WMO

Training Workshop on Integrated Flood Management for the Nile Basin Countries

23-27 November 2009-09-16 Nairobi, Kenya

Flood risk assessment/mapping

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PROGRAMME ON
FLOOD MANAGEMENT

Content

1. Introduction, Objectives
2. Hazard and risk assesment
3. Hazard and risk maps

The first step: What can happen?

The information is elaborated:

- The hazard analysis
- The analysis of vulnerability

Knowledge has only value if it is applied.

Therefore the results of the above analysis must be given to the different actors. Since spatial distribution is essential, maps are a good tool to inform. But maps must be accompanied by reports.

Maps are an **information tool** indicating :

- WHAT (Hazard and Risk parameters)
- WHERE (Geographic extend)

This information is one of the backbones for the IFM planning.

Different maps for different uses

Establishement of flood management plans

To establish a plan I must know

1. What can be affected? (extend)
2. What is the impact? (magnitude / intensity)
3. What are the consequences? (vulnerability)
4. What can be done? (measures)
5. Which safety can we afford? (economy)

The sequence is of importance

What can be done depends on the physical parameters of the event. Economic justification depends on the consequences and the probability of the event.

How to proceed?

Going from general to detail

1. Basin wide analysis
2. Historic events
3. Which processes (type of floods)
4. Parameter estimation (probability, impact)
5. Risk assessment
6. Maps

Although the main focus is on the hazard analysis we must keep an eye on vulnerability of the affected areas, since if there are no consequences no details are necessary.

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Flood types

- Riverine floods
- Pluvial floods
- Flash floods
- Landslides
- Debris and mud flows
- Gacial lake outburst
- Coastal flooding
- Ground water
- Lake overflows
- Ice jams
- Dam failure
- Levee breaches

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Hazard parameters

1. Depth of inundation
2. Duration
3. Extend
4. Rising velocity
5. Current velocity (pressure)
6. Debris (blocks, wood)
7. Sand and mud
8. Oil and other chemical agents

Methods for hazard analysis

1. **Historic events**
2. **Geomorphologic analysis**
3. **Hydrologic studies**
4. **Mathematical modeling**
5. **Failure analysis (capacity, stability)**

The most important is to analyze the events , which already happened. Documentation of new events should be made.

The next important is to go into the field, look for traces and signs indicating hazards

Determine vulnerability and risk

Must be carried out after hazard analysis and needs:

- Data on present land use
- Data on persons effected
- Data on buildings, industries and infrastructure
- Hot spots like hospitals, chemical depots, ect.

For the above objects the sensitivity to flooding must be determined

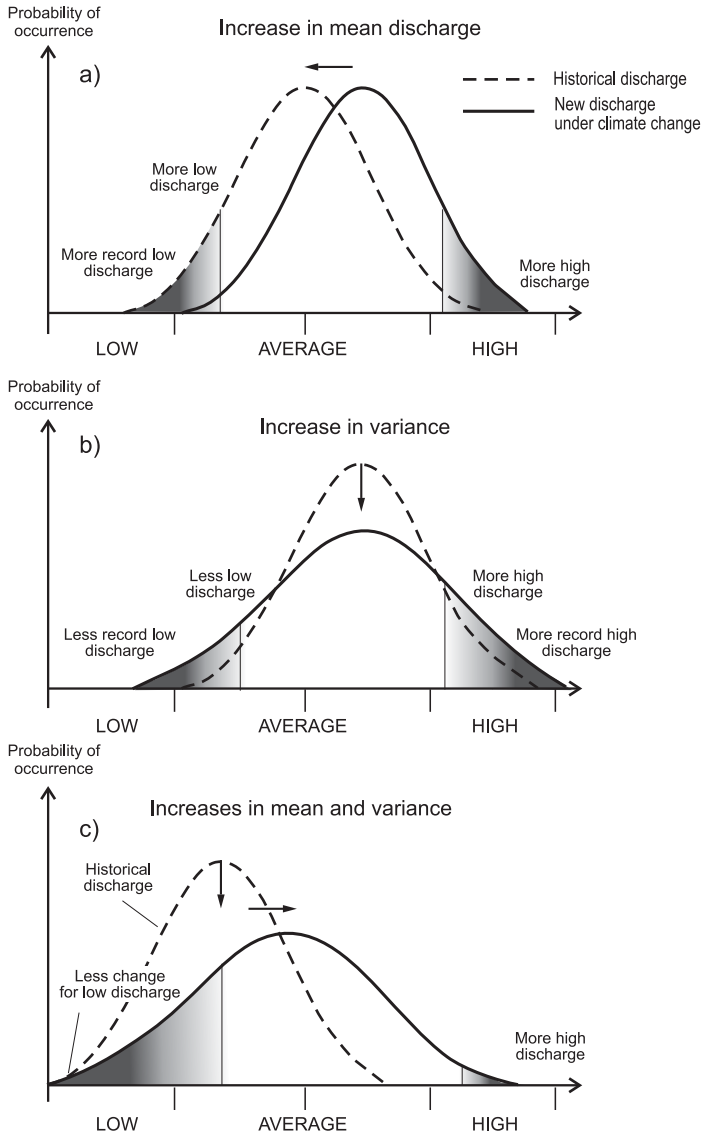
Probability of events

For economic evaluation quantitative probabilities must be assigned.

