

Interactive comment on “Modelling tree-ring cellulose $\delta^{18}\text{O}$ variations of two temperature-sensitive tree species from North and South America” by Aliénor Lavergne et al.

Anonymous Referee #2

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This paper is a welcome addition to the literature on tree ring isotopes and their potential to enrich palaeoclimate reconstructions. Application of the MAIDENiso (MI) model to two different species in two different environments was undertaken, and both of the target species have the potential to provide longer palaeoclimate reconstructions. The main aims are made clear from the outset: to evaluate if MI can simulate d^{18}O of tree rings, to identify physical processes that control d^{18}O of tree rings using mechanistic modeling, and assess the origin of how temperature is recorded in both target species. The mixture of settings and hemispheres is also nice to see. I was also delighted by the fact that this is a well-written paper, and I enjoyed reading it.

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I have only a few main comments that I believe can help, and a handful of minor ones. For Section 2.4. Estimation of parameters, I believe this is one of the more important elements of the study. It is my opinion here because in some cases, a range of unknowns need to be assumed or tested in a hierarchical way where observations are sparse. It might be good to mention other studies to the readers that have grappled with this issue in this section. For example, a range of unknown parameters for a Southern Hemisphere species with dendroclimatic potential was recently examined using a mechanistic model that augmented Barbour, Roden, Farquhar and Ehleringer (BRFE04). The ranges of some unknown parameters were tested simultaneously against a mean $\delta^{18}\text{O}$ chronology while others were empirically derived (Lorrey et al., 2016). The code for the model described in that paper can be found here: https://github.com/nicolasfauchereau/model_isotope

I can appreciate that some elements of MI will be different from other mechanistic models that have come before, so my pointing to the aforementioned resource is not to state it is better (or to get it cited), but rather suggesting that a myriad of modelling approaches can be helpful for distilling and probing important issues for isotope dendroclimatology.

It would also be really nice if a diagram that shows how the MI model was constructed (the main componentry and inputs, for example) could be included either in the main paper or the supplement.

Minor comments. 118-120. Reword this please as: The chronologies that were built for each species were significantly correlated between stands (Figure 1). This supported the construction of a combined isotope chronology for both the northeastern Canada and western Argentina sites. 124. please provide reference for MAIDENiso again here. If you can please provide links to the code for this model, it would be appreciated. 162. can you please cite any IAEA studies where the closest measurements would be, or have a look at whether anything useful can be gleaned from the data underpinning the online isotopes in precipitation calculator 164. First. Not Firstly. Prettification of

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words by adding 'ly' is not correct grammar. 175. As above with secondly. Second. 180. can you please spell out the acronym for LMDZ5A, and also fully spell out National Centers for Environmental Protection (NCEP), as well as fully refer to the 20th Century Reanalysis (20CR) 202. I see 20CRv2c mentioned here; it should be fine, but please explain why this reanalysis dataset is chosen over something like NCEP1 or ERA-Interim. 250. Lorrey et al. (2016) evaluated the outcomes of iterative changes to unknown parameters for a d18O model output in a similar way for NZ kauri (mentioned above). This appears to be a standard way to evaluate how well a mechanistic model does for d18Otr, in a simple way. I would just mention here a range of studies that may have undertaken a similar approach to show it is an acceptable method for evaluation. 318. Leaf water enrichment (are underscores needed?) 324. Last sentence. Can you please expand on this statement just a little bit more, for clarity? 348. '...agreement with previous work (Rozanski et al)' 356. Reword to start "In contrast, in northeastern Canada...". 362. Reword to start "Of interest, the ...". 374. Reword to say "Although isotope-enabled atmospheric global models can reproduce the mean annual precipitation isotopic values and seasonality for many areas (Risi et al)...". 385. Also mention here that the IAEA datasets that had a good deal of chemistry run on them in the 1970-80s may have been compromised by pan evaporation and therefore enrichment. Have to treat many of those extant (older) data sources very carefully. 471. Firstly. As above. 473. Secondly. As above. 475. Last instead of Finally. References. Some errors with author names (Farquhar was one) please check this carefully.

Lorrey, A.M., Brookman, T., Evans, M.N., Fauchereau, N.C., Barbour, M.M, Macinnis-Ng, C., Criscitiello, A.S., Eischeid, G., Horton, T.W., Fowler, A.M., Schrag, D.P. 2016. Stable oxygen isotope signatures of early season wood in New Zealand kauri (*Agathis australis*) tree rings: Prospects for palaeoclimate reconstruction. *Dendrochronologia*, 40, 50-63.

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