

Swiss Danger Maps – Rockfall in Frenieres-sur-Bex (Canton of Vaud, Switzerland)

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Objective

Create a danger map for Frenieres-sur-Bex for rockfall using modelling

Study area

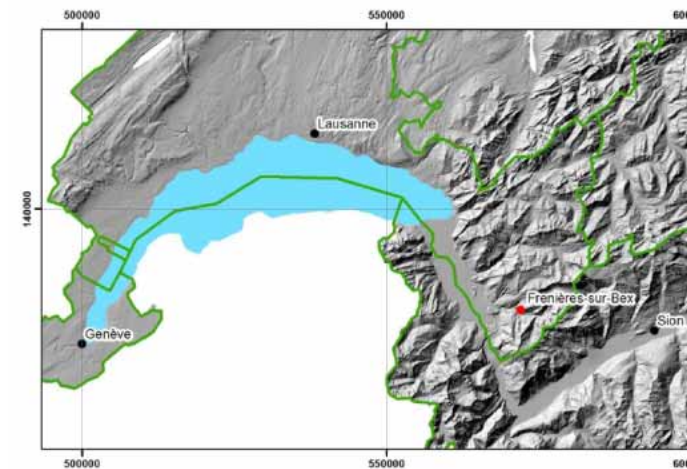
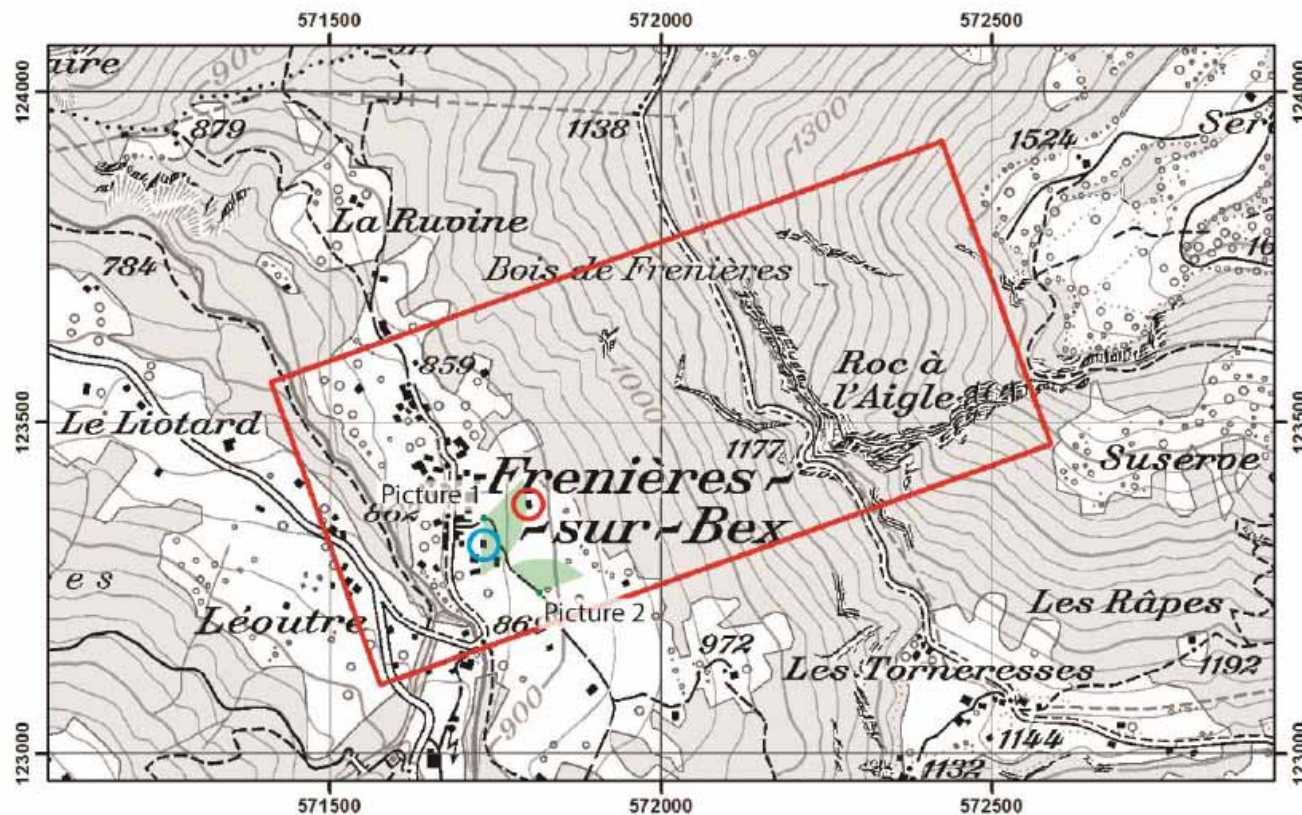