For long records standard techniques can be applied, but for many processes (debris flow, tsunamis) they must be estimated. For communication the words: rare, very rare ar easier understood then return periods.

Events of three probabilities should be investigated-

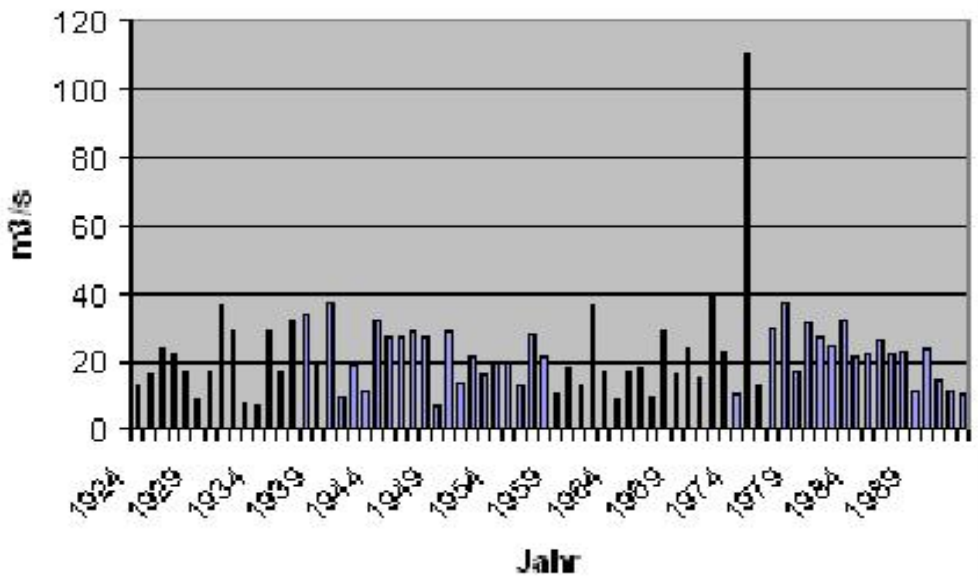
- Relative frequent (Return Period 10 to 30 years)
- Rare (Return period around 100 years
- Extreme



Extreme event: Why?

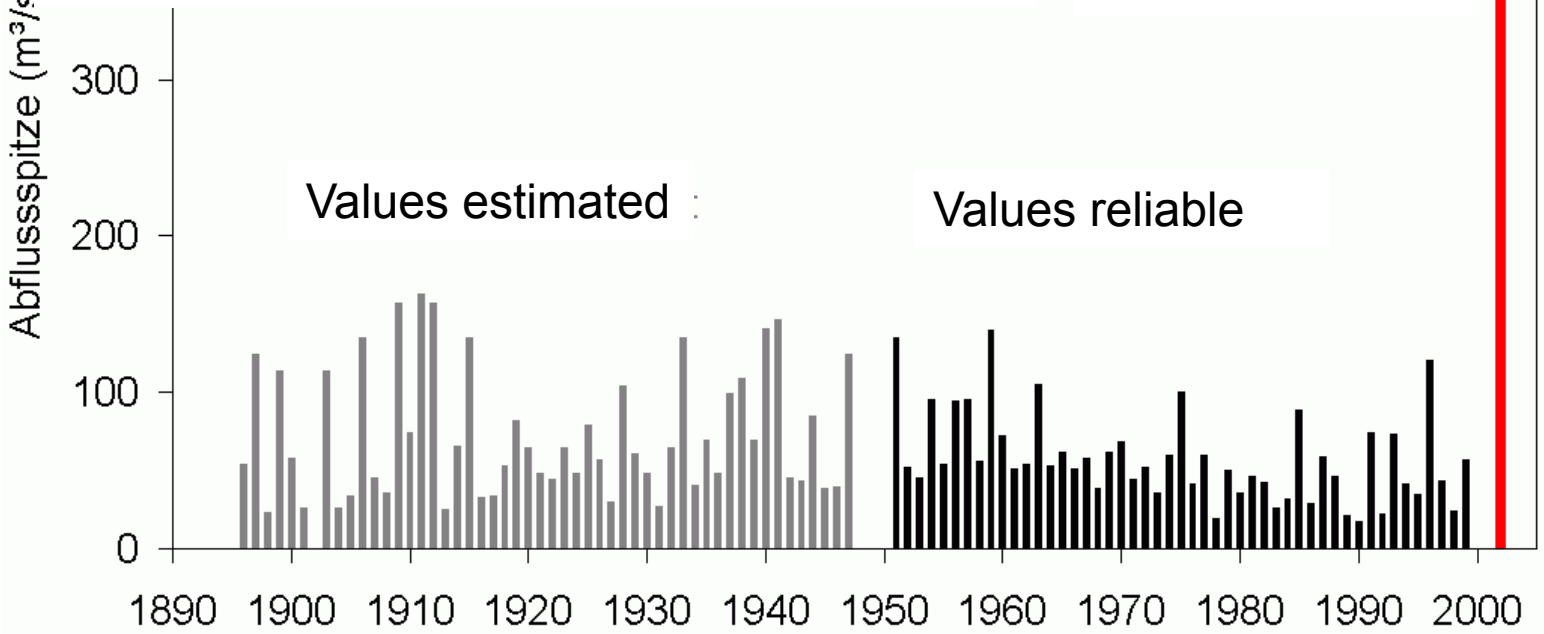
- gives the frame for detailed evaluation and optimization
- causes the maximum damage and the highest risk for life and measures are the most urgent
- serves for control of effectiveness of protection measures and determination of residual risk
- identify safe places which are safe since even in an extreme event

