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MultiRISK

A Platform for coherent Multi-Hazard Risk Modelling & Visualisation

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Stryszawa, Poland

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SEVENTH FRAMEWORK PROGRAMME

CHANGES Risk=HVA

Rationale

- Hazards are not directly comparable & contrasting modelling approaches
- Hazards interact ($\neq$ sum)
- High data requirement

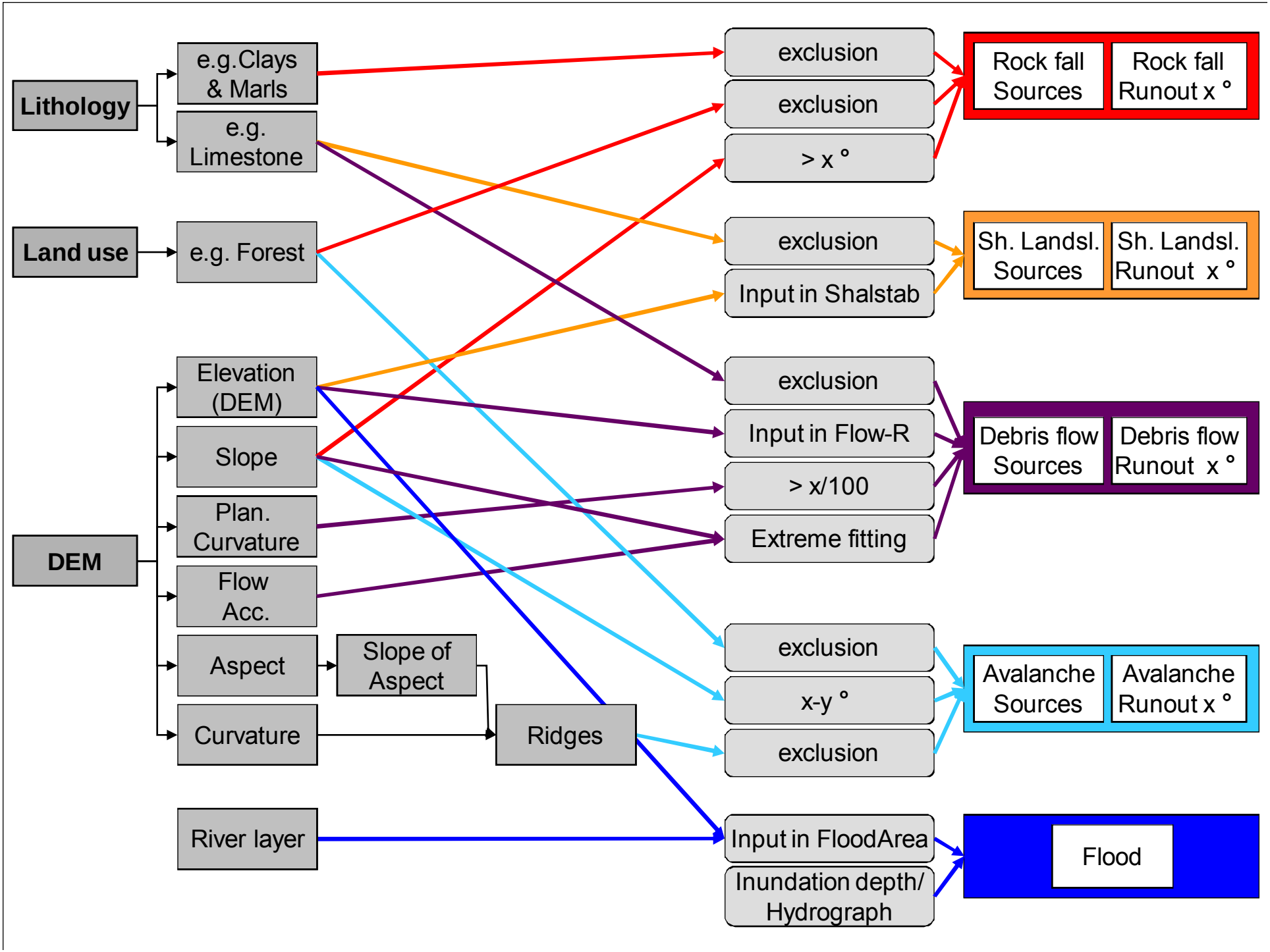
→ Joint multi-hazard analysis scheme

The MultiRISK Platform

- **Multi-scale top-down approach**: Regional (~1:25.000) + local scale
- Regional **exposure** analysis of 5 mountain hazards (debris flows, rock falls, shallow landslides, snow avalanches & river floods)
- Integration of hazard **interactions**
- Integration of a **validation** step
- Automation in a **software tool** (ArcGIS + Python + external models)
- Coupled with a **visualization tool** (Web-service)

