Response to Anonymous Referee #1

Below, we provide a point-by-point response to each comment. The reviewer's comments are shown in black italics, our responses in blue, and the revised text in red (*Reviewer comment*, Response, Revised text).

Anonymous Referee #1:

The study by Lin et al. presents three new oxygen-18 tree ring cellulose chronologies (d18Otrc) from the Eastern European Plain. The authors present an investigation of the climate signal in the d18Otrc, identifying the regional differences in the hydroclimate response of d18Otrc, including a comparison to the climate signal in traditional tree ring width (TRW) records. The main conclusion is that d18Otrc from the Eastern European Plain is a superior hydroclimate proxy compared to TRW records, and that long-term records for this region can provide important climate constraints for hydroclimate reconstructions and provide context for current and future climate change.

The manuscript is well-written with clearly defined scientific objectives, and the evaluation of the d18Otrc is well designed with extensive testing with reference data ranging from meteorological station data (Temp., precip.), gridded climate data sets (Temp., Rh, …), and output from an isotope enabled climate model (ECHAM5-wiso). References to existing literature is present where appropriate, and references are generally up-to-date, including background information in the introduction and theoretical considerations about the climate signal in d18Otrc and the role of tree physiology.

In conclusion, I consider the study by Lin et al. to be mature and close to be ready for publication after minor revisions taking into account the comments below.

We thank the reviewer for the positive and encouraging assessment of our manuscript. We have carefully considered all comments and suggestions and have revised the manuscript accordingly, as detailed in our responses below.

Specific comments.

Comments 1: *The authors compare to the climate signal in TRW, but there hardly any mention about maximum late wood density (MXD), which is commonly considered to have a stronger link to climate. Please explain why or add a discussion related to this.*

Response 1: Thank you for your comment. We agree that maximum latewood density (MXD) is an important tree-ring climate proxy, particularly in temperature-limited high-latitude and high-elevation regions, where its warm-season temperature response is often stronger than that of tree-ring width (TRW) (Frank and Esper, 2005; Björklund et al., 2019). In contrast, the main focus of the present study is to evaluate the hydroclimatic information recorded by tree-ring proxies. Compared with MXD, TRW chronologies and their climatic responses have been more extensively studied across the East European Plain, and the spatial differences in TRW climate signals along the latitudinal gradient are relatively well established. Previous studies have shown that the dominant climatic controls on TRW vary clearly along this gradient: TRW in the north is mainly limited by summer temperature, the central region is jointly influenced by temperature and moisture conditions, whereas the south gradually shifts toward warm-season moisture limitation (Matskovsky, 2016; Dolgova et al., 2022; Kuznetsova and Solomina, 2022). Therefore, TRW provides a suitable basis for consistent site-to-site comparisons along the latitudinal transect.

In addition, TRW chronologies have already been developed for all three study sites. Therefore, the main aim of this study is to evaluate the complementary hydroclimatic information provided by the newly developed $\delta^{18}O_{TRC}$ chronologies relative to the existing TRW records from the same sites, rather than to compare $\delta^{18}O_{TRC}$ with all available tree-ring proxies. We agree that MXD can provide important complementary information, particularly on warm-season temperature variability. Therefore, we have added a discussion of MXD and quantitative wood anatomy (QWA) as complementary proxies, as detailed below.

Added text in the Discussion (Lines 486–495): The contrasting climate responses of $\delta^{18}O_{TRC}$ and TRW observed in this study indicate that different tree-ring proxies record complementary climatic information. Previous studies have shown that, in temperature-limited environments, maximum latewood density (MXD) and some quantitative wood-anatomical traits generally exhibit stronger warm-season temperature signals than TRW and have been widely used to reconstruct warm-season temperature variability (Björklund et al., 2019, 2023). By contrast, stable carbon and oxygen isotopes can provide complementary information on tree physiological responses and hydroclimatic processes (McCarroll and Loader, 2004). Therefore, future multiproxy studies combining TRW, MXD, quantitative wood anatomy, and stable carbon and oxygen isotopes across the East European Plain could help more effectively disentangle regional temperature and moisture signals.

