

Flash floods, because they are unexpected, have severe consequences and there is not enough time to prepare for their occurrence, are becoming quite a serious societal problem. Therefore, the creation of a database on their occurrence and the negative consequences caused is an essential prerequisite for the systematic management of flood risk in river basins.

I have a few comments on the work.

**RESPONSE:** We would like to thank Dr. L. Solín for evaluation of our paper and raising several critical comments, which we are trying to answer below.

- *Note on flash flood definition:*

Consider flash floods without pluvial flooding (Kaiser et al. 2021) is not correct. During flash flood overland flow from a catchment, which occurs when the rainfall intensity is greater than the infiltration capacity of the land surface (pluvial flooding), is the critical component that contributes to a sudden and significant increase in the flow in the river channel and causes the water to overflow out of the channel (fluvial flooding). Flash flood is a mutual combination of fluvial and pluvial flooding.

**RESPONSE:** There exist a variety of different definitions of flash floods which are well known to the authors of this manuscript. In our study, we use the term “flash flood” as an umbrella term for all floods caused by intense rainfall events, usually of sudden onset and of a short duration, as supported by different definitions, extending those cited in our manuscript. For example, the United Nations Office for Disaster Risk Reduction (UNDRR) definitions are as follows: “A flash flood is a flood of short duration with a relatively high peak discharge in which the time interval between the observable causative event and the flood is less than four to six hours (WMO, 2006). Surface water flooding is that part of the rain which remains on the ground surface during rain and either runs off or infiltrates after the rain ends, not including depression storage (WMO, 2012).” Wheeler and Evans (2009), Miller and Hutchins (2017) and Allegri et al. (2024) consider pluvial flooding, that occurs when surface runoff generation exceeds infiltration rates and drainage capacity, often during high-intensity short-duration rainfall events, as a result from the combination of unfavourable hydro-meteorological and geomorphological conditions, including a failure of flood protection structures. A definition by United States’ National Weather Service says: “A rapid and extreme flow of high water into a normally dry area, or a rapid water level rise in a stream or creek above a predetermined flood level, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). However, the actual time threshold may vary in different parts of the country. On-going flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters.”

Based on the examples presented, it is apparent that the definitions of the individual types of floods can overlap and specifically can be selected by individual researchers. Although we agree that the flash flood is a mutual combination of fluvial and pluvial flooding, we noted on lines 71–72 that “our study **PRIMARILY CONSIDERS FLASH FLOODS DIRECTLY CONNECTED TO A WATERCOURSE**, excluding cases associated with torrential rain causing surface runoff from fields, slopes, or streets in settlements”.

**References:**

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- *Note on data collection.*

Data collection on flash floods based on information in newspapers and web portals as the authors note in the discussion is not exhaustive. As a rule, only major, catastrophic events are reported in these sources. Events who do not have a significant socio-economic impact go unnoticed. This type of uncertainty is considered by the authors to be a standard feature in such data collection. That is true, but how to deal with it, the authors do not give an answer. One way to get the most complete information about flash flooding is to analyse the frequency of declarations of Level 3 flood activity, which are usually declared by mayors of municipalities, in relation to meteorological and circulation patterns.

**RESPONSE:** As we argue in Sect. 2, we used newspapers, internet sources, CHMI data and professional papers. We doubt, that “events who do not have a significant socio-economic impact go unnoticed”, because it always depends on more circumstances leading to reporting of a particular event, and potential socio-economic impact need not to be always “significant”. Yes, working with this type of evidence in broader spatial scale as the Czech Republic can lead to loss of some information, what we are fairly saying in discussion of uncertainties. To avoid at least partly this problem, we have to use maximum evidence and sources available, which we tried to do in our study. We are sure, that our data are the most comprehensive dataset of flash floods existing in the Czech Republic despite different attempts made such flash flood set there. Moreover, we also have checked all second and third SPA (Level of flood activity) mentioned in CHMI flash flood reports – date and place using the internet to find out if there were any reports about consequences (damages) in municipalities and those with flooding were added into the database, but as we mentioned in 2.1.3 CHMI reports: “They also include instances where water levels in watercourses increased suddenly but did not overflow their banks; such cases were not included in our FF database.”

- *Note on hydrological and geographical factors influencing the occurrence of flash floods*

Compared to the meteorological and climatic aspects, the section on the influence of hydrological and geographical factors on spatial variability is treated in a very general way. Only sites with flash floods are listed and shown, and only a general statement is made that

factors such as catchment size, land use, average slope, and relief fragmentation, river network characteristics lithology are considered to be key in terms of their influence on flash floods. However, any analysis of the geographic attributes of the catchments in which flash floods have occurred, or the hydrographic attributes of their watercourses in relation to, for example, the frequency of flash floods, is entirely lacking. A key hydrological characteristic in relation to the occurrence of flash flooding is the base flow index, but this is not mentioned at all.

**RESPONSE:** Although the influence of hydrological and geographical factors is indisputable, our study is primarily focused on the analysis of the flash flood database and the information that can be extracted from it. Those general statements on the key physiographic factors are based on the findings of research carried out in the Czech Republic in 2009 after the catastrophic flash floods, that occurred in the Luha and Jičínka basins, and on the basis of which the ‘critical point’ methodology was developed (see the references in Sect. 3.3). A detailed analysis of the influence of the physiographic factors would go beyond the scope of this study. Our paper would have to be composed of a series of case studies for which both meteorological and hydrological data were available, including the information on the genesis of overland flow in locality. Yet, in the scientific literature, the lack of hydrological data is frequently discussed problem in connection with flash flood-related research. To conclude, we wanted to draw basic general findings to highlight that we are aware that the physiographic parameters play a role in runoff processes leading to the FF occurrence. In the scale of the whole Czech Republic, the performing an analysis of such type would be demanding, but it is one of the potentials of this paper that could be extended in the future work, which we are working on now in the following step (a more detailed study focused on physiographic parameters of catchments with higher values of unit peak discharge).

- *Note to victims of flash floods.*

For the sake of completeness, in the discussion of flash flood victims, it would be appropriate to also mention the victims that occurred in Slovakia. In July 1998, a storm accompanied by strong winds and hailstorms occurred in the basin of the Mala Svinka. In the affected area, more than 100 millimetres fell in about 120 minutes. Fifty Roma from Jarovnice, mainly children, were victims of the torrential wave.

**RESPONSE:** We agree that the flash flood on the Mala Svinka on 20 July 1998 is one of the largest events on small basins in Slovakia, as mentioned by Bačová Mitková et al. (2018). But we are not commenting individual deadly flash floods outside of the Czech Republic, which also concerns Slovakia. So we are very sorry, but we do not see the relevance of this information for our article.

References:

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