



Northwestward migration of the East Asian monsoonal limit during the Medieval Warm Period

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Background

- The East Asia summer monsoon (EASM) variability and changes in monsoonal rainfall are critical for hydrology and ecology conditions in water-stressed regions of northern China.
- Due to complex interactions of monsoonal and westerlies circulation, hydroclimatic conditions at the boundary between two circulation systems, commonly defined as the 300 mm annual rainfall line, remain poorly understood.
- Here we report alkenone records (UK'_{37} , $\%C_{37:4}$, and RIK_{37}) from Lake Eastern Juyanze in northern China to assess temperature and hydrological changes in marginal monsoon region over the last millennium.

Methods

- Lake Eastern Juyanze (42°16'–42°20'N, 101°13'–101°15'E, 900 m asl), a closed-basin, brackish lake located in the northwestern Badain Jaran Desert, Inner Mongolia, China.
- A ~ 1.1-m-long core from lake center, ¹⁴C dating, alkenone analysis.

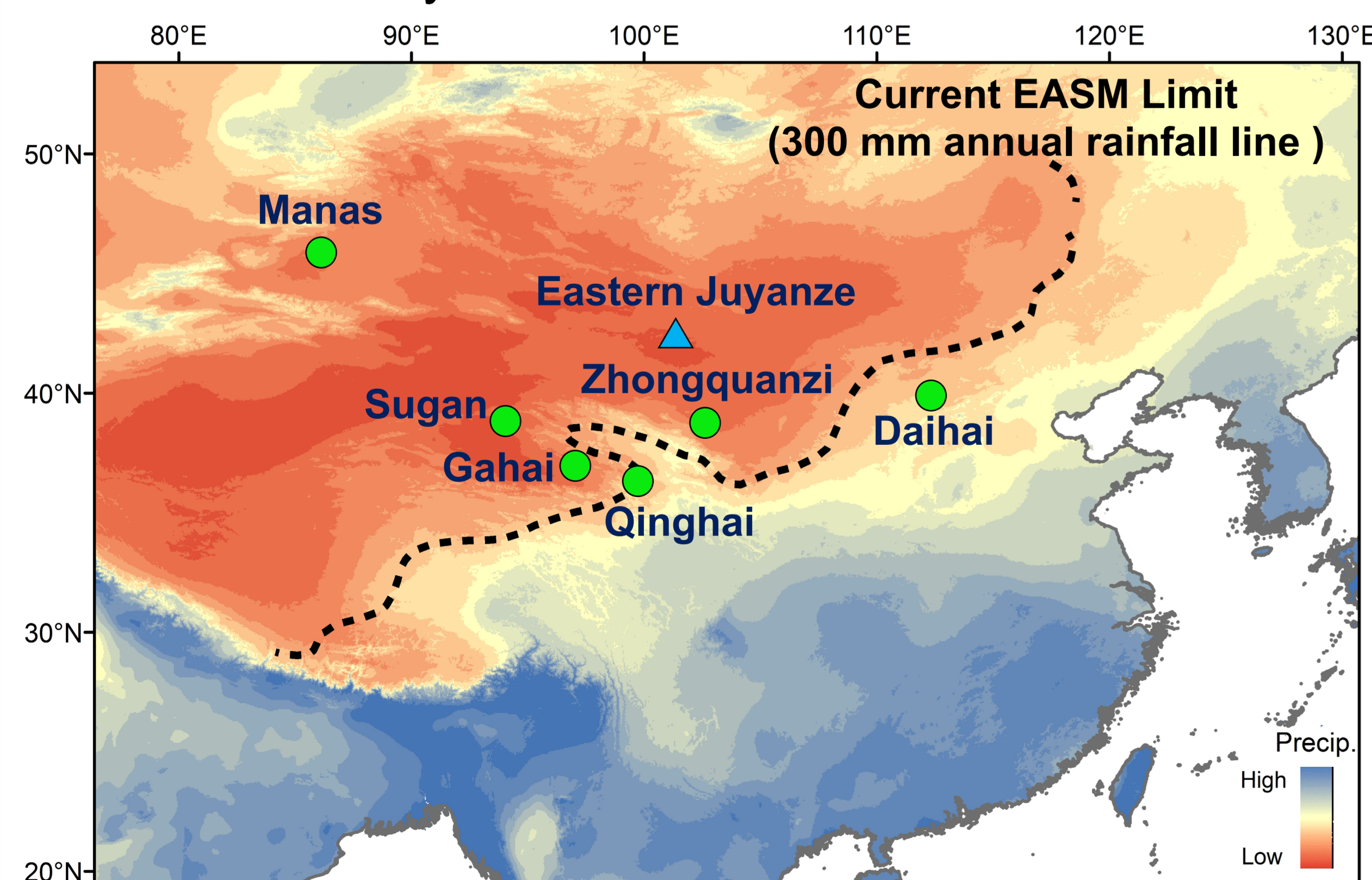


Fig. 1. Map showing the location of Lake Eastern Juyanze (blue triangle) and locations of other hydrological records in northern China (green dots).