Switzerland Annual flood peaks of the Langeten



What is an extreme event?

Austria: Annual flood peaks of the Kamp river

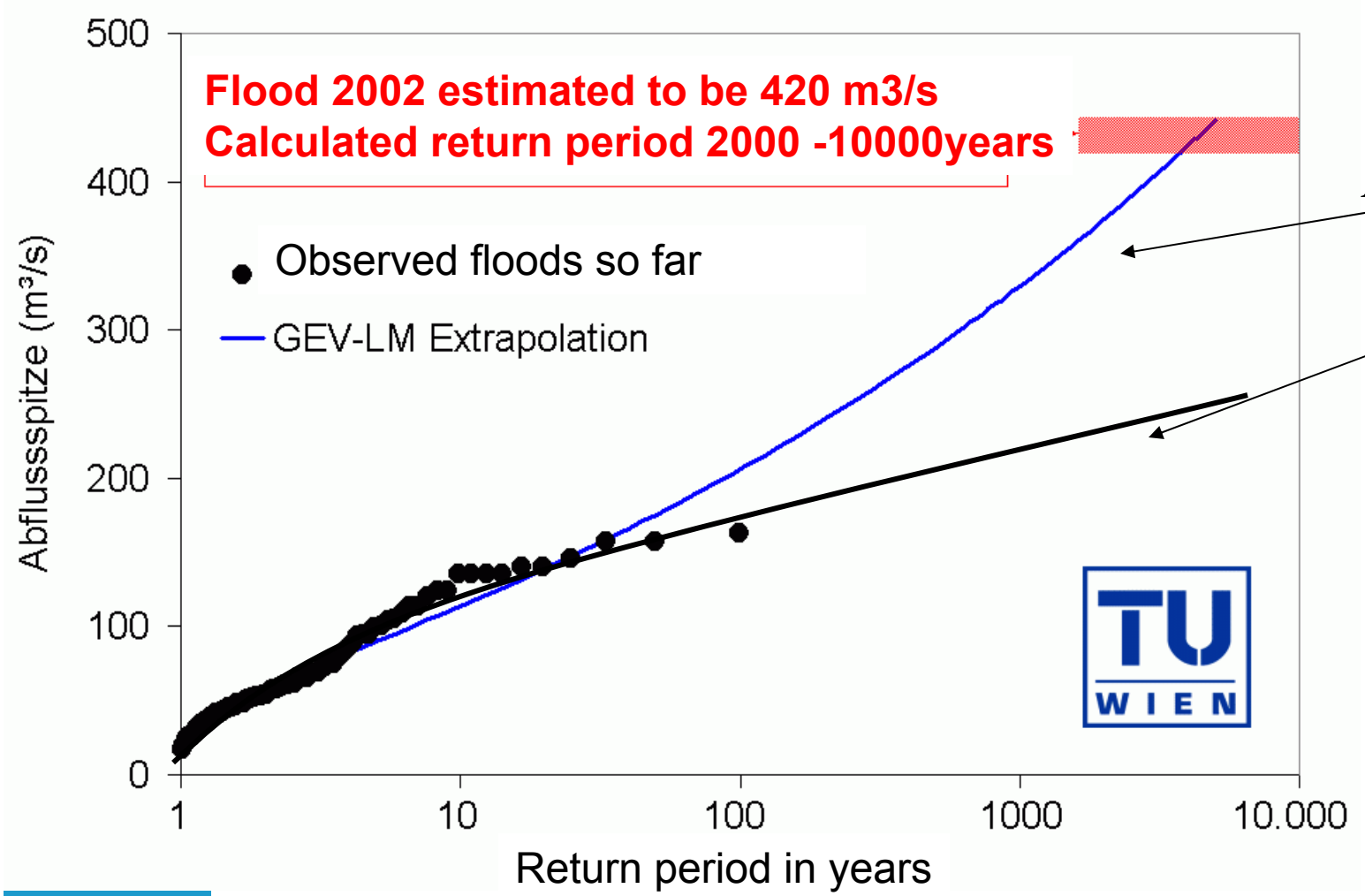


Estimation 2002
420 m3/s

The estimation of the probability for extreme events is extremely uncertain

Example Austria Kamptal

How to extrapolate ?



