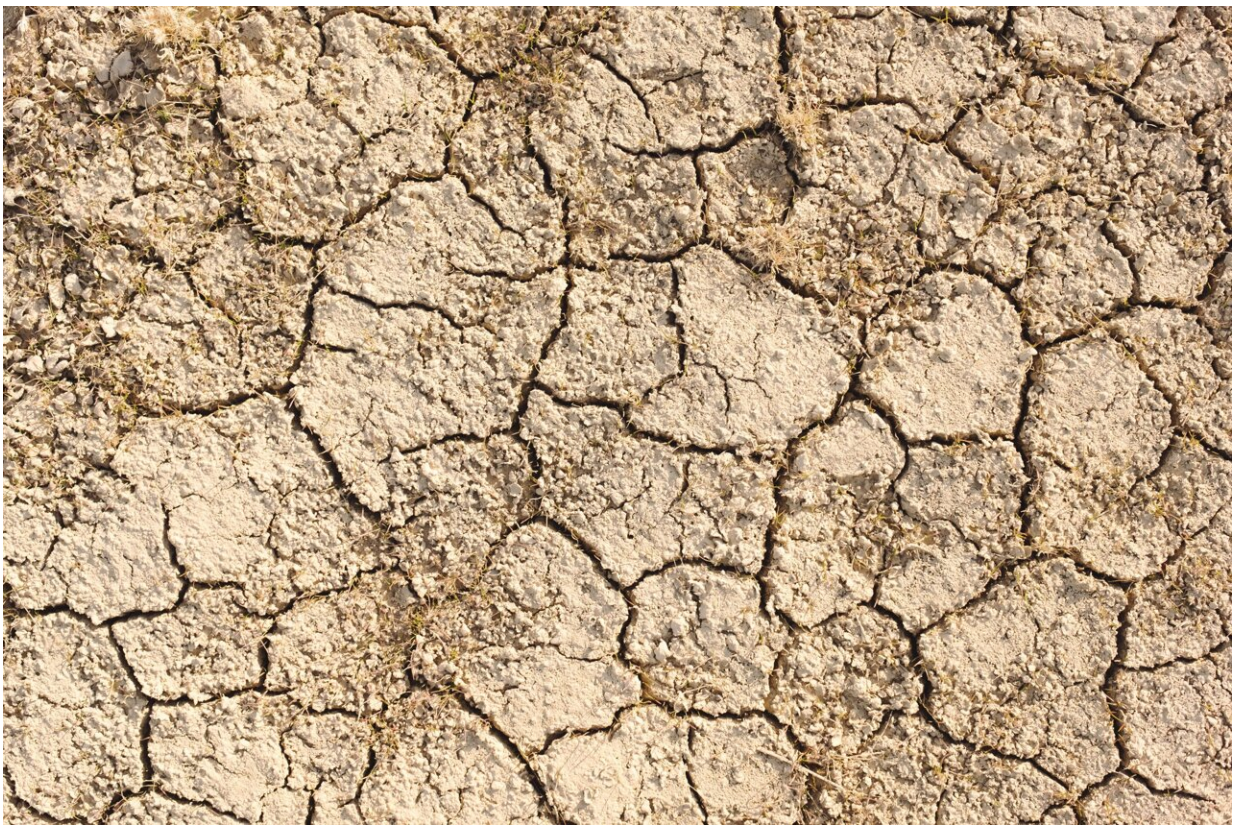
With changing climate, global lake evaporation loss larger than previously thought

June 29 2022, by Alyson Chapman



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A white mineral ring as tall as the Statue of Liberty creeps up the steep shoreline of Lake Mead, a Colorado River reservoir just east of Las

Vegas on the Nevada-Arizona border. It is the country's largest reservoir, and it's draining rapidly.

With much of the country experiencing above-normal temperatures, below-average rainfall and a changing climate, it is vital that water management decision-makers have accurate information.

Led by Huilin Gao, associate professor in the Zachry Department of Civil and Environmental Engineering at Texas A&M University, researchers created the global lake evaporation volume (GLEV) dataset. It leverages modeling and remote sensing to provide the first long-term monthly time series for 1.42 million individual natural lakes and artificial reservoirs worldwide.

The researchers published their findings in *Nature Communications*.

About 87% of fresh surface water in liquid form is stored in natural and artificial lakes (i.e., reservoirs). While the evaporation volume from these global lakes is substantial, little is known about its spatial distribution and its long-term trend.

From 1985 to 2018, researchers discovered that long-term average lake evaporation volume has increased at a rate of 3.12 cubic kilometers per year. The trend attributions include an increased evaporation rate of 58%, decreased lake ice coverage of 23% and increased lake surface area of 19%.

The results from the study underline the importance of using evaporation volume (rather than evaporation rate) as the primary index for assessing climatic impacts on lake systems.

"We found that the long-term lake evaporation is 1,500 plus or minus 150 cubic kilometers per year, which is 15.4% larger than previous

estimates," said first author Gang Zhao, a Texas A&M former student who is now a postdoctoral fellow in the Department of Global Ecology at the Carnegie Institute for Science. "This suggests that lake evaporation plays a larger role in the hydrological cycle than previously thought."

According to GLEV, 6,715 reservoirs only account for 5% of the water storage capacity and 10% of the surface area of all lakes (both natural and artificial). However, reservoirs contribute 16% to the evaporation volume. This quantity of reservoir evaporative loss is equivalent to 20% of the global annual consumption of water use. In the last 33 years, evaporative water loss from reservoirs has been increasing at a rate of 5.4% per year, outpacing the global trend of 2.1% for all lakes.

"With regard to evaporation loss, this study will be an invaluable venue to serve water resources researchers and decision-makers," Gao said. "Our findings have significant environmental, societal and economic implications as the global evaporative loss will be accelerated and further exacerbated in the future under global warming."

"From a global perspective, the total reservoir evaporation can be larger than the combined use of domestic and industrial water. However, even in the United States, very few lakes/reservoirs have reliable evaporation data."

Without accurately quantifying the magnitude and trend of volumetric evaporation loss individually for the millions of global lakes, researchers say reliable water and energy resources projections can't be made. This freely available dataset can benefit decision-makers and the wider science community.

"With results for individual water bodies, GLEV can really help improve reservoir management decision-making all over the world, especially under increasing drought events and population growth," Gao said. "This

dataset helps the science community better understand the role that these water bodies play in Earth systems, from global weather forecasting, flood and drought modeling to Earth system modeling under climate change."

More information: Gang Zhao et al, Evaporative water loss of 1.42 million global lakes, *Nature Communications* (2022). DOI: 10.1038/s41467-022-31125-6

GLEV dataset

Provided by Texas A&M University