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Climate of the Past Discussions

Interactive comment on "Extracting a common high frequency signal from northern Quebec black spruce tree-rings with a Bayesian hierarchical model" *by* J.-J. Boreux et al.

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This paper presents an approach for extracting a common signal from tree-rings. It is innovative regarding classical dendroclimatology methods because 1. it considers the extraction of a "common" signal which is assumed to be climatic. This is done without the help of climatic records (blind extraction of the signal), 2. it uses an up-to-date statistical modelling, namely Bayesian Hierarchical Model and an adapted inference algorithm. I therefore recommend its publication after major changes 1. strong and detailed arguments for the use of "blind extraction" instead of classic climate-ring width modelling (I think this is the innovative point of the method) 2. more details and

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clarification of the model's temporal feature. There is presently a mix between inter-annual/high frequency/temporal correlation 3. a defence in the context of climatology of your waste of data when discarding all information after the youngest tree 4. slight change of the level of speech: less statistics and more interpretation, climatology and dendroclimatology

I develop these points in the general comments.

General comments

1. About the "blind extraction". I think this is the innovative point of the method. It could open new ways for the analysis and understanding of the relations between climate and tree ring widths. It constitutes half of the work needed for climate reconstruction using tree ring and may have other interests for people dealing with tree ring. I do not agree with your poor (and bad) justification for such an approach (p799 l20..) "The main reason for such a choice is based on the intrinsic difficulties in linking tree-ring growths to specific explanatory variables and in interpreting these relationships." There exist numerous good reasons to use your blind extraction and you have to develop them if you want its publication (and use in the future). My suggestion is to have a discussion around the "blind-test" used in medical studies (allowing less subjective linking between climate and tree rings). Moreover you propose a new tool which helps in realising only half of the dendroclimatological work. This makes it an useless tool at the moment. You then have to propose reliable ways to fulfil climate reconstruction work. This problem is critical because your model transforms several trees into an unique, perfect, tree. In statistical words you transform a set of multi-realisations of a complex tree-growth process into a mean tree-growth process. How does this mean process can be linked (technically and theoretically) to climate ? You could propose to simulate "trees" using your model... This discussion must be extended in the conclusion.

2. Please clarify my confusion between inter-annual signal which is reconstructed, the term high-frequency and latter the analysis of temporal correlation in the model. I think

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this is partly due to the lack of interpretation of the main Y_ts variable used in the model. If you consider a log-signal (log(X_ts)), making differences (Y_ts) removes long term variations in the original signal, I agree. Moreover Y_ts is the derivative of the signal log(X_ts). In this context, what is the meaning for correlation in the derivative ? By proposing an interpretation for the Y variable your model would become easier to understand.

4. You could easily change the level of speech. In this journal it seems me that the audience is more interested in dendroclimatology, new methods for reconstruction, their potential etc. I try to indicate the lines where statistics are over-represented in the specific comments.

Specific comments

p798 l1: I do not understand the 1st phrase

p798 l8..10: What is the criteria for "success" ? Maybe you can remove this statement.

p798 l14: interannual high frequency signal ? Maybe you would say "interannual signal which reflects high frequency" or just "interannual" ?

p799 l17: "past" method ? Please, use a more concise vocabulary.

p799 l20..25: See comment 1. This is a very bad justification: "too hard for us". Explain and extend. The sentence "it is not always clear...". Certainly but it could be modelled, tested, etc.

p799 l28: "By bypassing this selection, our strategy is to let the raw data speak for themselves". Which selection ? In paleoclimatology it is often called calibration. It is not formal language and it do not have meaning.

p800 l3..4: Validation scheme ? To validate an unknown signal ? A better application may be to calibrate a relation between signal and climate ?

p800 l5..25: Please, be more precise. Instead of "BHMs handle elegantly and effi-

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ciently the uncertainty assessment of each layer by clearly identifying priors and posterior distributions of underlining processes" you could explain what is a prior, a posterior... Your explanation does not provide information to non-Bayesian readers and is useless for Bayesians. You justify the use of BHM saying that you are not the first. Maybe it is not very attractive.

p801 l1: The Bayesian paradigm do not have the monopoly on unobserved variables (but on priors). You could do it using Maximum likelihood paradigm and use MCEM type algorithms for inference.

p801 l2..15: Be more precise and direct, please.

p802 l15: I think this is the LEFT panel (l18, the same)

p802 l23: THIS issue (not with).

p802 l25: see comment 3: "inter-annual high frequency" + non-parametric not necessary.

p804 l26: A Gamma prior with parameter equal to 0 is not Gamma and thus an improper prior. You could propose very little parameter values or state "improper prior" but then you loose conjugacy properties. I note that you live in a Gaussian world !

p805 l1..5: In doing so you are defending the idea that your process can be mathematically undefined (with no meaning). Do you think that data are intelligent and choose the right model ? Personally I prefer to impose a defined model. It seems me that it is not a discussion for a paleoclimatology journal.

p805 l16: Please, cite R. You just have to start R and type >citation().

p805 l21..23: You mean that lambda an Z are not identifiable ? How did you solved this problem ? Does your algorithm converge ?

p806 l5..9: I do not understand the validation because a) you compare the method with another which is not based on the same assumptions. b) your only argu-

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ment/interpretation is "it is the same as older method". Please develop and change the argument because we could think that if the result is the same it is easier to use older methods. You could also compare your method to an arithmetic mean of the logratio transformed series. Presenting the mean and quantile of this very quick and dirty method which is based on your transformation, you could appreciate and show us what is the difference with your "elegant and efficient" method ?

p806 l11: Sometime you use 90% confidence intervals, here a 50% one. Do you try to hide something ? Is it significant at a 90% or 95% level ???

p806 l12: Why is it interesting to see that the value is in [-1,1] instead of their prior ??? I think that this point (see comment before) is useless.

p806 l23: "To check the quality of YOUR reconstruction" It is not my reconstruction.

p807 l6: Not so sure that it is very "elegant". It is very Gaussian for sure. The temporal structure in the derivative of the signal or the interannual signal. This definitely have not the same meaning. I cannot interpret something like "a year have been better than the preceding and then will be worst than the following". This is how I understand your model's structure.

p807 l20: This new tool in the toolbox will stay useless until 1. You do not link it to climate and 2. You waste a lot of data using the shortest tree available. You must discuss these two points in the conclusion.

Appendix : Problem with the parameters of the priors equals to 0. It implies an improper prior.

Fig2: You could align the trees ?

Fig4: Explain the dashed line in the graph. Please compare it to a naive average method based on your transformation.

Interactive comment on Clim. Past Discuss., 5, 797, 2009.