QUANTIFYING LANDSCAPE CHANGES THROUGH THE GEOREFERENCING OF SINGLE OBLIQUE HISTORICAL PHOTOS

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Agenda:

- Why historical photos?
- The mono-plotting principle
- Fields of application and examples
- Accuracy estimation: preliminary results of a *crazy* test
- Outlook

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Oblique photographs display a great potential for historical reconstruction of landscape dynamics

- They go back to the XIX century

1900 1950 2000

Oblique photographs display a great potential for historical reconstruction of landscape dynamics

- *There is a huge amount of images*

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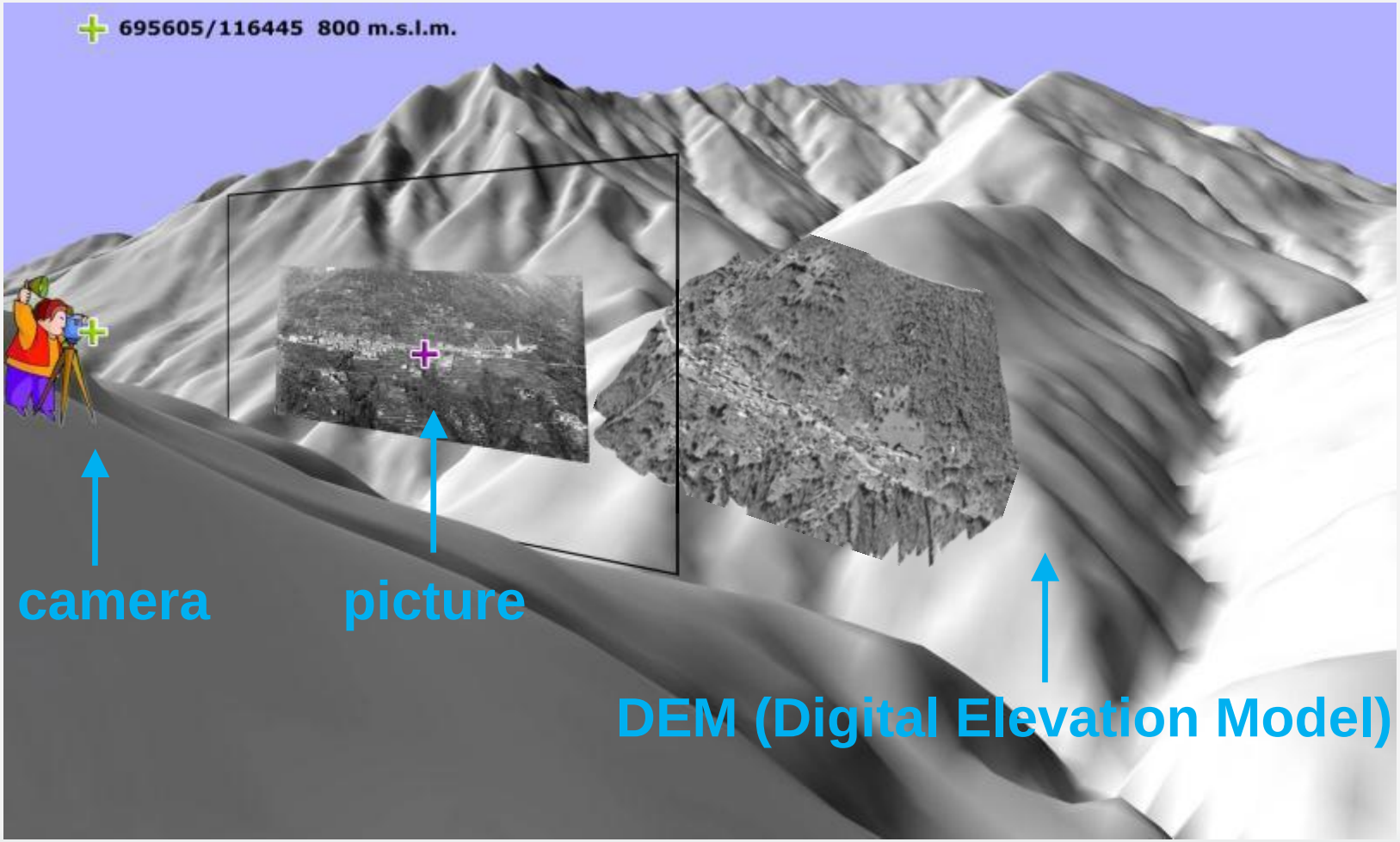
The mono-plotting principle

The main components of the system are:

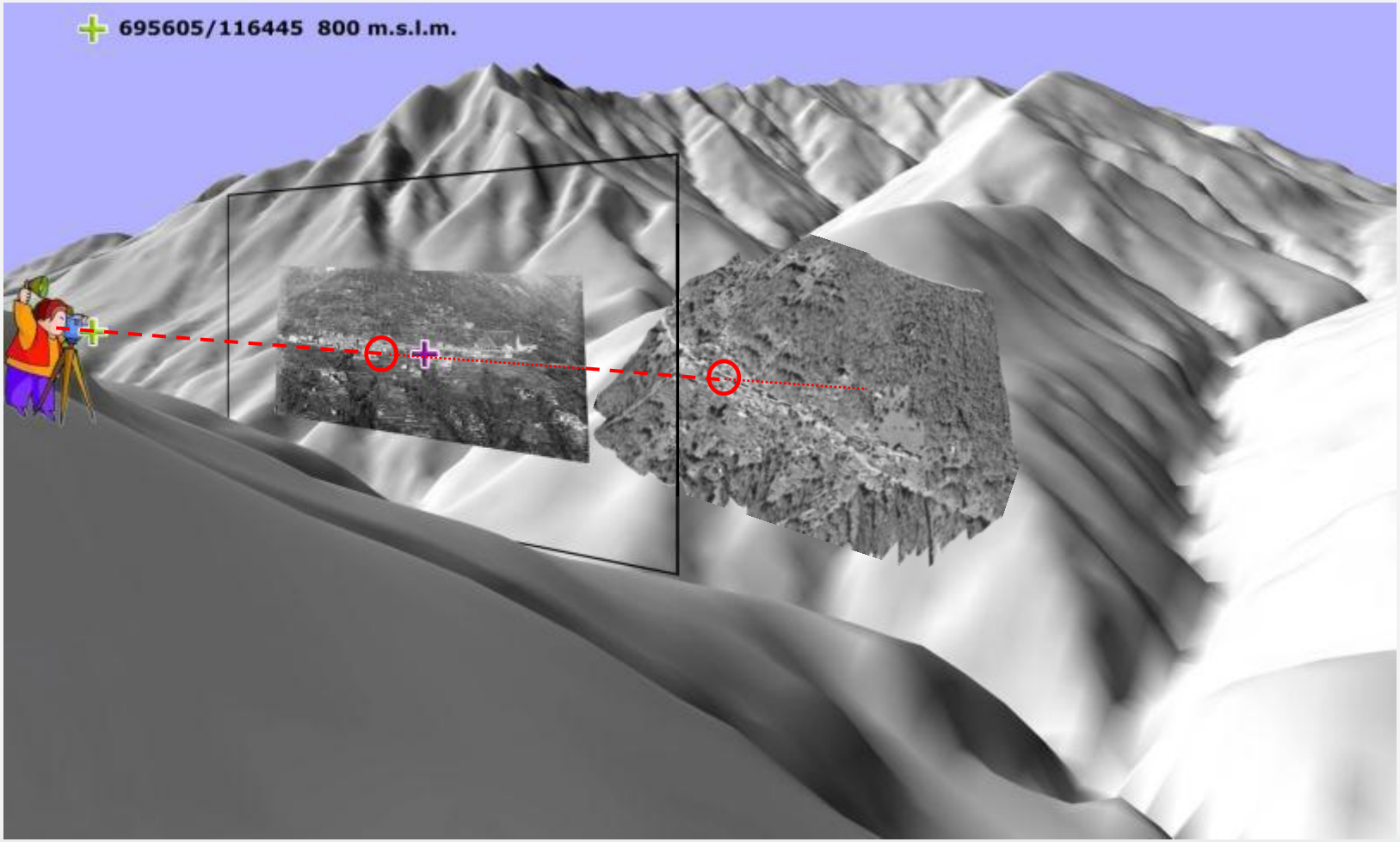
the camera, the picture and the DEM (Digital Elevation Model)



The mono-plotting principle

Camera and picture have to be placed in the world space so that:

a ray from the camera through a point on the picture will intersect the DEM at the corresponding real point



