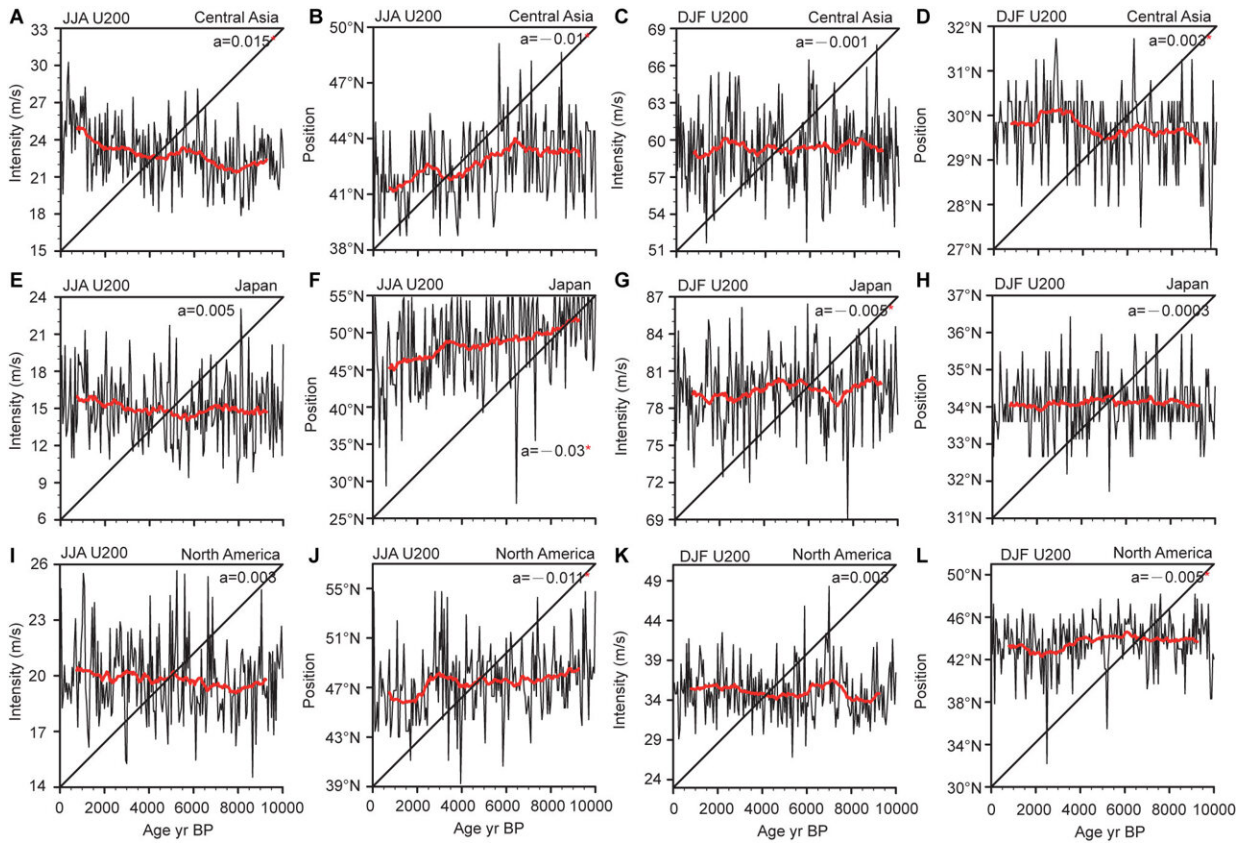
Study reveals inland arid climate dynamics over Asia since the Holocene

October 21 2021, by Li Yuan



Simulated changes in the intensity and position of WJ during the Holocene over Central Asia (a–d), Japan (e–h), and North America (i–l). The red line represents a 31-simulation-year moving average. The red pentagram indicates that slope is significant at the 99% significance level. Credit: DOI: 10.3389/feart.2020.00282

A joint research team led by Prof. Shi Zhengguo from the Institute of Earth Environment of the Chinese Academy of Sciences and their collaborators revealed the inland arid climate dynamics over Asia since the Holocene.

Their study was published in *Quaternary Science Reviews*.

The researchers conducted a high-resolution transient experiment by a coupled climate model to evaluate the dynamics of subtropical westerly jet (SWJ) and Central Asian precipitation since the Holocene.

SWJ in the upper troposphere is an important atmospheric circulation system, which can influence global climate by changes of its north-south migration and intensity.

The researchers found that the summer SWJ gradually migrated southwards and strongly strengthened over the Central Asia, Japan and North America from the early to late Holocene; meanwhile, the position of the winter SWJ almost barely moved and slightly changed. The variations of position and intensity of SWJ should be primarily attributed to the astronomical insolation changes.

The response of precipitation over arid Central Asia since the mid-Holocene is long considered to be controlled by astronomical insolation-induced changes in the westerlies. The simulated precipitation changes are distinctly different over regions although they are mainly associated with the westerlies. The annual precipitation increased over Balkhash-Altai region but decreased over Turan Plain, Mongolia-Baikal and Tarim Basin, in all of which the summer precipitation contributed most.

Following the summer insolation, the southward shift of westerly jet was accompanied by wave-like anomalies in the upper-tropospheric meridional winds across mid-latitude Eurasia, which resulted in distinct

summer precipitation changes. In contrast, the responses of winter precipitation were limited even in the winter-rainfall-dominated regime due to the small insolation change.

The decreased precipitation over Tarim was mainly explained by weakened low-level easterly wind anomaly and less moisture supply from East Asia.

More information: Zhengguo Shi et al, Distinct Holocene precipitation trends over arid Central Asia and linkages to westerlies and Asian monsoon, *Quaternary Science Reviews* (2021). DOI: 10.1016/j.quascirev.2021.107055

Peng Zhou et al, Response of Westerly Jet Over the Northern Hemisphere to Astronomical Insolation During the Holocene, *Frontiers in Earth Science* (2020). DOI: 10.3389/feart.2020.00282

Provided by Chinese Academy of Sciences