THE AVALANCHE RISK ESTIMATION IN ROMANIA

Narcisa Milian[1], Cristian Flueraru [2]

[1] South-Transylvania Regional Forecasting Center, National Meteorological Administration, Bucharest, Romania
[2] Remote Sensing and GIS Laboratory, National Meteorological Administration, Bucharest, Romania
E-mail : nivologiesibiu@gmail.com

Abstract: The first snow observations concerning avalanche risk started in Romania in february 2004. The analyzed area covered Bucegi, Piatra Craiului and Fagaras mountains, the massifs most frequented by tourists. One year later, in 2005, was realized the first avalanche risk bulletin; the activity is still "experimental" due to the lack of an avalanche cadastre. The dissemination of information started in January 2006 using two important web-resources: the Romanian Mountain Rescue web page and alpinet.org a mountain portal with more than 20000 visitors per day. For the cases with high risk, warnings were released towards the mass media. The future-work includes extending the observation network, the change of activity status to "operational", the continuity of validation and gathering all the existing datas into an avalanche cadastre..

Keywords: *avalanches, observations, Romania*

1. INTRODUCTION

People have been caught in avalanches in the romanian Carpathians almost every winter. The greatest avalanche risk is in the southern Carpathians, that have very steep slopes and deep glacier valleys, but there have been also cases in the other romanian massifs. In april 1977 an avalanche killed 23 people at Balea-Lac - in the Fagaras Mountains. After that the meteorological stations Balea-Lac (2050 m) was set up, but no avalanche studies have been started. In the last years the number of people practicing various types of winter sports has greatly increased, together with the number of victims triggered by avalanches – (fig. 1).

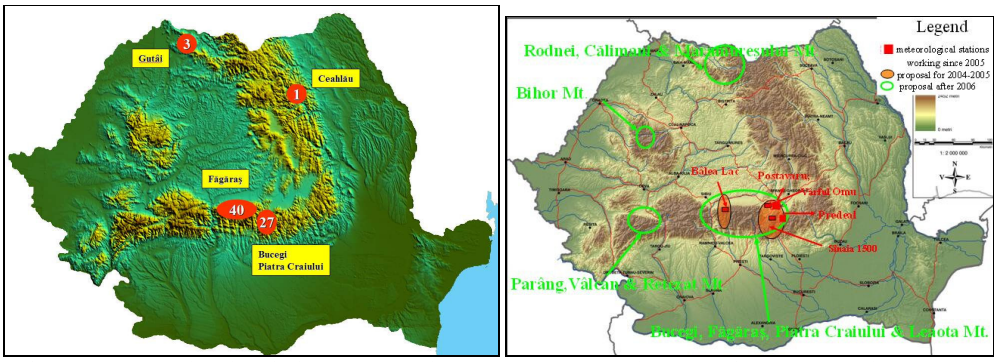

Figure 1: Left: Reported avalanche victims between january 2000 – march 2007. Right: observations network at the end of the 2005/2006 season and further development proposals

The snow and avalanche monitoring network was started in february 2004, in cooperation with CEN METEO FRANCE, after a deadly avalanche that had killed 5 skiers in the Bucegi Mountains. Since then, more than 20 victims have been caught in avalanches each year, and some of them have died. This demonstrates that the extension of sportive and touristic mountaneous activities must be corelated with a permanent natural hazards evaluation and monitoring, and shows up the necessity of specific snow observations and avalanche risk estimation.

The main objectives of the National Meteorological Administration's snow and avalanche network are the monitoring and forecasting of snow cover and avalanche risk in the Romanian Carphatians. The program includes five meteorological stations in three different mountaneous regions: Bucegi (Varful Omu, Sinaia 1500 and Predeal), Postavarul (Postavaru) and Fagaras (Balea-Lac) – (fig.1).