After event

Before event

Extreme event

Definition:

The extreme event exceeds substantially the 100 years flood or the highest observed flood

There is no specific probability assigned, since depending on data and methods the results may vary considerable. As very rough figure 150% of the 100 years flood may be applied, however this may depend on the type of the river, the available information on historic floods and other meteorological, hydrologic or hydraulic characteristics.

Selection of map type

When preparing a map I must be clear

- Which message I want to transmit
- Whom I want to inform
- What shall he do with the information
- What does he need
- Is the information understandable

As basis for planning we must go from general to detail
Overview: Scale smaller 1:25'000
Detailed: Scale larger 1:25'000

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Application

- **Planning:** Impacts of urbanisation, other land uses and climate change
- **Regulatory:** Land use regulation and building codes
- **Emergency response:** Location for building shelters and earmarking escape routes
- **Vulnerability:** spatial characterization of flood vulnerability of the population
- **Asset management**
- Flood **Insurance**
- **Public awareness**
- **Informational/Educational:** record of flood magnitudes in an area

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Preliminary assessment or indicative flood maps (small scale): Purpose

- frame for detailed evaluation
- quick recognition of possible conflicts
- overview on existing risks
- priority setting for detailed planning
- **RAISING AWARNESS**

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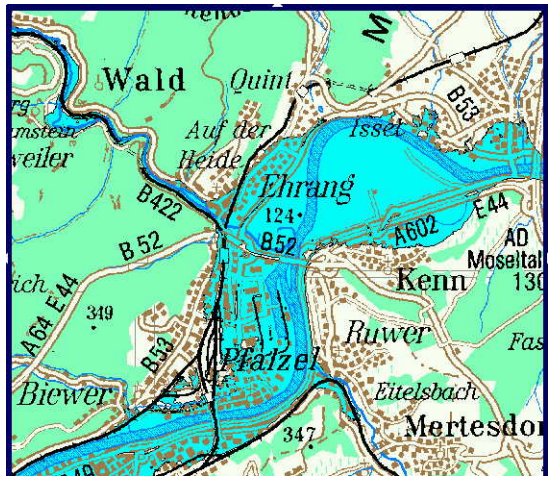
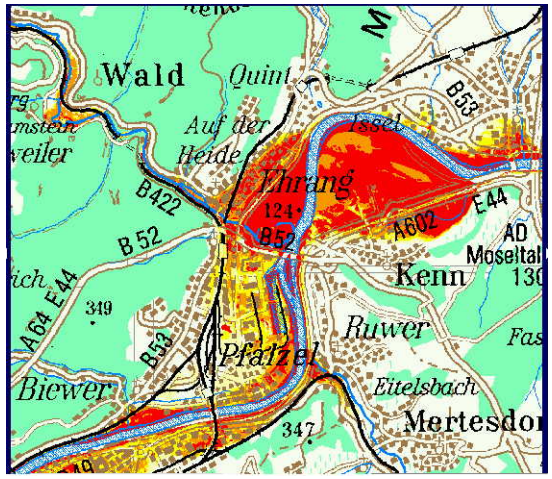


Synthetic map



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Preliminary assessment or indicative flood maps: Content

Obligatory

- type of hazard
- limits of possibly affected area (extreme event)
- settlements and important sensible objects

Desirable

- extend of historic floods
- indications on frequency and intensity (depth)

