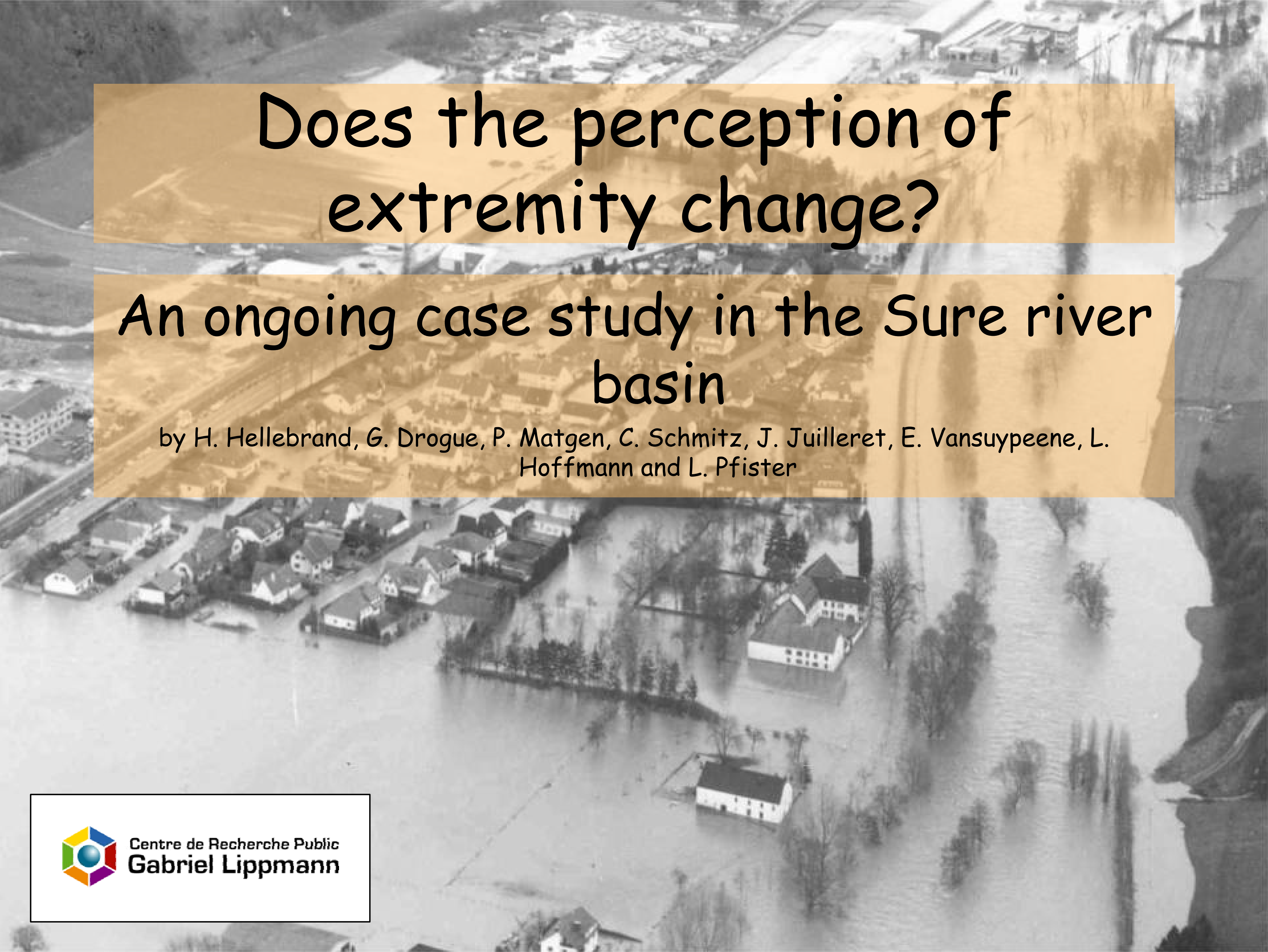


Does the perception of extremity change?

An ongoing case study in the Sure river basin

by H. Hellebrand, G. Drogue, P. Matgen, C. Schmitz, J. Juilleret, E. Vansuypeene, L. Hoffmann and L. Pfister

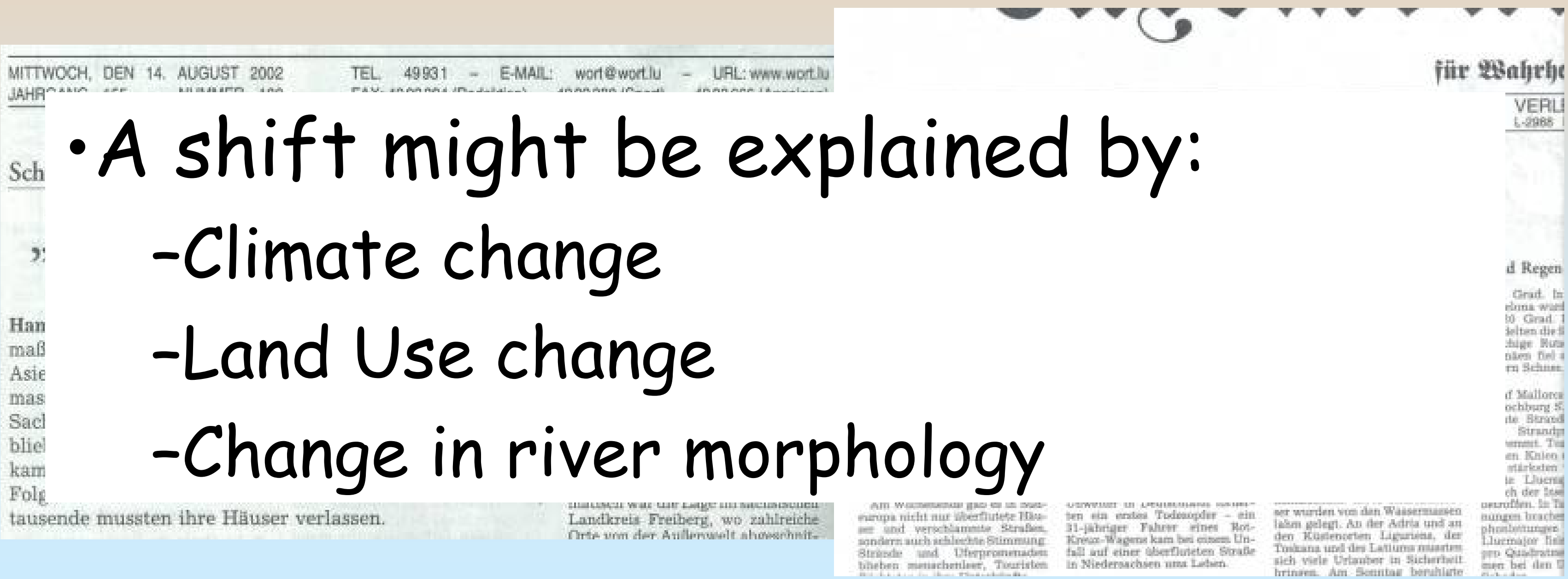
Centre de Recherche Public Gabriel Lippmann

