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Facts and findings on the 2021 floods in north-west Germany

International water security symposium

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- Geography
- Meteorology
- Hydrology
- Dams / Reservoirs
- Documentation of Damages
 - Infrastructure
 - Buildings / bridges
 - Erosive Processes
 - Personal
- Room for the River
- Conclusions



(Brüll, 2021)

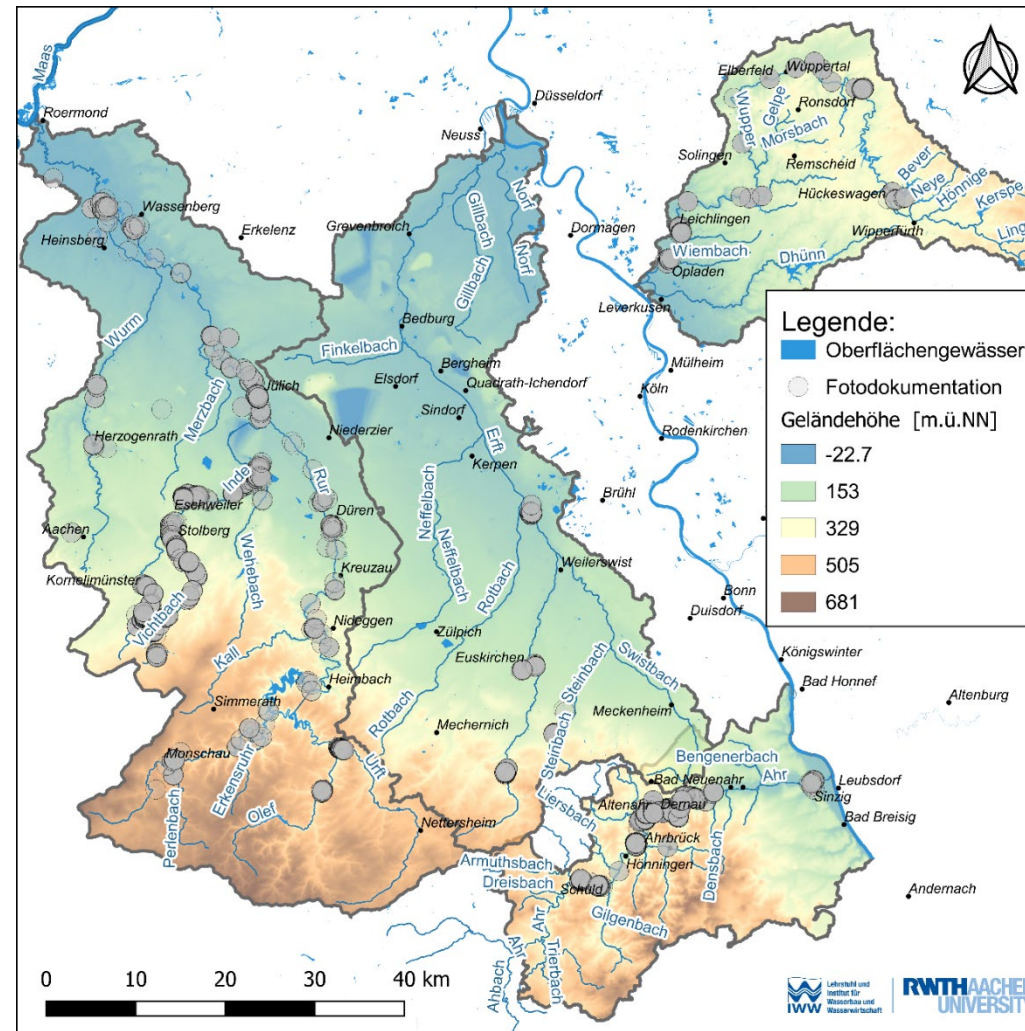


(diercke, 2022)

