Strategy and measures for reducing of flood risk in Balkan countries

L.Jovanović

ALFA BK University & ECOLOGICA Society, Belgrade, Serbia

Article info

Jovanović, L. (2019). Strategy and measures for reducing of flood risk in Balkan countries. *Fundamental and applied researches in practice of leading scientific schools*, 33 (3), 11–14.

Accepted 30.06.2019

Emeritus prof. dr Larisa
Jovanović

ALFA BK University &
ECOLOGICA Society,
Belgrade, Serbia

The EU Flood Directive states that flood risk management plans should focus on prediction, prevention, protection and preparedness. The legal framework of flood management in all countries of Western Balkan is aligned with the EU Flood Directive. Based on the Strategy for Water Management in the Republic of Serbia up to 2034, sector reforms will be implemented in order to achieve the necessary standards in water management. Structural measures (construction of flood defenses). Structural measures identified as “non-regret” in the Action Plan will be implemented through the EU Instrument for pre-accession assistance. The existing system of protection in the Republic of Serbia relies primarily on passive measures. In spite of such important infrastructure facilities, the concept of the fight against floods has proved to be unsustainable in recent times. Whereas the meteorological and hydrological conditions cannot be controlled early warning, preparedness and flood forecasts are essential to reduce the damages of flooding.

Keywords: flood; risk reduction strategy; measures; monitoring; mapping; forecasting.

Introduction

Balkan is one of the most dynamic and complex system in the world. It is also extremely fragile and sensitive to the effects of climate change. Climate change is gradually increasing the frequency and magnitude of extreme weather events and natural disasters in the region, which has led to higher levels of risk for population in Balkan countries.

The torrential rains and catastrophic floods that raged in the spring 2014 through parts of Serbia, Bosnia and Herzegovina, and Croatia were unprecedented in the historical record of the region, going back 120 years. In just a few days, some areas received an amount of rain equivalent to one third of their annual total.

During 18 years of XXI century there were 22 floods in Balkan countries.

The aim of this paper is to assess the capacity of flood protection measures and risk reducing in Balkan countries.

The EU Flood Directive and management of flood risks in Balkan countries

Figure 1 a,b - Catastrophic floods in Balkan countries, May, 2014

Volume 33, Number 3, 2019

In order to avoid and reduce the adverse effects of floods, the European Parliament and Council adopted Directive 2007/60/EC on the assessment and management of flood risks. The flood risk management plans should take into account the specific characteristics of Western Balkan areas they cover and provide for solutions according to the needs and priorities of those areas and promoting the achievement of environmental objectives laid down in Community legislation. The Directive states that flood risk management plans should focus on prediction, prevention, protection and preparedness. The legal framework of flood management in all countries of Western Balkan is aligned with the EU Flood Directive.

Strategy of flood risk reduction in Serbia

In 2017, the Government of the Republic of Serbia adopted the Strategy for Water Management in the Republic of Serbia up to 2034. On the basis of the Strategy, sector reforms will be implemented in order to achieve the necessary standards in water management.

Significant policy measures being focused on finding ways to effectively manage the financial impacts of flood risk, considering the roles of investments in risk reduction as well as mechanisms for transferring flood risk are very important (Miskic et al, 2017). The new Water Act should be ended in 2019.

Structural and nonstructural measures of flood risk reducing

Structural measures (construction of flood defenses such as riverbed regulation and the rehabilitation or construction of dikes) were the most prevalent measures in Serbia and B&H in the previous period. Structural measures identified as "non-regret" in the Action Plan will be implemented through the EU Instrument for pre-accession assistance 2014-2020 (IPA 2) and World Bank (WB) programs. Out of 39 areas identified as "under high flood risk".

Non-structural measures are proposed for the remaining 24 areas in 19 municipalities. Non-Structural Measures encompass activities that can be categorized as non-physical (planning and designing structural measures, preparedness measures, environmental measures, government and legislative measures, financial measures) or physical (emergency response measures).

The existing system of protection in the Republic of Serbia relies primarily on passive measures. In the waters of the first order, there were about 2,500 km of embankments, linear structures at a length of about 1,275 km, 58 dams. In spite of such important infrastructure facilities, the concept of the fight against floods has proved to be unsustainable in recent times.

Comparative analysis of modern technical and regulatory solutions integrated system of forecasting and early warning of the natural disasters as well as proposals to improve the system solutions in this area is possible by emergency response measures (Šećerov et al, 2018).

