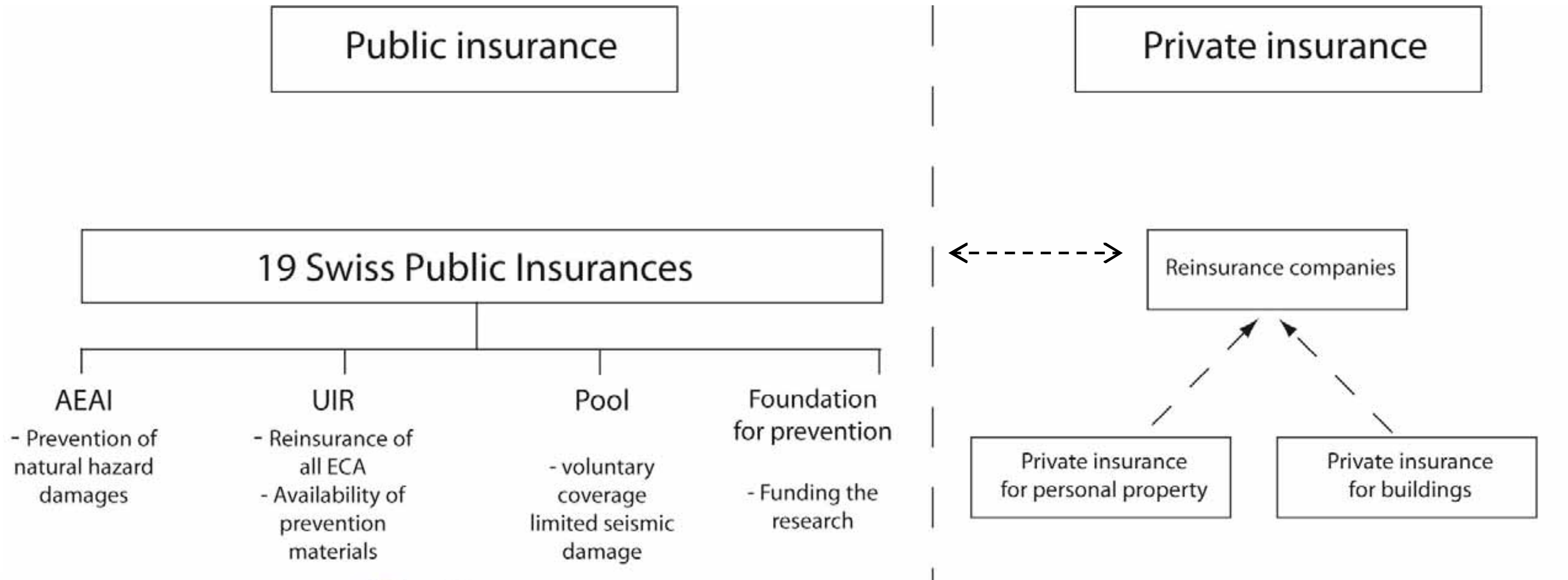
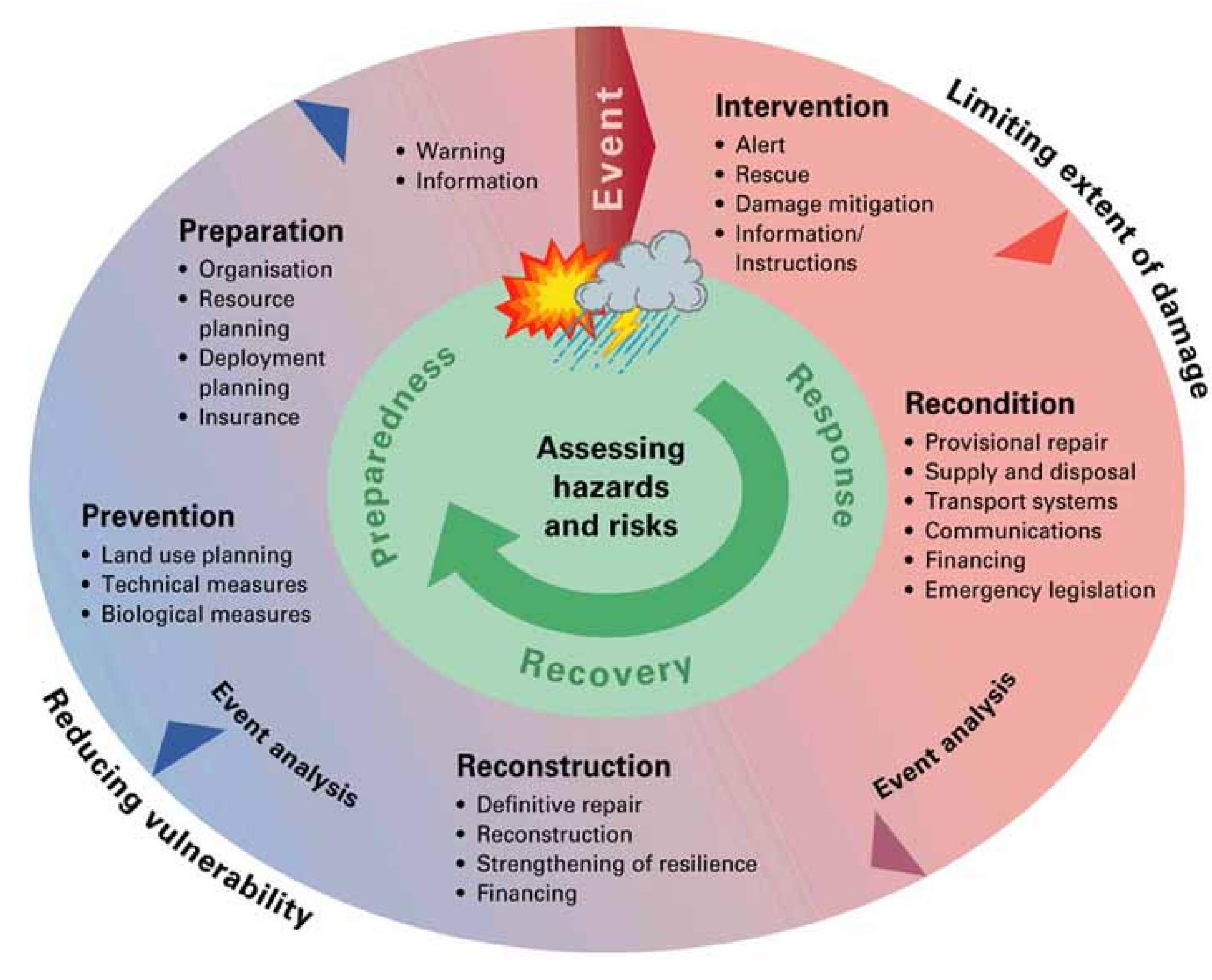
Swiss buildings insurance system



