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Investigating seasonal precipitation variations with high-resolution carbon isotope analyses of annual tree rings

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Seasonal variations in precipitation were recently shown to dominate the mean intra-annual variation in the carbon isotope composition of evergreen wood ($\delta^{13}\text{C}_{\text{cellulose}}$) across a range of biomes (Schubert & Jahren, 2011). Using a new high-resolution carbon isotope dataset of cellulose, we investigated this relationship further. At five FLUXNET sites spanning a significant gradient of moisture (MAP range of 280 to 900mm) and temperature (MAT range of -1 to 18°C) we collected tree core samples and extracted cellulose at high-resolution (≥ 3 cores per site). For each site, we explored whether the inter-annual variability of seasonal precipitation over the past 15 years dominated the inter-annual variations in the amplitude of $\delta^{13}\text{C}_{\text{cellulose}}$. Using the process-based model MuSICA (Ogée et al., 2009) that links $\delta^{13}\text{C}_{\text{cellulose}}$ signals in tree rings to environmental conditions, helped us interpret the observed patterns and explore the sensitivity of $\delta^{13}\text{C}_{\text{cellulose}}$ to light and temperature as these drivers may gain importance when trees grow without moisture limitations.

References

- Ogée, J., Barbour, M.M., Wingate, L., Bert, D., Bosc, A., Stievenard, M., Lambrot, C., Pierre, M., Berbigier, P., Bariac, T., Loustau, D. and Dewar, R. (2009). A single-substrate model to interpret intra-annual stable isotope signals in tree ring cellulose. *Plant, Cell and Environment*, Vol. 32, 8, 1071-1090, doi:10.1111/j.1365-3040.2009.01989.x
- Schubert, B.A. & Jahren, A.H., 2011. Quantifying seasonal precipitation using high-resolution carbon isotope analyses in evergreen wood. *Geochimica et Cosmochimica Acta* 75, 7291-7303.