

HIGH ELEVATION SITES IN THE NORTHWESTERN ALPS

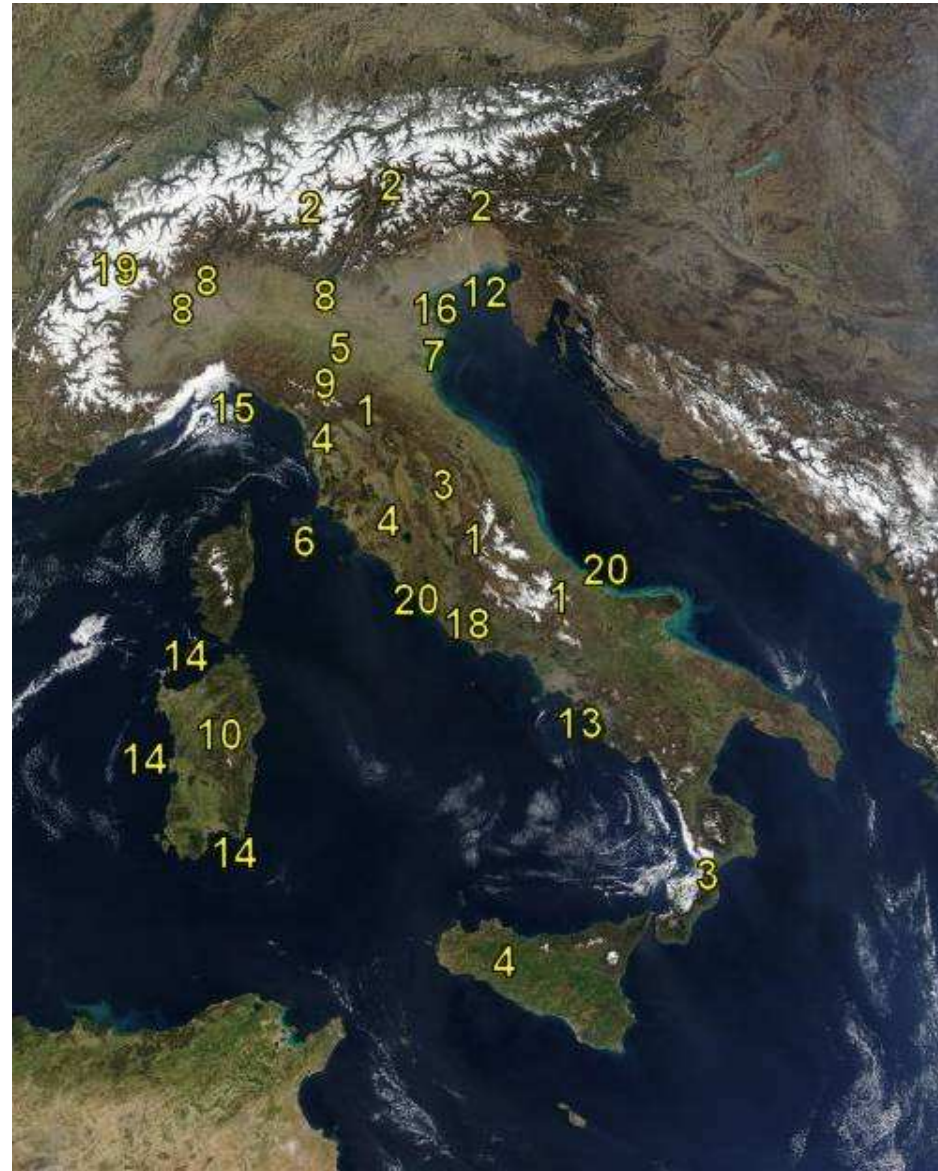
Michele Freppaz

Edoardo Cremonese



LTER - Italy

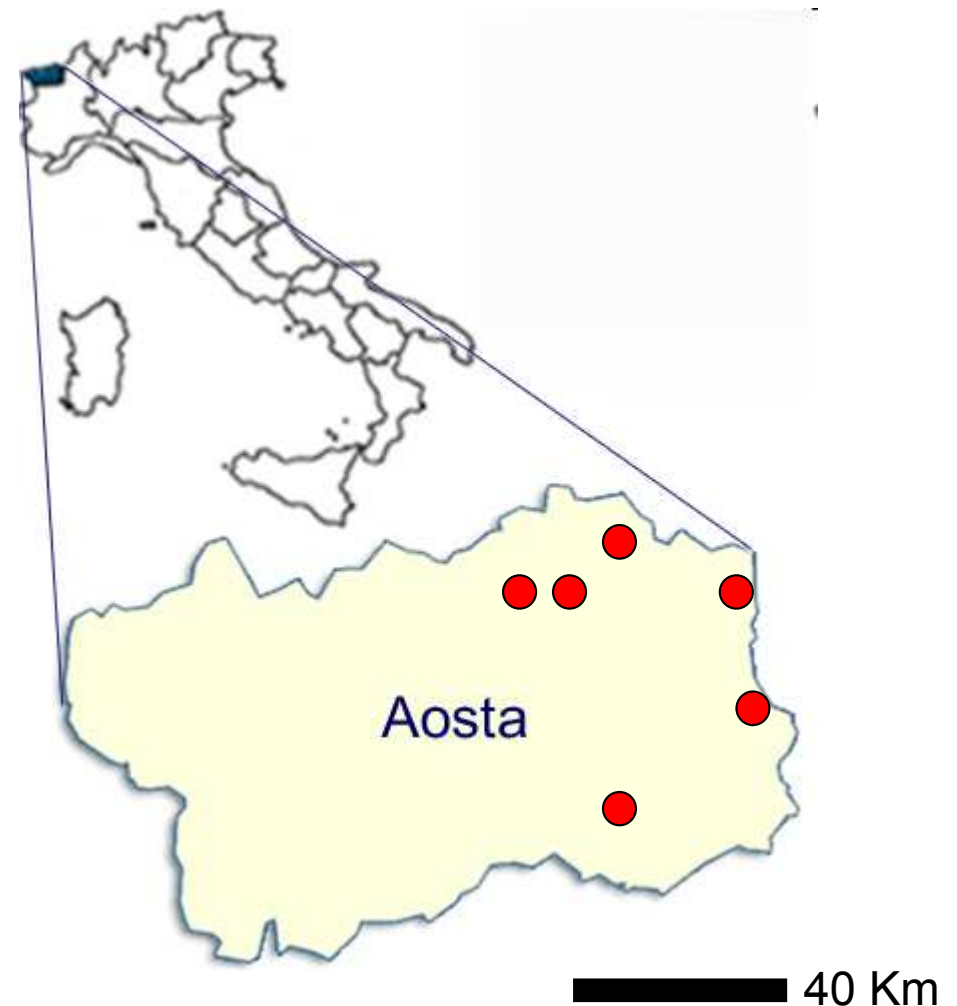
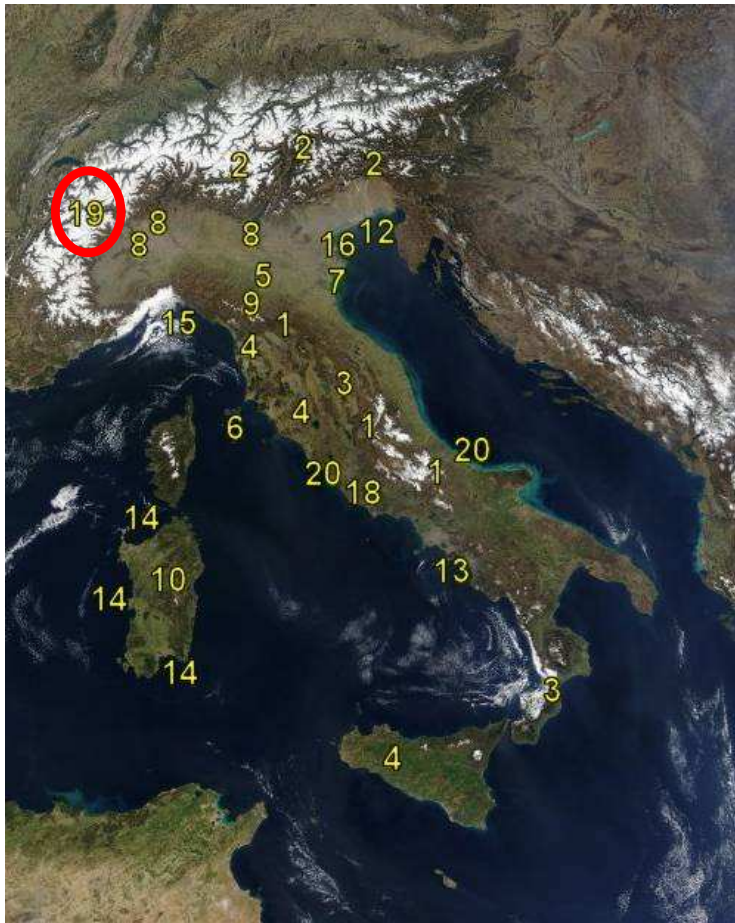
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- 20 sites
- National and International research stations (e.g. Antarctica)
- Since 2008: **“High elevation sites in the Northwestern Alps” (19)**

19 “High elevation sites in the Northwestern Alps”

This site is representative of high altitude environments of the North-Western Italian Alps. Six study areas, located along an altitudinal gradient ranging from 2100 to 3000 m a.s.l. were chosen.



