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Climate of the Past Discussions

Interactive comment on "Juniper tree-ring data from the Kuramenian Mountains (Republic of Tajikistan), reveals changing summer drought signals in western Central Asia" *by* Feng Chen et al.

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First of all, we thank you for your valuable advice, which will help us to further improve this article. General comment The paper "Juniper tree-ring data from the Kuramenian Mountains (Republic of Tajikistan), reveals changing summer drought signals in western Central Asia" by F. Chen et al. is devoted to reconstruct past summer drought variability (PDSI based) in western Central Asia (actually, the authors analyzed a very local area in the Kuramenian Mountains which contains just two sample plots). Overall impression of the work is very mixed. The authors use traditional techniques to

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analyze their dendroclimatical datasets and to obtain a local PDSI reconstruction and its analysis. As an example based on well-known “classical’ procedure they obtained tree-ring measurements from 81 juniper trees located at the elevations from 1600 to 2035 m. But what is a reason to mix them together? Early it was shown a tree-ring response on climate can be different for mountain regions and significantly depended on site elevations (e.g. Touchan et al., 2016 for vast part of Eastern Mediterranean). That response can be changed each 500 m of additional elevation. It means that the moisture on 2000 meters can be different from the values on 1000 meters. At the same time Chen F. and co-authors try to extend their results for the very diverse (in context of elevation) and vast region such as western Central Asia. Could the authors prove that the western Central Asia is a more homogeneous in comparison with the semi-arid Eastern Mediterranean in the context of the tree-ring response on climate depended on altitude (or elevation)? Response: Although it is a regional study, because it is the most densely populated area in Central Asia and a key area, it is important for the sustainable development of Central Asia. Due to the fact that the precipitation in the area is very small in summer, it is basically not due to differences in altitude. Since the data correlation of these sampling points is relatively good, cross-dating has been carried out. At the same time, we can see that this reconstruction sequence represents large-scale drought signals.

Other serious issue of the manuscript is a way to use different approaches which are not appropriate to obtain the certain results (see specific comments). Speculation concerning the global climate patterns and their connections with the obtained reconstruction should be clarified or proven taking into account wavelet features (see specific comments). For example, why the correlation between reconstructed scPDSI and sunspot number becomes much stronger in XX centuries in the highfrequency domain (Fig. 9b)? How that phenomena can be explained in terms of climatology? Response: Yes, although many studies have confirmed that solar activity has a significant impact on regional climate and tree growth, few studies have analyzed the mechanisms. If I get the opportunity to modify it, I will analyze the mechanism of these relationships

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I recommend to re-submit the paper after major revision. Specific comments Lines 70-72 Authors wrote: “To achieve this additional moisture-sensitive tree-ring chronologies are needed.” What does "moisture-sensitive tree-ring chronologies" mean? Is the local tree-ring signal sensitive to soil moisture or to mixed signal "precipitation-temperature", i.e. PDSI? Could the authors clarify it? Response: Yes, due to the lack of precipitation in this area and weather stations in mountainous areas, the signals here are generally mixed signals, so we only reconstruct the region PDSI, instead of choosing precipitation. I will improve.

Lines 103-104 Authors wrote: “Each raw ring-width series was first detrended to remove non-climatic trends using the negative exponential curve.” It was shown early (i.e. Melvin, 2004) that the selected standardization can be a reason of "divergence problem"? What was a criteria to select "the negative exponential curve" as a standardization method? Response: Yes, this is based on our sampling and tree growth curve. All of our tree-ring growth curves conform to the negative exponential function model. We have deleted abnormal sequences.

Lines 109-110 Authors wrote: “The regional chronology was correlated with a set of monthly climate variables (including monthly total rainfall and average temperature) from July. . .” What was a criteria to mix (average) tree-ring indexes from two different plots located on different elevation levels? The elevation difference is more than 500 m. Early it was shown tree-ring response is significantly different for different elevations and depended on site elevation for the extensive area of Eastern Mediterranean (Touchan et al., 2016). Can the authors prove the tree-ring signal are the same for the both sites? If they are able to show it then they can go further. Response: I can make a list of their relationships and charts to prove that there is a strong common signals between them.

