Postprint: EOF- and REOF-Based Analysis of Spatial Distribution Characteristics of Drought and Flood in the Middle and Lower Reaches of the Yellow River Region, 1470–1911

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Abstract

Based on the reconstructed historical drought-flood grade sequences for 36 stations in the middle and lower reaches of the Yellow River from 1470 to 1911 through historical literature and vectorized historical maps, the spatial characteristics of drought-flood disasters were analyzed using EOF and REOF methods. The EOF decomposition results indicate that the cumulative variance contribution rate of the first four modes is 71.85%, primarily manifested as the first, second, and fourth eigenvector fields exhibiting a meridional banded distribution, while the third eigenvector field shows a zonal distribution; the spatial distribution of the first eigenvector field is entirely positive, indicating that drought-flood variations in the middle and lower reaches of the Yellow River exhibit consistency, but the characteristics among the remaining eigenvector fields differ significantly, suggesting that under different background fields and influencing conditions, drought-flood variations also exhibit numerous local features; the REOF decomposition results can divide the drought-flood conditions in the middle and lower reaches of the Yellow River into five typical sensitive climate zones, which lays a foundation for further research on the regional characteristics of drought-flood variations in this area.

Full Text

Spatial-temporal Characteristics of Drought and Flood in the Middle and Lower Reaches of the Yellow River from 1470 to 1911 Based on EOF and REOF

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Abstract

Based on collected and compiled historical records of drought and flood events in the middle and lower reaches of the Yellow River region in China from 1470 to 1911, this study reconstructed the drought-flood sequences for 36 stations and historical maps of the study area, and analyzed their spatial patterns using Empirical Orthogonal Function (EOF) and Rotated Empirical Orthogonal Function (REOF) methods. The EOF analysis results showed that the cumulative variance contribution rate of the first four modes reached 71.85%. The primary characteristics indicated that the first, second, and fourth modes exhibited a longitudinal distribution pattern, while the third mode displayed a latitudinal distribution pattern. The spatial distribution of the first eigenvector field was entirely positive, indicating coherent drought-flood variations across the entire middle and lower reaches of the Yellow River region. However, significant differences existed among the remaining eigenvector fields, illustrating that drought and flood variations also exhibited local features under different background conditions and circulation patterns. Based on the REOF analysis results, the region could be divided into five typical climate-sensitive subregions. This analysis provides a foundation for further research on regional drought-flood characteristics.

Keywords: EOF; REOF; drought and flood; spatial characteristics; middle and lower reaches of the Yellow River

Note: Figure translations are in progress. See original paper for figures.