Subject: Re: Tree ring questions
From: "gantois, josephine" <josephine.gantois@ubc.ca>
Date: 1/29/22, 1:27 AM
To: "Wolkovich, Elizabeth" <e.wolkovich@ubc.ca>

Hello Lizzie,

Thank you for reaching out with followup comments. Here are some answers:

(1) I use all the tree ring data from the International Tree-Ring Data Bank that comes from the contiguous US and overlaps the 1901-2016 period. As you suggest there is usually a strong focus on specific species, and that focus is location-specific. This is why I estimate separate temperature response curves by ecoregion and not by species (many ecoregions have a single dominant species in that data, and even when there is more than 1 well represented species in an ecoregion, those species do not overlap much spatially, so I cannot say if differences in response are due to differences in species or to differences in sub-climates).

(2) I had actually read that paper and enjoyed it (I love this kind of methodological exploration!). I looked at it again more closely and I feel like the way I have set up the problem is a little different. What I show in my work is that tree growth responds non-linearly to temperature, as measured in degree-days. So an extra degree-day during the year is going to have a different impact on annual tree growth, depending on whether that degree-day is below or above a certain threshold (to estimate these impacts, I regress log tree growth on an annual sum of low degree days and an annual sum of high degree days). The threshold at which the non-linearity occurs is actually quite low (around 20°C for example in the ecoregion that includes Seattle), which means that the negative impact of "high" degree days that I see applies to temperatures that are not necessarily that high.

The implication for the divergence problem then is that regressing annual tree growth on an annual (or seasonal) average of temperature, means averaging over the non-linear response to degree days. If the temperature distribution at northern latitudes shifts, but the underlying biology (response of tree growth to degree days) doesn't, we might still see a weakening of the correlation between annual tree growth and the temperature aggregate, simply because the relative weights given to the positive low degree day impact and the negative high degree day impact are changing. I'm assuming here that the overall correlation between annual tree growth and annual average temperature is positive at northern latitudes.

There is one point where my work connects with that paper, if I understand it correctly. The impact of temperature that I measure reflects many different channels, including the impact of temperature on the rate of photosynthesis and respiration, the impact of temperature on tree growth via changes in soil moisture and vapor pressure deficit, and the impact of temperature on cambial reactivation. The latter is a thermal sum type of effect. So changes in the sensitivity to temperature of the timing of cambial reactivation, could reflect the statistical effect that you document. A remaining question is how much the relationship between tree growth and temperature at northern latitudes reflects changes in the timing of cambial reactivation.

I hope that I have understood your questions, I would be happy to answer followup comments.

I had actually intended to reach out to you for feedback on my work that maps changes in flowering phenology across the US. If you have any availability for a chat at some point (no rush on my end) let me know.

Best,

Joséphine

From: Wolkovich, Elizabeth

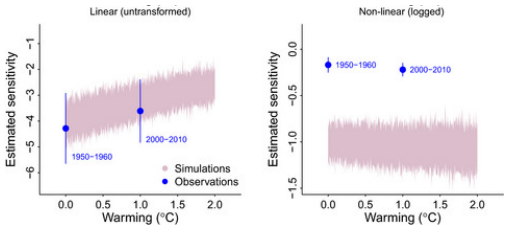
Sent: Monday, January 24, 2022 1:27:45 PM
To: gantois, josephine
Subject: Tree ring questions

Dear Dr. Gantois,

Apologies for the out-of-the-blue email. I watched your talk for the iBios position in IRES and had two questions for you. There's no rush to respond to these, especially if you're busy (and, to be clear, I am not in iBios, IRES, or in any way contributing to the job decision), but if you have time I was interested:

(1) I know you mentioned species was not in your tree ring model, but can you tell me what data you used? I suspect many would be concerned that part of the latitudinal trend could be in species turnover, but I also know dendro folks focus so strongly on certain species that perhaps this not an issue.

(2) I have been interested in the 'divergence' problem in dendro and wondering if it is just a statistical artifact. The non-linear response to mean temperatures is an interesting hypothesis, but I sort of doubt temperatures are getting that high. In contrast it could be an even simple non-linearity such as this one: https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15746 ... do you



A simple explanation for declining temperature sensitivity with warming - Wolkovich - 2021 - Global Change Biology - Wiley Online Library

onlinelibrary.wiley.com

Recently a growing body of literature has used shifting phenological sensitivities with higher temperatures as evidence that climate change is already reshaping fundamental biological processes. Here...

have any idea how thermal sum issues are accounted for in those models?

All the best,
Lizzie

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Attachments:

fig_ecoregionmap.png	511 KB
fig_speciesmap.png	586 KB