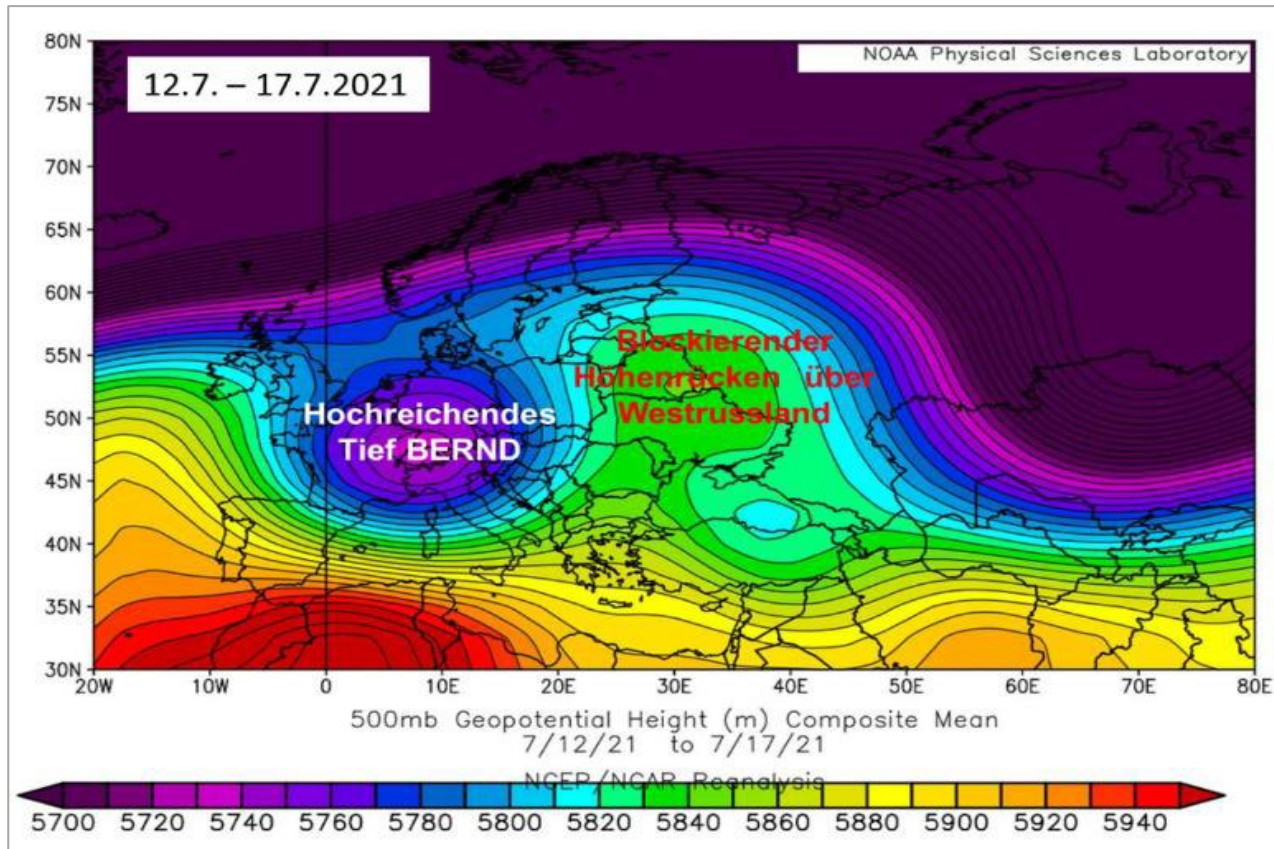


(bpb, 2021)

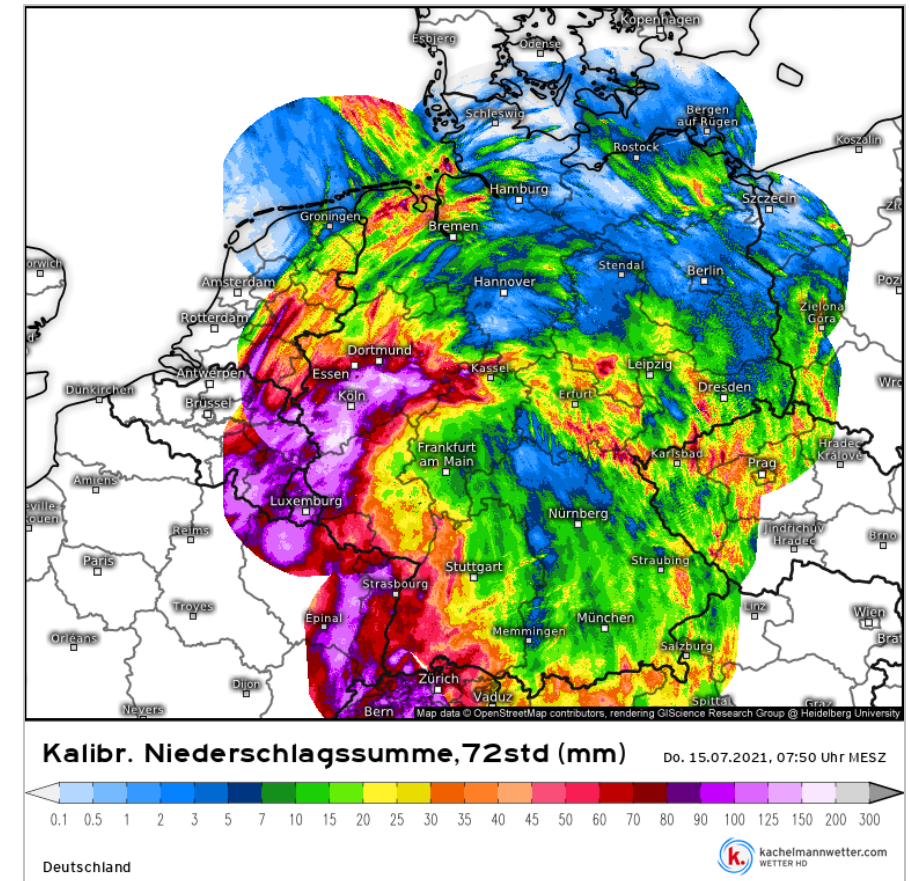
Flood documentation of IWW



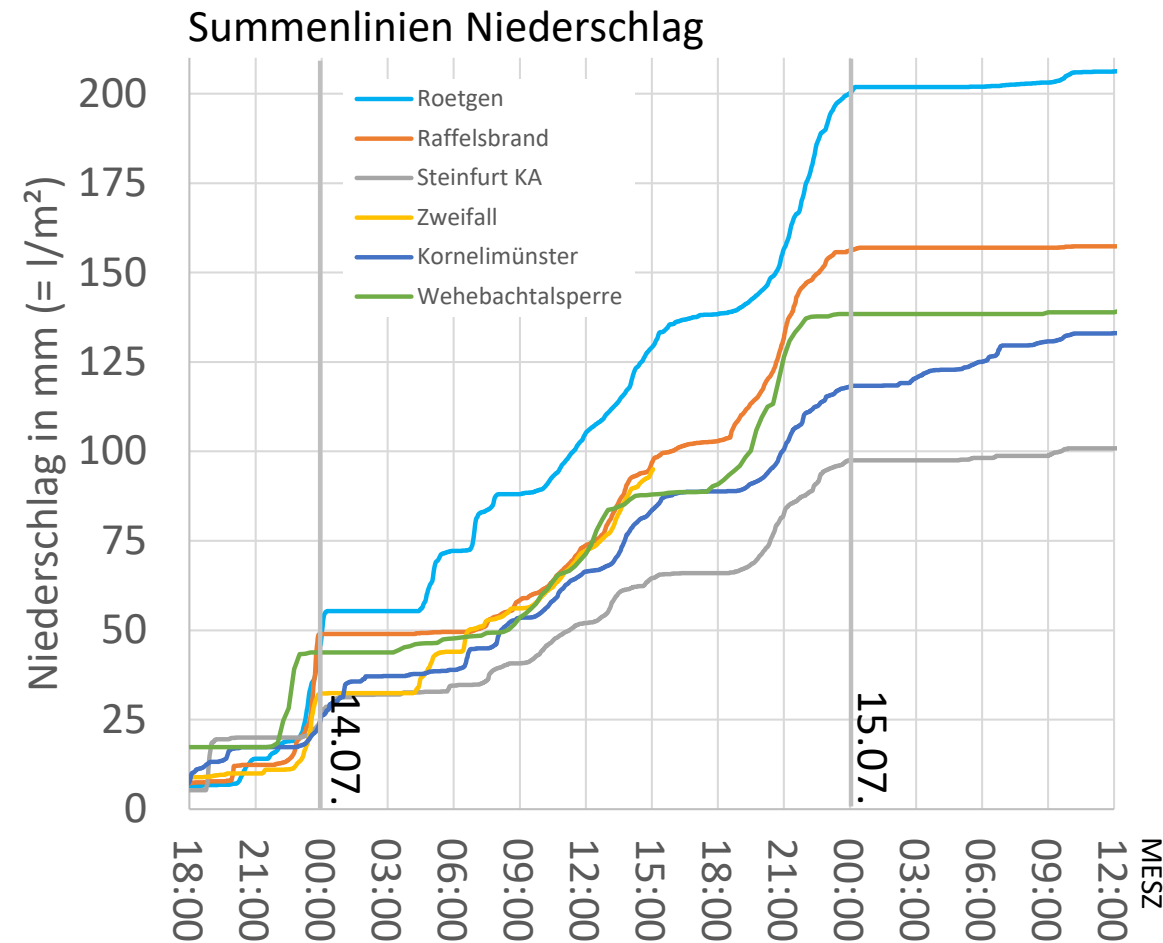
(IWW, 2021)



