

# An improved method for estimating the probability of extreme events

January 23 2019

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Researchers at VTT Technical Research Centre of Finland have developed a new and more accurate method for estimating the probability of extreme events, such as storms, floods and earthquakes.

The new method will be used in updating building codes and land-use regulations, and is applicable also in developing artificial intelligence, as well as in economics and medical data analysis.

Extreme events, such as storms, floods and earthquakes have always been disastrous to civilizations. Communities prepare for them by rigid constructions, flood banks, drainage channels and avoiding [building](#) at hazardous locations. For all such preparations, being able to estimate the probability of hazardous extremes is crucial. The estimation is based on the statistics of previously observed extremes, studied by so-called extreme value [analysis](#). Many extreme value analysis methods exist and it has not been clear which of them should be preferred.

Researchers at VTT, Lasse Makkonen and Maria Tikanmäki, developed a new more accurate extreme value analysis method. The problem of how to appropriately evaluate the goodness of such methods was also solved in this connection.

Makkonen and Tikanmäki showed, by numerical Monte Carlo simulations, that their new extreme value analysis method is much more accurate than the methods that are currently widely used. The difference is significant particularly when the number of available previously observed extremes is small. Typically, the current methods underestimate the probability of the most hazardous extreme events.

The new method, developed at VTT, will improve the estimation of the probability of extreme events and will thus contribute to preparation for [natural hazards](#) in an economically optimal but safe manner. This will happen via updating [building codes](#) and land-use planning regulations. The new method will have wide applications, because extreme value analysis is also in use e.g. in the development of artificial intelligence, in economics and in the analysis of medical data.

"Extreme value analysis of natural phenomena aims at appropriate preparation against hazardous extreme events. Therefore, it forms the foundation of all regulations that aim at securing the safety of buildings and infrastructure. Stronger constructions and protection arrangements increase costs, so that economic optimization is another issue here. Good estimation of the probability of [extreme events](#) is particularly important for those constructions for which indirect damage caused by a rare extreme event is exceptionally heavy, such as in the case of nuclear power plants and [large dams](#)," says Lasse Makkonen.

**More information:** Lasse Makkonen et al. An improved method of extreme value analysis, *Journal of Hydrology X* (2018). DOI: 10.1016/j.hydroa.2018.100012

Provided by VTT Technical Research Centre of Finland

Citation: An improved method for estimating the probability of extreme events (2019, January 23) retrieved 9 May 2024 from <https://phys.org/news/2019-01-method-probability-extreme-events.html>

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