Preliminary results

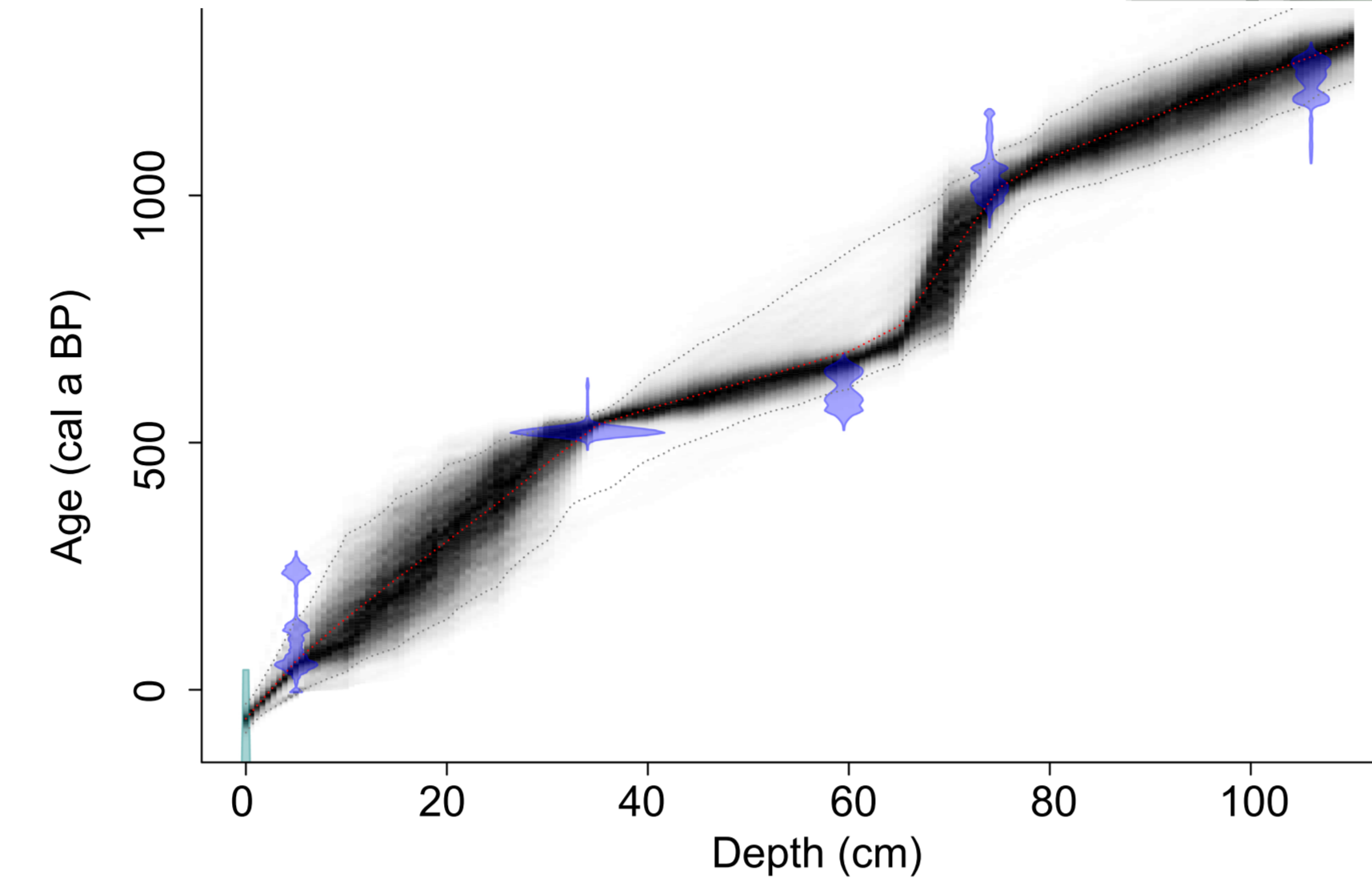


Fig. 2. Age model for the sediment core. Reservoir age: 3,250 years.

