

## ***Interactive comment on “An Overview on Isotopic Divergences – Causes for instability of Tree-Ring Isotopes and Climate Correlations” by Martine M. Savard and Valérie Daux***

**Martine M. Savard and Valérie Daux**

[martinem.savard@canada.ca](mailto:martinem.savard@canada.ca)

Received and published: 25 May 2020

MMS & VD - Here we only include replies to referee 2 comments that we have updated.

Anonymous Referee #2

Line 125. The Model "MAIDEN" is not well explained, so I recommend explaining it a little bit, so the reader can understand what the model it's all about.

REPLY – Lines 121-125 define the general approach to mechanistic modeling, which applies to MAIDEN as well as to the other models of the kind. We do not want to place too much emphasis on MAIDEN, but following the suggestion of referee 2, we explain

C1

briefly the main structure of MAIDENiso as follows (starting lines 129): Most models make forward predictions and allow verifying that the measured tree-ring isotopic trends compare well with the isotopic outputs modelled with the meteorological and non-meteorological inputs, and identifying processes behind isotopic responses. For instance, MAIDENiso is an expanded growth model which includes C and O modules. The model allows reproducing fractionation of carbon isotopes due to atmospheric CO<sub>2</sub> diffusion to the site of carboxylation, enzymatic photosynthesis and respiration, and estimates oxygen isotopes in precipitation, soil water and xylem water, and the fractionation in leaves due to evapotranspiration and biochemical formation of cellulose (details in Danis et al., 2012; Boucher et al., 2014).

Line 131 The citation for the Vaganov model it should be correctly cited, or add the papers where Vaganov published originally, then, of course, you can use other citations as usage examples.

REPLY – Good point. We will correct the name of the model and will refer to Vaganov et al., 2011. The text will read as follows: “Also considering process-based approaches, climatologists refer to the so-called proxy-system models (e.g., the Vaganov-Shashkin or VS model; Vaganov et al., 2011; Sánchez-Salguero et al., 2017).

Line 89 and Line 359 The percentage of oxygen isotope exchange during cellulose synthesis, as you mention, can indeed be variable. Recently there is a published paper addressing this same possibility and highlights some of the possible hypotheses that can be involved in such phenomena. Probably this is a reference you might be interested in exploring. *New Phytologist* (2020) doi: 10.1111/nph.16484

REPLY – Good point; this newly published reference is pertinent. We will add a citation to this article at former line 359 and add the full reference to the final list. The text will read: “However, this proportion may vary over growing seasons and longer periods due to relative humidity conditions (Gessler et al., 2009; Szejner et al., 2020).”

Line 253 The PIN correction of the pCO<sub>2</sub> influence on the D13C discrimina-

C2

tion should be double-checked. I think Gagen et al. 2007 made the first mention of the Pin correction that I know of. *The Holocene*, 17(4), 435–446. <https://doi.org/10.1177/0959683607077012>

REPLY – Correct. We add a citation to Gagen et al., 2007 before the citation to McCarroll et al., 2009, which describes six steps in the application of the method. The modified text will be: A widespread corrective approach uses a conditional, pre-industrial (pin) correction (Gagen et al., 2007). This six-steps non linear detrending of the low-frequency changes (McCarroll et al., 2009) better works when the measured  $\delta^{13}\text{C}$  series starts before or at the beginning of the industrial period (1850), otherwise. . .

Line 206 Another recent publication Citation that you might be interested in exploring about age effects in Tree ring isotopes is from Xu et al. 2020. I think this is relevant to your review as it addresses the age-related effect concerning Climate reconstructions. 2020 *Journal of Geophysical Research: Biogeosciences*, 0–2. <https://doi.org/10.1029/2019JG005513>

REPLY – Good point; this freshly appeared reference is pertinent. We will add the text below with the citation to this article at the end of the last paragraph in section 3.2, and add the full reference to the final list. Text: Finally, in some cases, though there is no trend in the tree-ring isotopic series, the response to climate in the isotopic chronologies may be age-dependent. For instance, in *Picea Schrenkiana* from northwestern China,  $\delta^{18}\text{O}$  and  $\delta^{13}\text{C}$  values in trees under 125 years have stronger response to relative humidity than trees older than 270 years (Xu et al., 2020). The diminution of the strength of the correlations with tree age advocates for the incorporation of young trees only to develop a non-divergent composite chronology.

---

Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2020-28>, 2020.