EGU2020 – Session CR 3.1 – May 6th, 2020

Climate change and cryosphere in high mountains:

preliminary results of field monitoring at Capanna Margherita hut, Punta Gnifetti (Monte Rosa, Pennine Alps)

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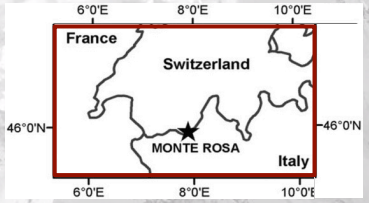
Photo Arnold Welf

Monte ROSA



European Western Alps
2nd highest mountain
4634 m a.s.l.

Climate change affects landscape dynamics of high mountains, as well as slope stability, erosion/sedimentation, and **hazard/risk** conditions.

East Face, Colle Gnifetti (Fadilla, **1893**). Large hanging glaciers.

East Face (Forumfree, **2016**). Few glaciers, slope instability.

One of the highest periglacial rock faces In the European Alps: the permafrost-affected and partially glacierised **East face of Monte Rosa** (Fisher et al., 2011).

Mountain Huts & Access Routes

Instability phenomena and cascading effects:

- *Glacier retreat*
- *Permafrost Degradation*
- *Rock block fall*
- *Accellerated erosion*
- *Debris flow*
- *Flood*

Margherita Hut

Est. by CAI on **1893**, re-built on **1980** at **Punta Gnifetti 4554 m a.s.l.**
The highest building in Europe, and UniTO scientific laboratory.

Interreg ALCOTRA «Eco innovation en altitude»

Margherita Hut

- **NW side of the hut:**
  Study of ice thickness by means of georadar.

- **Rocky spur N of the hut:**
  Monumentation of a topographical reference point for GPS network

- **Top pf Punta Gnifetti:**
  geological framework by means of petrographic samples and local structural data

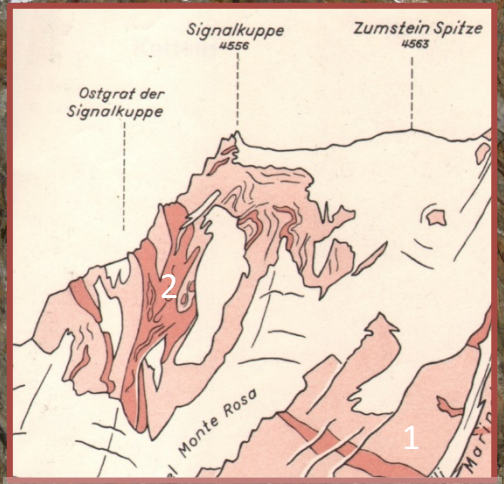
- **SE side of the hut:**
- *Geomechanical characterization of the rock mass by means of TLS*

- **Whole Punta Gnifetti and SE face:**
  retrospective collection, georeferencing and interpretation of **historical photos** maps and archival reports

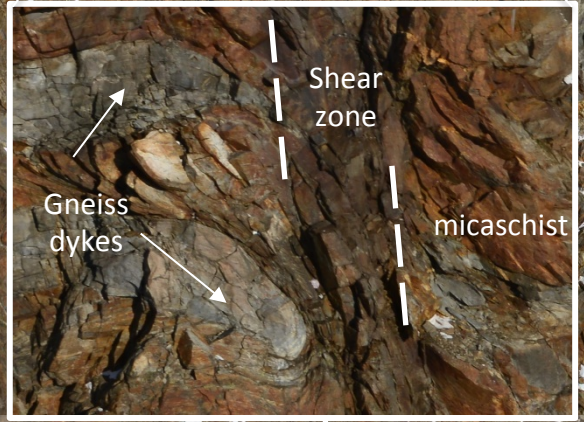
Geological framework

Isoclinal folding

WSW dip of regional main schistisity (dip-slope with respect to the East Face)

