

Referee #4

This is a well-developed paper that presents new novel precipitation and temperature reconstructions for the Czech Lands. The attached manuscript offers some thoughts and comments; however, these are almost all stylistic and structural rather than substantive issues that need to be addressed. I hope the authors find these helpful in reviewing the manuscript. I enjoyed reading the paper, thank you.

RESPONSE: We would like to thank Neil Macdonald for the generally positive evaluation of our study as well as for all thoughts and comments in the manuscript, which we are trying to respond below.

Line 10:

Response: The sentence “Secondary sources are only of limited use.” was deleted.

Lines 15-16:

Response: The sentence was corrected as proposed, i.e.: “These indices are more frequent for winter and summer, with fewer indices derived for spring and autumn.”

Line 19:

RESPONSE: Corrected as: “provide valuable information”

Section 2: A good section that explains why the different sources are found, and the socio-economic context to the records, which is often over looked.

RESPONSE: Thank you.

Line 52: “far as the 1380s. Economic” - add a citation so the reader can follow up on these themes?

RESPONSE: The corresponding citation is on line 57 (i.e., Čornej, 2003).

Line 53:

RESPONSE: Corrected as: “cause a deep”

Line 55: “perceived as corrupt and inept. Inevitably” - add citation

RESPONSE: The corresponding citation is on line 57 (i.e., Čornej, 2003).

Line 64: move so reads 'largely Catholic Czech nobility'. assuming this is what you mean “the Czech nobility, largely Catholic.”

RESPONSE: Corrected as: “largely Catholic Czech nobility”

Line 65:

RESPONSE: Corrected as: “to the isolation”

Lines 76-77: Proposed “... Pope Pius II, Jiri was excommunicated and his deposition as King of Bohemia was declared by the Catholic Church.

RESPONSE: We prefer our original expression with a small change: “with Pope Pius II, Jiří of Poděbrady was deposed by the Catholic Church in 1466 and cast into anathema.”

Lines 80-82:

RESPONSE: The sentence was modified as proposed, i.e. “The shared kingship and the acute risk of the Czech Lands dividing ended with Matthias’ death in 1490, the Czech Crown again unified.”

Lines 83-84:

RESPONSE: The sentence was corrected as: “The religious wars had left the Czech Lands totally devastated by the end of the 15th century (Macek, 2001).”

Line 90:

RESPONSE: Corrected as: “3.1 Documentary sources”

Line 114: This is a good point, I am sure that there are probably lots of accounts of the weather from around Europe in the Vatican archives from papal emissaries over the last millennia.

RESPONSE: Thank you, we agree.

Lines 166-167: Worth adding a sentence here on studies that have demonstrated the value of this approach with overlapping instrumental series - high similarities can be achieved, however extremes tend to be missed?

RESPONSE: We have added this into the second paragraph in Sect. 6 Discussion as follows: “In the case of numerous proxy reconstructions based on natural archives, direct comparison is severely limited by their seasonality, which is often restricted to late MAM and JJA (see Fig. 8). Moreover, depending on the used calibration method, proxy reconstructions may underestimate the intensity of extremes (see McCarroll et al., 2015 or Možný et al., 2016a for the Czech Lands).”

New reference:

McCarroll, D., Young, G., and Loader, N.: Measuring the skill of variance-scaled climate reconstructions and a test for the capture of extremes, *Holocene*, 25, 618–626, <https://doi.org/10.1177/0959683614565956>, 2015.

Line 231: define here

RESPONSE: Corrected as: “records of hydrometeorological extremes (HMEs) and”

Line 248: add citation to “destroyed houses. Many”

RESPONSE: Citations to this and following descriptions are given on lines 253-254.

Line 310: “the positive scPDSI value” - I think this is also a good argument for potentially using different drought indices e.g. SPI derived from temperature would be an interesting comparison, does it show the same variability? higher signal to the dendro?

RESPONSE: We fully agree that PDSI is not always the optimal target for dendroclimatological reconstruction. Because PDSI integrates both input (i.e., precipitation) and output (i.e., evaporation/evapotranspiration demands driven by temperature), it essentially becomes impossible to assert if a high (positive) PDSI value was caused by heavy precipitation or cold conditions. The Torbenson et al. (2023) paper used in the comparisons attempted to address this issue specifically, using the two predictors (carbon and oxygen stable isotopes from living and subfossil Czech oak trees) previously combined for the Büntgen et al. (2021) scPDSI reconstruction to separate temperature from water balance (the latter being very closely related to SPI). The results indicate that notable periods of high PDSI in pre-history were driven by vastly different hydrothermal conditions. For example, the exceptionally wet periods during the early 3rd century and late 4th century CE in the Büntgen

reconstructions are suggested to have stemmed from almost opposite drivers (i.e., warm and wet for 184-241 CE versus cold and near/below average precipitation for 365-422 CE). The same issue is present in the 15th century, albeit in somewhat different form. The positive trend in temperature indicated by the oak isotopes (Fig. 4a) affected the PDSI towards drier conditions towards the end of the century.

The value of studying hydroclimatic indices that do *not* weight evapotranspiration heavily (unlike PDSI) is further supported by the stronger relationship between the documentary-based indices presented here and the precipitation (Dobrovolný et al., 2018) and water balance (Torbenson et al., 2023) reconstructions (Fig. 5).

Line 318: “they found no reflection in documentary sources” - Yes, other studies e.g. Harvey & Macdonald, 2021 have identified this truncation.

RESPONSE: We added here a new reference as follows: “... they found no reflection in documentary sources (*cf.* Harvey-Fishenden and Macdonald, 2021).”

New reference:

Harvey-Fishenden, A. and Macdonald, N.: Evaluating the utility of qualitative personal diaries in precipitation reconstruction in the eighteenth and nineteenth centuries, *Clim. Past*, 17, 133–149, <https://doi.org/10.5194/cp-17-133-2021>, 2021.

Lines 370-371: this critical reflection of the model here is key - it has low constraints/inputs - higher uncertainty.

RESPONSE: This note concerns the quality of the Mode-RA reanalysis data. We are aware of higher uncertainty in Mode-RA data for the 15th century. Please see our response to Referee #2 (Point 3, last paragraph) for more details.

Line 421:

RESPONSE: Corrected as: “indices correspond well with”

End of the last paragraph before Discussion (line 437): The unknown here is the role of dry winters and the potential to exacerbate the impacts of 'warm-dry summers' as environments start the summer months in 'water' deficit, thereby potentially exacerbating the impacts felt (which could be documented in the sources) by communities, worthy of a comment?

RESPONSE: We agree with the referee's opinion that the perception of the character of individual seasons (in this case of dry summers) can be significantly influenced by the weather conditions in previous seasons in the case of documentary sources. Unfortunately, the density of the Czech documentary evidence in the 15th century especially about wet/dry character of seasons (precipitation indices) is too low to prove this influence as can be seen from Fig. 2. Moreover, Czech indices indicate rather the persistent nature of wet winters and wet summers (e.g., 1433 or 1496) than dry winters and summers.

Line 504: “occurred in 1477 (Toohey and Sigl, 2017)” - Veidivotn eruption in Iceland

RESPONSE: The corresponding sentence was complemented as follows: “Conversely, the only major eruption of the 15th century identified in the Greenland ice cores occurred in 1477 (Toohey and Sigl, 2017), associated with the Veidivötn–Bárðarbunga volcanic system (Abbott et al., 2021).”