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Intra-annual stable isotopes in the tree rings of *Hymenaea courbaril* as a proxy for hydroclimate variations in southern Amazonia

FIGURES

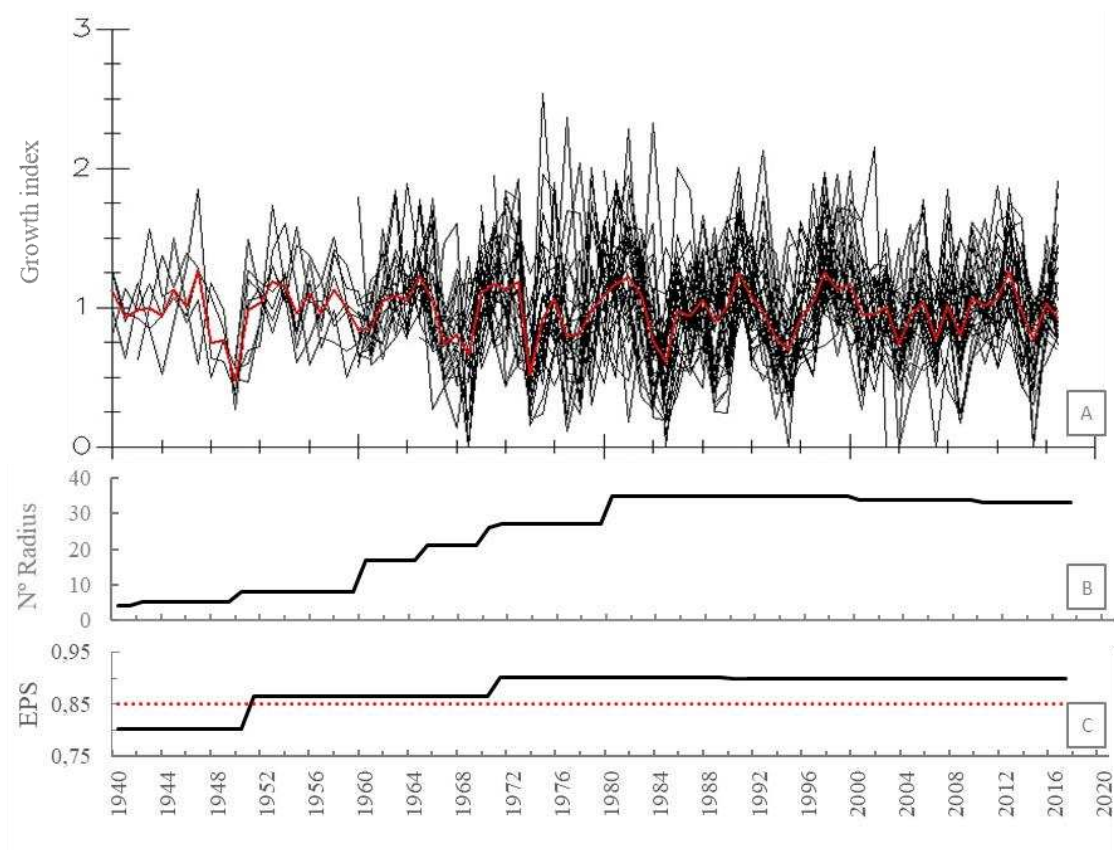


Figure A1. (A) Individual growth series (black lines) of 39 increment cores from 17 living trees, and average standard chronology (red line) of *Hymenaea courbaril* individuals growing in a forest in the southern Amazon. (B) Number of radii used for the elaboration of the time series. (C) Expressed Population Signal (EPS) values for 10-year spacing with a 5-year overlap (black line). The red dotted line in the EPS indicates the minimum value (0.85) for years well represented by the number of samples (Wigley et al. 1984).

