

## **Assessing the Variation in Snow Surface Roughness**

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**Abstract.** The snowpack surface roughness can vary spatially, temporally and directionally. These changes have implications on aerodynamic roughness, and subsequently predictions of snowpack sublimation and redistribution, especially since values of  $z_0$  are often assumed to be constant due to the difficulty in measuring aerodynamic roughness variations at or near the snow surface.

Snow surface roughness sampling was undertaken using digital photography of black snow boards inserted into the snowpack. The sampling occurred during the winter of 2006 in an open meadow on the Colorado State Forest near Cameron Pass, in northern Colorado. The image analysis procedure is summarized. The spatial, temporal, and directional variability in snow surface roughness is presented in terms of systematic differences in spatial structure using fractal analysis, a roughness index, and by comparison to meteorological data. The fractal analysis demonstrates the fractal dimension of different roughness surfaces (in space, time and direction), as well as the associated correlation length, or scale break. Similarly, the roughness index presents a standardized method of comparison. Data from the nearby Natural Resources Conservation Service Joe Wright SNOTEL site illustrate the relationship between surface roughness and meteorology.