Comments 2: *Similarly, quantitative wood anatomy (QWA) analysis shows stronger climate signal than TRW and MXD (e.g., Björklund et al., 2023). Could QWA be a way to extract more climate information for your Eastern European Plain sites?*

Response 2: Thank you for your comment. We agree that quantitative wood anatomy (QWA) can provide climatic information at the cellular scale. Particularly in temperature-limited high-latitude environments, some wood-anatomical traits can exhibit stronger warm-season temperature signals than TRW and MXD and therefore have considerable potential for temperature reconstruction (Björklund et al., 2023). QWA could thus provide additional climatic information for the East European Plain, especially regarding warm-season temperature variability, whereas the main focus of the present study is to evaluate the hydroclimatic information recorded by tree-ring proxies.

As noted in Response 1, the present study primarily compares the newly developed $\delta^{18}O_{TRC}$ chronologies with the existing TRW chronologies from the same sites to evaluate the complementary hydroclimatic information provided by $\delta^{18}O_{TRC}$. We have therefore added a discussion highlighting the potential of future multiproxy studies combining QWA, MXD, TRW, and tree-ring stable isotopes to provide more comprehensive information on regional temperature and moisture variability. The corresponding added text is provided in Response 1.

Comments 3: *The three different sites show different seasonality in the relations to climate parameters. Can you provide explanations for this? For example, spring ground water recharge from snow melt at the northern site which could account for the lagged winter signal recorded in d18Otrc, or is regional differences in auto-correlation of climate parameters/weather patterns enough to result in spurious significant correlations (for example due to large scale winter variability (NAO/EA/SCA patterns, Comas-Bru & Hernández, 2018))?*

Response 3: Thank you for this comment. In addition to recording summer hydroclimatic signals, $\delta^{18}O_{TRC}$ at all three sites also shows relationships with temperature during the previous cold season and the current spring, although the strongest response windows differ among sites. The northern

site shows its strongest relationship with maximum temperature from March to September of the current year, whereas the central and southern sites show their strongest relationships with mean temperature from the previous October to the current September.

To examine whether these cross-seasonal signals could be caused by interseasonal temperature covariance, we further calculated the correlations between June–August mean temperature and mean temperature during the previous October–November and the current March–April (Table R1). The results show that only at the northern site was summer temperature significantly correlated with spring temperature ($r = 0.38$, $p < 0.01$), whereas all other correlations were not significant. Therefore, interseasonal temperature covariance may partly explain the extended spring–summer response window at the northern site, but cannot fully explain the preceding cold-season and spring temperature signals observed across all three sites.

As suggested by the reviewer, the preceding cold-season signal may also be related to the delayed influence of snow accumulation and snowmelt on tree source water. Cold-season precipitation can be stored as snow and subsequently enter soil water or shallow water reservoirs during spring snowmelt, where it may remain available for tree uptake during the growing season. A similar mechanism has been proposed to explain winter signals in Greenland tree-ring $\delta^{18}O$ records (Xu et al., 2021). However, because our study lacks direct observations of snowpack, soil-water isotopes, and xylem-water isotopes, this mechanism can only be considered a possible explanation.

We also examined the relationships between the three $\delta^{18}O_{TRC}$ chronologies and the North Atlantic Oscillation (NAO), East Atlantic (EA), and Scandinavian (SCAND) indices (Figure R1). These indices were obtained **from** the KNMI Climate Explorer. The results show no significant relationships at any of the three sites during the previous October–November. During March–April, only isolated significant relationships were observed, including a negative correlation between $\delta^{18}O_{TRC}$ and SCAND at the central site and a positive correlation between $\delta^{18}O_{TRC}$ and EA at the southern site. These relationships lack consistent spatial and seasonal patterns. Therefore, there is currently no clear evidence that NAO, EA, or SCAND provides a common explanation for the preceding cold-season and spring signals across the three sites.

Overall, neither interseasonal temperature covariance nor direct statistical relationships with large-scale circulation patterns are sufficient to explain the cross-seasonal temperature relationships observed across the three sites. Snowmelt and antecedent water storage may represent a possible mechanism, but the available data do not allow reliable attribution. We therefore provide these additional analyses in response to the reviewer's comment, but given the lack of a clear conclusion and the focus of this study on summer hydroclimate variability, we do not further elaborate on these possible mechanisms in the Discussion.