Figure 1: Localization of the study area (coordinates: Swiss metric grid, data: ©Swisstopo)

Data

ology map

erial photo

ographic map

AR DEM

ld observation (photos)

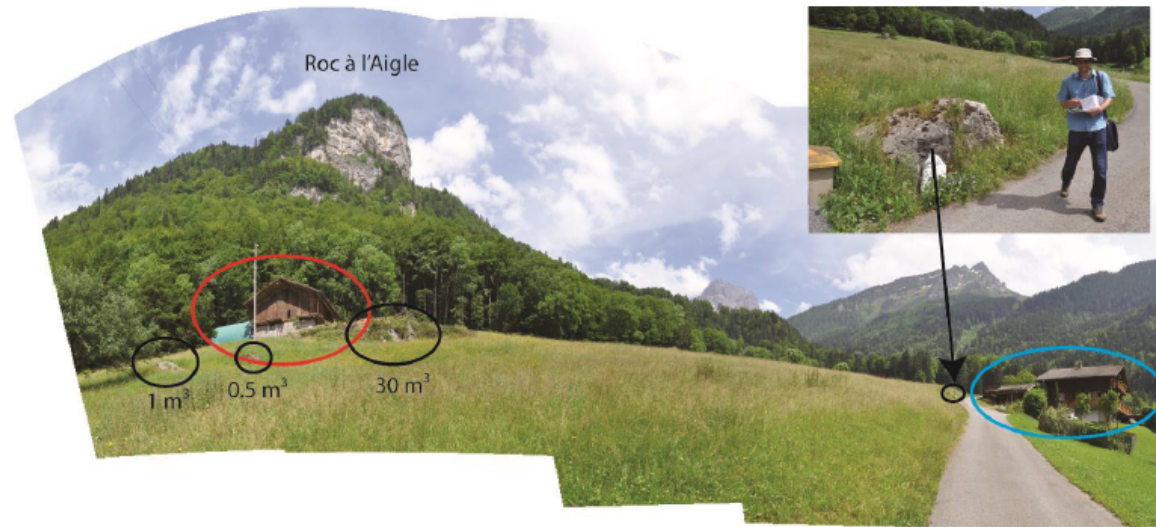


Figure 2: Panoramic view towards the East (picture 1). All blocks are massive limestone