Outline

- Introduction
- Methodology
  - Models, maps, flood hazard and vulnerability assessment
- Preliminary results
  - Maps, flood hazard, security deficit
- Conclusion
- Perspectives

Introduction

- Why this study?
  - Recent floods in Luxembourg
  - Is there a shift in flood frequency?



- A shift might be explained by:
  - Climate change
  - Land Use change
  - Change in river morphology

Observed changes

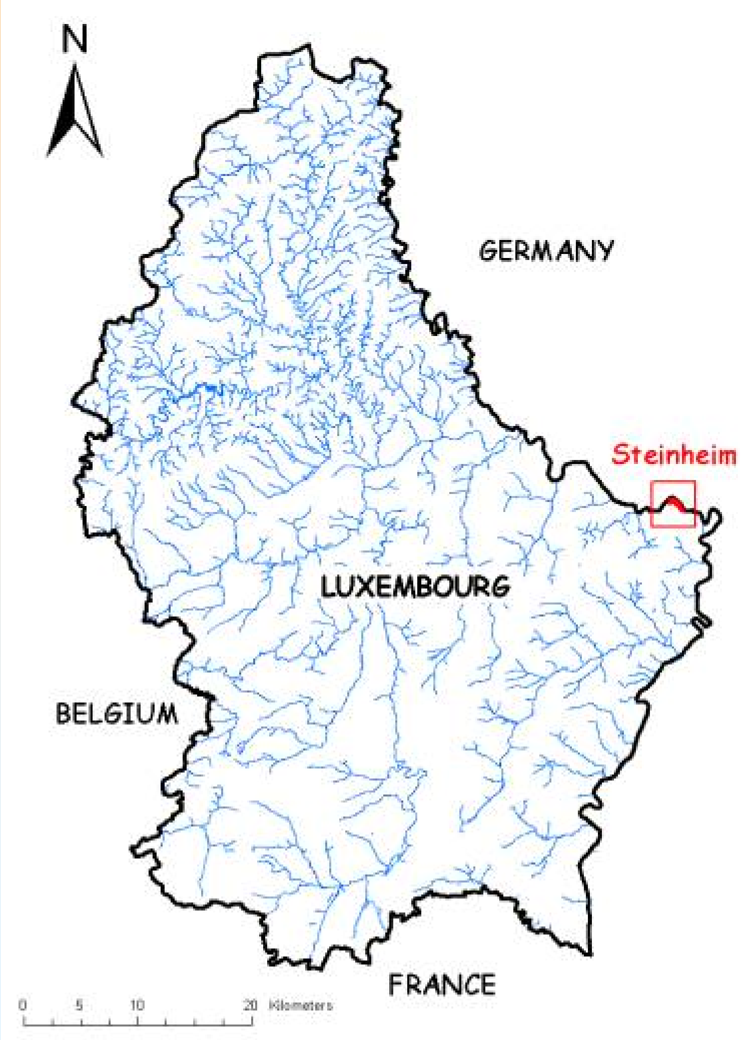
- Climate change (Saar-Lor-Lux region)
  - Increase of winter rainfall in last 50 years
  - Increase of westerly fluxes bringing storm fronts
  - From 19th to 20th century clear trend towards long lasting and intense westerly rainfall events
- Land Use change (Sure basin)
  - Increase of urban area
  - Increase of drained agricultural lands
  - No observed change in forest area
- Changes in river bed (Alzette basin)
  - 55% loss of floodplain in last 200 years

