This study collected shrub tree-ring samples from 26 sites in a region influenced by both the westerlies and East Asian summer monsoon (EASM). By establishing chronologies and analyzing the relationship with climatic factors, the study found that water is the primary limiting factor affecting shrub growth. It is found that shrub growth shows no clear relationship with the westerlies and EASM on an interannual scale, characterizing by a positive correlation with westerlies and a negative correlation with the EASM on a decadal scale. I recommend a revision.

Major comments:

1. Lines 263 and 274: Figure 5 and Table 1 show a strong correlation between the tree-ring chronology and the westerlies and EASM. However, this correlation is based on time-series data obtained from 11-year moving average. This may introduce spurious correlations, creating the illusion of strong correlation. As shown in Figure 4, the correlations are not strong at the interannual scale. And the differences in decadal trends, shown in Figure 5, are quite pronounced. These increase the likelihood of spurious correlation.

Reply: Thank you for the comment. Variability on interannual, decadal, centennial, and even millennial timescales is an intrinsic characteristic of the Earth system and atmospheric circulation. The superposition of multiple periodic influences leads to considerable complexity in the temporal evolution of regional climate, environment, and vegetation. The lack of statistically significant correlations at the interannual scale may result from the combined influence of both interannual and longer-term variability, whereas the significant correlations at the decadal scale suggest that decadal variability may represent a dominant cycle governing the climate–vegetation system in the study region. An 11-year cycle is generally considered the primary decadal periodicity associated with solar sunspot activity. Therefore, in this study, an 11-year moving average was applied to analyze

the correlations between the tree-ring chronology and the two major circulation systems. In addition, as the study area is located within the interaction zone of these two circulation systems, their interplay further increases the complexity of desert vegetation growth responses. Partial correlation analyses between the chronology and the two circulation systems further help to explain their respective primary influence regions as well as their interaction zones.

At present, studies on the climatic and environmental impacts of atmospheric circulation systems have mainly focused on their core regions, while research on marginal and interaction zones remains relatively limited. Based on shrub tree-ring records and the two major circulation systems, this study provides a preliminary identification of their respective primary influence regions and interaction zones. More comprehensive conclusions will require further in-depth research in the future.

2. Line 402: The authors use the foehn effect to explain the negative impact of the EASM on tree growth. However, EASM has a dual role, bringing both moisture and the foehn effect. Analyzing the impact of EASM on drought in the study area would help strengthen the conclusions.

Reply: Thank you for the comment. The main objective of this study is to reveal the interaction between the two major circulation systems in the study area. The impact of the EASM on drought in the study area is, in fact, largely a consequence of the foehn effect induced by high mountain ranges. As discussed in Lines 400–414, we consider that although the EASM can transport substantial moisture to its influenced regions, the presence of high mountains leads to a pronounced foehn effect. This results in reduced precipitation and increased temperatures in the monsoon marginal or terminal regions, thereby intensifying drought conditions and further suppressing

vegetation growth in these areas. The desert landscape observed in the study area also provides empirical support for this interpretation.

3. The authors aim to elucidate the interaction between the westerlies and EASM on the climate of the study area. But, shrub growth under different westerlies and the EASM (Figure 5) does not adequately answer the scientific questions. The authors have identified that shrub growth in this region is influenced by moisture conditions. So, I suggest establishing structural equation models (or other functions) comprising factors such as westerlies, EASM, climate factors and chronologies. By comparing the direct and indirect effects of the westerlies and EASM on shrub growth, you can demonstrate the direction and intensity of their effects.

Reply: Thank you for the comment. This study is part of a series of works previously published in Climate of the Past (Xiao, S. C., Peng, X. M., Tian, Q. Y., Ding, A. J., Xie, J. L., and Su, J. R.: Interaction between the East Asian summer monsoon and westerlies as shown by tree-ring records, Clim. Past., 20(7), 1687–1701, https://doi.org/10.5194/cp-20-1687-2024, 2024). The previous study mainly focused on the radial growth of coniferous trees in the mountainous areas surrounding the Alxa Plateau and their responses to the two major circulation systems, whereas the present study investigates desert shrubs within the Alxa Plateau. The aim is to provide a more comprehensive understanding of the impacts and spatiotemporal heterogeneity of the two circulation systems and their interactions on regional climate and vegetation changes. To maintain consistency between the two studies, we consider it appropriate to adopt a similar research framework and analytical approach.