Scale: 1:100'000 until 1:25'000

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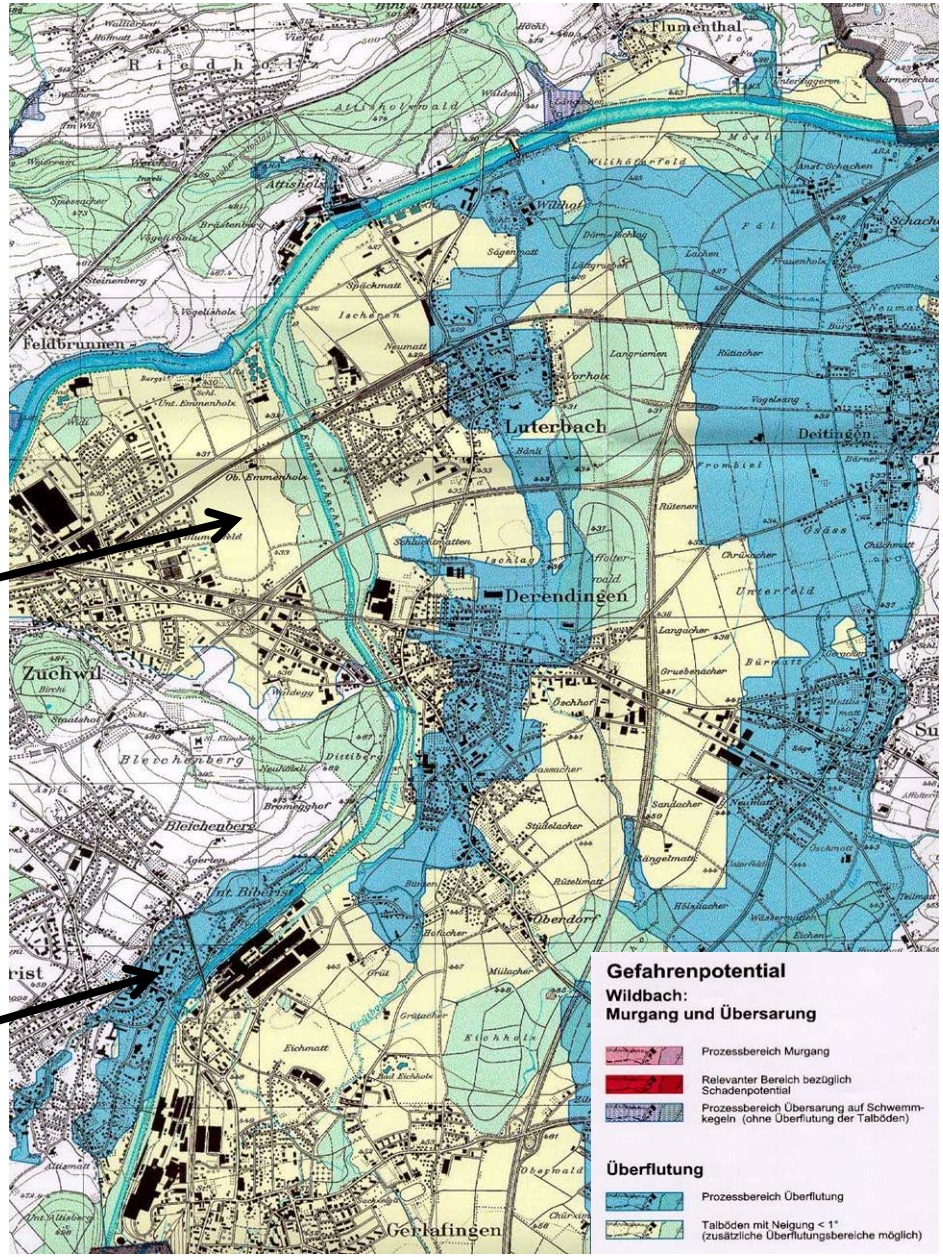
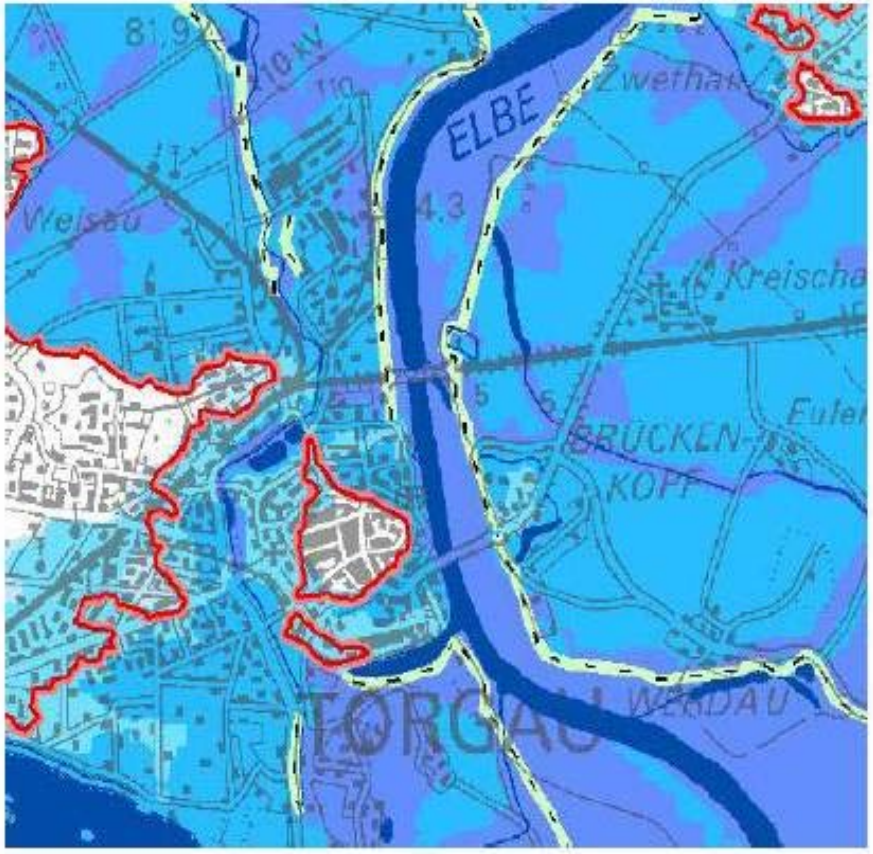
Example: Indicative map Canton Aargau (CH)

Flooding possible

Flooding probable



Example of hazard and risk (vulnerability) map (Saxonia, Germany)

