



# A new test site in Aosta Valley (northwestern Italian Alps) for measuring the effects of snow-gliding on avalanche defence structures

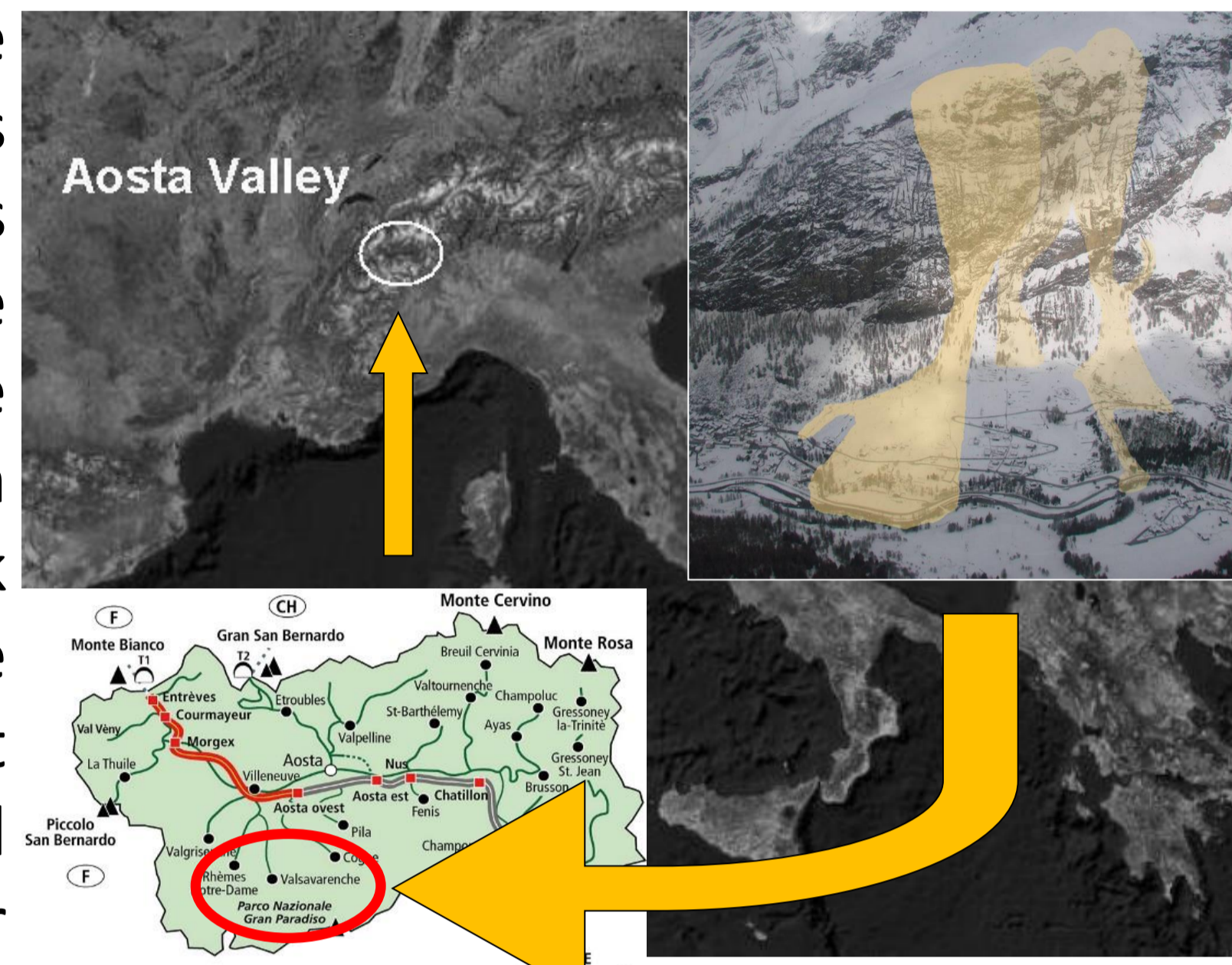


Barbero M. (2), Barpi F. (2), Borri Brunetto M. (2), Bovet E. (2), Bruno E. (3), Ceaglio E. (3), Chiaia B. (2), Valerio De Biagi (2), Fassin D.(4), Freppaz M. (3), Frigo B. (2), Maggioni M. (3), Pallara O. (2), Pitet L. (1), Segor V. (1), Vicari C. (1), Zanini E. (3)

