Avalanche Frequency and Magnitude: Using Power-Law Exponents to Investigate Snow Avalanche Size Proportions Through Time and Space

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Power-laws provide a means for investigating snow avalanche frequency-magnitude relationships and their contributing factors. This research uses power laws to explore variations in avalanche size proportions through space and time, as well as investigating factors which may contribute to these variations. Data utilized for this work includes the Westwide Avalanche Network data from the western United States for regional analyses, with path-specific analyses focused on data from Utah's Little Cottonwood Canyon. Results show power-law exponents vary through space both at the regional level and between individual avalanche paths. Avalanche size proportions, with respect to space, are the product of terrain based variables at both the mountain range and the path levels, with alpha angles significantly correlated to the proportion of small to large avalanches. This research also indicates that variation in exponents through time is indicative of changes in seasonal weather and snowpack characteristics, with mean snow height also significantly correlated to the proportion of small to large avalanches. Knowledge of power-law exponents for particular avalanche paths, and their relationship to seasonal snowpack depth, may be helpful for managing avalanches along highway corridors, in ski areas, or in backcountry forecasting operations.