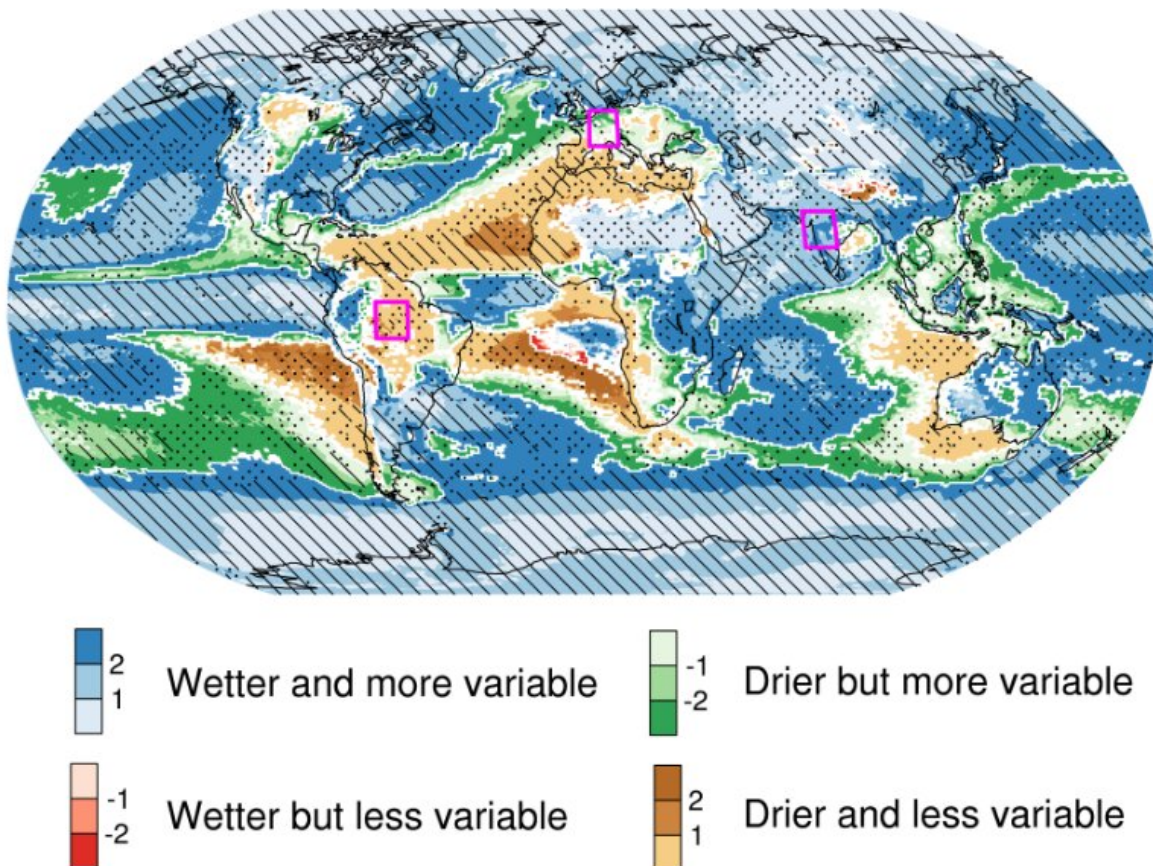


Rainfall becomes increasingly variable as climate warms

July 29 2021, by Li Yuan

Change in variability/change in mean state



Classification of precipitation change regimes based on changes in the precipitation mean state and variability. Shading indicates the ratio of change in precipitation variability and mean precipitation. Credit: IAP

Climate models predict that rainfall variability over wet regions globally will be greatly enhanced by global warming, causing wide swings between dry and wet conditions, according to a joint study by the Institute of Atmospheric Physics (IAP) of the Chinese Academy of Sciences (CAS) and the Met Office, the UK's national meteorological service.

This study was published in *Science Advances* on July 28 2021.

Increased [rainfall](#) leads to floods, less rainfall to drought. Researchers realized decades ago that [global warming](#) drives increased rainfall on average. How this increase is delivered in time matters enormously. A 2 to 3 percent increase of annual precipitation uniformly spreading across the year does not mean much, but if it falls in a week or a day, it will cause havoc.

Using large ensembles of state-of-the-art [climate](#) model simulations, this study highlights the increase in [rainfall variability](#) across a range of time scales from daily to multiyear. Scientists have found that in a future warming world, climatologically wet regions (including the tropics, monsoon regions and mid- to high-latitudes) will not only get wetter on average, but also swing widely between wet and dry conditions.

"As climate warms, climatologically wet regions will generally get wetter and dry regions get drier. Such a global pattern of mean rainfall change is often described as 'wet-get-wetter'. By analogy, the global pattern of rainfall variability change features a 'wet-get-more variable' paradigm. Moreover, the global mean increase in rainfall variability is more than twice as fast as the increase in mean rainfall in a percentage sense," said Zhou Tianjun, corresponding author of the study. Zhou is a senior scientist at IAP. He is also a professor at the University of Chinese Academy of Sciences.

The enhanced rainfall variability, to a first order, is due to increased [water vapor](#) in the air as climate warms, but is partly offset by the weakening circulation variability. The latter dominates regional patterns of change in rainfall variability.

By considering changes in both the mean state and variability of precipitation, the research provides a new perspective for interpreting future precipitation change regimes. "Around two-thirds of land will face a 'wetter and more variable' hydroclimate, while the remaining land regions are projected to become 'drier but more variable' or 'drier and less variable'. This classification of different precipitation change regimes is valuable for regional adaptation planning," said Zhang Wenxia, lead author of the study.

"The globally amplified rainfall variability manifests the fact that global warming is making our climate more uneven—more extreme in both wet and dry conditions, with wider and probably more rapid transitions between them," said Kalli Furtado, expert scientist at the Met Office and second author of the study. "The more variable rainfall events could further translate into impacts on [crop yields](#) and river flows, challenging the existing climate resilience of infrastructures, human society and ecosystems. This makes climate change adaptation more difficult."

More information: Increasing precipitation variability on daily-to-multiyear time scales in a warmer world, *Science Advances*, DOI: [10.1126/sciadv.abf8021](https://doi.org/10.1126/sciadv.abf8021)

Provided by Chinese Academy of Sciences

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