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(1) Direzione assetto idrogeologico dei bacini montani, Regione Autonoma Valle d'Aosta (IT)  
 (2) DISTR, Politecnico di Torino (IT)  
 (3) Di.Va.P.R.A. - LNSA, Chimica Agraria e Pedologia, Università di Torino (IT)

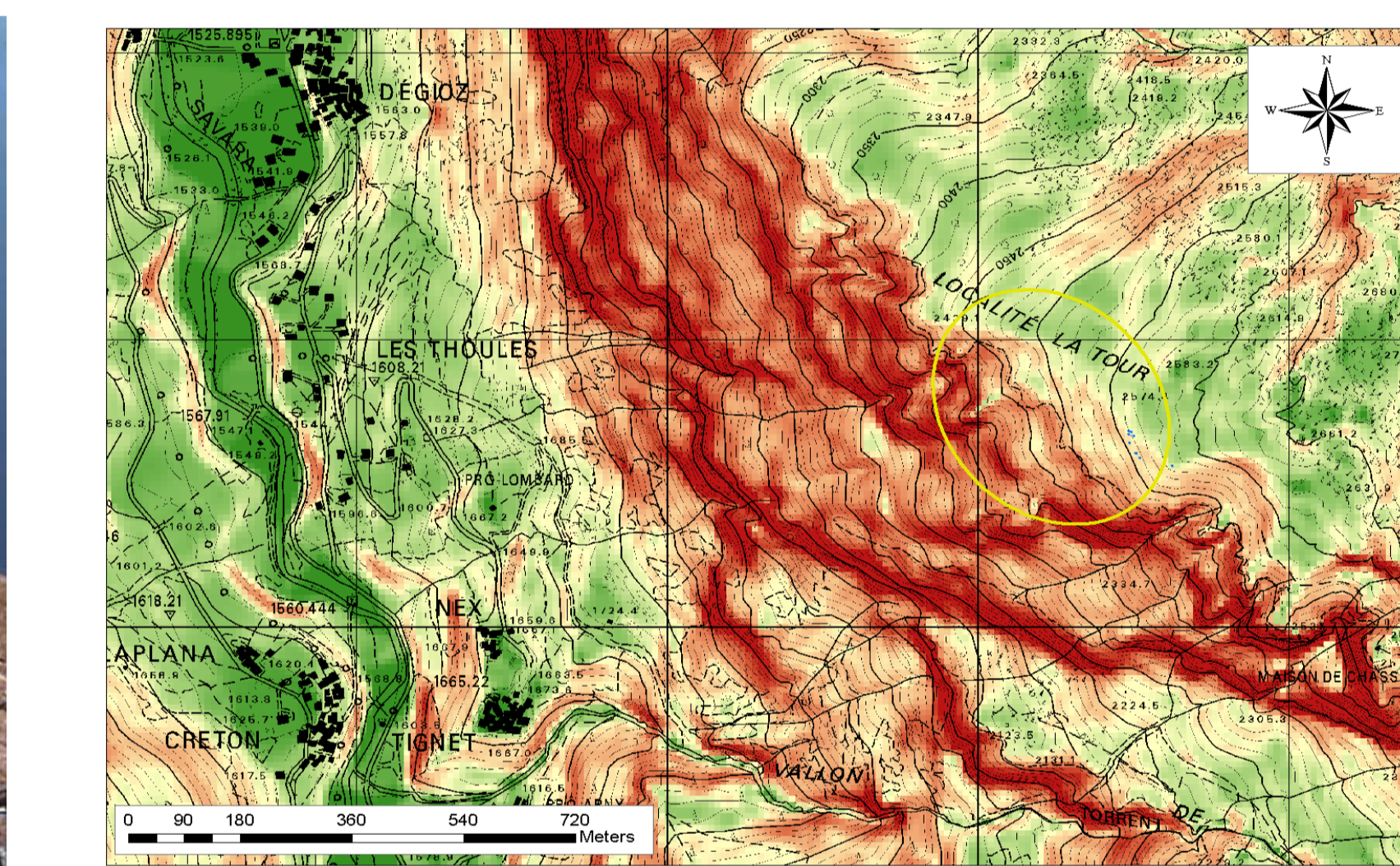
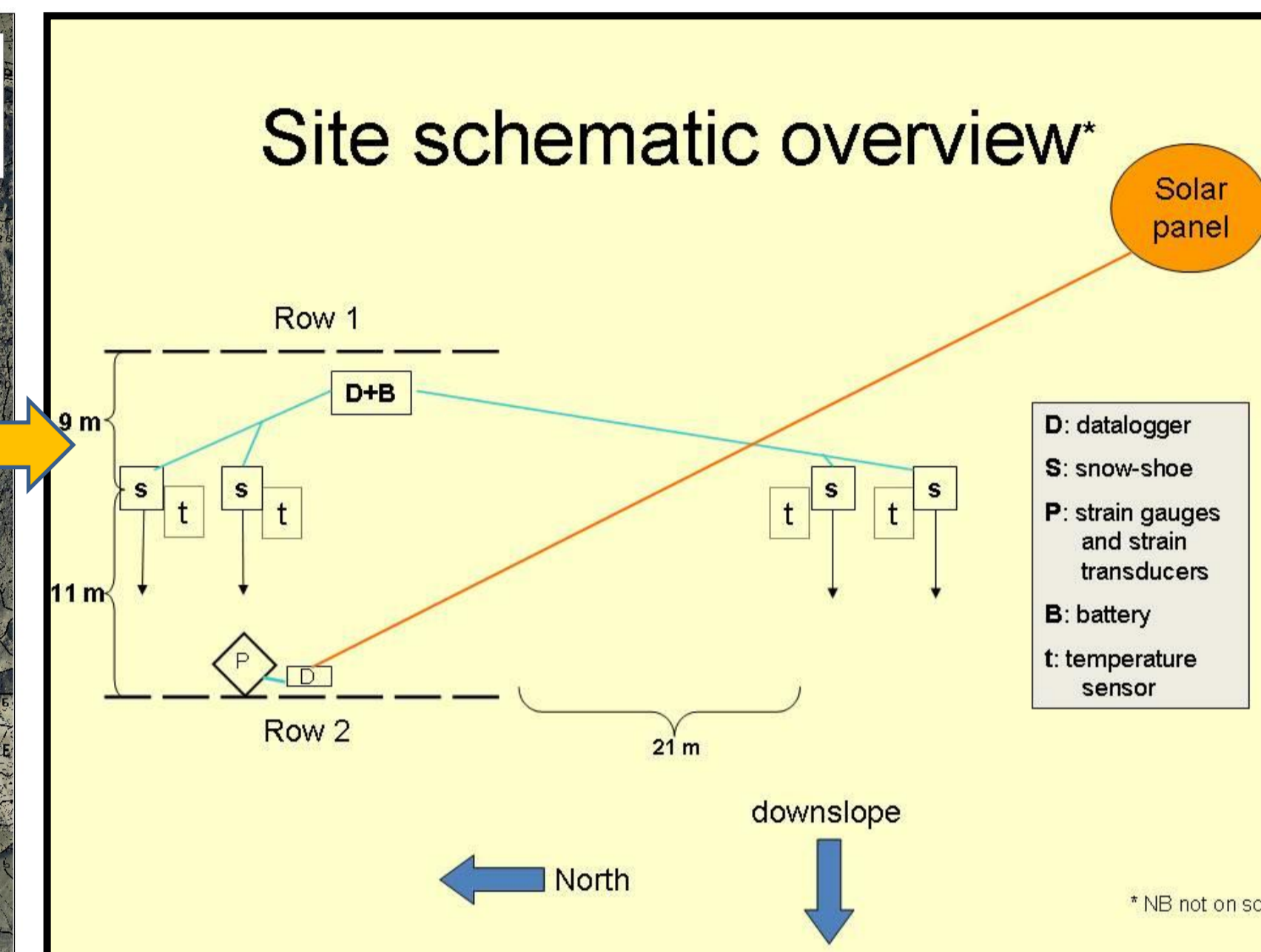
