

EGU21-2151, updated on 29 Nov 2022

<https://doi.org/10.5194/egusphere-egu21-2151>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Reconstruction of the Southern Hemisphere climate over the past millennium taking into account explicitly the links between climate and tree growth with process-based dendroclimatic models

Jeanne Rezsöhazi<sup>1,2</sup>, Hugues Goosse<sup>1</sup>, Joël Guiot<sup>2</sup>, François Klein<sup>1</sup>, and Quentin Dalaiden<sup>1</sup>

<sup>1</sup>Université catholique de Louvain, Earth and Life Institute, Earth&Climate, Louvain-La-Neuve, Belgium

(jeanne.rezsohazi@uclouvain.be)

<sup>2</sup>Aix-Marseille Université, CNRS, IRD, CEREGE, Aix-en-Provence, France

Trees are one of the main archives to reconstruct past climate variability at the interannual scale. The links between tree-ring proxies and climate have usually been estimated on the basis of statistical approaches, assuming linear and stationary relationships. Yet, both assumptions can be inadequate. This issue can be overcome by the use of process-based dendroclimatic models. For example, MAIDEN (Modeling and Analysis In DENdroecology) is a mechanistic tree-growth model that simulates tree-ring growth starting from surface air temperature, precipitation and CO<sub>2</sub> daily inputs. VS-Lite (Vaganov-Shashkin Lite) is a simplified model that is more generally used in global applications and simulates unitless tree-growth indexes with monthly temperature and precipitation as inputs. In this study, we provide a climate reconstruction of continental temperature, precipitation and winds in the mid to high latitudes of the Southern Hemisphere over the last millennium that takes into account explicitly the links between climate and tree growth with process-based dendroclimatic models. To this end, an offline data assimilation procedure is used to combine the information from the physics of the climate system, as included in climate models, and paleoclimate records, in particular tree-ring width and ice cores records (snow accumulation and  $\delta^{18}\text{O}$ ). Those records are the best available continental proxies in the Southern Hemisphere continents (South America, Australia, Tasmania, New Zealand and Antarctica) for reconstructing the past climate. MAIDEN and VS-Lite are used here as proxy system models, also referred to as observation operators in data assimilation framework, to make the link between climate model outputs and indirect climate observations from tree-rings. The ice cores records are directly compared to the outputs of the climate model. More specifically, we evaluate the benefits of using tree-growth models such as VS-Lite and MAIDEN for reconstructing past climate with data assimilation compared to the commonly used linear regression.