality began to impact the European economy and environ-

ment, the ICPDR was established. In addition, other commissions were formed, such as the International Sava River Basin Commission (ISRBC), which started to operate in 2005. Together with other commissions, it aimed at planning and management at the tributaries. All of them operate based on EU policies and regulations, presented in a series of documents, directives and similar, such as the EU WFD [3].

The Danube Strategy [4, 5, 6] repeated and again emphasized major needs and prospects in a wider domain compared to “only” the Danube water resources management, but also based on no more and no less than that.

Thus, what would be the first remarks or perhaps comments, concerning coping with major components of the Strategy topics?

What could be preliminary answers to the questions that the Strategy has raised? In other words, is there any successful integrative process or progress in integration of the (whole) Danube region, including numerous regions, stakeholders and states, or not?

Is it to be advised that wide public information and, even more, education at all levels for all people at the basin (but not only for them), should be the first priority and the first step on a long and widening road aiming at safety and security of entire environmental life [7].

NATIONAL AND INTERNATIONAL STUDIES AT THE DANUBE RIVER

The Joint Danube Survey project, supported by the ICPDR, was carried out three times – in 2001, 2007 and 2013. It implied an integrated evaluation and assessment of the Danube water. Its results should also be taken into further consideration, particularly in a detailed analysis of (non)-stationarity/periodicity/trend of the processes noticed and analyzed at a basin scale, in comparison with national studies [8].

Several major studies were carried out in order to evaluate the quality and quantity of the water and the environment in total, but all of those were designed to tackle a portion of the problem. In other words, based on the published results, all dilemmas resolved were only partially useful for stakeholders. Reliable information on numerous processes in the Danube water basin, including water quality, flow rate criteria, stage levels and sediment deposition are of the highest interest for stakeholders such as: public enterprises, hydro-meteorological services, the electric-power industry, navigation authorities, including “Vode Vojvodine”, “Srbijavode”, the petrochemical complex, municipi-

palties such as Belgrade, Novi Sad, Smederevo, Pančevo and many other small communities/settlements, and hundreds of thousands of people all along the Danube and tributaries' banks, but not only them. Thus, most of those support monitoring and promote the needs for further measurement and modelling [9, 10, 11].

CONCLUSIONS

This paper consists of an introduction about the needs and demands concerning the implementation of the EU Strategy for the Danube Region, from the perspective of an experienced group of hydraulic engineers. A series of project results presented in recent years, including the results usually presented at workshops and important events such as the Budapest Forum, give hope that there is mutual understanding of needs and pathways toward the fulfilment of the goals defined by the EU Strategy Action Plan. Worth noting is the recently launched International Postgraduate Course on Flood Management, organised in cooperation with the Danube Strategy Project Fund and carried out by the Hungarian National University of Public Service and the University of Belgrade – Faculty of Civil Engineering. The two universities' websites contain information about international experts from the Danube basin, and about the course contents, topics and target students/engineers [12].

There is a need for proper and more integrative policies and research, including well-tailored projects for everyone. These should involve not only high-level political negotiations and conferences about global issues, but also projects for ordinary people such as peasants, fishermen, herb collectors, as well engineers, forest and landscape architects, environmentalists and others.

The experience and communication of the National IHP UNESCO Committees' initiatives in the past 70 years should be taken as a model to be followed and supported, aiming at effective implementation of the EU Strategy.

There is also a strong need to turn ideas from the Danube Strategy into concrete projects for a wide range of interested people, from professionals, fishermen and children up to academics. All of them have to believe and live their lives at the Danube basin in a promising and fruitful way, i.e. live there, work, be educated, enjoy culture – going beyond floods, poor economy, non-planned development, limitless river-bed gravel dredging, and collection of plastic and other debris, garbage and other waste.

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ИНТЕГРИСАНА ОЦЕНА ХИДРОЛОШКИХ, ХИДРАУЛИЧКИХ И СЕДИМЕНТОЛОШКИХ ПРОЦЕСА НА ДУНАВУ ПОД УТИЦАЈЕМ ЂЕРДАПСКЕ АКУМУЛАЦИЈЕ, СА ЦИЉЕМ ПРОЈЕКЦИЈЕ БЕЗБЕДНОСТИ СИСТЕМА УЗИМАЈУЋИ У ОБЗИР ГЛОБАЛНЕ И КЛИМАТСКЕ ПРОМЕНЕ

Јован ДЕСПОТОВИЋ, Марко ИВЕТИЋ, Михајло ГАВРИЋ,
Александар ШОТИЋ

Резиме

У раду је дата оцена сложених хидролошких, морфолошких и других процеса на Дунаву, под утицајем Ђердапске акумулације, чији је циљ одржавање безбедности система, у контексту Стратегије ЕУ за регион Дунава. Између осталих циљева, у Стратегији је стављен акценат на безбедност система Дунава, укључујући безбедност људи, природе и целокупне животне средине. Ти аспекти биће анализирани, на основу искуства, у низу националних и међународних студија и докумената, који су настали током седмдесетогодишње сарадње националних комитета у оквиру Међународног хидролошког програма УНЕСКО.

Спроведене су бројне студије, на основу мерења и анализа, праћења и других истраживачких активности које су спроведене током деценија након Другог светског рата, под вођством Комисије за пловидбу на Дунаву и, доста касније, Међународне комисије за заштиту Дунава (*ICPDR*). Поред тога, бројне хидрометеоролошке станице у земљама на сливу Дунава обавиле су мукотрпан студијски и лабораторијски рад и рад на терену, од извора, дуж тока реке до делте у Црном мору.

Ниједна од тих студија није обухватила главне процене хидролошких, хидрауличких и седиментних процеса у интегрисаном виду, оне садрже пројекције сигурности и безбедности система, укључујући глобалне и климатске промене.

Ипак, у тексту су наведене одабране главне студије и дате су референце у вези с делимично постигнутим резултатима, као и предлози за даљи рад на спровођењу Стратегије ЕУ за регион Дунава. Свакако, то нису једине или најбоље студије, али су доступне и добро познате. Поред тога, наведени су пројекти који се спроводе у региону.

Штавише, није спроведена свеобухватна анализа процеса седиментације нити загађења у сливу Дунава под утицајем Ђердапске акумулације, узводно, али ни низводно од две бране Ђердап I и Ђердап II.

Поновна анализа и/или међусобно повезивање спроведених студија, имајући у виду процену главних утицаја (према њиховој важности) на смањење одрживости животне средине, може бити корисно у спречавању даљег угрожавања водног режима и живог света у комплетном ланцу животне средине у сливу Дунава.

Кључне речи: Дунав, процес, хидрологија, хидраулика, седимент, ђердапска акумулација, безбедност, сигурност, промене: глобалне, климатске