

HOW RESEARCH CAN HELP IN AVALANCHE RISK MANAGEMENT

THREE NEW EXPERIMENTAL SITES IN AOSTA VALLEY (ITALY)

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INTRODUCTION

The Aosta Valley is the smallest Italian region (3.263 km²) and presents 70% of its territory above 1500 m asl and 4% covered by glaciers. The evidence of the high potential risk due to avalanches is highlighted by the fact that 70-80% of the Aosta Valley is potentially influenced by avalanches. The Regional Avalanche Cadastre (since the '70s) counts around thousands events and many protection structures (active and passive) are present all over the territory. The main problem is that the avalanche risk tends to grow due both to the greater frequentation of mountains and to the more frequent extreme meteorological events. To reach this goal, a detailed knowledge of the snowpack characteristics, of the avalanche release process, of the avalanche dynamics and of the avalanche effects on buildings, forest or infrastructures is fundamental. Though research on these topics began many years ago, some processes are still not completely known, due to the difficulty of getting data from reality.

In order to answer the previous research and practical problems, within the Operational programme 'Italy - France (Alps - ALCOTRA) Projects "DynAval" and "RiskNat", three new experimental sites have been realized: Punta Seehore in Gressoney La Trinité, Plan de la Tour in Valsavarenche and Mont de la Saxe in Courmayeur. In winter 2010/2011, the activities in test sites are starting, but another winter is needed to validate the measurements.

PUNTA SEEHORE: AVALANCHE DYNAMICS AND INTERACTION FLOW/OBSTACLES

The test site "Punta Seehore" is located on the Monte Rosa Massif. The main goal of the site is to better understand the dynamics of small/medium size avalanches and their impact on obstacles. The slope, with an altitude difference of about 300 m (from 2300 to 2570 m ASL), has a mean inclination of about 38°. Generally, avalanches are artificially released for the security of the ski-runs; they are usually dense flow avalanches but also a powder cloud may occasionally form. The site is instrumented with a steel obstacle composed by two masts of about 4 m of height supporting 5 instrumented horizontal plates that measure the effects of the avalanche impacting on it. Different kind of activities are made before, during and after each artificial release: physical and mechanical properties of the snow in the release, track and deposition zones of the avalanche are recorded, front velocity, erosion and deposition mass are estimated by field surveys or by multi-pictures analysis and laser-scan measurements.

PLAN DE LA TOUR: SNOW-GLIDING AND OVERLOAD OF SNOWPACK ON DEFENCE STRUCTURES

The test site "Plan de la Tour" is located within the Gran Paradiso National Park on the Gran Paradiso Massif. The main goal of the site is to measure and understand the snow gliding process and the snowpack overload on umbrellas defence structures. The site is at 2550 m ASL and it is characterised by a slope angle between 28° and 45°. In October 2010, in order to measure the snow-gliding two

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couples (one within the area covered by snow umbrellas and another outside it) of snow-shoes connected to related specific snow-gliding sensors were placed, coupled with data-loggers measuring the temperature at the snow/soil interface. On the other hand, the measurements of the pressure caused by the snow-gliding and creeping on the defence structures are performed by monitoring the deformation of one of the cross beams composing the snow umbrella and the overall force on the foundation. Eight strain transducers were installed on a beam of the retaining structure in order to evaluate the curvature under the snow load. In addition, strain gauges were directly stuck on both the plates constituting the link between the mast and the foundation rod.

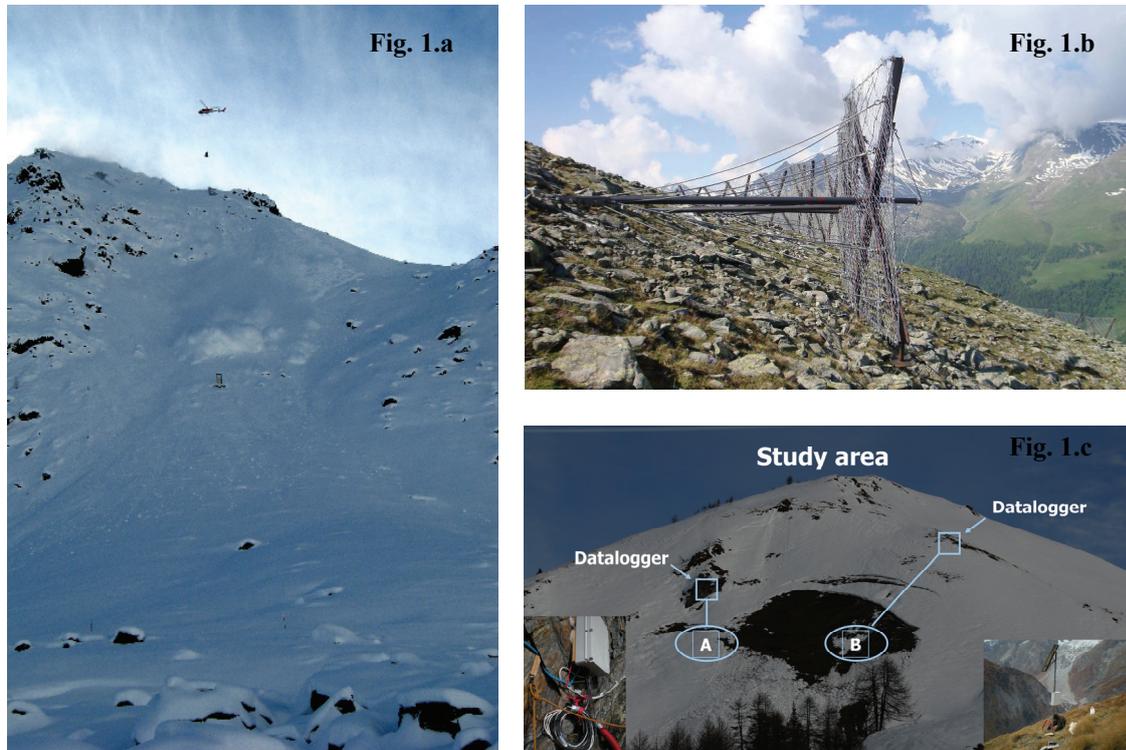


Fig. 1. Experimental sites in Aosta Valley. a) Punta Seehore. b) Plan de la Tour. c) Mont de la Saxe.

MONT DE LA SAXE: SNOW-GLIDING AND SOIL EROSION BY GROUND AVALANCHES

The test site of Mont de La Saxe is located in the north-western part of the Aosta Valley, very close to the Mont Blanc Massif (4810 m asl) in the municipality of Courmayeur. The avalanche path runs from 2115 m to 1250 m ASL on a west aspect. Full-depth, wet snow avalanches are frequent in Spring and Fall. The release zone is often characterized by intense snow glide and glide cracks formation. These processes often involve the soil with a considerable removal and subsequent transport of snow mixed with soil, rock and plant material, which are accumulated in the deposition areas.

The main goal of the site is to investigate the intensity of snow movements in an avalanche release area related to soil erosion, with particular attention to the processes at the snow/soil interface, investigating the temperature and humidity parameters, and to the weather conditions, which might contribute to avalanche release.

In autumn 2009 the avalanche release area was equipped with two plots at the same elevation, slope angle and aspect, but with different soil water content, due to the presence of a spring: in each plot sensors for continuous measurements of snow gliding at the snow-soil interface, and soil water content and temperature in the soil, at the snow-soil interface and in the snow were placed.

Keywords: snow avalanches, snow load on defence structures, snow/soil interface, snow gliding.