First glimpse of global flash drought occurrence, distribution, drivers and trends: past and future

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Flash droughts have received widespread attention due to their abrupt onset or swift intensification, which makes it challenging to forecast and prepare for them, hence posing serious impacts on ecosystems, socioeconomic development, and agriculture. To accurate identify the occurrence, distribution, drivers, and trends of flash drought on a global scale is still a big challenge and largely unexplored, and hence demands a deep understanding of flash droughts and the underlying mechanisms. Here, we investigate and highlight the critical flash drought hotspots on a global scale from 1981 to 2014 by applying a standardized evaporative stress ratio method (SESR). Our results indicate that flash drought hotspots dominantly occur across the Great Rift Valley, the Sahel, India, and Brazil, with significant regional hotspots over northeastern China, some parts of Russia, and the central part of the United States. Out of the 15 study regions, six regions witnessed a substantial increasing trend ($p<0.1$) whereas three regions observed a substantial decline in flash drought coverage from 1981 to 2014. In addition, future estimation of flash drought is also performed at a global scale using CMIP6 and GeoMIP future scenarios. From the investigation, it was observed that flash droughts intensification is expected to continue over the majority of regions, with larger intensity under high emission scenarios. Finally, the results demonstrate that several research pathways are required to improve our understanding of flash drought occurrence and their regional drivers, and the complex relationships between socioeconomic impacts and flash drought. Our results facilitate the policymakers/managers to formulate effective drought prevention and mitigation strategies to ensure ecosystem sustainability.

Keywords: CMIP6, Flash drought, Rapid intensification, Regional drivers, Standardized evaporative stress ratio (SESR).