Water availability has changed, and humans are to blame

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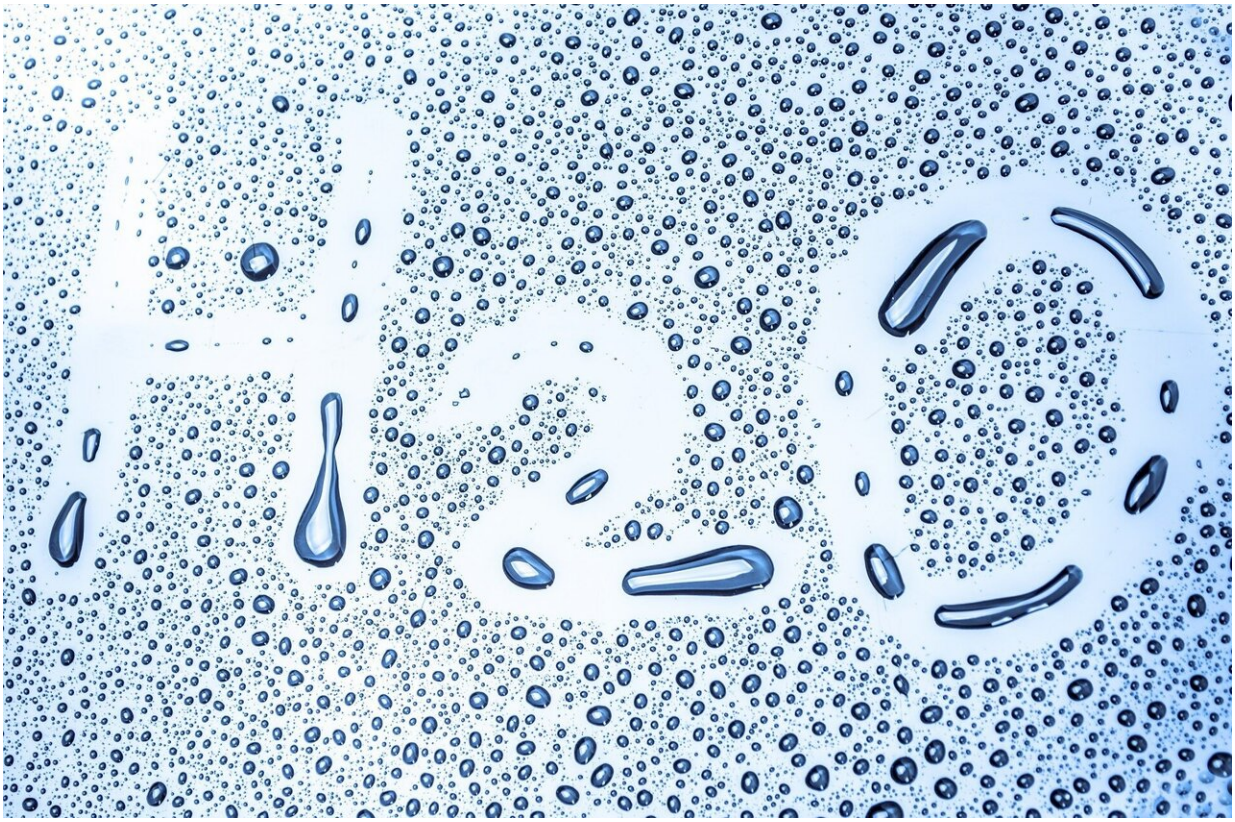

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Changes in the water cycle have important impacts on ecosystems and human activities. In the context of the current and expected temperature rise due to global warming, it is extremely important to understand the

origin and extent of these changes.

A recent study published in the journal *Nature Geosciences* analyzes the changes in global average water availability on land—defined by the difference between precipitation and evapotranspiration—eliminating any remaining uncertainties about human responsibility for variations in the hydrological cycle observed during the dry-season throughout the last century.

The research, realized with the contribution of the CMCC Foundation—Euro-Mediterranean Center on Climate Change, is entitled "Observed changes in dry-season water availability attributed to human-induced climate change" and is made up of two phases.

First, authors used land surface models and statistical models guided by observations to produce and compare global maps of water availability from 1902 to 2014, a period during which our planet experienced a global warming effect of approximately 1°C. The analysis focused on the difference in average water availability of the driest month between the 1902-1950 and the 1985-2014 period.

Results show a reduction in average water availability at a global level during the last century, with some regions experiencing increased and some decreased water availability. 57-59% of land areas, predominantly in extratropical latitudes, experienced a decrease in dry-season water availability. These areas include Europe, western North America, northern Asia, southern South America, Australia, northern Andes and eastern Africa. On the other hand, humidity during the dry season has increased in 41-43% of land areas, including inland China, southeastern Asia and the Sahel.

Moreover, the study shows that the intensification of the dry season is generally a consequence of increasing evapotranspiration rather than

decreasing precipitation.

The second step was to understand the causes of this change, in order to understand if and in what terms these effects are connected to human-induced climate change rather than natural variability.

"Through a multi-model analysis, we have compared in different sets of experiments the spatial distribution of water availability in three different configurations: the world in 1850 (pre-industrial), the world as we observe it today (which is influenced by both natural and human-induced variability) and the world we would observe today if the climate had been influenced only by natural variability," explains Daniele Peano, researcher within the Climate Simulations and Predictions division at the CMCC Foundation, and co-author of the study.

"With or without considering human activity, simulations bring us into a completely different early twenty-first-century world. Instead, the pre-industrial world is not so different from what we would have had today without anthropogenic influence on the climate system. Thus, we excluded the impact of natural variability, establishing human influence as the only explanation for the changes in water availability on land from the pre-industrial era to date."

This is the first time a scientific study demonstrates a correlation between human-induced climate change and changes in the water availability during the dry seasons: in previous assessments, a high level of uncertainty remained, due to the inability to exclude the influence of natural climate variability.

More information: Ryan S. Padrón et al, Observed changes in dry-season water availability attributed to human-induced climate change, *Nature Geoscience* (2020). DOI: 10.1038/s41561-020-0594-1

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