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Avalanche extremes and atmospheric circulation patterns

K.W. Birkeland
U.S. Forest Service National Avalanche Center, P.O. Box 130, Bozeman, Montana 59771, U.S.A., and Department of Earth Sciences, Montana State University, Bozeman, Montana 59717, U.S.A.

C.J. Mock
Department of Geography, University of S. Carolina, Columbia, South Carolina 29208, U.S.A.

J.J. Shinker
Department of Geography, University of Oregon, Eugene, Oregon 97403, U.S.A.

ABSTRACT. Avalanche forecasters can better anticipate avalanche extremes if they understand the relationships between those extremes and atmospheric circulation patterns. We investigated the relationship between extreme avalanche days and atmospheric circulation patterns at four sites in the western United States: Bridger Bowl, Montana, Jackson Hole, Wyoming, Alta, Utah, and Taos, New Mexico. For each site, we calculated a daily avalanche hazard index based on the number and size of avalanches, and we defined abnormal avalanche events as the top ten percent of days with recorded avalanche activity. We assessed the influence of different variables on avalanche extremes, and found that high snow water equivalent and high snowfall correspond most closely to days of high avalanche hazard. Composite-anomaly maps of 500-hPa heights during those avalanche extremes clearly illustrate that spatial patterns of anomalous troughing prevail, though the exact position of the troughing varies between sites. These patterns can be explained by the topography of the western United States, and the low elevation pathways for moisture that exist to the west of each of the sites. The methods developed for this research can be applied to other sites with long-term climate and avalanche databases to further our understanding of the spatial distribution of atmospheric patterns associated with extreme avalanche days.