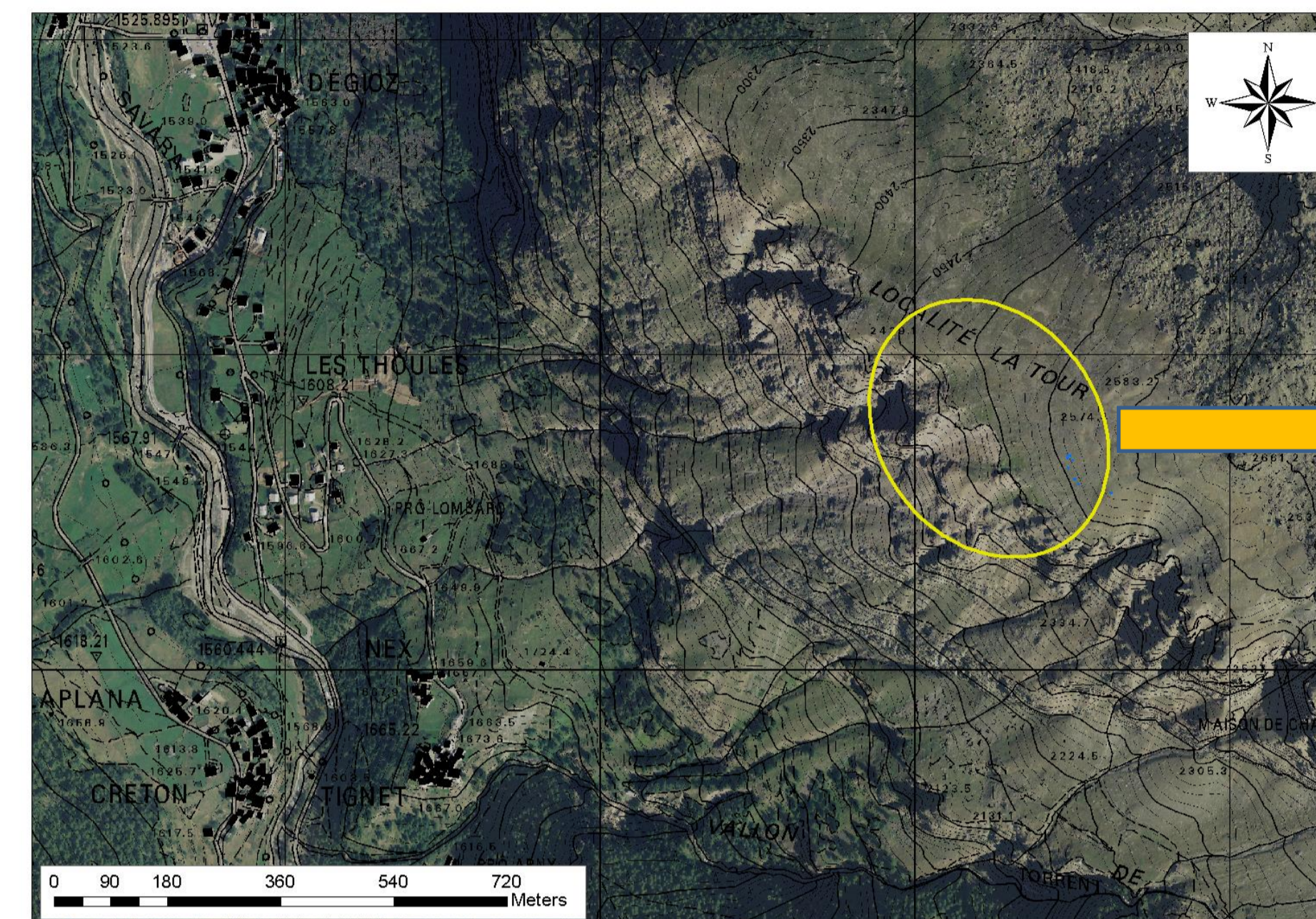
**LOCATION:** The catastrophic avalanche of December 15th, 2008 in Valsavarenche (Italy) caused the collapse or the damage of ten houses in Les Thoules village. Following that, 2.60 km of snow umbrellas (distributed over ten rows) were installed in the avalanche release zone named Plan de La Tour. The test site is located in Aosta Valley (North-western Italian Alps) within the Gran Paradiso National Park on the Gran Paradiso Massif. The site, an alpine meadow characterized slightly rock covered, is at 2550 m ASL and the slope angle between 28° and 45°. The instrumentation was installed in October 2010, it is located in the upper part of the release zone. The site is not accessible during winter time