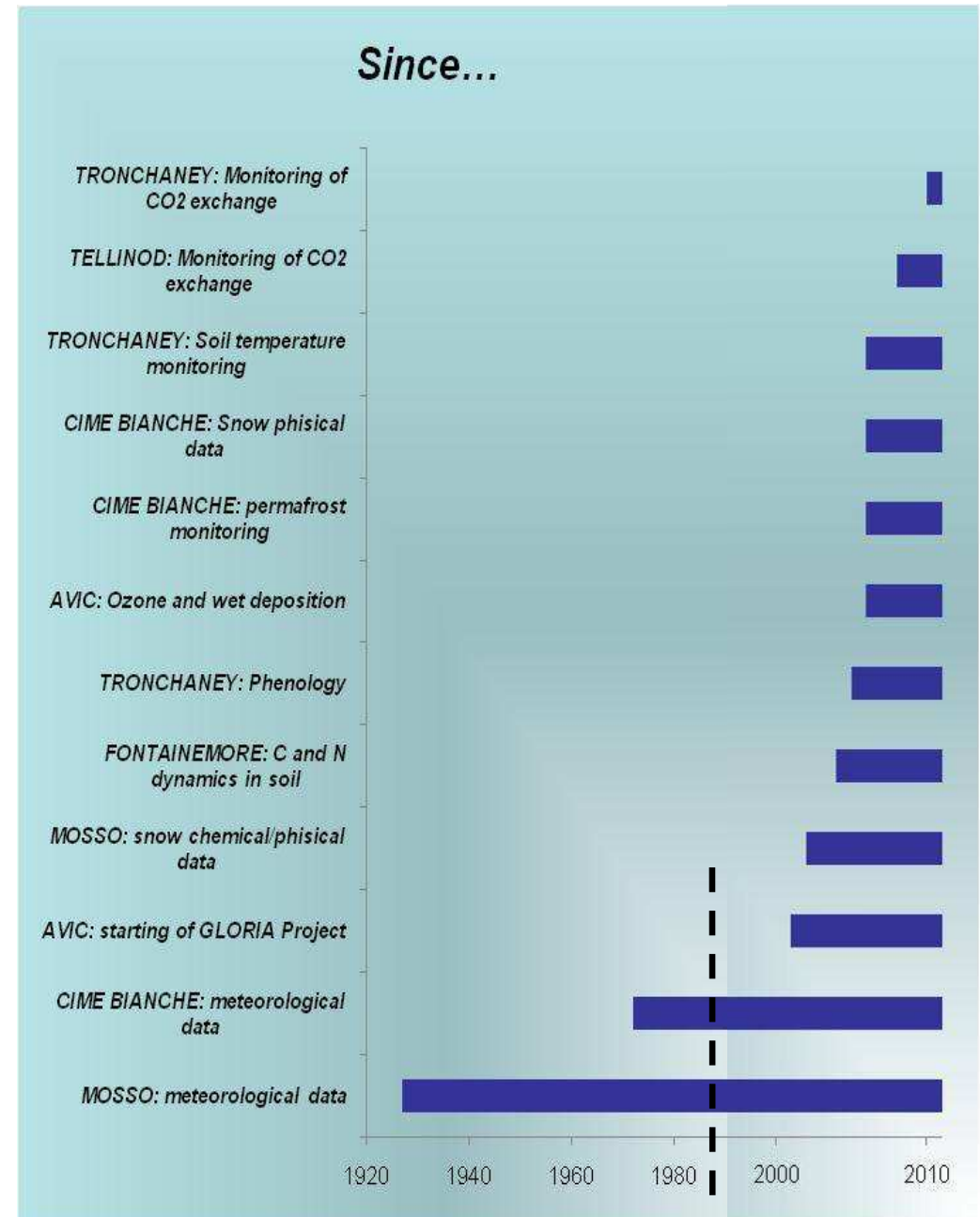
Common activities between sites

Monitoring of abiotic parameters:

- Soil/substrate temperature
- Meteorological parameters

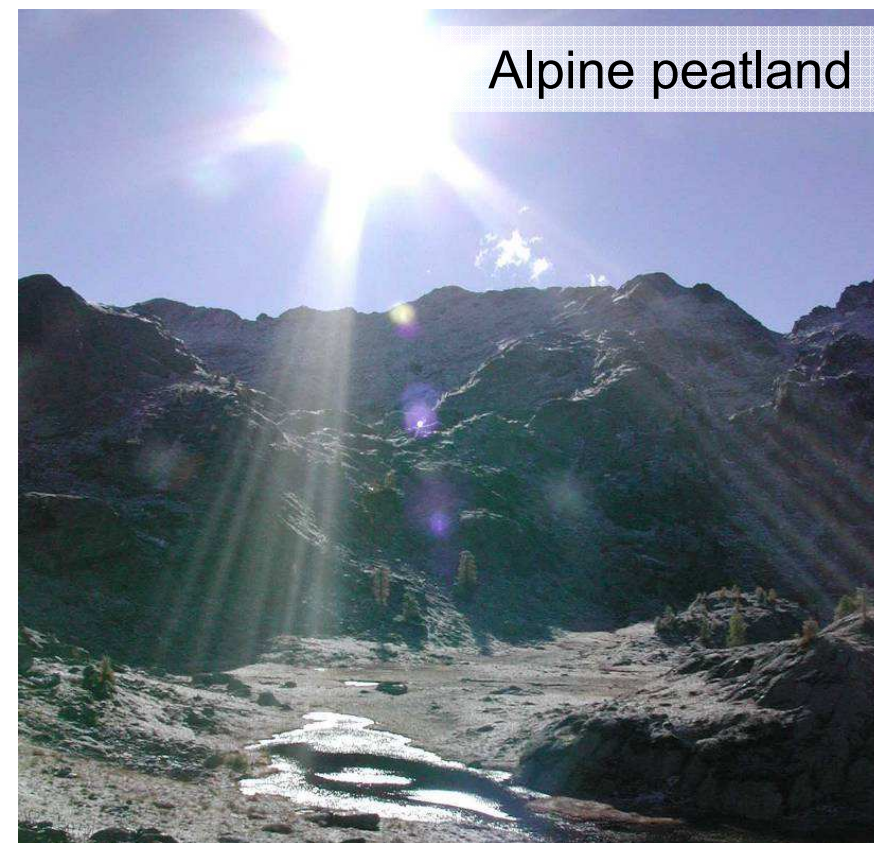
Monitoring of chemical-physical properties:

- Routine soil/substrate characterization
- Recording of snow properties



Site 1: FONTAINEMORE

- ✓ Soil organic matter dynamics in alpine peatlands
- ✓ Nutrient cycle modifications related to snow cover and climate changes
- ✓ Mid-term monitoring of snow chemical properties (since 2005)



Site 2: MOSSO

Istituto A. Mosso (Col d'Olen) 2901 m ASL

Year Foundation: 1907

Queen Regina Margherita

University of Torino

Royal Society London (UK)

