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Remote Sensing, Model-Derived and Ground Measurements of Snow Water Equivalent and Snow Density in Alaska

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ABSTRACT

Snow water equivalent (SWE) is important for investigations of annual to decadal-scale changes in Arctic environment and energy-water cycles. Passive microwave satellite-based retrieval algorithm estimates of SWE now span more than three decades. SWE retrievals by the Advanced Microwave Scanning Radiometer for the Earth Observation System (AMSR-E) onboard the NASA-Aqua satellite ended at October 2011. A critical parameter in the AMSR-E retrieval algorithm is snow density assumed from surveys in Canada and Russia from 1940s-1990s. We compare ground SWE measurements in Alaska to those of AMSR-E, European Space Agency GlobSnow, and GIPL model. AMSR-E SWE underperforms (is less than on average) ground SWE measurements in Alaska through 2011. Snow density measurements along the Alaska permafrost transect in April 2009 and 2010 show a significant latitude-gradient in snow density increasing to the Arctic coast at Prudhoe Bay. Large differences are apparent in comparisons of our measured mean snow densities on a same snow cover class basis March-April 2009-2011 Alaska to those measured in Alaska winter 1989-1992 and Canadian March-April 1961-1990. Snow density like other properties of snow is an indicator of climate and a non-stationary variable of SWE.

KEYWORDS

AMSR-E; GlobSnow; GIPL Model; Ground Measurements; Snow Water Equivalent; Snow Density; Alaska

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