The timing of unprecedented hydrological drought under climate change

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Droughts that exceed the magnitudes of historical variation ranges could occur increasingly frequently under future climate conditions. However, the time of the emergence of unprecedented drought conditions under climate change has rarely been examined. Here, using multimodel hydrological simulations, we investigate the changes in the frequency of hydrological drought (defined as abnormally low river discharge) under high and low greenhouse gas concentration scenarios and existing water resource management and estimate the time of the first emergence of unprecedented regional drought conditions centered on the low-flow season. The times are detected for several subcontinental-scale regions, and three regions, namely, Southwestern South America, Mediterranean Europe, and Northern Africa, exhibit particularly robust results under the high-emission scenario. These three regions are expected to confront unprecedented conditions within the next 30 years with a high likelihood regardless of the emission scenarios. Additionally, the results obtained herein demonstrate the benefits of the lower-emission pathway in reducing the likelihood of emergence. The Paris Agreement goals are shown to be effective in reducing the likelihood to the unlikely level in most regions. However, appropriate and prior adaptation measures are considered indispensable to when facing upprecedented drought conditions. The results of this study underscore the importance of improving drought preparedness within the considered time horizons.

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