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Canadian Hydrology Symposium: '79

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The Canadian Hydrology Symposium: '79 - "Cold Climate Hydrology" took place in the Four Seasons Hotel, Vancouver, May 10 to 11, 1979. The conference was sponsored by the Associate Committee on Hydrology, (ACH) of the National Research Council of Canada, and concentrated on those aspects of hydrology that are treated differently because of a cold climate or are due entirely to problems caused by a cold climate. The Symposium was organized in sessions on River Ice, Modelling, Processes, Remote Sensing, and Special Topics.

The first session on River Ice, was built around five papers prepared by the ACH working group on Hydraulics of Ice Covered Rivers to form part of a consolidated report on the "Resistance to Flow in Ice Covered rivers". K. S. Davar (University of New Brunswick), Chairman of the working group presented an introductory paper summarizing the state of knowledge and pointing out the connection between the more detailed papers on different types of ice cover. B.D. Pratte (Hydraulics Laboratory, NRC) covered the flow resistance of consolidated smooth and rough ice covers; S. Beltaos (Alberta Research Council), discussed the flow resistance of fragmented ice covers (ice jams); G. Tsang (National Water Research Institute), presented the problems of frazil ice and anchor ice and their resistance effect; and, B. J. Grey and D. K. MacKay (National Hydrological Research Institute), described aufeis (overflow ice) in rivers.

The working group papers reviewed our present understanding of the resistance aspects of ice on rivers and of the various computational methods used in dealing with related problems and together with the leading general paper by R. Gerard (University of Alberta), on ice as related to hydro technical engineering, pointed out that the present state of knowledge leaves much to be desired. It is very difficult to gather accurate data from under ice covers or even on top of them in many cases, particularly with ice jams, and it has been a much neglected area of interest in Canada. This lack of data has meant that the modelling approach so frequently used in other areas in hydrology could not be used here to the same extent although some progress is being made.

It was pointed out that an instrument is under development to measure the concentration of frazil ice by measuring changes in conductivity between two electrodes and assuming that the ice is a non conductor, therefore, the lower the conductivity the higher the ice flow. Such instrumentation is badly needed to provide quantitative data.

Other papers presented some interesting discussion on the influence of channel cross sections on the regime of streams in winter, and on the rather unusual effects of bottom fast ice. For example in the spring it can erode rapidly or suddenly float up to surface and cause extremely erratic stream stage relationships. R. F Carlson (University of Alaska), proposed a theory relating potential stream bed erosion to aufeis and comments suggest that it possibly is true and evidence for it should be sought.

The Modelling section covered a variety of problems varying from the application of simplified models to small arctic basins and the adaption of larger or widely used models, (e.g. the UBC watershed model and the SAR model to specific glacier or arctic conditions) to flood forecasting problems in large water resources developments such as Peace River in British Columbia and the Alcan developments in Quebec. A common thread that ran through all papers was the need for better aerial information and particularly the need for better information on the water content of snow stored in basins of any size. Two papers showed that detailed snow surveys of basins in the arctic indicated roughly twice as much snow stored in the basins as that indicated by spot measurements at a nearby climatological station. It was also pointed out that the frost level in frozen soil should not be automatically assumed to be an impermeable boundary as frozen soil could be quite permeable in some cases

The session on Processes dealt largely with those on and in the snow pack. It started with a paper on estimating the aerial snow water equivalent in the prairie environment. This involved dicussions on the processes leading to the irregular type of snow pack found in the prairies and the problems of estimating the snow water equivalent. Other papers continued the same theme with discussion of how snow melted, how the snow melt was affected by radiation and by the movement of water through the snow pack, not only in areas of very deep snow pack, such as the western mountains, but also in farming areas in Southern Ontario where the peak run-off can be greatly delayed by the movement of flood waters through the snow pack that remains in drainage channels. The role of shallow organic soils, particularly in permafrost regions was discussed The dense ground cover of moss, lichens, plant roots and litter not only forms an insulation but can store up to five cm of water before there is any infiltration. Under these conditions the hydraulic conductivity of the soil is greatly affected by the moisture content in the fall as pores may be completely filled with ice or may be completely empty.

