This study presents new climate field reconstructions for the North Atlantic region spanning from 1241 to 1970 CE at annual, seasonal, and monthly resolutions, using a small network of proxy data combined with isotope-enabled climate model simulations. The authors reconstructed four key climate variables: 2-meter temperature, sea surface temperature, sea level pressure, and precipitation. Validation against reanalysis data and long-term temperature observations shows strong correlations of up to 0.7 for seasonal and annual temperature data, though monthly resolution correlations were weak. The reconstructions successfully captured large-scale winter circulation patterns in sea level pressure and demonstrated basin-wide skill for North Atlantic sea surface temperatures, providing valuable long-term climate context for understanding natural variability.

Scientific Significance:

This manuscript makes a meaningful contribution to paleoclimate reconstruction by extending North Atlantic climate records back to 1241 CE with multi-resolution temporal coverage. While the geographic focus and general reconstruction approach build on established methods, the improved methodology, proxy data and sub-annual resolution data represent valuable advances.

Scientific Quality:

The scientific approach appears methodologically sound. The validation strategy is comprehensive, employing multiple independent datasets including reanalysis data, observed SST, and instrumental temperature records. However, at least for the monthly reconstruction I would suggest a validation with instrumental data sets for the 20th century.

Presentation Quality:

While the abstract provides a clear overview and the introduction is very well written, some parts of the main paper could be improved. For instance, proxy selection criteria could be better explained. Results and discussion could be separated better, e.g. ModE-RA results only appear in the discussion instead of the results.

We thank the reviewer for the positive review, thorough reading of our manuscript and constructive comments. We appreciate this opportunity to improve our work based on the comments by the reviewer.

For the revision we will move the ModE-RA comparison to the results section as suggested by the reviewer.

Specific Comments:

1. *I'm really skeptical about the monthly reconstruction in this study. ModE-RA winter temperatures at least in Europe should be well constrained by historical information and early instrumental measurements. How would Fig. 7 look for 20CR? Maybe that would be a figure for the supplement. Please also check the monthly reconstruction with gridded instrumental data sets for the 20th century. Maybe rather remove the*

monthly reconstruction from the paper and "monthly" from the title or discuss it more carefully.

I our approach we choose to only include proxy data that span the entire reconstructed timeframe. We do this to have a consistent product with, in theory, same performance, throughout the reconstruction. As our method doesn't include tuning to observations, the skill obtained in the evaluation with instrumental records in principle indicates the level of performance for any time frame of the reconstruction.

The skill for monthly the reconstruction varies regionally as due to the seasonality of the proxy data and seasonal shifts in climate patterns, which is part of the reason the average monthly correlations remain low, although they peak above 0.6 for temperature during July and August (Figure S9). So, winter months and summer months do not have high skill at the same location, and the mean for all months becomes comparably low. As mentioned at the end of section 3.3, the monthly reconstruction captures a large part of the modulation of the annual cycle, and as mentioned in L253-254 the monthly reconstruction can also be useful for comparison to other datasets as you can extract any months for comparing to records with different seasonality.

We will revise the results section and discussion to clarify the text and include the explanation of the above points.

The information on the monthly comparison to 20CRv3 is actually included in the supplementary (Figure 9S), although in a somewhat convoluted format. We agree that showing monthly correlation maps for T2m would be helpful to the reader, and we will include this as a new figure in the supplementary (Figure R1 attached below).

2. *How can you deal with 1 year dating uncertainty (line 80)? And how may wrongly dated proxies influence your entire study and data set? Did you consider comparing neighboring proxies with different lags to check for potential dating problems?*

0-1 year dating error referred to in L80 are the conditions for choosing the proxy data. The dating of the dendrochronologies is considered to have zero uncertainty, while the ice core records are estimated to have 0–1-year uncertainty for the reconstructed period (Vinther et al., 2006). As the ice core records are dated using a combination of layer counting and volcanic horizons an entire ice core record is never shifted by one year. However, one cannot exclude that some records are off by up to one year in some intervals between dating horizons. While it goes beyond the scope of this study with such details of the ice core dating, we are happy add text to explain this in the data section.

3. *Why do you "use JJA for representing the growing season and the extended winter season (Nov-Apr) to represent the winter preceding the growing season"? In this setup May does not play any role. Why not also an extended summer growing season starting in May?*

This is based on investigations of the seasonal signal in the d18Ocell, where correlation to climate variables drops in spring and picks up again in the main growing season (Büntgen et al., 2021). Also, since we use the extended winter for the ice core data, the choice of the

extended winter means that we are matching with the same model d18O field for all proxy data for the winter season. This explanation will be included in the revision.

4. *With this analog method you disturb the temporal evolution of the model simulations. Are the transitions from one year to the next year smooth in the ocean with its memory/autocorrelation? Especially in the monthly reconstruction I would imagine that this could be an issue.*

The auto-correlation of the reconstruction is determined by the properties of the proxy data. Since the proxies are sensitive to atmospheric processes the reviewer is correct in the assumption that this results in the variance of the SST to be overestimated, although this is partly compensated by the variance correction. We will include this point in the discussion.

