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Tree-rings stable isotope ($\delta^{18}O$ and $\delta^{2}H$) based 368 years long term precipitation reconstruction of South Eastern Kashmir Himalaya

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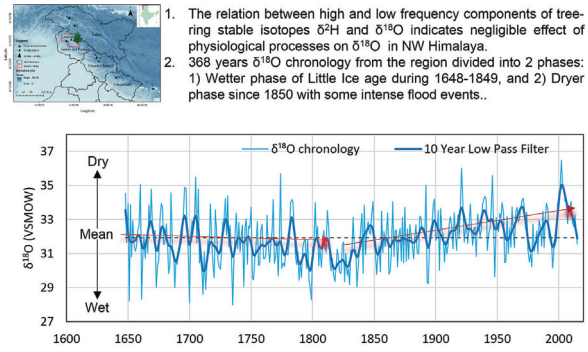
HIGHLIGHTS

- Tree-ring $\delta^{18}O$ can be utilized to reconstruct past rainfall in Kashmir Himalaya (KH).
- The 368 years long chronology of $\delta^{18}O$ and $\delta^{2}H$ were developed from SE KH.
- The minimum effect of physiological process on stable isotopes of tree-rings in the KH.
- The reconstructed rainfall reveals that region is in drought phase since 1850s.
- The teleconnection indicates direct relationship with westerlies region.

GRAPHICAL ABSTRACT



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ABSTRACT

The hydroclimatic variability in Kashmir Himalaya is influenced by the western disturbances and the Indian Summer Monsoon. To investigate long-term hydroclimatic variability, 368 years tree-ring oxygen and hydrogen isotope ratios ($\delta^{18}O$ and $\delta^{2}H$) extending from 1648 to 2015 CE were analysed. These isotopic ratios are calculated using five core samples of Himalayan silver fir (*Abies pindrow*) collected from the south-eastern region of Kashmir valley. The relationship between the long and short periodicity components of $\delta^{18}O$ and $\delta^{2}H$ suggested that physiological processes had a minimum effect on the tree-ring stable isotopes in Kashmir Himalaya. The $\delta^{18}O$ chronology was developed based on the average of five-individual tree-ring $\delta^{18}O$ time series covering the time span of 1648–2015 CE. The climate response analysis revealed the strongest and most significant negative correlation between tree ring $\delta^{18}O$ and precipitation amount from the previous year's December to current year's August ($D2A_{pre}$). The reconstructed $D2A_{pre}$ ($D2A_{rec}$) explains precipitation variability from 1671 to 2015 CE and is supported by historical and other proxy-based hydroclimatic records. The reconstruction has two distinguishing features: first, it is characterized by stable wet conditions during the last phase of Little Ice Age (LIA) i.e., from 1682 to 1841 CE; and second, the southeast Kashmir Himalaya had experienced drier conditions as compared to recent and historical period with intense pluvial events since 1850. The present reconstruction shows, there have been more extreme dry events than extreme wet events since 1921. A tele-connection is observed between $D2A_{rec}$ and Sea Surface Temperature (SST) of the Westerly region.

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