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Climate of the Past
Discussions

Interactive comment on "Mid-winter (DJF) temperature reconstruction in Jerusalem since 1750 with some regional implications" *by* Assaf Hochman et al.

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This paper presents a statistical reconstruction of annually-resolved winter (DJF) temperature in Jerusalem since 1750. The statistical methodology is based on principal component regression, using both instrumental data (precipitation and sea level pressure) from stations in central and western Europe and high temporal resolution records of proxy data (tree ring chronologies from Jordan). New climatic records are welcome and indeed needed for the region. However, as Referee #1 pointed out, I have serious concerns about the novelty, methodology and lack of supporting proxies.

Major Comments: 1) The authors stated that reconstructed winter temperature in Jerusalem is a first comprehensive attempt. However, Mann (2002) reconstructed an-

nual and seasonal patterns of temperature back through the mid-18th century through a method that combines all of the information available in instrumental, historical, and proxy climate indicators. Therefore, I couldn't truly get the point that makes the reconstructed winter temperature in Jerusalem different from Mann (2002). If the authors think that their study differs from Mann (2002) in terms of methodology, proxy sources, etc., they must include a discussion/comparison on that. Mann, M. E., 2002. Large-scale climate variability and connections with the Middle East in past centuries. Climatic Change, 55(3), 287-314.

In response: Please see the response to reviewer 1 for the same comment.

2) Without doubt, the authors are aware of that the most prominent influence of largescale forcing is NAO, however, other teleconnection patterns have been demonstrated to play a key role in characterizing the eastern Mediterranean hydroclimate variability such as NCP and EAWR. In the manuscript, the authors chose long-term precipitation and sea level pressure observations located in central and western Europe indicating a highly correlated relationship with the climate of region of interest, which can largely be linked to the NAO. However, recent studies highlighted that past (up to LIA and MCA) hydroclimate variability of the eastern Mediterranean region has been controlled not by NAO forcing alone and more importantly, the character of the NAO and its teleconnections have been non-stationary, indicating contrasting spatio-temporal trends and patterns in the Mediterranean region (e.g., Roberts et al., 2012). My concerns about the methodology arise here because the authors have used a limited geographical coverage of dataset in which the dominance of non-stationary components at high frequencies of the climate signal may take place. In parallel to Referee #1, I strongly believe that including and interpreting available high-resolution paleorecords would add a contribution to the body of knowledge aimed at understanding the uncertainties coming from non-stationary climate signals. Roberts, N. et al., 2012. Paleolimnological evidence for an east-west climate see-saw in the Mediterranean since AD 900. Global and Planetary Change, 84-845, 23-34.

In response: Thank you for highlighting this important study. In our opinion no one climate reconstruction study can give the full picture. As climate scientists we can only present the data we have with its associated uncertainties, as presented in the text. The NAO is not the only climate index but it accounts for a large portion of the variability in temperature in the discussed region. Although Roberts et al. demonstrate interesting reconstructions, their reconstructions are based on lake sediments which do not capture inter-annual variability and are difficult to date. Furthermore, their data is not seasonally resolved. Summer and winter together in the same reconstruction obscure the signal. The comparison is done for lakes in Turkey and Spain both located in the mountains which are affected strongly by local factors. Nar Lake in Turkey is located $\sim$ 1000km to the North of Jerusalem in a mountainous region of Turkey.

Other Comments: 1) Northern Hemisphere meteorological season of winter starts from December 1 to February 28. Therefore, I am confused with the expression of "Mid-winter (DJF)". I recommend the authors just use "winter" or "mid-wet season" or "mid-cold season".

In response: We will consider changing the names in the revised version.

2) Pg. 3, line 42-49: Considering the importance of the extreme hydrometerological events such as 2007-2010 drought in Syria mentioned here, it would be good to analyze and discuss the extreme climate characteristics of Jerusalem. For instance, the authors discussed Jerusalem as a representative of Eastern Mediterranean climate. Is this evaluation also valid in the extreme hydrometeorological events? I would recommend the authors here include some extreme climate indices to perform the representative analysis.

In response: This would be an interesting idea to follow-up for this paper, but is beyond the scope of the mean temperature reconstruction.

3) Pg. 3, line 50-58: Given the fact that the region is located in a transition zone and under the influence of by sub-tropical and mid-latitude circulations as well as by tropical

intrusions, the authors should include some other observations and/or high-resolution paleo-records in the southern parts of the region (see Major Comment #2). Please refer to: Felis, T. and Rimbu, N., 2010. Mediterranean climate variability documented in oxygen isotope records from northern Red Sea corals – A review. Global and Planetary Change, 71, 232-241.

In response: Tropical intrusions in the form of the Red Sea Trough mostly affect the temperatures and precipitation of autumn and spring. This is why we focus solely on the mid-winter (DJF) in which air masses mostly propagate from the West. Felis and Rimbu strongly support our notion of using European precipitation records and reviews the connection with the NAO/AO oscillation for winter season for the last few centuries even in Red Sea corals. The resolution of this kind of proxy is not on the same order of tree rings and instrumental data.

4) Pg. 7, line 167-174: I have some doubts and questions here: i) Do the stations have exactly the same temporal coverage? If not, the method applied between short time series and longer ones would be misleading in the choice of reference stations.

In response: These are the long instrumental records for the region. The calculations were done on the 1930-1990 period were virtually no missing values are present. We will discuss this in the revised version.

ii) Has the methodology applied to each individual monthly series of a tested station? Or at seasonal time scale?

In response: seasonal time scale

iii) I couldn't get the exact representative scores (mean correlations/mean significance) in Table 2.Some of the values are different from mean correlations/mean significance result. Please check it out or am I missing something?

In response: The spatial representative score was developed so that High average correlations between pairs are high and the p value low the station gets a higher representative score. The average correlations and average significance levels are rounded numbers to two digits, therefore you don't get the exact representative score which is shown. We will improve the table so it would be clear in the revised version.

iv) How about the representativeness of the extreme hydrometeorological events and interannual variability? (Please see Other Comments #2).

In response: This could be interesting to check, but it was not done in this study.

5) Pg. 7, line 197: Why 300mb geopotential height? Please briefly explain the physical/dynamical reason for that.

In response: The reason we show this map is to explain the use of tele connected instrumental data for the reconstruction of Jerusalem. It is briefly explained in the text and can be further discussed in the revised version: "Figure 4 presents teleconnection patterns between Jerusalem mid-winter temperature and 300mb geopotential heights. A strong negative relationship is observed over central and western Europe. These findings along with the negative SLP relationship with Jerusalem mid-winter temperature (Figure 2) reinforce the statistical relationship between mid-winter precipitation in Europe and temperature in Jerusalem, with a dynamical one. European high pressure causes northerly winds in Israel which bring cold air from western Russia to the region, in a process governed by the phase configuration of Rossby waves (Ziv et al., 2006). "

Figures and Tables: The figures are generally of good quality, however the labels and legends are difficult to read in Figure 2. It would be good to add a topographic background in Figure 1. Please check Table 2 (Please see Other Comments #4).

In response: Thanks for these comments. We will improve the specified figures in the revised version.

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