Scalability and Measurement Density for Montane Snow Depth and Elevation Data at Several Colorado Sites

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Abstract. Until recently, large extent elevation data, and other topographic variables derived therefrom, were only available at 1000 m (e.g., GTOPO30, USGS HYDRO1k) and then for specific regions at a 100-m resolution. Satellite and other data currently allow us to acquire and use 30-m elevation data for many parts of the world. These data are being supplemented for smaller regions at a much finer resolution (~1 m) by through directed data collected, such as IKONOS and airborne Light Detection And Ranging (LiDAR).

Comparison of the multiple scale data by examining variance, fractal dimension and scale breaks generated from variogram analysis in log-log space allows us to investigate the ability to extrapolate from finer to coarser scale data. In this paper, we use LiDAR elevation and combined vegetation-elevation data, collected as part of the NASA Cold Lands Process Experiment, at several Northern Colorado montane sites to compare to the USGS National Elevation Dataset (NED) 1 Arc Second (~30m resolution) elevation data. The LiDAR data extend over 1.1-km blocks, and 11-km blocks of NED data with the same center have been extracted. The LiDAR data have been subsetted at 5, 10, and 30-m resolutions to examine measurement density and data representivity. Subsetting has used the mean, median, mode and a random point taken from a uniform distribution to define the probability distributions for the data. The same data degradation has been performed for LiDAR snow depth data. No snow data were available for the larger extents covered by the TM elevation data.