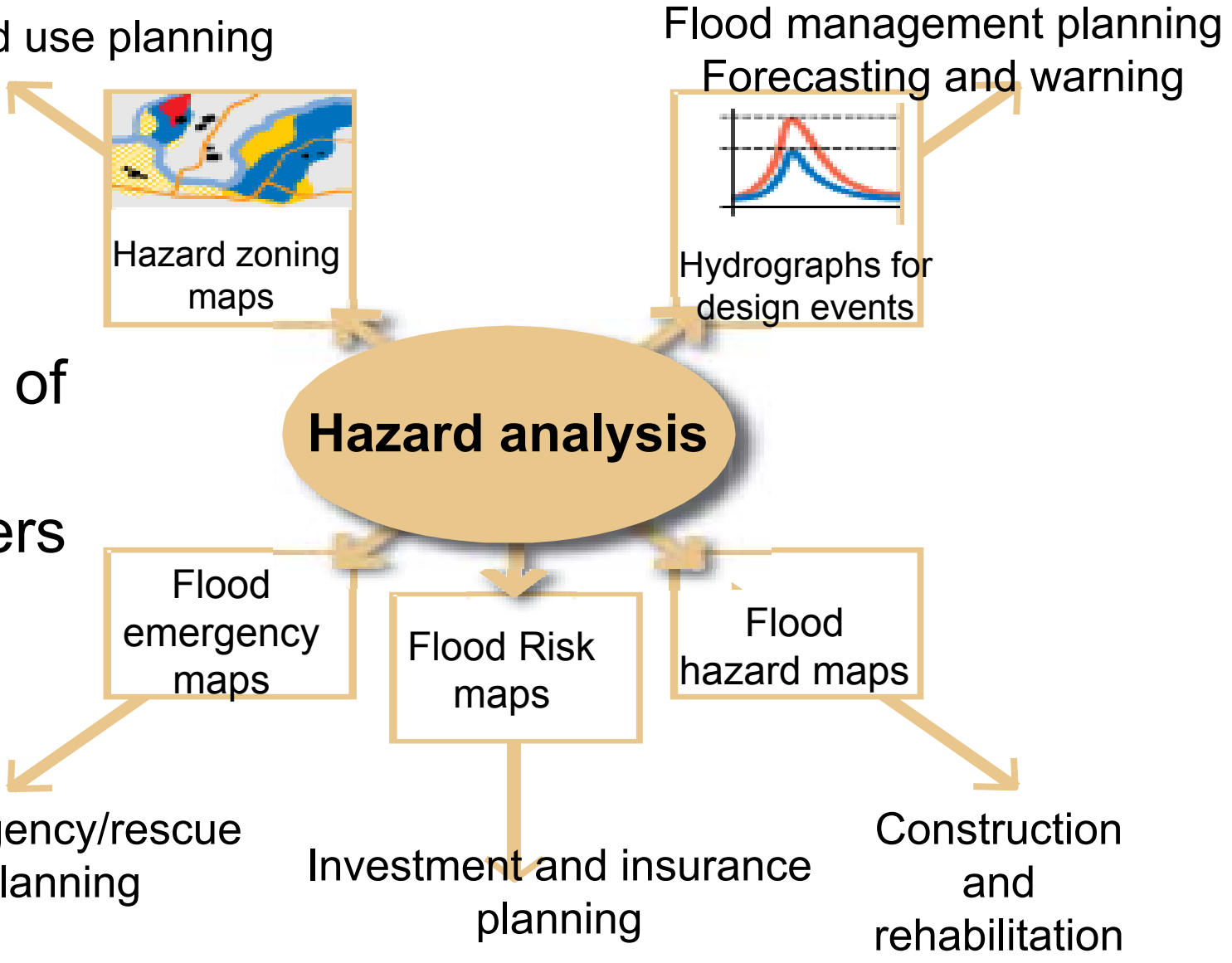


Hazard map showing different flooding depth

Vulnerability map showing average damage per unit area and sensible objects

Detailed maps

Depending on the type of information and the users



Different types of maps for different purposes

For Planning:

Basic information spatial distribution of parameters

- Flood event maps
- Flood hazard maps (depth, velocity, etc.)
- Vulnerability maps (exposed values)

For Realisation:

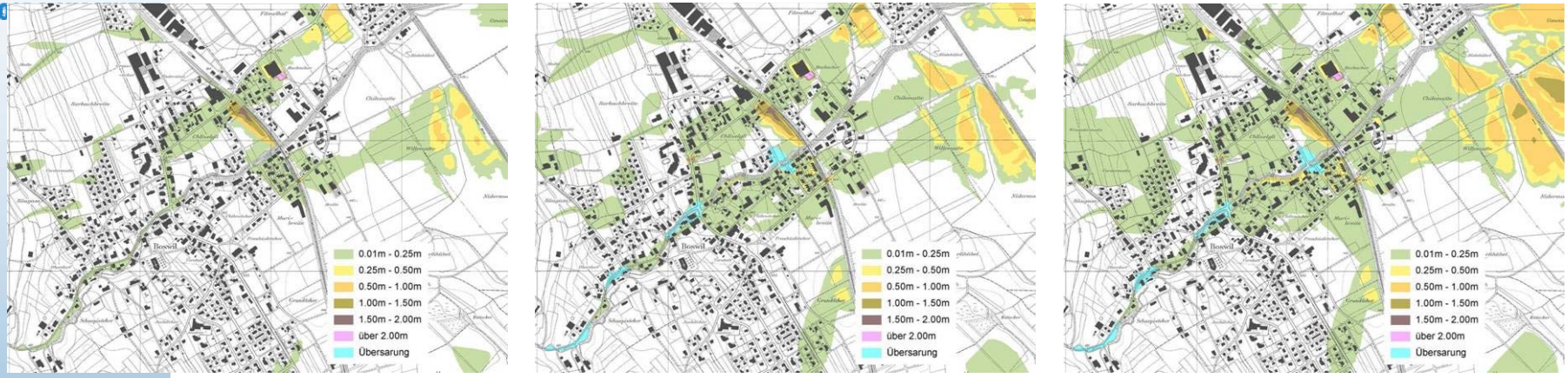
Result of the planning process leading to action:

