Point-by-point response to reviewer 2:

Dhyani et al. present a new summer temperature reconstruction derived from maximum latewood density from 55 *Pinus sylvestris* trees in the Lesser Caucasus, a region where information on past climate conditions are sparse. Thus, the authors indeed fill a critical spatial gap in mid-latitude tree-ring based temperature reconstructions. The paper is very well written and clearly structured.

The focus of the study which is expressed in the statement "Strong volcanic imprints contrast with a mild Little Ice Age" (LIA) is, however, too strong given that the reconstruction does not cover the full LIA (c. 1350 – 1850) and thus is lacking the long-term context and is missing much low-frequency temperature variations. Here, Samuli Helema and one reviewer already provided highly valuable and extensive comments on the issues on detrending and temporal coverage regarding the LIA. Considering those comments and thereby changing the focus of the paper towards highlighting the unprecedented 21th century warming would result in a much stronger paper.

Since major points were already addressed, I have only a few minor comments:

Response: We thank the reviewer for the positive evaluation of our manuscript and for recognizing its contribution in filling an important spatial gap in mid-latitude tree-ring based temperature reconstructions. We also appreciate the helpful suggestions for improving clarity and consistency throughout the manuscript. In line with this and the comments from other reviewers, we have revised the manuscript to reduce the emphasis on the LIA and instead highlight the robust findings of the study. The title, abstract, discussion, and conclusions have been adjusted accordingly.

l. 125: the abbreviation "TRW" is already introduced in line 55

Response: The abbreviation "TRW" has been removed.

l. 137: gridded data itself cannot apply a gap filling and I would suggest to rephrase the sentence to: "…for gridded data a robust sophisticated gap filling was applied…"

Response: The sentence has been rephrased to "We used the three nearest gridded temperature data points from the CRU TS 4.09 dataset, which is a pre-processed product derived through interpolation of monthly climate anomalies from extensive weather station observations and provides continuous monthly mean temperatures from 1901 to most recent available period"

l. 141: the second part of the sentence "the correlation between the averaged station-based and CRU-based time series" is redundant and thus can be removed

Response: The sentence has been removed.

l. 155 and 165: For the reconstruction a nested approach was chosen where MXD values are dropped and new nest chronologies developed. The development of this "final MXD chronology using bi-weight robust means" is actually not necessary, only when using it for the climate growth analysis. Please clarify. Also, state what data were used for the nested approach, the 55 individual detrended MXD series?

Response: The description has been revised in the section 2.7 to clarify that the nested approach is based on the 73 detrended individual MXD series from which successive nest chronologies are developed by reducing replication.

l. 159–161: use “detrended MXD chronology” and delete “or seasonal”

Response: Revised as suggested.

l. 173: use “nest chronology” throughout when referring to those as it could be otherwise confusing

Response: “nest chronology” is now used consistently throughout the manuscript.

l. 202: Numbers until nine are written in full and hence, change “6 years” to “six years”. Please revise the manuscript accordingly.

Response: Revised as suggested.

l. 248: I find that the cold extremes are quite well distributed across the 300 years with three each in the 18th and 19th century and four cold extremes in the 20th century (1700, 1701, 1781, 1810, 1816, 1817, 1914, 1956, 1959, 1967) and thus, I would not say that cold extremes are “clustered mainly in the early 1800s (e.g., 1810, 1816, 1817)”. Please rephrase.

Response: The sentence has been rephrased to “At the annual scale, the ten coldest years; 1700, 1701, 1781, 1810, 1816, 1817, 1914, 1956, 1959, 1967 (average anomaly of −1.84 °C) spread over the last three centuries with three each in the 18th (1700, 1701, 1781) and 19th (1810, 1816, 1817) century and four cold extremes in the 20th century (1914, 1956, 1959, 1967), while the nine warmest years; 2008, 2010, 2015, 2017, 2018, 2019, 2020, 2021, 2022 are exclusively concentrated in early 21st century.”

l. 270: when stating correlation coefficients, please use “r =” and for value ranges use a dash (–) (not hyphen). Please revise the manuscript accordingly, i.e. from line 210 onwards.

Response: Corrected as suggested.

l. 309: Specify, also throughout the manuscript, that the reconstructions represent the summer season only, thus state “observed June to September temperatures”.

Response: Revised as suggested.

Fig. 4: It is difficult to pinpoint the extreme years on the reconstruction using 100-year steps on the x-axis. Please add a finer x-axis labelling. Also the yellow band (outer nest 5–95% band) is not really discernible and thus, please change colour.

