

2.树木年轮与全球变化

The response to drought extremes is asymmetric in tree-ring width but less in stable isotopes

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摘要: Tree-ring data is a critical proxy to explore past drought extremes, however, the biotic memory effects lead to some asymmetric responses to drought extremes in tree-ring data, which has challenges for drought extremes detection and assessment. We explore the extent to which existing drought-sensitive tree-ring records, including tree-ring width (TRW, $n = 4070$), tree-ring $\delta^{13}\text{C}$ ($n = 410$), and $\delta^{18}\text{O}$ ($n = 181$) series, capture drought extremes in the North Hemisphere and evaluate how these asymmetric responses distributed at different climatic zones. We find a dry-biased asymmetry in more than half of drought-sensitive TRW records whereas only 19% of sites capture wet extremes as well as or better than dry extremes during the growing season. We reveal that the TRW sites at the arid, warm temperate, and snow climatic zones captured dry extremes up to 8% more than wet extremes, while TRW sites at the equatorial and polar climatic zones captured dry and wet extremes nearly equal. We also found no bias in extremes capture in tree-ring $\delta^{18}\text{O}$, but a dry-biased asymmetry in drought extremes capture in tree-ring $\delta^{13}\text{C}$ in the warm temperate climatic zone. Our results suggest that the importance of directly addressing the asymmetric drought extremes response in tree-ring records can help our exploration of drought extremes and trees' resilience to drought extremes over the past and future.

关键词: Tree rings; drought reponse; drought extremes; asymmetric