



## THE EXTRAORDINARY WINTER 2008-2009

*M. Valt and P. Cianfarra*

The present work analyses the last winter season, and particularly its essential snow aspects such as snowfalls, depth of snow on the ground and snow duration, with some historical studies. Some considerations are also made about natural avalanches, the avalanche risk degree and the avalanche accidents occurred during the last season.

In particular, winter 2008-2009 was one of the snowiest since 1930 to date on the whole southern Alpine range, with long periods of perturbed weather and numerous avalanches that caused major troubles to mountain people.

The season was in fact characterized by some ten snowfalls with a very similar synoptic chart and frequent Atlantic troughs from the British Islands or near the Atlantic, with snow falling also in the Po valley. In almost all the stations of the Alpine range the amount of snow exceeded average reference values (1976-2005) and in many cases even reached the values observed in the 1951 season, historically the snowiest one since 1930.

Abundant snowfalls in late November and December determined the accumulation of a deep snowcover that continued to grow during winter in many areas of the Alps. In the central period of winter snow-

falls were of variable intensity, while the lack of major precipitation in April, except for the second ten-year period of the month, and the mild climate of the first half of April and May, accelerated the ablation of snowcover, which was still very deep on the whole Alpine range. Snowcover melting occurred more rapidly than many other snowy winter seasons.

There were a number of avalanches in winter, and mainly in December. Several evacuation plans were carried out, many even in secluded villages for long periods and, in some cases, avalanches buried homes, which had been fortunately previously evacuated.

From December to late April, there were 25 days where numerous large avalanches were observed at least in one of the 225 daily measuring stations (Mod 1 AINEVA) on the southern side of the Alps, Alto Adige excluded, and the hazard degree 5 – very high, was reached several times. Last but not least, in the period of snowfalls avalanche accidents on roads outnumbered avalanche accidents taking place during leisure activities, which instead reached their peak in periods of stable good weather like February and March.

## SNOW ON THE PO VALLEY

*M. Pifferetti*

The 2008-2009 winter season was particularly snowy both on the Alpine range

(Valt and Cianfarra, 2009) and the Apennines (Pecci, 2009).

Snow fell on the Po valley at least ten times, determining in some cases major troubles to urban and extra-urban traffic. The largest snow accumulations were measured in the north-west section of the Po valley, in Piedmont. Particularly abundant was the Epiphany snowfall in Milan with about 40 cm of fresh snow, the fifth value in the last 70 years after that recorded in February 1947 (82 cm), January 1985 (75 cm), January 1954 (63 cm) and January 2006 (40 cm). The present work provides a short outline of the snowfalls that affected the Po valley in winter 2008 - 2009.

## SNOW AND SAND ON CENTRAL APENNINES

*M. Pecci*

The 2008-2009 winter season will be remembered as a "normal" season for the Apennines, after many winters characterized by anomalous amounts and distributions of precipitations on the Tyrrhenian and Adriatic sides, given that normal temperature values, even slightly higher than seasonal averages, alternated with numerous and abundant precipitations on both sides and at all latitudes, with a well-balanced subdivision of the central-Mediterranean sector between sirocco currents from southern quadrants and cold currents from north and east.

The ski season could have ended in the best possible way, with "Easter on skis", had not it been for the earthquake that hit the Aquila area the night of 6 April 2009, devastating the most renowned and lively towns and ski resorts in the area.

## INTENSE RAINFALLS AND SNOWFALLS BETWEEN 14-17 DECEMBER IN PIEDMONT

### Meteo-climatic and snow analysis of the event

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After a week of bad weather with heavy snowfalls, starting from the night of Saturday 13 December to the night of Wednesday 17, Piedmont was affected by intense and widespread precipitations that caused critical conditions linked to both the heavy snowfalls on the Alpine valleys and the hydrogeological instability phenomena on plains.

During the event, exceptional snowfalls brought at 2,000 m of height 80-100 cm of new snow on Lepontine Alps, 160-180 cm on Pennine Alps, 180-200 cm on Graian Alps, 120-140 cm on northern Cottian, Ligurian and Maritime Alps, 140-160 cm on southern Cottian Alps. Duration and intensity of precipitations for three days determined a very high avalanche risk on all the alpine sectors, corresponding to scale 5 – very high, the highest value of the European scale.