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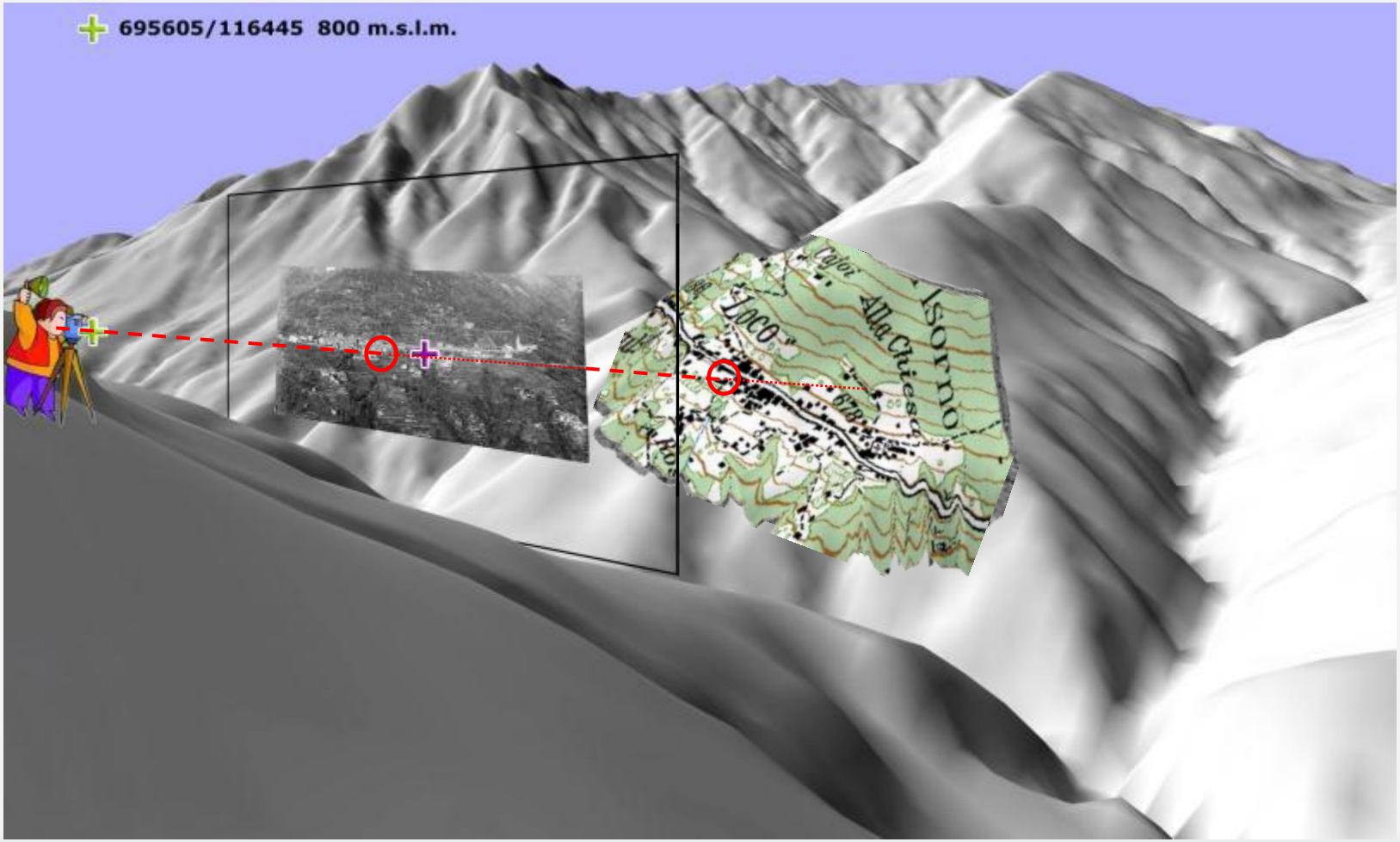


The mono-plotting principle

The accuracy of the system is influenced by:

- ***camera:*** *accuracy of camera calibration*

- ***picture:*** *resolution*

- ***DEM:*** *accuracy*

  correspondence between DEM and relief at the time of the picture

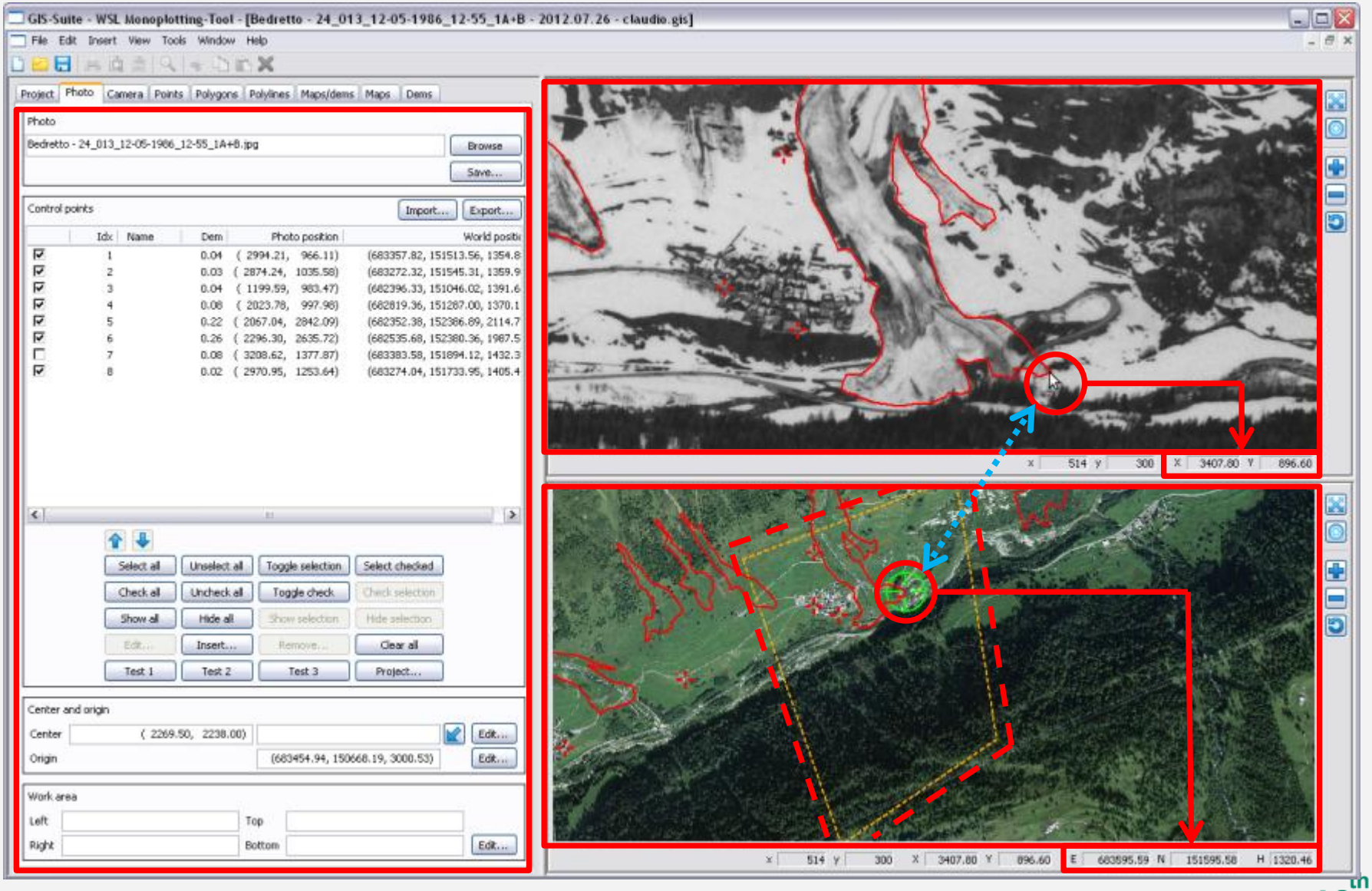
The WSL Monoplotting Tool

"A tool for inserting and managing oblique photographs in the corresponding 3D-space"

Main requirements:

- assuring the correspondence of each pixel of the picture with the corresponding xyz coordinates in the real space
- enabling digitization or measure of specific features in the picture
- importing and exporting digitized features from the picture to the standard GIS systems
- self-intuitive, user-friendly handling

