

This paper introduces a new East Asian summer monsoon rainfall reconstruction from the northwest Chinese loess plateau over the last 650,000 years. The new precipitation proxy (Ca/Ti) and speleothem $\delta^{18}\text{O}$ ($\delta^{18}\text{O}_{\text{sp}}$) are assessed to illustrate the modulating drivers of magnitude of millennial monsoon variability (MMV) at the orbital timescale. Wavelet analysis highlights the remarkable ice volume and GHG modulation at 100 kyr band as well as GHG and local insolation forcing at precession band for the MMV of Ca/Ti, but not that of MMV in $\delta^{18}\text{O}_{\text{sp}}$. The MMV of loess Ca/Ti and $\delta^{18}\text{O}_{\text{sp}}$ are modulated differently at orbital time scales, implying that these two proxies document different climatic response of millennial-scale monsoon circulations. At the precession band, increasing atmospheric GHG following with larger insolation results in further enhancement in MMV of EASM rainfall, which agrees with the model result and prediction in more frequently occurrence of extreme rainfall under future global warming conditions.

In general, the content of their paper is very interesting. They link the interactions between millennial-scale variability and orbital-scale driving factors. Based on their findings, they predict how would millennial-scale abrupt East Asian summer monsoon rainfall would evolve under future warming conditions. Some suggestion are as follows:

One Highlight of this paper is the new summer rainfall indicator Ca/Ti. However, they do not mention too much about how Ca/Ti link to the East Asian summer rainfall and associated mechanism.

Re: Thanks for reminding us of highlighting our new proxy. We would add relative contents in last paragraph of introduction section. See new revised version.

In the introduction section, the logic of each paragraph could make some changes for improvements.

Re: We would like to check logic of each paragraph and make some changes for the introduction part.

In results section, the content includes some discussion sentences.

Re: Yes, the last paragraph of result section includes some discussion. These sentences are applied to introduce scientific questions that we want to discuss in next section.