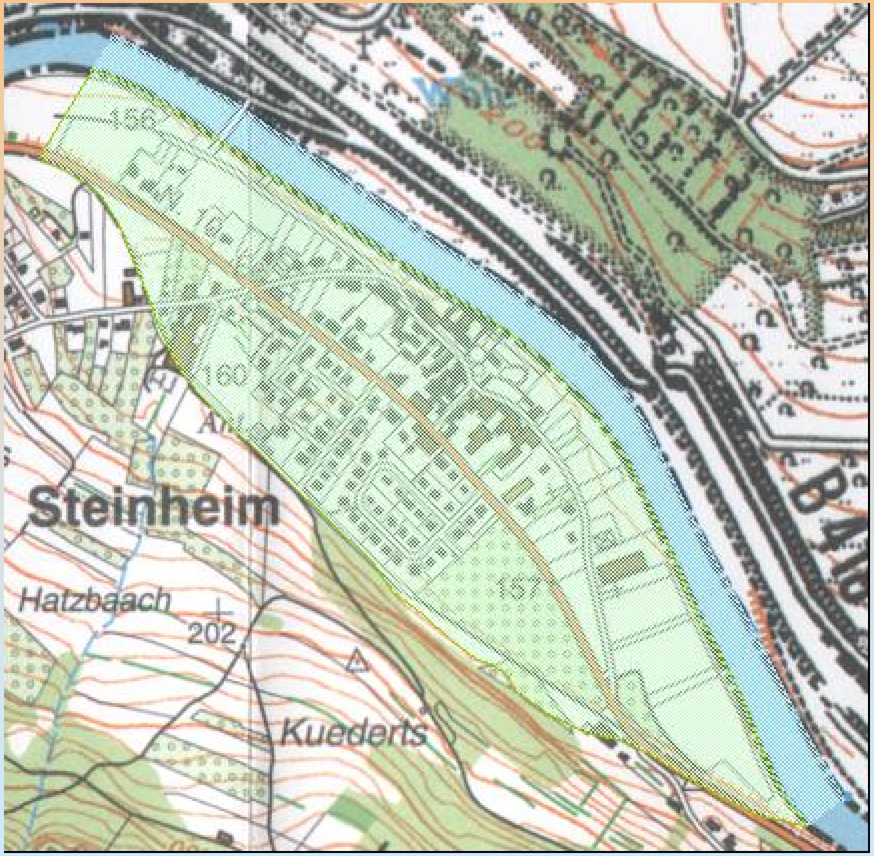
However

- Effects of climate change are strongly influenced by topography
- Effects of urbanisation only strong in headwaters
- Interaction between the effects make it difficult to predict changes in flood frequency

Study area

Stretch of the Sure river at Steinheim (Luxembourg)





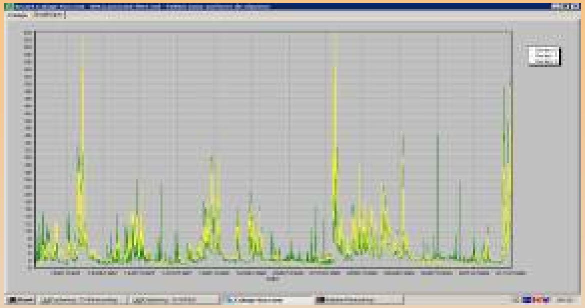
Methodology

outline

- Use of hydro-climatological data sets as input for models
  - Peak discharges from 1870-1920 (Steinheim)
  - Daily rainfall from 1966-1996 (Sure basin)
  - Hourly rainfall (Sure basin) + discharge (Steinheim) 1996-2003
- Calculation of flood maps
  - Flood frequency
  - Flood hazard
- Assessment of urbanisation & security deficit

Methodology

modelling



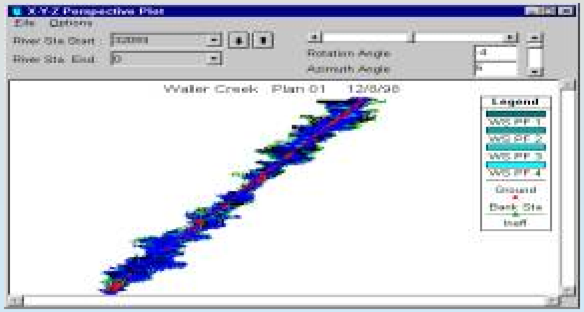
1. Rainfall runoff model (HBV)
   - Calibration with hourly 1996-2003 discharge data

2. Rainfall data
   - 1966-1996 daily rainfall as input

19/01/1873	870	13/12/1966	718
28/01/1877	514	21/02/1977	565
22/11/1878	510	04/02/1980	483
27/12/1879	582	06/01/1982	454
30/12/1880	749	27/05/1983	495
12/12/1881	1014	07/02/1984	689
27/11/1882	521	03/02/1988	464
04/11/1883	760	04/01/1991	461

3. Two peak discharge data series: 1870-1920

   1966-2003



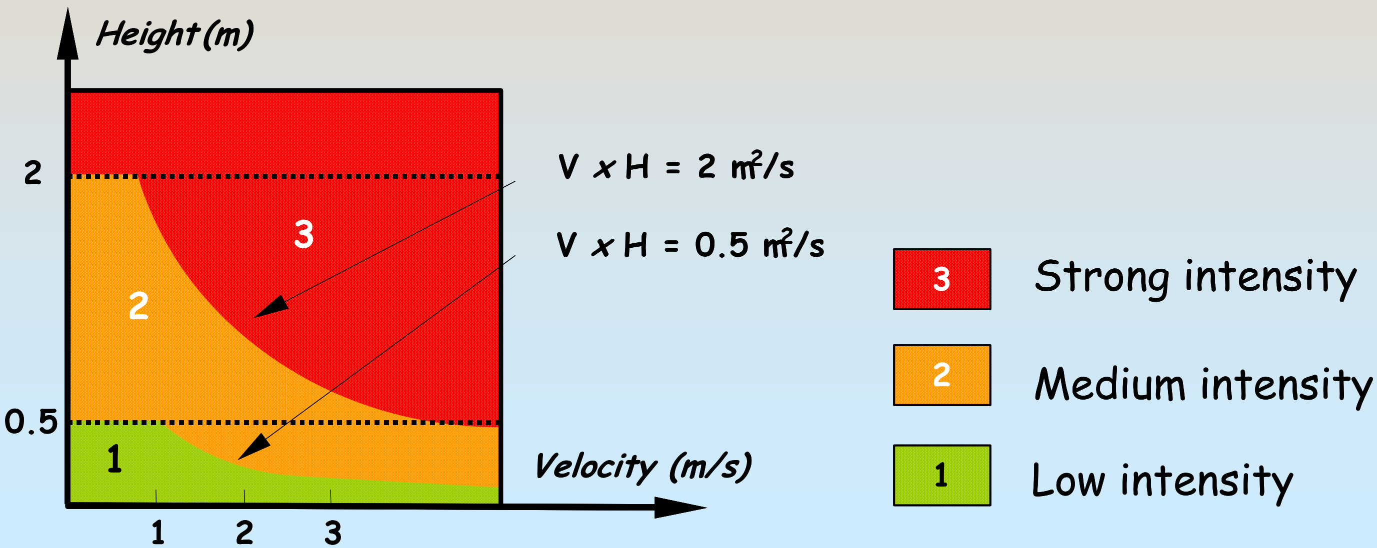
4. Hydraulic model (HEC-RAS)
   - Calculation of flood extension maps