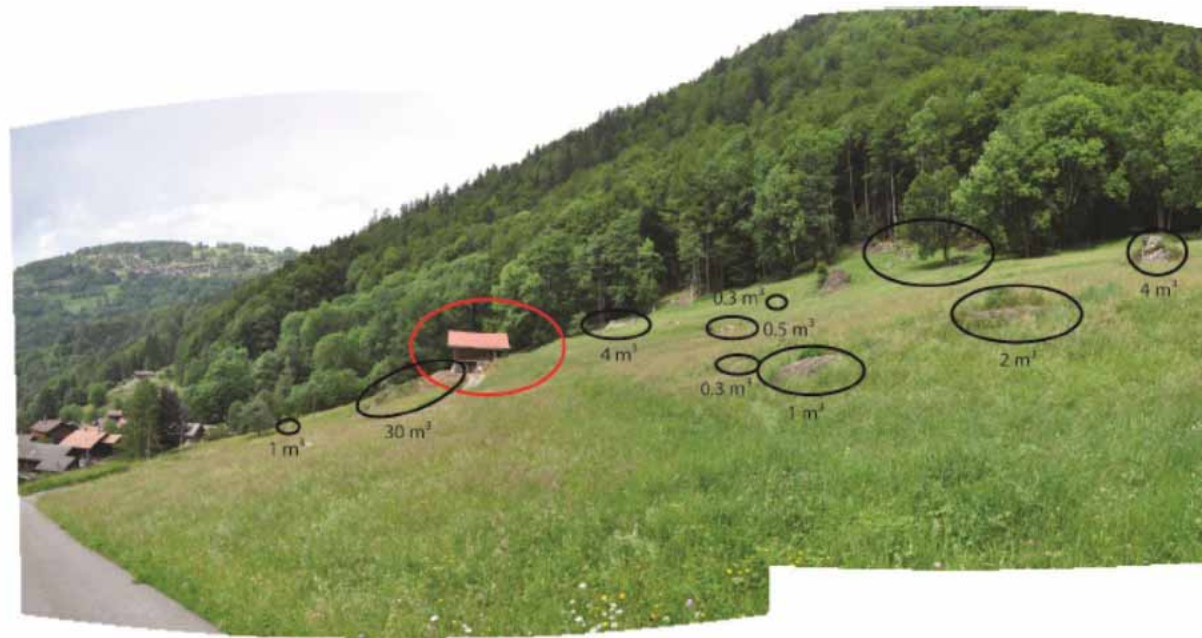


Figure 3: Panoramic view towards the North (picture 2). All blocks are massive limestone

Methodology

Registered the boulders in ArcGIS, based on their position in the photos
Estimated the characteristic blocks with 30, 100 and 300 years return period
Prepared a shapefile for Rocky3D by dividing the area in homogeneous zones:

Pasture

Forest

Built area

Outcrop

Transformed the shapefiles resulted in ASCII grids, using Pimp My Rockyfor3D

Performed a trajectographic study in Rockyfor3D for 3 scenarios:

