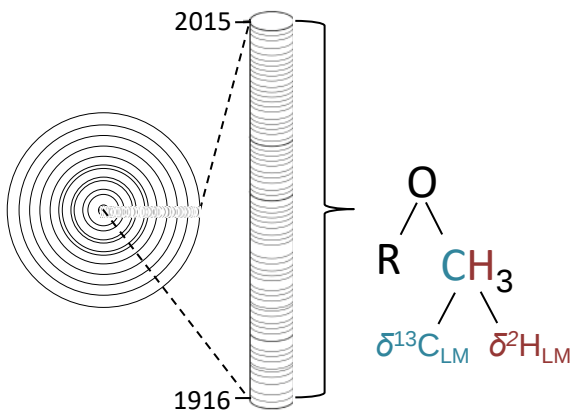
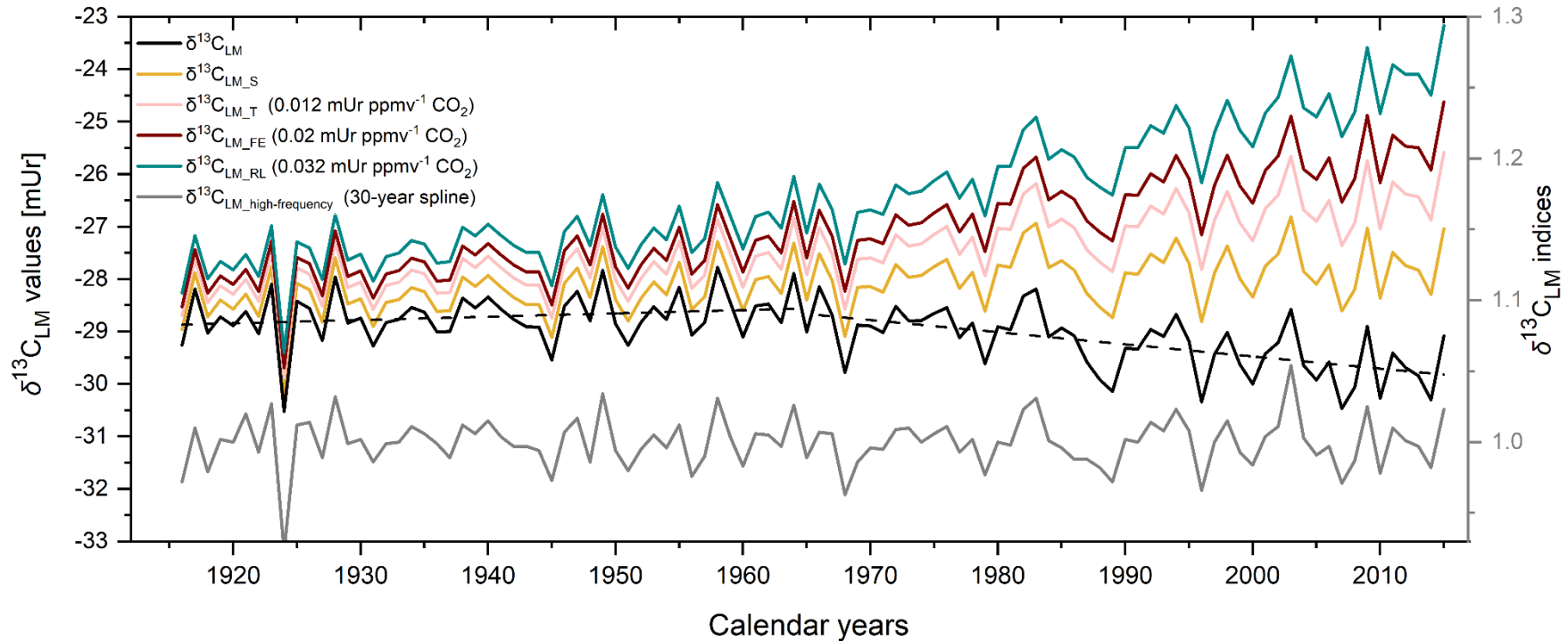




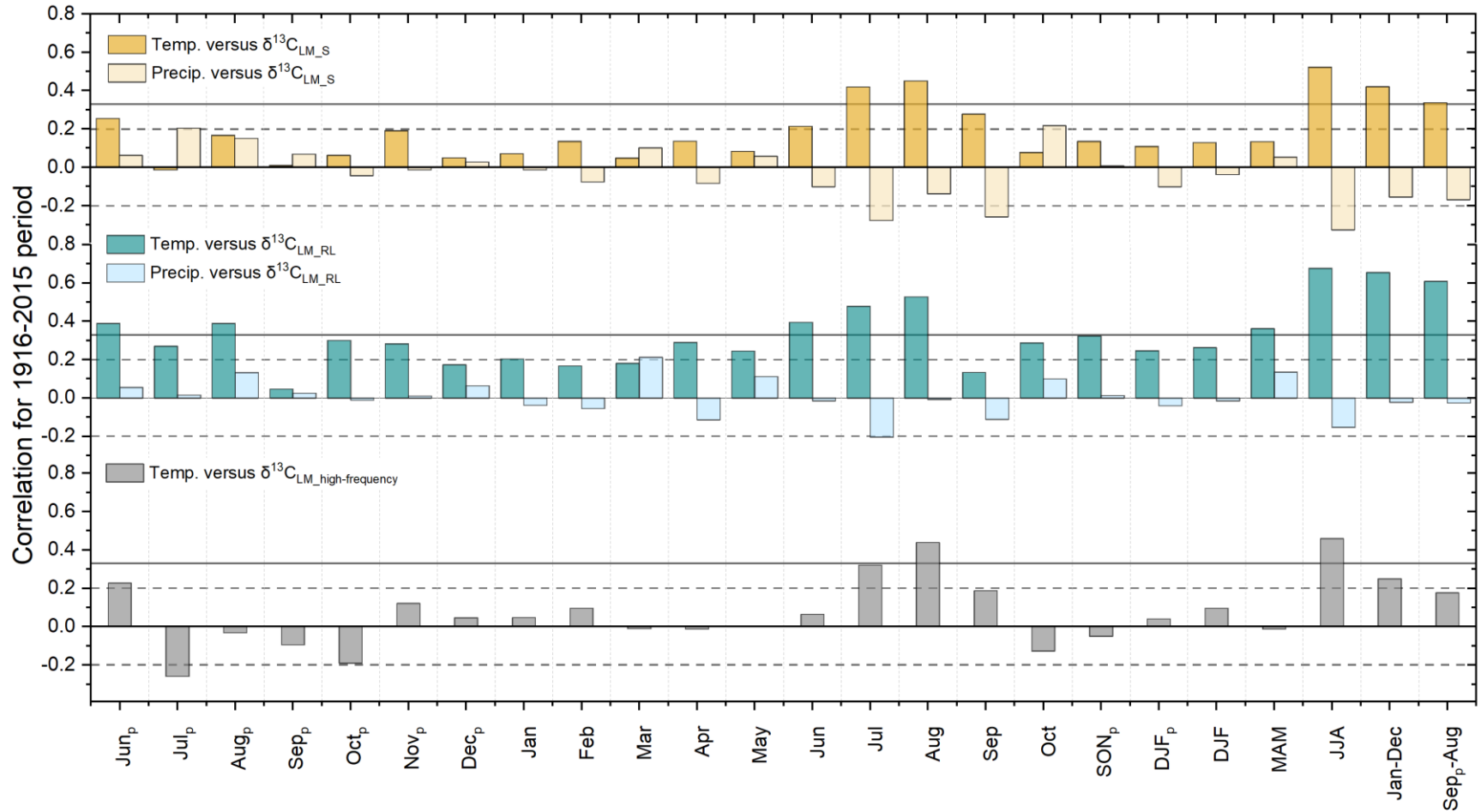
