

EGU21-6499, updated on 19 Sep 2021

<https://doi.org/10.5194/egusphere-egu21-6499>

EGU General Assembly 2021

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The Temporal Propagation Processes of Multiple Types of Drought in Central Asia

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Drought propagation processes interlink closely with the water cycle, which has so far been mostly investigated without tracking temporal propagation across multiple types of drought. Central Asia, including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Xinjiang (China) areas, is one of the most drought-prone areas in the world and extremely vulnerable to water scarcity. Understanding the multiple pathways of drought propagation over time in Central Asia is necessary for food security, human health, and poverty alleviation. In this study, we quantify the propagation time and track the details of temporal propagation processes of drought across the atmosphere, the geosphere, and the hydrosphere. The standardized indices are calculated using variables directly related to each type of drought: precipitation (SPI), evapotranspiration (SEDI), soil moisture (SSI), and runoff (SRI)^{1, 2}. The drought propagation processes are divided into the development stage and recovery stage. The propagation time at different stages between multiple types of drought is calculated by the Pearson correlation coefficient ($p < 0.05$)³ and run theory method⁴. Besides, the potential influencing factors on the temporal propagation are explored from the meteorological, land cover, and water management aspects. As the main results, the propagation time in winter is longer than in summer. And topography has a significant impact on drought propagation time. These key findings could further benefit the early warning of drought and facilitate the drought mitigation-adaptation in both Central Asia and other continents.

Keywords: Temporal propagation, Central Asia, Influencing factors, Land cover

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