Assessing the Impact of Measurement Spatial Resolution on Passive Microwave Observations of Snow from the Cold Land Processes Experiment

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The NASA Cold Land Processes Experiment (CLPX) conducted in 2002 and 2003 provides a unique opportunity for hydrologic scientists to investigate snow hydrology processes from a multitude of ground, aircraft and satellite-based measurements. Aircraft passive microwave observations at 10, 18, 21, 37 and 89 GHz frequencies from NOAA's Polarimetric Scanning Radiometer (PSR) enable studies to be conducted that investigate the microwave responses from snow fields at different spatial scales.

In this paper, a study is described that uses CLPX PSR measurements at 10, 18 and 37 GHz to characterize the spatial variability of the passive microwave response of snow within three Mesocell Study Area (MSA) at medium to coarse spatial resolution scale lengths. PSR observations are spatially averaged to simulate instantaneous field of view observations ranging from 500 m to 25 km in size. Geostatistical analysis is applied to characterize the passive microwave response of snow in the three MSAs at each spatial scale. Ground-based snow field survey measurements made by CLPX scientists, and ancillary geospatial data sets of the MSAs (such as digital elevation models and vegetation cover) are combined in a simple model to represent snow depths and snow water equivalent fields. A geostatistical characterization of the survey-based fields is conducted and compared with the geostatistics of the multi-scale passive microwave scale observations. The effect of observing snow fields at different spatial resolutions, especially with respect to the impact on representativity of snow field variability, is discussed.