The WSL Monoplotting Tool: state of the art



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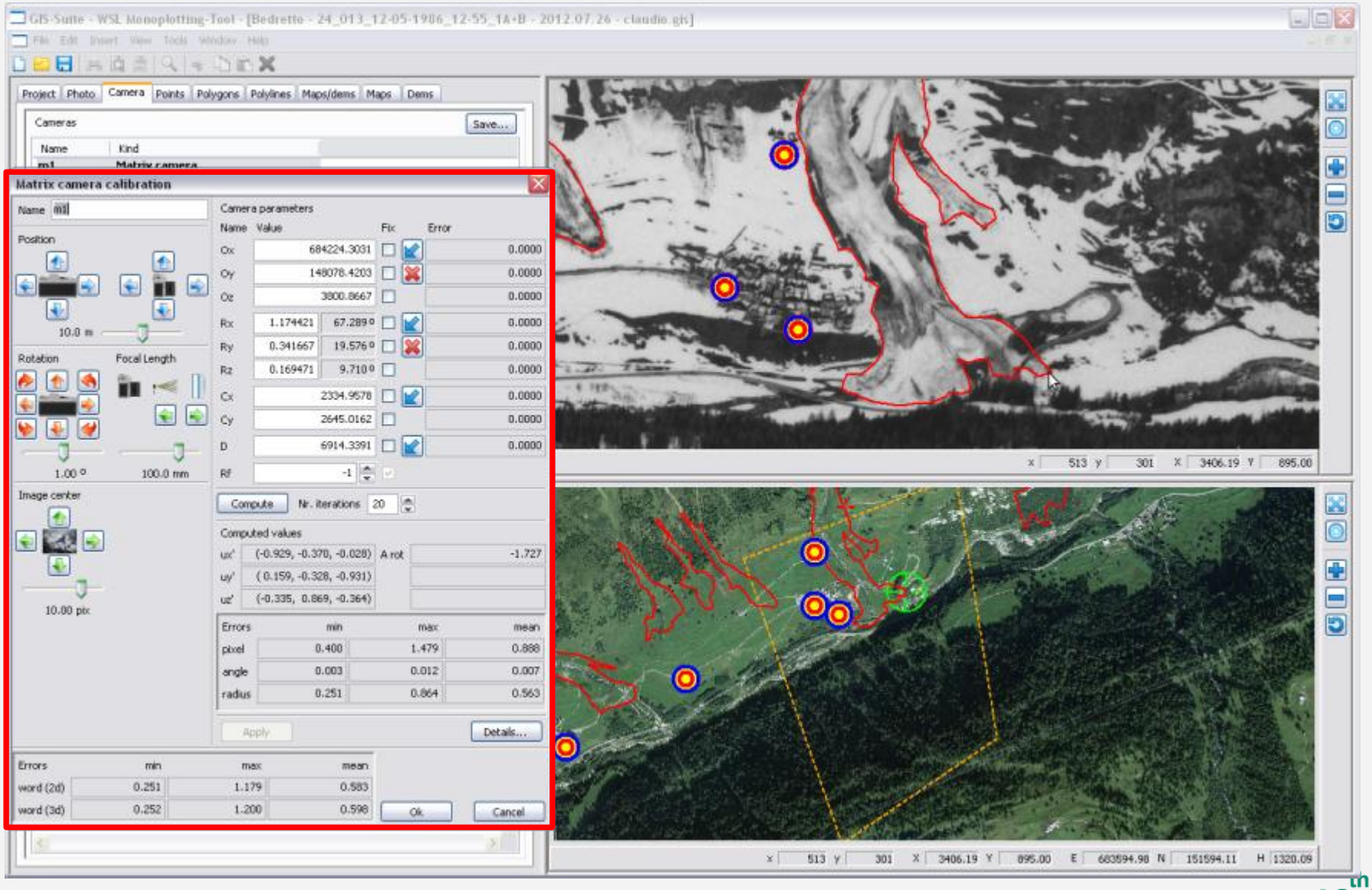

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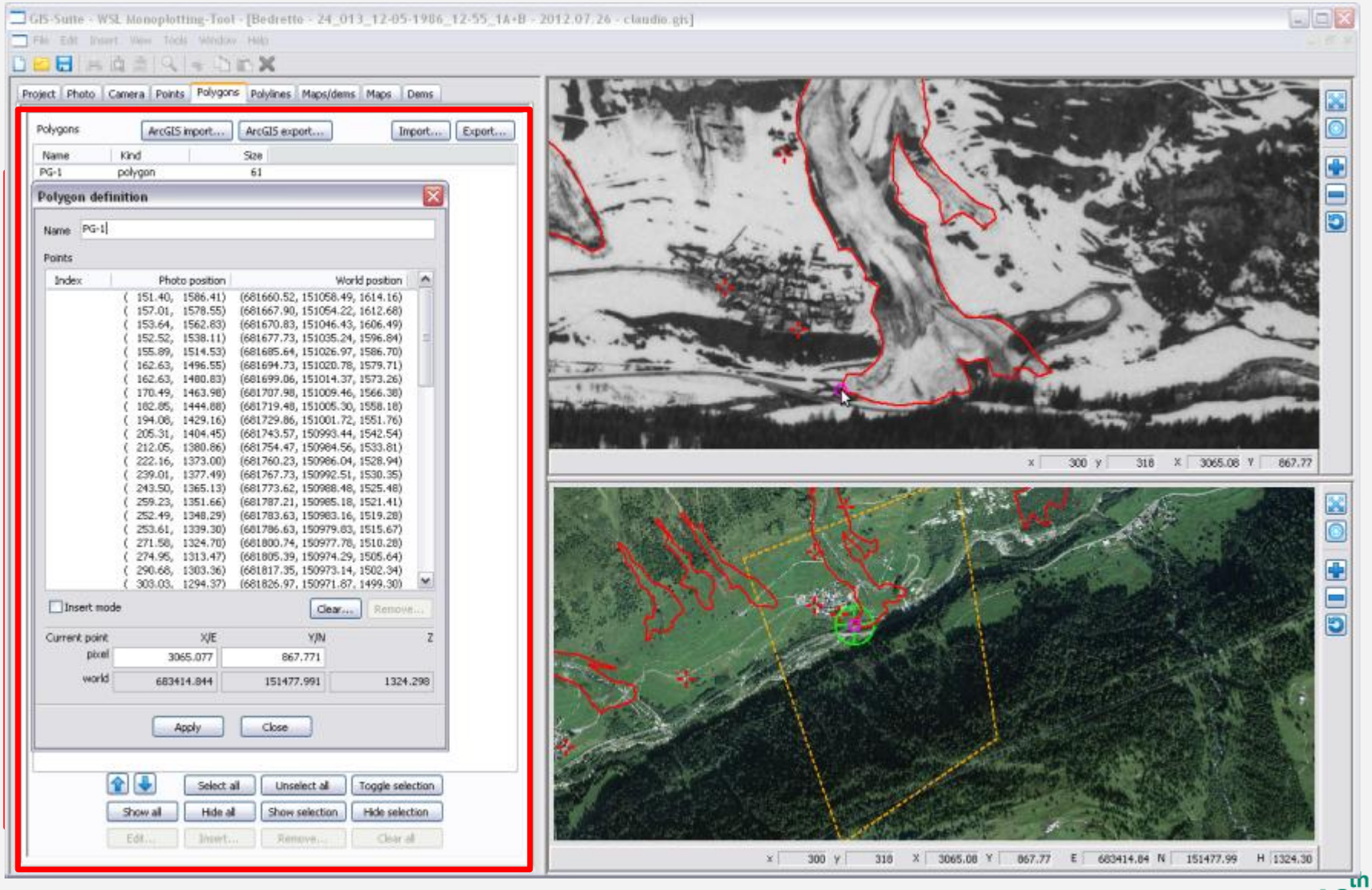

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Fields of application and examples

Reconstruction of natural events: flood of 1927

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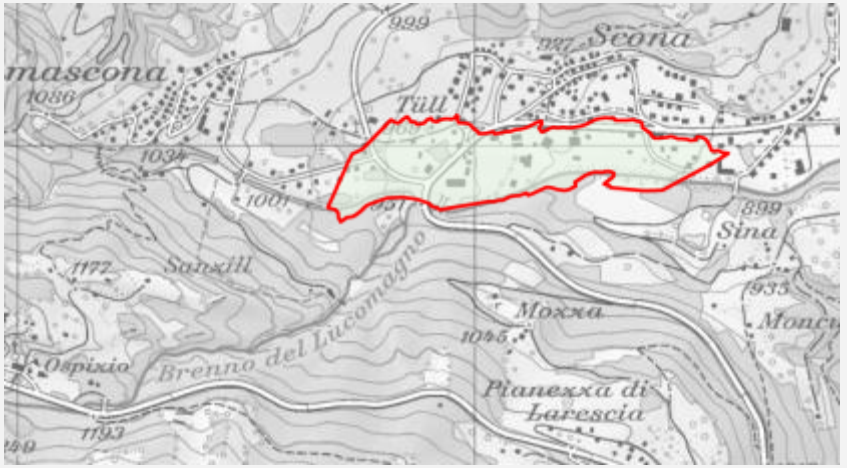

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Office for Natural Hazards (TI) – Olivone 1927: boundary of the alluvial material

