

Clim. Past Discuss., referee comment RC1  
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## Comment on cp-2021-137

Anonymous Referee #1

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Referee comment on "Humidity changes and possible forcing mechanisms over the last millennium in arid Central Asia" by Shengnan Feng et al., Clim. Past Discuss.,  
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Comments on "Humidity changes and possible forcing mechanisms over the last millennium in arid Central Asia".

Authors: Shengnan Feng, Xingqi Liu, Feng Shi, Xin Mao, Yun Li, Jiaping Wang

The instability of humidity variation, especially on decadal to multi-decadal timescales, has a profound impact on human welfare in arid central Asia (ACA). However, it is still uncertain whether the regional hydrological evolution was controlled by external driving or internal driving. In this study, the authors provided a ~1.8-year high-resolution humidity record spanning the past 840 years from Lake Dalongchi. Based on this record, a dry Medieval Warm Period (MWP) and a wet, unstable Little Ice Age (LIA) was determined. Moreover, they suggested that the climate instability during the LIA was controlled by Gleissberg solar cycle and ENSO on centennial and multi-decadal timescales, respectively. Such high-resolution record is very rare in the ACA. This manuscript provides critical insights into regional climate change history, although the results still need to be further corroborated. Therefore, I suggest that the manuscript can be accepted for publication after a minor revision.

### Major comments:

1. A previous study discussed climate instability in Northwestern China during the LIA, which proposed that the instability of North Atlantic Oscillation (NAO) was a major driving factor (Chen et al., 2019). In this manuscript, the authors emphasized the influences of solar forcing and ENSO on climate instability during the LIA, but neglected the influences of NAO. It would make the conclusions more complete by adding the related discussion in the manuscript.

*Chen, J., Liu, J., Zhang, X., Chen, S., Huang, W., Chen, J., Zhang, S., Zhou, A., and Chen, F. Unstable Little Ice Age climate revealed by high-resolution proxy records from northwestern China, Climate Dynamics, 2019, 53, 1-10.*

2. During 1400-1800 CE, the variation of humidity index was negatively correlated with that of ENSO variance (Fig. 7d). However, the humidity index showed consistent variation with ENSO variance during 1800-1950 CE. How to explain the complicated relationship between humidity index and ENSO variance? More discussion is needed in here.

3. Figure 6 shows the comparison of humidity records from Lake Dalongchi with other records. However, the authors only use one sentence to describe it (Lines 146-149). It would be better to add more statements.

### **Minor comments**

1. In Line 140, the authors stated that "Positive and negative Z-scores indicate dry and wet climatic conditions (Fig. 5a)." But this statement is opposite to the contents of Figure 5.

2. The authors used *bacon* 2.2 to establish the age-depth model. However, the latest version is *bacon* 2.5.7, which used new calibration curve.

3. The statement of "at different timescales" should be changed to "on different timescales". This issue should be revised throughout the whole manuscript.

4. Line 89: Is "mass susceptibility" supposed to "magnetic susceptibility"?

5. Line 119, 120: Change "fraction" to "percentage".

6. Line 133: Change "high susceptibility" to "high MS values".

7. Line 143: Given that the correlation coefficient between humidity index and instrumental data is only 0.298, it's inaccurate to state it as "good consistency".

8. Line 245-247: The DOI of this paper was missed.

9. Line 358: The "." should be removed from "10.1029/2009GL040951.,".