**Elisabeth Thompson Science
Found (USA)**



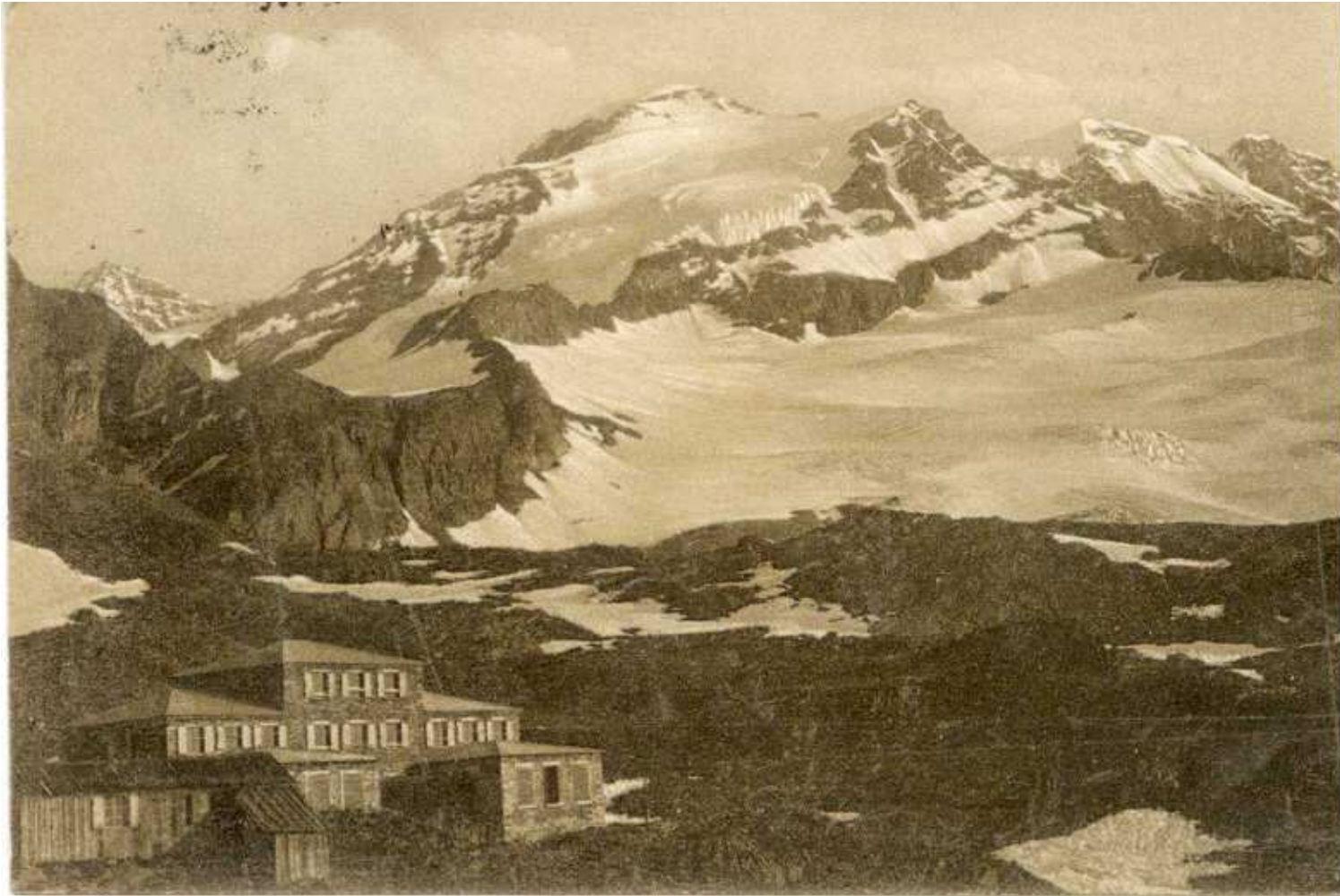
Istituto A. Mosso (Col d'Olen) 2901 m ASL

A few years ago.....



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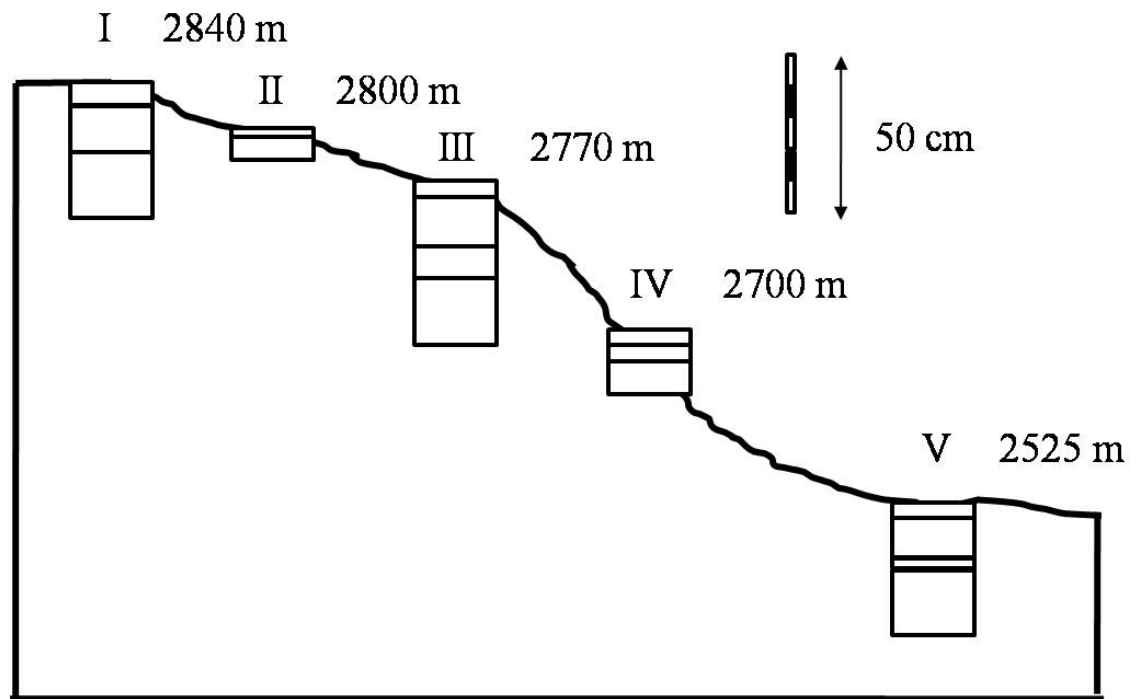
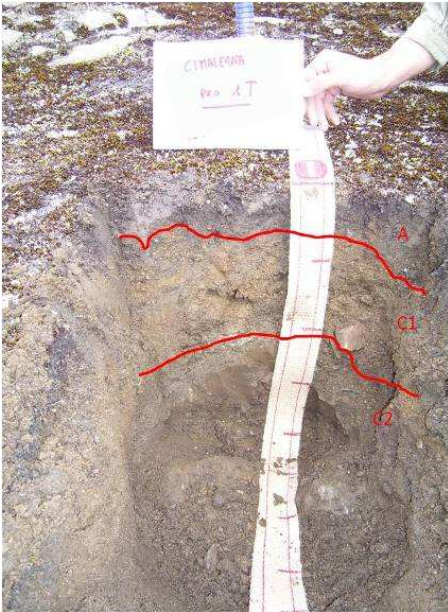
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Main Research fields