Models

	Sources	Run out
Debris flows	Planar curvature Slope Land use & Lithology	Flow direction Flow spreading Flow inertia
Rock falls	Slope Land use & Lithology	
Shallow landslides	Soil bulk density Slope Critical rainfall Lithology	
Snow avalanches	Slope Ridges Land use	
River floods	Hydrograph or flood depth	


Lithology
e.g.Clays & Marls
e.g. Limestone
Land use
e.g. Forest
DEM
Elevation (DEM)
Slope
Plan. Curvature
Flow Acc.
Aspect
Slope of Aspect
Curvature
Ridges
River layer
exclusion
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Extreme fitting
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Inundation depth/ Hydrograph
Rock fall Sources
Rock fall Runout x °
Sh. Landsl. Sources
Sh. Landsl. Runout x °
Debris flow Sources
Debris flow Runout x °
Avalanche Sources
Avalanche Runout x °
Flood

The MultiRisk Modelling: Analysis Scheme

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Interactions: Disposition - Trigger

Disposition

e.g. Fire-flood cycle

→ Identification of interactions and updating of the recent hazard level

Trigger

e.g. landslide > damming of a river > dam break > debris flow / flash flood

→ Analysis of the overall hazard (and overall risk, respectively)

The MultiRisk Modelling: Examples of interactions

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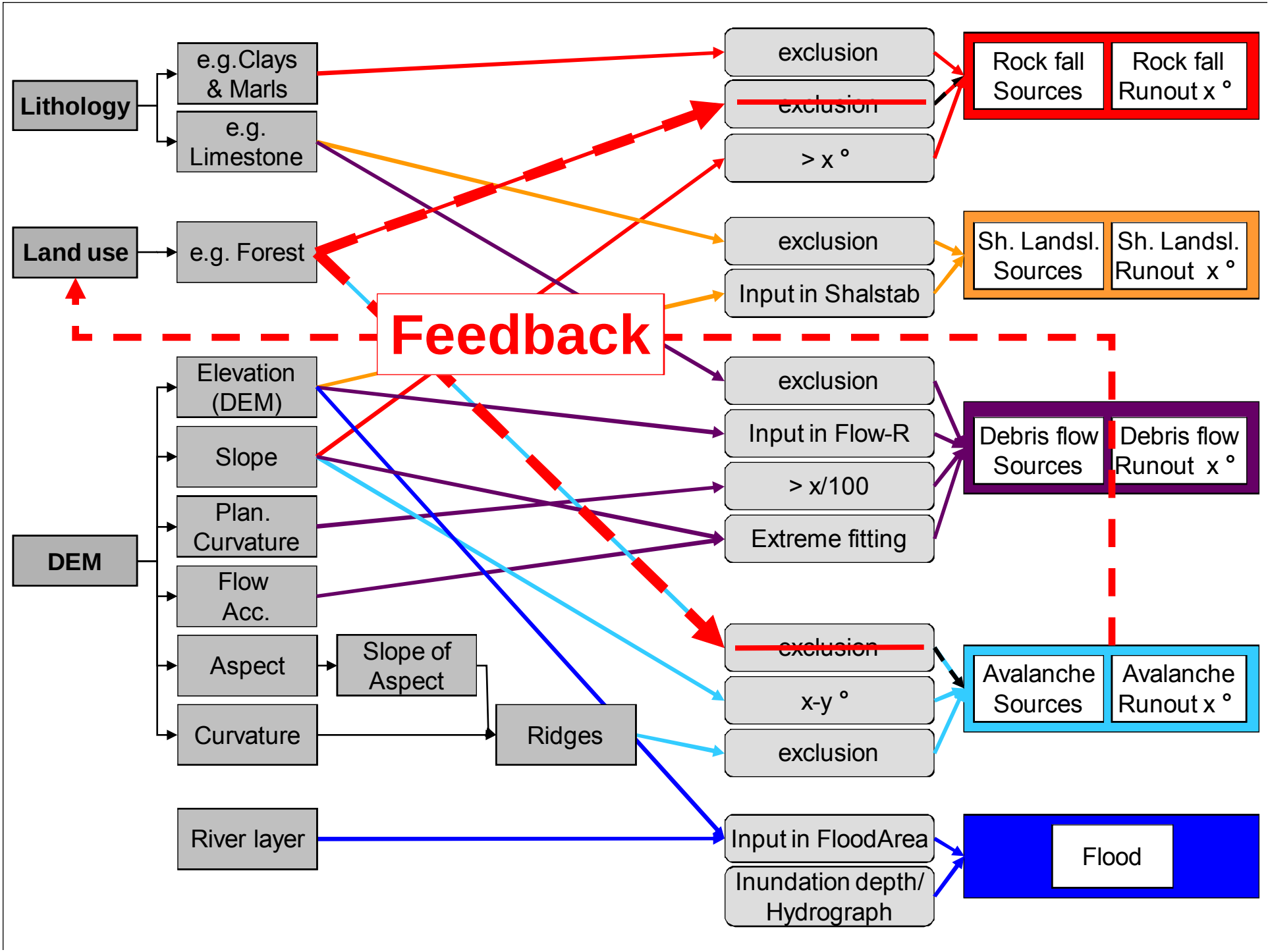
Avalanche	Influence on vegetation cover (Removal of forest)	Influence on vegetation cover (Removal of forest)	Influence on vegetation cover	Supply of material (e.g. snow, rocks, trees)
-	**Debris Flow**	-	-	Change of river bed morphology (acc. & erosion)
Increased slope roughness	Supply of material	**Rock Falls**	Increase of load	Material accumulation in river bed
Alteration of surface roughness	Supply of material	-	**Landslides**	Change of river course
-	Remobilisation of material	-	Erosion / saturation of landslide deposits	**Floods**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The MultiRisk Modelling: One example …

