Spatial Scaling Behavior of Brightness Temperatures during CLPX and Appropriate Satellite Sensor Resolution

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Accurate estimates of snow water equivalent and other properties play an important role in weather and hydrological forecasting and climate modeling over a range of scales in space and time. Such estimates also have important uses in natural hazard forecasting (e.g., melt-related floods) and water resource applications such as agriculture and hydropower, and there is a strong heritage for the retrieval of snow parameters using passive microwave remote sensing techniques.

Improving the spatial resolution of new passive microwave satellite sensors is a major desire in order to (literally) resolve subpixel heterogeneity effects on the accuracy of retrievals, but limited spacecraft and mission resources impose severe constraints and tradeoffs. In order to maximize science return while mitigating risk for a sensor concept, it is essential to understand the scaling behavior of snow in terms of what the sensor sees (brightness temperature) as well as in terms of retrieved quantities (snow water equivalent, SWE). NASA's Cold Land Processes Experiment-1 (CLPX-1: Colorado, 2002 & 2003) was designed to provide data to measure these scaling behaviors for varying snow conditions in areas with forested, alpine, and meadow/pasture land cover.

We will use observations from CLPX-1 ground, airborne, and satellite passive microwave sensors to examine and evaluate the scaling behavior of brightness temperatures and retrieved SWE across scales from meters to 10's of kilometers.

The conclusions will provide direct examples of the appropriate spatial sampling scales of new sensors for snow remote sensing. The analyses will also illustrate the roles and spatial scales of the underlying phenomena (e.g., land cover) that control subpixel heterogeneity.