- Human adaptation to high elevations (ex training for the Italian K2 expedition in 1954)
- Geology
- Microbiology
- Climatology
- Snow and Avalanches
- High elevation soils



Site 2: MOSSO

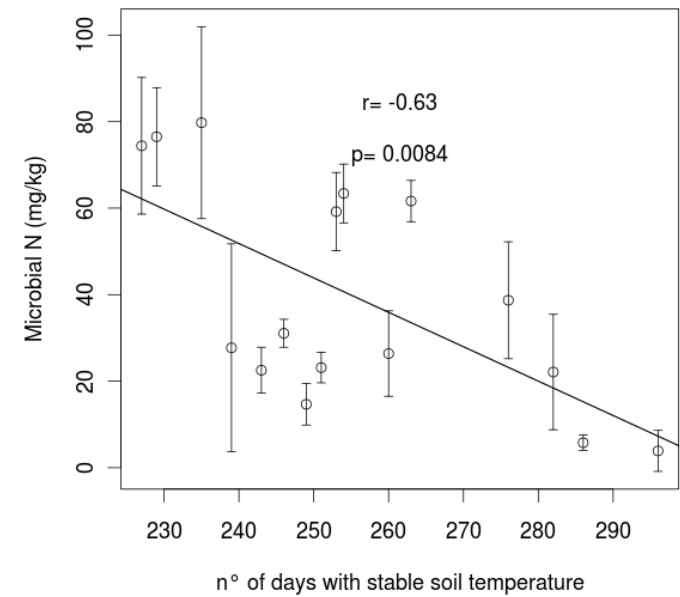
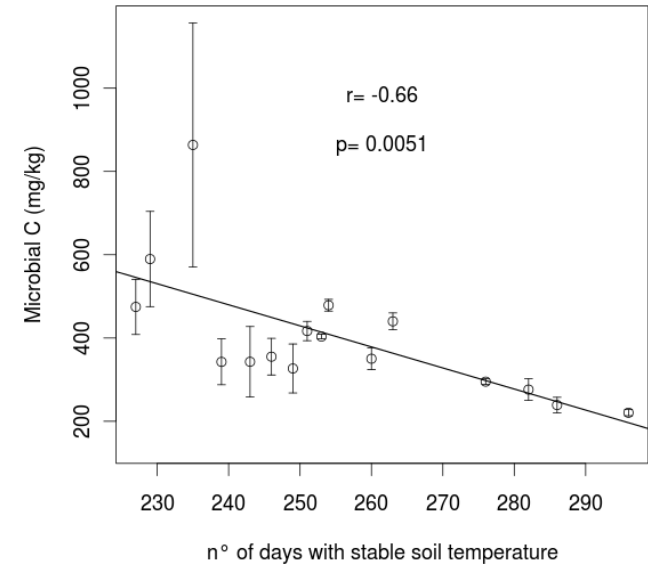
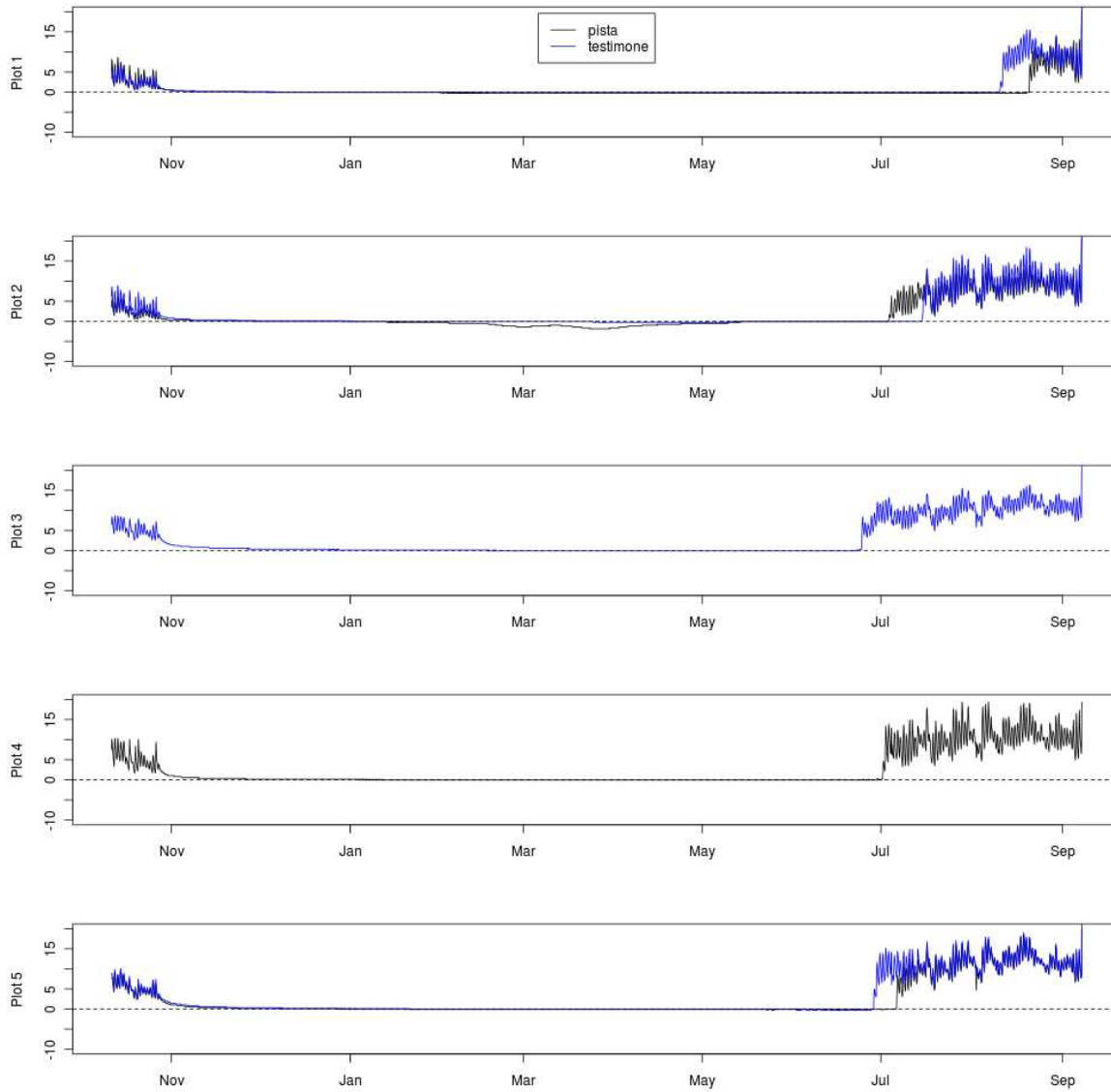