Methodology

calculation of flood hazard

According to a Swiss methodology (developed by OFEE, 1997), a flood hazard should be expressed in terms of flood intensity. The flood depth [m] and the flood velocity [m/s] have to be considered to assess the flood intensity of a given flood event.

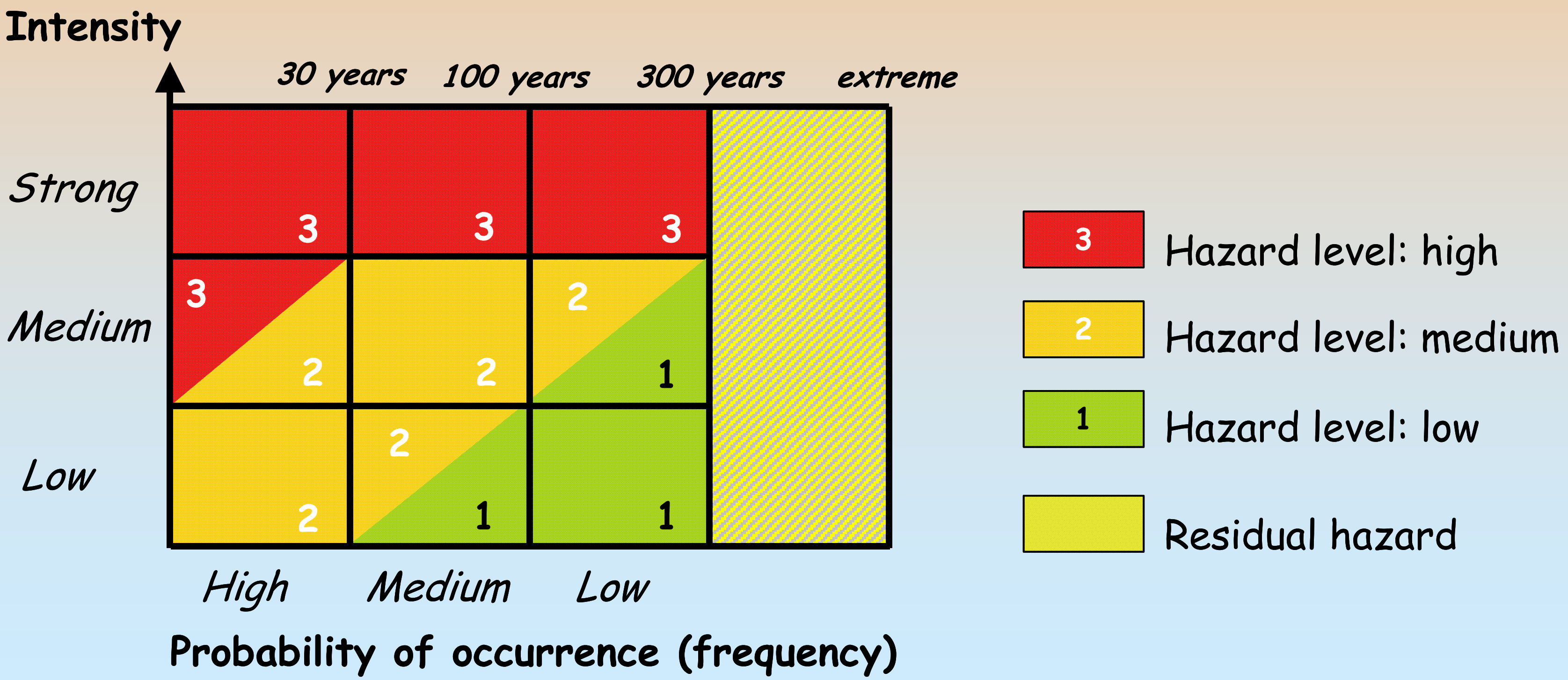
Flood intensity	Level	If V < 1 m/s	If V > 1 m/s
Strong	3	2.0 m < H	2.0 m^2/s < HxV
Medium	2	0.5 m < H < 2.0 m	0.5 m^2/s > HxV < 2.0 m^2/s
Weak	1	0.0 m < H < 0.5 m	0.0 m^2/s < HxV < 0.5 m^2/s