Fields of application and examples

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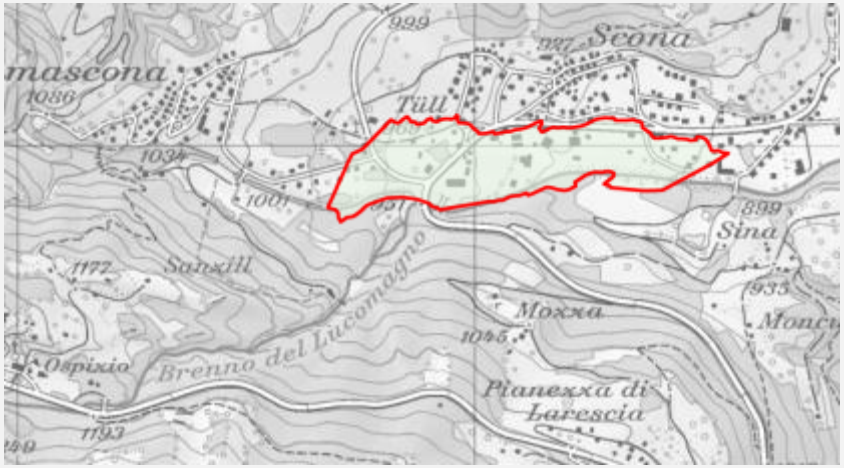

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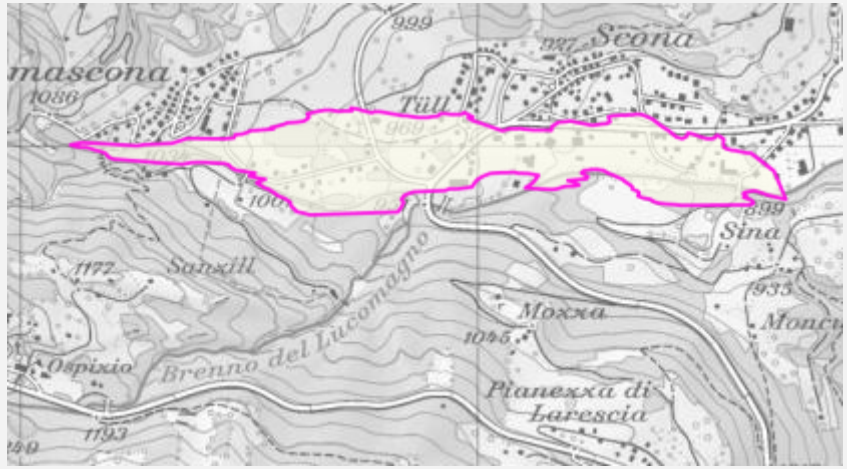

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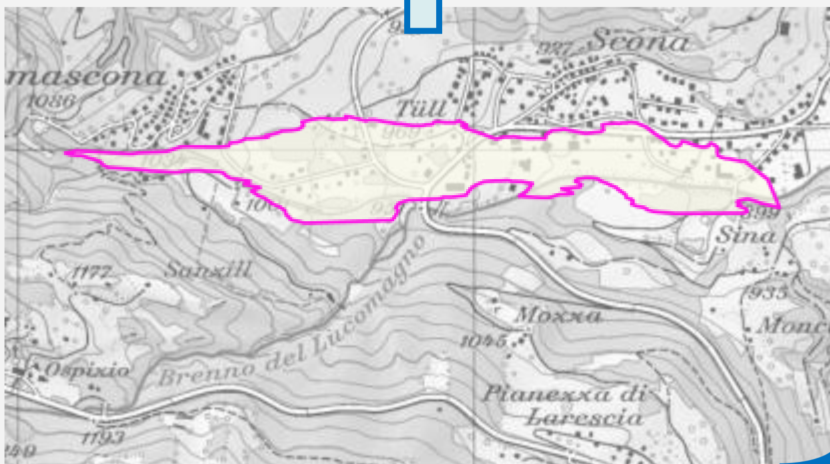

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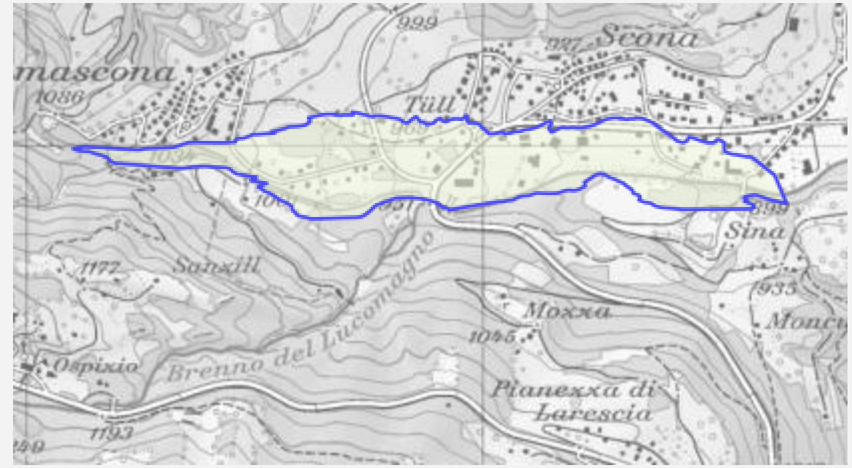

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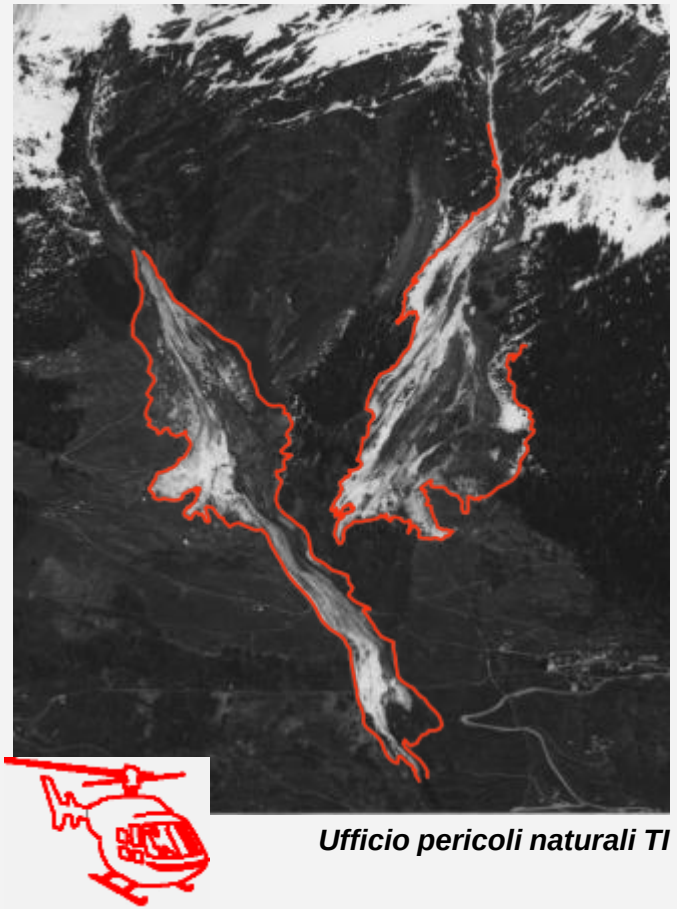
Fields of application and examples

