

SUBARCTIC SNOWMELT RUNOFF GENERATION

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ABSTRACT

Many of the floods of record in cold regions are produced by snow ablation. Accurate prediction of flood magnitudes, using computer models, hinges on an understanding of the hydrologic role of frozen soils. One objective of this study was to examine how the moisture content in the soil profile changes over the winter season and how this redistribution of moisture influences the infiltration of snowmelt in the spring. In general, soil moisture migrated towards the freezing front from the warmer soils. This has the net effect of increasing the moisture content near the surface of the mineral soil. With high ice contents, the infiltration rate is reduced and greater runoff produced. For the area studied, two extreme soil conditions exist. Ice-rich soils are found in conjunction with permafrost, while relatively well-drained soils exist in nonpermafrost areas. Our field studies indicated that little runoff was generated from nonpermafrost areas although extensive seasonal frost existed. The measured runoff was therefore generated from permafrost areas of the watershed.

INTRODUCTION

Engineering methods for estimating the probability of a flood occurring at a given magnitude or for generating continuous runoff hydrographs by computer models have been evolving for several decades. However, only recently has an effort been made to modify these techniques to include runoff from snowpacks. While the maximum flood of record may be caused by rainfall, a majority of the peak flows in cold regions are a result of snow ablation. One cannot predict runoff magnitude based on the quantity of the snowpack alone; one must also examine the soil and climatological conditions that exist during the melt period. This study evolved out of a need to relate the quantity of runoff to the soil conditions.

PHYSICAL SYSTEM

In order to quantify watershed response to snowmelt within the taiga of interior Alaska, snowmelt runoff studies have been conducted in 1979 and 1980 at or near Glenn Creek watershed near Fox, Alaska.

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