Public insurance system

Source: Marc Choffet

Risk management



OFPP 2001

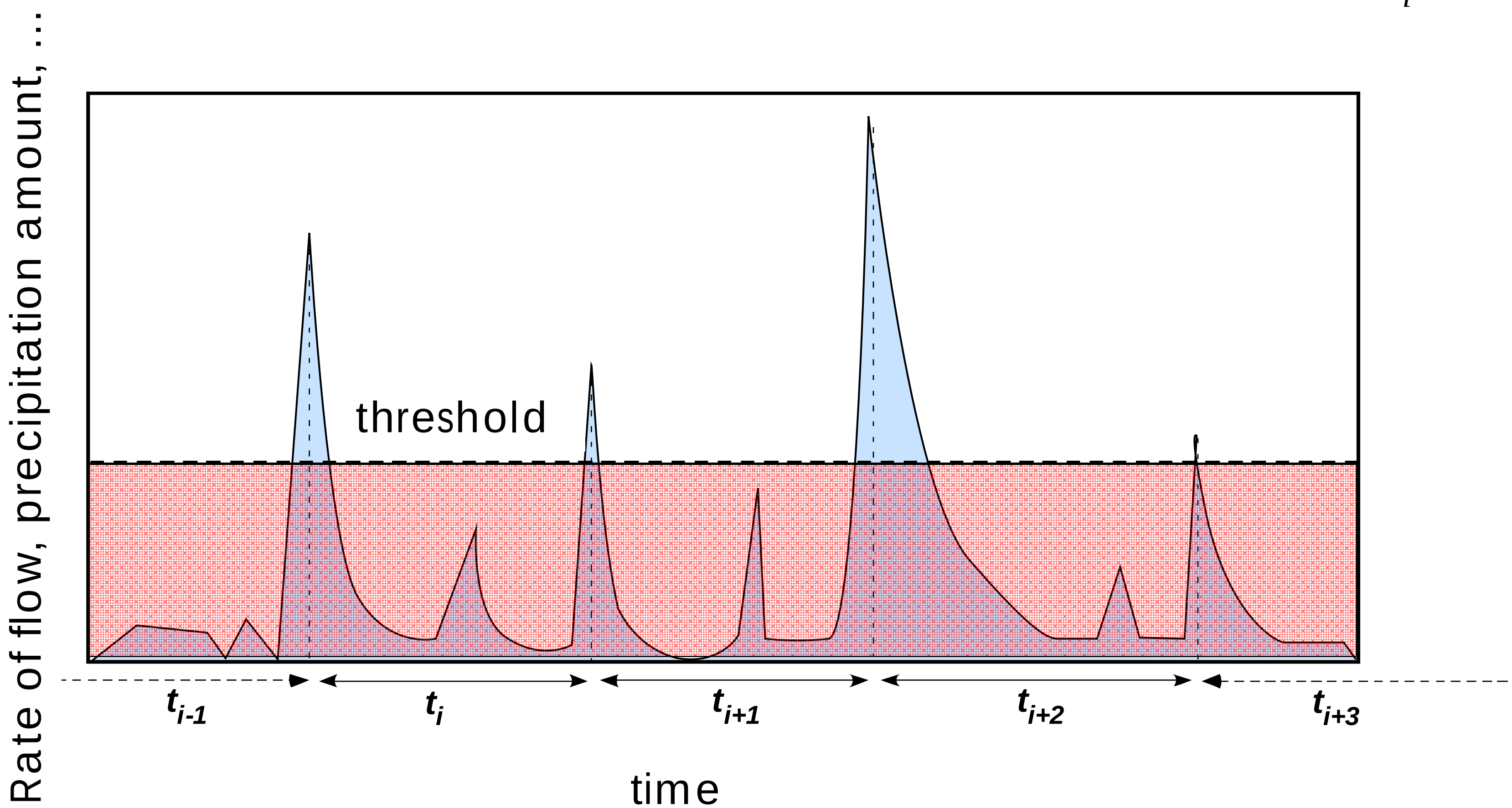
OFPP 2012

DANGER MAPS: CONCEPTS COMMON TO ALL PROCESSES

Return period (T)

Mean time between two exceeds of a threshold value (or two occurrences of an event)

$$T = \frac{1}{n}\sum_i t_i$$



Frequency vs. probability

Frequency is the inverse of the return period. Its unity is usually year[1], which corresponds to the average number of event per year.

Probability is the estimation of the likelihood of an event occurring (a given number of time) in a period of time. It is a number between 0 and 1.

If the events occurs independently according to a mean number λ in the interval, the probability that k events occurs in this interval is given by

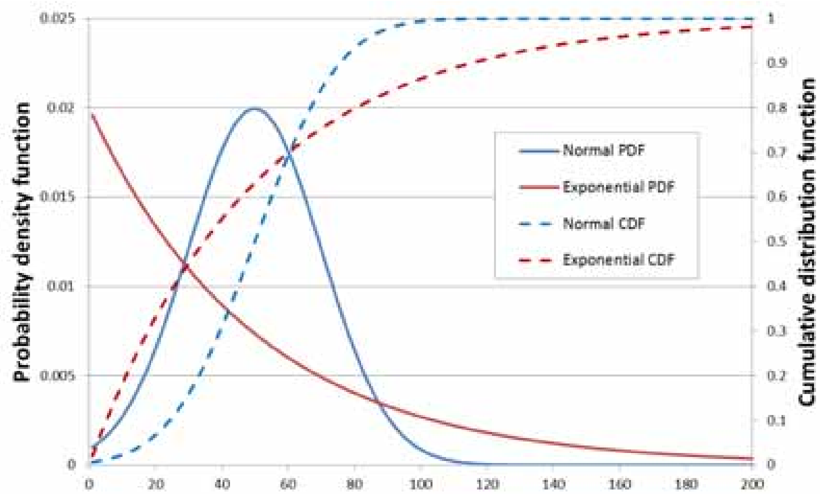
$$P(X = k) = e^{-\lambda}\frac{\lambda^k}{k!}$$

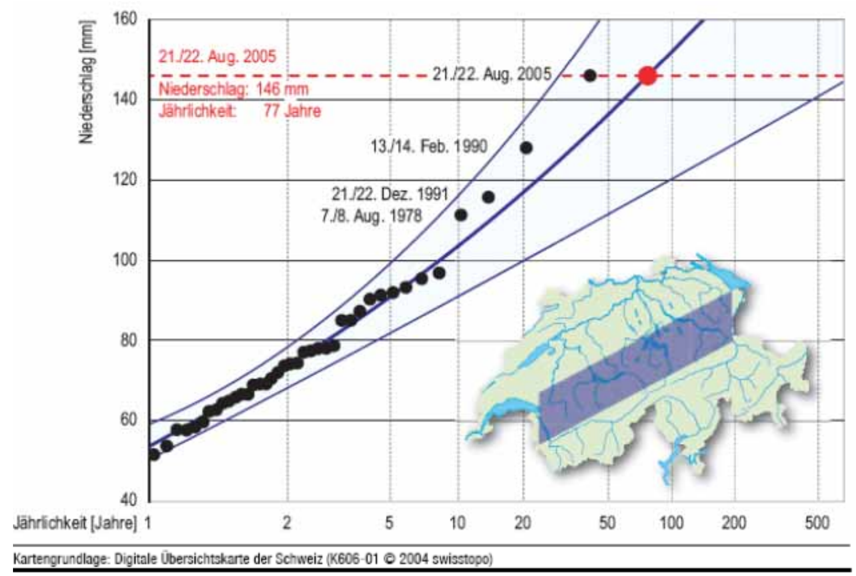
Which means that the probability that an event which occurs on average once year, do not happen in a year is 36.8%

Statistics of extreme events

To estimate the frequency of a rare event, statistical distributions, such as Gumbel, Pareto, GEV... are used. On the opposite as the normal distribution, for example, these distributions include rare and extreme events.

