Dear editor and reviewers, we would like first to thank you for your useful feedbacks and comments on our manuscript. You can find here below the Referee’s comments in *italics* and our answer in blue. In **bold**, you can find the modifications that will be made to the manuscript.

Referee#1 Vladimir Shishov

The paper “Application and evaluation of the dendroclimatic process-based model MAIDEN during the last century in Canada and Europe” by Rezsöhazy et al. is a good example to explain specifics of MAIDEN model application taking into account a complexity of such multidimensional tool to simulate tree growth under climatic influence in different environments. The overall impression of the paper is very good. The logical structure of the manuscript, a detailed description of the parametrization procedure of the model itself and skills comparison of two models: VS-Lite and MAIDEN are noteworthy. I want to underline that the parametrization of such models, their calibration and verification is a key point to apply correctly a tree-growth simulation in different habitats.

We would like to warmly thank the Referee for this very positive general feedback, for the careful evaluation of our manuscript as well as for the useful comments that will be addressed in the revised version as specified here below.

The authors mentioned that their “results provide a protocol for the application of MAIDEN to potentially any site with tree-ring width data in the extratropical region”. I am wondering did the authors make the MAIDEN code available in some open-access depository to use it for wider group of researchers. I am sure the tables of optimal parameter values for some sites as well as corresponded climate data and tree-ring chronologies putting on-line will allow to make the model itself more applicable in the research community.

I suggest that the paper can be published after minor revision.

We agree with the Referee that an open-access depository with results and data from the paper would be worthwhile. Currently, all climatic data are publicly available (except NRCAN that is available on request) and the links for downloading them will be added to the manuscript. The links to access the European tree-ring width data will also be added. For the Eastern Canadian taiga sites from Nicault et al. (2014) and Boucher et al. (2017) that has been used in the paper, an online reference will be provided in the paper, that links to a web site under development to share the tree-ring network of Québec-Labrador from which the Canadian data in the manuscript come: http://dendro-qc-lab.ca/trw.html. Finally, the parameters values will be added in the supplementary material, following to another comment from the Referee (see below).

The structure of the MAIDEN model is visible online (https://figshare.com/articles/MAIDEN_ecophysiological_forest_model/5446435/1) and its modules are available upon request.

Specific comments

Section 100 “...the ongoing phenological phase (five phases per year: winter 1, winter 2, budburst, summer and fall)” Could the authors explain what is the difference between winter1 and winter 2 phenological phases?

The explanation will be added to the text on lines 103-104 (p.4), as follows: "(five phases per year: **winter 1 with no accumulation of growing degree days (GDD), winter 2 with active GDD accumulation**, budburst, summer and fall)".

Section 125 "Those chronologies have been standardized using the Age-Band Regional Curve Standardization (or RCS) method". Did the authors use pith estimations for individual tree-ring series? Did the authors split fast and slow growing trees to avoid end-effect bias?

We would like to highlight that the tree-ring series were compiled before this article. All trees were dated and measured on cross-sections sampled at breast height (1.3m). The pith offset was done one for all trees. All samples were collected on dominant trees growing in homogeneous forests and it was not necessary to separate fast-growing trees from slow growing trees in such conditions.

Accordingly, we will add the following information to the manuscript, on lines 129-131 (p.5):
"A network of tree-ring width chronologies of Picea mariana collected in similar conditions is available for the Eastern Canadian taiga (Nicault et al., 2014; Boucher et al., 2017). **The tree-ring series were compiled before this article.** Those chronologies have been previously standardized using the Age-Band Regional Curve Standardization (or RCS) method by Briffa et al. (2001) **and further applied to a similar boreal dataset by Nicault et al. (2014).**"

Similarly, the same information will be added on lines 159-160 (p.6) for the European sites:
"**Similarly to the Eastern Canadian taiga chronologies, the tree-ring series were compiled before this article.**"

Section 135 "...we get five aggregated sites (Table 1)" What are intersite correlations (Rbar) between tree-ring chronologies at the same one-degree grid? Could the authors clarity this point in the paper?

Proximity between sites was used as a criterion for building our aggregated chronologies because we assume that we can reduce the non-climatic noise in low-replicated chronologies by averaging close chronologies. A one degree grid appears to us as an objective way to merge sites together. The intersite correlations between tree-ring chronologies (chronologies inside the same one-degree grid have the same colour) is presented here below (all significant at a confidence level of 99%).

The average intersite correlations for all aggregated sites will be added to the manuscript on lines 142-143 (p.5), as follows: "**The aggregation allows us to get relatively good inter-sites correlations inside the same one-degree grid, ranging from 0.442 to 0.732 with an average of 0.558.**".

	WCORPL	WNFL1V	WNFLR1	WDA1R	WTHH	WROZM	WROZX	WHER	WHH1	WHM1	WHM2
WCORILE	0.692	0.539	0.624	0.626	0.643	0.653	0.588	0.472	0.374	0.586	0.461
WCORPL		0.492	0.577	0.537	0.329	0.497	0.731	0.504	0.587	0.581	0.570
WNFL1V			0.509	0.235	0.239	0.466	0.400	0.241	0.135	0.280	0.456
WNFLR1				0.541	0.177	0.541	0.662	0.389	0.313	0.429	0.333
WDA1R					0.442	0.621	0.586	0.303	0.548	0.579	0.493
WTHH						0.494	0.140	0.222	0.025	0.535	0.296
WROZM							0.582	0.331	0.349	0.598	0.499
WROZX								0.548	0.641	0.528	0.518
WHER									0.485	0.501	0.454
WHH1										0.589	0.593
WHM1											0.732
WHM2											

Section 135 “This observational network represents an archetypal example of a singular species that covers an important hydroclimatic gradient” Why is the gradient important? Could the authors explain it?

