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Flash drought as a new normal in a warming climate

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Conventional droughts are creeping climate anomalies that take months or years to fully develop, causing devastating impact silently. In contrast, flash droughts have been considered as a type of drought with more rapid onset, develop and terminate at a shorter time scale. There has been a hot debate on the definition of flash drought, and whether it is necessary to investigate the impact of flash drought given the duration is usually shorter than conventional drought. We clarify that flash drought is not a monster, while it has complete onset and recovery processes as conventional drought. Flash drought expands the conventional drought from seasonal-to-decadal scales to sub-seasonal scale, where synoptic land-atmospheric coupling might become critical for its onset. Focusing on a once-in-a-century flash drought in late summer of 2019, we analyze the latest Coupled Model Intercomparison Project Phase 6 (CMIP6) climate model data and show that climate change caused by anthropogenic activities (e.g., emissions of greenhouse gases and aerosols, land use change, etc) has increased the likelihood of such drought onset speed by $42\pm 19\%$. A further analysis based on CMIP6 multi-model ensemble simulations over the global land areas shows that there was no significant trend in frequency during 1850-1970, but flash drought became more frequency in the recent 40 years. All these results suggest that climate change accelerates the drought development speed, and flash drought might become as a new normal in a warming climate. The eco-hydrological impact of this “new normal” will also be discussed by investigating FLUXNET in-situ observations and MODIS satellite retrievals.