Soil elevation gradient to evaluate:

- ✓Vegetation sampling (species composition, biomass,...)
- ✓Soil thermal properties
- ✓Soil evolution on high altitude ski slopes
- ✓Soil nutrient pools under different climate scenarios

Site 2: MOSSO

Temperatura del suolo (0-10 cm), Vallone dell'Olen: 2008-2009



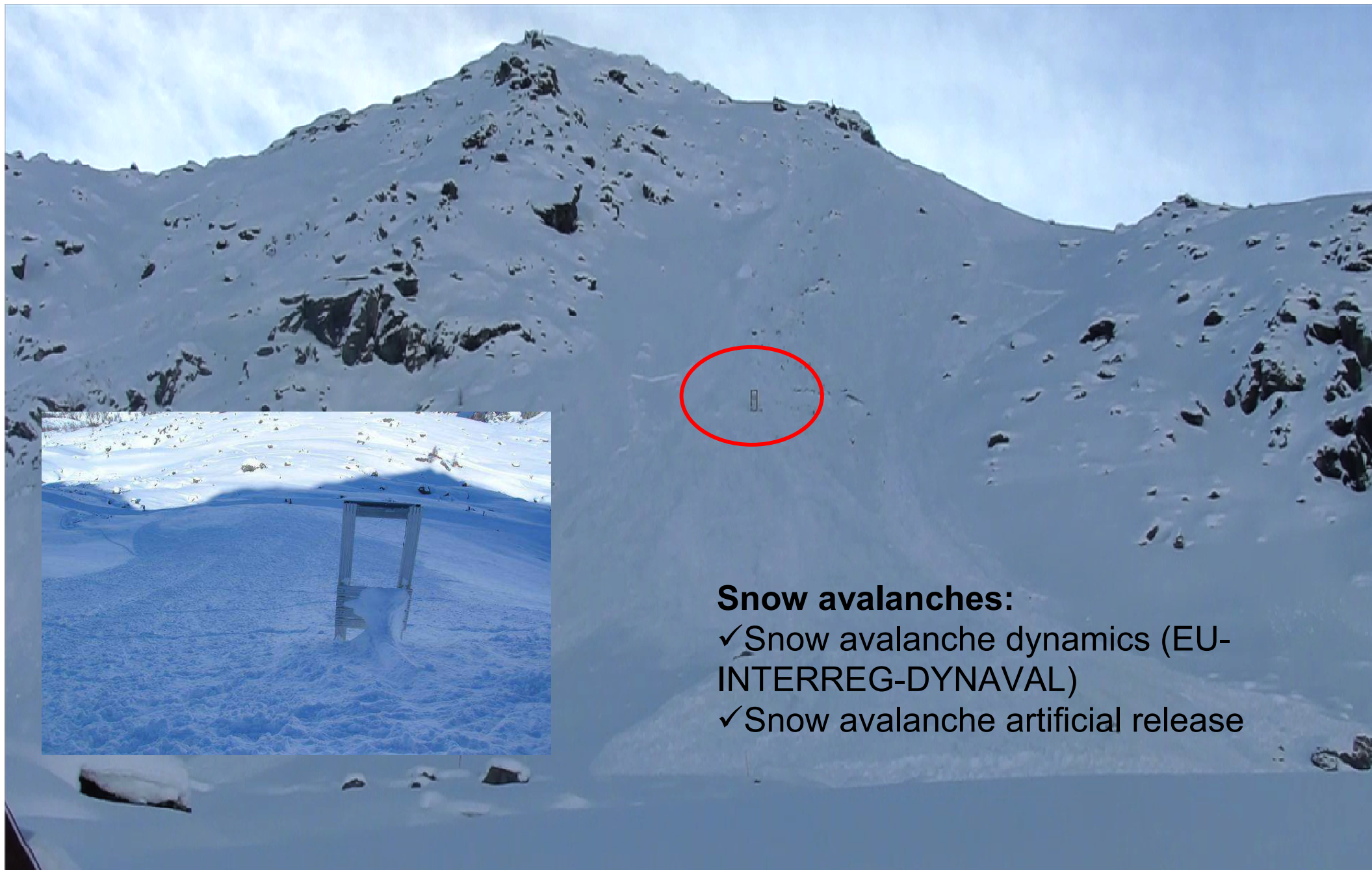
Site 2: MOSSO



Snow chemical and physical properties to evaluate:

- ✓ Nutrient and water inputs into the soil
- ✓ Air quality

Site 2: MOSSO



Snow avalanches:

- ✓ Snow avalanche dynamics (EU-INTERREG-DYNAVAL)
- ✓ Snow avalanche artificial release

Site 3: Torgnon - Tronchaney

Larch Forest (2100 m asl)



Site 3: Torgnon - Tronchaney

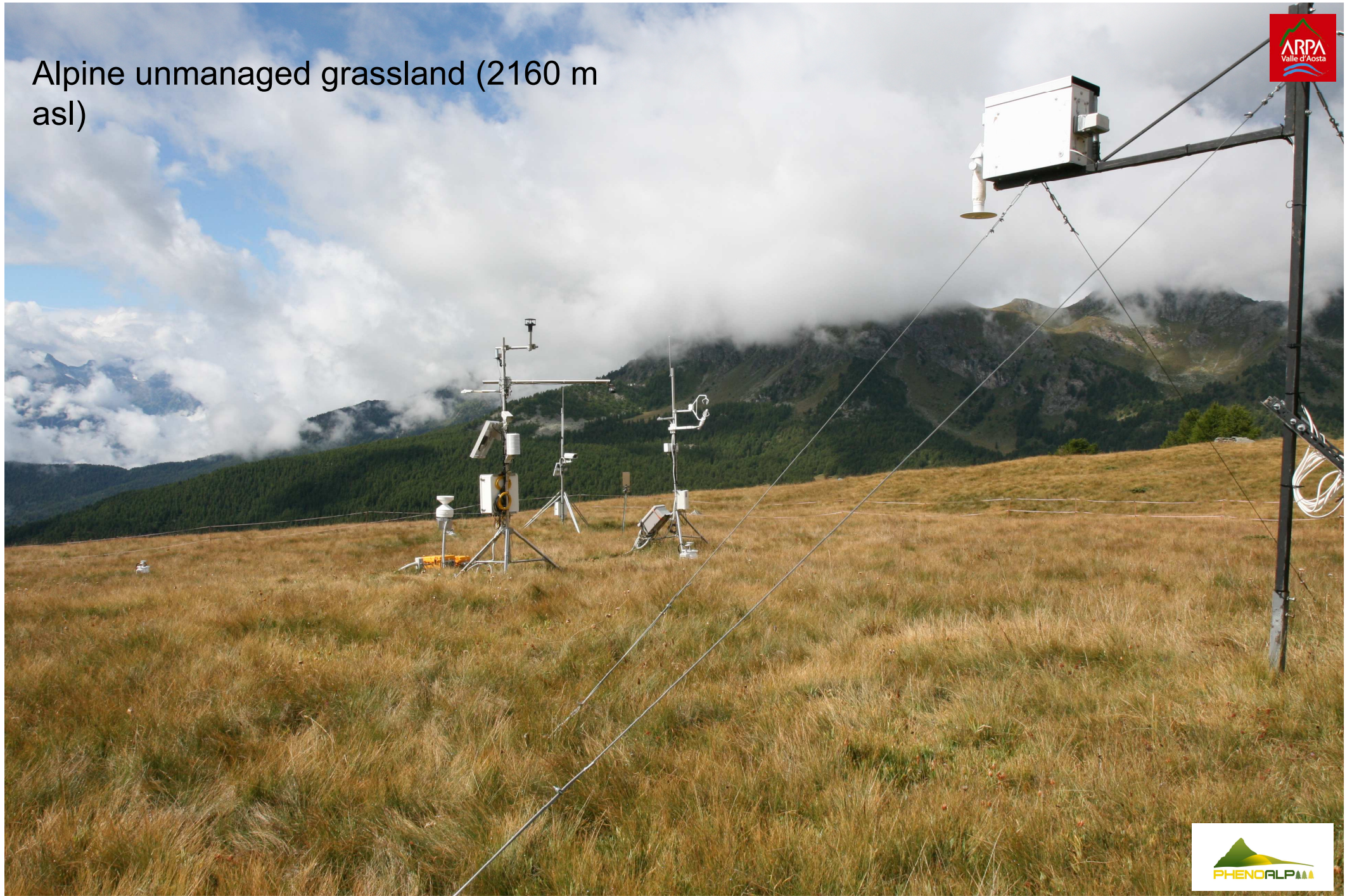
Larch Forest (2100 m asl)

- ✓ Since 2005: larch phenological observations (spring and autumn phases on 60 trees) + T_{air} and T_{soil} measurements in 4 plots
- ✓ Since 2010: CO₂/H₂O fluxes (eddy covariance technique) + met variable
- ✓ Since 2010: larch phenology with webcam
- ✓ Since 2010: soil respiration (snow free period: LI8100 / winter: snow flux tower weekly sampling)
- ✓ Since 2011: spectral vegetation indexes (NDVI – PRI Skye sensors)
- ✓ Since 2011: soil solution collection (lismeters) and chemical characterization