In this example, the frequency of the 2 day precipitation event responsible for the 2005 flood event in Switzerland is estimated at 77 years (with an uncertainty) according to a Gumbel distribution.





Rotach et al. (2008)

Indicative hazard maps

Indicative hazard maps are established to identify the regions were a danger map is necessary.

They are based on simple models applied with a conservative approach (i.e. to identify the maximal extent) and don't identify the intensities or probabilities

Snow avalanche indicative hazars map, geoplanet.vd.ch

The danger maps products

Phenomenon map: field map showing the observed phenomenon (deposited blocks,…) and the relevant objects for the process (bridges,…)

Events registry: database of all known historical events

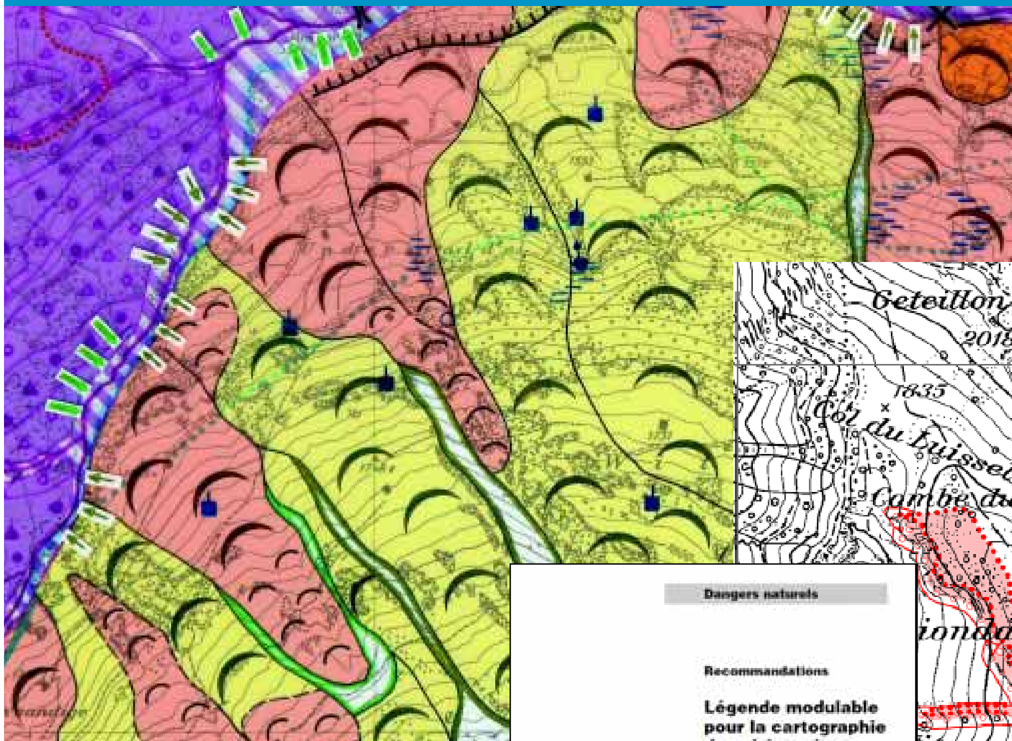
Scenarios: description of the considered scenarios for each return period class

Models

Intensity map: map showing the intensity according to the 3 classes, for each scenario

Danger map: combination of the (3) intensity maps with the matrix symbology

Phenomenon map



Lateltin (1997)