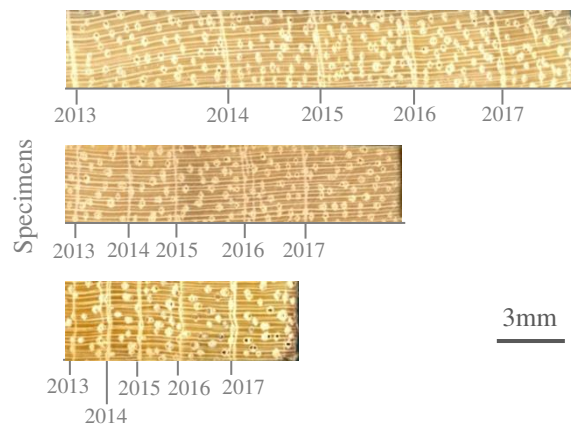


Figure A2. Radii of *Hymenaea courbaril* we used to analyze stable carbon and oxygen isotopes. Ten carbon and ten oxygen analyses were performed in each tree ring, between 2013 and 2017. Scale bar 3 mm.

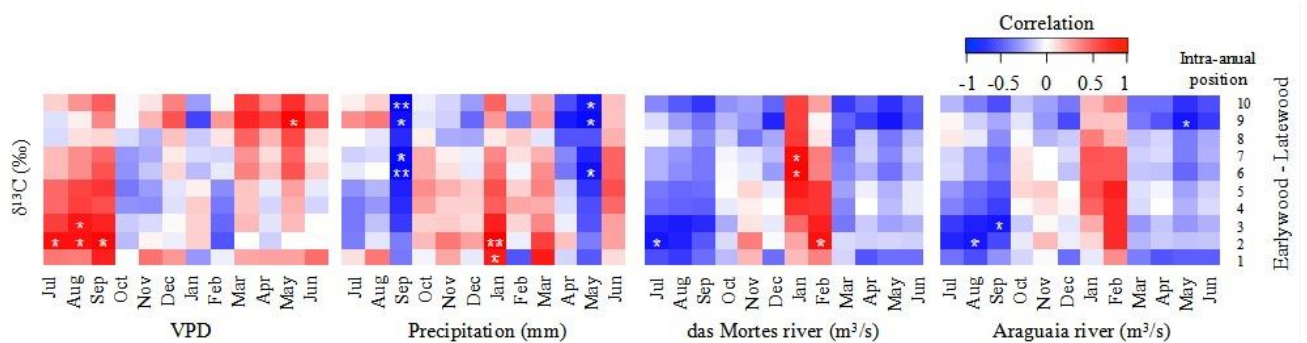


Figure A3. Correlations between $\delta^{13}\text{C}$ and Vapour Pressure Deficit, Precipitation, das Mortes, and Araguaia river discharge between June 2013 and July 2018. Heatmaps show the values between oxygen isotopic series and climate data. For the intra-annual position, the sample sizes are $n = 5$. Correlation values are presented per month between vapour pressure deficit, precipitation, and river discharges. * significant values for $\alpha = 0.05$ and ** for $\alpha = 0.01$. Climate data were obtained from climate stations of the cities of Nova Xavantina and Cocalinho, Mato Grosso, Brazil.