Reconstruction of natural events: avalanche of 1986

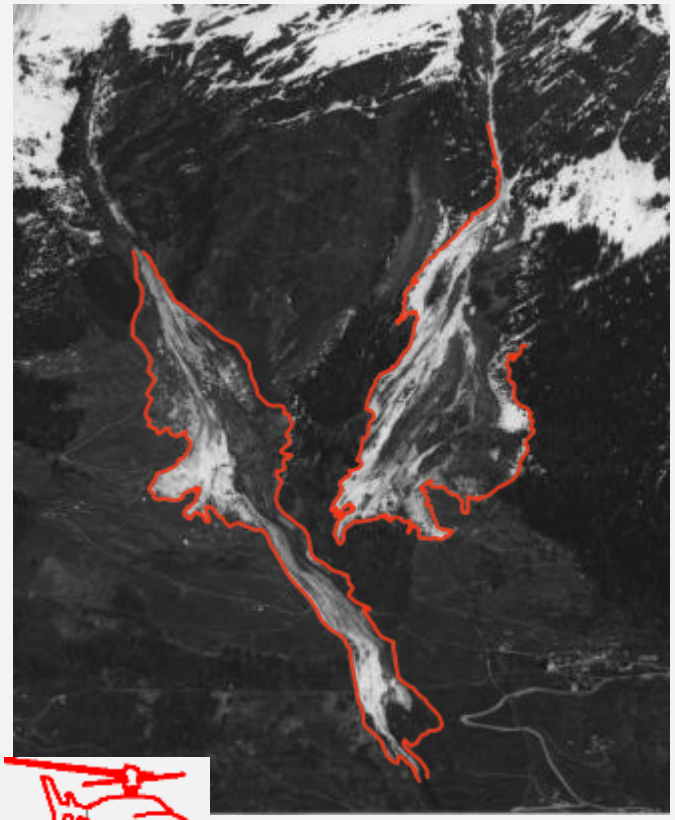


Ufficio pericoli naturali TI

Office for Natural Hazards (TI) – Quinto 1986: avalanche tracks and outlets

Fields of application and examples

Reconstruction of natural events: avalanche of 1986



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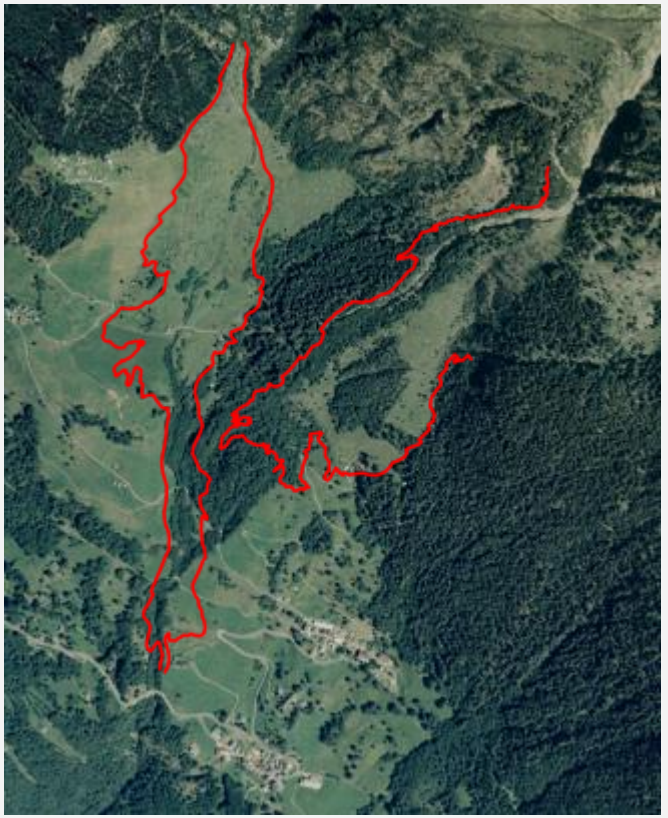

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Office for Natural Hazards (TI) – Quinto 1986: avalanche tracks and outlets

Fields of application and examples

Landscape changes due to a rockslide: Airolo 28.12.1898

Before the event

Ufficio pericoli naturali TI

Just after the event

Ufficio pericoli naturali TI

Office for Natural Hazards (TI) – Airolo 1898: rockslide

Fields of application and examples

Landscape changes due to a rockslide: Airolo 28.12.1898

Before the event

Ufficio pericoli naturali TI

Just after the event

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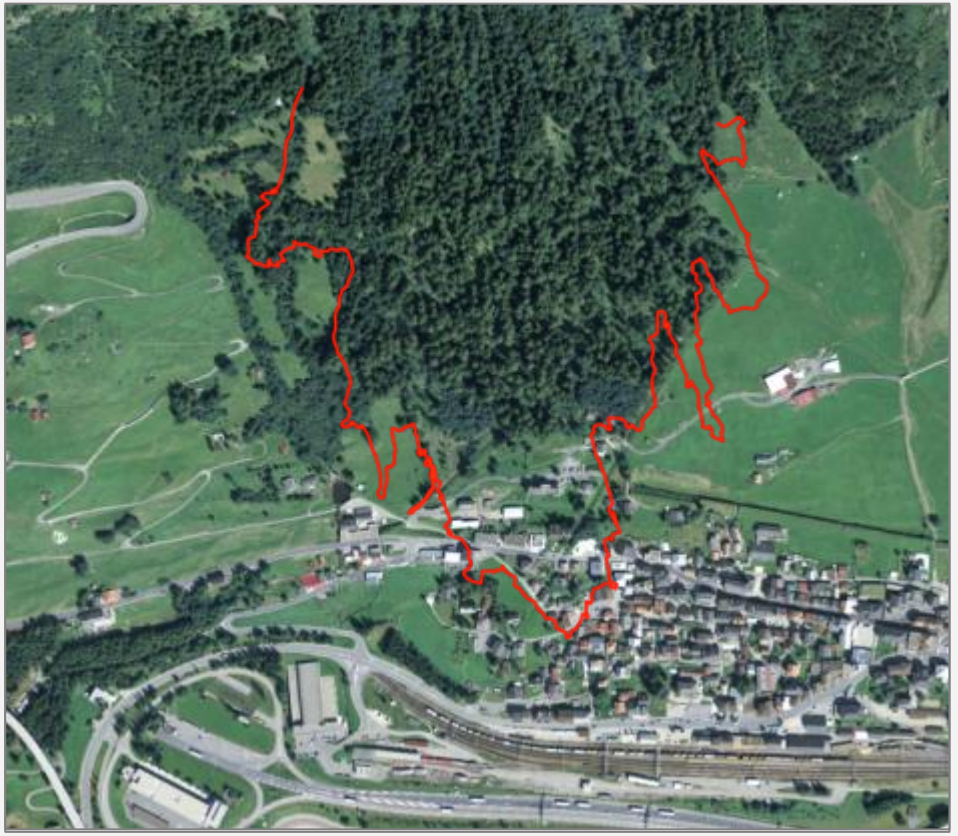
Office for Natural Hazards (TI) – Airolo 1898: rockslide