2. DATAS AND METHODS

Two daily observations that include meteorological and specific snow parameters are made around 06.00 and 12.00 GMT and weekly measurements of the snow layer. The obsevational datas are introduced into GELINIV, a programme developed by CEN Meteo France, and transmitted afterwards through email to the forecasting team. The forecasting team started with two workgroups, one from the central laboratory in Bucharest and at the other one from Sibiu Regional Forecasting Center. From january 2007 the daily avalanche risk estimations was taken over at Sibiu. The avalanche risk bulletin includes a meteorological forecast for the next 24 hours, together with the estimated altitude of the 0^0 and -10^0 isothermes, speed and wind direction at 2500m, present snow layers description and avalanche risk estimation for the next 24 hours, together with a meteorological forecast and an avalanche risk tendency for the next 48 hours. The European Avalanche Risk Scale is used for the risk estimation.

Simulation and forecasting the evolution of the snow cover and avalanche risk is made using the CROCUS MEPRA PC Version Roumanie 2004 programme, part of the french "chain" - SCM (SAFRAN, Crocus and MEPRA).

The meteorological parameters for CROCUS are taken from GELINIV (real observations) and extrapolated from the numerical weather prediction models (for the next hours: precipitation amount, humidity, nebulosity and wind speed). Simulations are made for each mountain massif, using different orientations and angular slope (0°, 20°, 40°). The interpretation of estimated avalanche risk is then made integrating all the observational data – about snow and weather, satellite and radar images, weather forecast data and simulations of the snow cover and avalanche risk, reported avalanche events, as well as informations from other sources (internet, mass-media).

The third part of SCM chain, the SAFRAN programme is not yet being used. The nearest neighbor's programme ASTRAL (Guyomarc'h 94) – is also not yet used in Romania.

3. RESULTS

Because the activity is still experimental, the bulletins have been first edited only on the internal network until january 15, 2006. Since than they have been made public, to the Romanian Alpine Club, National Rescue Mountain Center and Local Rescue Mountain Services from Sinaia, Busteni, Azuga, Sibiu and Arges, Mountain Rangers, meteorological stations where snow obsevations are made, alpine internet sites and mass-media (only the warnings).

An yearly Nivological Report has been made, in wich the meteorological and specific snow conditions are described for each observational station, as well as the avalanche activity for the three mountain massifs and case studies.

Avalanche and highly risk areas mapping are at the very beginning, in colaboration with the Mountain Rescue Teams and the Energency Services. The first mapping was realised for a valley in the Bucegi Mountains, using clasical methods and determining avalanche zones on terrain.

Both Bucegi and Fagaras Mountains are favorable to high avalanche activity, of different types: from the most common (slab, melting) to atypical ones (in the forests). A statistic made for the Bucegi Mountains, based on weather and snow cover evolution, ground cover and relief characteristics, shows that the periodicity of smaller avalanches causing small or medium damages generally in high altitude limit forests, soil erosion and mobilization of debris deposits is about 10-15 days/events for 1 to 10 seasons; and for the ones causing high forests damages with trees breaking, high erosion, changes in relief, debris deposits on dams and routes, and distroyed buildings about 1-5 days/events for 10 to 30 seasons.

The statistics of snow bulletin visualisation on the internet shows a continuous interest increase, especially before week-ends and in hollidays. If in the first two months of its external publication (january 15 – march 15, 2006), the medium number of visitors was only 44, with an increase in february 01 when a warning avalanche risk was issued, in the next months that number was double, with a maximum of 214 visitors in april 19, before the Easter holliday.

During the two nivological seasons: 2004/2005 and 2005/2006, there were no risk 5 estimations in 2005/2006, risk 3 and 2 estimations have increased, and risk 4 was less used. Though, comparing the two massifs avalanche risk estimations, it can be seen that in Fagaras risk 4 is more used than in Bucegi. This is due to a higher snow amount in Fagaras, the highest Carpathian Massif, were snow usually lasts until next fall (fig. 2).