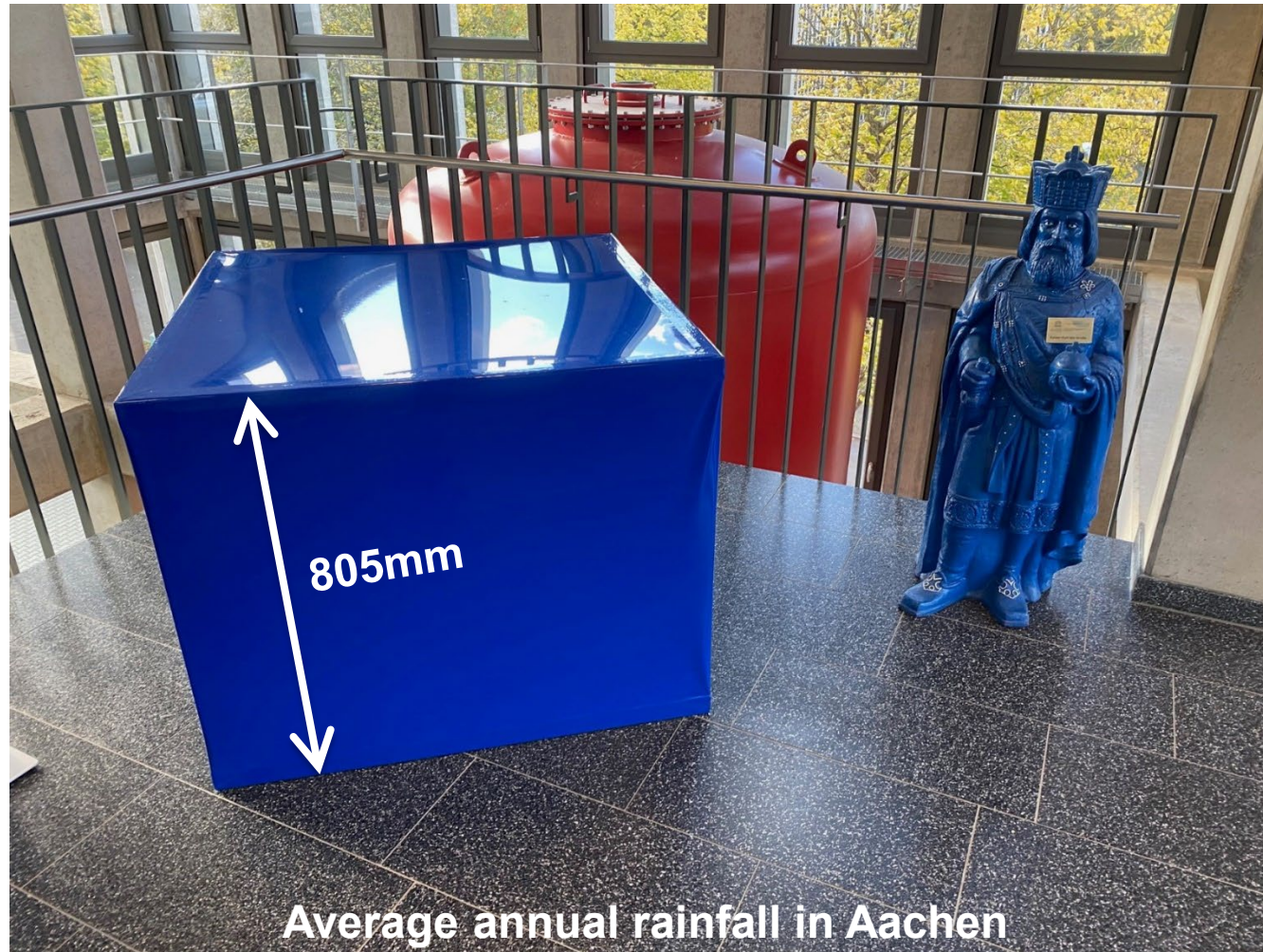
(Faust, 2021)



(kachmannwetter, 2022)