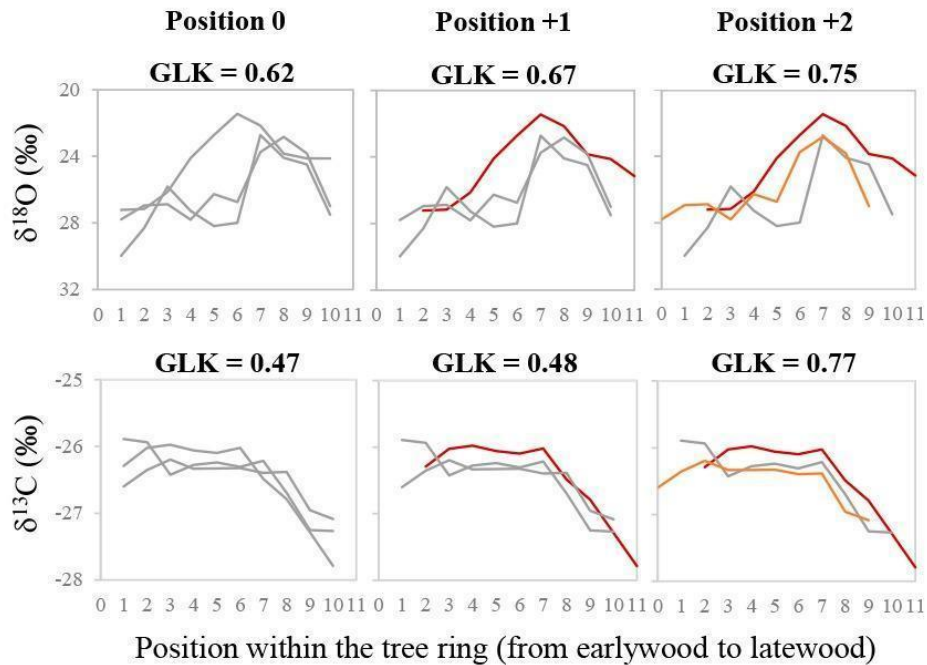


Figure A4. Example of synchronization procedure for the intra-annual $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ series of the 2013 tree ring of three trees. Position “0” represents the isotope series as obtained in the tree rings, each of the grey lines represents an individual isotope series. Position “+1” represents shifting one individual isotope series to the right. While Position “+2” represents shifting two isotope series one position to the right and order to the left. The red line represents the isotopic series that has been moved one position to the right and the orange line represents the isotopic series that has been moved one position to the left. GLK was calculated for the positions.

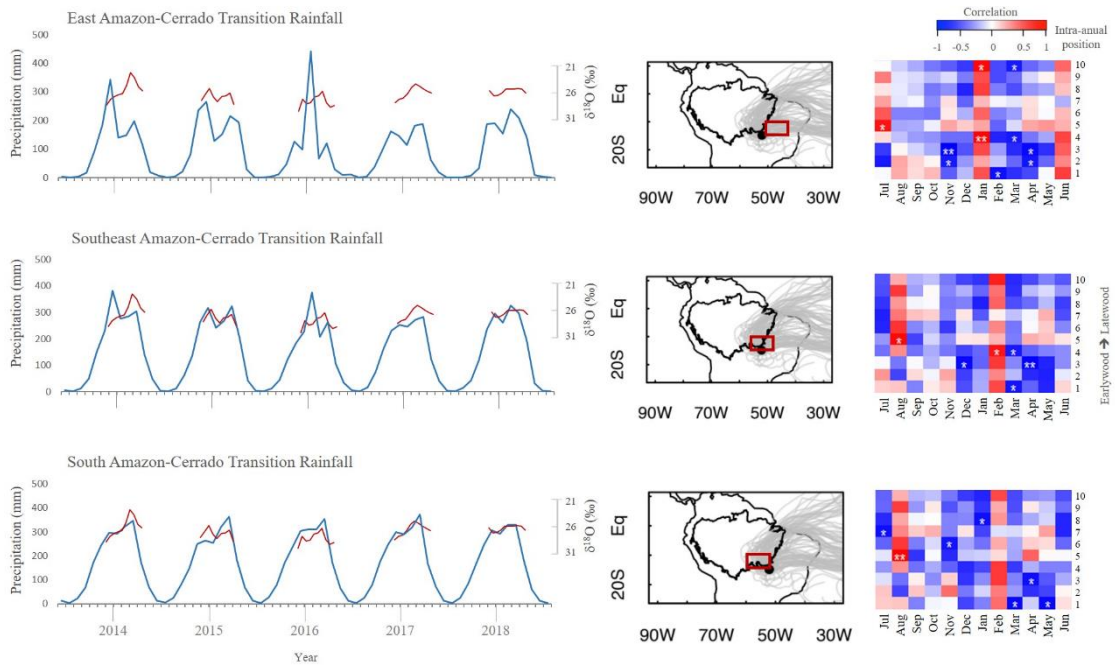


Figure A5. Precipitation of the southeast portion of the Amazonia-Cerrado transition between June 2014 and July 2018 (blue lines) and oxygen isotopes series (red lines). In each graph (left panes), the precipitation corresponds to the average monthly precipitation within the area shown as red squares in the maps (middle panels). The selection of the areas denoted by the red squares was guided by regions where the rainout of H_2^{18}O over land should contribute to the $\delta^{18}\text{O}$ of rainfall water at the sampling site, which is indicated by HYSPLIT daily back trajectories of moisture at 2000m altitude for the year of 2005 C.E. (gray lines on maps, middle panels). Heatmaps show the correlation values between oxygen isotopic series and precipitation, and the correlation values are presented per month. * significant values for $\alpha = 0.05$ and ** for $\alpha = 0.01$. Climate data were obtained from the Climate Research Unit (CRU – 0.5°).