- Flood emergency maps
- Flood zoning maps for land use planning
- Flood defence projects planned measures

Detailed maps

Hazard map Canton Aargau showing flooding depth for different return periods

R=30 **R=100** **R=1000**



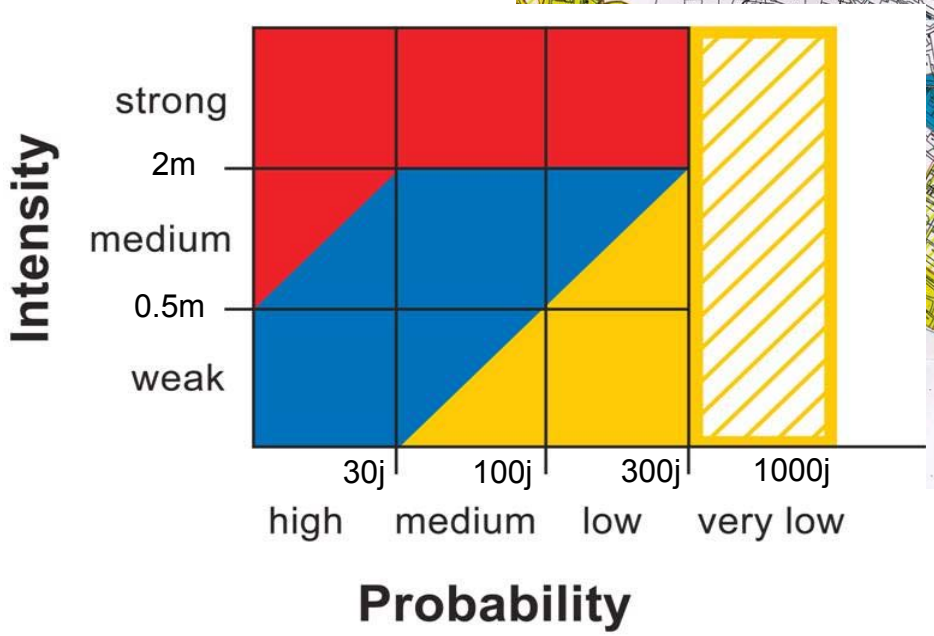
- detailed assessment of flood depth
- return period: **30, 100, 1000yr**
- water depth in **0.25m / 0.5m** steps
- scale **1:5000**
- high topographic accuracy **10cm**

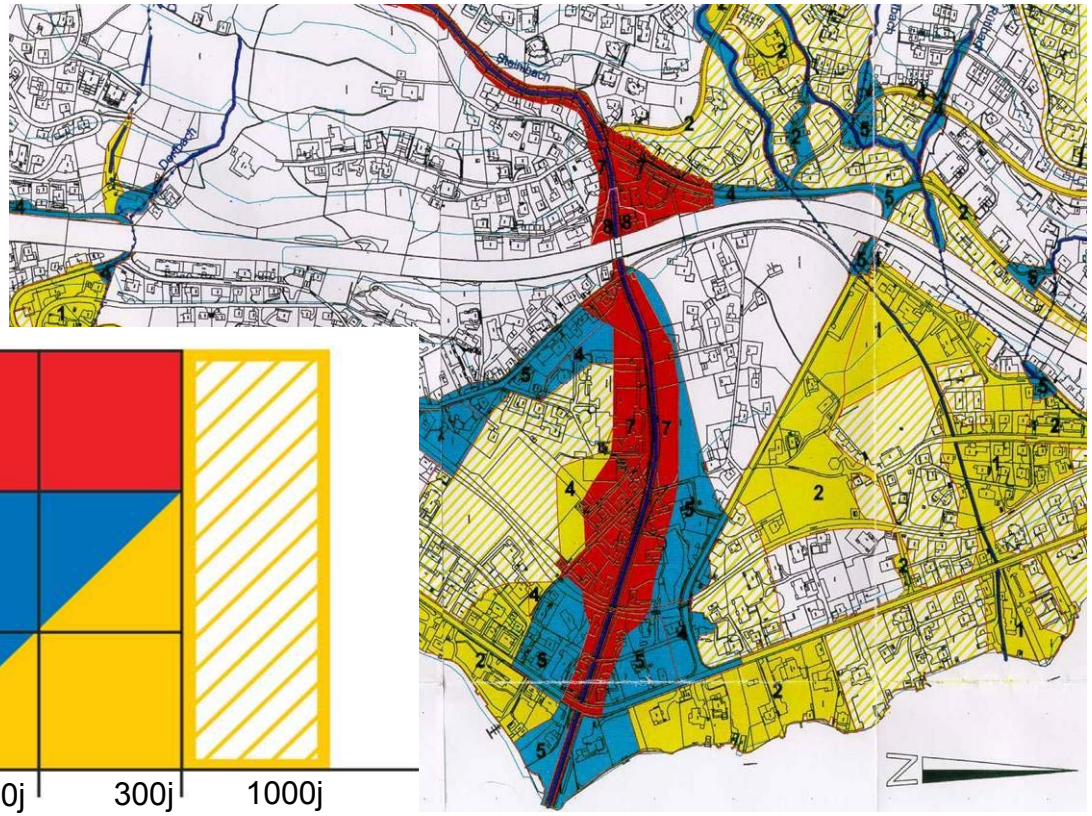
0.01m - 0.25m
0.25m - 0.50m
0.50m - 1.00m
1.00m - 1.50m
1.50m - 2.00m
über 2.00m