30 years return period

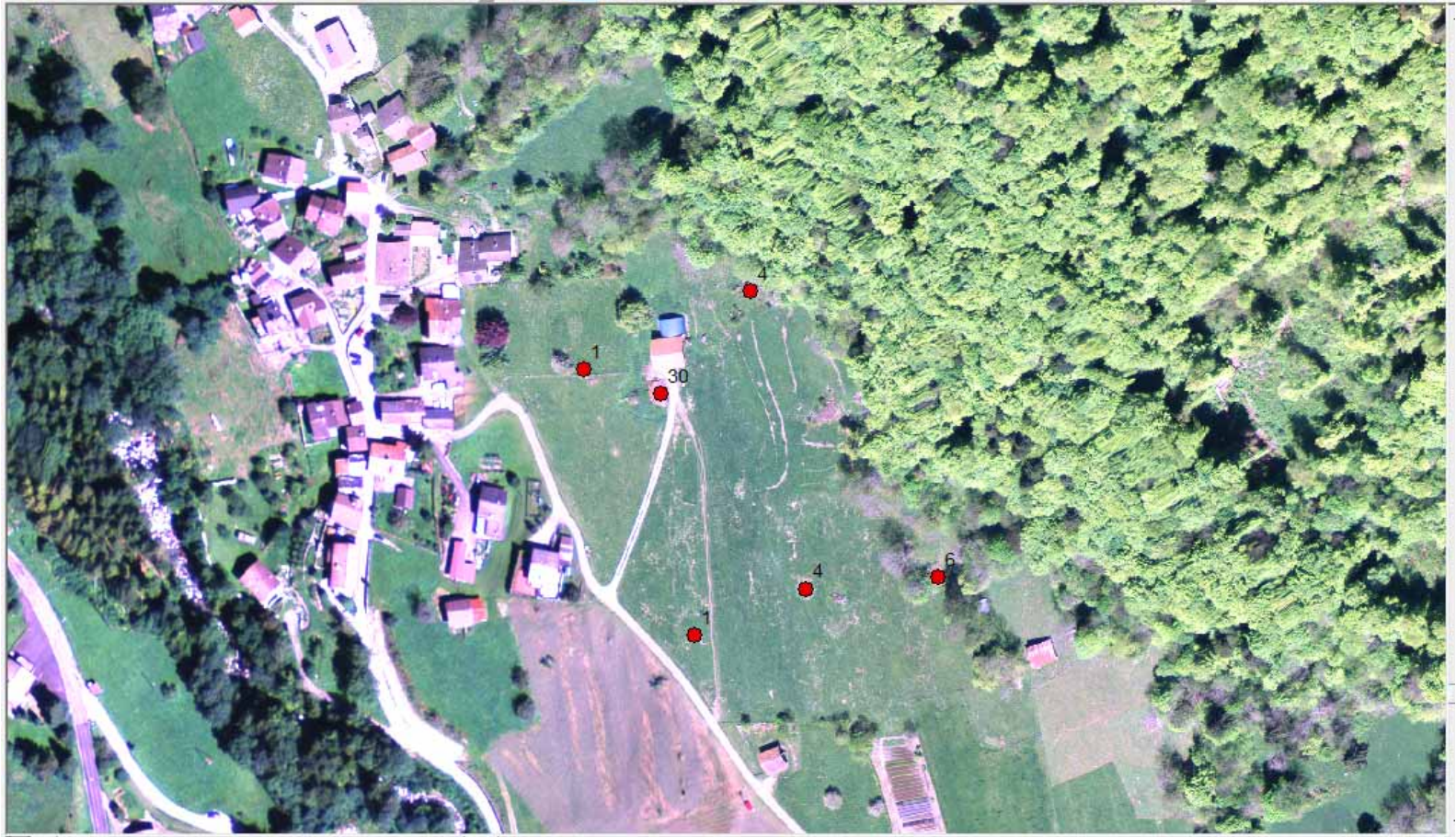
100 years return period

300 years return period

Show an intensity map for each scenario

Show the hazard map

Registering the boulders in GIS, based on their position in the photos



Estimation of the characteristic blocks with 30, 100 and 300 years return period

Shape	Id	rockdens	d1	d2	d3	bshape	rg70	rg20	rg10	soiltype	LandUse
gon	0	0	0	0	0	0	0	0.5	0.1	7	1
gon	0	0	0	0	0	0	0	0.5	0.1	7	2
gon	0	0	0	0	0	0	0	0.5	0.1	7	3
gon	0	0	0	0	0	0	0	0.5	0.1	7	4
gon	0	0	0	0	0	0	0	0.5	0.1	7	5
gon	0	0	0	0	0	0	0	0.5	0.1	7	6
gon	0	0	0	0	0	0	0	0.5	0.1	7	7
gon	0	0	0	0	0	0	0	0.5	0.1	7	8
gon	0	0	0	0	0	0	0	0.5	0.1	7	9
gon	0	0	0	0	0	0	0	0.5	0.1	7	10
gon	0	0	0	0	0	0	0	0.5	0.1	7	11
gon	0	0	0	0	0	0	0	0.5	0.1	7	12
gon	0	0	0	0	0	0	0	0.5	0.1	7	13
gon	0	0	0	0	0	0	0	0.5	0.1	7	14
gon	0	0	0	0	0	0	0	0.5	0.1	7	15
gon	0	0	0	0	0	0	0	0.5	0.1	7	16
gon	0	0	0	0	0	0	0	0.5	0.1	7	17
gon	0	0	0	0	0	0	0	0.5	0.1	7	18
gon	0	0	0	0	0	0	0	0.5	0.1	7	19
gon	0	0	0	0	0	0	0	0.5	0.1	7	20
gon	0	0	0	0	0	0	0	0.5	0.1	7	21
gon	0	0	0	0	0	0	0	0.5	0.1	7	22
gon	0	0	0	0	0	0	0	0.5	0.1	7	23
gon	0	0	0	0	0	0	0	0.5	0.1	7	24
gon	0	0	0	0	0	0	0	0.5	0.1	7	25
