

A review of flash flood events in Dobrogea region

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1. INTRODUCTION

Flash flood is a rapid flood generated by a heavy rainfall (very high intensity rainstorms) or a rainfall on saturated soil and occurring in a small area/basin (RDHD, 2015). This hazard produces many economic and human losses. Investigating the major floods of 1950-2005 period, Barredo (2007) found that "flash floods caused on average 50 casualties per year in Europe, 70% of the total number of deaths due to floods". The frequency of flash flood events is increasing due to climate change, deforestation and urbanization. Human development within the basins is proving to be an important influence in the behavior of rain water that runs off the terrain adding another level of modification of the previously recorded data and thus making it less accurate. Deforestation is a major factor in runoff, but other modifications of parts of the basin are equally important for the changing of runoff behavior, such as landscape management (changing perennial vegetation to grass lawns) or transport infrastructure. "Urbanization disrupts the hill slope profiles, ruptures of vegetation, compacts soils and disrupts the stream long profiles. It also changes the natural drainage patterns and increases the urban flood hazard" [1]. In 2009, Stancalie et al. show that "150 flash flood events have been observed in the last 30 years in Romania". This paper presents a review of the principal flash flood events in Dobrogea region (located in south-east of Romania) in the 2014 -2020 period. After an introduction about flash flood, its characteristics, the second part of this paper is focused on the study area. We present the main characteristics of the climate and hidrology of the Dobrogea area. In the third part we present the flash flood events occurring in Dobrogea, its characteristics and losses.

2. METHODS AND METHODOLOGIES

This study is focussed on the evolution of the flash flood in Dobrogea region. Dobrogea is located in south-east of Romania between the lower Danube and Black Sea (fig. 1).

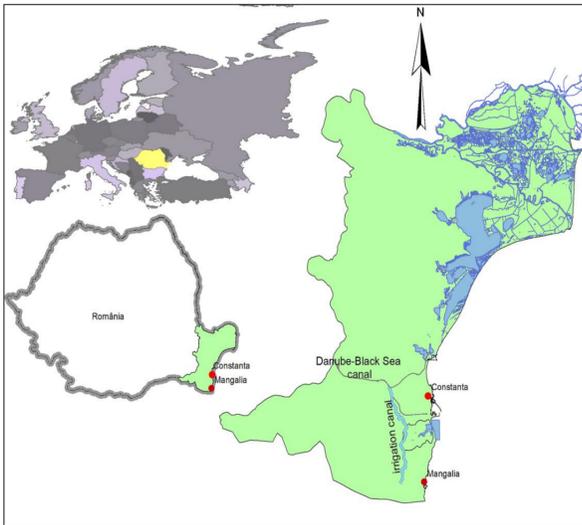


Figure 1. Dobrogea region (Maftei C., et. al. 2020)

From the climatic point of view, Dobrogea region could be divided in two regions [2]: (i) the Eastern region (20-50km on the littoral) which comprises the territory of Danube Delta, its south and the Razim Sinoe lagoons and; (ii) the western region. The climate of first region is continental influenced by the Black Sea and the second one has a temperate continental climate. The average temperature decreases from the Black Sea and Danube towards the interior: the temperature on the coast varies between 11.7°C (Constanta) - 11.60C (Mangalia) and 9.90C (Corugea – in interior of Dobrogea). The annual precipitation varies in wide limits (260–500mm approximately), the highest values being registered in the North and center of the region [3]. This area is subject to frequent droughts since it's average precipitation is much lower than the country average of 600-800mm. The Black Sea presents a strong influence on the air humidity throughout the Dobrogea region, but strongest within the first 15-25km from the shore. The hydrographic network consists of rivers that are generally under 50km long with very low multi-annual mean flows of 0.43 m³/s (Telita) to 0.64m³/s (Casimcea). The area, especially in the central and southern sector is littered with hills and hundreds of dry valleys, and generally little forest coverage.

3. RESULTS AND DISCUSSION

In recent years (2014-2020) there have been at least 27 recorded flash flood events in the Constanta county alone. This is consistent with the climate change scenario and also fits with previous studies such as the April 2003 study by Ph. Hoyois, D. Guha-Sapir (CRED-UCL) which indicated that "during the last three decades (1973 – 2002), the reported number of disasters caused by floods has dramatically increased in the UN European Macro-Region, from 31 in the priod 1973 - 1982 to 179 during the last decade"

Regarding the Dobrogea Region, according to data from the National Institute for Hydrology and Water Management in an earlier assessment of rainfall over the Dobrogea area, previous to the year 2004, the heaviest recorded rainfall was 111mm in the year 1992. In 2004 the maximum recorded rainfall was 201mm and in 2005, the locality of Costinesti and others were severely afflicted by flash floods caused by record rains (222mm over 24h recorded at Biruinta rain gauge). In the following decade, rains of 100mm and more in a time period as short as one hour have been recorded.

