

Overlooked trends in annual precipitation reveal underestimated risks worldwide

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A reanalysis of worldwide annual trends in precipitation demonstrates that risk to human and environmental systems has been underestimated, according to a team of University of Maine researchers. As a result, they found more than 38 percent of the global population and over 44 percent

of land area have been experiencing overlooked precipitation trends.

Conventional [trend](#) analysis approaches examine changes in mean annual [precipitation](#) over time, and erroneously assume that changes in high and low precipitation follow suit, according to Anne Lausier, a UMaine doctoral candidate in civil and environmental engineering and a National Science Foundation Graduate Research Fellow, and Shaleen Jain, associate professor of civil and environmental engineering.

The historical record of annual precipitation is summarized by the probability distribution function (PDF), where the frequency with which precipitation amounts within a certain interval occur and the probability of exceedance (non-exceedance) above (below) a given threshold can be readily estimated.

In their paper, "Overlooked Trends in Observed Global Annual Precipitation Reveal Underestimated Risks," published in the journal *Scientific Reports*, Lausier and Jain present an innovative trend typology using quantile regression and offer a comprehensive analysis of overlooked trends worldwide.

Their trend typology, rather than focusing on mean and median trends alone, extends analyses to the upper and lower tails of the PDF to assess the compounded influence of risk and variability at various thresholds.

The most frequently overlooked trends include an increased risk of extreme wet conditions and increased variability found in parts of the midwestern United States, northern Canada, south-central Asia and Indonesia—regions that are home to nearly 860 million people.

Conversely, the new comprehensive analysis found 840 million people exposed to a decreased risk of wet conditions, particularly in southern Africa, South America and parts of northern Asia, indicating a decrease

in the incidence of high annual totals.

An estimated 630 million people are impacted by an increased risk of dry conditions in parts of southern Europe, the U.S. West, southern Canada and northern Africa.

More than 40 percent of global rainfed agricultural areas are exposed to overlooked trends including parts of southern and western Africa and the midwest U.S.

"Human adaptation to climate change requires understanding the likelihood of experiencing detrimental impacts," Lausier and Jain write. "Mischaracterization of risks to human and environmental systems may underestimate the urgency of climate adaptation or could lead to inappropriate strategies. Our results show that significant population and land areas on the global scale correspond with changes in precipitation risk and variability, and are mischaracterized by conventional approaches."

"Unreliable or erroneous estimates of risk are of special concern for more vulnerable contexts and communities," the researchers say. "Our results underscore how trends overlooked in terms of spatial extent, regionality, and severity have implications for a range of human and environmental systems. Application of our approach in future climate studies will allow for risk assessment at more appropriate adaptation targets."

More information: Anne M. Lausier et al, Overlooked Trends in Observed Global Annual Precipitation Reveal Underestimated Risks, *Scientific Reports* (2018). [DOI: 10.1038/s41598-018-34993-5](https://doi.org/10.1038/s41598-018-34993-5)

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