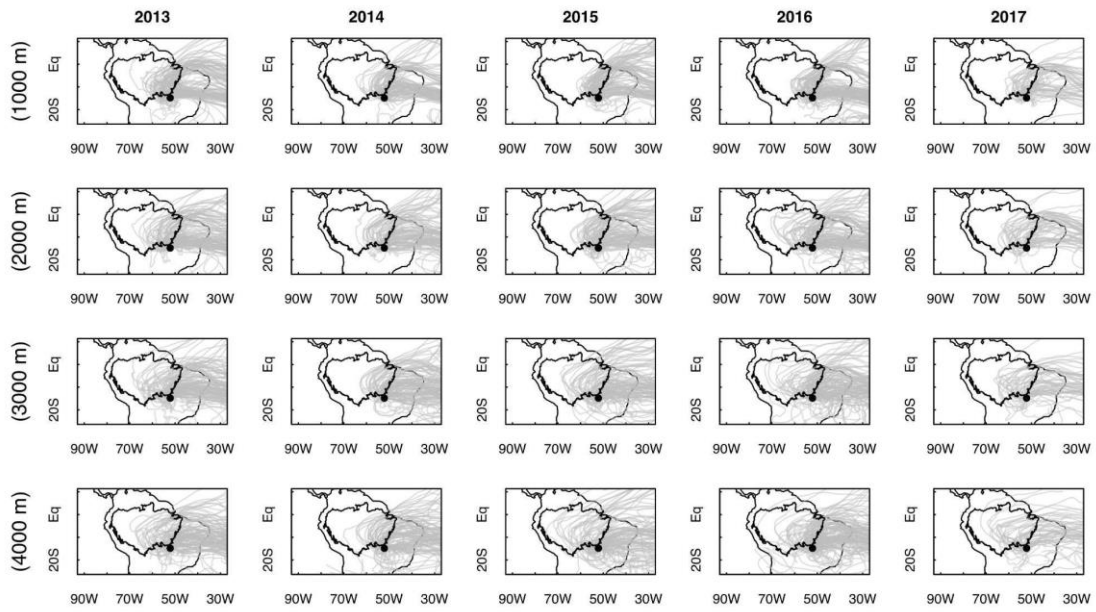


Figure A6. HYSPLIT daily back trajectories of moisture from the sampling site at 1000m, 2000m, 3000m, and 4000m height.

Table A1. Descriptive statistics of *Hymenaea courbaril* standard chronology. Intercorrelation and sensitivity were calculated using COFECHA software and the other values using ARSTAN software. EPS = Expressed Population Sign.

Parameters	Standard chronology
Number of individuals (radius)	16 (33)
Total number of dated tree rings	1921
Intercorrelation	0.44
Sensitivity	0.38
Maximum length (years)	78
Medium EPS	0.87

Table A2. Pearson correlation between annual oxygen isotope series averaged between positions 3 to 7 within the tree ring and annual climate data, and rainy season climate data. Correlations and p-values are shown for das Mortes and Araguaia river flow, precipitation, and vapour pressure deficit (VPD).

Pearson Correlation				
	das Mortes River	Araguaia River	Precipitation	VPD
All year	-0.52	-0.56	-0.79	0.17
Rainy season	-0.74	-0.75	-0.90	0.71

P-value				
	das Mortes River	Araguaia River	Precipitation	VPD
All year	0.119	0.080	0.167	0.630
Rainy season	0.147	0.137	0.035	0.176

Table A3. Pearson correlation between annual oxygen isotope series averaged between positions 1 to 10 within the tree ring and annual climate data, and rainy season climate data. Correlations and p-values are shown for das Mortes and Araguaia river flow, precipitation, and vapour pressure deficit (VPD).

Pearson Correlation				
	das Mortes River	Araguaia River	Precipitation	VPD
All year	-0.56	-0.61	-0.79	0.28
Rainy season	-0.73	-0.75	-0.86	0.77

P-value				
	das Mortes River	Araguaia River	Precipitation	VPD
All year	0.090	0.060	0.080	0.440
Rainy season	0.160	0.140	0.062	0.129