Flood monitoring and mapping

Most countries have developed some sort of flood risk maps for some areas, but it is highly different how these are made. Many countries are referring to the EU Flood Directive (EU, 2007). Flood maps are still missing for many rivers or are only based on previous floods (North Macedonia). The flood risk maps will to some degree be used as a planning tool for future flood monitoring and flood protection. Figure 2 represents the monitoring scheme.

The meteorological network density is very low for Bosnia and Hercegovina and for Montenegro, also. Serbian meteorological network has 458 stations, only 28 of these are automatic (<http://hidmet.gov.rs/>) The manual stations observe 3 times per day (53 stations) or once per day (390 stations).

Table 1 - Overview of the meteorological network for Balkan countries

Country	Manual	Automatic	Data transfer	Radar(s)
Albania	120	30	Immediately - monthly	1
Bosnia and Herzegovina	24	21	Daily	0
North Macedonia	103	33	Immediately - monthly	⁽¹⁾ 2
Montenegro	29	15	Immediately - monthly	0
Serbia	458	28	Immediate	15

(1) These radars are old and/or there are problems with maintenance

Figure 2 - The scheme of monitoring of meteorological data

Hydrological network

Table 2 gives an overview of the hydrological networks for each country. Compared to the area, the highest numbers of stations are found in Albania and Serbia. Serbian hydrological network consists of 180 manual stations and 95 automatic stations.

Table 2 - Overview of the hydrological network

Country	Manual	Automatic	Hydrological data transfer
Albania	85	20	2 hours - monthly
Bosnia and Herzegovina	15	118	Daily
North Macedonia	65	10	Immediately - daily
Montenegro	3	24	Daily - monthly
Serbia	180	95	Immediately

Forecasting and modelling

Serbia have ongoing projects for implementing a national weather forecasting model. Several models are used for forecasting for different rivers (table 3). For the large ones, it is mainly a combination of statistical methods and river routing.

For small and medium catchments, the HBV model is applied.

Table 3 - Weather forecasting in different countries

	Mem ber ECM WF ⁽¹⁾	Nati onal NWP (2)	ECM WF	COS MO/ ICO N	GF S/ NC EP	D W D	W RF	Alad in/ Arp ege/ Aro me
Albania			I ⁽³⁾	I	I		X	
Bosnia and Herzegovina		X		X ⁽⁴⁾	X		X	X
North Macedonia	C	X	X ⁽⁴⁾				X	
Montenegro	C	X	X		X		X	
Serbia	X	X	X		X	X	X	

(1) X - member state, C - cooperating state

(2) X - countries having their own numerical weather prediction

(3) I - the country receives images (charts) from the large-scale forecasters

(4) X - the country receives numerical forecasts from the large-scale forecasters

Sava Super Model (Croatia)

The Sava Super Model (Sava SM) is a model, created on the MIKE11-DHI software platform, covering the Sava River Basin on the territory of the Republic of Croatia, from the border with the Republic of Slovenia to the border with the Republic of Serbia (Fig.3).

(http://meteo.hr/infrastruktura.php?section=prognosticki_modeli¶m=sava_sm)

Figure 3 - Hydrological state and prognosis: The scope of the model with indicated prognostic points

International cooperation

Flooding is quite often a transboundary issue, and all countries have the cooperation with the neighboring countries. All the assessed countries that are covered by the current extent of the European Flood Awareness System (EFAS), are now also partners of EFAS. It is a partner-based service under the umbrella of Copernicus Emergency Management Service, monitoring and forecasting flood events across Europe. This system offers probabilistic 1-10 day flood forecasts for all rivers above 2000 km² in addition to flash flood forecasts and a range of related products: forecast precipitation, remotely sensed and estimated soil moisture content and snow depth.

Serbia also has bilateral agreements with Romania and Hungary, and is partner of the Sava Flood Forecasting and Warning System (Sava FFWS).

There are also other EU driven projects that bring countries together:

- IPA FLOODS - has been developed in order to support the approximation to the EU Floods directive in Western Balkans countries. It is a Program for Prevention, Preparedness and Response to Floods (<http://ipafloods.ipacivilprotection.eu/>).
- IPA DRAM - In the same framework, the Program for Disaster Risk Assessment and Mapping (IPA DRAM) contributes to enhance the capabilities of the partner countries to strengthen disaster risk management (<http://www.ipadram.eu/about-the-programme/>)

Early warning system framework for Balkan cities

Early Warning Systems (EWS) can play a crucial role in mitigating flood risk by detecting conditions and predicting the onset of a catastrophe before the event occurs, and by providing real time information during an event (Fig.4).