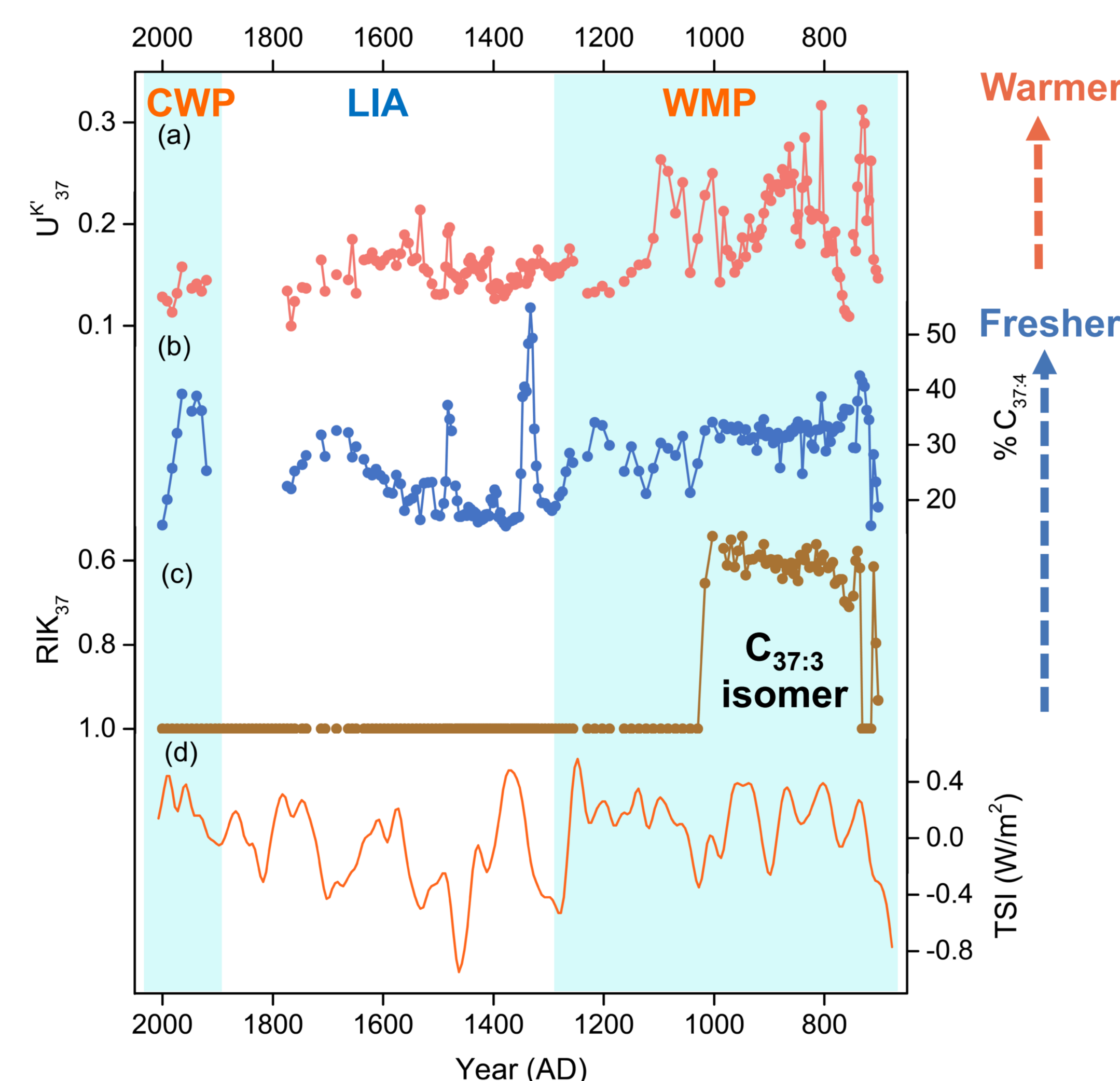


Fig. 3. Alkenone records and total solar irradiance.

- High UK'_{37} and $\%C_{37:4}$ values, and appearance of alkenone $C_{37:3}$ isomer during the Medieval Warm Period (MWP).
- The paired records follow the warm-wet and cold-dry association in monsoonal region over the last millennium, opposite to the pattern in westerlies region, although Lake Eastern Juyanze is located to the northwest of current monsoonal limit.

