

REVIEWS

M. G. MARCUS. *Climate-glacier studies in the Juneau Ice Field region, Alaska*. Chicago, Department of Geography, University of Chicago, 1964. ix, 128 p., illus. (University of Chicago. Department of Geography. Research Paper No. 88.)

THE Lemon Creek Glacier is a small, alpine glacier located in the coastal mountains of south-east Alaska immediately north-east of the city of Juneau. It is at the south-west edge of the glacier complex known as the Juneau Ice Field. Altitude of the present Lemon Creek Glacier firn limit is around 1,100 m. and the area of active ice is 9.21 km.². This glacier, 10 airline kilometers from the tidewater of Gastineau Channel, was the site of a study program from 1953 through 1958, first as a part of the American Geographical Society's Juneau Ice Field Research Project, and then as an official station during the International Geophysical Year.

Dr. Marcus has compiled in detail the available data on mass budget and climatological observations for the Lemon Creek Glacier and examined these in relation to lowland climate records and existing knowledge of climate and glacier behavior on the Juneau Ice Field. He concludes that the sum of ablation season degree-days above 0°C., and the accumulation season precipitation, are the two climatological factors which exert dominant control over the glacier mass budgets in this area. He also joins the growing list of glaciologists who recognize the critical character of spring and fall weather to glacier regimes in maritime climates.

A succinct presentation of the data, and conclusions drawn with adequate cognizance of relevant existing literature, would have been a welcome addition to the growing fund of knowledge about glaciers and their relation to climate. The present report falls short of this goal, for the unquestioned value of the material is obscured in the text by awkward mathematical formulations, loose reasoning and the intrusion of non-communicative discourse.

Two examples will illustrate deficiencies. The author points out, in a rather involved fashion, that the Lemon Creek Glacier mass budget can be determined if the snow line position is known. In general, a glacier's annual mass budget can be determined if the snow line position *and* the activity index (Meier), or the energy of glaciation (Shumskiy), are known. Dr. Marcus has attempted a general formulation of the snow line-mass budget relation without taking note of the latter factor, although it is implicit in his actual manipulation of the Lemon Creek Glacier data. Another type of difficulty is introduced when the annual mass budgets are plotted as a function of snow line altitude and two of the points are connected by a line on which extrapolations are based, after the author explicitly states that the sample is too small for a curve to be fitted.

More importantly, a fundamental question about the analysis of glacier-climate relations is raised by this report. Dr. Marcus seeks to relate climate and mass budget variations by comparing measured glacier budgets with lowland weather station records extrapolated in time and space. Some of these extrapolations are weak and are so recognized by the author. He also recognizes that many of the data are inadequate for sound statistical analyses, but unhappily he then proceeds to draw conclusions from analyses of scatter diagrams. The important question, however, is not how good the data are, nor how statistically correct the treatment is (the author has clearly noted certain limitations), but whether conclusions of this type can justifiably be drawn at all. Physical cause-and-effect is no more proved by sound statistical analysis than it is suggested imprecisely by scatter diagrams "as a device to recognize visually those situations wherein certain climate-budget interactions can be identified". The basic limitation of statistics applies in either case: they describe relations between groups of numbers which are not necessarily constrained by physical reality. Recognition that the data are inadequate does not remove this limitation.

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