



**HAL**  
open science

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

Lisa Wingate, Emmi Hiltavuori, Raphaël Dulhoste, Didier Bert, James Rolfe, Tamara Markovic, Michel Stievenard, Pasi Kolari, Pepi Hari, Barbara Köstner, et al.

### ► To cite this version:

Lisa Wingate, Emmi Hiltavuori, Raphaël Dulhoste, Didier Bert, James Rolfe, et al.. Investigating seasonal precipitation variations with high-resolution carbon isotope analyses of annual tree rings. TRACE - Tree Rings in Archaeology, Climatology and Ecology, May 2012, Potsdam, Germany. 1 p., 2012. hal-02809865

**HAL Id: hal-02809865**

**<https://hal.inrae.fr/hal-02809865>**

Submitted on 6 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

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

Wingate, Lisa<sup>1,2</sup>; Hiltavuori, Emmi<sup>3</sup>; Dulhoste, Raphaël<sup>1</sup>; Bert, Didier<sup>4</sup>; Rolfe, James<sup>5</sup>; Markovic, Tamara<sup>1</sup>; Stievenard, Michel<sup>6</sup>; Kolari, Pasi<sup>3</sup>; Hari, Pasi<sup>3</sup>; Köstner, Barbara<sup>7</sup>; Grünwald, Thomas<sup>7</sup>; Maseyk, Kadmiel<sup>8</sup>; Rotenberg, Eyal<sup>9</sup>; Plaza, Andrés<sup>2</sup> and Ogée, Jérôme<sup>1</sup>

<sup>1</sup>INRA EPHYSE UR1263, Bordeaux, France

<sup>2</sup>University of Cambridge, Department of Plant Sciences, Cambridge, UK

<sup>3</sup>University of Helsinki, Helsinki, Finland

<sup>4</sup>INRA BIOGECO UMR1202, Bordeaux, France

<sup>5</sup>The University of Cambridge, Department of Earth Sciences, Cambridge

<sup>6</sup>LSCE, CEA/CNRS, 91191, Paris, France

<sup>7</sup>Chair of Meteorology, Technische Universität Dresden, Tharandt, Germany

<sup>8</sup>BIOEMCO- Université Pierre et Marie Curie, Thiverval-Grignon, France

<sup>9</sup>Weizmann Institute of Science, Rehovot, Israel

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 ( $\geq 3$  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.