

Tree-Ring and Wood
Anatomy Laboratory
ESALQ-USP

Tree-ring oxygen isotopes as an indicator of hydroclimate variation in eastern Amazon over the past century

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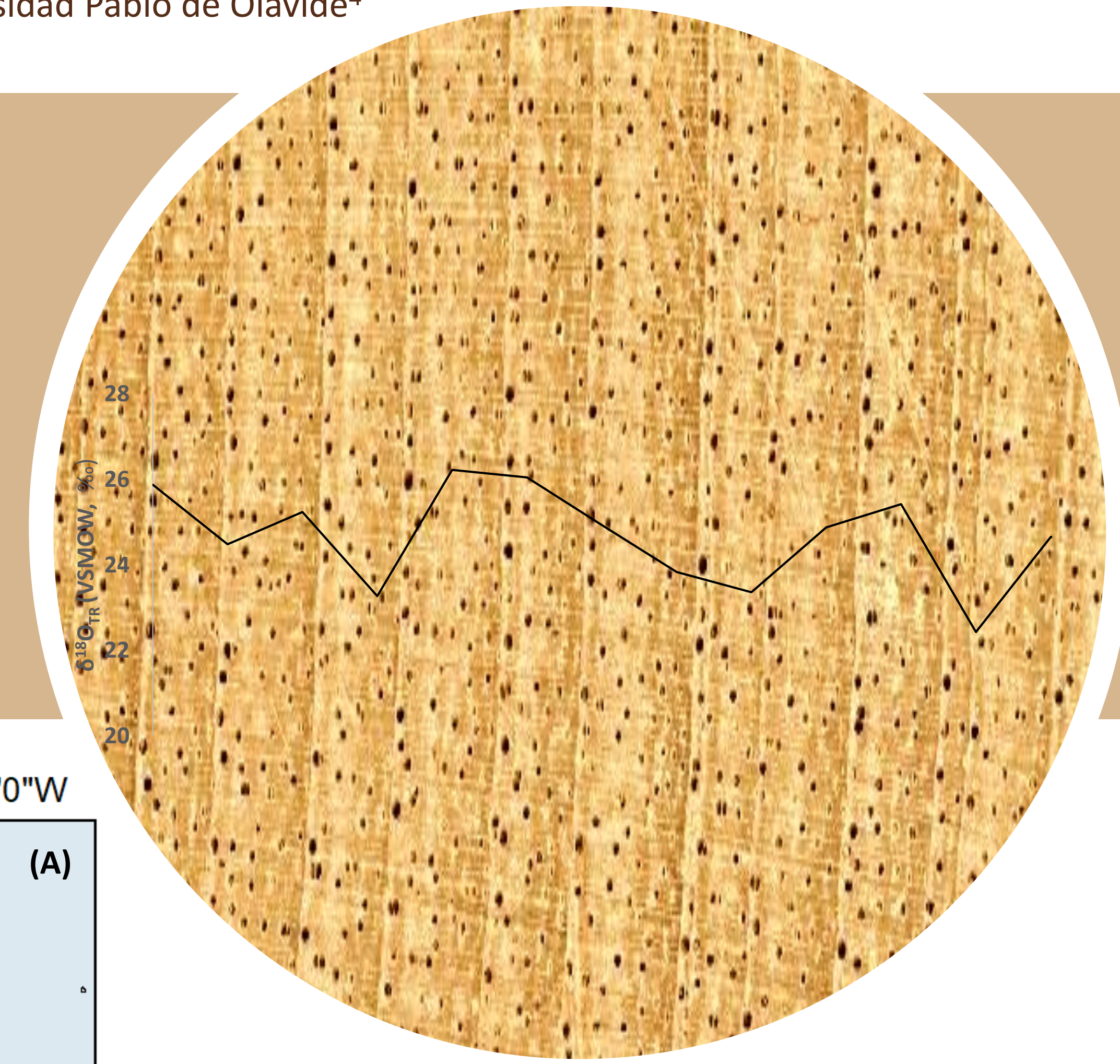
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INTRODUCTION

Oxygen isotope ratios in tree rings ($\delta^{18}\text{O}_{\text{TR}}$) from Amazon forests have been shown to provide historical records of rainfall amounts at a large scale, due to the rainout of heavy isotopes during moisture transport^{1,2}. Here, we present a 110-year oxygen isotope record obtained from tree ring-cellulose of six *Cedrela odorata* trees (Fig. 01B) from the region of Tapajós River, Eastern Amazon.



MATERIAL AND METHODS

Wood sample from the region of Tapajos River, Eastern Amazon (Fig.1) and previous cross-dated³

Isotopic ratio of oxygen in the cellulose extracted from wood cross-sectional laths^{4,5}. EA-IRMS (Thermo) do LES/IGc/USP.

HYSPLIT moisture trajectories^{1,2} and correlation between $\delta^{18}\text{O}_{\text{TR}}$ series with rainfall from CRU TS 4.05 (1901-2014) and mean accumulated rainfall at 3000 m high.

