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Sub-annual oxygen isotope variations in Indian teak cellulose: implications to monsoon reconstruction

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We analyzed cellulose from several annual growth rings of tropical trees, teak (*Tectona grandis*) from central and southern India for understanding sub-annual variations in the oxygen isotopic composition (δ^{18}O). Analysis of three such trees from central ndia receiving dominantly the south-west (SW) (summer) monsoon, revealed a seasonal cycle in δ^{18}O with higher values at the early and late growing seasons and lower values at the middle. The amplitudes were 1.9 to 5.0‰ and up to 6.8‰ in coarse and fine resolution sub-annual samplings, respectively. Comparison of the δ^{18}O profile of a ring (year 1971), analyzed with the highest resolution, and a model profile constructed on the basis of concurrent local meteorological data reveals that (i) relative humidity rather than the amount of rainfall decides sub-annual δ^{18}O variations, and (ii) it is possible to achieve a $\sim$20 day resolution in monsoon reconstruction. High and coarse resolution sub-annual analyses of δ^{18}O of teak cellulose from southern India receiving both rains, the south-west (SW) (summer) monsoon and the north-east (NE) (winter) monsoon (more depleted in ^{18}O) rains, revealed a trend opposite to the one observed in the trees from central India. Results showed a seasonal cycle with amplitudes of 1 to 3‰, with lower δ^{18}O values at the early and late growing seasons and higher values at the middle. This, when compared with model-derived values, revealed that the observed pattern of sub-annual variation can be explained only if the tree sampled rainfall from both the monsoons. This has implications to the interpretation of δ^{18}O time series from locations which receive rains with seasonally changing δ^{18}O values.