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In-Situ, Model and Satellite-Derived Snow Water Equivalent Comparisons in Alaskan Permafrost Biosequestration Regions

R.R. Muskett

University of Alaska Fairbanks, Geophysical Institute, Fairbanks, Alaska, United States (reginald.muskett@gmail.com, 907 474-2691)

Permafrost stability and biosequestration are affected by changes of snow cover and changes of land-surface temperature. Satellite retrieval algorithms for estimates of snow water equivalent (SWE) have been performed since the NOAA NIMBUS-7 Scanning Multi-channel Microwave Radiometer beginning in October 1978. A key parameter of Advanced Microwave Scanning Radiometer for the Earth Observation System (AMSR-E) retrieval algorithm is snow density from surveys in Canada during 1946-1995 and Eurasia during 1966-1996. We compare in-situ measures of SWE model-derived and satellite-derived SWE in Alaska. On-average, AMSR-E underperforms (is less than) in-situ measured SWE. Snow density measurement along the Alaska permafrost transect in April 2009 and 2010 show a significant gradient, less dense snow in central Alaska to more dense snow near the Arctic coast of Prudhoe Bay. Air and land-surface temperatures show increases in the Arctic that are greater than the global average increase. We hypothesize that a factor in the AMSR-E SWE underperformance is caused by assumption of snow densities from the 1950s to 1990s that are no longer representative of Arctic snow packs due to effects from Arctic climate change, when other factors are negligible.

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