



FLASH FLOODS IN THE CZECH REPUBLIC – EVENT OF 2009 & METHOD OF FLASH FLOOD RISK EVALUATION

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Abstract

Paper presents some basic outputs from evaluation of June-July 2009 flash floods in the Czech Republic. Flash flood risk evaluation methodology to be used in Flood Directive implementation process is introduced. Methodology for potential damage is also briefly described.

1 Introduction

The Czech Republic experienced catastrophic flash floods in June and July 2009. It affected several locations and in total demanded 15 victims and caused damage of 330 mil. EUR.

The project on evaluation of flash floods was made under the coordination of Czech Hydrometeorological Institute. It proved that in affected small basins (<100 km²) a causing precipitation usually prevailed for 2 to 3 hours and reached 60 to 120 mm. Evaluation proved the significant impact of initial saturation of the basin on the flash flood response.

Synoptic situation of eastern warm and moist air flow prevail for 12 day, what was extraordinary long duration in last 65 years.

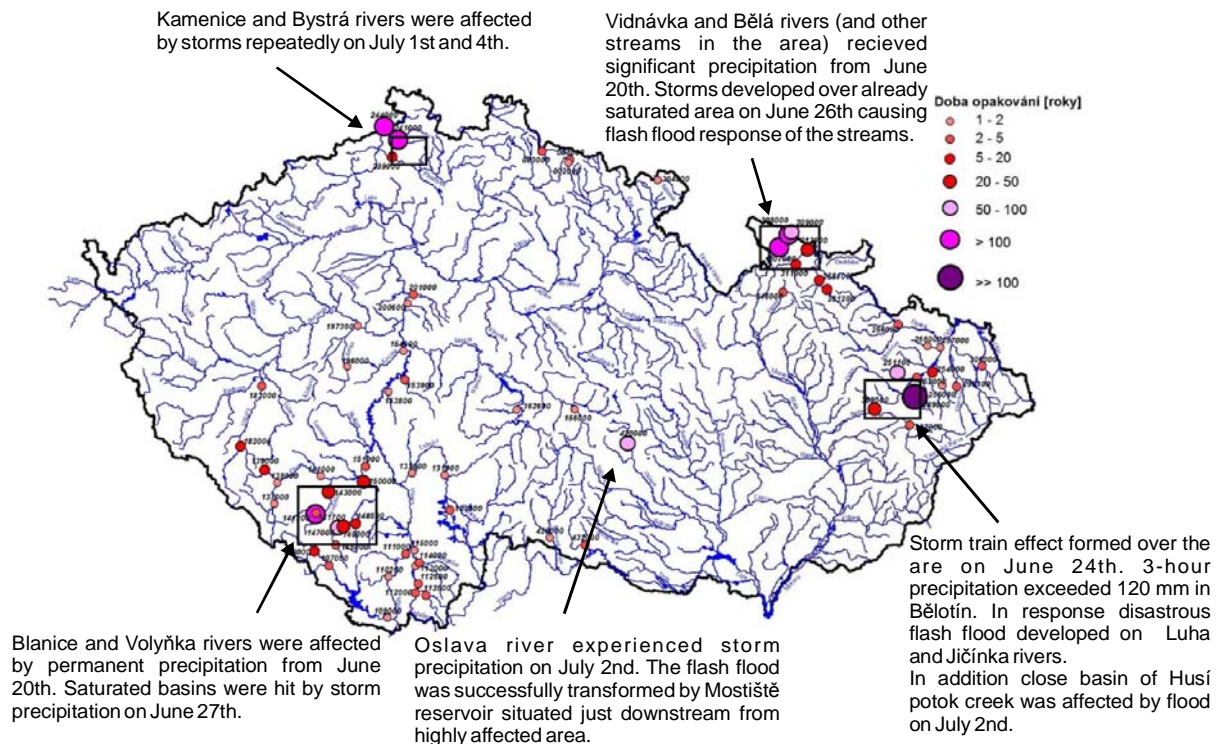


Figure 1. Overview of areas affected by flash floods in the Czech Republic in June-July 2009.

2 Flash Flood Risk Evaluation Methodology

The flash flood evaluation included (among others) the application, verification and further development of methods for flash flood risk assessment and methods for potential damage estimation.

To identify critical areas for surface runoff development the drainage areas above intravilan are selected according following criteria:

- 1 - drainage area $\geq 0.3 \text{ km}^2$
- 2 - average slope $\geq 3.5 \%$
- 3 - arable land portion $\geq 40 \%$ (not applied if drainage area $\geq 1 \text{ km}^2$ and average slope $\geq 5 \%$)
- 4 - critical criteria $F \geq 1.85$

A synthetic criteria (F) was developed to assess the hazard of surface runoff development in small basins of size $<10 \text{ km}^2$. F index is based on basin characteristics (basin area, average slope, arable land area, CN



value) and theoretical 100-year daily precipitation estimate (see equation).