Fields of application and examples

Landscape changes due to a rockslide: Airolo 28.12.1898



Today

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Just after the event

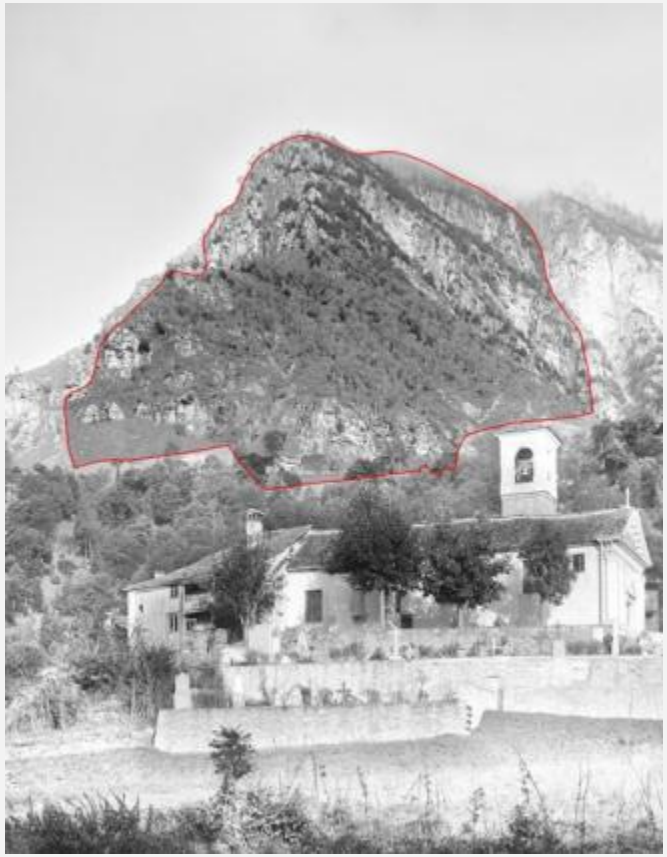
Ufficio pericoli naturali TI

Office for Natural Hazards (TI) – Airolo 1898: rockslide

Fields of application and examples

Landscape evolution: Crana 1910 - 1933 - 2012

Bär: vegetation map of 1910

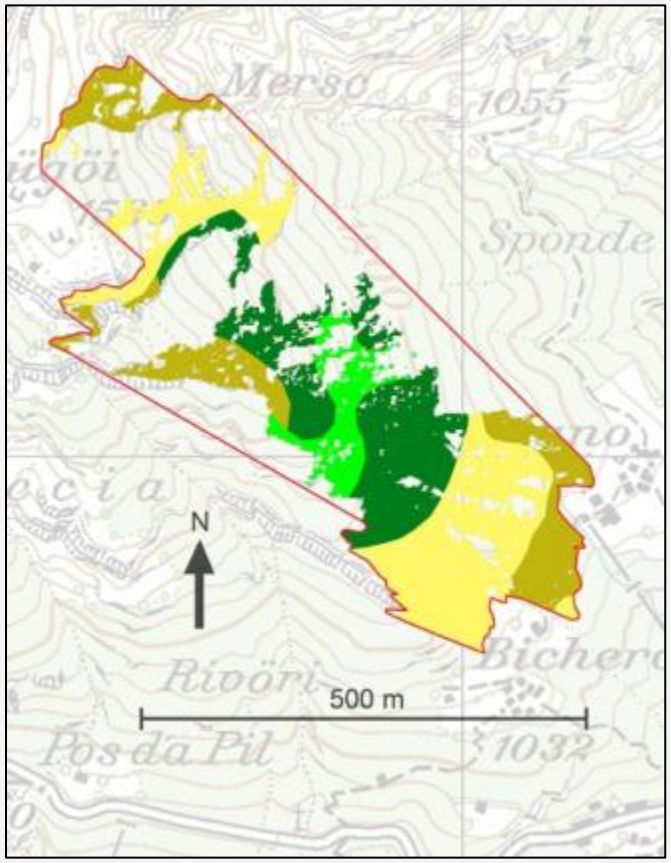


Zinggeler: photo of 1933

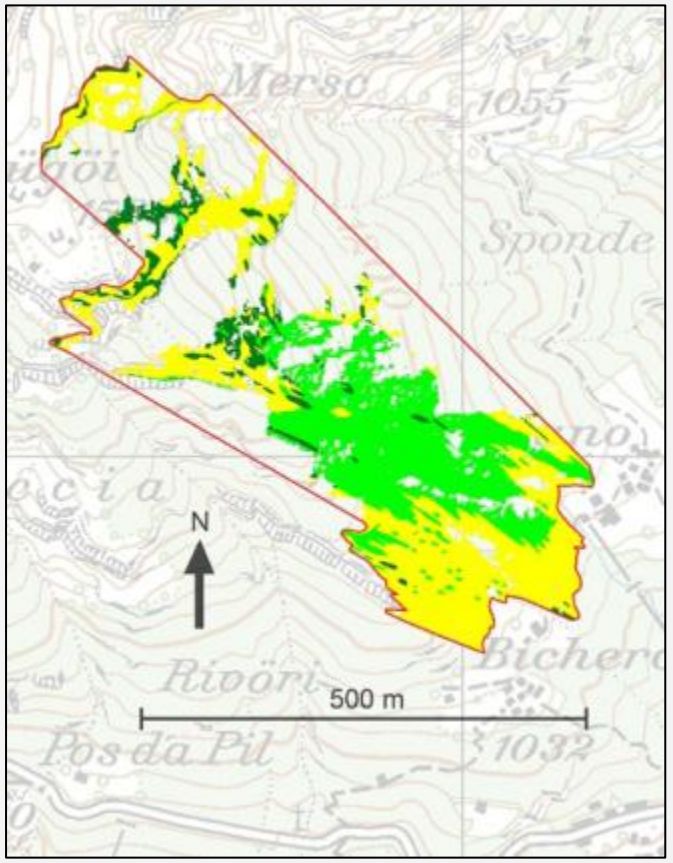
Krebs: photo of 2012

Fields of application and examples

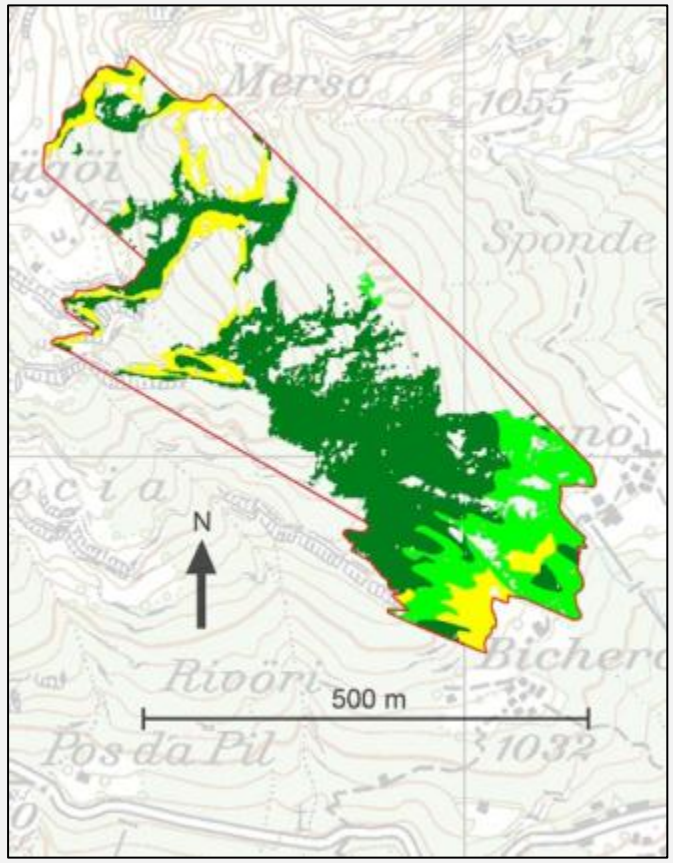
Landscape evolution: Crana 1910 - 1933 - 2012



Bär: vegetation map of 1910



Zinggeler: photo of 1933



Krebs: photo of 2012

pasture with bushes | open pasture | pasture | birch | beech

Fields of application and examples

Landscape evolution:

- *reconstruction of forest boundary and stand age*
- *glacier' s dynamics*
- *land-use changes (i.e. urbanization)*

Archaeology and history:

- *roads and trails*
- *channels for water and material transport*
- *disappeared or no longer recognizable elements*

Reconstruction of natural events:

- *floods*
- *landslides*
- *avalanches*

Monitoring of current processes:

- *surface of glacier melt water*
- *snowmelt*
- *wind erosion*

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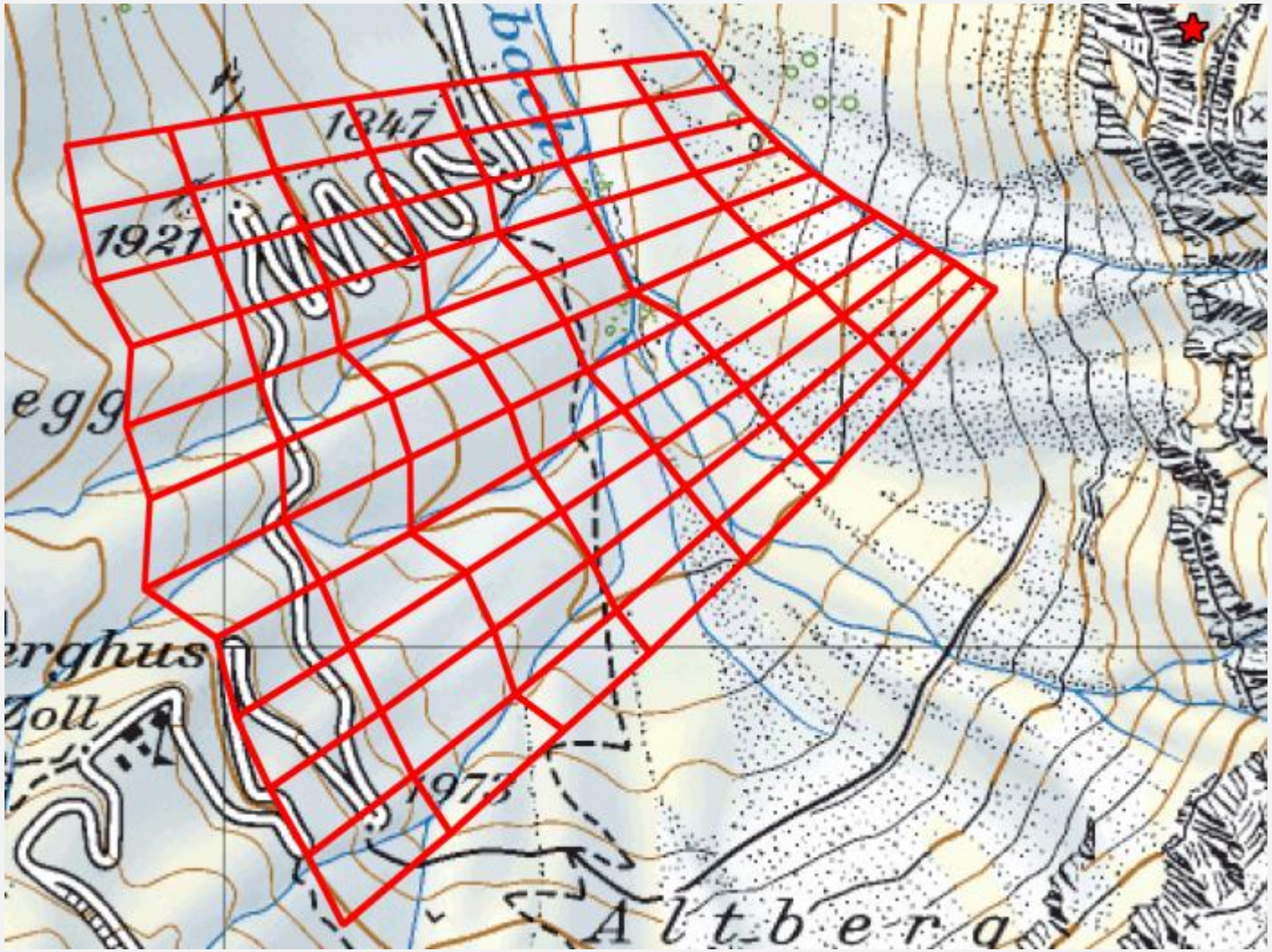
Accuracy estimation: a *crazy* test in the real world