The current level of preparedness of the Serbian protection and rescue system lags behind the estimated needs and objective opportunities available to the state, it is necessary to transform the management system from single-phase to integrated disaster risk management (Cvetkovic, Miladinovic, 2018).

In times of natural catastrophes, it is important to provide the information, as soon as possible in order to overcome the crisis and define the goals of the solution process and the tools used the crisis situation (Brzaković et

al., 2017).

Developing monitoring tools and early warning systems for alerting the population to natural disasters and for flood response requires not only meteorological and hydrological monitoring, but also specific expertise, adequate IT support and solid administrative and legal framework (Sarian et al., 2018).

The education of people in order to respond adequately or survival during the natural catastrophe events has the priority in the community (Cvetković et al., 2017). Also, we can use scientific knowledge for improving the safety of people from the disaster (Cvetković, Filipović, 2018).

Figure 4 - Model of EWS
(<http://www.urbanflood.eu/Pages/aboutus.html>)

Meteoalarm EU

provides the most relevant information needed to prepare for extreme weather, expected to occur somewhere over Europe (today or tomorrow). This information is presented consistently to ensure coherent interpretation as widely as possible throughout Europe and Balkan countries (www.meteoalarm.eu).

Conclusion

The focus of Balkan countries Strategy of flood risk reducing is the developing of catastrophe prediction, risk zones protection and preparedness, also training of citizens for emergency situations. Meteorological and hydrological monitoring can give an indication of flood risk and help in developing flood forecasts. Real-time monitoring, access to meteorological forecasts and a capacity to issue qualitative or quantitative forecasts will give more time for evacuation and installation of temporary flood protection measures along rivers. Developing comprehensive national monitoring tools and early warning systems for flood response at local and regional level requires not only an effective monitoring infrastructure for hydrometeorological variables, but also specific expertise, adequate IT and a solid administrative and legal framework.

The capacity for flood monitoring and modelling is highly different in the different countries. Some countries have a large number of automatic meteorological and hydrological stations, others are still relying on manual

stations. The main need in Balkan countries is more automatic meteorological and hydrological stations.

References

- Brzaković, M., Madžgalj, J., van Veghel, H., Brzaković, P. (2017). The importance of information in emergency situations in the function of sustainable development, *Ecologica* 88, 932-935
- Cvetković, V.M., Jakovljević, V., Gačić, J., Filipović, M. (2017). Training of citizens for emergency situations, *Ecologica* 88, 856-861.
- Cvetković, V.M., Filipović, M. (2018). Theory of disaster resilience, *Ecologica* 89, 202-206.
- Cvetković, V.M., Miladinović, S. (2018). Preparedness of Serbian protection and rescue system for implementation of integrated disaster risk management: recommendations for the research, *Ecologica* 92, 995-1000.
- Jovanović, L. (2005). The study of floods and landslides in Belgrade. 14th Meeting of the Association of European Geological Societies (MAEGS 14), Torino, Abstracts, pp. 93-94.
- Miskic, M., Corić, G., Beslac, M. (2017). Risk management of floods by insurance companies and banks, *Ecologica* 88, 850-855.
- Sarian, V., Ermakov, V., Jovanović, L. (2018). The role of earthquakes and waterfloods monitoring system (in frame of the 58th meeting of APEC, Taipei, Taiwan), *Ecologica* 92, 1001-1006.
- Šećerov, P., Madžgalj, J., Vilotijević, I., Laban, M., Rakonjac, N. (2018). Early warning system for alerting the population to natural disasters with a review of the proposal of the solution for the territory of the city of Belgrade, *Ecologica* 91, 551-554.
- Directive 2007/60/EC, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32007L0060>
- EU Flood Recovery Program in Bosnia and Herzegovina, https://ec.europa.eu/budget/euprojects/eu-flood-recovery-programme-bosnia-and-herzegovina_en
- Law on Water, Official Gazette of RS, No. 30/2010, 93/2012 and 101/2016.
- Strategy for Water Management in the Republic of Serbia up to 2034. Official Gazette of RS, No. 3/2017 (18.01.2017).
- <http://www.hidmet.gov.rs/eng/meteorologija/index.php>
- <http://www.urbanflood.eu/Pages/aboutus.html>
- http://meteo.hr/infrastruktura.php?section=prognosticki_modeli¶m=sa_va_sm
- <http://www.meteoalarm.eu>
- <http://www.ipadram.eu/about-the-programme/>
- http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108843/online_version.pdf
- <http://emergency.copernicus.eu/>
- <http://hidmet.gov.rs/>