Table R1: Correlations between summer mean temperature and mean temperature during the previous October–November and the current March–April at the three study sites.

Site	JJA vs. previous Oct–Nov	JJA vs. Mar–Apr
Northern (1950-2021)	0.05 ($p > 0.05$)	0.38 ($p < 0.01$)
Central (1950-2020)	0.002 ($p > 0.05$)	0.16 ($p > 0.05$)
Southern (1950-2014)	0.24 ($p > 0.05$)	0.14 ($p > 0.05$)

JJA denotes June–August, previous Oct–Nov denotes October–November of the previous year, and Mar–Apr denotes March–April of the current year.

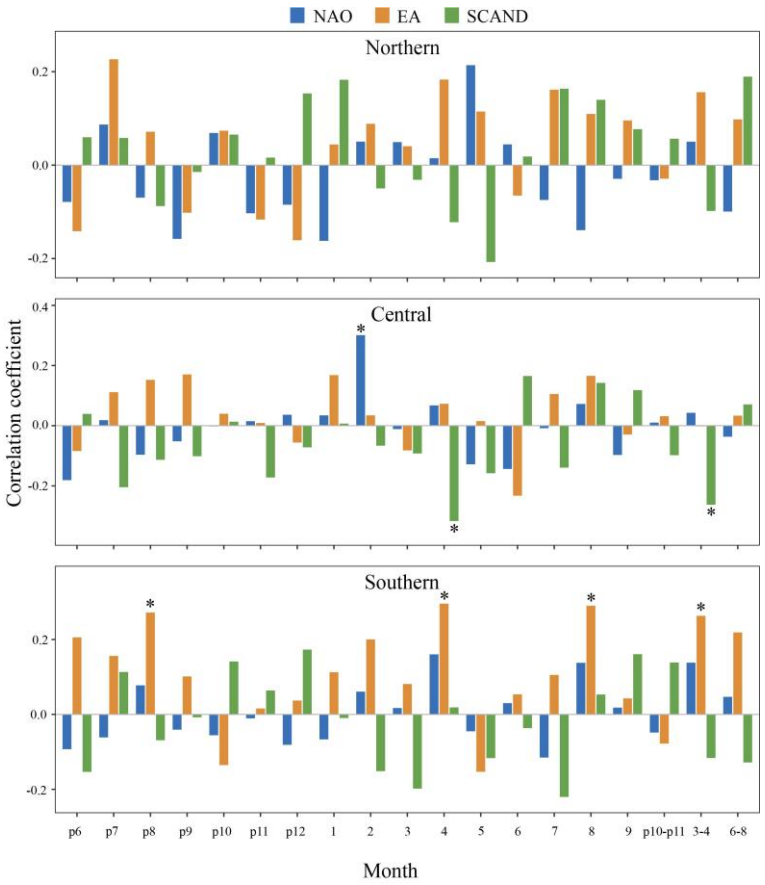


Figure R1: Correlations between the $\delta^{18}O_{TRC}$ chronologies and the NAO, EA, and SCAND indices at the three study sites. Asterisks indicate statistically significant correlations at $p < 0.05$.

References

Björklund, J., Seftigen, K., Stoffel, M. et al. Fennoscandian tree-ring anatomy shows a warmer modern than medieval climate. Nature 620, 97–103 (2023). https://doi.org/10.1038/s41586-023-06176-4

Comas-Bru, L. and Hernández, A.: Reconciling North Atlantic climate modes: revised monthly indices for the East Atlantic and the Scandinavian patterns beyond the 20th century, Earth Syst. Sci. Data, 10, 2329–2344, https://doi.org/10.5194/essd-10-2329-2018, 2018.

References cited in our response

Björklund, J., von Arx, G., Nievergelt, D., et al.: Scientific merits and analytical challenges of tree-ring densitometry, Rev. Geophys., 57, 1224–1264, https://doi.org/10.1029/2019RG000642, 2019.

Dolgova, E. A., Solomina, O. N., Matskovsky, V. V., et al.: Climate signal strength in tree-ring width of spruce growing in the Solovetsky Islands (Russia), Dendrochronologia, 76, 126012, https://doi.org/10.1016/j.dendro.2022.126012, 2022.