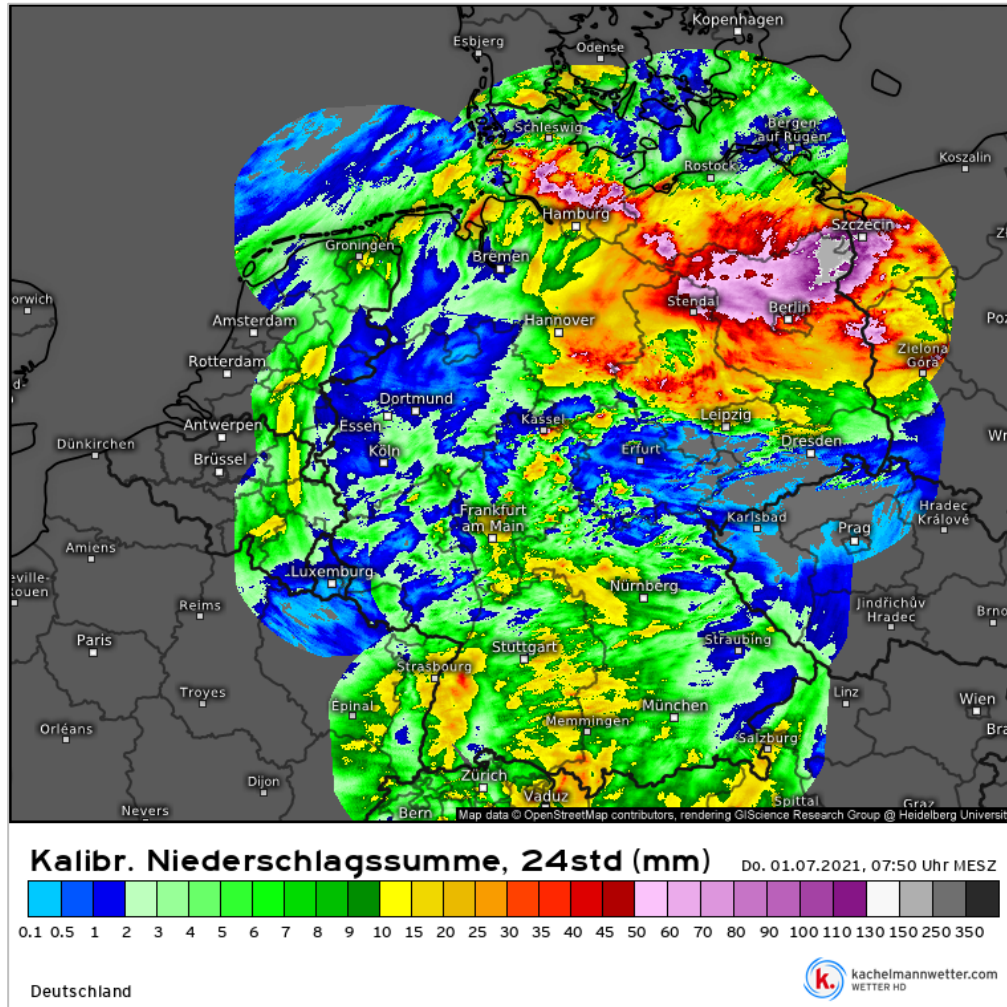


(Data: WVER, 2021)



(Schüttrumpf, 2020)

Extreme precipitation 2021



Tief "Xero" bringt Unwetter

Mehr als 180 Liter Niederschlag in 24 Stunden in der Uckermark



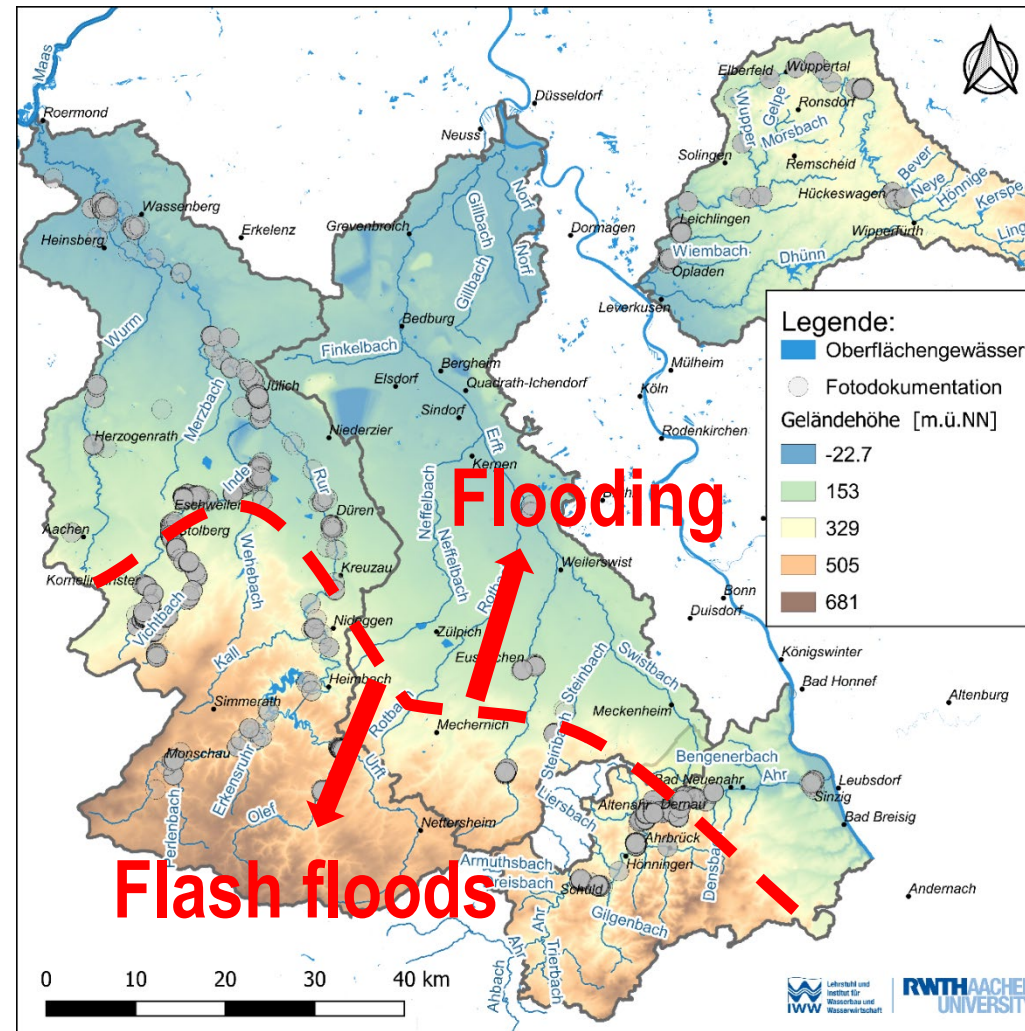
Video: rbb|24 | 01.07.2021 | Material: TeleNewsNetwork | Bild: dpa/F. Sommer

01.07.21 | 18:19 Uhr

Tief "Xero" beschert Berlin und Brandenburg vollgelaufene Keller und umgeknickte Bäume. Noch am Donnerstag soll sich die Wetterlage jedoch beruhigen. Für einige Regionen gelten dennoch Unwetterwarnungen. Besonders die Uckermark erlebte seltene Regenmengen.