Sites located along the western (near James Bay, WNFL1V) and eastern (near Labrador sea, WL32) margins of the study area present the warmest growing seasons in the network (864 growing degree-days >5°C for the 1976-2005 period, Hutchinson et al., 2009). Sites located in the center of the Quebec-Labrador peninsula (WHM2) present a much shorter growing season (692 growing degree-days >5°C) much like the sites located further north (WLECA, 573 growing degree-days >5°C). Annual precipitation increase from west to east, passing from 668 mm (WNFL1V) to 907 mm (WL32) but significantly decrease with latitude, reaching only 567 mm (WLECA) for the 1976-2005 period (Hutchinson et al, 2009).

The manuscript will be modified accordingly on lines 144-151 (p.5), as follows: “This observational network represents an archetypal example of a singular species that covers an important hydroclimatic gradient. **Sites located along the western (near James Bay, WNFLV1, Fig. 1a) and eastern (near Labrador sea, WL32, Fig. 1a) margins of the study area present the warmest growing seasons in the network (864 growing degree-days above 5° for the 1976-2005 period, Hutchinson et al., 2009). Sites located in the center of the Quebec-Labrador peninsula (WHM2, Fig. 1a) present a much shorter growing season (692 growing degree-days above 5°), much like the sites located further north (WLECA, Fig. 1a, 573 growing degree-days above 5°). Annual precipitation increases from west to east, passing from 668 mm (WNFLV1, Fig. 1a) to 907 mm (WL32, Fig. 1a), and significantly decreases with latitude, reaching only 567 mm at WLECA (Fig. 1a) for the 1976-2005 period (Hutchinson et al., 2009). This makes it a relevant candidate for our calibration and validation exercises.**”

Section 170 “The comparison relies on the computation of the model likelihood defined as the sum of the logarithms of the normal probability densities of the residuals between the model simulation and the observations”. Why the authors use the logarithms of the normal probability densities of the residuals? Are the residuals non-normal distributed? It seems to me by such transformation the authors tried to adopt the Markov chains procedure to their parametrization taking into account strong requirement of data normality in Markov processes.

The logarithmic transformation appears to us as a common operation to maximise likelihood in Bayesian statistics for reasons of algebraic simplicity as well as numerical stability, as mentioned in Vrugt (2016, p.275, just before equation (8)). This paper also presents the DREAM software that we use for the Bayesian calibration of our selected parameters.

Vrugt, J.A.: Markov chain Monte Carlo simulation using the DREAM sofware package: Theory, concepts, and MATLAB implementation, Environmental Modelling & Software, 75, 273-316, 2016.

Section 190 "Pearson correlation coefficients between observed TRW and simulated Dstem were computed, as well as the corresponding confidence level" Pearson correlation is not enough to guarantee a convergence of simulated curve with initial chronology. Why did not the authors use an additional criterion such as RMSE minimising or others?

We agree with the Referee that other indicators could have been used for the analysis. We wanted to only use one indicator in order to simplify the message but in the future, other statistical measures could be considered for a more careful evaluation of our method. We also would like to highlight that because of the normalization of both observations and simulations (due to different units), some indicators like RMSE do not bring much new information compared to correlations.

Section 200 "The VS-Lite parameters are calibrated at each location..." How many parameters were optimized keeping in mind that overall 11 of them were used in the VS-lite? Could the authors describe them more precisely in the ms.

Four VS-Lite parameters, corresponding to the lower and upper temperature (T_1 and T_2 in Tolwinski-Ward et al., 2011) and soil moisture (M_1 and M_2 in Tolwinski-Ward et al., 2011) thresholds of the model, have been optimized using the Matlab code from Tolwinski-Ward et al. (2013). The other parameters have been kept to default values. This information will be added to the manuscript on lines 224-226 (p.10), as follows: "The VS-Lite parameters are calibrated at each location following a bayesian approach described in Tolwinski-Ward et al. (2013). **In this study, four VS-Lite parameters, corresponding to the lower and upper temperature (respectively T_1 and T_2 in Tolwinski-Ward et al., 2011) and soil moisture (respectively M_1 and M_2 in Tolwinski-Ward et al., 2011) thresholds of the model, have been optimized. The other parameters have been kept to default values**."

Supplementary materials. Could the authors include the table with the optimal MAIDEN and VS-lite parameter values for all sites in Canada and Europe?

We will add the tables in the supplementary materials for all 21 Canadian sites, 5 aggregated Canadian sites and three European sites (1950-2000).

Supplementary materials. Among with Fig. S2, S3 could the authors include the obtained distributions of the MAIDEN parameters?

We will add the figures in the supplementary materials for all 21 Canadian sites, 5 aggregated Canadian sites (NRCAN high-resolution dataset) and three European sites (GHCN high-resolution dataset). The high-resolution dataset is the most relevant considering our results and adding more distributions to the supplementary materials will result in a high number of pages.

Supplementary materials. Could the authors include the obtained distribution of the VS-lite *parameters?*

For technical reasons, and as the paper focusses on MAIDEN, we are unfortunately not able to provide the distributions that would correspond to several additional figures in an already long supplement.