Frank, D. and Esper, J.: Temperature reconstructions and comparisons with instrumental data from a tree-ring network for the European Alps, Int. J. Climatol., 25, 1437–1454, https://doi.org/10.1002/joc.1210, 2005.

Kuznetsova, V. V. and Solomina, O. N.: Contrasting climate signals across a Scots pine (*Pinus sylvestris* L.) tree-ring network in the Middle Volga (European Russia), Dendrochronologia, 73, 125957, https://doi.org/10.1016/j.dendro.2022.125957, 2022.

Matskovsky, V.: Climatic signal in tree-ring width chronologies of conifers in European Russia, Int. J. Climatol., 36, 3398–3406, https://doi.org/10.1002/joc.4563, 2016.

Xu, C., Buckley, B. M., Wang, S.-Y. S., et al.: Oxygen isotopes in tree rings from Greenland: A new proxy of NAO, Atmosphere, 12, 39, https://doi.org/10.3390/atmos12010039, 2021.

Response to Anonymous Referee #2

Below, we provide a point-by-point response to each comment. The reviewer's comments are shown in black italics, our responses in blue, and the revised text in red (*Reviewer comment*, Response, Revised text).

Anonymous Referee #2:

This study by Lin et al. presents three tree-ring cellulose oxygen-isotope chronologies developed along a latitudinal gradient and evaluates their potential for reconstructing hydroclimatic variability across the East European Plain, a region where this proxy remains comparatively understudied.

The main finding from this study is that δ18OTRC retains stronger sensitivity to atmospheric moisture conditions than TRW at the wetter, temperature-limited northern and central sites, whereas TRW more directly reflects soil-moisture limitation at the drier southern site.

Overall, the study is well-organised and shows a clear main objective, consistently developed throughout the manuscript. The methods used for sample preparation and the general analytical framework are appropriate. The manuscript is generally well grounded in the relevant literature and the discussion includes topics which are of great interest within this research field.

I found the manuscript scientifically interesting and generally well prepared. My comments mainly concern methodological transparency, statistical interpretation and the clarity of some passages. The following comments should help improve the methodological transparency, clarity and interpretation of the results.

We thank the reviewer for the careful and constructive assessment of our manuscript. The comments have helped us improve the methodological transparency, statistical interpretation, and clarity of the study. We have carefully considered each comment and have revised the manuscript accordingly, as detailed below.

Comments 1: *Lines 43–54: The paragraph provides a useful broad overview of the latitudinal transition from temperature- to moisture-limited TRW. However, it would benefit from a more explicit summary of the principal seasonal climate controls reported in previous studies, for example, which temperature and moisture variables dominate, during which months or seasons and in which parts of the region. This would provide a clearer basis for evaluating the additional information supplied by δ18OTRC.*

Response 1: Thank you for this comment. We have revised this paragraph to more clearly describe the dominant climatic variables, seasonal response windows, and their spatial distribution for TRW across the East European Plain. The revised text clarifies that TRW in the northern region responds primarily to June–July temperature, the central transitional region is influenced jointly by summer temperature and moisture conditions, whereas TRW in the southern region is primarily limited by warm-season moisture availability. These additions provide a clearer background for evaluating the complementary hydroclimatic information provided by $\delta^{18}O_{TRC}$. The corresponding revision is provided below.

Revised text in the Introduction (Lines 45–56): First, TRW–climate relationships show pronounced regional differences across the East European Plain, with a transition from temperature limitation to moisture limitation around 55–60° N (Matskovsky, 2016). North of approximately 60°

N, conifer TRW generally responds positively to summer temperature, with the strongest responses occurring mainly in June and July (Dolgova et al., 2022; Matskovsky, 2016; Semenyak and Dolgova, 2023). In the central transitional region at approximately 54–56° N, TRW is jointly influenced by summer temperature and moisture conditions, with the main moisture-related variables including precipitation, PDSI, and soil moisture (Matskovsky, 2016). Farther south, in the southern Middle Volga region and the forest-steppe zone of Voronezh, pine growth is primarily limited by warm-season moisture availability (Kuznetsova and Solomina, 2022; Matveev et al., 2019).