gon	0	0	0	0	0	0	0	0.5	0.1	7	26
gon	0	0	0	0	0	0	0	0.5	0.1	7	27
gon	0	0	0	0	0	0	0	0.5	0.1	7	28
gon	0	0	0	0	0	0	0	0.5	0.1	7	29
gon	0	0	0	0	0	0	0	0.5	0.1	7	30
gon	0	0	0	0	0	0	0	0.5	0.1	7	31
gon	0	0	0	0	0	0	0	0.5	0.1	7	32
gon	0	0	0	0	0	0	0	0.5	0.1	7	33
gon	0	0	0	0	0	0	0	0.5	0.1	7	34
gon	0	0	0	0	0	0	0	0.5	0.1	7	35
gon	0	0	0	0	0	0	0	0.5	0.1	7	36
gon	0	0	0	0	0	0	0	0.5	0.1	7	37
gon	0	0	0	0	0	0	0	0.5	0.1	7	38
gon	0	0	0	0	0	0	0	0.5	0.1	7	39
gon	0	0	0	0	0	0	0	0.5	0.1	7	40
gon	0	0	0	0	0	0	0	0.5	0.1	7	41
gon	0	0	0	0	0	0	0	0.5	0.1	7	42
gon	0	0	0	0	0	0	0	0.5	0.1	7	43
gon	0	0	0	0	0	0	0	0.5	0.1	7	44
gon	0	0	0	0	0	0	0	0.5	0.1	7	45
gon	0	0	0	0	0	0	0	0.5	0.1	7	46
gon	0	0	0	0	0	0	0	0.5	0.1	7	47
gon	0	0	0	0	0	0	0	0.5	0.1	7	48
gon	0	0	0	0	0	0	0	0.5	0.1	7	49
gon	0	0	0	0	0	0	0	0.5	0.1	7	50
gon	0	0	0	0	0	0	0	0.5	0.1	7	51
gon	0	0	0	0	0	0	0	0.5	0.1	7	52
gon	0	0	0	0	0	0	0	0.5	0.1	7	53
gon	0	0	0	0	0	0	0	0.5	0.1	7	54
gon	0	0	0	0	0	0	0	0.5	0.1	7	55
gon	0	0	0	0	0	0	0	0.5	0.1	7	56
gon	0	0	0	0	0	0	0	0.5	0.1	7	57
gon	0	0	0	0	0	0	0	0.5	0.1	7	58
gon	0	0	0	0	0	0	0	0.5	0.1	7	59
gon	0	0	0	0	0	0	0	0.5	0.1	7	60
gon	0	0	0	0	0	0	0	0.5	0.1	7	61
gon	0	0	0	0	0	0	0	0.5	0.1	7	62
gon	0	0	0	0	0	0	0	0.5	0.1	7	63
