ATHABASCA GLACIER - 1973; 1 : 10'000

(Terrestrial photogrammetric map)

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Since 1945, the Water Survey of Canada and its predecessors have conducted surveys of the toe area of the Athabasca Glacier. In 1959 and 1962 in order to gain knowledge of the ablation area of the glacier, and the runoff characteristics downstream this Branch carried out Aerial Photogrammetric Surveys. In 1963 the Branch switched to surveying the glacier by terrestrial photogrammetry and has continued surveying the glacier at two year intervals since.

Terrestrial photogrammetric survey methods for this glacier offer certain advantages over aerial methods. A small field party can carry out the survey in a few days even under cloud conditions with comparable accuracy to an aerial survey. The photogrammetrist takes part in the survey to ensure high quality interpretation when plotting. From a series of maps one can determine volumetric, areal, directional, linear and surface changes of the glacier.

On arriving at the glacier, for a terrestrial photogrammetric survey, the party firstly carries out a reconnaissance to locate the best possible area to establish photo stations. The simplest case is one photo base on top of a ridge overlooking the glacier so that the closest part of the glacier to be mapped is at least four times the base length away, while the most distant part is not more than 20 times the base length away. In equation form this can be expressed as $\frac{D\ max}{20} < b < \frac{D\ min}{4}$ where b is the base length and D is the distance from the base being mapped.

The location of the cairns are important. In practice each stereo overlap requires four to six well chosen control points. These should be located; one near the centre (top) of the stereo overlap; one midway at either side of the area near the outer limit of the stereo overlap and one or two points near the bottom of the overlap. These points including the photo base can be tied-in by triangulation using a one-second reading theodolite.

The orientation of the glacier map can be arbitrary or preferably tied-into the National Topographic System.

In the reduction of data the position of the X,Y,Z coordinates should be computed to an order of accuracy commensurate with the order of accuracy of the field work.

The plotting is carried out on a high precision plotter. It is mandatory in the planning stage of a terrestrial photogrammetric survey that it is determined that the photographic plates can be plotted on the plotting instrument available. As an example, only the Wild A-5 and A-7 plotters will accept inclined or tilted photography obtained with the Wild P-30 phototheodolite, while only the Zeiss Terrograph can be used to plot photography taken with the Zeiss terrestrial camera.

Since the time of the first photogrammetric survey to the 1971 survey, the toe of the Athabasca Glacier has retreated at the rate of 12 m/a and the average decrease in volume of the ablation zone has been 2.5 x $10^6 m^3/a$. The toe of the glacier has retreated at a long-term average rate of 13 m/a from 1870-1971 while the average decrease in volume over the same period has been 3.2 x $10^6 m^3/a$.

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