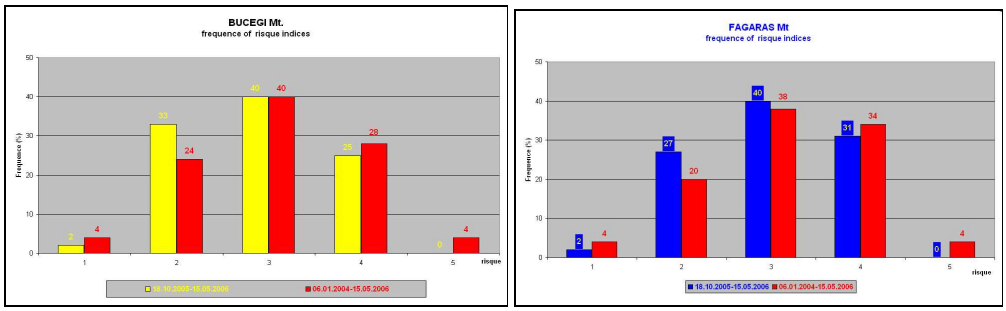

Figure 2: Comparation of frequence estimated risk using in Bucegi (right) and Fagaras Massifs (left) during the 2 nivological seasons (2004/2005 and 2005/2006)

Some of the avalanches in the last three years are presented below. Most of them were caused by hykers or skiers; some of the melting avalanches are going down to the valleys causing forest damaging.

Figure 3: from right to left: hard slab avalanche with no victims-march01 2004 (Balea-Lac, Fagaras Mt); slab avalanche - april10, 2004 caused refuge damages (Balea-Lac); melting avalanche-april 2004, blocking routes (Capra valley), signs of avalanches at the Capra tunnel

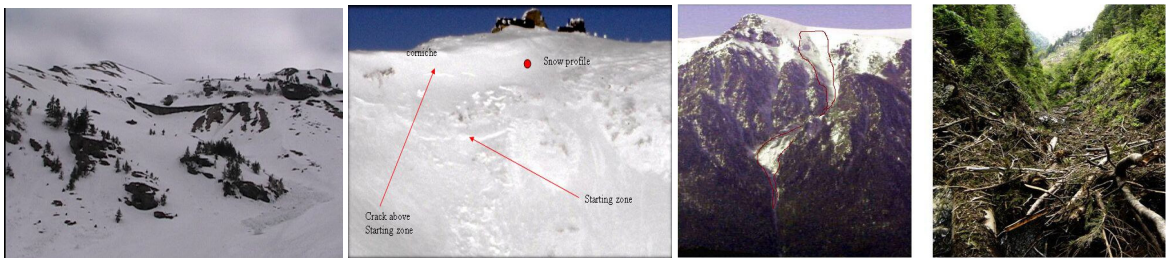

Figure 4: from right to left: deadly slab avalanche-march 09,2005 (Capra Valley, Fagaras Mt); deadly slab avalanche january 29, 2006 (Cerbului Valley, Bucegi Mt); airborne avalanche causing huge forest damaging-march 2006 (Urlatoarea Mica Valley, Bucegi Mt)

Figure 5: from right to left: Melting snow avalanche april 30, 2004 - partially buried shepherds hut, with roof destroyed (Cerbului Valley, Bucegi Mt); atypical avalanches occured in decidous or mixed forest in Bucegi Mountains; slab avalanche triggered by tourists, 11 victims - march 2007 (Fagaras Mt)

4. CONCLUSIONS

The growing need for a regulary snow and avalanche bulletin will have to be materialized in further extension of the existing network for the monitorized area to all the other mountaneous areas (fig.1), as well as in continuous improvement of the operational bulletins and warnings, creating an avalanche data base and

risk map. Another purpose is to integrate the romanian avalanche service to the other european countries, in order to provide a useful tool for all the tourists and skiers coming in the Romanian Carpathians.

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