Comments 2: *Line 72: Including some comments about the cited spatial heterogeneity would give important context on how the dominant controls and seasonal response windows of δ18OTRC are expected to vary with moisture source, transport pathway and local hydroclimatic regime. Now it is only mentioned that the dominant controls "can shift with changes in moisture sources…", but it is not specified how those shifts actually are.*

Response 2: Thank you for this comment. We have revised this paragraph to further explain the mechanisms underlying the spatial heterogeneity in the climate sensitivity of $\delta^{18}O_{TRC}$. The revised text clarifies that moisture sources and transport pathways influence the isotopic composition of precipitation and tree source water; local relative humidity and evaporative demand regulate leaf-water evaporative enrichment; and soil-water storage and the mixing of precipitation from different seasons alter the seasonal contribution of precipitation to tree source water. These processes may cause the dominant controls, response strength, and seasonal windows of $\delta^{18}O_{TRC}$ to vary under different hydroclimatic settings. This spatial heterogeneity motivated our regional, multi-site assessment across the East European Plain. The corresponding revision is provided below.

Revised text in the Introduction (Lines 78–87): Moisture sources and transport pathways influence the isotopic composition of precipitation and tree source water, whereas local relative humidity and evaporative demand regulate leaf-water evaporative enrichment (Gat, 1996; McCarroll and Loader, 2004; Roden et al., 2000). Soil-water storage and seasonal mixing can further alter the contribution of precipitation from different seasons to tree source water, potentially extending the $\delta^{18}O$ climate response beyond the period of cellulose formation (Treydte et al., 2014). Consequently, the dominant controls, response strength, and seasonal response windows of $\delta^{18}O_{TRC}$ may differ among hydroclimatic settings (Freund et al., 2023; Treydte et al., 2007).

Comments 3: *Lines 101-106: The description of summer temperature is potentially confusing because "temperatures decreased from the south to the central region" may be read as implying a temporal change rather than a spatial gradient. Please rephrase the sentence to state the site values directly or describe an increase in summer temperature from north to south.*

Response 3: Thank you for this comment. We have revised the sentence to report the mean summer temperature at each of the three sites directly and to clearly describe the north–south spatial gradient. The corresponding revision is provided below.

Revised text in the Material and methods (Lines 119–122): Mean summer (June–August) temperature increased from 12.86 °C at the northern site to 16.73 °C at the central site and 19.66 °C at the southern site.

Comments 4: *Lines 131–132: Please explain and justify the criteria used to select cores for δ18O analysis. How many candidate trees and cores were available at each site, how many met the*

eligibility criteria and how were the four analysed trees selected from that eligible set? In particular, please clarify why cores containing missing or extremely narrow rings were excluded and whether these criteria were defined a priori and applied consistently across sites. Extremely narrow rings may record biologically and climatically meaningful growth-suppression events; excluding them could therefore introduce selection bias unless exclusion was analytically necessary, for example because they provided insufficient cellulose for reliable isotope measurement. The methodological justification should be supported with relevant literature. Please also explain why replication was increased only at the northern site and discuss the resulting imbalance among sites.

Response 4: Thank you for this comment. We have added the selection criteria for cores used in the $\delta^{18}O_{TRC}$ analysis to the Methods section, and Supplementary Table S1 now lists the numbers of candidate trees, candidate cores, and cores finally selected for isotope analysis at each site.

Regarding core selection, although the three sites were sampled at different times, our laboratory has long applied the same selection criteria, which were used consistently across all three sites. These criteria included preferentially selecting the oldest cores to minimize potential juvenile effects; reliable cross-dating and continuous coverage of the target period; clearly identifiable ring boundaries; the ability to separate individual rings without contamination from adjacent rings; and sufficient α-cellulose for isotope measurements (Xu et al., 2011, 2013b). Narrow rings were not excluded simply because of their small width; they were retained as long as they could be reliably separated and provided sufficient material for isotope analysis. Cores containing missing rings were not selected because they could not provide a continuous annual isotope series. Based on these criteria, four cores from four different trees were selected directly from all candidate cores at each site.

