Climate of the Past Discussions

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-189

Anonymous Referee #1

Referee comment on "Using a process-based dendroclimatic proxy system model in a data assimilation framework: a test case in the Southern Hemisphere over the past centuries" by Jeanne Rezsöhazy et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2021-189-RC1, 2022

General comments

The manuscript "Using a process-based dendroclimatic proxy system model in a data assimilation framework: a test case in the Southern Hemisphere over the past centuries" by Rezsöhazy et al. is a good example of using a process-based model MAIDEN as new tool in the assimilation-based climate (particularly, near-surface air temperature, precipitation and winds) reconstructions in the Southern Hemisphere over the last 400 years. I note that the Southern Hemisphere is poor investigated area in the context of climate reconstructions so far. Mostly the published long-term climate reconstructions are based on different regression approaches to make the link between the GCMs outputs and the proxy observations obtained from tree rings, ice cores, etc. In this work the authors made a considerable effort to use the process-based MAIDEN (that removes a number of limitations inherent in conventional regressions) as a proxy system model in a data assimilation procedure, using as a test the reconstructions of three climatic variables.

The paper is well structured and written. The introduction provided a comprehensive overview of the background information and the pertinent literature, and it demonstrated the need for the current study. They involved a wide range of statistical and modeling techniques, included original ideas, as well as several international global databases for testing their hypotheses and confirming their results.

But there is an issue which can be considered in the MS. The particle filter method described in Sect. 2.1 is not used often in research. Could the authors describe in details how were those climate particles used to adjust different climate reconstructions used as inputs of MAIDEN over the past 400 years (see the Section 2.4.1)? Could the authors produce some visualization (figure) how does this algorithm work? Is there some public domain where the code of the algorithm is located?

The principal idea of the MS is to use the certain process-based model as a proxy system model. What is a reason to use an additional proxy data (e.g. delta 18O) which was used in data assimilation procedure tradionally (through the linear regression)?

I would suggest to publish the MS after minor revisions.

Specific comments

Section 45: The term 'pseudoproxies' should be clarified.

Section 50: I would suggest to remove 'offline' because this term is introduced later in the MS.

Section 75: The term 'June-Jule year' should be clarified because this is the first mention of it in the work.

Section 80: A reference on the 'Bayes theorem' interpretation is needed!

Section 90: The statement "the predictability of the variables of interest is smaller than the temporal resolution of DA (i.e, one year in our study)" should be clarified with the corresponded reference.

Section 105: Is the code of the particle filter approach available in some public depository?

Section 105: What does 'chosen frequency' mean?

Section 125: The time span used in the work is the last 400 years. What was a reason to mention ‘July 850 – June 2005 CE time period’ as a time span ‘used in this study’?

Section 145: What was a standardization procedure of TRW data used taking into account a non-climate noise (e.g., age-dependent trends, etc) in raw TRW measurements?

Section 230: Why did the authors consider positive correlations only? Are the significant negative correlations worse?

Figure 2. The green dots should be highlighted stronger.

Figure 3. What does 'uncertainty' mean? This term should be clarified.

Section 370: What do ‘Aus_002 and SAm_24’ mean? Clarification is needed.