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Testing the influence of snow and meteorological conditions on snow avalanche deposit volumes

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Snow avalanche deposit volume is an important characteristic that determines vulnerability to snow avalanche. However, there is insufficient knowledge about snow and meteorological variables controlling deposit volumes. Our study focuses on the analysis of 1986 deposit volumes from 182 paths located in different regions of the French Alps including Queyras, and Maurienne valleys, between 2003 and 2017. This work uses data from the Permanent Avalanche Survey (EPA) database, an inventory of avalanche events occurring at well-known, delineated and mapped paths in France. We investigated relationships between snow deposit volumes and meteorological quantities, such as precipitation and temperature determined from SAFRAN reanalyses and snow-depth and wet snow-depth estimated from CROCUS reanalyses at a daily time scale at 2100m a.s.l. Analysis was conducted at an annual and seasonal time scale considering winter (November-February) and spring (March-May) between the mean deposit volumes and the mean meteorological and snow conditions.

Results do not show any significant relationship between deposit volumes and meteorological or snow conditions at an annual time scale or for spring season. However, correlations between deposit volumes and meteorological and snow variables are high in winter ($R^2=0.78$). The best model includes two snow variables: mean snow-depth and maximal wet snow-depth. We suggest that these two important snow variables reflect variations in the snow cover characteristics later influencing the nature of the flow and the deposit volumes. Dividing the studied paths sample into several classes according to their morphology (i.e: surface area or mean slope) increases the significance of the relationship for both seasons and highlights more complex relationships with meteorological and snow variables.