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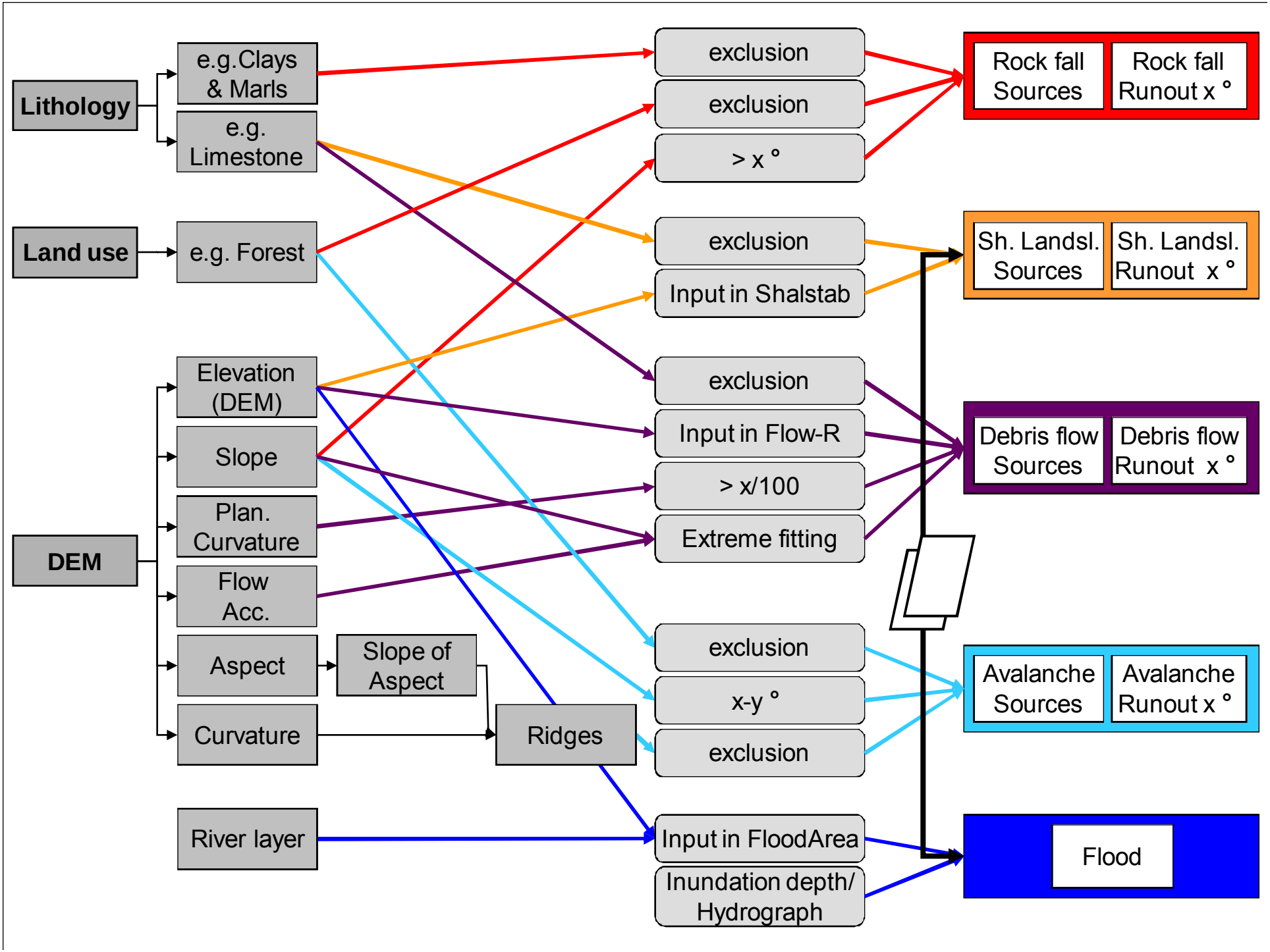
Avalanche				
	Debris Flow			
		Rock Falls		
			Landslides	River damming
			Slope undercutting	**Floods**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Avalanche Runout x °
Flood

