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## Comparison of Pre and Post Development Low Flow Conditions for Drina River

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### Abstract

Extreme hydrological events are significant for river basin management and very important input for future development. However, comparison between pre and post development conditions is often neglected in extreme events assessment. Analyses of low flow conditions as a significant hydrological parameter are of the great importance for transboundary Drina River Basin, since it is a source of clean fresh water with significant potential for hydropower development. Hydrological analyses presented here reflect low flow statistics comparison for pre and post development conditions. Evaluated time series correspond to periods prior and after development of existing dams, reservoirs and hydropower plants. Confidence intervals estimation for different scenarios underline uncertainty associated with low flow assessment. The results indicate importance of comparison for pre and post development conditions with respect to extreme events and generate recommendations for future hydrological analyses in Drina River Basin and other river basins.

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**Keywords:** Low flow; hydrological analyses; transboundary river basin management; uncertainty; pre and post development

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### 1. Background

Dam development is associated with many disputes in recent decades, in particular regarding high dams both existing and planned. According to Water Framework Directive (Article 4.3) water bodies associated with dams are designated as heavily modified water bodies as result of alteration by human activities and considerable change in their natural conditions [1]. On the contrary, given the benefits of hydropower, increase in energy use and objectives of EU Renewable energy Directive [2] the International Commission for Protection of Danube River (ICPDR) developed Sustainable Hydropower Development in the Danube Basin Guiding Principles to framework policies and address issues that would result in sustainable use of hydropower in Danube region [3]. In addition to hydropower production many hydropower dams provide other benefits for society, e.g., water for irrigation and regulate flow regime. Methodology introduced in this paper is based on low flow condition assessment within the international River Drina catchment based on observed flow data for pre and post development circumstances. The length of time series is from 1926 to 2014 [4] and includes data from six hydrological stations that illustrates low flow conditions for river length of over 320 km. For each dam location data series included in assessment are divided into sub data sets that reflect pre and post development with respect to high dam upstream reservoir development. For both scenarios probability of occurrence and confidence intervals are defined and data are fitted with frequency distributions commonly applied in low flow analyses. Results based on comparison between pre and post development scenarios indicate benefits of developed dams within Drina River Basin with respect to low flow conditions.

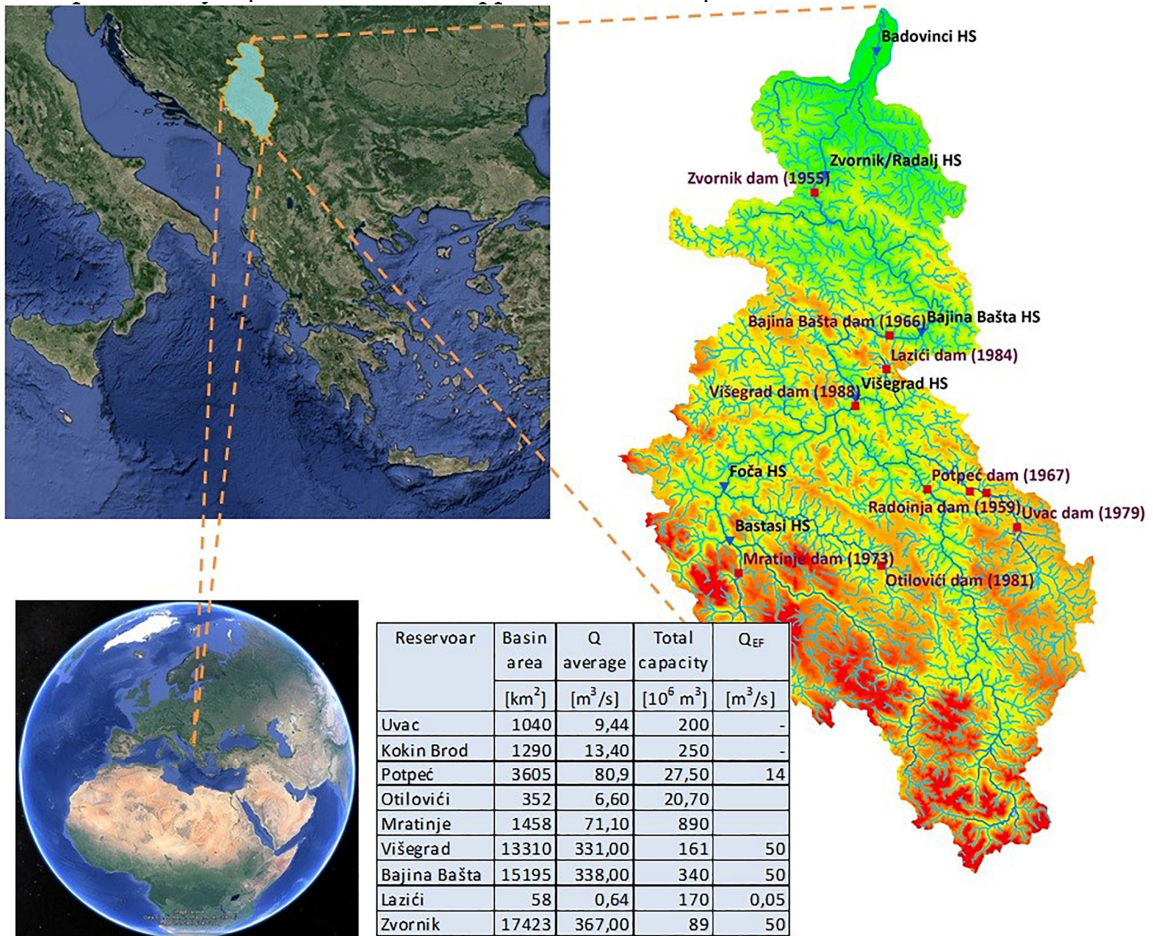


Fig. 1. Location of Drina River Basin

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