BRAIN STORMING SESSION

ON

HYDROLOGICAL PROBLEMS AND PERSPECTIVES

IN

WESTERN HIMALAYAN REGION

MARCH 14, 1997

Present Day Glaciers in North Western Himalaya (Indus Valley) and Some Data on their Mass Balance

BY

Dr M N Kaul
Univ. of Jammu, Jammu

WESTERN HIMALAYAN REGIONAL CENTER
NATIONAL INSTITUTE OF HYDROLOGY
JAMMU CANTT 180 003, INDIA

Present Day Glaciers in North Western Himalaya (Indus Valley) and Some Data on their Mass Balance

Dr M N Kaul
Reader
Department of Geography
University of Jammu
Jammu - 180 001

Rapidly growing population, industrialization and assured irrigation has imposed increased demand upon water resources. In order to meet these demands the existing water supplies must be managed efficiently. Runoff from melting of snow and glaciers, contribute nearly 70% of annual discharge of Western Himalayan rivers. The knowledge of glacial areal extent in different watersheds is helpful to hydrologist as well as to hydroelectric planners for deducing certain hypothesis and projecting total runoff of the basin for efficient management of Himalayan Water resources. However these glaciers are not easily accessible and their monitoring through existing techniques is highly cumbersome. The glaciers in Himalaya differ from their counterpart in Alps, is being highly dirty and rubble covered in ablation zone and more than often is being covered by supra glacial material and melt water usually exhibits well developed ice caves.

There are 4795 glaciers in Himalaya, covering 38473 km^2, extending from Kashmir in West to Sikkim in east. Out of these 550 glaciers are confined in Indus Valley, covering a total area of 1365 sq.km in J&K and Himachal Pradesh. The glaciers are of varying size about 50 meters long to as large as 72 km in Siachan glacier. Three scattered ice fences at Liddar (Kashmir), Buzas (Jammu) and Baspa (H.P) converges in the region, have been taken as sampling areas for the present study. These glaciers have been studied in the field extensively for their geometry and mass balance estimates during past twelve years. On an average Himalayan glacier produces 0.1 cubic kilometer of water. Indian Himalayan glaciers contain 2500 cubic kilometer of water reservoir which is about 130 times Govind Sagar reservoir (Vohra, 1997). As such it is of great economic importance as melting reaches its maximum in season when non perennial rivers dry up. There has been general retreat of glaciers in Himalaya since the beginning of the present century. This is analogous to global retreat of glaciers due to increase in warmth and decrease in snowfall in catchment areas. Due to these there has been net reduction in thickness and length of glaciers which ultimately affected rate of melt water production and geometry of channel.

The paper discusses about the methodology developed for glacial inventory of the Indus basin and for estimation of glacial stored water. In addition attempt has been made to develop a model on Hydro-meteorological basis, accumulation area and on basis of few climatic parameters. Number of energy balance studies have been carried out in part in glaciers (Mayewski, 1979, Portor 1976, Dey, 1992). These studies have provided important information about process which determine melt rate

on different glaciers. However when it comes to estimating the mass balance of glacier, energy balance method have obvious draw back because in general many variables needed for calculations have not been observed and therefore must be estimated.

In Indus valley the present day distribution of glaciers are notably assymetric. A majority of them flow towards north and northwest. The north flowing glaciers are between 3 to 9 km long and their south flowing counterparts are less than 2 km in length. In J&K 286 glaciers are confined in area 563.85 sq.km - Liddar basin 48 glaciers (38.95 sq.km) Sind 57 glaciers (38.95 sq km), Drass 62 glaciers (165 sq. km), Suru basin 96(303.3 sq.km), Chindi basin 23(18.2 sq.km.). In Himachal Pradesh out of 222 glaciers (425.25 sq.km), 89 glaciers are confined in Baspa basin of Sutlej valley. In this basin 23 glaciers exist between 4901-5100m interval and 17 glaciers occur in 4500-4700 intervals. The above mentioned glacial inventory is formulated on the basis of toposheets, Photographs, published accounts and satellite imageries.

The mass balance of glaciers was estimated in field by accumulation and ablation measurements. The annual snow accumulation was measured in the field by sounding and digging pits in stratified basis on the glacier to assess total accumulation of snow in water equivalent for Liddar glaciers (1982-84), Kol glacier (Chenab) (1991-96); and Naradu glacier (1994-96). The ablation measurement for summer period were recorded by fixing stakes in a body of glacier and carefully monitoring their length at different interval.

The specific net balance for Liddar, Kol and Naradu glacier revealed negative balance 2.842 x $10^6 m^3$, $-3.514 \times 10^6 m^3$ and $-0.856 \times 10^3 m^3$ respectively. These estimates are further being corroborated on basis of hydro-precipitation model, in which input parameters were precipitation and discharge rate and energy balance model in terms of Solar radiation, precipitation and number of days of requisite solar radiation, and area accumulation ratio model. The average retreat per year varies from 8.4m to 3.0 metres.

REFERENCES

Portev, S.C. (1970) 'Quaternary glacial record in Swat Kohistan, West Pakistan', Bulletin Geological Society of America, Vol. 81, pp 1445-46.

Mayewski, P.A. and Jeschike, P.A. (1978) 'Himalayan and Trans Himalayan glacier fluctuations since A.D. 1812, Arctic and Alpine Research vol 11, No. 3 pp 267-287.

Dey, B. and Sharma, V.K. (1989) 'A Test of Snowmelt - Runoff Model for a major River Basin Western Himalaya', Nordic Hydrology, vol. 20, pp 167-178.

Vohra, C.P. (1997) 'Glaciology, Needs, Potential and Programs' President address National Symposium on Himalayan Glaciers and Snow cover, J.N.U., New Delhi.

***