The MultiRisk Modelling: Interaction: Floods - landslides

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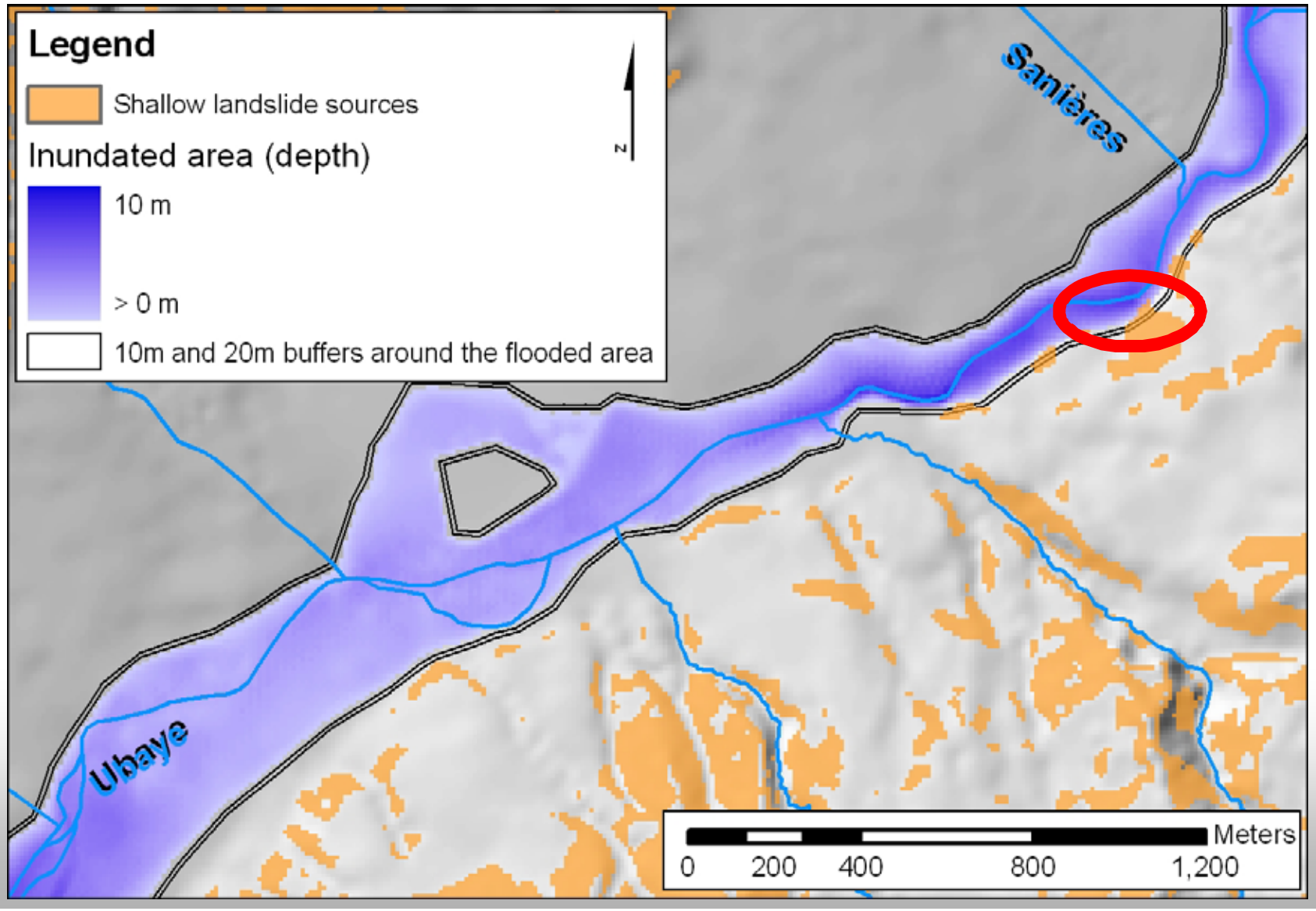