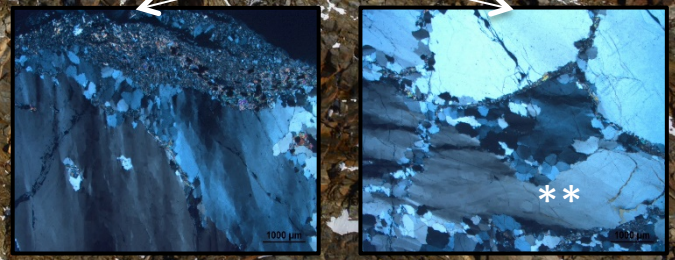


Folded structure with 1) micashists and 2) othogneisses (Bearth, 1953)



Geological contacts and ductile structure: detachment due to the contrast of competence, respect to deformation.

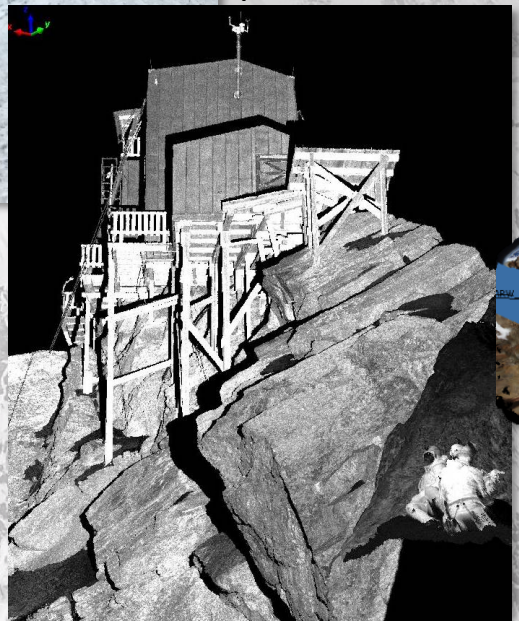
Enhanced instability of fractured micashists and micro-sheared ortogneiss (reduced strenght to ΔT)



A "brittle" Qz for sin-kynematic ri-crysrallization and micro-deformation (**cross ploarized light)

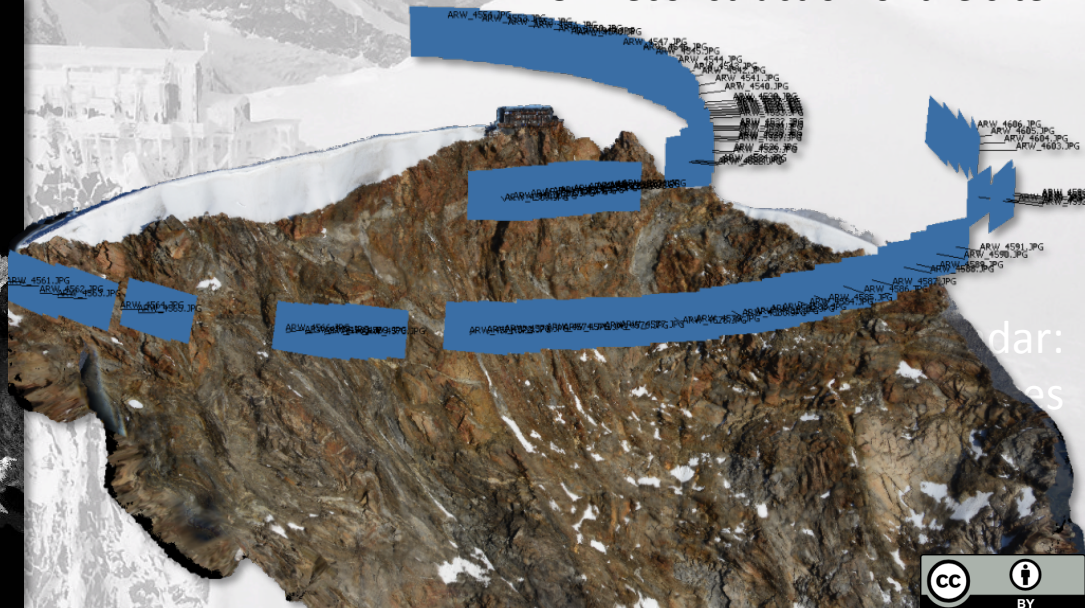
Field activities: 3D modeling

Terrestrial Laser Scanner:
Detailed characterization of the geomechanical structure of the rock mass



