



Climate Change: impact on snow load on structures and consequences on built environment

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Abstract

The effect of climate change could significantly affect, in the mid-term future, climatic actions and then the design of new structures as well as the reliability of existing ones, designed according the provisions of current or past codes. In this work, a suitable procedure to derive snow loads on ground under non-stationary climate conditions is proposed, combining data provided by observational dataset and outputs of climate models. The analyses are performed for the Italian Mediterranean region and the results in terms of updated snow load maps are presented for movable 30 year time windows till 2100 according different greenhouse gas emission scenarios.

Keywords: Climate Change; Snow Loads; Extreme Values; Bayesian Methods; Structural Safety.

1 Introduction

In the mid-term future, the climate change could determine significant alterations of climatic actions, so impacting the design of new structures and the reliability of existing, ones designed in accordance with present or past Codes [1].

Climatic actions on structures are currently based on extreme value analysis applied to past observations of the underlying natural phenomena, under the assumption of stationary climate conditions [2]. In design context, climate is considered as a stationary stochastic process varying in a neighbourhood of an unchanging mean state, so that statistical parameters of climatic actions can be considered nearly constant from year to year [3]; consequently, stationary return level and no changes in the frequency of extremes are usually assumed. Since changing climate makes this assumption questionable, alterations of frequency and intensity of extremes events [4] as well as variations of statistical properties of extremes may be expected over time. Since snow loads is the governing action for

most lightweight structures, the study of the possible existence of trends in the extremes of ground snow load under climate change conditions is very relevant. The aim of the paper is the study of influence of climate change on snow load on ground, combining the information provided by observed data series with projections provided by climatic models, in order to arrive to a more reliable set of snow load maps. This purpose is particularly motivated in view of the evolution of the second generation of the structural Eurocodes, and especially of Eurocode EN 1991 - Part 1-3 - Snow loads, as requested by the Mandate M/515 of European Commission [5] to CEN (Comité Européen de Normalisation) [6].

1.1 Snow loads in a changing climate

The common sense feeling is that the rise of the average temperature should necessarily lead to a general reduction of the ground snow loads. But this belief is not always true; as a matter of fact, as clearly demonstrated by in situ measurements, in some locations, the increase of temperature could even result in a marked increase of snow loads,