The Modelling Approach: Exposure

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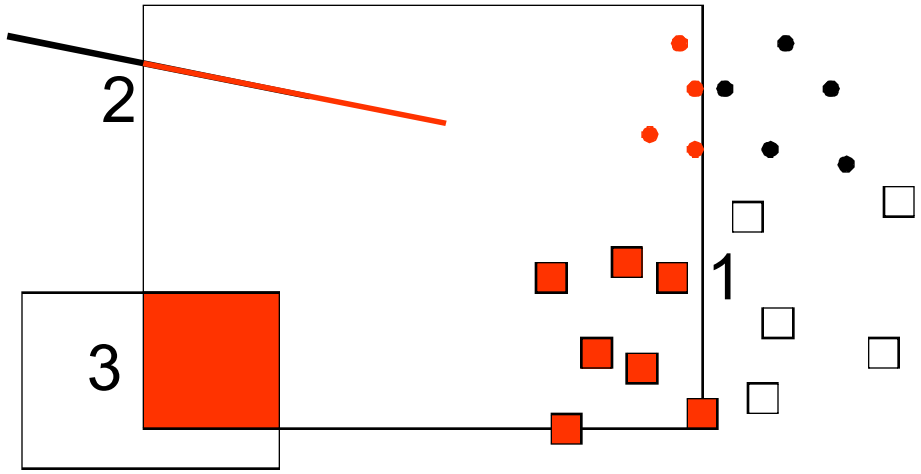
Overlay of susceptibility zones and elements at risk