5. *In the results you ask the question "how many model analogues to use in the ensemble reconstruction". But in the methods section above you wrote that you "calculated the ensemble mean using a logarithmic weighting function". I understood that all members are included. Maybe, I just misunderstood something but please explain this more clearly.*

We assume that the reviewer is referring to L161 in the results section. It should be “how many model analogues *per reconstruction year …*”, which we will correct. So, all model years are included in the entire reconstruction, but either 150 or 300 model analogues are used per year for the two different versions of the reconstruction.

6. Fig. 2: the JJA SLP reconstruction has negative correlations if you just move slightly out of the region covered by the proxy data. What could be the reason and would you consider shrinking the reconstruction region to the area covered by proxy data?

Negative correlations can have multiple sources. For JJA the reason is most likely a combination of less well constrained large-scale circulation during summer and model biases in the JJA SLP of ECHAM5-MIPOM (Sjolte et al., 2020). We will add this to the description of the results for summer SLP. Since the temperature shows large-scale coherent patterns in correlation, we would lose this if we limit the area.

Small remarks:

Thank you for the corrections listed below. We will include all of them in the revision.

Abstract:

Line 6: "seasonal and seasonal" should probably be "seasonal and monthly"

Introduction:

Line 19: "... data and while ..."should be without "and"

Line 27: "the main mode of wither variability" should be "winter variability"

Data Section:

Line 110: "reconstrcutions" should be "reconstructions"

Line 176: "emsemble members" should be "ensemble members"

Unclear English:

Introduction:

Line 51-52: "Well-dated, long-term seasonally resolved proxy data" maybe better "well-dated, seasonally resolved, long-term proxy data"?

Line 65: "creates biases the representation" should be "creates biases in the representation"?

Results Section:

Line 193: "This is coeval with results" - "coeval" is uncommon; "consistent with" would be clearer

Line 208: "skill of the reconstructing" should be "skill of the reconstruction"

Discussion:

Line 248: "Compared to the SEA18/20 reconstructions our new reconstruction" missing comma after "reconstructions"

Line 267-269: "as shown in SEA18/20 even a low number" missing comma after "SEA18/20"

New figure for revised supplementary

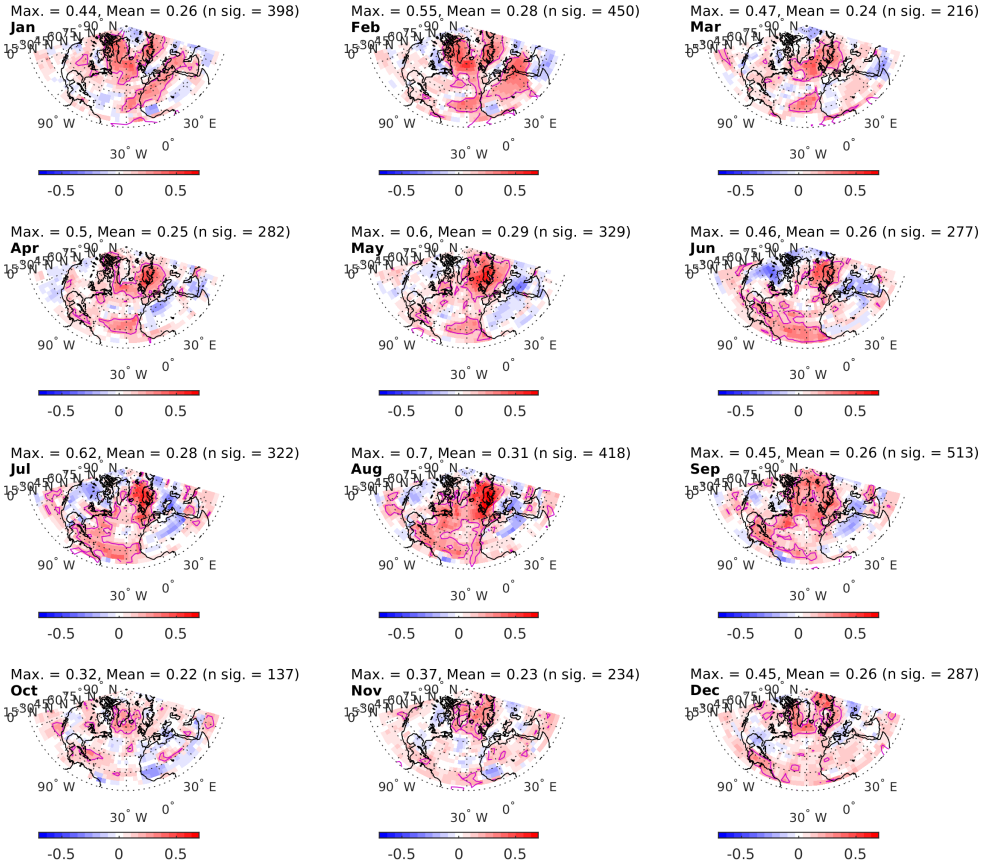

Figure R1 Point-wise correlation between SAT25 and 20CRv3 monthly T2m. The maximum correlation, mean significant correlation and number of grid points with significant correlation in indicated for each subplot. Contour indicates p = 0.01.