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Snow load climatology for design working lives of the greenhouse structures in Croatia

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The climatic loads should be considered in the structural design and construction of the greenhouses to ensure their overall stability and durability. The snow load (SL), defined as the weight of snow on a surface area per square meter, is particularly important because it can cause structure collapse and consequently significant economic damages. Characteristic snow load for different constructions is usually 50 years, however, greenhouse structures are usually designed for shorter periods. The classification and design of greenhouses are based on the European standard EN 13031-1 which also provides the procedure for snow load adjustments to appropriate return values. In this study, characteristic snow loads are analysed for Croatia. First, the general climatology of maximum snow load is prepared according to snow depth data from 117 stations across the country covering the period from 1968 to 2020. The results revealed four main climate snow regions in Croatia: mainland, mountainous, coastal hinterland, and Adriatic. The trend analysis showed a decreasing trend in maximum snow load data for the highest elevation stations, while a slight increase was detected for central continental and middle Adriatic areas, however, the trend is statistically significant only at two stations in the highlands. For calculating the characteristic snow load, the value associated with a 50-year return period, the Gumbel distribution was used. Non-stationarity of snow load data was tested by the likelihood ratio method which revealed no significant changes in the Gumbel distribution parameters. This led to the conclusion that a stationary model is sufficient to describe data at most stations. Besides the characteristic SL, the return values of maximum SL associated with the return periods of 5, 10, 15 and 50 years were estimated. Moving to the engineering perspective, the adjustment factors for the design of greenhouse structures given in the standard are also discussed.