

NOAA POLARIMETRIC SCANNING RADIOMETER MEASUREMENTS OF SNOW COVER PROPERTIES IN THE COLORADO ROCKY MOUNTAINS

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The 2002, 2003A, and 2003B field campaigns of the Cold Land Processes Experiment (CLPX) were multi-institutional studies designed to both provide improved understanding of cryospheric processes and to support the design of an advanced cryospheric observation system. These campaigns involved one of the most intensive snow sampling efforts undertaken, and used as the primary airborne sensor the NOAA Environmental Technology Laboratory's Polarimetric Scanning Radiometer (PSR). The PSR was operated over three sites within the Colorado Rocky Mountains in February 2002 on board the NASA DC-8 aircraft and again in February and March 2003 on board the NASA/WFF P-3B to obtain the first high-resolution (150-500 m) airborne multiband microwave imagery of snowpack. The PSR is the first operational airborne conical imaging radiometer system and provides a unique means of simulating what a future NASA cryospheric satellite could observe. Such spaceborne snowpack data will ultimately improve techniques for monitoring and prediction of hydrological runoff and storage, avalanche danger, and regional weather and climate trends. The PSR also provides snow emissivity data for NOAA and NPOESS retrieval algorithm development

In this paper we present the PSR multiband microwave polarimetric snow images over the three CLPX mesocell study areas (MSAs) in the AMSR-E bands for 21 flights spanning two seasons. Conditions included drought, normal snowpack, and spring snowmelt. The brightness temperatures are related to the physical snowpack quantities, particularly snow water equivalent (SWE). Comparisons of the PSR/A-derived SWE estimates compare favorably with in situ measurements, Gamma SWE observations, and AMSR-E retrievals after correction for grain size. A conclusion is that snow grain size is of great importance in retrieval algorithms based on 18 and 37 GHz data. We also use the PSR CLPX data set to study relationships between land cover type and snow brightness spectra to establish the principal modes of brightness variation caused by snowfall. Emissivity depressions of up to 70-75 percent were observed for fresh snowfall at 89 GHz horizontal polarization, but are highly sensitive to snowmelt state. New algorithms tailored to use information from a broad suite of microwave channels are discussed.

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