Response: Fig. 4 has been revised as suggested.

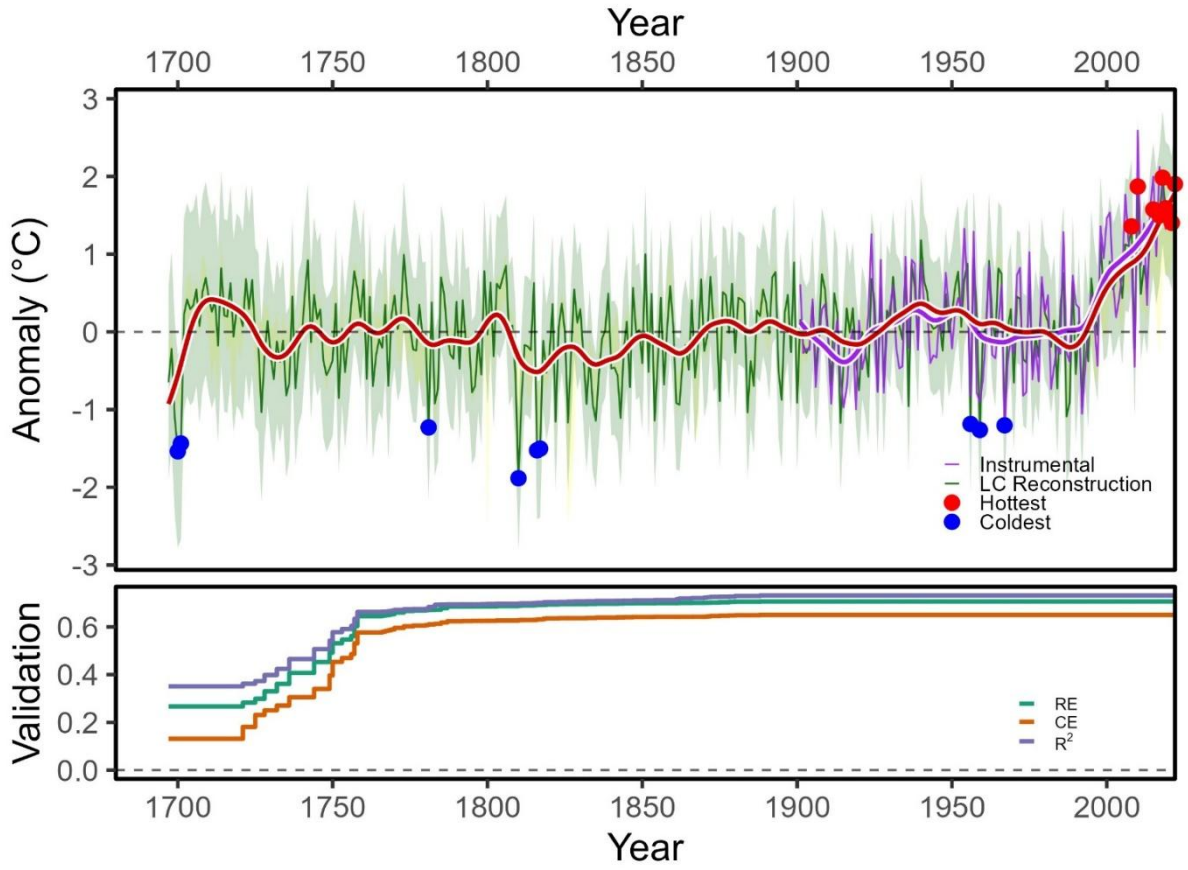

Figure 4: Reconstructed and observed JJAS temperature anomalies (°C) for 1697-2022 relative to 1961–1990. The LC reconstruction is shown as a thin dark-green line with a 20-yr spline (bold red line); instrumental temperature appears as the thin purple line with a 20-yr spline (bold purple line). Calibration uncertainty is conveyed by the inner ±2σ model band (light green) and the sampling uncertainty is shown by outer nest 5–95% band (yellow). Red and blue circles mark the 10 hottest and coldest reconstructed years, respectively. The bottom panel shows median RE, CE, and R^2 across nests and the dashed horizontal line indicates zero skill.

Fig. 5: It might be not clear to all readers what NTREND is referring to. Add reference and also the description of the spatial correlation in chapter 2.7.

Response: We have added a reference in the caption of Fig.5 and the description of the NTREND dataset in section 2.7 to clarify its meaning and context for readers. The description of spatial correlation is already described in section 3.3.