

Biogeosciences Discuss., referee comment RC2  
<https://doi.org/10.5194/bg-2022-191-RC2>, 2022  
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## **Comment on bg-2022-191**

Anonymous Referee #2

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Referee comment on "Revisiting and attributing the global controls over terrestrial ecosystem functions of climate and plant traits at FLUXNET sites via causal graphical models" by Haiyang Shi et al., Biogeosciences Discuss.,  
<https://doi.org/10.5194/bg-2022-191-RC2>, 2022

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### **Review of the manuscript 'Revisiting and attributing the global controls on terrestrial ecosystem functions of climate and plant traits at FLUXNET sites with causal networks'**

#### **1. General comments**

The study describes exemplarily the construction of a network linking plant traits and climatic drivers not only with a statistical background but by taking into account causal linkages. Using a Bayesian Network (BN), expert knowledge is introduced to evaluate the causal effects of climate variables for ecosystem functions. The main achievement and argument is that this type of analysis goes beyond usual statistical relationships which often fail to reveal indirect effects and trade-offs. Although this approach is appealing and from an ecological point of view very promising, the manuscript does not provide a proper validation of the method. The increasing availability of data such as collected within the FLUXNET community hopefully will further trigger new ways of exploring the connection of environmental conditions with the evolving plant community and at the same time allow to test and consolidate analysis tools. Here, the method would benefit from better methodological clarification, description of data use, validation and presentation of the results which are detailed below. The paper needs major revisions before publication.

#### **2. Specific comments**

- The text includes various repetitions when stressing that the new method is superior to usual analyses. Please be more concise when making this point (e.g. in introduction and discussion) or more specific when certain aspects are described in detail (e.g. in results). The re-occurring statement is not strengthening the argument.

- Although the data base for the BN is given in table 1 in detail, the choice of the variables does not become clear. Which variables were taken into account and why? Some variables are taken as is and some averaged. Please state as well the temporal resolutions of original variables and averages (why mean values and not medians?). Also the choice of the intervals for discretization (right column in table 1) is not motivated – please provide more detail and reasoning.

- The interesting part of constructing the BN in section 2.2 is not transparent. On which basis is the expert knowledge extracted from Reichstein et al. (2014) and how is it transferred to the BN? When the authors main agenda is to promote their new analysis method, it would be good to give more insights in the process of finding the linkages that should be considered.

- The result section would benefit from a better description of the results of both methods. Reducing the text with general statements should give enough space for guiding through figure 4 and highlighting the benefits of the second approach. How do you motivate this statement when e.g. comparing the results for AGB in the BN-plant-trait-climate in comparison to the BN-plant-trait?

- One major concern is a validation. A presentation of a data-driven method without a validation can hardly be recommended for publication. Please not only provide one but also make clear which data are used for building the model, getting the results and performing the validation.

### **3. Technical remarks**

L 20 and 31: The term 'emphasized' seems not appropriate in this context. Please be more specific what you mean here.

L 36: 'Changes in climate change' is misleading – please modify.

L 64: The sentence is very long and could be split into two.

L 67: Also very long sentence which makes me wonder, if you assume all relations in these systems to be causal, which they are of course not. Please clarify.

L 96: Including the cumulative soil water index means that a variable is chosen which is already the result of precipitation and evapotranspiration. How do you deal with the

interdependency of the variables?

Fig. 2: please explain the black dots in the figures.

L 142: Another very long sentence on a complex issue. A stepwise approach would increase readability.

L 163: How do you evaluate the compilation as being 'successful'? Which criteria are fulfilled?

Fig. 4: Values and text in the figure are very small. Why did you choose '?' as a separator between mean and standard deviation?

L 190: As an example for the wish for a better presentation of the results please give more reasoning for the statement that climate variables 'showed a role beyond plant traits'. Without an understandable link to the results shown, a sentence like this is appropriate in the discussion.

L 224: The methods described in the caption and the text should be moved to the methods section! Here, please elaborate more on the explanation of the very valuable figure 6.

L 281: The idea of extending the causal linkages to the temporal dimension is intriguing but opens the problem of non-independent variables. Do you have an idea how to treat causally linked and dependent variables in this approach?

L 308: Although the conclusions are free to mention related issues which are not part of the study, I would recommend to replace this last point e.g. by the importance of your findings for the modeling community.