Clim. Past Discuss., 10, C1203–C1210, 2014
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Climate of the Past Discussions

Interactive comment on "Late Holocene environmental reconstructions and the implications on flood events, typhoon patterns, and agriculture activities in NE Taiwan" *by* L.-C. Wang et al.

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Dear Editor:

We really appreciate your help on accessing the review works and your constructive comments. All comments had been responded carefully in below.

Editor: In addition to reviewers' comments, I have the following comments. First, the pollen and diatom records reflect local environmental changes in the study area. According to the data and the author's interpretation, the study site changed from an

alluvial plain to a shallow lake environment. Diatom frustules are a good indicator of lake water, indicating that shallow lake was situated at the study site in the late 10th century and after 15th century. The authors should describe the development of depositional setting based on lithology and diatom fossils. Based on limited information in this paper, the shallow lake (2 m deep) environment is just a local expression of the transient phase of the development of the alluvial plain at the study rather than the expression of regional change. Fig. 4 shows that drastic changes in pollen assemblage were associated with the establishment of shallow lake environment. I wonder that pollen assemblages reflect the local depositional environments rather than regional vegetation. I also wonder whether or not the wet-dry information is successfully extracted from pollen and diatom assemblages. I thus suggest the author to interpret what pollen assemblage implies with careful consideration of local depositional environment.

Reply: We agreed to the editor's comment. The abrupt variation of pollen assemblages during late LPZ 1, and LPZ 3 (LIA1) can only reflect the local depositional environments rather than the regional vegetation. For this, we revised the contents in discussion 5.2, and focused on floodplain evolution on the basis of lithology and diatom fossils, while the palynological proxies (ex. Pollen-PC1, Pollen-PC2) were only used for interpretation of human activity and local hydrological conditions. The climate interpretation has been removed.

Editor: Second, the some results of the study core DH7-B were already reported by Chen et al. (2012, JQS). The authors should cite Chen et al. (2012) in a proper way. All of the radiocarbon dates were reported in Chen et al. (2012). Thus, the description should be located in "results" but in "method" with citation of Chen et al. (2012). The discussions on the grain size, typhoon, and the linkage between typhoon signal and ENSO are the same as those in Chen et al. (2012). The authors should clearly indicate that they borrow the discussion from Chen et al. (2012).

Reply: We moved the radiocarbon description from the methods section to the results

section with the citation of Chen et al. (2012). We revised and quoted clearly to the discussions from Chen et al. (2012) on the issue of grain size, typhoon, and the linkage between typhoon track and ENSO.

Editor: Third, the discussion on the linkage between pollen-PC2, typhoon signal (sand content) and climate parameters is speculative. I suggest to remove the discussion and focus on agricultural development or to rewrite it thoroughly.

Reply: We revised our discussion thoroughly according to the editor's suggestions. For details, please see in below.

Editor: The description of modern linkage between the typhoon precipitation in Ilan area and the ENSO is not enough in introduction. The diagrams showing the monthly precipitation in typical El Nino and La Nina years are helpful for readers.

Reply: We added the diagram of the overlapping annual rainfall and multivariate ENSO Index (Fig. 2). We also added the description of TC rainfall and ENSO in northern Taiwan in section 2 as below.

"According to the long-term Ilan meteorological record the annual precipitation represents a negative correlation with ENSO intensity (Fig. 2). TC frequency and TC-trigger rainfall, which decrease in Ilan during El Niño years because mean steering flows become southerly and drive TCs to recurve northward toward Japan and the North Pacific (Chen et al., 2010)."

Editor: Explain why the typhoon record from the study site is different from that from south Japan (Woodruf et al., 2009, QSR, 28, 1774-1785).

Reply: We quoted the assumption from Chen et al. (2012), and explained it in section 5.3 as below.

"The records of pollen, diatoms and grain size in the DHL sediments show the frequent typhoon activity during 500-700 AD and the LIA 2 in NE Taiwan with the negative correlation with ENSO intensity (Fig. 9). However, stronger typhoon activities in

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Japan were recorded during 900-1100 AD, showing a positive correlation with ENSO intensity (Woodruff et al., 2009). Chen et al. (2012) suggested that the inconsistent paleo-typhoon record between Taiwan and Japan is relative to the shift in the TC track influenced by the ENSO (Fogarty et al., 2006; Huang and Xu, 2010). This phenomena agrees with the statistical study of 50-years of typhoon records in Fujian (Fig. 1), revealing that the number of TCs affecting Fujian in general is higher during La Niña years (Yin et al., 2010). Thus, the precipitation anomaly caused by frequent typhoons during 500-700AD and the LIA 2 may correlate to TC track shifts during La Niña-like periods, which caused the asymmetrical distribution in local precipitation superimposed on the regional hydrological pattern."

