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Detecting multidecadal variation of short-term drought risk by combining frequency analysis and Fourier transformation methods: A case study in the Yangtze River Basin

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Abstract: Due to the steady increase in global temperature, both long-term (seasonal or longer) and short-term (monthly to seasonal) drought events have become more frequent around the world (especially for short-term drought events). However, methods for detecting changes in short-term drought risk currently remain inadequate. We proposed a new statistical method to quantify short-term drought risk by combining frequency analysis and Fourier transformation with phase-randomization. The effectiveness of the proposed method was demonstrated using the long-term data (1949–2018) of the largest river basin in China, i.e., Yangtze River Basin (YRB) where drought risk is high and short-term drought risks have rarely been evaluated. The mean short-term drought risk was 71.7 ± 11.9% (mean ± one standard deviation). Regarding the temporal trend, short-term drought risk for 65.4% of grids increased over time (0.23 ± 0.15%·yr $^{-1}$), of which 90.0% were statistically significant (p<0.05). Such spatiotemporal variability is possibly resulted from the joint influence of the Western Pacific Subtropical High, the Atlantic Multidecadal Oscillation and the Pacific Decadal Oscillation. This study proposed a new method to quantify short-term drought risk and then firstly evaluated multidecadal variation of short-term drought risk of the YRB. Given the greater increase in short-term drought risk than long-term drought risk, greater attention should be given to evaluating short-term drought risk in relation to drought prevention and drought risk management.

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