gon	0	0	0	0	0	0	0	0.5	0.1	7	64
gon	0	0	0	0	0	0	0	0.5	0.1	7	65
gon	0	0	0	0	0	0	0	0.5	0.1	7	66
gon	0	0	0	0	0	0	0	0.5	0.1	7	67
gon	0	0	0	0	0	0	0	0.5	0.1	7	68
gon	0	0	0	0	0	0	0	0.5	0.1	7	69
gon	0	0	0	0	0	0	0	0.5	0.1	7	70
gon	0	0	0	0	0	0	0	0.5	0.1	7	71
gon	0	0	0	0	0	0	0	0.5	0.1	7	72
gon	0	0	0	0	0	0	0	0.5	0.1	7	73
gon	0	0	0	0	0	0	0	0.5	0.1	7	74
gon	0	0	0	0	0	0	0	0.5	0.1	7	75
gon	0	0	0	0	0	0	0	0.5	0.1	7	76
gon	0	0	0	0	0	0	0	0.5	0.1	7	77
gon	0	0	0	0	0	0	0	0.5	0.1	7	78
gon	0	0	0	0	0	0	0	0.5	0.1	7	79
gon	0	0	0	0	0	0	0	0.5	0.1	7	80
gon	0	0	0	0	0	0	0	0.5	0.1	7	81
gon	0	0	0	0	0	0	0	0.5	0.1	7	82
gon	0	0	0	0	0	0	0	0.5	0.1	7	83
gon	0	0	0	0	0	0	0	0.5	0.1	7	84
gon	0	0	0	0	0	0	0	0.5	0.1	7	85
gon	0	0	0	0	0	0	0	0.5	0.1	7	86
gon	0	0	0	0	0	0	0	0.5	0.1	7	87
gon	0	0	0	0	0	0	0	0.5	0.1	7	88
gon	0	0	0	0	0	0	0	0.5	0.1	7	89
gon	0	0	0	0	0	0	0	0.5	0.1	7	90
gon	0	0	0	0	0	0	0	0.5	0.1	7	91
gon	0	0	0	0	0	0	0	0.5	0.1	7	92
gon	0	0	0	0	0	0	0	0.5	0.1	7	93
gon	0	0	0	0	0	0	0	0.5	0.1	7	94
gon	0	0	0	0	0	0	0	0.5	0.1	7	95
gon	0	0	0	0	0	0	0	0.5	0.1	7	96
gon	0	0	0	0	0	0	0	0.5	0.1	7	97
gon	0	0	0	0	0	0	0	0.5	0.1	7	98
gon	0	0	0	0	0	0	0	0.5	0.1	7	99
gon	0	0	0	0	0	0	0	0.5	0.1	7	100