The MultiRisk Modelling

HAZARD MODELING

Upload of data/ choice of a project

⇩

Hazard Choice

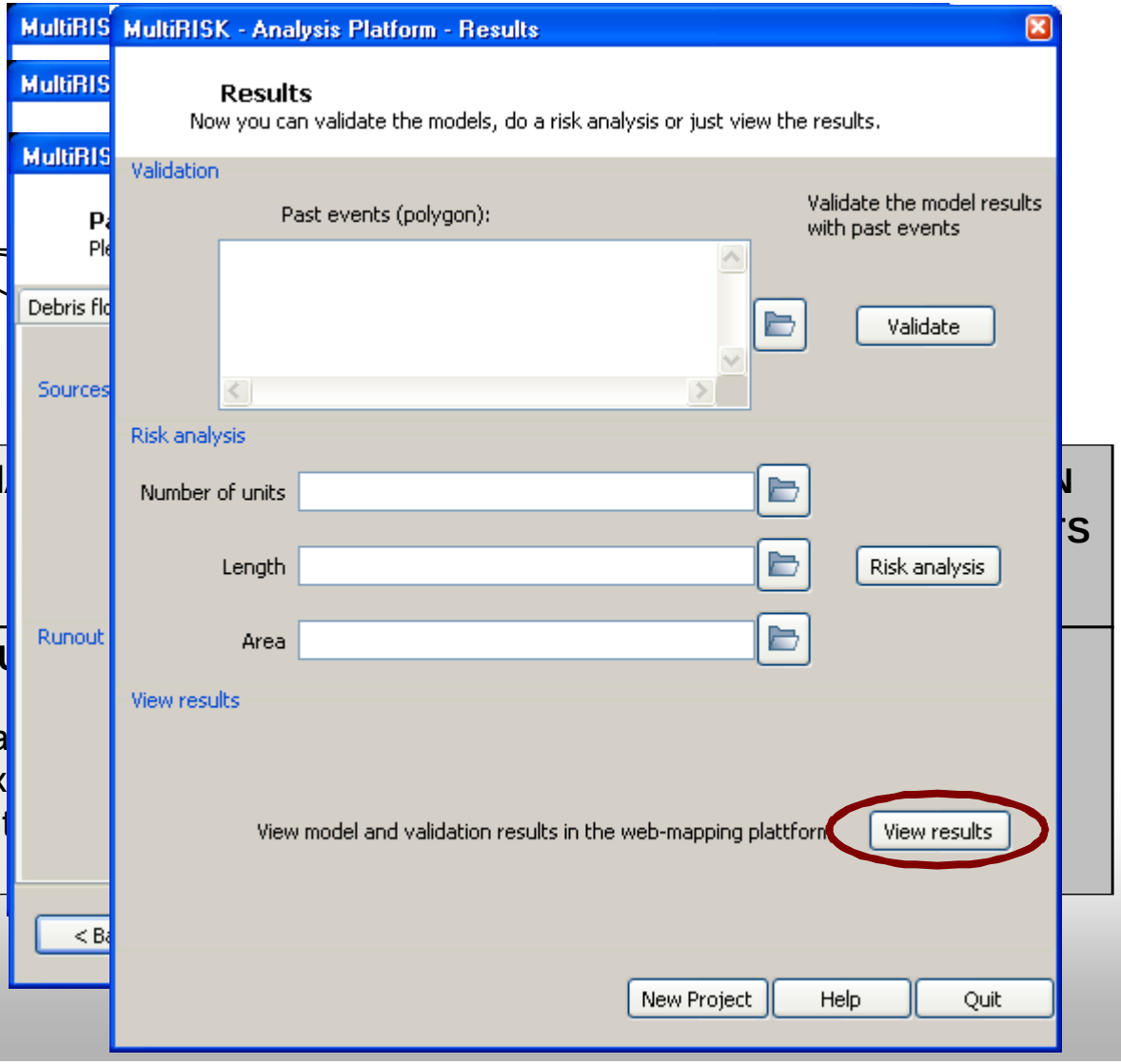
⇩

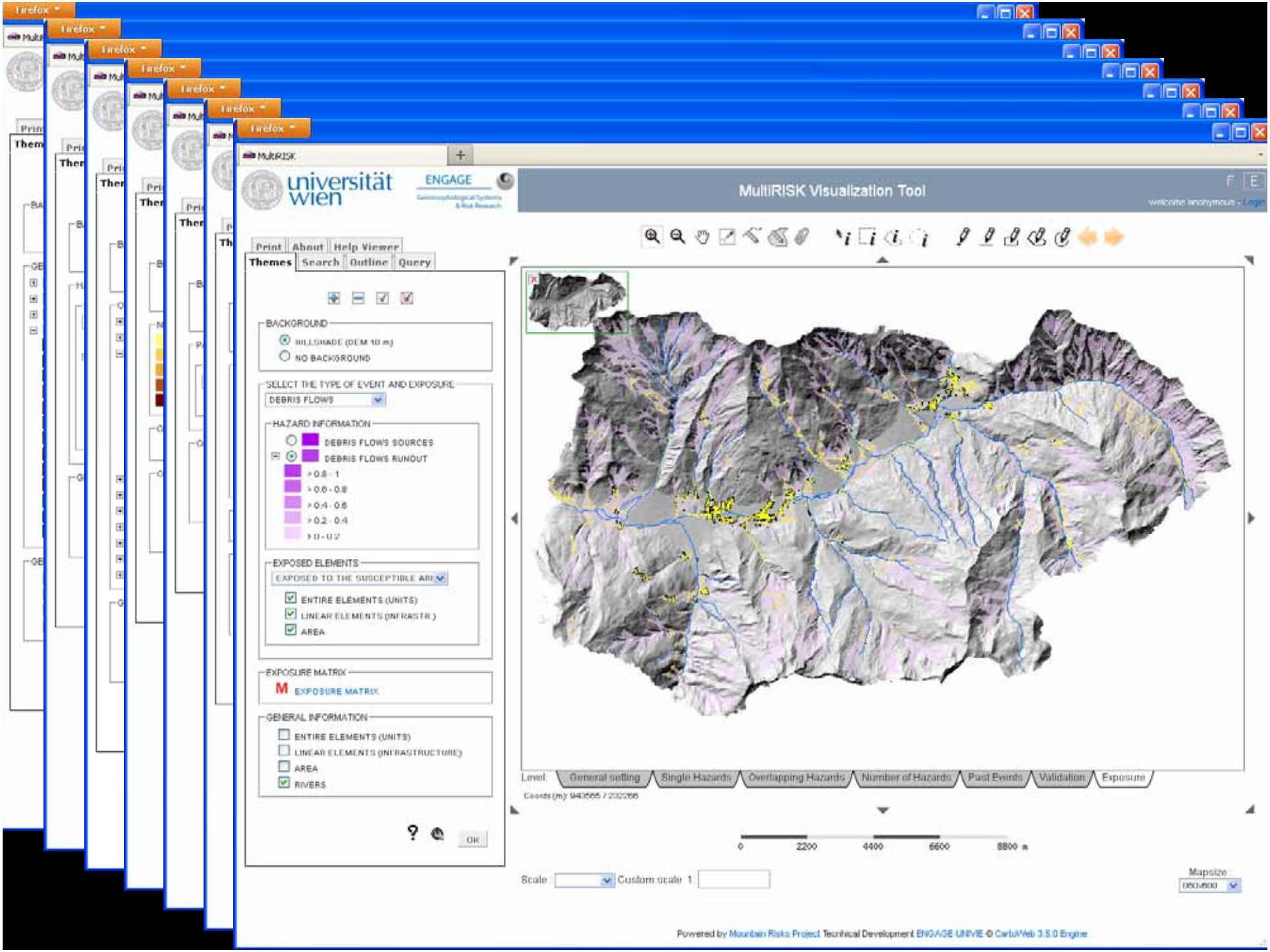
Parameter choice for each single-hazard model

⇩

Confirmation of parameter choice

Run

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ENGAGE
MultiRISK Visualization Tool
Print
About
Help Viewer
Themes
Search
Outline
Query
BACKGROUND
HILLSHADE (DEM 10 m)
NO BACKGROUND
SELECT THE TYPE OF EVENT AND EXPOSURE
DEBRIS FLOWS
HAZARD INFORMATION
DEBRIS FLOWS SOURCES
DEBRIS FLOWS RUNOUT
> 0.8 - 1
> 0.6 - 0.8
> 0.4 - 0.6
> 0.2 - 0.4
> 0 - 0.2
EXPOSED ELEMENTS
ENTIRE ELEMENTS (UNITS)
LINEAR ELEMENTS (INFRASTR.)
AREA
EXPOSURE MATRIX
EXPOSURE MATRIX
GENERAL INFORMATION
ENTIRE ELEMENTS (UNITS)
LINEAR ELEMENTS (INFRASTRUCTURE)
AREA
RIVERS
OK
Level
General setting
Single Hazards
Overlapping Hazards
Number of Hazards
Past Events
Validation
Exposure
0
2200
4400
6600
8800 m
Scale
Custom scale 1:
Mapsize
Powered by Mountain Risks Project Technical Development ENGAGE UNIVIE © CartoWeb 3.5.0 Engine

Outlook

Extended by …

- … additional processes
- … further scales
- … a variety of models
- vulnerability assessments
- risk analysis

Adaptation to exact user needs (data available, processes present, set of models fitting well, calibration in the area, establishment of interactions …)

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Thank you for your attention!

