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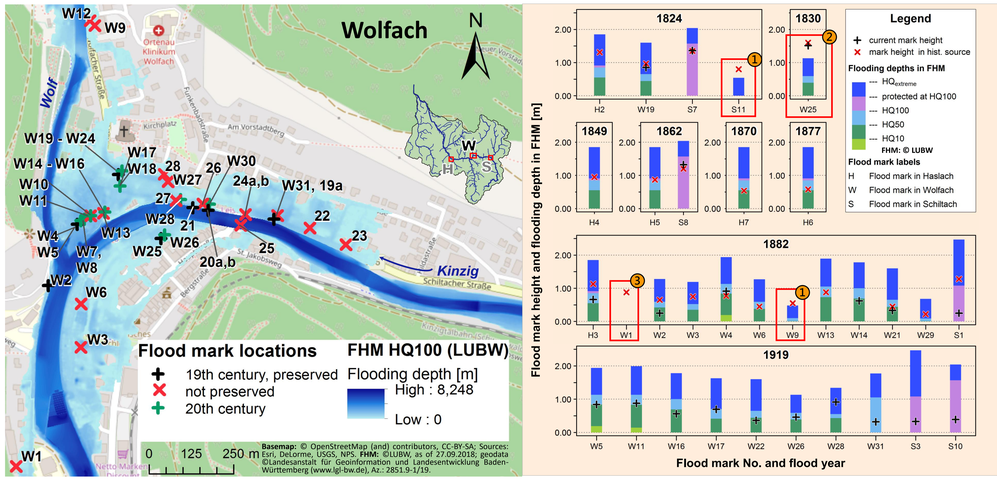
This multi-temporal study utilized cross-checking with written documents to assess the preservation of flood marks and involved uncertainties.

Found to be a valuable source of information, flood marks can help to verify the modelled flood hazard maps, if interpreted carefully.



A large number of preserved and lost flood marks document flood events in the Kinzig catchment (here: flood marks and the HQ100 flood area in the community of Wolfach, *left*). A comparison between the flood mark heights (*right*, selection) and the flood hazard maps (FHM) flooding depths illustrates wide agreement as well as a few exceptions (*numbered*).

A critical evaluation of present flood hazard maps in Southwest Germany using epigraphic marks and historical written data

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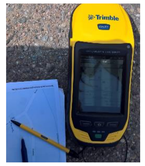
Methods



- **Archives and data research:**
  historical documents on flood events, (early-)instrumental data, FHM
- **Mapping of flood marks & cross-checking with documentary evidence**
  in 3 communities in the middle and upper catchment
- **GIS-analysis**

Motivation

Flood marks can increase public risk awareness and can thereby create a collective risk memory.

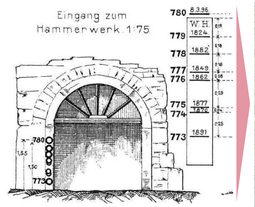
They also represent a valuable source of information on historical flood events which may help to achieve a more comprehensive flood risk management.

However, flood marks provide relatively rudimentary information and can be affected by various error sources.

Results

More than 60 marks mapped or checked related to **14 floods in 1824—1991.**

The **preservation is rather limited** due to construction, weathering, etc.



Above: Flood marks in Haslach (ZMH 1908).

Still preserved?	19th century flood marks
✓	~ 35 %
×	~ 65 %

A comparison between mapped marks and historical documentation disclosed **occasional flaws** in the documents and **relocation of ~ 30 % of the preserved marks**.

Flood mark position and relative height is nevertheless mostly in accordance with FHM flooding depths, particular for more recent events. **Exceptions** represent ① extreme floods along tributary rivers, ② major ice-jam floods and ③ (local) river construction effects.

Objectives

1) A multi-temporal study on flood marks to test for their credibility and temporal continuity
2) Comparing flood marks with current modelled flood hazard maps (FHM)

Study site

Kinzig catchment

- > Upper Rhine tributary coming from the Black Forest
- > Well-documented flood history
- > River rectification during the 19th century; timber rafting until 1896
- > Long systematic discharge record

Conclusion

The Kinzig catchment contains an outstandingly high number of flood marks. Yet, many documented marks are not preserved any more or have been modified or relocated. Therefore, the **available written documents are an invaluable source**.

Both the **high agreement of flood marks and FHM** and the **plausible exceptions** point to the undeniable value of flood marks. Yet, the 19th century flood frequency is relatively high posing the question of **whether the FHM might still underestimate flood hazard.**

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FHM (as of 27.09.2018): data provided by the UIS (*Umweltinformationssystem*) of LUBW (*Landesanstalt für Umwelt Baden-Württemberg*); geodata © LGL (*Landesanstalt für Geoinformation und Landesentwicklung*) Baden-Württemberg (www.lgl-bw.de), Az.: 2851.9-1/19.

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Maps and plots were created using ArcGIS and R (R Development Core Team (2008). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

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