ABSTRACTS OF PAPERS ACCEPTED FOR THE SYMPOSIUM BUT NOT PRESENTED

AN AUTOMATIC SNOW-DEPTH METER USING INFRARED BEAM REFLECTION FROM A SNOW SURFACE FOR THE MEASUREMENT OF THE SNOW DEPTH ON THE ROAD

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ABSTRACT. In order to measure the snow depth on a road, a new type of snow-depth meter based on trigonometry with an infrared beam source, beam reflection points on the snow surface and a detector of the reflected beam, was developed using a gallium-arsenide infrared-emission diode and a silicon infrared-detection dual diode. The prototype of this meter operated successfully from 1 February to 31 March 1975 at Nagaoka, Japan.

In the prototype, an infrared beam source, with 10 mW output power, and a detector were fixed 4 m above the ground facing each other at a distance of 5 m. These two photo-electric elements were set in small light-weight cases. Each has a small window (4 cm × 10 cm) to emit or receive the infrared beam. To avoid catching snow or rain in the windows, air was ejected through them. The visual field of the detector was 4.8° and the dip angle of its centre line was fixed at 45°. On the other hand the beam source emitted with 1.4° divergence and varied its dip angle from 90° to 20° with a period of 4 min in the vertical plane which contains the centre line of the visual field of the detector. This beam was reflected by the snow surface and received by the detector in its visual field. When the detection system of the meter detected the beam centre, the dip angle of the scanning beam was measured by a potentio-meter connected mechanically to the infrared source scanner. Output voltages of the potentio-meter indicated the measurement of snow depth within an accuracy of ±5 mm for the flat plate or snow surface from 0 to 1.5 m above the ground.

In addition, a phase-sensitive detection circuit with equivalent band-width of 0.4 Hz and driven by a synchronous signal of 1 kHz from the modulation circuit of the beam source was adopted in order to eliminate noise such as occurs due to sunshine, heavy snow-storms or traffic. As a result very reliable movements were obtained under conditions of heavy snow-storms with horizontal visibility less than 30 m at eye level in daytime.

CALCULATION AND PREDICTION OF THE TOTAL GLACIAL MELTING IN WATERSHEDS OF CENTRAL ASIA

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ABSTRACT. A computer method for calculating the total melting from May to October has been developed both for a single glacier and for a glacial area. In the second case (which is the more interesting and important for hydrology and glaciology) it is necessary to calculate some characteristics of an "average" glacier of the region using morphometric characteristics included in the Catalogue of the U.S.S.R. glaciers. These are: glacier area; average area of

moraine on the glacier; weighted average of heights of upper and lower ends of a glacier and weighted average of mean height of firn line. It is also necessary to obtain data on glacier area distribution by height, precipitation data, and data on air temperature and cloudiness at meteorological stations.

In addition to defining typical glacial regions within the limits of the glacial area considered and determination of the "average" glacier characteristics listed above, preparation of the computer programme includes (a) definition of precipitation dependence on orography height and calculation of appropriate parameters, (b) reduction (if necessary) of data obtained from the meteorological station nearest to glacial area to a more prolonged range, (c) calculation of a special balance index of accumulation and melting of seasonal precipitation which makes it possible to define maximum excess of seasonal snow line over the "average" glacier terminus in separate years, and (d) computation of total solar radiation occuring in clear days during May to October.

In the course of computation on computer the following operations are realized: (a) determination of an average value of total radiation arriving during months of May to October period given the real cloudiness conditions, (b) calculation of the height of the snow line on the glacier, (c) calculation of quantity and duration of solid atmospheric precipitation which melts between May and October on the glacier surface, (d) estimation of absorbed solar radiation taking account of the differing albedo of glacial surfaces situated above and below the seasonal snow line, (e) calculation of the total melting of glaciers belonging to the given mountain watershed.

Checking of the calculational method has been performed using data from Lednik Tsentralnyy Tuyuksu and Lednik Ayutor-2 where numerous ablation stakes were installed. Values of measured and calculated melting agree satisfactorily.

SIMULATION OF ICE FLOW USING THE FINITE-ELEMENT METHOD

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Abstract. A plane-strain, incremental, initial-strain finite-element analysis, incorporating creep laws appropriate for the ranges of stresses and temperature involved, is used to simulate typical ice-slope flow problems. The flow of a uniform ice slope, assuming the mass is intact and no basal sliding occurs, shows that differences in steady-state velocities can be by orders of magnitude for various creep laws. A non-uniform ice slope and a uniform slope behind a concrete wall are also considered. Time-independent developments of tensile crack and basal shear are investigated by introducing joint elements with appropriate stiffness properties at ice–rock interfaces and tension zones. Then, the simulation model is modified to account for both time-dependent basal sliding (surging) and tensile crack development. In one case, basal shear failure is considered imminent if the shear strain in a thin basal ice layer, that allows wide variation in sliding velocity, exceeds a critical value. For the other case, the basal ice layer is replaced by joint elements and the progressive shear-stress failure mechanism during flow is demonstrated.