Methodology

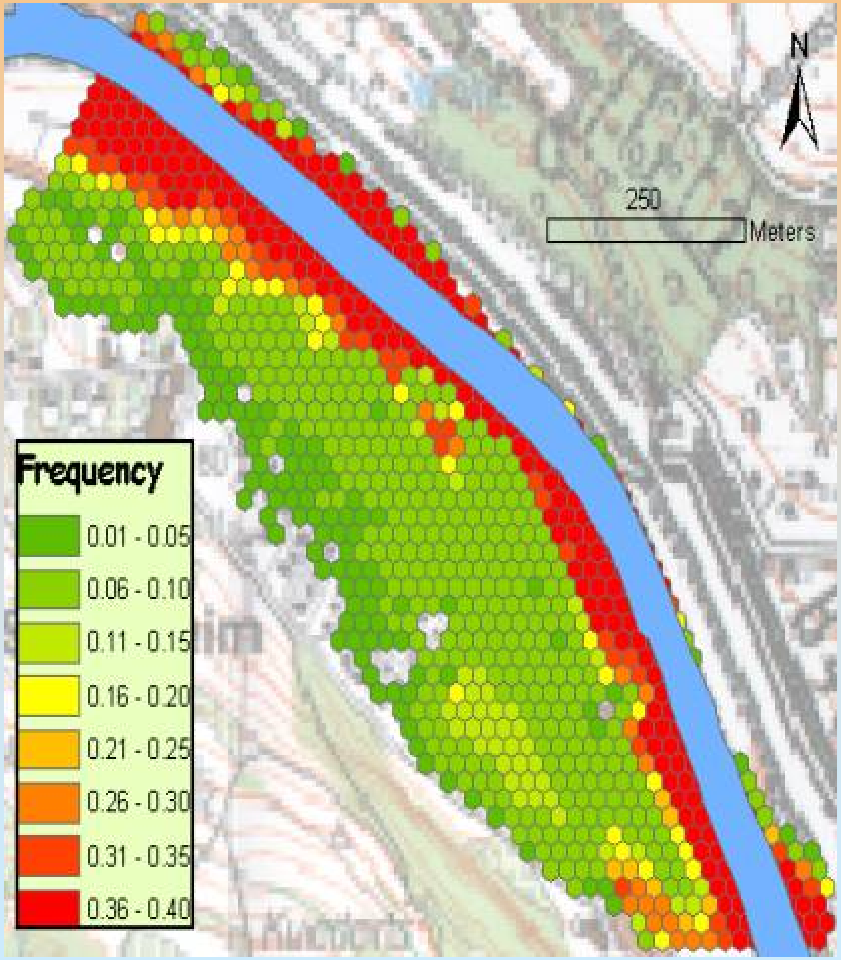
calculation of flood hazard

- By comparing flood intensity maps with the return period of peak discharges the flood hazard can be assessed

