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On statistical biases and their common neglect

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The study of natural phenomena such as hydroclimatic processes demands the use of stochastic tools and the good understanding thereof. However, common statistical practices are often based on classical statistics, which assumes independent identically distributed variables with Gaussian distributions. However, in most cases geophysical processes exhibit temporal dependence and even long term persistence. Also, some statistical estimators for nonnegative random variables have distributions radically different from Gaussian. We demonstrate the impact of neglecting dependence and non-normality in parameter estimators and how this can result in misleading conclusions and futile predictions. To accomplish that, we use synthetic examples derived by Monte Carlo techniques and we also provide a number of examples of misuse.

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