Dangers naturels

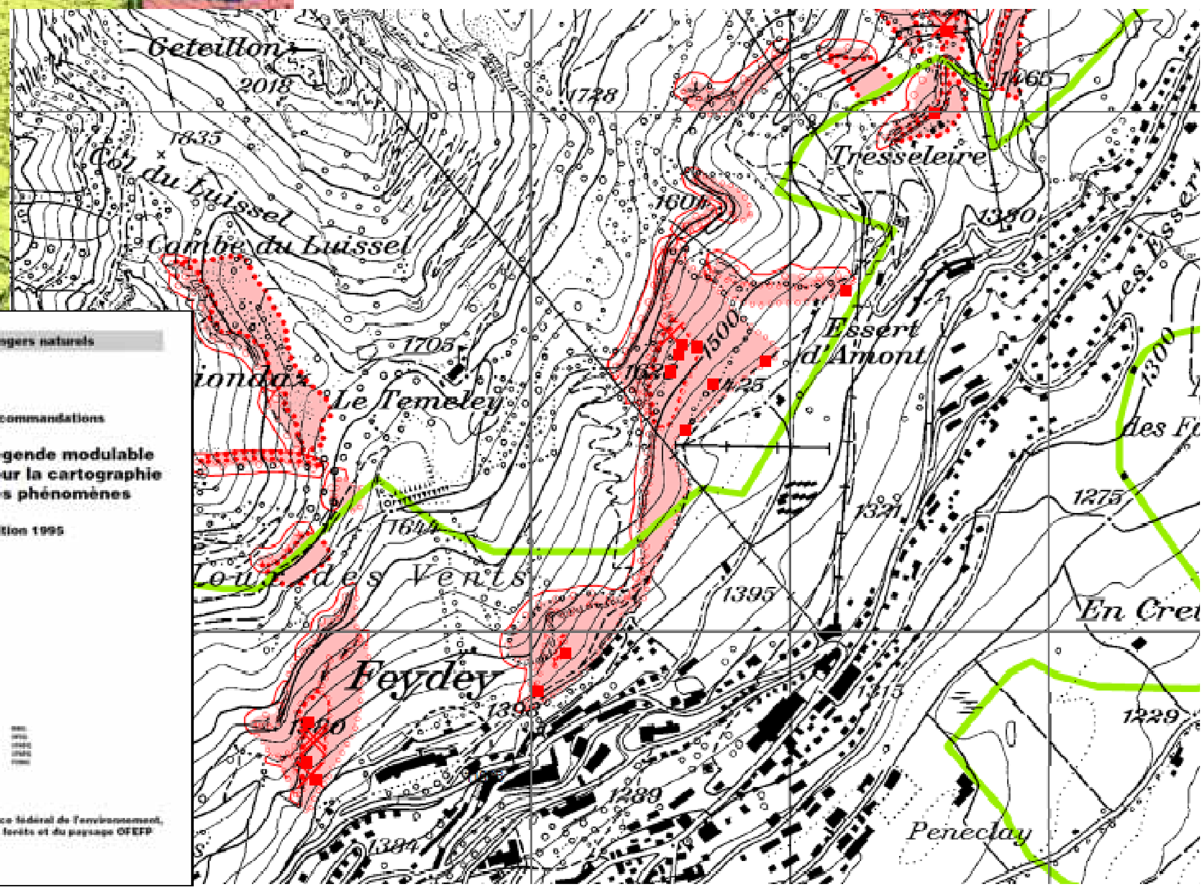
Recommandations

Légende modulable pour la cartographie des phénomènes

Edition 1995

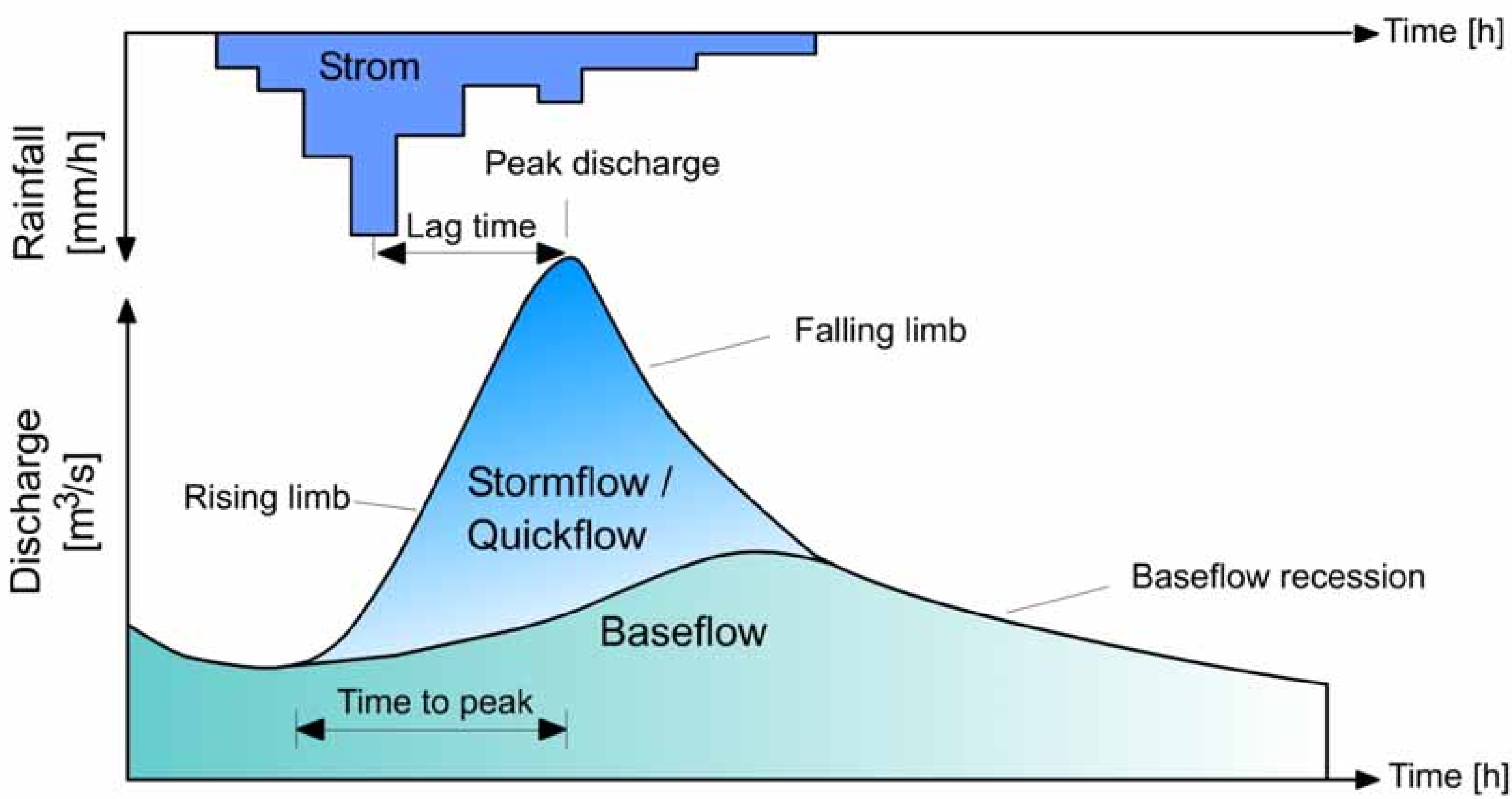
Office fédéral de l'environnement, des forêts et du paysage OFEFP

BEG (2011)