Splügenpass, Grisons, Switzerland: day 1



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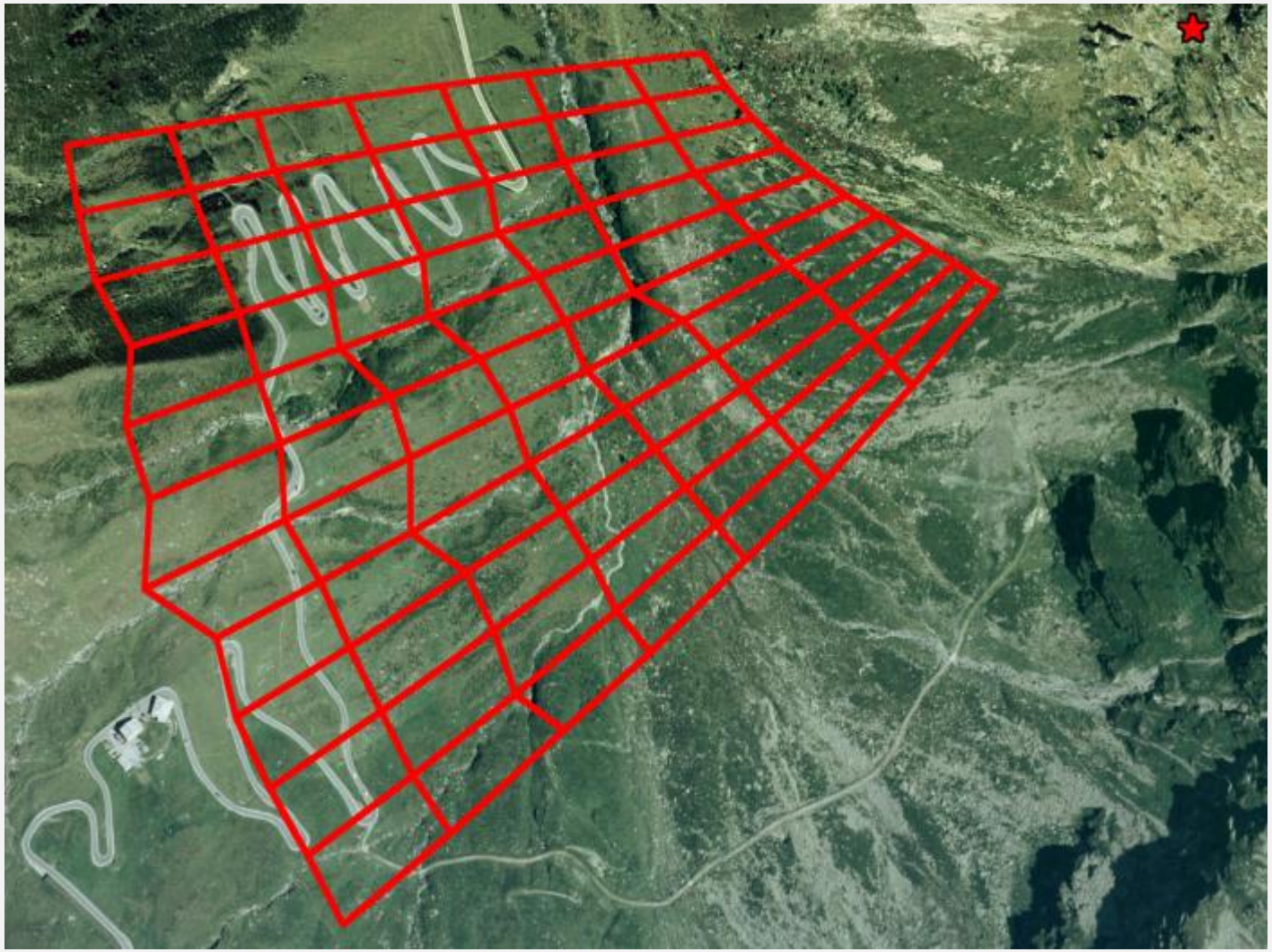

Accuracy estimation: a *crazy* test in the real world

Splügenpass, Grisons, Switzerland: day 2

Accuracy estimation: a *crazy* test in the real world

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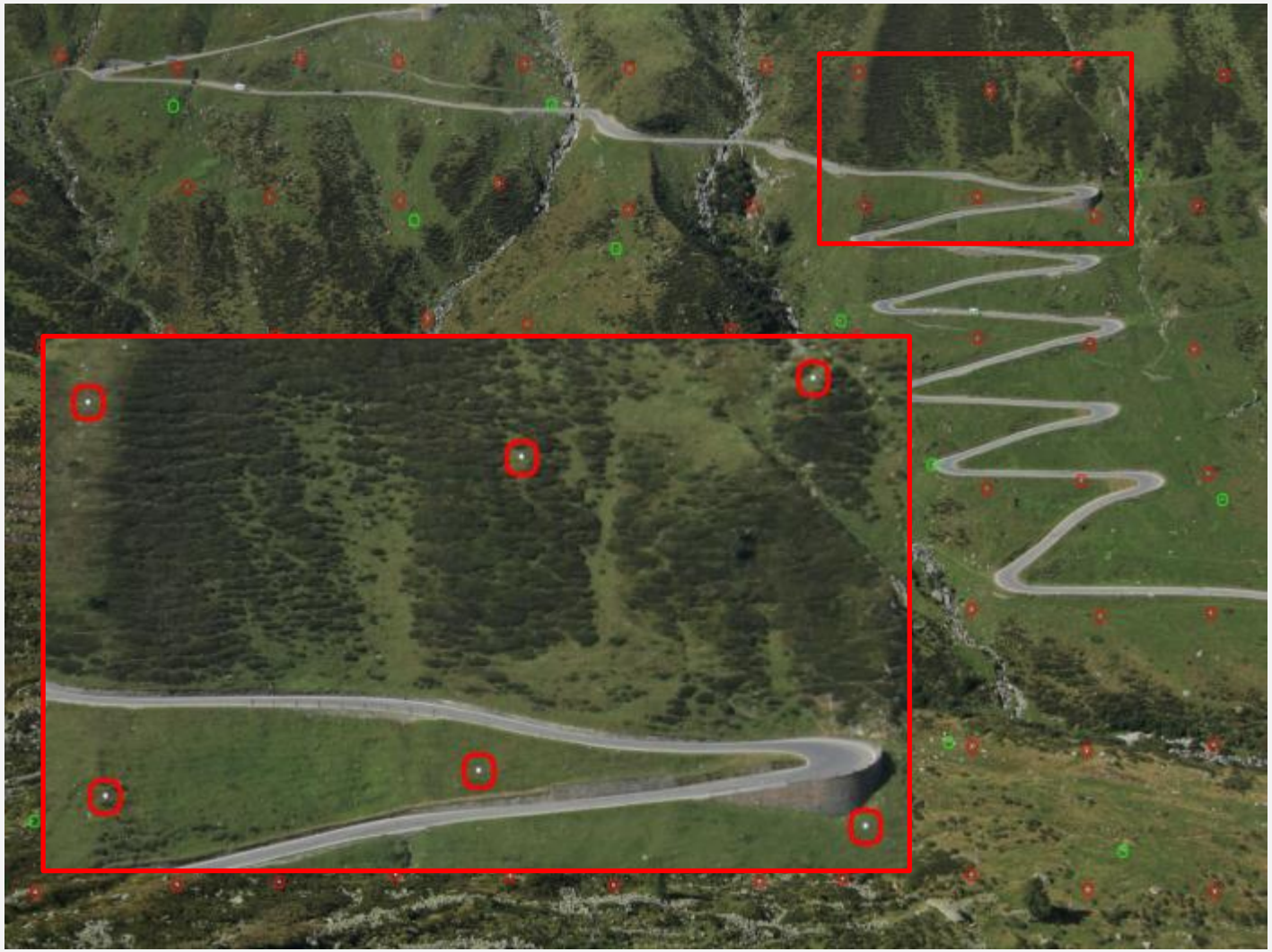
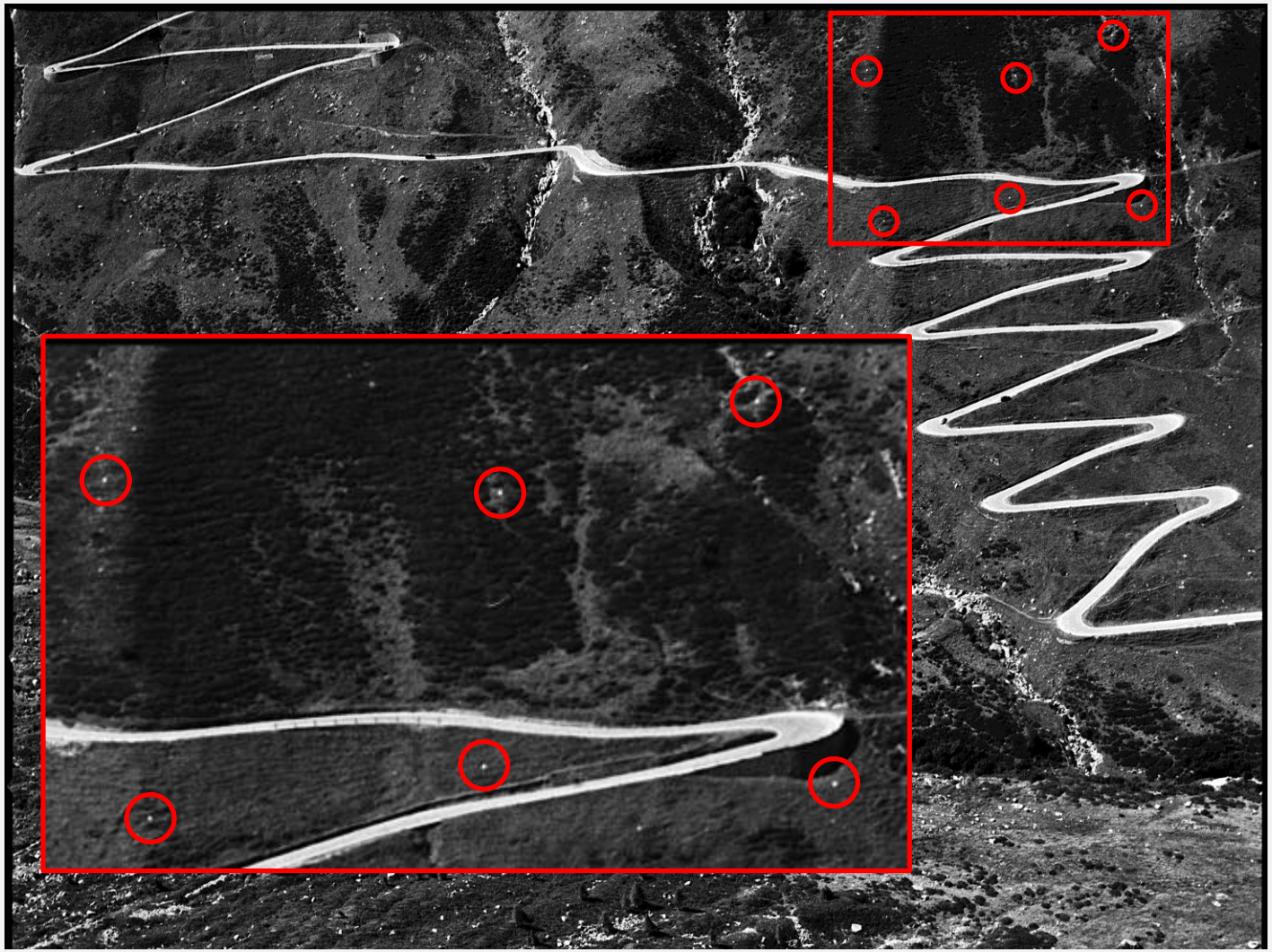