The session on Remote Sensing started with a general review paper by J. Kruus (Atmospheric Environment Service), presenting those hydrological elements peculiar to a cold climate that could be or had been adequately monitored by remote sensing. This included permafrost which can be mapped indirectly by using land forms and ground cover best displayed by colored infra red aerial photographs. Large areas of ice and snow can be monitored as well as the slow movement of glaciers. Lake and river break-up and freeze-up can be

determined and forecasting systems have been applied particularly in the Mackenzie River Basin. Studies of river channels for probable locations for ice jams have been done.

Snow line and snow cover received by far the most attention by other authors and mention was made of techniques being developed to provide quantitative data on snow water content. Snow cover maps are turned out on an operational basis in British Columbia and New Brunswick and on a near operational basis in other areas of Canada as in Ontario and Quebec. Data retransmission was mentioned as well as some of the potential new instruments and techniques which may overcome the two most persistent problems of remote sensing i.e., cloud cover and detection of snow line under coniferous forest cover. These depend on new developments in the visible and near infra red region combined with digital mapping techniques that have been used both with LANDSAT data and with meteorogical satellites. Research is underway into aspects of microwave measurements that have promise to measure snow and snow water equivalent even through cloud cover.

It was pointed out that remote sensing is done from both aircraft and satellite platforms and that its ability to provide information is largely related to the ability to differentiate ground detail. The required detail can be seen in remote sensing from aircraft but similar detail is not yet availabe from satellites. However, images from satellite are rapidly improving and do provide coverage of large areas not available from other sources.

The final session on Special Topics included a number of different subjects not covered elsewhere. The first of these was a very interesting paper on climatic changes by G. A. MacKay (Atmospheric Environment Service), which related the different scales of climatic change from those of short duration to those extending over hundreds or even hundreds of thousands of years to present day interests and their effect on human activities or of human activities on them.

Three papers dealt with chemical aspects related to winter conditions and the problems of sampling water in the winter. One, considered the effect of the release of sewage lagoon effluents under ice cover on stream water quality and on the biota in the stream. Another described the use of winter water quality to determine sources of ground water discharge. The third, used winter water quality data to separate the runoff components in glacier alpine water sheds.

An interesting paper compared the run-off relationships in the water budgets of three experimental lake basins in the continental climatic region of the Precambrian Shield, in the sub-arctic climatic region of Northern Manitoba and in the arctic climatic region near Chesterfield Inlet. These studies have only been under way for a short time but preliminary indications are that the effects on the fish life in lakes are not as different as might be imagined under these widely differing conditions.

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Symposium on Quaternary Climatic Change

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The fourth Quaternary conference was held at York University from May 18 to 20. Speakers from across North America and Great Britain discussed *methods* of reconstructing paleo-climate. Speakers focused on stratigraphic, pedologic, geomorphologic, isotopic, paleonotologic, palynologic and archaeologic evidence, as well as the degree of resolution possible, in reconstructing the magnitude of climatic change.

The morning session of May 18, chaired by B. D. Fahey (Guelph University) and J. C. Ritchie (University of Toronto), started with a discussion by A. Ronai (Hungarian Geological Institute) and H. B. S. Cooke (Dalhousie Univerity, Halifax) of the Pleistocene time column and climatic record shown from deep boreholes in the Great Hungarian Plain. Cooke discussed the fauna, pollen, and paleomagnetic record shown by the cores and gave an inferred paleoclimatic interpretation. J. T. Andrews *et al.* (University of Colorado, Institute of Arctic and Alpine Research, Boulder), discussed the terrestrial and ocean paleoenvironment record derived from morphostratigraphy, lithostratigraphy, faunal assemblages and amino acid epimerization in shells from raised marine sediments, which suggest warm inshore water conditions during the last glaciation. The Holocene climatic record from Western North America, discussed by T. N. V. Karlstrom