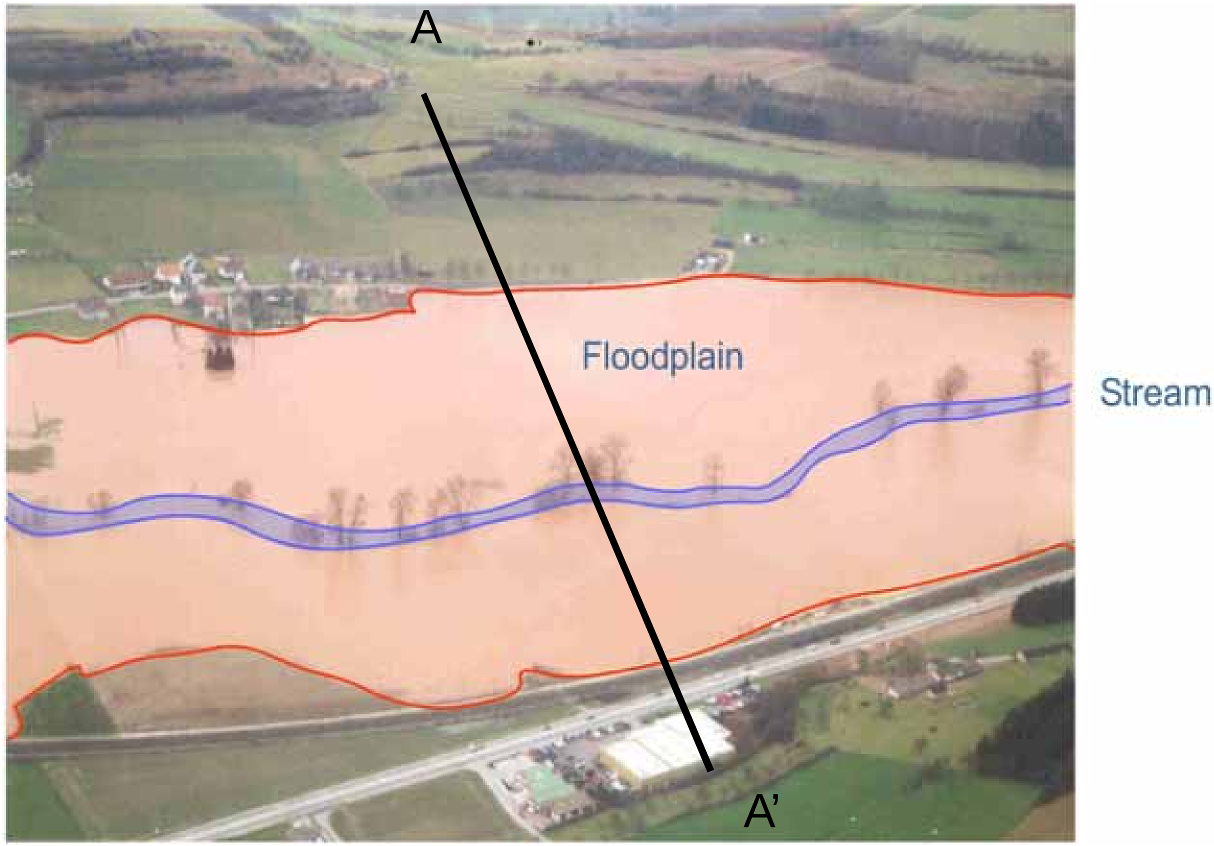
FLOODS

Hydrograph

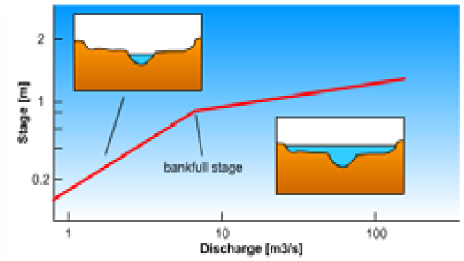


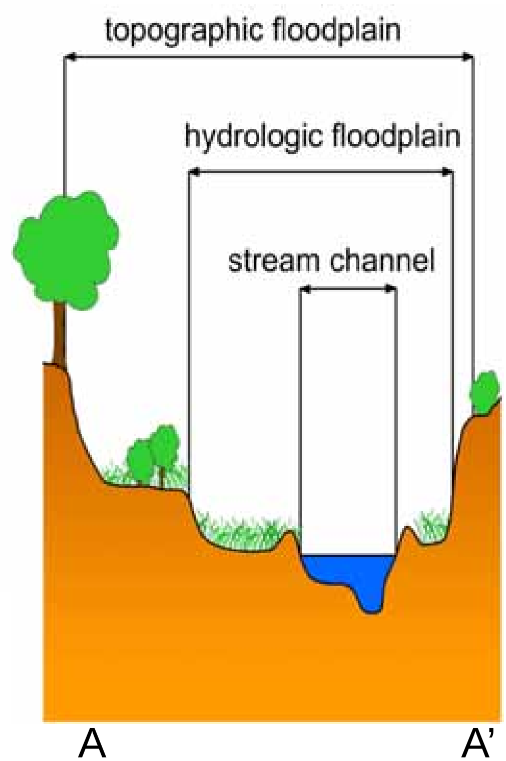
Source: R. Metzger (2009)

The river-floodplain system



Source: R. Metzger (2009)



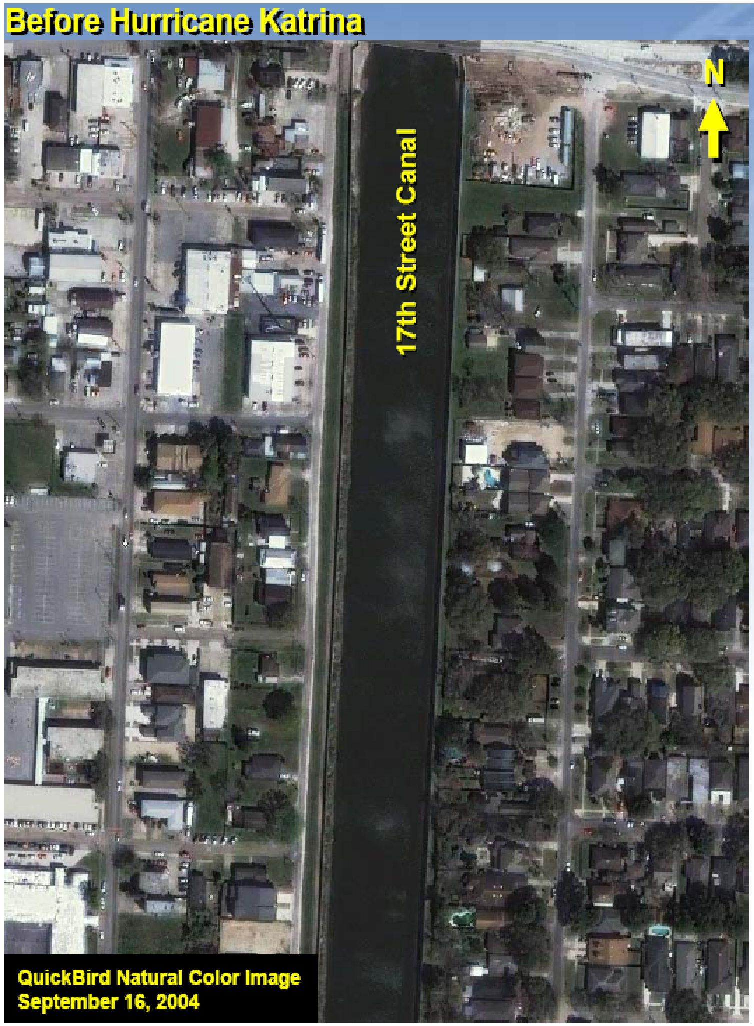


Primary process example: obstruction

Source: Gli eventi alluvionali del 22 e 27 settembre in Liguria Studio Idrologico e Geomorfologico, GEAM XXX n°4, 1993

Source: R. Metzger (2009)

Primary process example: Digue break in New Orleans



Source: R. Metzger (2009)

Secondary process example: Erosion in Engelberg

Source: R. Metzger (2009)

Secondary process example: Flooding

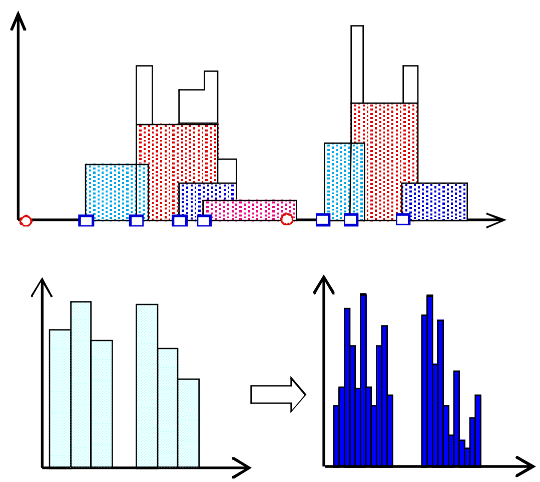
Source: R. Metzger (2009)

