# ABSTRACT

## AVALANCHE RISK, HUMAN FACTOR AND HEURISTIC TRAPS

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Any kind of activity taking place in a snow-covered mountain environment is subject to the risk of avalanche release and consequently the risk of burial.

Worldwide statistic figures emphasize a significant difference as for the rate of accidents among those who practice recreational activities on snow and professionals, despite that in the last decades science has made major achievements in the knowledge of physical parameters of avalanches (snow science, avalanche dynamics, meteorological and morphological factors) and that ski-mountaineering/backcountry skiing courses organized by CAI, the Italian alpine club, are generally focused on accident prevention (evaluation of stability, avalanche release dynamics, setting up and leading an excursion). It has in fact been ascertained that most of the accidents take place because of human error, but scientists still have not managed to properly understand the decision-making dynamics and the factors affecting it. Some authors (see References) have shown that expert people, though being subject to higher risks, are able to develop their own decision-making process, therefore reducing human errors, particularly heuristic traps.

## Integrated management system for the regional avalanche databank THE NEW AVALANCHE REGISTER IN VALLE D'AOSTA

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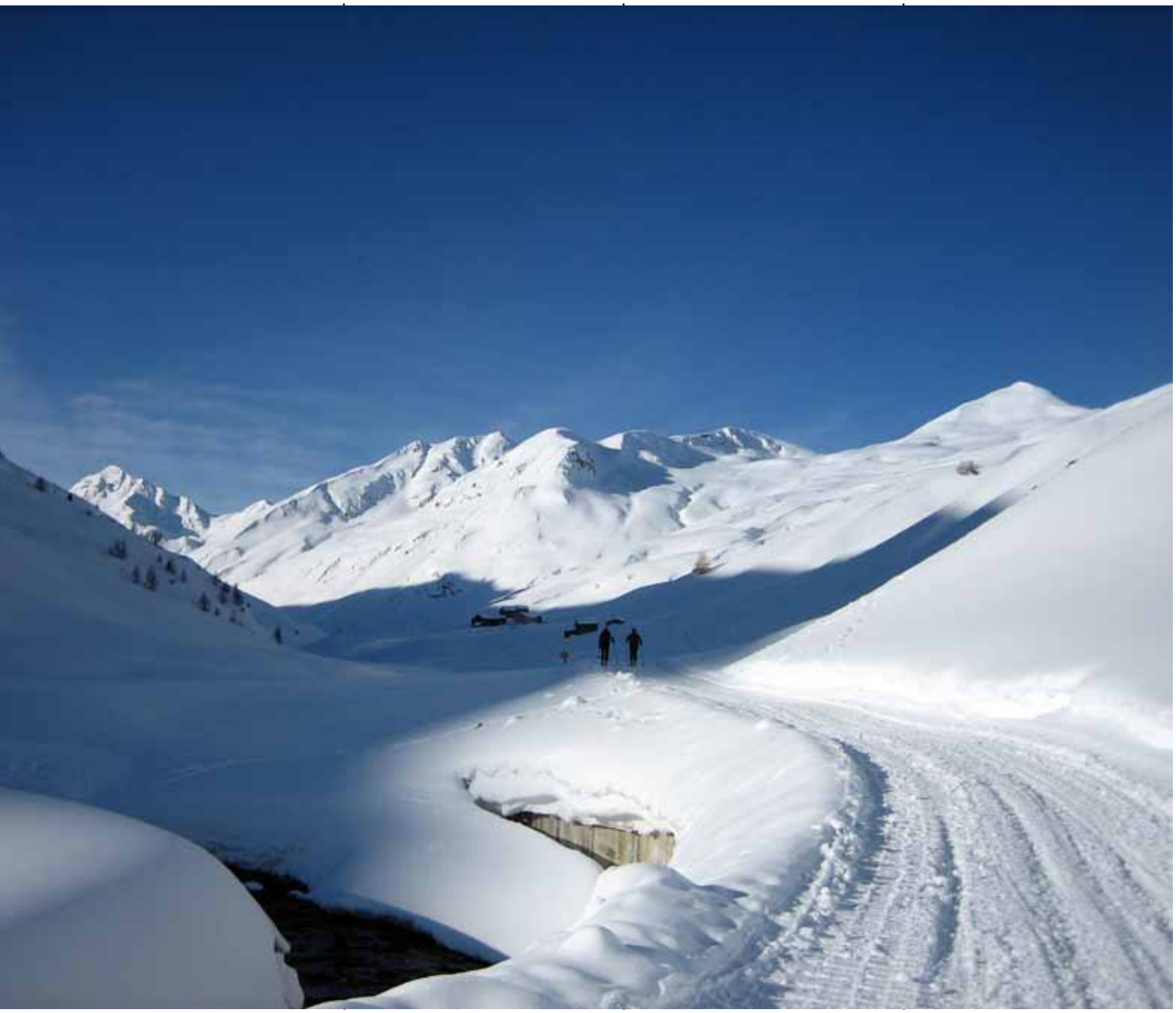
Starting from mid-1990s the Autonomous Region of Valle d'Aosta has been developing S.I.T.R., a regional territorial information system, whose implementation by the various Services of the Regional Administration has led, mainly in the last five years, to widespread digitalization of the archives containing territorial data.

In this framework the digitalized Avalanche Database was set up, which led to the enhancement of a sector of S.I.T.R., S.I.G., the Geological Information System, which originally only included landslides and hydrogeological phenomena.