RESULTS

The $\delta^{18}\text{O}_{\text{TR}}$ series reflects inter-annual variability of wet season (JFMAM) precipitation over Northeast Brazil (Fig. 2B). The strongest correlation is observed with rainfall in MAM, which corresponds to the peak of precipitation over Northeast Brazil when the ITCZ reaches its southernmost positions.

Spatial correlations of $\delta^{18}\text{O}_{\text{TR}}$ with sea surface temperatures (SST) show association with the El Niño 3.4 region and Tropical North/South Atlantic SST (Fig. 2B). Historical droughts in Northeast Brazil are 90% represented by elevated $\delta^{18}\text{O}_{\text{TR}}$ values, only a few years do not correspond to recorded droughts (Fig. 2C).

CONCLUSIONS

This study suggests that $\delta^{18}\text{O}_{\text{TR}}$ series from Eastern Amazon may be used as a reliable record of historical droughts in Northeast Brazil over the past century.

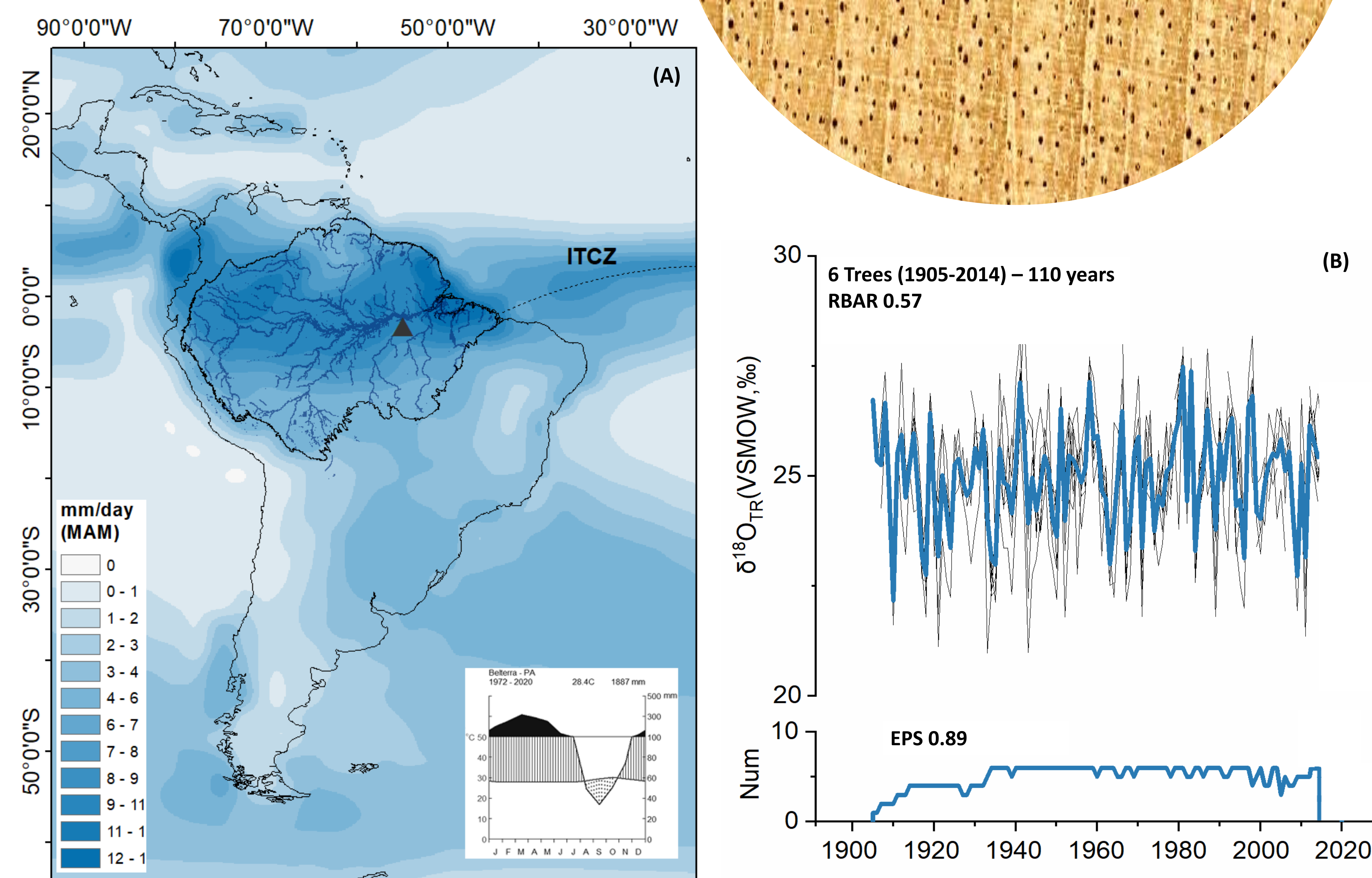


Figure 1. Map of Tapajós National Forest, Tapajós River, and climograph. Position of the Intertropical Convergence Zone during austral autumn (MAM) (A). $\delta^{18}\text{O}_{\text{TR}}$ record based on six *Cedrela odorata* trees from eastern showing Expressed Population Signal (EPS) and mean inter-series correlation (RBAR) (B).