Regarding sample size, four cores from four different trees were initially analyzed at each of the three sites. Additional sampling at the northern site in 2021 allowed us to extend the isotope chronology to 2021, whereas no comparable additional material was available for the central and southern sites. Because the three additional northern cores cover only approximately 20 years (2000–2021), the long-term Rbar and EPS for the northern site were still calculated from the original four long cores, yielding values of 0.67 and 0.89, respectively. During the overlapping period, the original four-tree chronology and the expanded seven-tree chronology showed similar interannual variability (Fig. S2a), and their climate-response patterns were also broadly consistent, particularly for summer hydroclimatic variables (Fig. S2b, c). Therefore, the increased recent replication at the northern site did not substantially alter the dominant climate signals identified in this study or the main conclusions. Accordingly, we have expanded the description of core selection, added the corresponding comparison results, and added Table S1 and Fig. S2 to the Supplementary Material, as detailed below.

Table S1. Numbers of candidate trees and cores available, and cores selected for $\delta^{18}O_{TRC}$ analysis at each study site.

Site	Candidate trees	Candidate cores	Selected cores
Northern—B75S	21	42	4
Northern—B93S	18	36	3
Central—A22S	16	30	4
Southern—T03S	21	36	4

B75S, B93S, A22S, and T03S are sample codes. B93S denotes the additional samples collected during the 2021 resampling campaign at the northern site.

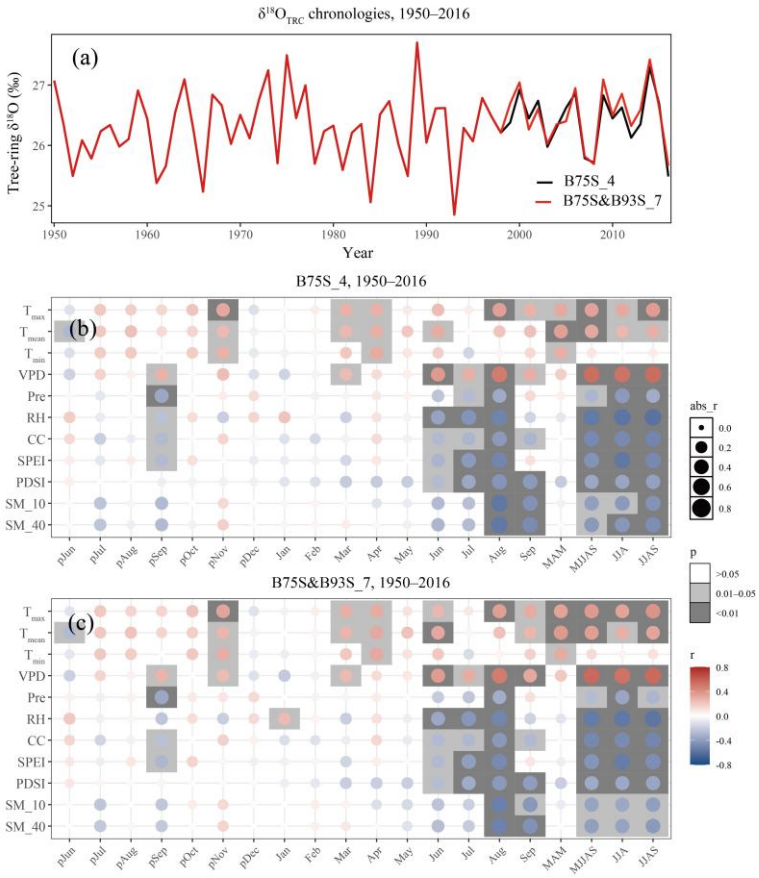


Figure S2. Comparison of the original and expanded northern $\delta^{18}O_{TRC}$ chronologies and their climate responses. (a) Comparison between the original four-tree chronology (B75S_4) and the expanded seven-tree chronology (B75S&B93S_7); correlations between climate variables and (b) the original four-tree $\delta^{18}O_{TRC}$ chronology and (c) the expanded seven-tree $\delta^{18}O_{TRC}$ chronology.

Revised text in the Material and methods (Lines 150–163): The numbers of candidate samples and the results of core selection for $\delta^{18}O_{TRC}$ analysis are summarized in Table S1. The same selection criteria were applied at all three sites, including preferentially selecting the oldest cores to minimize potential juvenile effects, reliable cross-dating and continuous temporal coverage, clearly identifiable ring boundaries, and the ability to isolate individual rings without contamination from adjacent rings while obtaining sufficient α-cellulose for isotope measurement (Xu et al., 2011, 2013b). Narrow rings were retained as long as they could be reliably separated and provided sufficient material, whereas cores containing missing rings or rings that could not be reliably separated and measured were not selected. Based on these criteria, four cores from four different trees were initially selected from all candidate cores at each site. Additional sampling at the northern site in 2021 provided three further cores covering 2000–2021, allowing the isotope chronology to be extended to 2021.

