

A NEW APPROACH FOR THE SUB ZONATION OF SNOW CLIMATIC ZONES OF WESTERN HIMALAYAN REGION, INDIA

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ABSTRACT: The Western Himalayan region is broadly categorized into three distinct snow climatic zones, namely Lower, Middle and Upper snow climatic zones (Sharma et al 1999). The general characteristic of each of the zones defines the evolution of snow structure and associated avalanche activity. Some areas in these zones were found to have distinctive characteristics, not akin to the zone in which they presently lie. The detailed analysis of such areas and the additional input of a few more stations in Western Himalayan region have revealed the necessity of reclassification of the entire region afresh. Based on this analysis, the Lower and Middle Himalayan zones defined in earlier classification have now been put in three distinct snow climatic zones, which are proposed as Warm, Mild and Cold snow climatic zones. Further, the Cold Snow climatic zone has been categorized into two sub-zones based on the type of the evolution of crystal structure in the snow pack subjected to steep temperature gradient. The proposed sub-zones are Sugar Grain and Depth Hoar Zones.

A new quantitative method of Relative Euclidian Distance (RED) value has been introduced for the delineation of different regions of Himalaya into above mentioned zones. The RED value calculates distance between the stations based on the mean of maximum, minimum and ambient temperature of the stations with respect to a station that records lowest minimum of all the above mentioned parameters. The RED attains a maximum value of 21 for the farthest station with reference to the coldest station under study. This RED value of different stations with respect to the coldest station has been compared with temperature gradient values of each of the stations. The RED value of ≥ 18 in relation with the mean temperature gradient of less than $3^{\circ}\text{C}/\text{m}$ defines a region of Warm Snow Climatic Zone in which most of the deposited seasonal snow layers remain moist or wet during mid winter period and snow pack dominates of rounded and melt freeze grains. The RED value between 13 and 18 with mean temperature gradient between 3 and $10^{\circ}\text{C}/\text{m}$ defines a region of Mild Snow Climatic Zone in which most of the deposited layers remain either dry or moist during mid winter period with occasional appearance of sugar grains. Sugar Grain Zone with RED value between 13 to 7 and the temperature gradient value between 5 and $10^{\circ}\text{C}/\text{m}$ dominates with sugar grains with occasional appearance of a few depth hoar snow layers. The Depth Hoar Zone has RED value of less than 7 and temperature gradient of greater than $10^{\circ}\text{C}/\text{m}$ and dominates with depth hoar grains.

The revised classification has helped avalanche forecasters in delineating areas producing similar type of avalanche activity in each region, thus helping them in accurate prediction of avalanches.

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