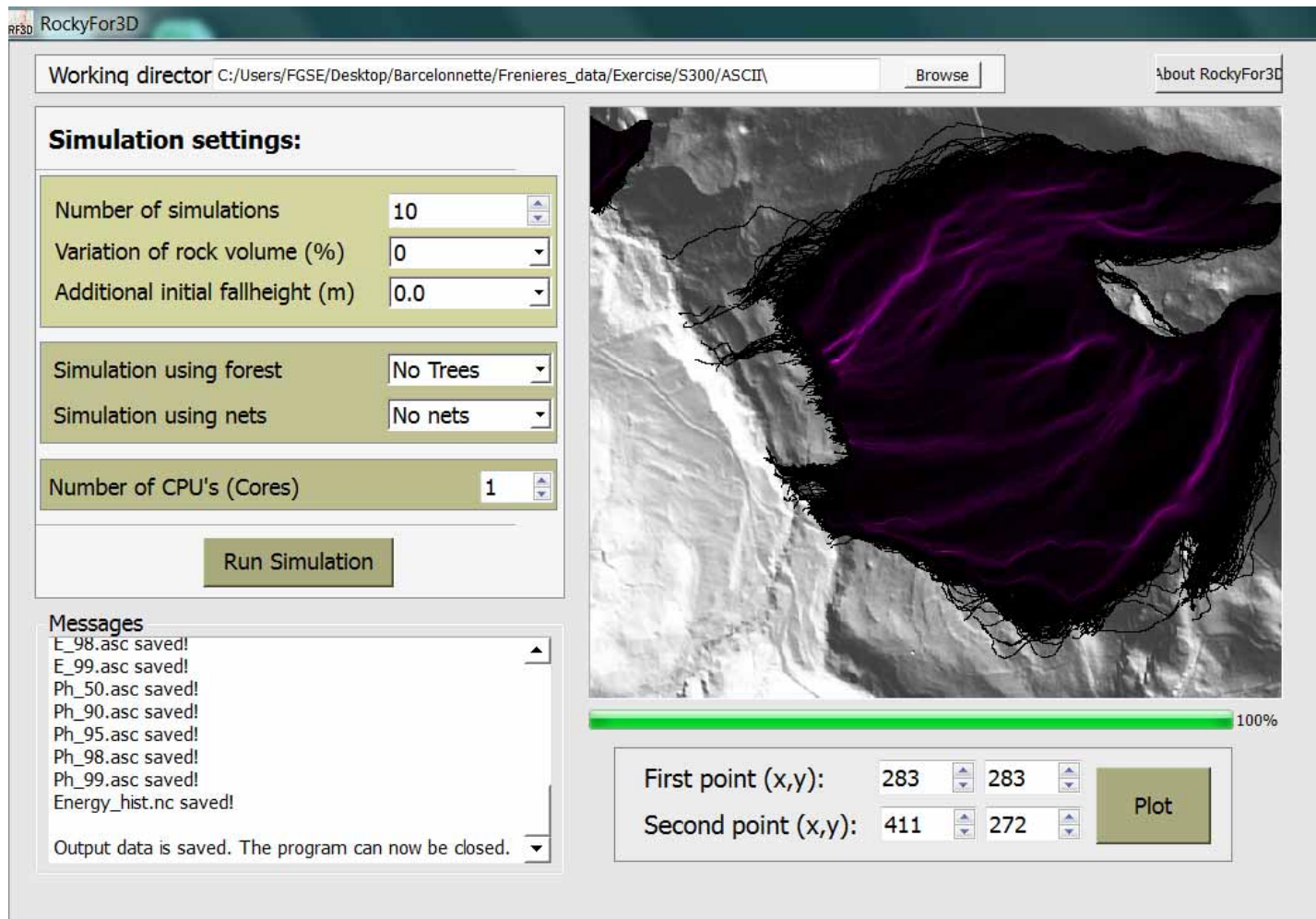
- d1 – height
- d2 – width
- d3 – length
- d1...d3 – based on the volume and on t photos
- rg70, rg20, rg10 – roughness (m) based the guidelines given
- Soil type – based on the aerial photogra and on the guidelines given