Added text in the Results (Lines 253–255): The original four-tree and expanded seven-tree chronologies at the northern site showed similar interannual variability over their overlapping period (Fig. S2a).

Added text in the Results (Lines 297-299): Notably, at the northern site, the original four-tree and expanded seven-tree chronologies also showed broadly consistent climate-response patterns, particularly for summer hydroclimatic variables (Fig. S2b, c).

Comments 5: *Lines 187–190 and 213–219: The central and southern isotope chronologies are based on only four trees and have EPS values of 0.84. Although these values indicate appreciable common signal strength, the statement that the chronologies "effectively capture a common environmental signal" may be too categorical, particularly because 0.85 is frequently used as a conventional benchmark and because EPS does not by itself eliminate the uncertainty associated with low replication. Please provide the precise calculation procedure and clarify whether EPS and Rbar vary through time. If available, time-varying sample depth, Rbar and EPS should be shown. The conclusions concerning regional representativeness and reconstruction potential should also acknowledge this limitation.*

Response 5: Thank you for this comment. We agree that the EPS values at the central and southern sites (0.84) are slightly below the commonly used reference threshold of 0.85. Therefore, the original statement that "these chronologies effectively capture a common environmental signal" was too definitive. We have revised this statement to indicate that "EPS ≥ 0.84 suggests overall coherent inter-tree signals within each site," and we have also acknowledged the uncertainty associated with low sample replication when discussing the regional representativeness and reconstruction potential of the chronologies.

We have further added details on the calculation of Rbar and EPS in the Methods section. At each site, pairwise Pearson correlations were calculated among the four individual-tree $\delta^{18}O_{TRC}$ series, and the arithmetic mean of the six pairwise correlation coefficients was used as Rbar. EPS was then calculated from Rbar and a fixed sample replication of N = 4, following Wigley et al. (1984). The three additional series collected at the northern site in 2021 cover only approximately 2000–2021 and were therefore not included in the calculation of the long-term Rbar and EPS. Because the isotope chronologies span only approximately 65–72 years and have relatively low sample replication, Rbar and EPS were used as summary measures of inter-tree coherence over the common period of the four original core series at each site rather than being calculated using moving windows. Annual sample replication at each site has now been added to Fig. 2. Accordingly, we have clarified the Rbar and EPS calculations, revised the interpretation of EPS, acknowledged the limitation associated with low replication, and added annual sample depth to Fig. 2, as detailed below.

Added text in the Material and methods (Lines 220–225): Rbar was calculated as the mean of all pairwise Pearson correlations among the four original core series at each site, and EPS was derived from Rbar using a fixed sample replication of N = 4. Because the isotope chronologies span only approximately 65–72 years, Rbar and EPS were calculated over the common period of the four original core series at each site rather than using moving-window analyses. The three additional northern series cover only approximately 2000–2021 and were therefore excluded from these calculations.

Revised text in the Results (Lines 255–257): EPS was ≥ 0.84 at all three sites, suggesting overall coherent inter-tree signals within each site.

Added text in the Discussion (Lines 462–464): However, the low replication and EPS values of 0.84 at the central and southern sites introduce uncertainty into chronology representativeness and should be considered when evaluating their regional applicability and reconstruction potential.