(rbb, 2021)

Flood documentation of IWW



(IWW, 2021)

Water levels and discharges

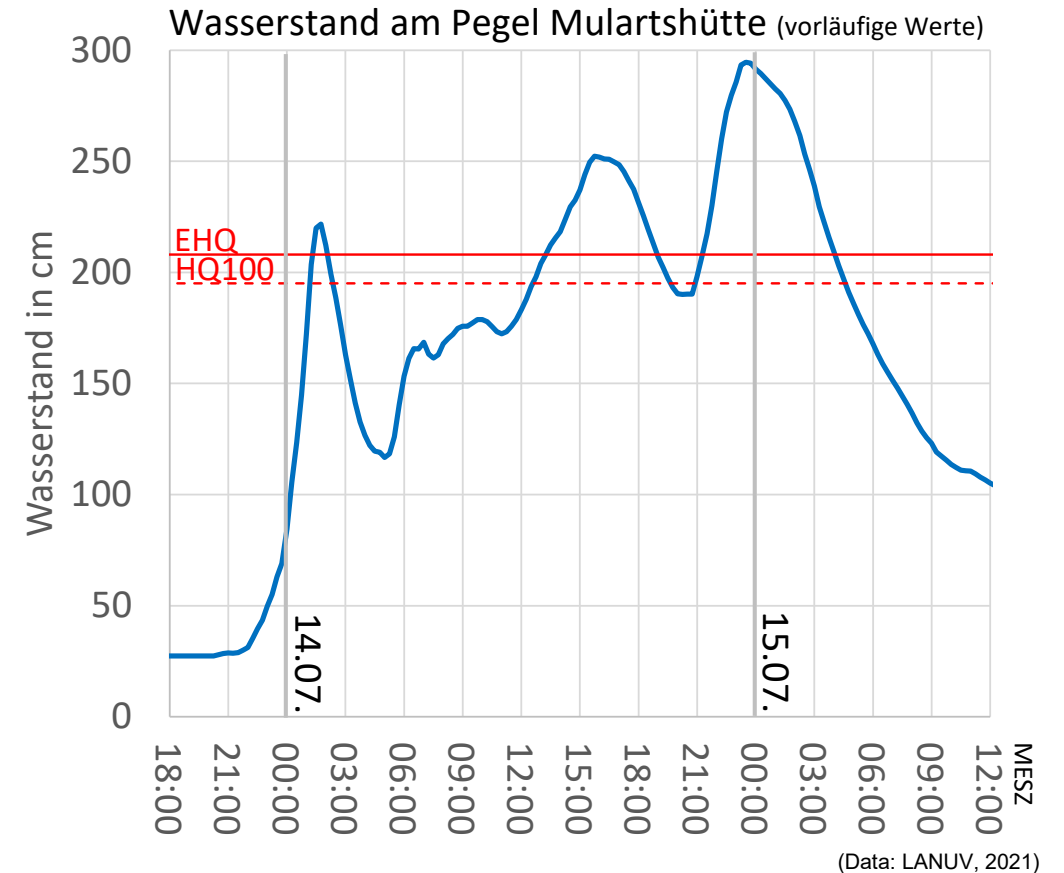
- *NRW*: 40% of the 81 gauges exceeded in July 2021 Information value 3
 - *RLP*: 3 gauges on the Ahr destroyed and 5 have failed
 - Water levels far higher than any previously measured were reached at many gauges
- Problem:
- destruction of entire gauges or their measuring equipment
 - proliferation of rivers also in the area of the gauging stations - flowed around laterally
 - no or not reliable data
 - no direct conclusions about the actual discharge volumes



(IWW, 2021)

Water levels and discharges

- maximum water levels in the night from 14.07.2021 to 15.07.2021
- at some gauges, the extreme flood (HQ_{extrem}) estimated water levels were exceeded
- Water levels far higher than any previously measured were reached at many gauges
 - Eschweiler: 3,96 m; 15.07.2021
 - Schleiden: 4,67 m; 14.07.2021
 - Gemünd: 5,57 m; 14.07.2021
 - Rurtalsperre: up to 500 m³/s ~ $HQ_{10.000}$
 - Altenahr: up to 980 m³/s → HQ_{extrem} (277 m³/s)





Comparison 1804 - 2021



(Photos: Oetjen, 2021)

- **Comparison of different areas**

- With/without dams
- With/without recultivation
- In/out mountains

- **Damages to critical infrastructures**

- Hospitals
- Police stations / fire departments
- Kindergarten, Schools

- **Damages to infrastructures**

- Roads and railways
- Sewer systems, electricity supply, gas supply
- Telecommunication

