

### **What made the June 2013 flood in Germany an exceptional event? A hydro-meteorological evaluation.**

In this paper, the 2013 flood is compared to two large-scale summer floods (1954 and 2002) using extreme value statistics and severity indices. The focus of this paper are the floods in Germany, and the analyses are carried out with a consistent data base of precipitation and discharge data was used.

I enjoyed reading the paper, however, some issues were not entirely clear. After reading the other comments in the interactive discussion (which I did after writing down my comments) I realized that some have been mentioned there already.

In my opinion, the scientific significance can be rated 1-2, the scientific quality 1 and the presentation quality 2. As for the scientific significance, I don't know if there are any substantial new concepts or methods, but it is certainly important to understand large scale floods and the processes behind them. I liked the database, even though some issues concerning this data were not entirely clear. As for the presentation quality, there is some improvement possible. Some values were used without any further explanation (e.g., API30, return period rp5) which should be clarified, also the description of the interpolation of the 1954 precipitation is missing.

I have three larger issues, and several minor which I have listed below.

#### **Major comments**

1. You use a number of geographical locations and you also provide a map (Figure A1) in which several of these locations are shown. However, there are a number of stations mentioned in the paper not shown on this map.
2. You have used a discharge database from 1952 to 2002. Somewhere you say that you have identified 74 events from 1960-2009. But you analyze the 1954 and 2013 events. Is there some confusion with the years? Or is there a different reason? Please clarify.
3. How was the precipitation data for the 1954 interpolated? There is no information given. You have used the REGNIE data set for 1960-2009 and 2013.

#### **Minor comments**

Page 8126, lines 1-2.

*... since at least 1952*

The year 1952 is mentioned a few times in the paper. Is this year only mentioned as it is the start of the data base in the Uhlemann et al. (2010) paper? To my knowledge (or at least from the paper) there has been no flood in 1952.

Page 8127, line 14.

Blöschl et al. (2013) has been published in HESS  
Hydrol. Earth Syst. Sci., 17, 5197–5212, 2013, [www.hydrol-earth-syst-sci.net/17/5197/2013/doi:10.5194/hess-17-5197-2013](http://www.hydrol-earth-syst-sci.net/17/5197/2013/doi:10.5194/hess-17-5197-2013)

Page 8127, Line 28-29.

This hypothesis has also been one of the findings of Blöschl et al. (2013)

Page 8128, line 15

*... with the event of Uhlemann ...*

Should probably be paper instead of event.

Page 8129, line 3

Now the first point becomes clear, Uhlemann's data set starts in 1952 and has been expanded to 2009. To my understanding, you updated the database from 2002 to 2009 (and I assume, also the 2013 event). Why did you not include the years 2010-2012? Because it is raw data? Also for the 2013, you have used raw data (see page 8130, line 18).

Page 8129, line 11

You say that there are 74 large scale floods in Germany in the period 1960-2009. Does this number include the 2002 event? Why are the 1954 and 2013 events not included in this number? What is the reason for this? You use the number 74 several times throughout the paper.

Page 8129, line 21

The 1954 event is not included in the data set? How did you analyze the precipitation data for this event? Please clarify.

Page 8129, line 28

Maybe it should be „underestimates“.

Page 8130, line 9-11

*Compared to the past ... this persistency is not significant and cannot explain the extraordinary situation in 2013.*

From this I would say there was at least one other event with a more significant persistency of the weather patterns. Could you clarify and give some more details?

Page 8130 – Section 2.3

In both, sections 2.1 and 2.3, you talk about hydrological data. Maybe you can combine these two sections.

Page 8132, line 7

What about the 1954 event? And the 2013 event?

Page 8132, line 15

Is there a reason for using API30? Why not API20 or some other period?

Page 8132, line 19

Where does the factor 0.9 come from?

Page 8132, line 24

What about the 1954 event? And the 2013 event?

Page 8133, line 5

Why 5 year return period?

Page 8134, line 5

See previous comment.

Page 8134, line 17.

Here you use the annual maximum series of daily mean discharge. In section 2.1, the database was compiled using the peak over threshold criterion. Does this mean, you reduced the number of 74 flood events to 60 (annual maximum values)?

Page 8134, line 20

Why 5 year return period?

Page 8137, line 12

Could you add some details about the size of the upper Elbe and upper Danube catchments in the figure caption? Or add a table with area of the catchments, mean precipitation, precipitation during the 3 events, ...

Page 8137, line 26

If possible, add the location of the station Aschau-Stein in figure A1.

Page 8138, line 6 (Figure 5)

Please use the same legend for all three subfigures, so that in each figure you have the same color for days 1, 2, 3,... 7 from the first day? The right figure will not change, as the difference between day 1 and day 7 is the biggest time difference, but for the middle (only little change) and left figure (big change) it will. I think, the patterns will not change much, but it will be more easily comparable and most likely, the homogeneity will be visible even better.

Page 8138, line 22.

Can you give a description of the LCL? What is a very low LCL, what is a high LCL?

Page 8138, line 24.

You can tell from the figures where Munich and Stuttgart are. But how about Meiningen and Kümmersbruck? Is it really necessary to name these stations? If possible, add the location in figure A1.

Page 8138, line 26ff

... *precipitable water pw ... was large ...*

What are typical values for pw, why is a pw of 25 mm large? Could you add some details?

... which is far outside the interquartile range ...

Could you give the values in this paper? I know that I could check the values in Kunz (2011).

Page 8139, line 15.

Again, where exactly is Aschau-Stein?

Page 8140, line 2.

Just as the previous comment, where is Zinnwald-Georgenfeld?

Page 8140, section 3.3.1

You show that the API 30 is high over large parts of Germany, and you give estimates of the return periods of the API, which are on the order of 5-30 years in large parts of Bavaria and 50 and more in the North of Bavaria. In the report of the BfG (Das Juni-Hochwasser des Jahres 2013 in Deutschland. BfG Bericht Nr 1793, Bundesanstalt für Gewässerkunde, Koblenz), there is a figure with results of soil moisture simulation. From this figure I would say that in the Northern parts of Bavaria the soil moisture was the highest value in the period 1962-2012. This would mean, that the return period was around 50 years. The numbers correspond approximately.

My question is – are the results of your APIs and the soil moisture values of the BfG comparable?

Page 8143, line 5

... *comparison to other large-scale summer flood events...*

Why summer flood events? First, you mentioned POT, then AMS and now summer flood events – did you just concentrate on summer floods?

Page 8144, line 12

... *less extended in August 2002* ...

„in“ is missing

Page 8145, line 23.

... *above around 40 increase* ...

Increase - should be plural, not singular.

Page 8145, line 11, Figure 12

Should be upper right corner.

Page 8145, line 27.

ERMS=13.2 What does this value say? Where does it come from?

Page 8147, line 4.

1952? Again, the beginning of the Uhlemann data set?

Page 8147, line 10.

*In contrast to ... Blöschl et al. (2013)...*

I think this statement needs to be clarified for several reasons.

First, you state that „initial wetness was a minor factor for the 1954 flood in Germany“, whereas Blöschl et al. just looked at the Danube Basin. Second, Blöschl et al. said that the defining feature of the event was the spatial distribution with high precipitation (which is in line with your results), however, there was a pre-event which increased soil moisture. E.g., the Inn river had two peaks, one smaller (the pre-event) and the more extreme second event. The Danube in Germany just has one peak during this event. Third, you looked at the API30 and figure 7 clearly shows values of up to 150 mm along the alpine ridge in an area that is even larger than 2013. Your API30 includes the first block of precipitation mentioned before. Could you comment on this and clarify this in the paper?