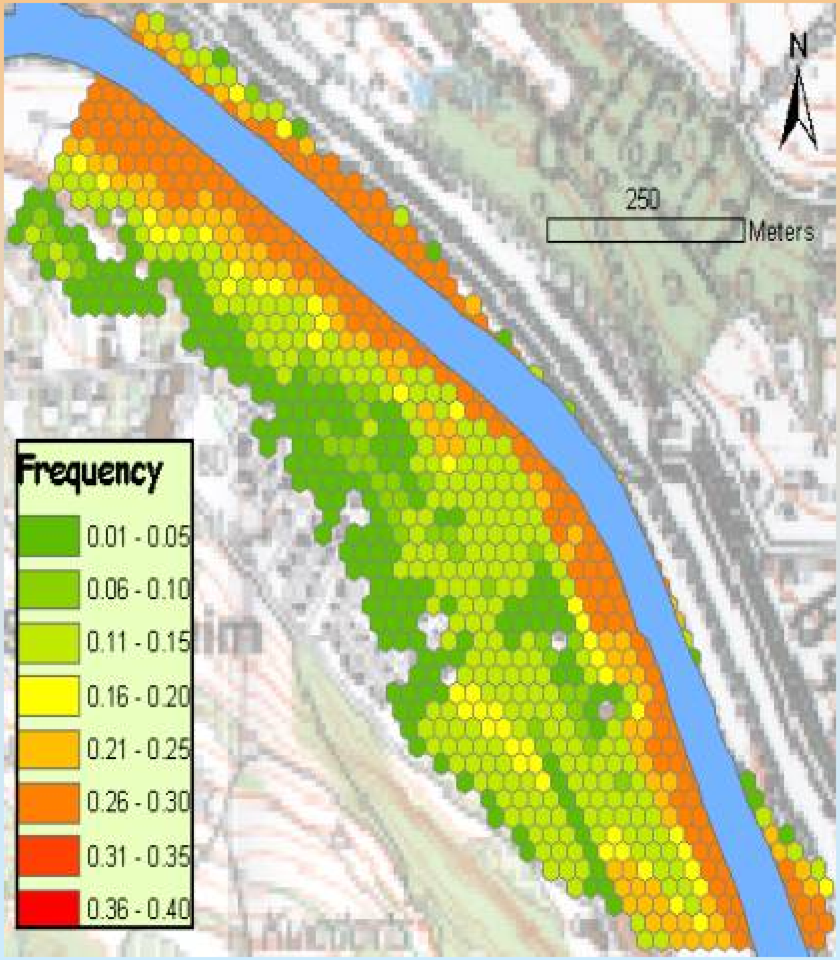


Preliminary results
flood frequency maps

1870-1920

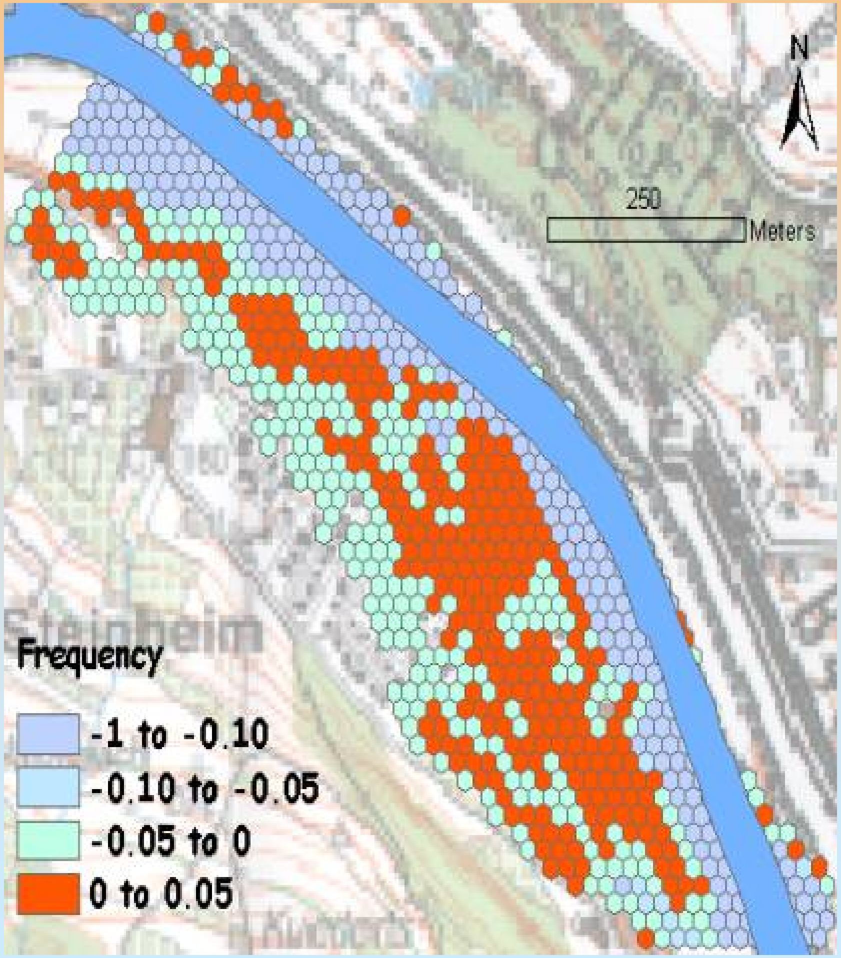


1966-2003



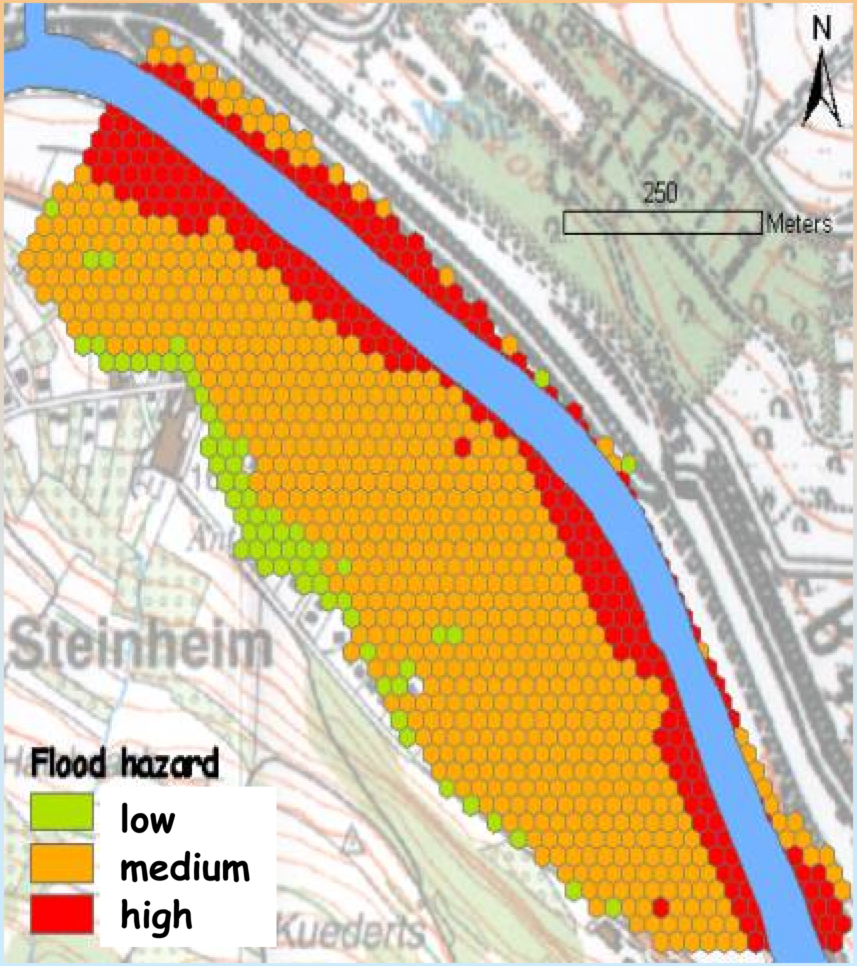
Preliminary results
flood frequency maps