- **Damages to buildings**

- Water / mud / oil
- Structural damages

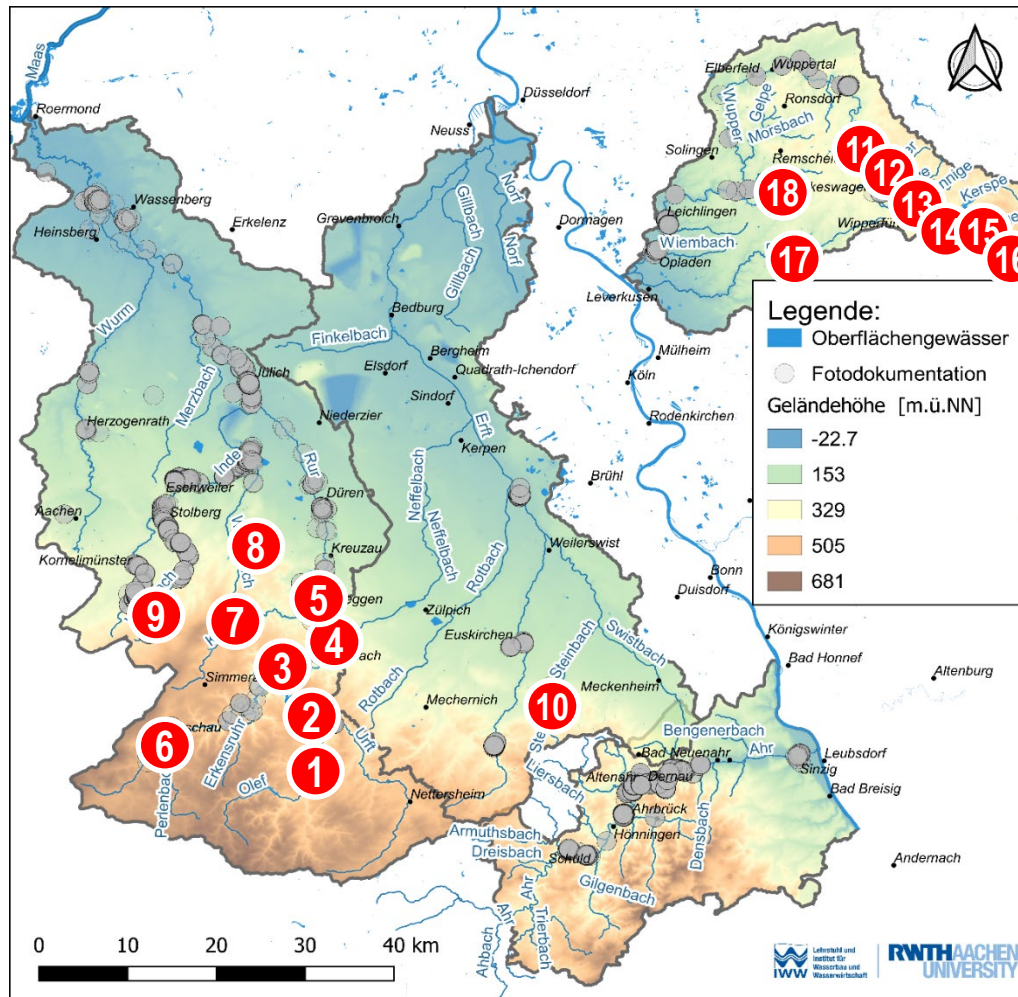
- **Log jam of bridges**

- **Morphodynamic processes**

- Erosion
- Sedimentation
- Contaminants

- **Personal damages**

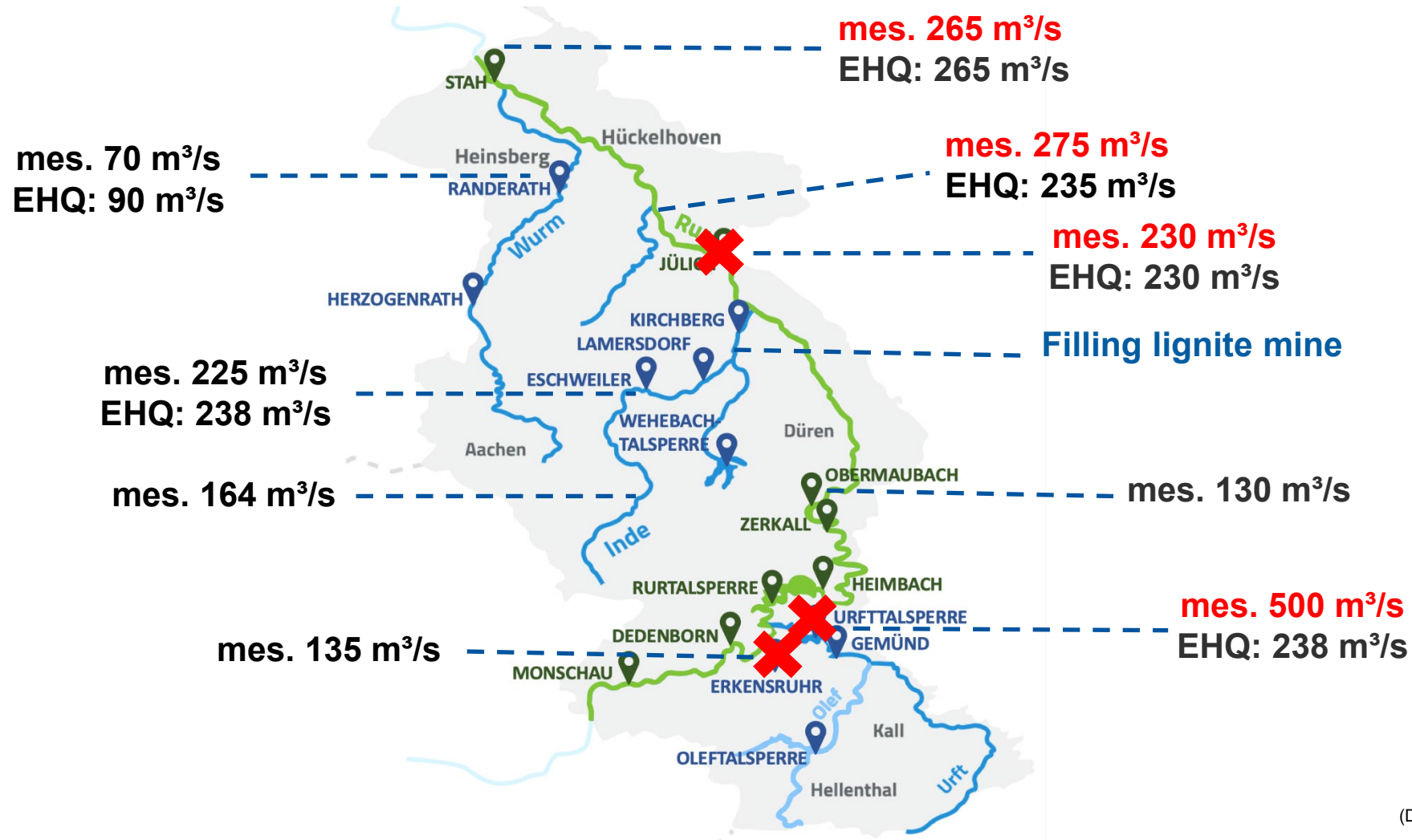
- Physical
- Psychological



(IWW, 2021)