Site 4: Torgnon - Tellinod

Alpine unmanaged grassland (2160 m asl)



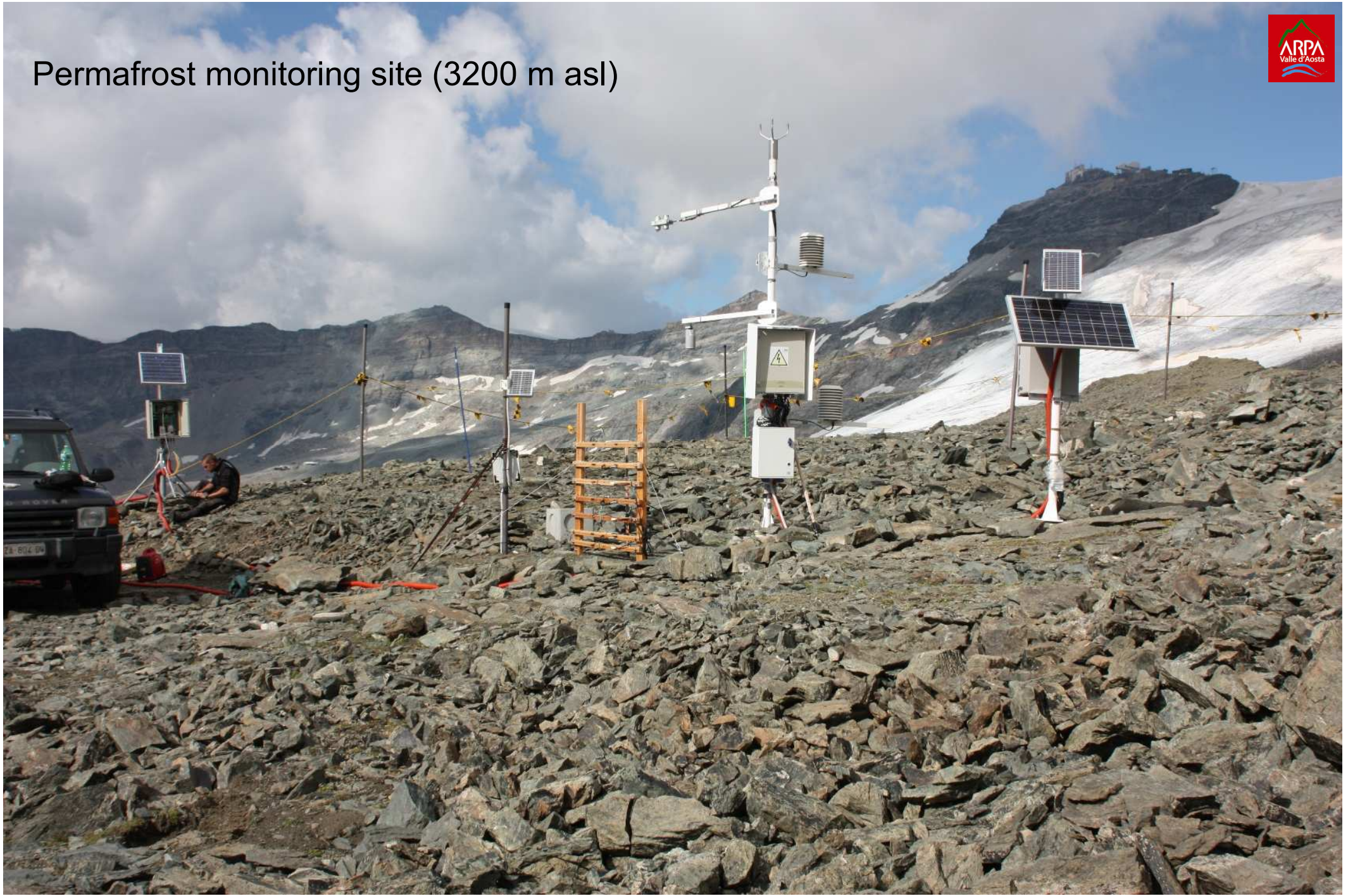
Site 4: Torgnon - Tellinod

Alpine unmanaged grassland (2160 m asl)

- ✓ Since 2008: CO₂/H₂O fluxes (eddy covariance technique) + met variable
- ✓ Since 2008: High resolution radiometric measurement (HSI)
- ✓ Since 2009: grassland phenological observation (PhenoALP protocol)
- ✓ Since 2009: grassland phenological observations with webcam
- ✓ Since 2010: soil respiration (snow free period: LI8100 / winter: snow tower weekly sampling)
- ✓ Since 2011: spectral vegetation indexes (NDVI – PRI Skye sensors)

Site 5: Cime Bianche

Permafrost monitoring site (3200 m asl)



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Permafrost monitoring site (3200 m asl)

- ✓ Since 2004: permafrost and soil temperature measurements in boreholes (7m & 41m) + met data + snow physical properties
- ✓ Since 2005: snow spatial distribution at plot scale (40x10m) + ground surface temperature (CALM grid)
- ✓ Since 2005: rock walls surface temperature monitoring (Cervino south face + Capanna Carrel Hut)
- ✓ Since 2010: ground surface temperature at basin scale (20Km²)



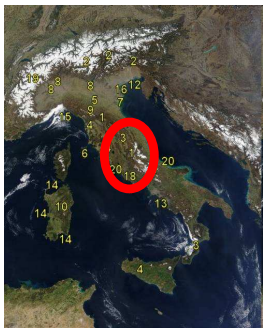
Site 6: Mont Avic Natural Park



Collaborations in other LTER sites

“High elevation sites in the Appennines”

Snow chemistry and soil characterization



Collaborations in other LTER sites

“Niwot Ridge”