frequency change

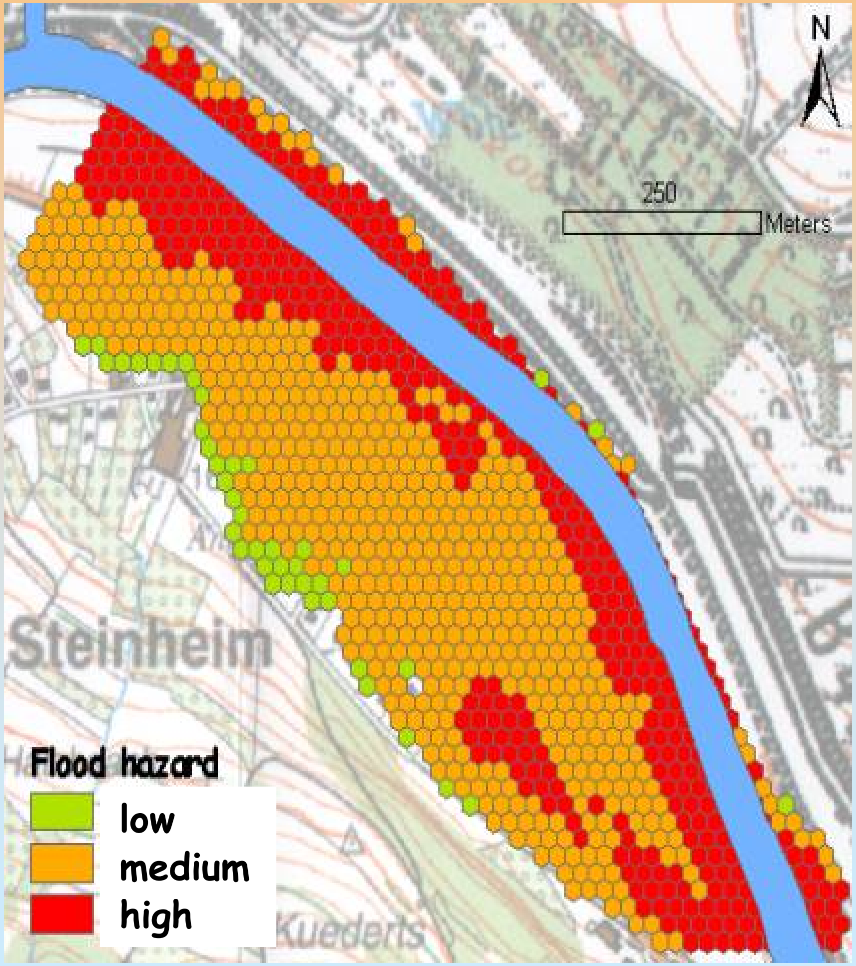


Preliminary results
flood hazard maps

1870-1920



1966-2003



Preliminary results
urbanisation of Steinheim

1775

1910

1952

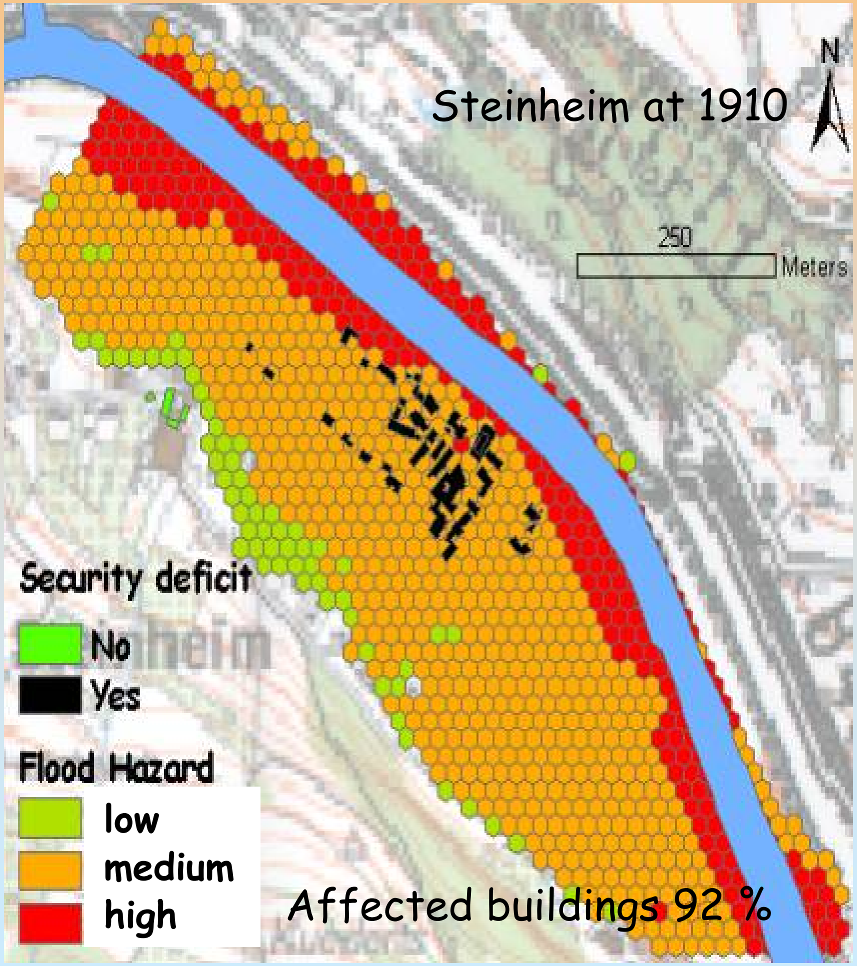
1993

2002

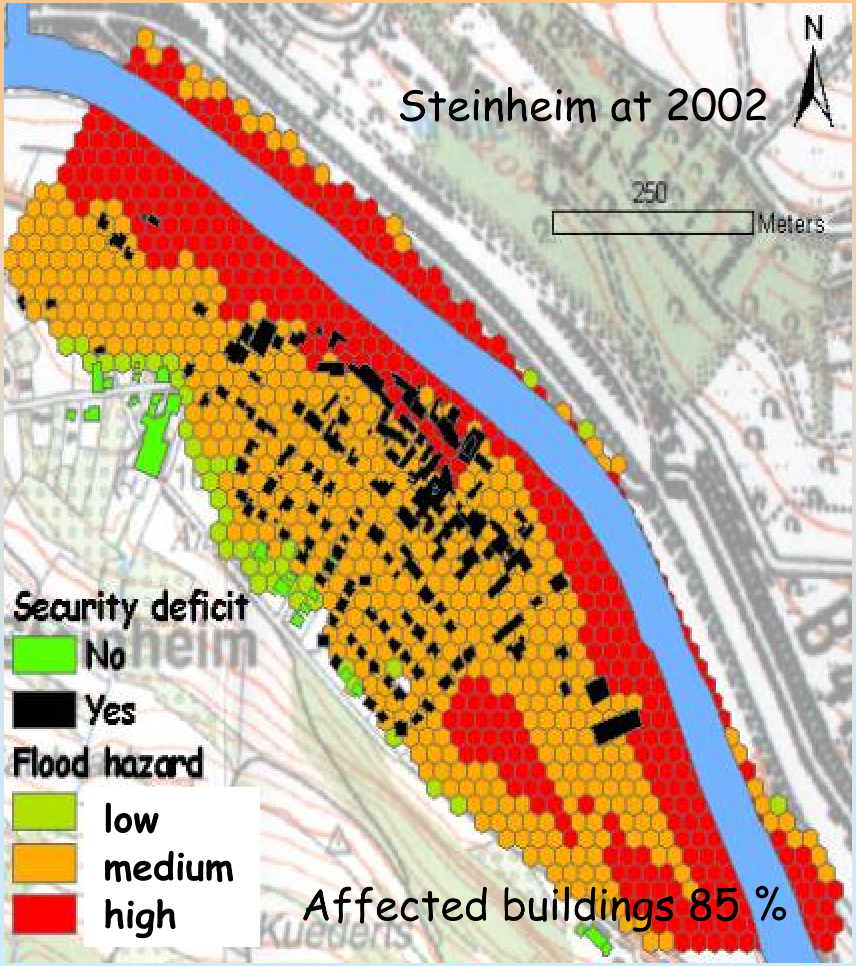
From 1775 to 2002 the urbanised area increased almost six fold

Preliminary results
security deficit maps

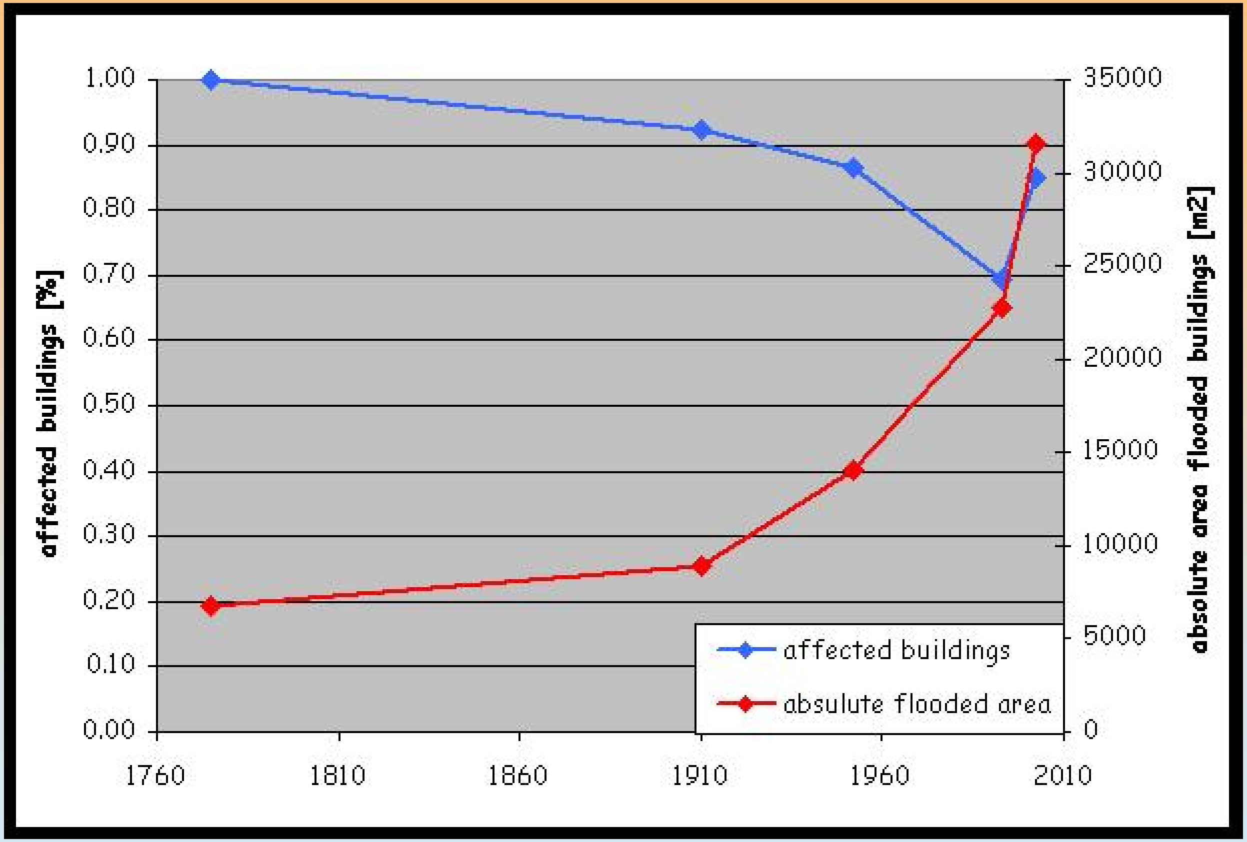
1870-1920



1966-2003



Preliminary results
Affected buildings



Decrease of percentage of affected buildings till 1993

Increase of vulnerability

Conclusion

- Change of flood frequency:
  - Less medium floods
  - Slight increase of major floods
- No major change in flood hazard
- Decrease of percentage of affected buildings
- Increase of total vulnerable area

Perspectives

- Difficult to assess a change in flood frequency with respect to climate-, land use- and river morphology change
- Perception has changed
  - From small village (nobody cared) to large village (more people involved)
  - Change from flood awareness to no flood awareness to flood awareness

Questions