Editor: The SOI index by Yan et al. (2011 Nature Geoscience) is a grain size record in lake sediments from a northern South China Sea island; lager grains were deposited in heavy rainfall events. The record indicates heavier precipitation (larger grain size) in the LIA and drier (smaller grain size) in the MWP. In contrast, the PC-2 suggests wetter climate in the MWP. What caused this difference.

Reply: We assumed the precipitation triggered by the north shift of ITCZ might not induce the heavy rainfall in northern Taiwan (or our record cannot reflect the shift of ITCZ). We explained it in the section 5.3 as follow.

"The flood intensity seems to be positively correlated with the SST of IPWP and EASM, but is weakly linked to the variations in the EAWM and ITCZ, suggesting that the rainfall is influenced by the EAWM strengths or the shift in ITCZ, generally not high enough to trigger flood events in NE Taiwan."

Editor: The speleothem record from Wanxiang Cave (Zhang et al., 2008 Science, 322, 940-942) rather than the Dongge Cave record may have better correlation with Ilan records. If this is true, it suggests the linkage with the East Asian summer monsoon.

Reply: We follow the editor's comment, and used the speleothem record from Wanxiang Cave (Zhang et al., 2008) as the proxy of the EASM proxy. We re-drawed Fig.1

and Fig.8 to fit changes. The new Fig.8 represents the linkage between flood events and EASM intensity. Accordingly, we revised our abstract, discussion, and conclusions.

Interactive comment on Clim. Past Discuss., 10, 1977, 2014.

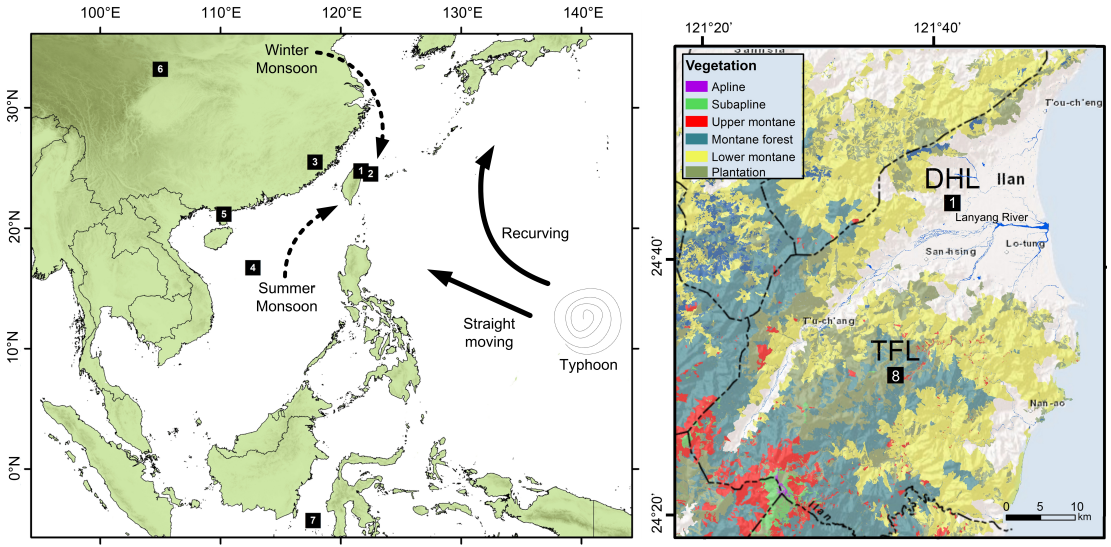

Fig. 1. Major forces affecting precipitations in Taiwan (left) and location of Dahu Lake (DHL) with modern vegetation cover (right). Locations (black squares) are used for discussions as follow: (1) DHL; (2)