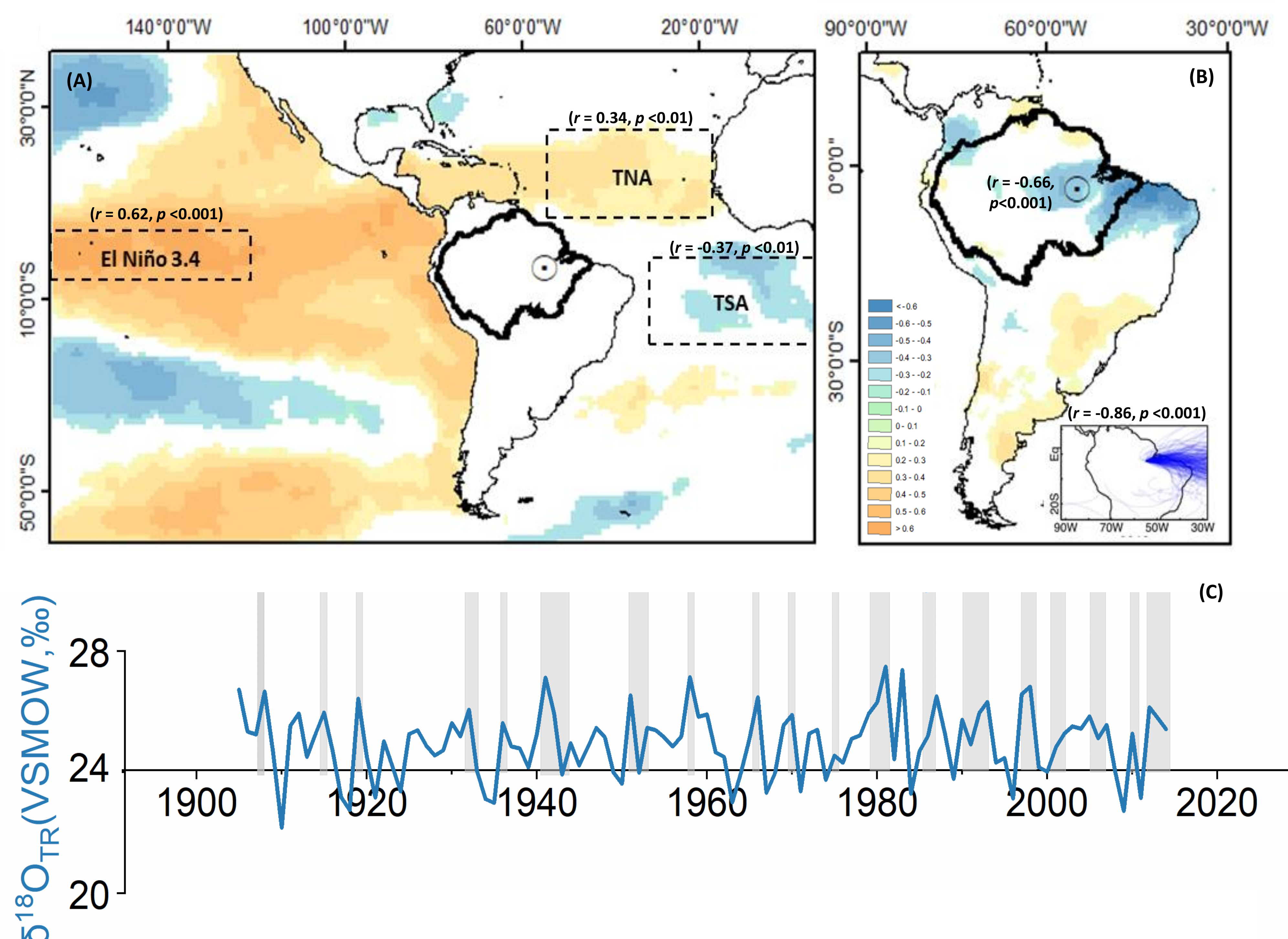


Figure 2. Global spatial correlation maps of $\delta^{18}\text{O}_{\text{TR}}$ with sea surface temperatures (SST) – ENSO, TNA and TSA (JFMAM, $p < 0.05$)⁶ (A). Correlations with regional precipitation and trajectory mean accumulated rainfall at 3000 m (MAM) and map of HYSPLIT moisture trajectories (B). Years of extreme drought Northeast Brazil identified in $\delta^{18}\text{O}_{\text{TR}}$ series. Years 1907, 1915, 1919, 1932–1933, 1941–1944, 1951–1953, 1958, 1970, 1979–1981, 1983–1983, 1986–1987, 1990–1993, 1997–1998, 2001–2002, 2005–2007, 2010, 2012–2014⁷ (C).

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