## MAIN OBJECTIVES:

- Measure the snow-gliding within the snow umbrellas and outside.
- Measure the pressure caused by the snow-gliding on the defence structures by monitoring the deformation of one of the cross beams composing the snow umbrella and the overall force on the foundation.
- Analyse the possible relation between snow-gliding and pressure on the snow umbrella.
- Verification of the dimensioning of this kind of defence structures.

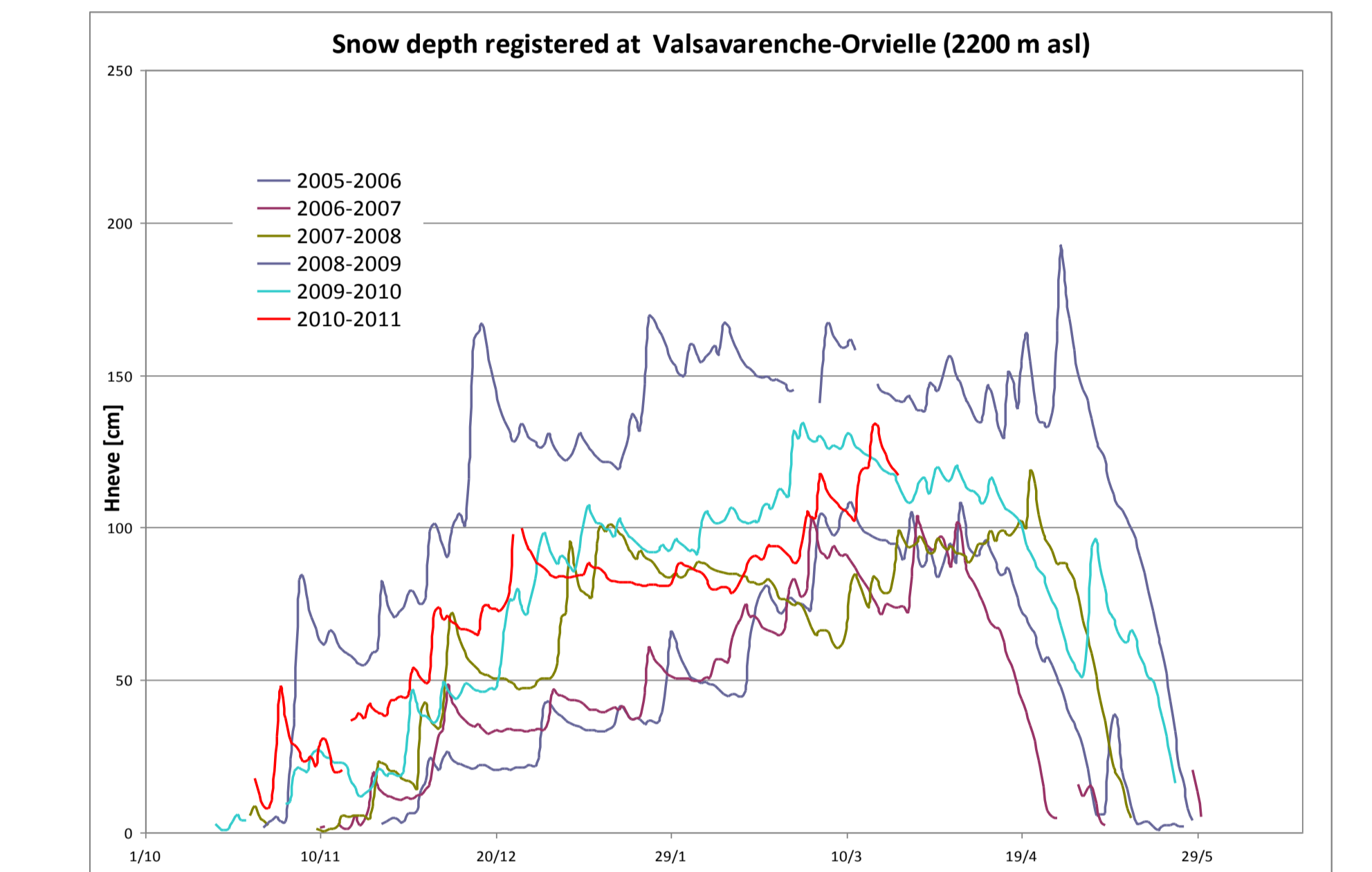
## EXPERIMENTAL SITE



## Nivometeorological conditions

Mean annual snow accumulation : 700 cm\*  
 Mean annual snow deposition length: 250 days\*  
 Meteorological data are obtained by the nearby automatic station located at Orvielle

\*Referred to the Aosta Valley Region at an altitude of 2500m asl



## Future works

- To collect data registered during winter season 2010-2011