An analysis of the official flood data for the Constanta County shows that in the past 7 years (2014-2020) only 7.22% of total registered flood damage was due to overflowing of rivers, and that is mostly due to the river Danube causing minor floods in 2015. In the last 5 years (2016-2020) only 0.89% of total flood damage is due to overflowing of rivers, the rest is all due to flash floods and runoff. At the same time, 100% of flooded homes are due to runoff and not overflowing of rivers. This shows that the riverbed management is relatively efficient, given the weather patterns, and only runoff on the slopes and dry riverbeds (torrents) is problematic and needs to be studied further and managed better. It is thus important to properly understand methods for evaluation of flash floods and the way they adapt to different scenarios in order to get the most accurate results.

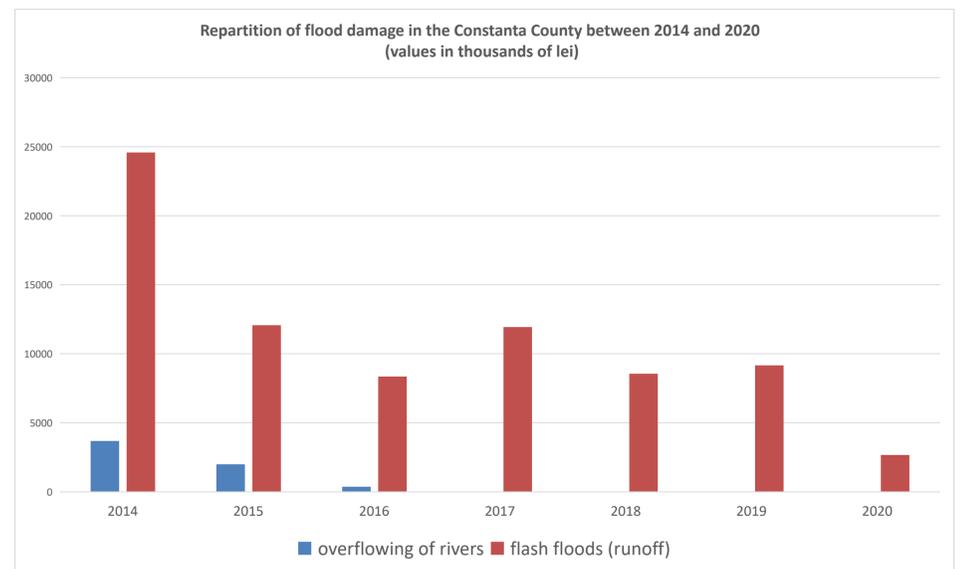


Figure 2. Repartition of flood damage in the Constanta County between 2014 - 2020

Total recorded damages due to flash floods in the Constanta county, for the specified interval was 77.22 million lei. The precipitation context was a normal one, without many record rains being registered in this interval, with one notable exception in October 2015 when the locality of Corbu was affected by flash floods caused by a rainfall of 122mm in about 3 hours (175.8mm in the 24h interval). The interesting characteristic of this particular flash flood is that the intense rain only manifested over a small area of about 10 km². [4]

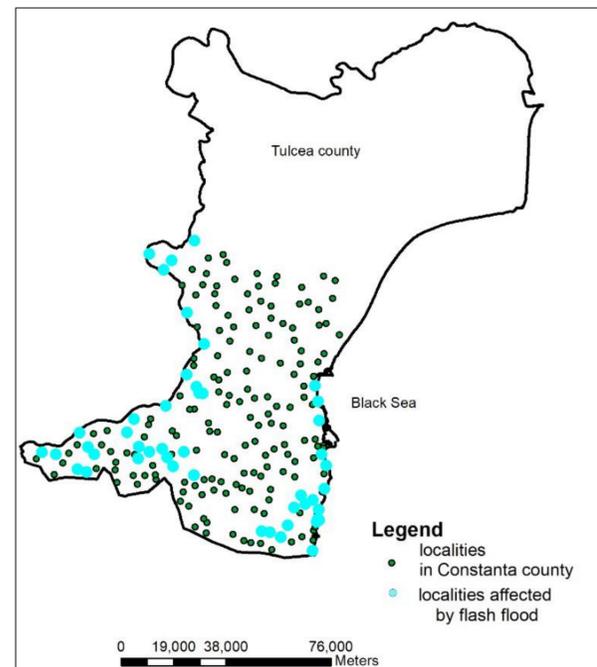


Figure 3. Repartition of localities affected by flash floods in the Constanta county - 2014

Generally, the coast, the east and south-eastern part of Constanta county are more affected by the flash floods (figure 3).

The latest research [5] demonstrates a trend in the extreme rainfall frequency occurring which could lead to an increase in the number of flash flood events. In this respect, a strategy for flash flood assessment and management must be created an implemented.

References:

- [1] Dunne.T., Leopold. L. B. 1978. Water in environmental planning. W. H. Freeman co San Francisco, CA. USA
- [2] Paltineanu Cristian, et. al. 2000
- [3] Maftei C. Barbulescu A., 2008
- [4] Official data provided by the Dobrogea-Litoral Water Basin Administration (DLWBA)
- [5] Cheroy O. Analysis of hydrometeorological data sets for 1945-2013 and projections of future climate parameters in the Danube Delta region. Expert report. 2013