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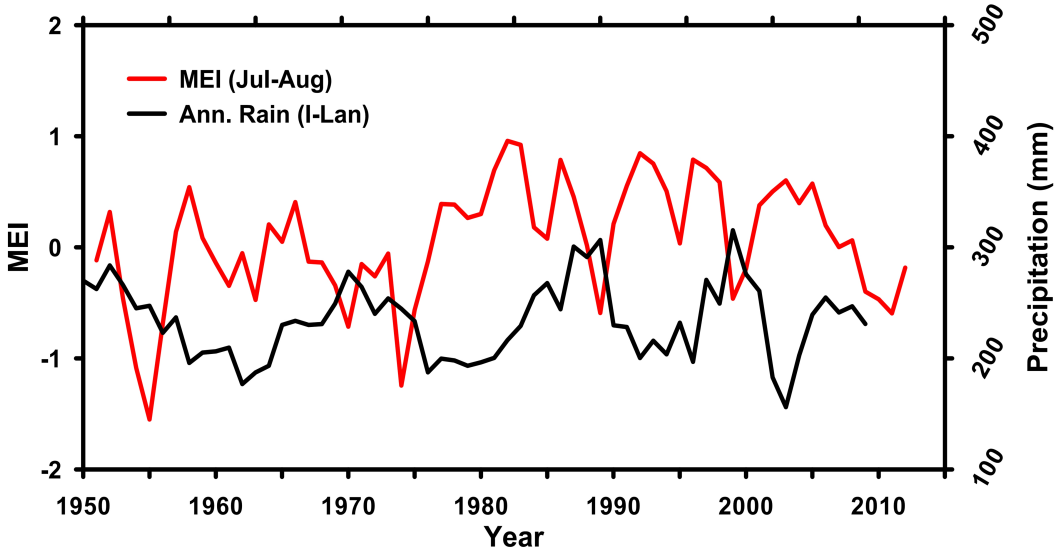

Fig. 2. Annual rainfall data from the Ilan weather station overlaping with the multivariate ENSO Index (MEI) (Wolter and Timlin, 2011). The negative linkage between annual precipitation and MEI indicate the d

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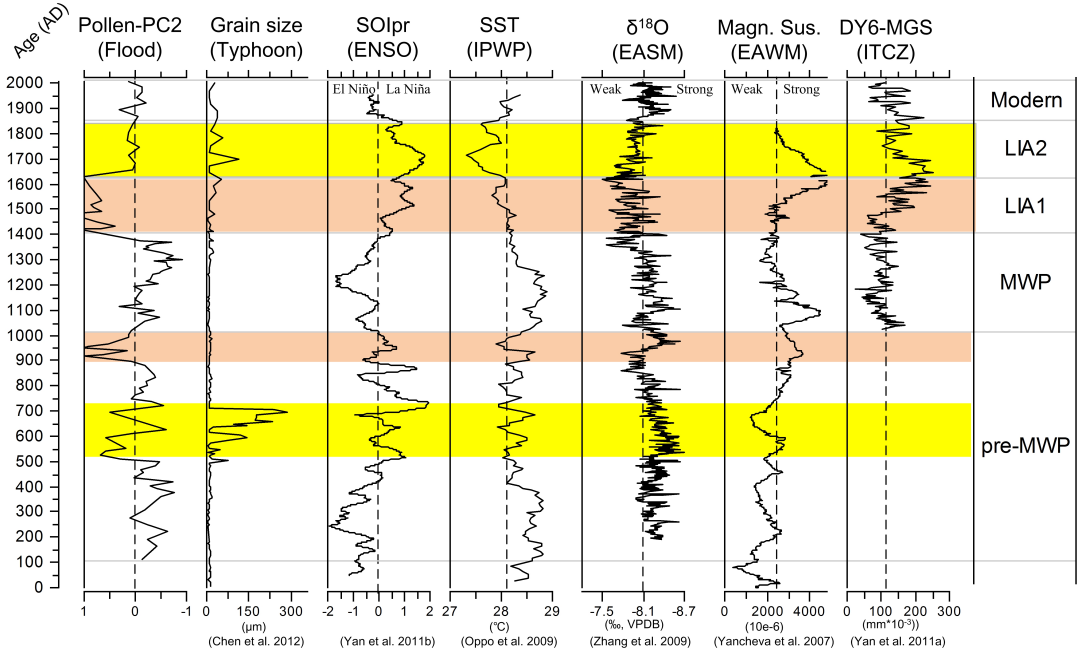

Fig. 3. Fig. 8 Variations of diatom-inferred precipitations during the last thousand years in subalpine lake (TFL), lowland lake (DHL), and offshore marine sediments (SOT).