- To find the relation between snow-gliding and the load on the defence structures
- Use our data to verify the well know rule concerning the determination of snow pressure on obstacles
- To measure the vertical trend of pressure on the umbrella
- To test the response of the umbrella under snow loads during the winter

## SNOW SHOES FOR SNOW-GLIDING MEASURING



- Measuring range: 0 - 4 m distance
- Field of application: -35 - +60 °C
- Output: Resistor output (10 kOhm)
- Gear ratio: Potentiometer 1:5
- Power consumption: max. 200 mA
- Protection type: IP 58
- Dimensions: 160 x 90 x 80 mm (WxHxD)
- Length Rail 200 mm
- Drum Ø 30 mm
- Installation: 4 earth spikes Ø 8 mm

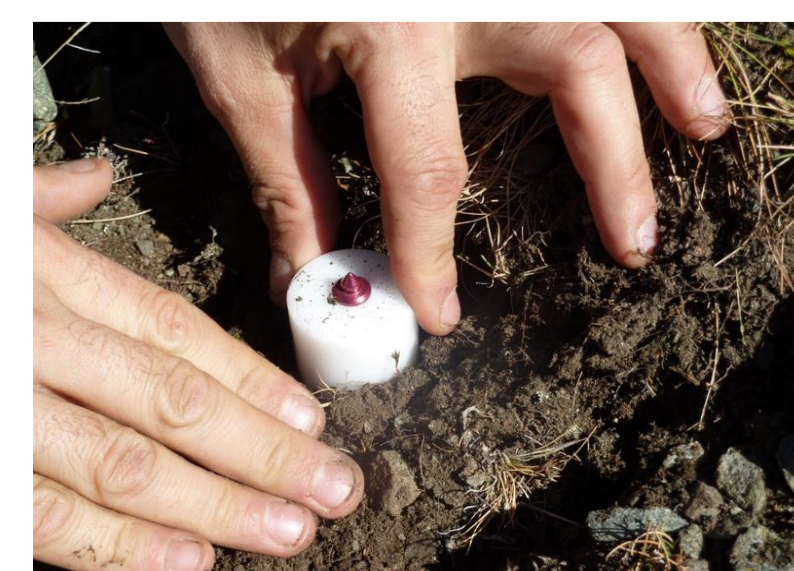
## SNOW-GLIDING DATALOGGER AND BATTERY



- Data recording every 5 minutes
- Data storage every 30 minutes
- Power requirement 0.6mA sleeping mode up to 27.6 mA recording mode
- Power supplied by a 12 Vdc 110 Ah battery