Basin flash flood hazard (F) with respect to potential damage to urbanized areas is going to be used for preliminary flash flood risk evaluation (according to Flood Directive) in the Czech Republic. It should be also mentioned, that the affected area of Luha and Jičínka river basins rank among the areas of highest F values in the Czech Republic as based on first computations.

$$F = P_{p,r} \cdot H_{m,r} \cdot (a_1 \cdot I_p + a_2 \cdot ORP + a_3 \cdot CNII)$$

F critical criterion, a weights vector [1,48876; 3,09204; 0,467171], $P_{p,r}$ relative area (to 10 km²), I_p average slope [%], ORP arable land fraction [%], CNII CN value for normal saturation, $H_{m,r}$ relative value of theoretical 100-year daily precipitation (to max of. 285.7 mm).

Ministry of the Environment, 2009: Evaluation of floods in June and July 2009 in the Czech Republic. <http://voda.chmi.cz/ps09/index.html>

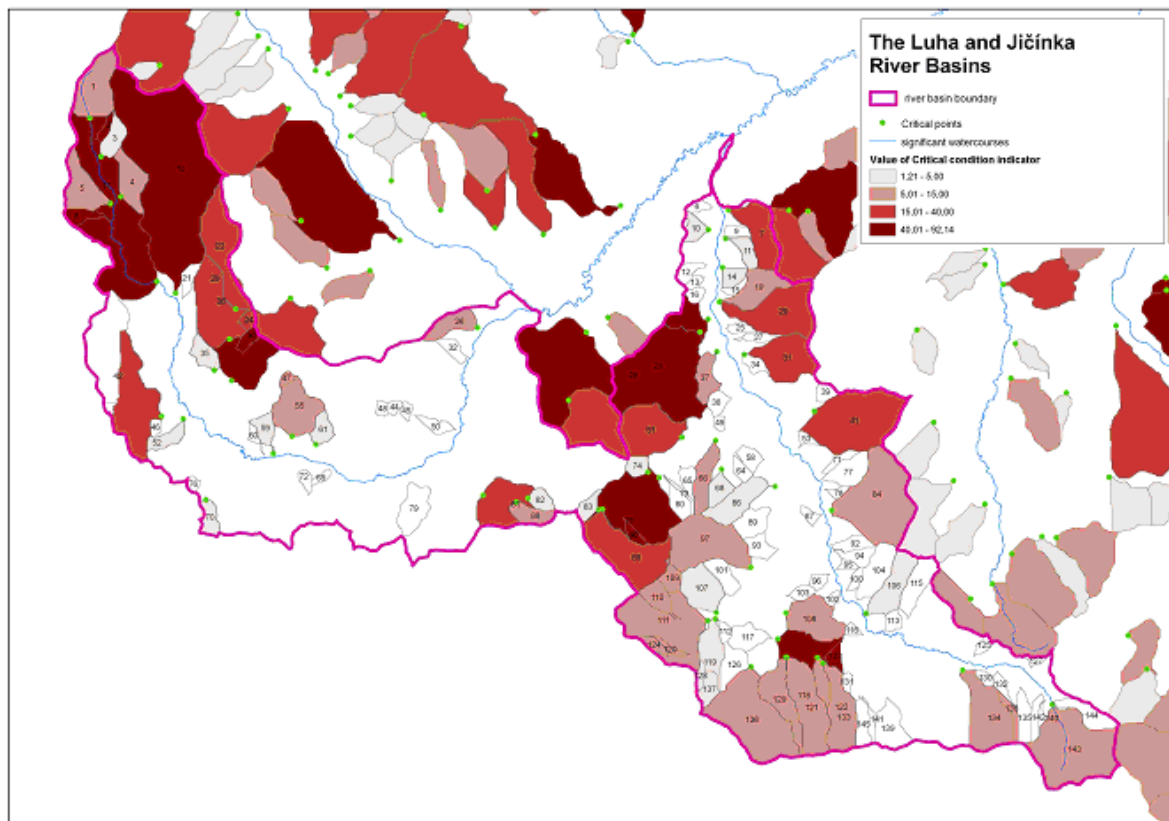


Figure 2. Concept of critical points was used. Critical points are situated at drainage paths of the area between 0.3 to 10 km² at its entrance to the polygon of intravilan (build up area). Detail map of Jičinka and Luha rivers basins shows identified critical points and evaluation of risk based on F criterion.

3 Damage Estimation Methodology

The evaluation of potential flood damages is done for larger rivers based on inundation extent delimitation and special damage curves application. The method was applied in flash flood affected area. To do that, the field research of real damage and flood inundation extent there has to be done. The method estimated 36.1 to 61.3 mil. EUR damage in Nový Jičín, while actual damage reached 64.4 mil. EUR. The underestimation was due to underestimated damage to transport infrastructure. In that case probably the dynamic power of flow increased the damage roads and bridges are often damaged or destroyed by flash floods, while static inundation of roads cause minimal damage.



4 Conclusions

Flash Floods in the CEE region are specific for its generally smaller spatial extent, but it could cause significant economic damage and lost of lives.

References

Ministry of the Environment, 2009: Evaluation of floods in June and July 2009 in the Czech Republic. <http://voda.chmi.cz/ps09/index.html>