Secondary process example: alluvial deposits in Klosters

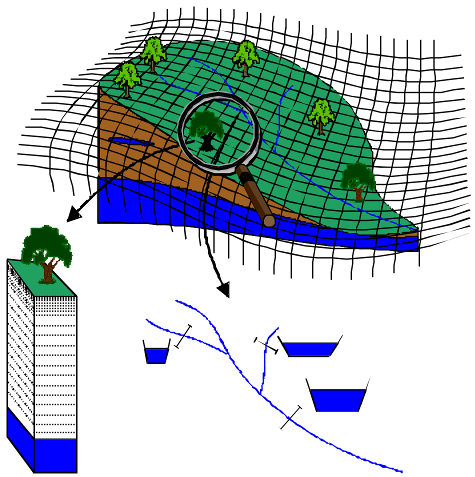
Source: R. Metzger (2009)

From climate hazard to hydrological consequences

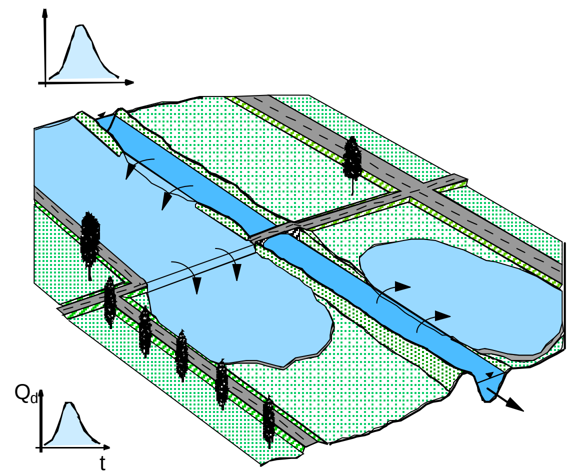
Rainfall analysis and modelling



Modelling of the watershed hydrological response



Flood Modelling

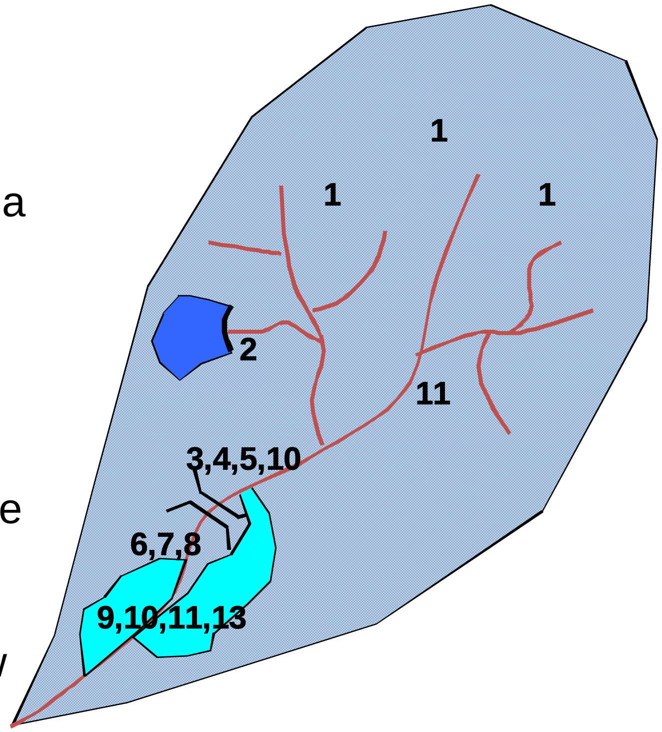


Source: R. Metzger (2009)

Analysis of potential events at watershed scale

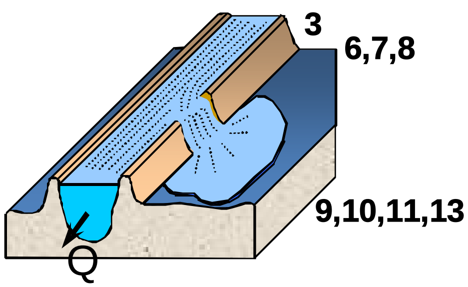
Primary processes (at the origin of the flood):

(1) Material mobilization area
(2) Failure of retention structures
(3) Sedimentation
(4) Obstruction by bridges
(5) Obstruction of pipes
(6) Seepage and dam failure by internal erosion
(7) Banks overflow
(8) Dike break after overflow

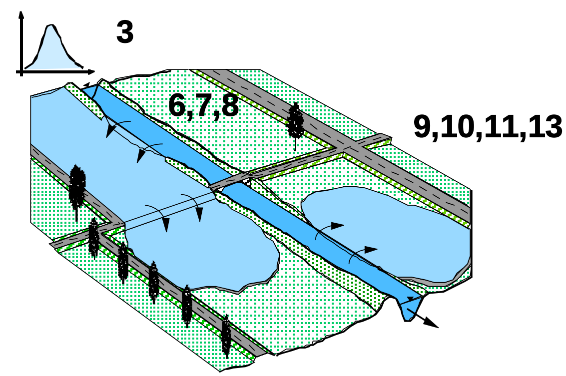


Secondary processes (at the origin of damage):

(9) Moderate flood (low velocity)
(10) Long duration flood
(11) Dangerous flood
(12) Erosion
(13) Overflow with alluvial deposits



Data
- Synthesis of all existing elements
- DTM
- Terrain analysis



Source: R. Metzger (2009)