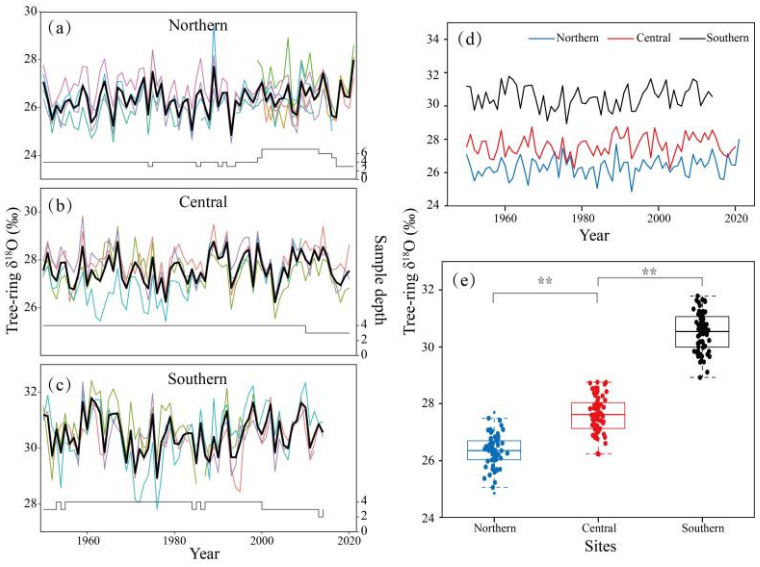


Figure 2. $\delta^{18}O_{TRC}$ chronologies for the northern (a), central (b), and southern (c) East European Plain. Individual $\delta^{18}O_{TRC}$ series are shown as thin colored lines; the site mean chronologies are shown as thick black lines. Annual sample depth is shown by the gray step lines in panels (a–c). Time-series plots (d) and box-and-whisker plots (e; 1950–2014) show the $\delta^{18}O_{TRC}$ chronologies at the three sites. In panel (e), the line within each box denotes the median; box limits indicate the 25th and 75th percentiles; and filled circles denote outliers. Asterisks indicate statistical significance (**, $p < 0.01$).

Comments 6: *Lines 411–417 and 440–451, particularly lines 445-446: The conclusion that the northern chronology is sufficiently strong and stable to support a "reliable climate reconstruction" appears stronger than the analyses presented. The study demonstrates a statistically significant climate–proxy association and explores its temporal stability, but it does not perform a reconstruction or report calibration–verification statistics. I suggest consistently referring to "reconstruction potential" unless predictive skill is evaluated using an appropriate calibration and validation framework.*

Response 6: Thank you for this comment. We have revised "reliable climate reconstruction" and similar statements throughout the manuscript to "climate reconstruction potential." The corresponding revisions are provided below.

Revised text in the Discussion (Lines 455–458): The northern $\delta^{18}O_{TRC}$ chronology exhibits a strong and stable growing-season VPD signal (Fig. 3; Fig. S3; Fig. S7), indicating particularly strong potential for high-latitude hydroclimate reconstruction.

Revised text in the Conclusions (Lines 500–504): The $\delta^{18}O_{TRC}$ chronologies at three sites record a coherent signal of regional summer hydroclimate variability, but the northern chronology shows the strongest and most stable climate response, indicating the greatest reconstruction potential.

Revised text in the Conclusions (Lines 507–511): Overall, our study demonstrates that $\delta^{18}O_{TRC}$ contains valuable information on the spatiotemporal patterns of hydroclimate variability across the East European Plain and highlights its potential for future hydroclimate reconstruction.

References cited in our response

Xu, C., Sano, M., and Nakatsuka, T.: Tree ring cellulose $\delta^{18}O$ of *Fokienia hodginsii* in northern Laos: A promising proxy to reconstruct ENSO?, J. Geophys. Res.-Atmos., 116, D24109, https://doi.org/10.1029/2011JD016694, 2011.

Xu, C., Zheng, H., Nakatsuka, T., and Sano, M.: Oxygen isotope signatures preserved in tree ring cellulose as a proxy for April–September precipitation in Fujian, the subtropical region of southeast China, J. Geophys. Res.-Atmos., 118, 12805–12815, https://doi.org/10.1002/2013JD019803, 2013b.

Wigley, T. M. L., Briffa, K. R., and Jones, P. D.: On the Average Value of Correlated Time Series, with Applications in Dendroclimatology and Hydrometeorology, J. Clim. Appl. Meteorol., 23, 201–213, https://doi.org/10.1175/1520-0450(1984)023%3C0201:OTAVOC%3E2.0.CO;2, 1984.

Additional minor correction:

We also corrected a typographical error in the spelling of co-author Zhengtang Guo’s name in the manuscript to ensure consistency with the author information already registered in the submission system. This correction does not involve any change in the author list or authorship.