The reviewer suggested using structural equation models (SEM) to analyze the effects of the two circulation systems and climatic factors on the regional chronologies. In fact, our study is also based on a conceptual framework of "circulation system forcing – regional climate response (e.g., drought indices such as SPEI) – vegetation growth change." Accordingly, we conducted correlation analyses between shrub tree-ring chronologies and both climate variables and atmospheric circulation indices at interannual and decadal scales, as well as partial correlation analyses between the two circulation systems and the chronologies. These analyses effectively capture the relationships that can also be revealed by SEM.

In addition, we applied SEM to analyze the relationships among the two circulation indices, SPEI9, and four regional chronologies at both interannual and decadal (11-year moving average) scales. The results show correlation patterns and significance levels that are generally consistent with those presented in the original manuscript (see figure below). The SEM results at the interannual scale support the findings shown in Figures 3 and 4, while the decadal (11-year moving average) results are consistent with Figure 5 and Table 1. The decadal-scale data enhance the shared long-term trends among circulation indices, SPEI, and tree-ring chronologies, significantly improving the explanatory power of the model, but at the cost of reduced model fit ($P = 0.005$). However, the SEM framework cannot intuitively represent the temporal combination patterns of the two circulation systems (e.g., the red arrows shown in Figure 5). Therefore, we consider that the current structure of the manuscript provides a clearer and more detailed presentation of the results, while SEM may offer a more flexible form of expression.

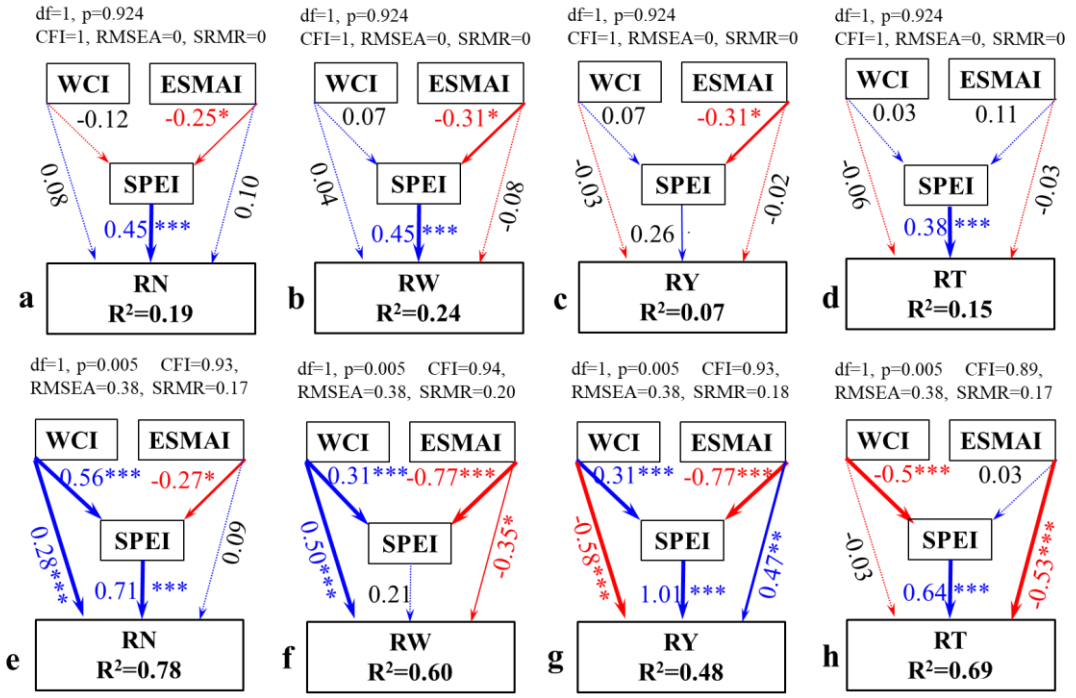

Figure: SEM results at the interannual scale for the four regions. Panels a–d represent interannual-scale results, while panels e–h represent decadal-scale results (11-year moving average). RN, RW, RY, and RT denote the four regional chronologies, and R^2 indicates the overall explained variance. If both the editor and reviewers consider the use of SEM to be more appropriate, we can include the corresponding results in the Discussion section to further support the findings presented in each section of the manuscript.

4. Text and figures require correction. Such as the punctuation in Line 160, the font size in the figures and the order of sub-figures in Figure 7.

Reply: Thank you for the comment. The punctuation in Line 160 has been corrected. The order of the sub-figures in Figure 7 was arranged based on the principle of comparing geographically adjacent study sites. If the editor and reviewers consider it necessary to reorder the sub-figures

according to the order of citation in the main text, we are willing to revise this accordingly in the revised manuscript.