Once all data has been entered, a demanding task, the new digital Avalanche Database will allow for better management of the large amount of data gathered by the several technicians who have worked at the centre for about forty years, since when the Snow and Avalanche Office was created.

Being integrated within an already existing information system, the database will allow technicians to carry out important and immediate territorial analyses, therefore enabling integrated land planning and management (floods, landsli-



des, earthquakes and avalanches). It will also be possible for technicians to display all related cartographic information using the Regional Technical Map on a 1:10.000 scale or colour orthophotographs as a background. Data can be consulted by selecting graphical elements or interrogating the associated database.

The Avalanche Database digitalization, which is still underway, offers scientists the possibility to reconstruct and achieve a very important territory planning tool, but mainly steadily and more easily update the large amount of information gathered in winter seasons by both technicians from the Snow and Avalanche office and all the other operators who are actively involved in the area (e.g. Valle d'Aosta foresters, financial police, snow observers, mountain guides). The development of the new information system, other than representing the achievement of a result pursued for many years, should be seen as a first step toward the creation of a very useful instrument to the service of the Snow and Avalanche office, based on steady and dynamic updating of the avalanche phenomena taking place every year.

## SPATIAL VARIABILITY OF ALBEDO ON THE GLACIERS OF UPPER VAL DE LA MARE (ORTLES-CEVEDALE GROUP)

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In the framework of a research project on the cryosphere and the hydrologic effects of the climatic changes in high altitude watersheds, a study on the spatial variability of the albedo on glaciers was carried out. The survey campaign took place during the summers of 2007 and 2008 on two glaciers in Val de la Mare (Ortles-Cevedale group, Trentino).

Albedo defines the quantity of short-wave radiation which is absorbed by surface and is therefore crucial in the energy and mass-balance of glaciers. Parameterizations usually found in scientific literature often aim at describing the spatial and temporal variability of snow albedo, while the ice albedo is often considered as a constant, or parameterized in a more essential way, for example relating it to elevation. The surveys carried out in Val de la Mare show a high variability of glacier ice albedo, which is mostly related to the superficial debris cover. On the basis of these observations, we investigated the possibility to use ground-based photographic surveys as a faster method for simple and reliable evaluations of albedo. The results obtained confirm that this method allows to fully seize the spatial variability of ice albedo on glaciers.

## ENVIRONMENTAL QUALITY OF SNOW "IN TRENCH" Results of the 3-year activity of gathering of expeditious chimical-environmental data

*G. Kappenberger, M. Freppaz, P. Dellavedova and G. Filippa*

As a rule, a "trench" is used by people needing to defend themselves from enemies. But snow experts and lovers alike think it is the snow itself that defends itself (and us, too) from an enemy called anthropic pollution, though it is true that snow in trench offers us the opportunity to know it better. After three years of observations, experimental measurements, tests and technical-scientific debates, started in winter 2005-06, the informal work team made up of researchers from EIM, ARPA of Veneto (CVA of Arabba) and of Lombardy (Centro Nivometeo of Bormio) and Università di Torino (DIVAPRA – Alpine snow and land laboratory) has finally completed its research. Over 700 measurements of pH and conductivity were carried out that provide a "photography" of the state of the environmental quality of the Alps and Apennines, though being extremely simplified and localized. All that has led to considering snow "in trench", an environmental framework that needs to be analyzed in depth and kept under control, of which the preliminary results from the annual steps of the experimental research work have already been published (Pecci et al., 2007; Pecci et al., 2008; Pecci, 2009).

## INFLUENCE OF ASPECT ON THE SNOWCOVER PHYSICAL-CHEMICAL CHARACTERISTICS

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In alpine ecosystems, snowpacks are characterized by both spatial and temporal variability at the same site, as a function of meteorological factors, such as wind and aspect. This study aims to study the spatial variability of the seasonal snowpack on a small scale to evaluate the influence of the micro-topography on the snow cover evolution. This factor is usually neglected while evaluating the avalanche risk, which however could be extremely variable on the small scale. Several snowpack profiles were dug during the second half of winter 2006/2007 (from February to May) in an alpine valley closed to the Monte Rosa Massif in north-western Italy. Three sites were chosen at an altitude of 2600 m asl, 50 m far from each other with different slope angles (25° and 0°) and different aspects (North, South and 360°). For each profile, grain size and type, snow density, hardness and humidity were measured, as well as pH and Electrical Conductivity at 10 cm vertical increments within the snowpack. The resulting data allowed us to track the physical (snow structure and stability) and chemical properties (storage and release of solutes) over time and to evaluate the effect of the aspect and the slope angle on the physical and chemical properties of snow. During the winter season, the structure and composition of snow displayed significant differences among sites, with consequences on the snow stability. The snowpack at the flat site was comparable to the north-facing site (25°) in the lower part of the profile, while it was similar to the south-facing site (25°) in the upper part the profile. From the chemical point of view, the nutrient release started at the end of February at the south-facing site and flat site and occurred with different ionic pulses throughout the winter. On the contrary, at the north-facing site the release occurred with a unique ionic pulse at the end of April. This study shows that the physical properties of snowpack can vary broadly as a function of micro-topography, determining different stability conditions that are usually neglected while forecasting the avalanche risk. The same topographic conditions play a role in the process of solute release, with different consequences in the nutrient input from snowmelt to alpine soils.