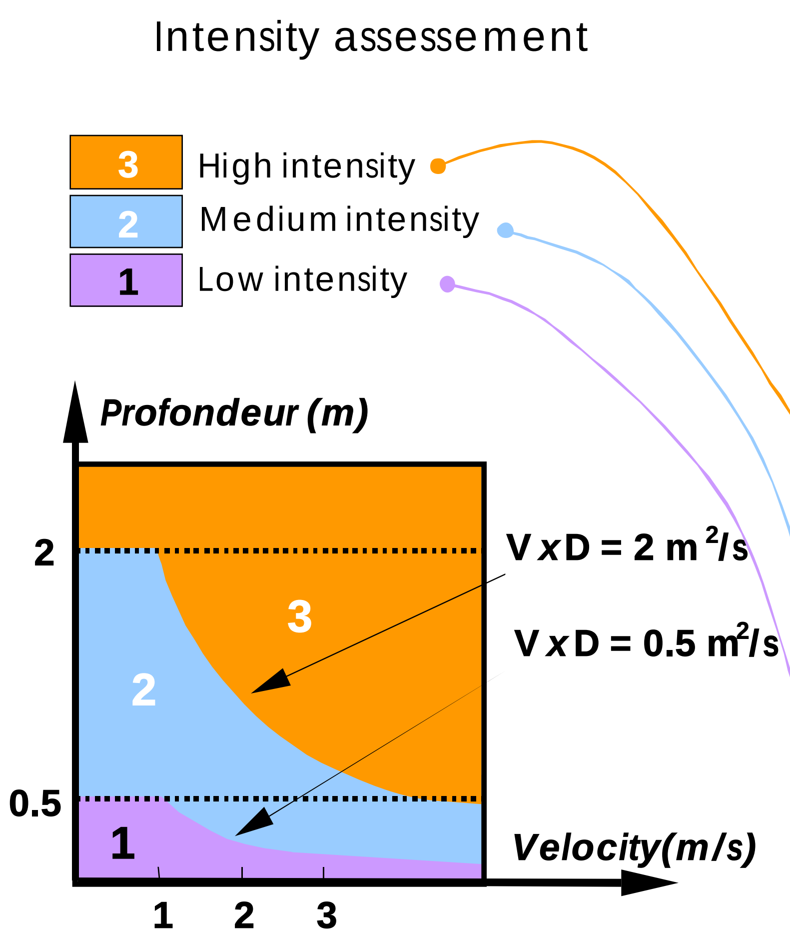
Static vs. dynamic flood

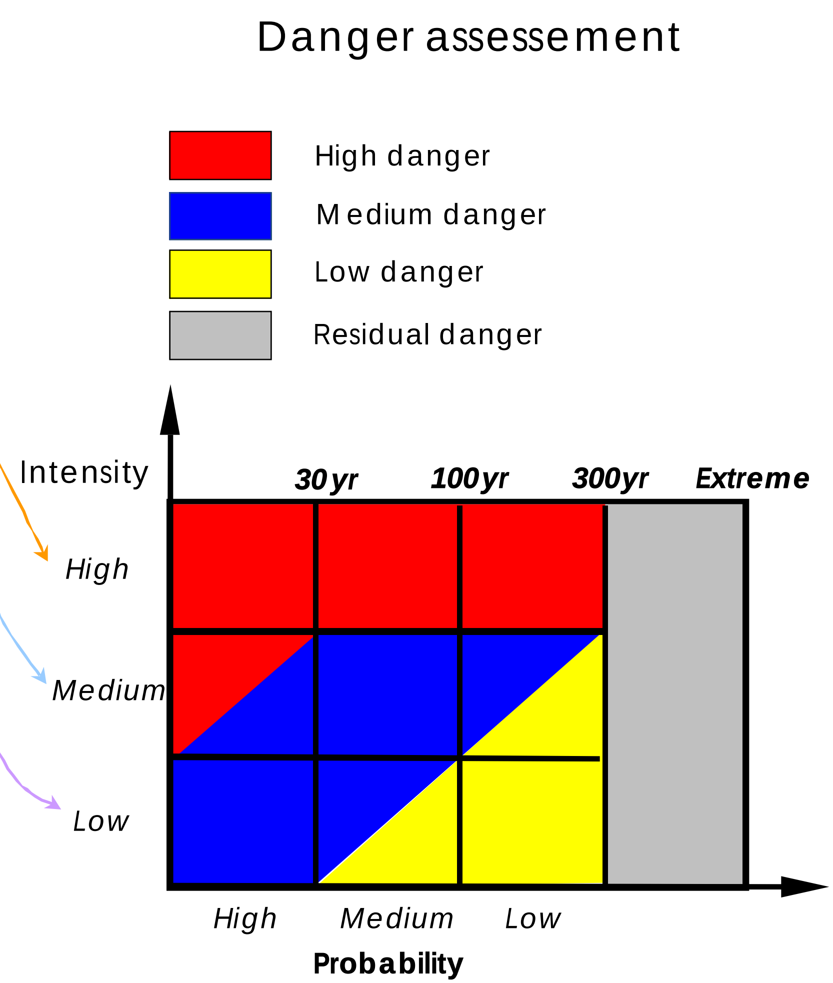
Photo: R. Loat

Photo: E. Gertsh

→ Depending on the velocity of the water, as well as the transported materials, the consequences of the flood will be different

Intensity


Intensity assessement
3
High intensity
2
Medium intensity
1
Low intensity
Profondeur (m)
2
0.5
3
2
1
V x D = 2 m²/s
V x D = 0.5 m²/s
Velocity(m/s)
1
2
3

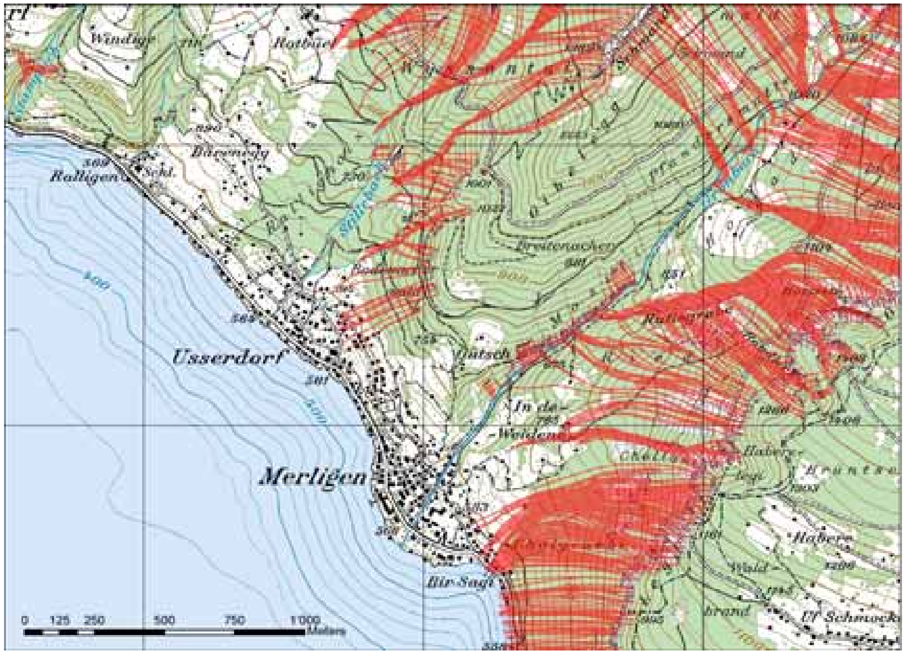

Danger assessement
High danger
Medium danger
Low danger
Residual danger
Intensity
High
Medium
Low
30 yr
100yr
300yr
Extreme
High
Medium
Low
Probability

ROCKFALLS

Indicative hazard maps: example 1

Goal: identify forests acting as a protection (for funding purpose)

Method: 3D modeling of 1 m^3 rockfalls using all the area identified as rocks on the 1:25'000 topographic maps

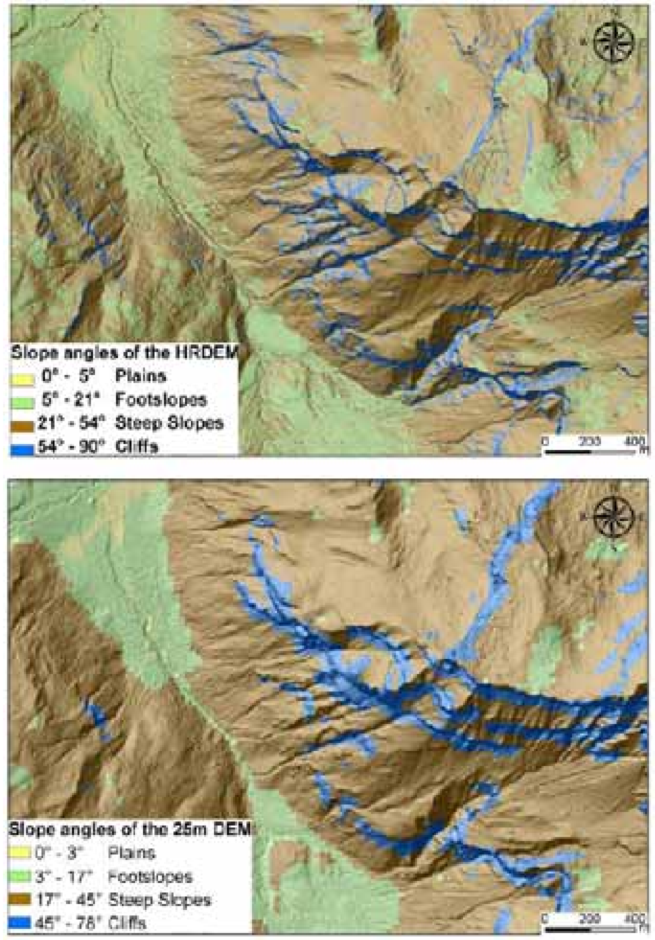


Source: Liener et al. (2008)