## TEMPERATURE SENSORS & DATALOGGERS

Placed within the ground (depth 1cm) – data recording and storing every 30 minutes



## STRAIN TRANSDUCERS ON A TRANSVERSE UMBRELLA BEAM



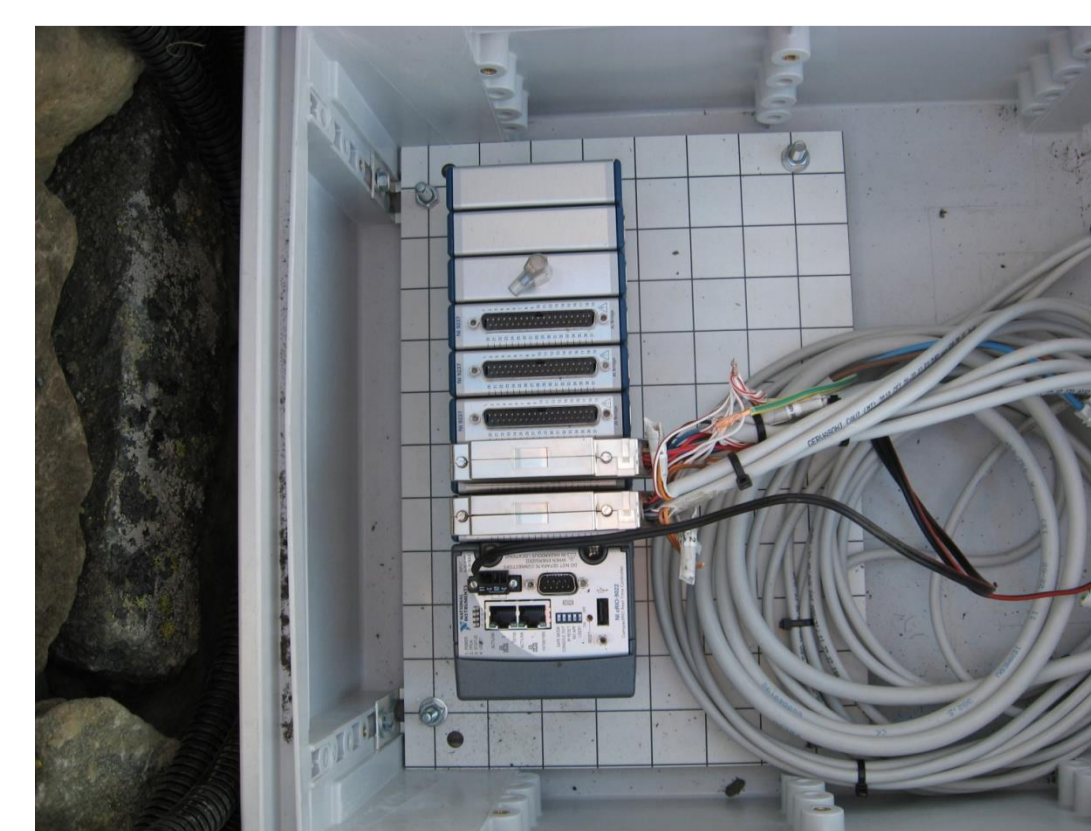
Eight strain transducer were installed along the beam. From the strain field, curvature is computed and thus the forces on the element are found.

## STRAIN GAGES ON THE FOUNDATION CONNECTION



On the anchorage plates strain gages were stuck. The total force acting on the foundation is thus computed via the measured strain in the element.

## DATALOGGERS FOR STRUCTURAL MEASUREMENTS



Voltages variations due to transducers and strain gages measurements are monitored each 30 minutes and processed in an electronic device. Data are recorded on a SD-card.



The power supply is given from a solar panel.