A bivariate analysis of temperature and rainfall series for snowfall return time estimation

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The lack of snowfall events observations make snow return time estimation a relevant issue. Where snowfalls are infrequent, areas are usually characterized by the absence of snow measurements. Thus the post-event effects, regarding electrical, hydraulic and road infrastructures on these regions, become difficult to be managed.
The issue of snow events return time estimation is faced analysing pairs of rainfall and temperature data.
In this study, first, the statistical dependence of the three variables is analysed, second, the return time of a rainfall sample selected conditioning values to a specific range of temperature is evaluated. Finally, the equivalence of both return times is investigated.
The direct return time estimation of snow events is compared to the indirect return time estimation evaluated using rainfall and temperature bivariate analysis. Case studies where rainfall, snow and temperature observations are available, are selected to test the proposed methodology.
The procedure applied for selecting rainfall sample in respect to a given temperature range allows to easily compute the indirect return time of rainfall and temperature. Moreover results obtained with the two approaches are compared, presenting encouraging perspective in terms of return time value equivalence.