



## **Are extremes increasing or have we underestimated them?**

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### **ABSTRACT**

A common view in scientific literature and in public media is that extreme weather events are increasing with global climate change. A justification for this view is that many disastrous extreme weather events appear to occur in the present climate more frequently than expected based on historical data. This observation may, however, also be explained by systematic underestimation of the probabilities of extreme events due to methodological problems. We show in this paper that the present statistics of extreme events are indeed largely based on inappropriate statistical methods. These include the widely-spread use of distribution-dependent estimators of plotting positions instead of the correct Weibull formula. Another common error is that the asymptotic extreme value theory is applied as if it applied to extremes drawn from a limited number of observations. Furthermore, some commonly used curve fitting methods appear to be unsuitable for the extreme value analysis and the so called pre-conditioning of data is inappropriately justified. We demonstrate that these problems have typically resulted in underestimation of the probability of extreme weather events. These errors are in many cases of the same order of magnitude as the changes projected to occur within this century due to the global climate change.