During snowfalls and in the subsequent days numerous natural loose and slab avalanches, frequently of large size, interrupted the main and secondary roads in the valley bottom, particularly in the alpine valleys between Pennine and Maritime Alps. In some cases avalanches also affected some resorts: Macugnaga in Valle Anzasca Ceresola Reale in Valle Orco, Pragelato in Val Chisone, Prali in Val Germanasca, Pontechianale in Val Varaita and Bellino. Avalanches caused damage to infrastructures, but fortunately with no casualties.

## LOAD OF SNOW ON BUILDINGS

### Eastern Alps - Winter 2008-2009

*M. Valt*

The 2008-2009 winter season was one of the snowiest since 1930 to date. Heavy precipitations were recorded already in December with a resulting deep snowcover

ver that was further increased by snowfalls in the subsequent months. Starting from January, the high snow thickness resulted in several collapses of building roofs, which became more frequent following February snowfalls. Making the most of the data taken from snow profiles carried out for local Avalanche Services and during two measuring campaigns focusing on the valley bottom, the present work has determined for several stations the load values attained and also the theoretical ones, emphasizing critical conditions according to geographical area. For these areas, a previous work (Valt e Moro, 2009), had already determined the average snow density values based on altimetric range, snow depth and month, highlighting the climate differences between the prealpine range of Eastern Alps, southern Dolomites, Carnic and Julian Alps compared with northern Dolomites. Data gathered from the 2008- 2009 winter season can instead be used as a benchmark of a critical situation that may occur in the medium period, given that winter was very snowy.

In fact, the load curve obtained for eastern Alps, with the load values reached in winter 2008 – 2009, turned out to be lower than that established by current Italian standards.

All that confirms that as a general rule the loads established by Italian laws are in any case precautionary. However, as Italian laws also remind, in alpine environments it is advisable to take into account local situations, as confirmed by the critical conditions recorded in some valleys of the Dolomites, and general conditions alike, which on the other hand applies to all the infrastructures that are built beyond 1,500 m of height.

### 2008-2009 WINTER SEASON: characteristics, avalanches and seismic monitoring

*M. Valt and D. Pesaresi*

The 2008 – 2009 winter season was snowy on the whole southern Alpine range in the Dolomites, with long periods of bad weather, heavy snowfalls and frequent avalanche activity.

In the Dolomites, a wide-band high-dynamics and high-sensitivity seismograph station has been installed by Istituto Minerario U. Follador of Agordo.

After outlining the essential characteristics of the last winter season, the present work illustrates the seismic waves generated by avalanches and recorded by the Agordo seismograph and the seismic network managed by OGS in north-east Italy. Search and detection of such signals, based initially on known avalanches, may help find out analysis methods that reconstruct the whole avalanche activity taking place in the area near seismographs.

The seismic traces recorded by the Agordo station, with characteristics typical of avalanche dynamics, allowed experts to reconstruct the periods of avalanche activity, thus effectively supporting verification of the several avalanche bulletins issued in the neighbouring areas. Research carried out with this work suggests the installation of a denser seismic network that is dedicated, even in temporary mode, to avalanche detection.

### DAISY BELL An innovative helicopter-transported explosive gas system for avalanche triggering

*P. Berthet Rambaud, L. Noel, B. Farizy, J. M. Neuville, S. Constant, P. Roux and E. Bassetti*

Controlled avalanche release, as shown by last winter, requires a wide variety of means and techniques in order to be carried out in short times and be effective. Strict regulations and difficulties in using traditional triggering devices (explosives) led to the introduction of different technical solutions based on the explosion of gas mixtures placed within special containers (Gazex; Heli-avahlex and Avalanche Blast).

In the last two years a new helicopter-transported device based on this principle was successfully tested: DaisyBell. The article illustrates its technical features and performances, also providing a first evaluation.



# Soluzioni per la sicurezza in montagna

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