Example: Hazard map for spatial planning Canton Nidwalden

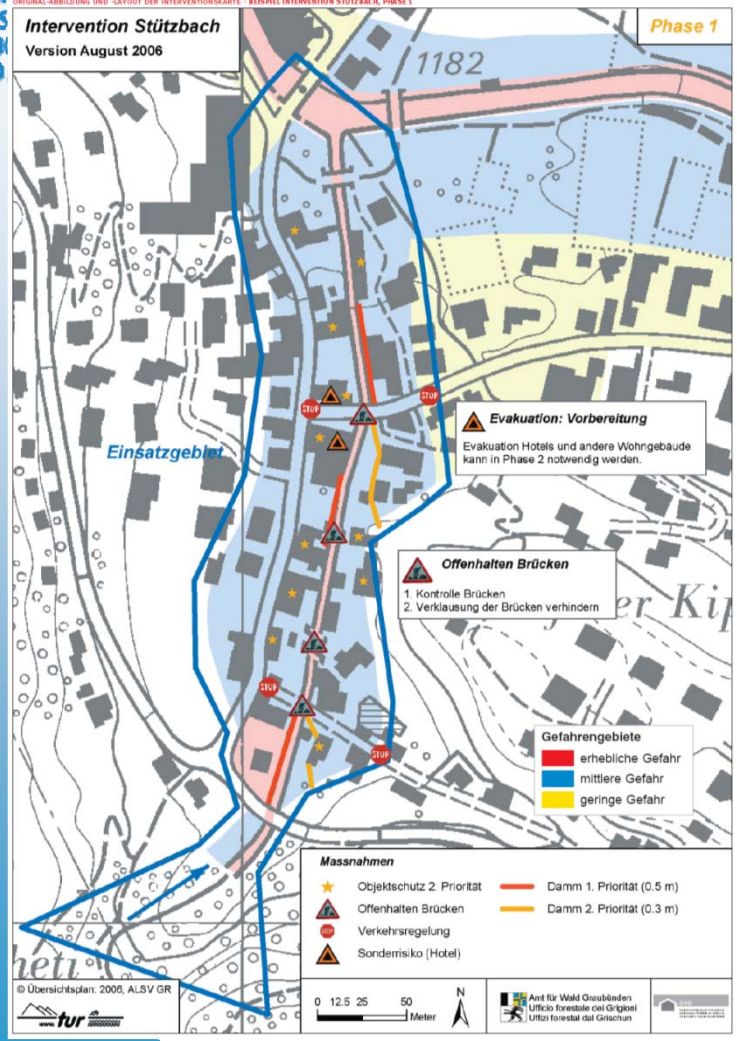
Land use planning

- red: no new constructions allowed
- blue: constructions allowed with restrictions
- yellow: informations for the land-owners





Example: Emergency map Canton Graubünden



from planning to action

Indicative or preliminary maps (small scale)

- **Flood risk maps** are the **first step** to a risk management plan showing where we have conflicts but also where we have potential retention areas.
- Small scale flood risk maps are needed for strategic planning and priority setting. transfer information to politics and general public. The content must be restricted to the essentials to be easily understood.
- Preliminary flood risk maps should be established rapidly. The necessary details can be elaborated in the later phases.
- Preliminary flood risk maps should focus on the hazard. Vulnerability is necessary but only in a general way.

Final or detailed maps (large scale)

Detailed maps should contain all information necessary for a certain action.

Content must be adopted to the use. Examples are:
- spatial planning
- emergency operations
- Risk assessment (insurance)
- Planning of mitigation measures (p.e: Water proofing of houses)

- The information included in the flood map is elaborated by specialists in the process of hazard and risk analysis. This is a continuous process. The maximum of knowledge is needed when planning the measures.

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Mapping is important - but not everywhere

Thank you for your attention