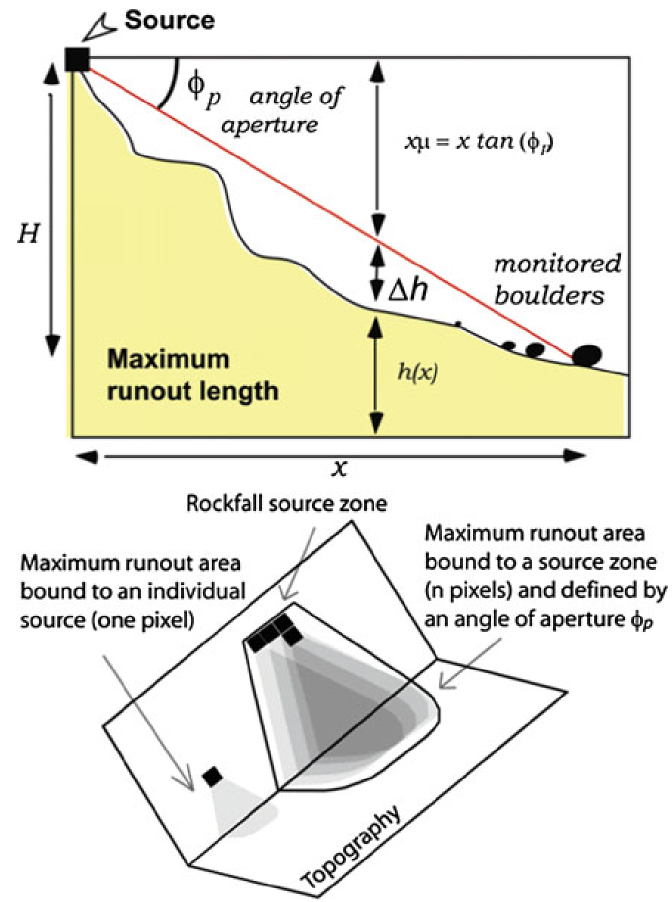
Indicative hazard maps: example 2

Goal: identify potential risk area where danger maps will be established

Method: Slope angle distribution to identify potential source area and shadow angle to assess the runout

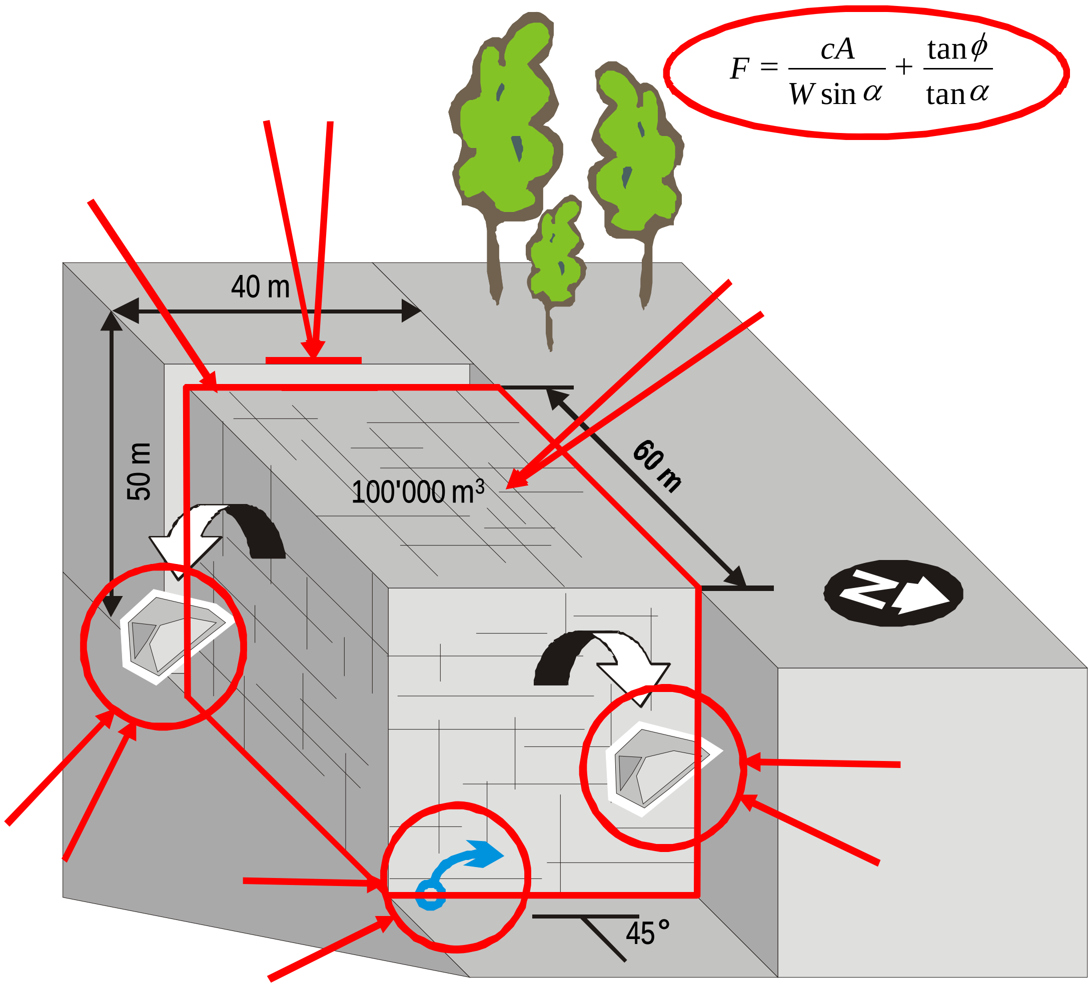


Source: Loye et al. (2009)



Source: Jaboyedoff et al. (2012)

Source area characterization



Continuity	5
Activity	15
Water	3
Sensitivity to degrading factors	1
Sensitivity to triggering factors	20
Sensitivity to stabilizing factors	-3
Factor of safety – appreciation	20
TOTAL	61

Susceptibility:
HIGH