Migration of monsoonal limit

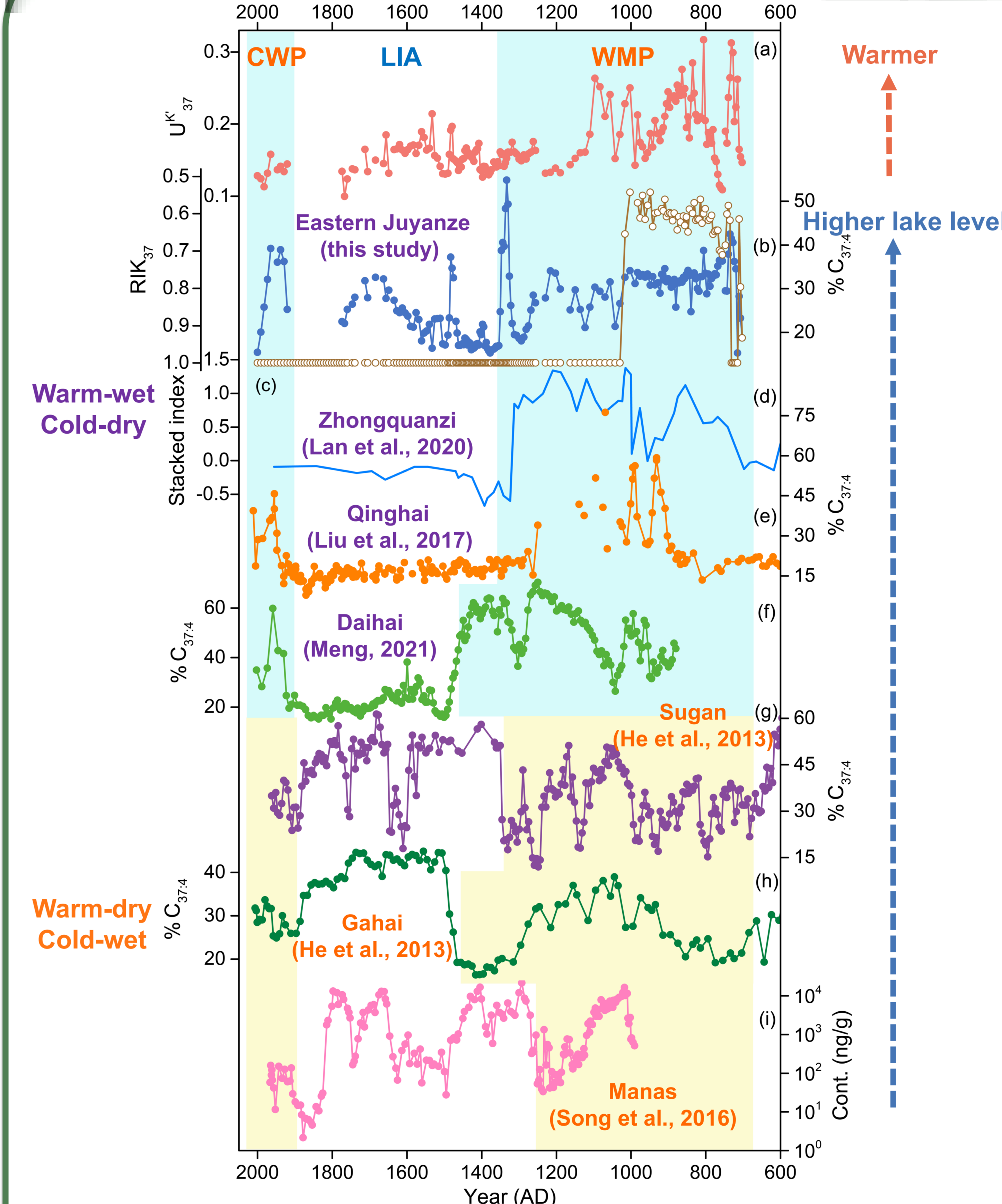


Fig. 4. Alkenone records from Lake Eastern Juyanze (a, b) and hydrological records from lakes in northern China (c-i).

- Warm-wet/cold-dry association in Badain Jaran Desert, indicating northwestward migration of East Asia monsoonal limit during the MWP over the western Inner Mongolian Plateau.
- The monsoonal limit may not change substantially over the northeastern Qinghai-Tibetan Plateau during the MWP, possibly associated with mountain barriers.

Conclusions

- Northwestward migration of East Asia monsoonal limit during the Medieval Warm Period associated with relatively high solar irradiance and enhanced summer monsoon circulation.
- Findings in this study highlight the complexity of hydroclimatic changes in marginal monsoonal regions, and further investigations focusing on the Holocene and current warm period are highly recommended.

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