Annals of Glaciology 9 1987

THE TIMING OF INITIAL SPRING MELT IN THE ARCTIC FROM NIMBUS-7 SMMR DATA

(Abstract)

by

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ABSTRACT

The ablation of sea ice is an important feature in the global climate system. During the melt season in the Arctic, rapid changes occur in sea-ice surface conditions and areal extent of ice. These changes alter the albedo and vary the energy budgets. Understanding the spatial and temporal variations of melt is critical in the polar regions. This study investigates the spring onset of melt in the seasonal sea-ice zone of the Arctic Basin through the use of a melt signature derived by Anderson and others from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) data. The signature is recognized in the "gradient ratio" of the 18 and 37 GHz vertical brightness temperatures used to distinguish multi-year ice. A spuriously high fraction of multi-year ice appears rapidly during the initial melt of sea ice, when the snow-pack on the ice surface has started to melt. The brightness-temperature changes are a result of either enlarged snow crystals or incipient puddles forming at the snow/ice interface.

The timing of these melt events varies geographically and with time. Within the Arctic Basin, the melt signatures are observed first in the Chukchi and Kara/Barents Seas. As the melt progresses, the location of the melt signature moves westward from the Chukchi Sea and eastward from the Kara/Barents Seas to the Laptev Sea region. The timing of the melt signal also varies with year. For example, the melt signature occurred first in the Chukchi Sea in 1979, while in 1980 the signature was first observed in the Kara Sea.

There are also differences in the timing of melt for specific geographic locations between years. The melt signature varied almost 25 days in the Chukchi Sea region between 1979 and 1980. The other areas had changes in the 7–10 day range.

The occurrence of these melt signatures can be used as an indicator of climate variability in the seasonal sea-ice zones of the Arctic. The timing of the microwave melt signature has also been examined in relation to melt observed on short-wave imagery. The melt events derived from the SMMR data are also related to the large-scale climate conditions.

MICROWAVE SNOW-WATER EQUIVALENT MAPPING OF THE UPPER COLORADO RIVER BASIN, U.S.A.

(Abstract)

by

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ABSTRACT

During spring 1984, a joint agency research effort was made to explore the use of satellite passive microwave techniques to measure snow–water equivalents in the upper Colorado River basin. This study involved the near real-time acquisition of microwave radiances from the Scanning Multichannel Microwave Radiometer (SMMR) aboard the Nimbus-7 satellite, coupled with quasi-simultaneous surface measurements of snow-pack depth and profiles of temperature, density, and crystal size within the basin. A key idea in this study was to compare, for the same space and time-scales, the SMMR synoptic physics data taken in the basin. Such a snow-measurement program was logistically difficult, but two field teams took detailed snow-pit measurements at 18 sites in Colorado, Utah, and Wyoming during the last 2 weeks of March, when the snow-pack is normally at its maximum extent and depth. These observations were coupled with snow–water-equivalent measurements from Soil Conservation Service SNOTEL sites. Microwave-gradient ratio, Gr (Gr is the difference of the vertically polarized radiances at 8 mm and 17 mm divided

https://doi.org/10.3189/S0260305500000811 Published online by Cambridge University Press