9 points of view
Cloud of 128 M points

Heli-photogrammetry:
96 shoots (preliminary flight)
3D reconstruction of the site



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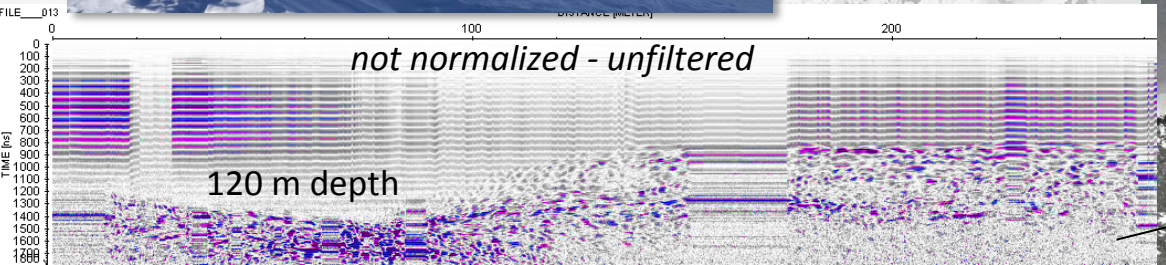
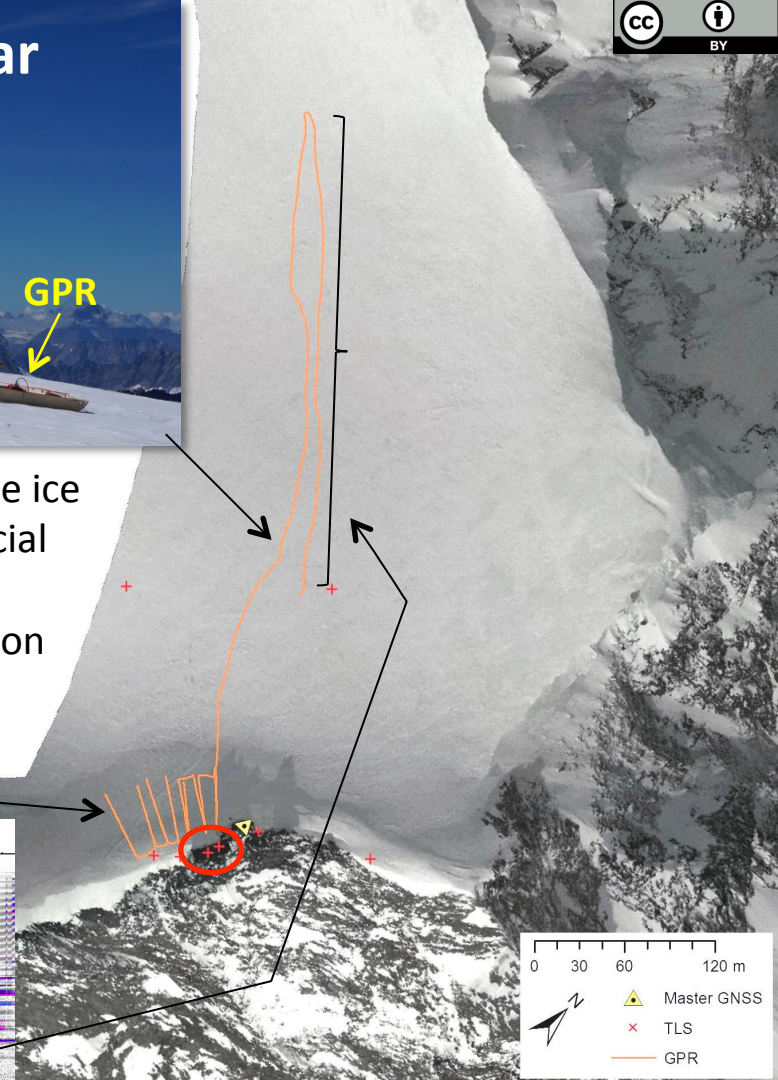
Ground Penetrating Radar