on behalf of the whole research group …

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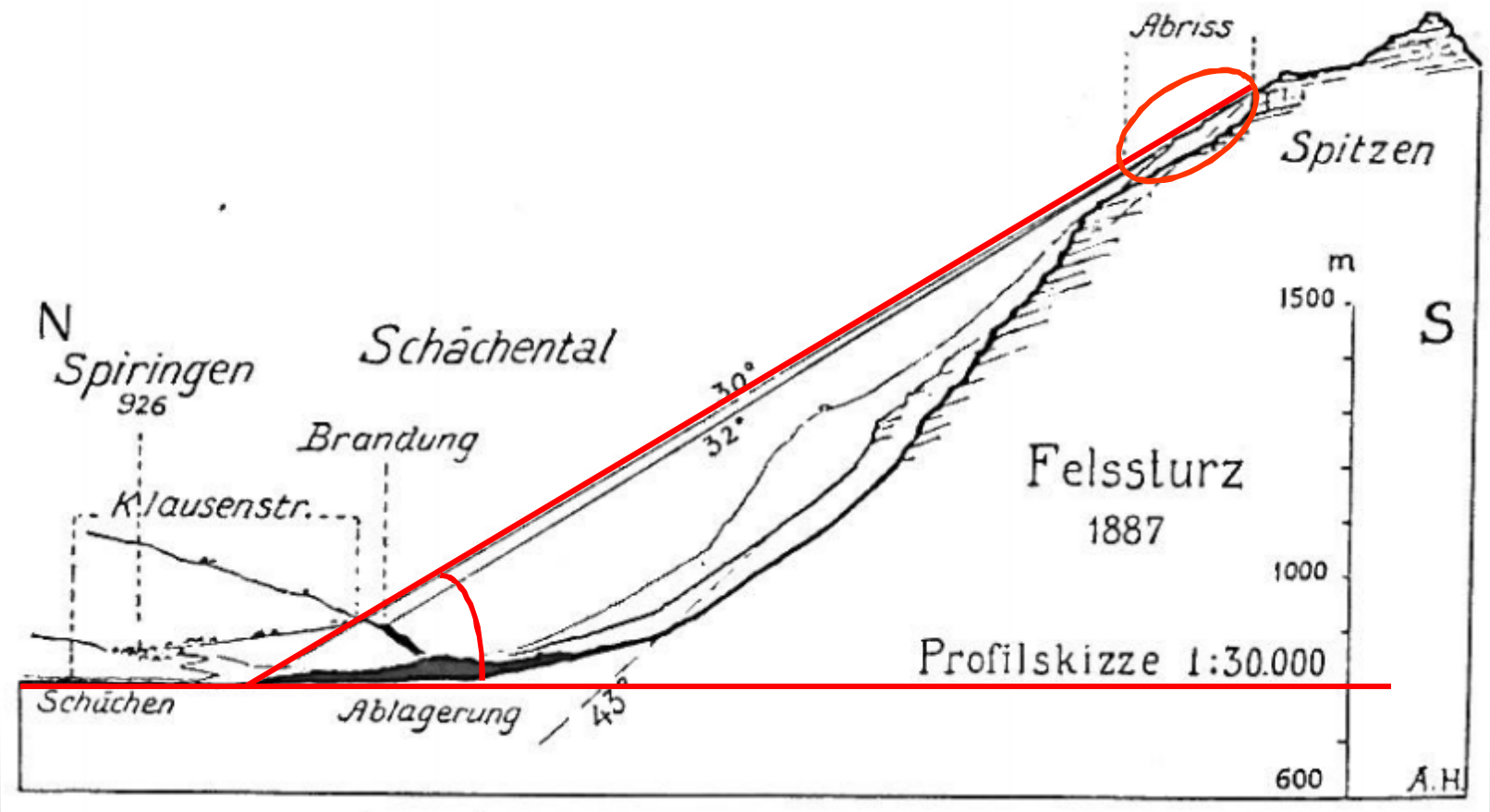
http://homepage.univie.ac.at/thomas.glade

The MultiRisk Modelling: Analysis Scheme



Heim (1932)

The MultiRisk Modelling: Validation

	Modelled	**Not modelled**
Recorded	True Positives	False Negatives
Not recorded	False Positives	True Negatives

Positive predictive power Sensitivity