Line 126 Authors wrote: “. . .principal component analyses (Jolliffe, 2002). . .” Could the authors include PCA statistics in the MS to understand why and how new PCA components can be associated with "common drought signals"? Response: Yes, I

can improve. To investigate common drought signals among the tree-ring chronologies (spruce and juniper) from Western Central Asia, I did the PCAfor large-scale.

Line 128 Authors wrote: “In this study, wet and dry periods were determined if the 31-year low-pass values. . .” Why the “31-years low-pass filter” is selected? I am sure in case of other window for filter we can obtain other wet and dry periods. Response: Yes, you are right. Due to the difference in window, there will be a difference in dry and wet periods. But we needed to get more low-frequency signals, so we tried multiple Windows, we compared the results, we chose the 31-year window.

Lines 132-133 Authors wrote: “Wavelet analysis was employed to reveal any periodicities in the scPDSI reconstruction. . .” What was a kind of wavelet analysis used to "reveal any periodicities" taking into account that in most cases the wavelet technique allows to obtain a frequency strongly affected by the time window? Response: Yes, I used morlet wavelet, I will improve.

Line 135 Authors wrote: “. . .smoothed with a 20-year low-pass filter.” Why was 20-years filter used? What will be a difference in case of 15-, 21-, 25-years filters used? Response: We compared the results, we chose the 20-year window.

Line 144 Authors wrote: “. . .signal-to-noise ratio (32.22) and EPS (0.97).” What was a value of Rbar between individual trees for both sites? It seems to me the Rbar was pretty low (about 0.3 or less). Response: The correlations were both found to be significant at the 0.001 level.

Lines 144-145 Authors wrote: “The Variance in first the eigenvector of all series accounted for 51.6% of the total variance, . . .” What does “all series” mean? Are the time series indexed or raw? How the first PC is corresponding to regional chronology? Response: Yes , all time series indexed for the regional series. The correlation is 0.96 between the first PC and regional chronology.

Lines 153-158 It seems to me the lines 153-158 is not a result and they should be

removed to discussion section. Response: I will improve.

Line 164 Authors wrote: “These test results indicated that our statistical equation was reliable”. Where is the statistical equation or equations? The authors used crossvalidation approach to testify the model. They calibrated the model on the 1957-2012 and verified it on the 1901-1956 as a first step. Then they used an inverse approach (to change the calibration and verification periods). It means they obtained 2 equations as minimum (see table 2). How are the equations statistically different or the same? Which equation is used for reconstruction? And what does it mean “common calibration period 1901-2012”? Does it mean the third equation? Response: Yes, you and the first reviewer both pointed out this shortcoming. If you get a chance to modify it, I ’ll show you the reconstruction equation and the test results. No, I just used one model for 1901-2012

Lines 177-178 Authors wrote: “The three tree-ring width chronologies of juniper trees (this study; Seim et al., 2015; Chen et al., 2016) were correlated significantly ($p < 0.001$) among each other.” What are the correlation values between chronologies? What is the common time period? Response: Yes , it is easy. I will add. The correlation is over 0.4, the common period is 1700-2013.

Lines 189-192 Authors wrote: “Wavelet analysis indicated that some centennial (100-150 years), decadal (50-60, 24.3 and 11.4 year) and interannual (8.0, 2.0-3.5 years) periodicities were found in the reconstructed scPDSI data for the Kuramenian Mountains (Fig. 8).” It seems to me the wavelet analysis is not a best choice to analyze the periodicity in time series taking into account the wavelet features in time and frequency domains. For example, multi-taper method could be more appropriate in that case. Response: Yes, I can do multi-taper analysis with wavelet analysis.

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