

Comment on cp-2021-188

Anonymous Referee #1

Referee comment on "Greenhouse gases modulate the strength of millennial-scale subtropical rainfall, consistent with future predictions" by Fei Guo et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-188-RC1>, 2022

Review Guo et al.,

Guo et al., generated a high-resolution summer monsoon proxy (Ca/Ti) from Linxia on the western CLP. The Ca/Ti ratio is interpreted as a precipitation-sensitive proxy linked to summer monsoon rainfall (Guo et al., 2021). The new precipitation proxy (Ca/Ti) and an East Asian composite speleothem $\delta^{18}\text{O}$ record ($\delta^{18}\text{O}_{\text{sp}}$) are evaluated to elucidate the modulating drivers of these two proxy records.

The authors find that the MMV of Ca/Ti is mainly modulated by ice volume and greenhouse gases (GHG) at the eccentricity band. Both GHG and summer insolation modulate the MMV of Ca/Ti at the precession band but not that of $\delta^{18}\text{O}_{\text{sp}}$; $\delta^{18}\text{O}_{\text{sp}}$ MMV is modulated by winter insolation at the eccentricity and obliquity bands. The inferred mechanism of how these internal and external factors modulate the MMV calls on dynamic linkages to variability in AMOC at both eccentricity and precession bands.

Results suggest that the MMV EASM rainfall is modulated by ice volume, GHG, and insolation factors, consistent with those predicted to influence future changes in monsoonal precipitation.

This is an interesting study in which the authors address two important outstanding questions: 1) is there a reliable proxy for East Asian summer monsoon (EASM) rainfall at the millennial timescale and 2) what factors modulate the MMV thereof?

The paper is clear and well wrote, and is suitable for a journal such as *Climate of the Past*. However the authors must answer to major/minor comments (see below) to be sure that the main conclusions of their paper can be fully supported before considering publication.

Major comment:

- There is no Figure with the age control points that include the error bars on these control points and more generally no errors for the age model used in this study. I suggest to add a figure that include the depth/age and errors for the age model of the loess record.

What is the implication of the age model errors for the wavelet coherence correlations that authors conducted (against GHG, ETP, Insolation and benthic $\delta^{18}\text{O}$ on Figure 4) and for the millennial-scale component extraction (Figure 3) ?

Minor comments:

- What is the resolution of the Ca/Ti record (in years) before resampling? I could not find it in the text.

- Introduction part (lines 51-60) : "flood and drought events". What is the definition of the authors here for flood and drought events? And at which time scale this events occur? Are they directly related to the millennial scale variability the authors reconstruct in this paper?