**A new methodology for the spatial estimation**

**of snow load extremes**

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**Abstract**

Each building has to withstand a certain mass of snow, usually expressed in terms of snow water equivalent or snow load. The European Committee for Standardization defines zonings and calculation criteria for different European regions to assign snow loads for structural design. In the Alpine region these defaults are quite coarse; countries therefore use their own products, and inconsistencies at national borders are a common problem.

In this paper we present a new methodology to derive a snow load map for Austria. It is based on (i) modeling snow loads with the specially developed Δsnow model at 897 quality controlled snow depth series in Austria and neighboring countries from 1960-2019 and (ii) a generalized additive model for the GEV parameters where covariates and their combinations are represented by penalized regression splines, fitted to series of yearly snow load maxima derived in the first step. The new approach outperforms a standard smooth model and is much more accurate than the currently used Austrian snow load map when compared to the RMSE of the 50-year snow load return values through a cross-validation procedure. No zoning is necessary, and the new map's RMSE of station-wise estimated 50-year return levels gradually rises to 2.2 kNm−2 at an elevation of 2000 m. The bias is 0.18 kNm−2 and positive across all elevations. The new map is proposed as a successor of the current Austrian snow load map and the newly derived method provides a reproducible base for other countries, not only in Europe.