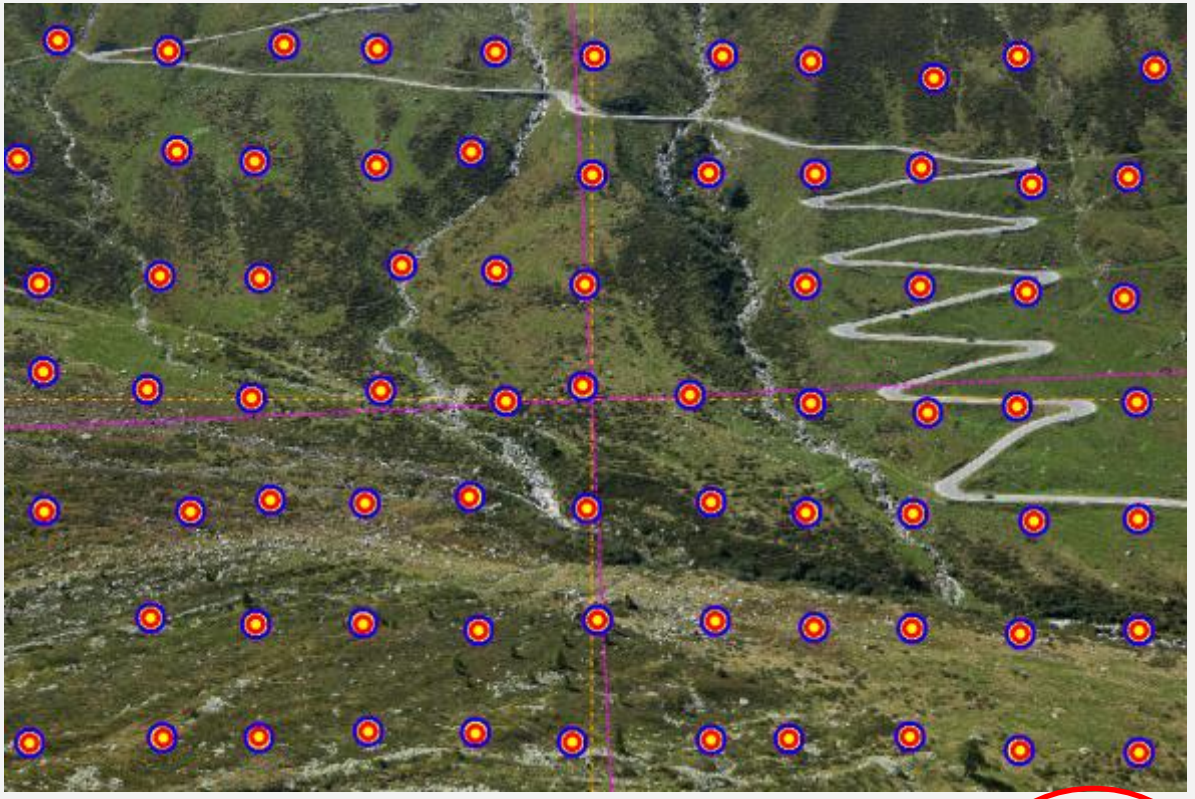
Accuracy estimation: a *crazy* test in the real world

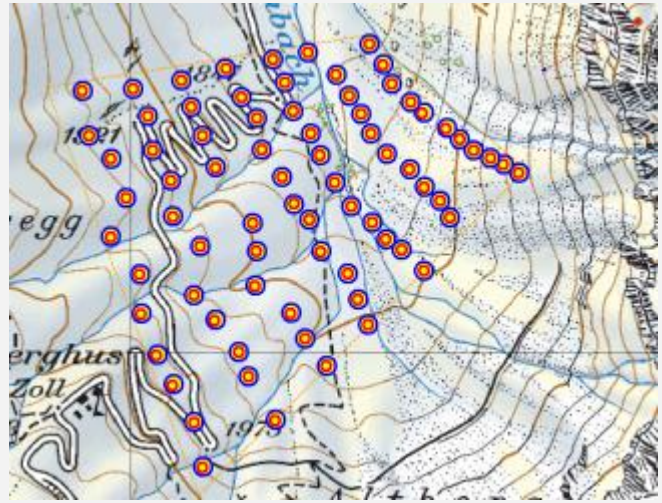
Splügenpass, Grisons, Switzerland: day 2

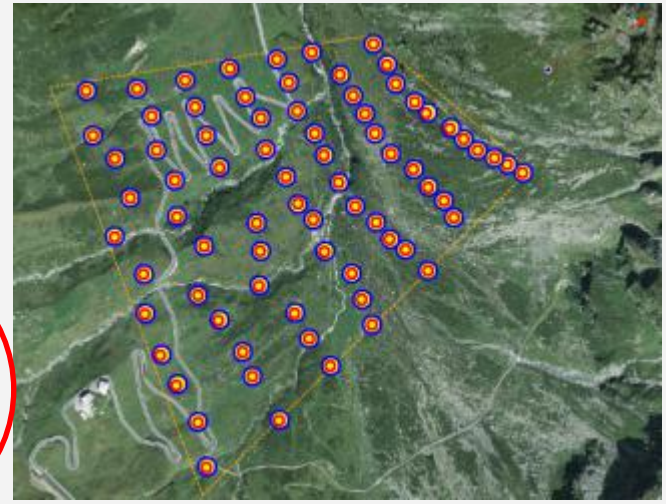


Accuracy estimation: a *crazy* test in the real world

Splügenpass, Grisons, Switzerland: very preliminary results







Errors	min	max	mean
word (2d)	0.028	3.770	0.589
word (3d)	0.040	4.748	0.653

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Outlook of the project

Current status:

- *user friendly, advanced prototype*
- *simple data editor (points, polylines, polygons)*
- *interoperability with GIS system through ASCII files (ArcGIS, Q-GIS)*

Future plans:

- *enhancing integration in ArcGIS*
- *implementing robust accuracy estimation*
- *encouraging the usage by research, educational and public institutions*

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For further information:

- contact me here, for practical demo
- claudio.bozzini@wsl.ch
- Google search: “wsl” and “bozzini”

Thank you.