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ABSTRACTS OF PAPERS PRESENTED AT THE SYMPOSIUM BUT NOT PUBLISHED IN FULL IN THIS VOLUME

PRELIMINARY RESEARCH ON PHYSICAL AND MECHANICAL PROPERTIES AND AVALANCHE OF SEASONAL SNOW COVER AT THE AVALANCHE STATION IN T'IEN-SHAN, CHINA

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ABSTRACT. The mountains of western and central T'ien-shan have extensive snow cover and consequent avalanches, however conditions in this area of central Asia are different from those in many other regions with avalanches. Snow cover is not very thick but it experiences very large temperature gradients which dominate its metamorphism, thus depth hoar forms extensively and becomes the principal snow type, so the density therefore remains low as does mechanical hardness. Avalanching activity and total volume vary enormously from year to year; 1968–69, with 211 avalanches of 147 000 m^3, accounts for 53% of the avalanches and 75% of the volume of all the avalanches in the seven years 1967–74 in the area of the Gunes avalanche station. Although they can occur from November to April, the main months are January and March with a minimum in February. A snow depth of 50–60 cm is needed for avalanching. Below −10°C dry-snow avalanches occur, while above about −5°C wet-snow avalanches happen. These are often caused by melt water penetrating rapidly through the extensive depth hoar and initiating full-depth avalanches.

RECENT PROGRESS AND NEW APPLICATIONS OF THE DYNAMICS OF AVALANCHES

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ABSTRACT. This paper reports the present stage in our research programme. We have used two very different models: (i) A numerical model treating the avalanche as a Newtonian liquid with a free surface; this model describes qualitatively the velocity fluctuations both of avalanche particles and of the front and gives some quantitative predictions, but much experimentation is needed to determine the large number of parameters involved. (ii) An analogue model in which powder avalanches have been simulated in an underground tunnel, taking account of the densimetric Froude number; this model reproduces the pressure rise which precedes the visible front, and also the pressure wave as the front passes which causes so much damage to engineering works—and human beings. These models have been applied to two cases—a bridge and a snow shed.

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The interplay between models and experimentation is discussed and the need for improved data on the mass output of an avalanche, of its detailed velocity history, and of the force on large objects is emphasized. Methods being used to try to supply this information are discussed; gamma-ray measurements for specific mass, high-speed stereophotogrammetry for velocity, and various pressure sensors for the force. The possibility of releasing real powder avalanches to enable such measurements to be made more reliably is being investigated.

FINITE-ELEMENT ANALYSIS OF SNOW ON SLOPES

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ABSTRACT. This study describes the application of an incremental rheological law for snow in a finite-element model. The computation simulates the variation of strains and stresses in a layer of snow covering an inclined plane of variable slope. At the same time, a physical simulation was carried out in a cold room to verify the results obtained with the model. This work illustrates the value of a finite-element model for snow, but also the complications attendant on its use. Indeed, the integration of the law may lead to oscillations due to the rate of variation of the stresses, and this means that the time increment must be modulated during the computation.

RADAR FOR AVALANCHES—MEASUREMENT AND WARNING

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ABSTRACT. Automatic measuring devices can greatly facilitate the difficult task of persons responsible for avalanche warnings or the closing of roads or ski runs. In favourable cases the traffic can be directly stopped by means of radar when an avalanche is released. The development of the necessary bases and technical realization are important tasks of research. Above all the snow height or the mass of snow (from a snow gauge) or the onset of movement of an avalanche need to be measured automatically. For research it is also interesting to determine the speed of the avalanche and its distribution in given coordinates—along and across the avalanche track. With automatic snow gauges two operating methods have proved successful: (1) ultrasonic sounding from a point above the snow; (2) absorption of cosmic radiation; apparatus for detecting this can also be built into the soil of a slope in the avalanche release zone. The moment of avalanche release can be identified by means of radar in the X-band with moving-target indicator and micro-computer evaluation.