SNOWFALLS ON MARCHE AND ON THE APENNINES AS A WHOLE FROM 1 TO 12 FEBRUARY 2012

S. Sofia

At the end of January 2012 the Azores anticyclone spread towards the Scandinavian Peninsula, and its union with the Russian-Siberian anticyclone enhanced a wide high pressure area. This circulation, on its turn, determined a brisk weakening of the pressure field on the entire Mediterranean basin.

In particular during the first half of February strong northern flows associated to extremely cold air on the high levels of the atmosphere kept bursting in to the Mediterranean basis through the Rhone valley, with consequent cyclogenesis on the Gulf of Lion and on the Ligurian Sea.

A NEW METHOD FOR VISUALISING SNOW STABILITY PROFILES

F. Monti, A. Cagnati, M.Valt, J. Schweizer

Snow stability assessment by interpreting snow profiles is a time consuming and fairly subjective process, especially when snow stratigraphy is carried out without a stability test. Snow stratigraphy is clearly related to snow stability. Many studies have in fact underlined the link between some specific snowpack properties such as grain size and type to instability.

In this work we suggest a new method to visualise snow stratigraphy in regard to stability based on six structural variables (also known as "Threshold sum approach"). Each snow layer is represented by the number of variables that are not in the corresponding critical range.

This approach has not only been implemented for manually recorded snow profiles but also – after adapting the threshold values – for simulated snow stratigraphy provided by the numerical snow cover model SNOWPACK.

The new visualisation method, applied both to the manually observed and simulated profiles, was tested by analysing the most critical avalanche situations of the winter 2008-2009 in the Veneto Dolomites.

Results indicate that the new visualisation method is well suited to quickly and intuitively derive snow stability. Also, stability information derived from simulated profiles was clearly related to the degree of avalanche danger. Supplementing the snow cover model SNOWPACK with the adjusted threshold sum approach increases its usefulness for avalanche forecasting purposes.

VALIDATION OF AUTOMATIC SNOW MEASUREMENTS: IMPLEMENTATION OF AN ALGORITHM FOR ANOMALOUS DATA IDENTIFICATION AND CORRECTION

S. Terzago, M. C. Prola, S. Fratianni, R. Cremonini, S.Barbero

The network of automatic snow and weather stations provides measurements data with high temporal resolution that is used for the estimatation of the amounts of snowfalls, the assessment of avalanche danger and for a variety of applications in the hydrologic field that require highly accurate and reliable observations.

Data collected by means of ultrasound snow gauges may however be distorted by a series of factors associated with meteorological conditions (snow accumulation/dispersal due to the wind action) and possible interferences during measurement, such as obstacles that temporarily cover the sensor, or the growth of grass following full snowpack melting.

All data gathered by the snow measuring stations of ARPA Piemonte regularly undergo a manual quality control procedure carried out daily by snow experts, who detect and correct all possible anomalies in measurements.

The aim of this study is to provide a support to manual validation of snow data through the development of an identification technique of "suspicious" data, such as possible *outliers*, isolated peaks or improbable values, given the seasonal trend of snowfalls. The procedure consists of a series of air temperature measures and implements a snowcover melting model to verify compatibility of snow data with the other meteorological variables measured. The algorithm was assessed by comparing automatically validated series with those manually validated by snow scientists, and results prove the accuracy of the method proposed.

ESTIMATION OF SOIL REDISTRIBUTION RATES DUE TO SNOW COVER RELATED PROCESSES IN A MOUNTAINOUS AREA (Valle d'Aosta, NW Italy)

E. Ceaglio, K. Meusburger, M. Freppaz, E. Zanini, C. Alewell

In mountain regions, in addition to the runoff processes, snow movements can also contribute to enhancing soil erosion. The aim of this study was to compare the soil redistribution rates attributable to the snow movements with the total yearly rates.

In an avalanche area characterized by intense snow gliding and by the frequent release of a full-depth slab avalanche, two methods were applied:

a) conventional method, based on field measurements of the sediments yielded in the avalanche deposition area by two events, in order to estimate the soil redistribution rates due to the snow movements; b) caesium-137 method, which supplies the cumulative net soil loss/gain since 1986, including all the erosion processes. The snow related soil accumulation (27.5 Mg ha^{-1} $event^{-1}$ and 161.0 Mg ha^{-1} $event^{-1}$) was even more intense than the yearly total deposition rate (12.6 Mg ha^{-1} yr^{-1}), the snow related soil erosion rates (3.7 Mg ha^{-1} and 20.8 Mg ha^{-1}) were comparable to the yearly total erosion rates, and, even if the comparability between the two techniques was limited by their different time scale, both methods yielded similar magnitudes of soil redistribution. Snow movements could be considered the main driving force of soil redistribution in this area.

To which extent this is true for other areas, less affected by ground avalanche release and snow gliding, needs further investigation.

Nonetheless, the study highlights that soil erosion due to the snow movements should be considered in the soil vulnerability assessment in mountain areas, as they significantly determine the pattern of soil redistribution.

SPECIFIC SNOW PRESSURE ON SNOW SUPPORTING STRUCTURES IN AVALANCHE STARTING ZONES

R. Castaldini

The definition of the snow pressure on the permanent supporting structures in the avalanche starting zone is very complex. Often difficult to predict phenomena occur even with careful observations and measurements.

The formulation proposed by R. Haefeli in 1954 and afterwards received as basis of the "Guidelines for Defense structures in avalanche starting zones" technical guidelines as an aid to enforcement, 2007 edition FOEN (Swiss Federal Office for the Environment) and SFISAR (Swiss Federal Institute for Snow and Avalanche Research) in Davos, is necessarily a simplification compared to what happens in nature. However, this formulation has the great advantage of being easy to understand, easy to apply and its reliability, at least on the snows of Alpine type, has been confirmed by measurements in actual cases (Margreth, 1995, Rammer 2009).

For this reason, the calculation of the forces acting on the snow supporting structures (snow nets, snow bridge and snow rakes), are generally referred to the Swiss Guidelines, whose validity is internationally recognized and supported by more than fifty years of experience and field validation of works carried out and calculated according to them; however, adopting such guidelines does not relieve the structure designer to carry out an indispensable verification of their applicability, and an appropriate and careful calibration of parameters they contain, for geographical and climate areas different from that of the Swiss Alps. In addition, the standard snow supporting structures are generally classified with reference to the thickness of the snow D_k the glide coefficient N, assuming usually a slope inclination = 45 and a altitude factor f_c = 1,1. The formulas given by Swiss Guidelines for the calculation of components parallel and perpendicular to the slope of the specific pressure of the snow were therefore rewritten, as general as possible, as a function of explicit parameters D_K, N, () and , so as to make them easily and immediately usable in contexts other than the Swiss Alps and a simple sensitivity analysis of the main involved parameters was carried out.

Without a doubt, the most sensitive parameter is the thickness of the snow D_k, which appears high to the square in the formula, but it's certainly interesting to observe also how the specific pressure of the snow on the supporting structures varies, with a curved parabolic shape, as a function of the average density of snow and of the slope inclination value in the avalanche starting zone.

The graphs obtained can be a fast and useful tool for a rough and preliminary pre-dimensioning of the snow supporting structures.