Flash droughts

Flash droughts develop rapidly and have led to severe impacts around the world in recent years, such as the droughts over central USA in 2012 which caused billions of dollars of economic losses; those in southern China in 2013 that affected 2 million hectares of crops in the Guizhou and Hunan provinces alone; and those in southern Africa in 2015. There is an urgent need to investigate how flash droughts develop and how their risk is changing in a warming climate.

Thousands of observations reveal that the number of flash drought events over China have significantly increased since the 1960s[1]. Research in CSSP China shows that human-induced climate change triggered by increased greenhouse gas concentrations accounts for most of this increase[2].

The project is also working to understand the conditions that lead to flash droughts in different regions of China and improve the ability of models to simulate such events, which will lead to better predictability and therefore early warning. Work so far has found that flash droughts occur most frequently in eastern and southern China and particularly along the Yangtze River valley, with events lasting longest over southern China[3].

Natural modes of climate variability have been shown to affect the occurrence and location of flash droughts. For example, in the summer after El Niño events, the frequency of flash droughts increases by up to 20% on average over southern China. Also, in dry phases of the Madden-Julian Oscillation and Boreal Summer Intra-seasonal Oscillation the number of flash droughts decreases in southern China whilst increasing in eastern China. Understanding the relationships between these events and flash droughts will help develop advanced predictions and warnings of such events, which will reduce impacts on societies and economies.

CSSP China has also demonstrated a projected increase in flash drought risk over China during the middle and end of this century, especially over southern China, where both humans and ecosystems have high exposure and poor adaptability. This is mainly caused by climate change and population growth. However over northern and north-eastern China, future exposure risk of flash drought will decrease due to reductions in flash droughts and population, especially by the end of this century. These results suggest that climate change will alter the traditional arid areas, and more attention should be paid to deal with flash drought risks in humid and semi-humid areas.

[1] https://www.nature.com/articles/srep30571
[2] https://www.nature.com/articles/s41467-019-12692-7
[3] Tian et al, 2020. The driving processes of flash droughts. Submitted to Journal of Climate.