1. Oleftalsperre
2. Urfttalsperre
3. Rurtalsperre
4. Heimbach
5. Obermaubach
6. Perlenbachtalsperre
7. Kalttalsperre
8. Wehebachtalsperre
9. Dreilägerbachtalsperre
10. Steinbachtalsperre
11. Wuppertalsperre
12. Bevertalsperre
13. Neyetalsperre
14. Kerspetalsperre
15. Lingesetalsperre
16. Brucher Talsperre
17. Große Dhünn Talsperre
18. Eschbachtalsperre

Hydrology (Preliminary results)



(Data: WVER, 2021)



(Vonden, 2021)

Inflow (estimated): 500 m³/s
discharge via spillway: ~ 350 m³/s

EHQ: 238 m³/s
HQ₁₀₀: 172 m³/s (Data: WVER, 2021)

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Damages to critical infrastructures

fire brigade Bad Münstereifel



(Photos: IWW, 2021)

wastewater treatment plant Altenahr



(Grates, 2017)

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Damages to infrastructures



(Photos: IWW, 2021)

Damages to infrastructures



(Photos: IWW, 2021)

Damages of roads

North Rhine-Westphalia

- Closure of 68 federal and rural roads
- Closures of the A1 and A61
- A total of 220 roads closed



Damages mobility

Wasserstand



40.000 cars \approx 200.000.000 Mio. € damage

(Data: auto24.de, 2022)

Damages Ahrtal



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Damages Ahrtal



Damages Stolberg



Damages Inden

water level



Damages to buildings



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Log jam of bridges



(Photos: Schüttrumpf, 2021)

Log jam of bridges



(dpa, 2021)

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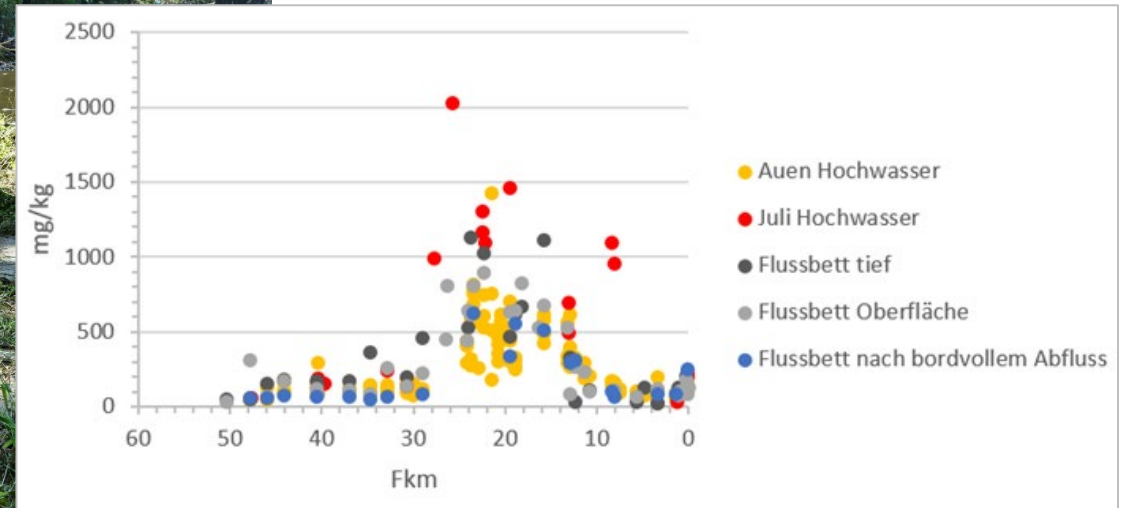
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Lignite mine Inden



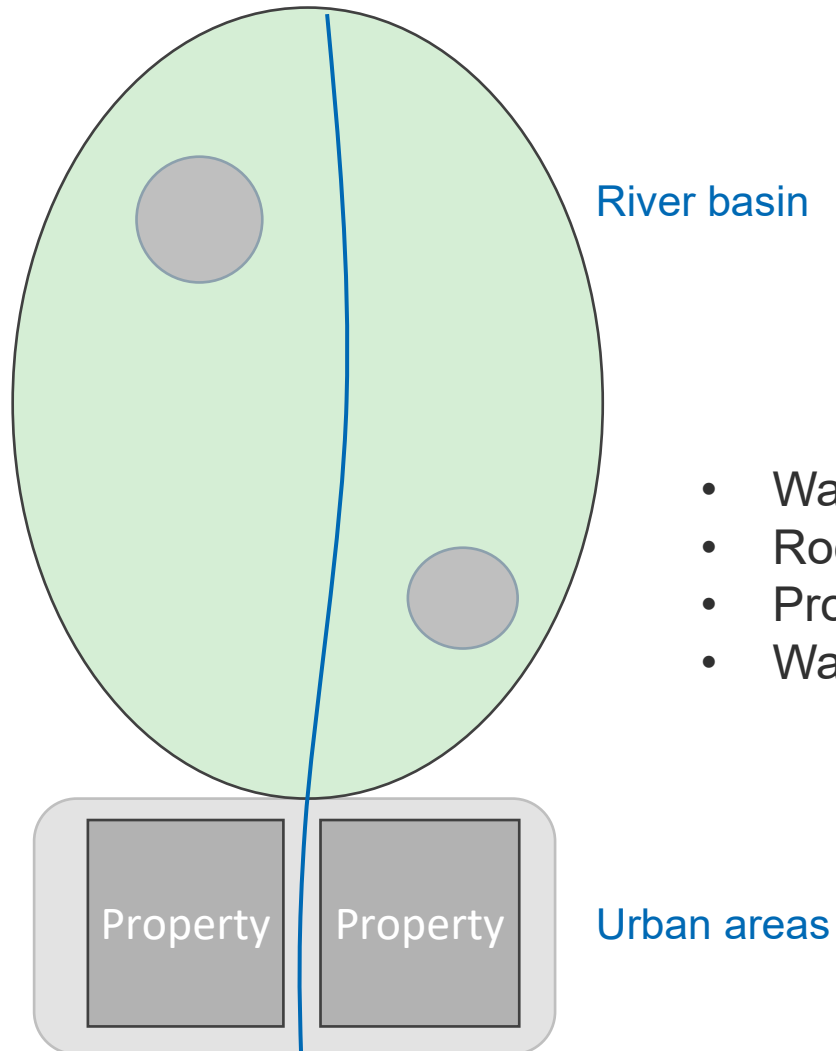
(PGG, 2021)



