

Interactive comment on “Climatic history of the northeastern United States during the past 3000 years” by Jennifer R. Marlon et al.

Anonymous Referee #2

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The authors attempted to give a complete overview of climatic history of the northeastern United States in the context of the past 3000 years. It is crucial and helpful to assess current climate conditions in the sparsely-distributed study region. They tried to combine different proxy records with high-resolution and lower-resolutions, including lake, bog and varve sediments, pollen and marine records as well as tree rings. They firstly give an overview on each of proxy archives in terms of basic principles recording climate signals, and their strengths and weaknesses separately, and then reconstructed temperature and hydroclimate variations over the late Holocene by comparing different proxy records. They argued that the NE US witnessed a regional long-term pre-industrial cooling but reversed after the 1800s. As for hydroclimate variations, they identified the most widespread drought in the NE US occurring during the period 550-750 AD. However, the divergence between Regional testate amoeba records and the

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lake-level data remain a big question and new paleoclimate records are necessary to resolve the differences. Generally, the paper is well-written. Their efforts have added new contribution to the knowledge of regional climate variability and to site selection of new data collection. The detailed description on each of proxy records is informative and an excellent addition. This work is worthy of publication in the *Climate of the Past*. However, there are some concerns should be clarified or explained before it is ready to go.

Comments:

My major concern is that the sections 3.3 and 3.4 seem to be a little bit confusing. I suggest that they set out a priority of different proxy records for organizing their discussion and defining the special climate events. For example, tree rings is ranked the first priority, varve thickness second, pollen third, and so on. Specific comments are as below.

- 1) Page 3, line 29, I am confused with 'bogs with groundwater-sourced inputs'. Do you mean that the bog is influenced by groundwater?
- 2) Page 10, line 13, please rephrase this sentence.
- 3) Page 16, lines 18-21, it is important to clarify why the two reconstructions have very different trends considering both used the same dataset.
- 4) Page 18, lines 11-12 are confusing and need clarification. It is not the case by visual inspection.
- 5) Page 20, line 6: Visual inspection did not show that bog water levels were lower at that time.
- 6) Figure 1: 'Proxy type' should be proxy type and sites? It is unclear that each of the pollen sites hosts a long-term climate history?
- 7) Figure 2: What do you mean by "E" in the Figure 2? It needs full name. The same is for Q, and others. Please check on the figure 2 to be sure all the descriptions are correct and complete.
- 8) Figure 3: it is confusing and somewhat misleading why the temporal resolution (vertical axis) of trees varies from seasonal to 100 years. Please clarify and confirm it. The same question is for modern/Historical instruments.
- 9) In Figure 4, bottom row, right panel: correct 'precipitation' as precipitation. What do you mean by 'NY, MN, and others'? Please provide the full name, and the compared common periods

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are also needed for clarification. 10) Figure 5: It would be more logical to arrange the simulation curves together. Anyway, the curves in Figure 5 need to be re-arranged. The pollen data F, H and I are very different from each other. Which is more reliable? The difference is caused due to regional temperature differences as identified in Figure 6 or different methods or dating uncertainties? More discussion is needed for clarification, rather than just listing them together. I don't know why the G and F figures were arranged reversely. Did the North central and northeastern US simulations correspond to the west and the Atlantic margin in Figure 6 respectively? Liu et al., 2010 did not match with Liu et al. 2009 in the reference list. The Liu et al. 2009 simulation represents a long-term decreasing trend which is similar to most of reconstructions, but it is different from reconstructions in term of on medium-frequency domains. Also, I miss some discussions on driving mechanism in the study region considering that they used the GCM simulation results. To my knowledge, Esper et al. (2012) identified an orbital forcing in tree-ring data in high NH latitudes (to the north of 65 degrees north latitude), but the forcing weakens quickly towards middle- and lower-latitudes. The study region in this manuscript is located in middle latitudes. Perhaps the orbital forcing is not strong or non-existing. Anyway, more discussion is helpful for mechanism hinted for the last 3000 years. Figure 7: The authors presented spatiotemporal patterns in the historical mean annual temperature anomalies from 1895 to 2010 as shown in Figure 6. Is it possible to organize or discuss the temperature variations over the last 3000 years separately for the east and west part of the study region, considering that the two parts of the study region represent very different temporal variations in temperature and it is possible that the same situation occurred in the past too. On the other hand, the Figure 6 represents the variations in mean annual temperature. It is recommended to present similar figures or results in the text because most of proxy records are sensitive to summer temperatures. The same suggestion is applied to moisture variations. Maybe a figure similar to the Figure 6 is helpful to guide the authors to organize the different archives based on the sub-regions in the study area. I guess that the moisture variations might have differed more regionally than temperature. 11) Figure 7: What

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do they mean by the '+' symbol? Please clarify it in the Figure legend. How about the dating uncertainties for lake or bog sediment records? It is crucial for comparison with other high-resolution data. It is possible that the dating accuracy affects poor correspondence among the proxies. An additional table outlining all the details including dating material, sampling resolution, temporal resolution, dating methods and so on is useful. As a result, a separate discussion paragraph is needed. What is the full name for NY, RI, ME and others? All the testate amoeba data are from the same region, west or eastern region? From Figure 1, the related data distribute widely. Are they arranged regionally or not? Can they provide the simulation output results for moisture variations over the past 3000 years from GCM modeling? If so, it would be a very helpful addition.

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