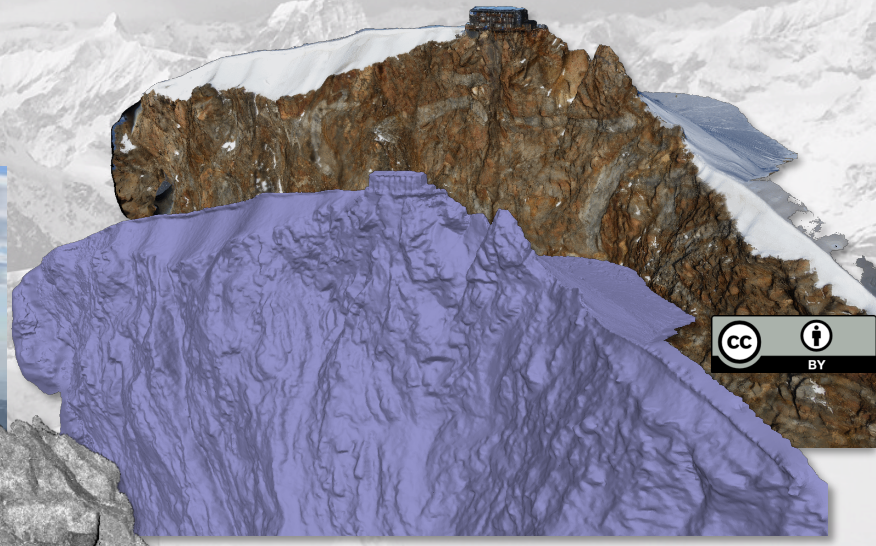
Determination of the ice thickness of the glacial cover, long 1.5 km traces, in particular on the summit ramp.

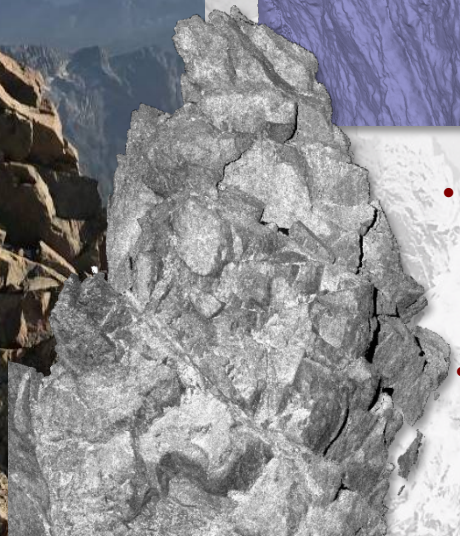




Results (work in progress)

- P.ta Gnifetti 3D model
- Rock-cliff detailed 3D model
- Capanna Margherita detailed 3D model
- Ice-depth map





- **geomechanical characterization** of the rock mass (main discontinuity sets) from point cloud processing;
- integration with **on site surveys**;
- **stability analyses** of the rock face to changes in the boundary and initial conditions

Discussion

Retrospective collection and interpretation of photos, archival news and climate data.

- Creation of a **multi-temporal model of geomorphological settings** of Punta Gnifetti
- Comparison to meteorological historical series for creating a **morphoclimatic "timeline".**

New plan for effective data collection on 2020 (!?), including comparative analyses to:

- identify the relevant geomechanical features for **rock mass stability**;
- verify presence of ice inside fractures forpossible **permafrost degradation**;
- reconstruct the **ice-covered morphology** of the Punta Gnifetti peak.

Thank you for your attention…