(IWW, 2021)

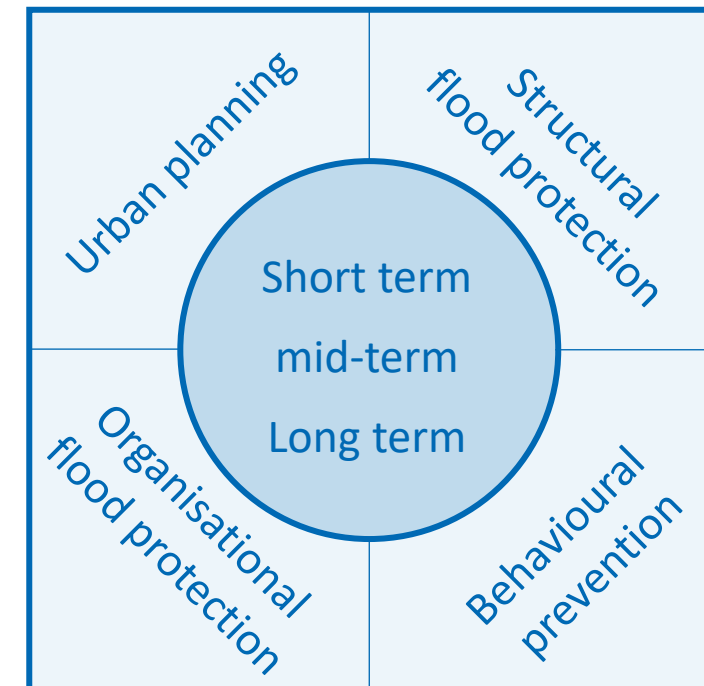
(Winandy, 2021)

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Subjects

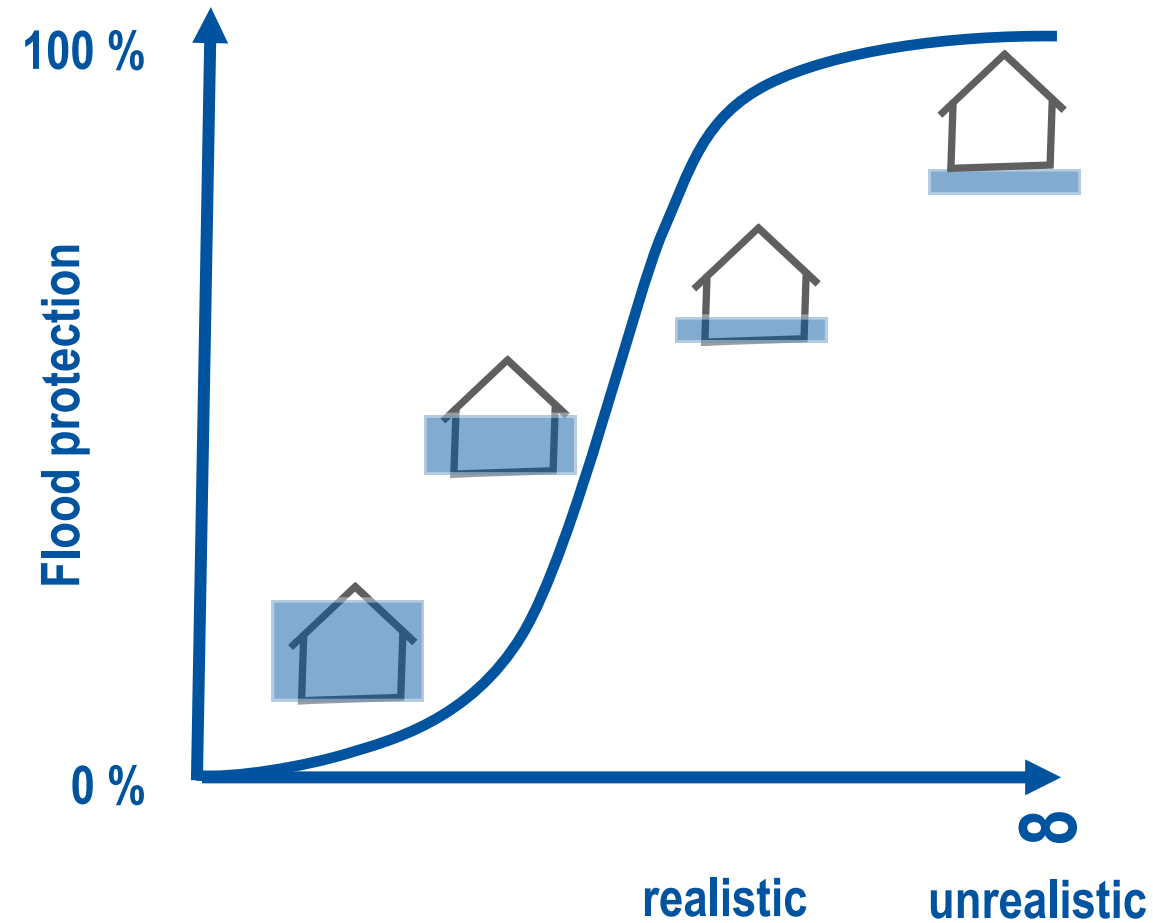
- Water retention
- Room for the river
- Property protections
- Warning



Room for the River!



Which risk is acceptable?



- Saving human lives has priority! Warning and evacuation!
- Room for the river!
- Dams reduce damage!
- Critical infrastructures need special attention!
- Consideration of historical flood events!
- Discharge obstacles must be removed!
- Oil is a problem!
- Reconstruction creates facts!

We have to learn from the flood disaster in 2021!

We will never have 100 % protection!

Thank you very much for your attention!