Preparation of a shapefile for Rocky3D by dividing the area in homogeneous zones

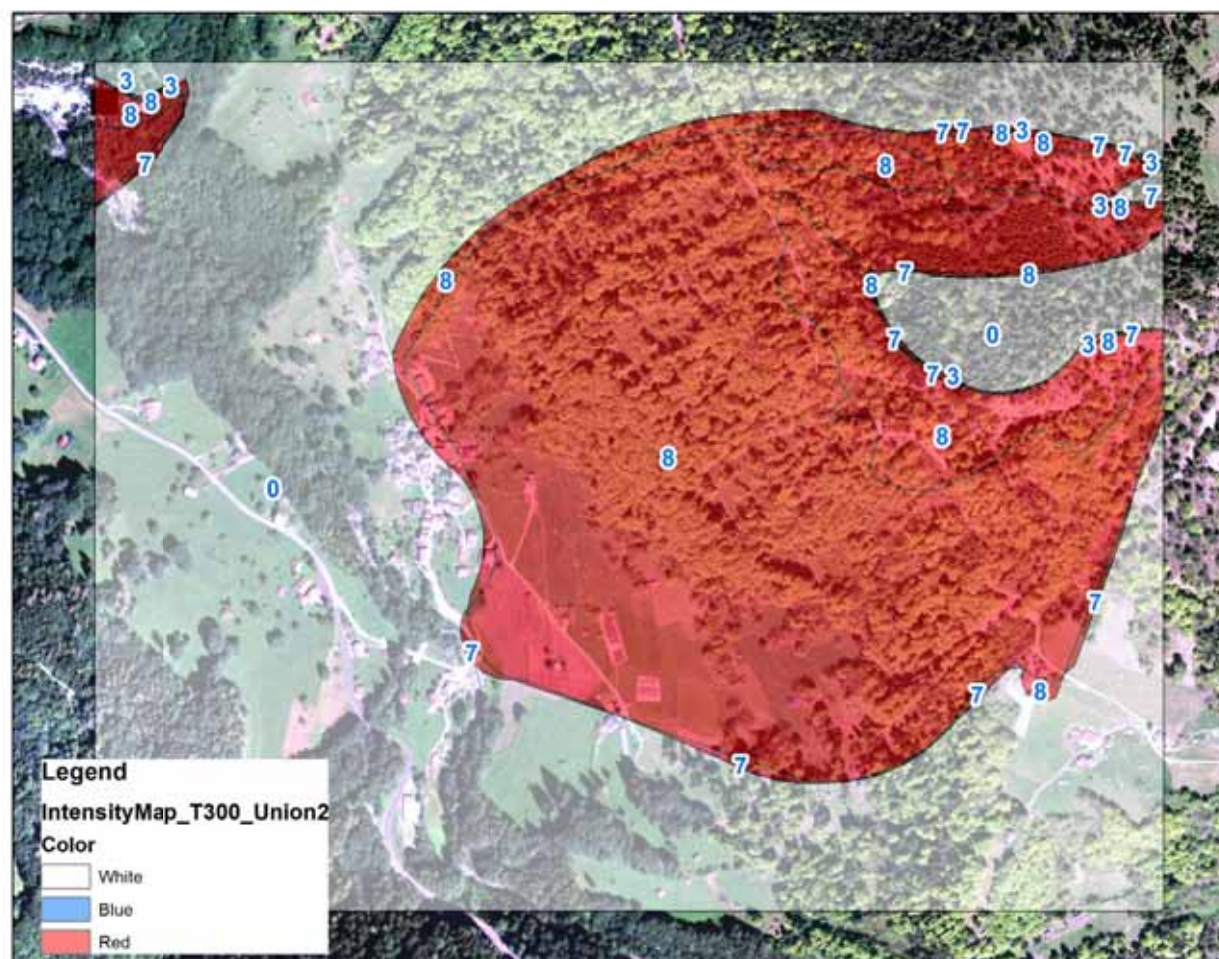
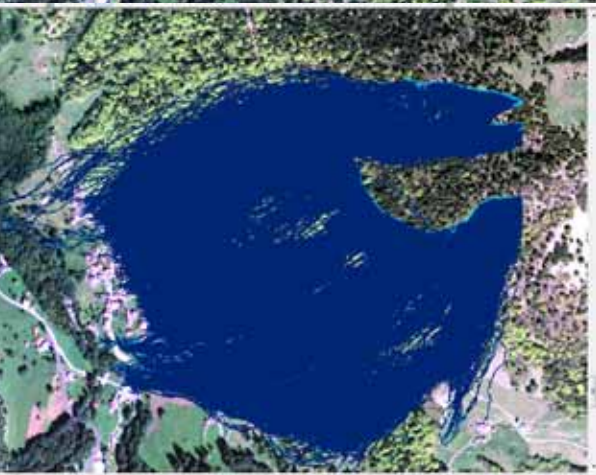


Land use	Code
<i>Forest</i>	1
<i>Pastures</i>	2
<i>Outcrop</i>	3
<i>Built-up area</i>	4

Modeling in Rockyfor3D



An aerial photograph of a forested landscape. A large, irregularly shaped area in the upper right portion of the image is highlighted in yellow. This highlighted area appears to be a dense forest or a specific land use zone. The surrounding area consists of various shades of green, indicating different types of vegetation or land cover. There are some roads and cleared areas visible in the lower left and bottom center of the image.



Conclusions

The method is a conservative one and it overestimates the risk

The values obtained show the presence of a high rockfall risk in the study area

High risk due to high present exposure compared with past exposure (1870)

Thank you!