Climate signals in stable carbon and hydrogen isotopes
of lignin methoxy groups:
assessing the potential for temperature reconstructions at
different spatial and temporal scales

Anna Wieland, Markus Greule, Philipp Roemer, Jan Esper, and Frank Keppler

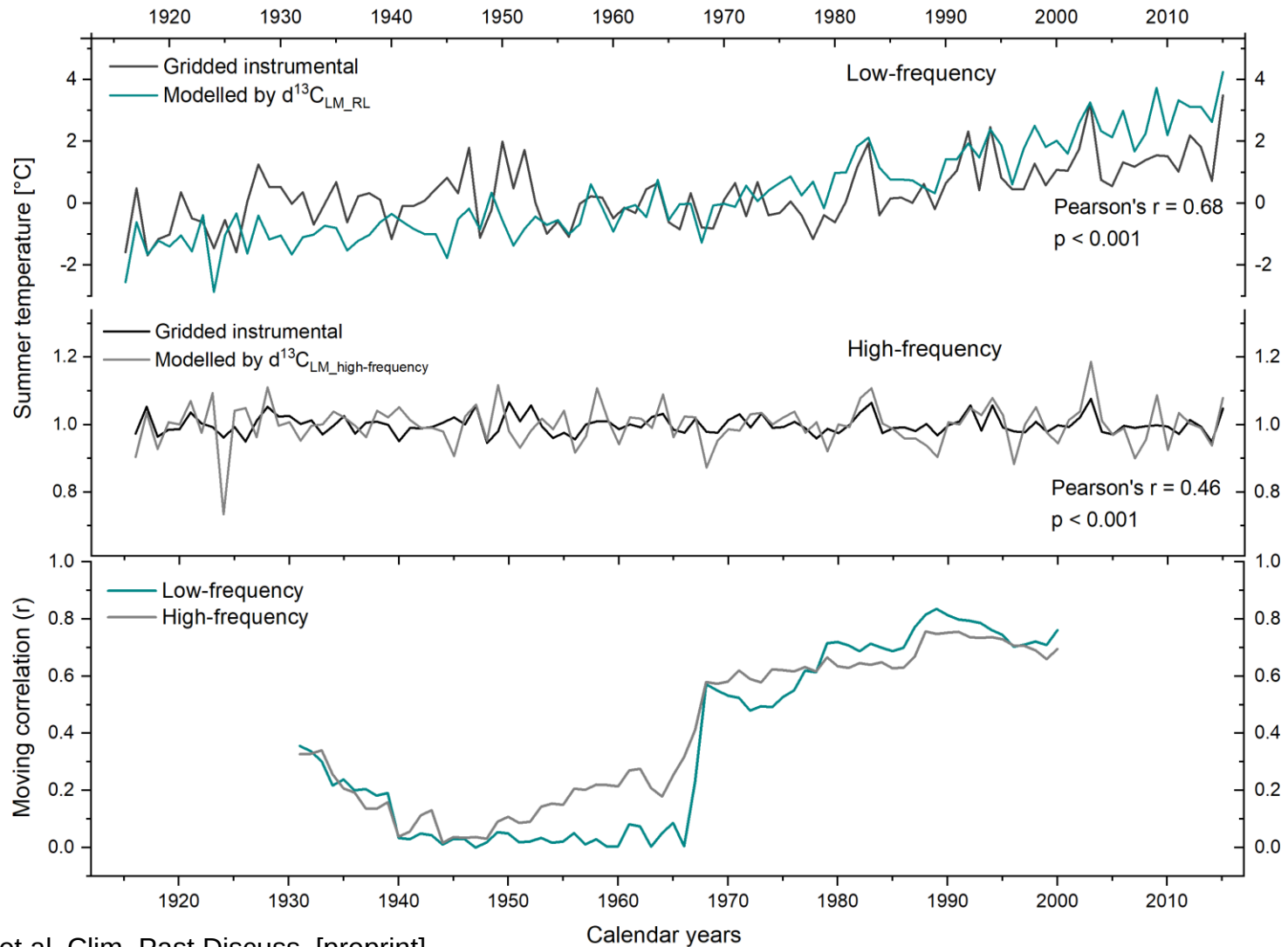
$\delta^{13}\text{C}_{\text{LM}}$ values correction for the Suess effect and physiological response



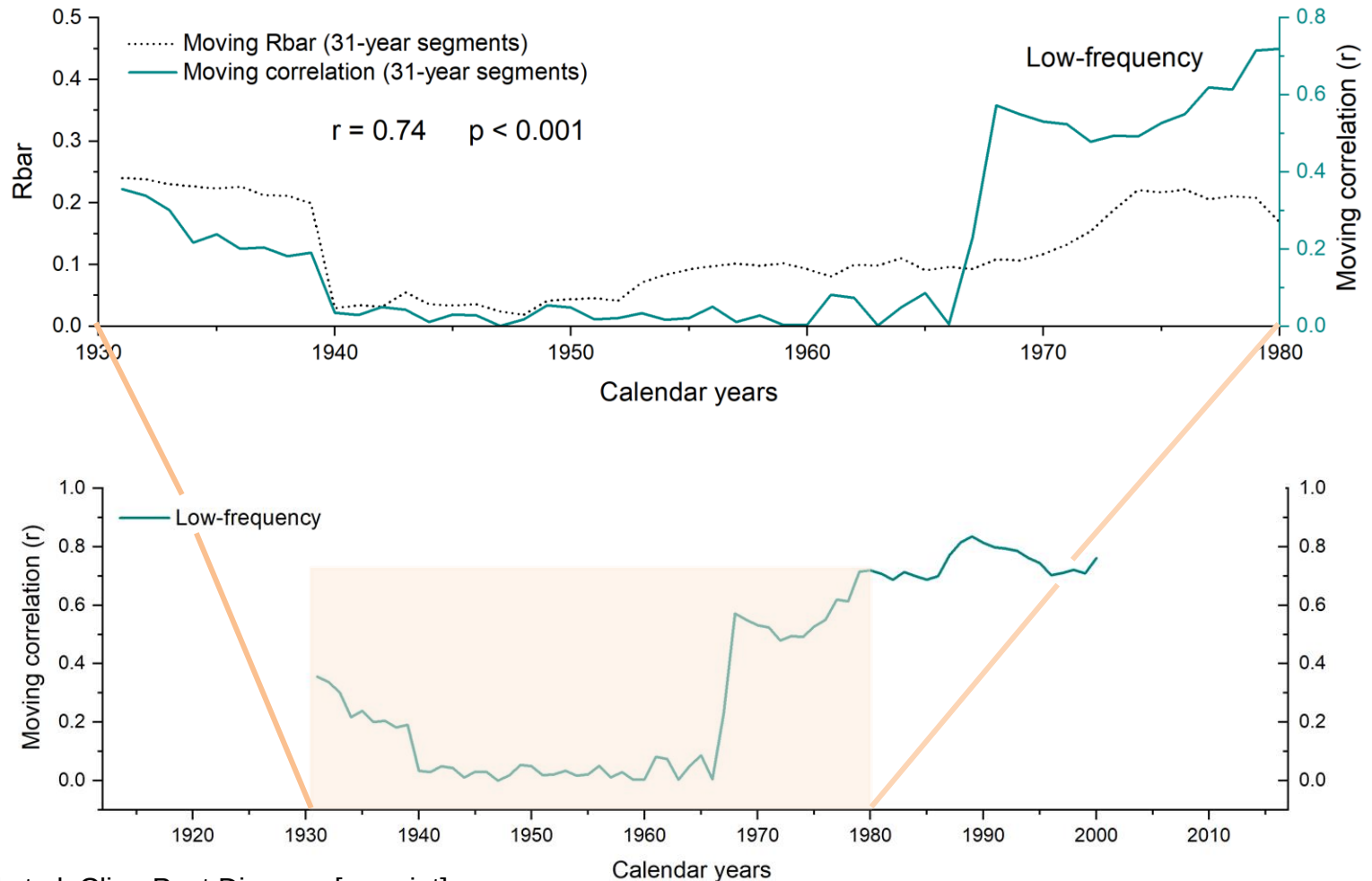
Relationship between $\delta^{13}\text{C}_{\text{LM}}$ chronologies and climate parameter



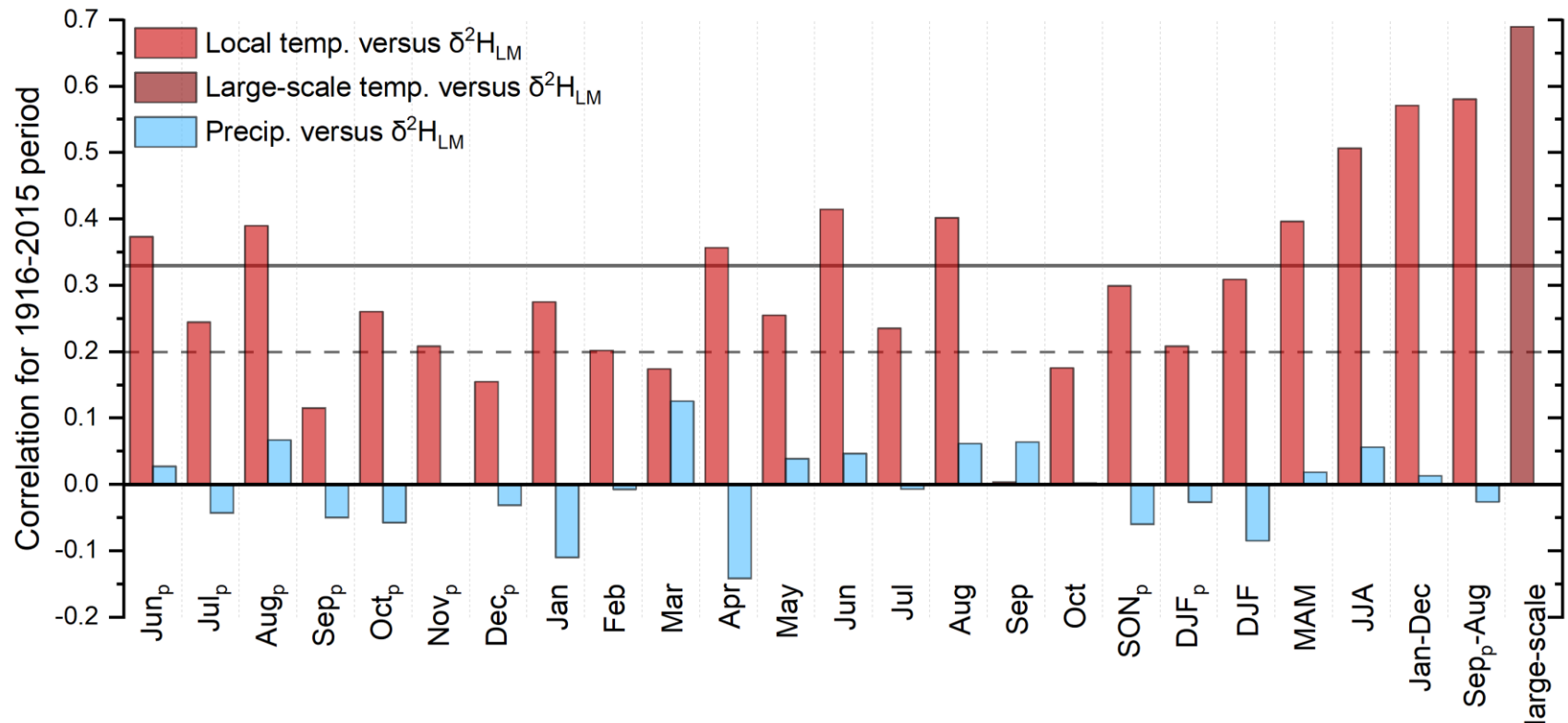
Transfer function and moving correlation



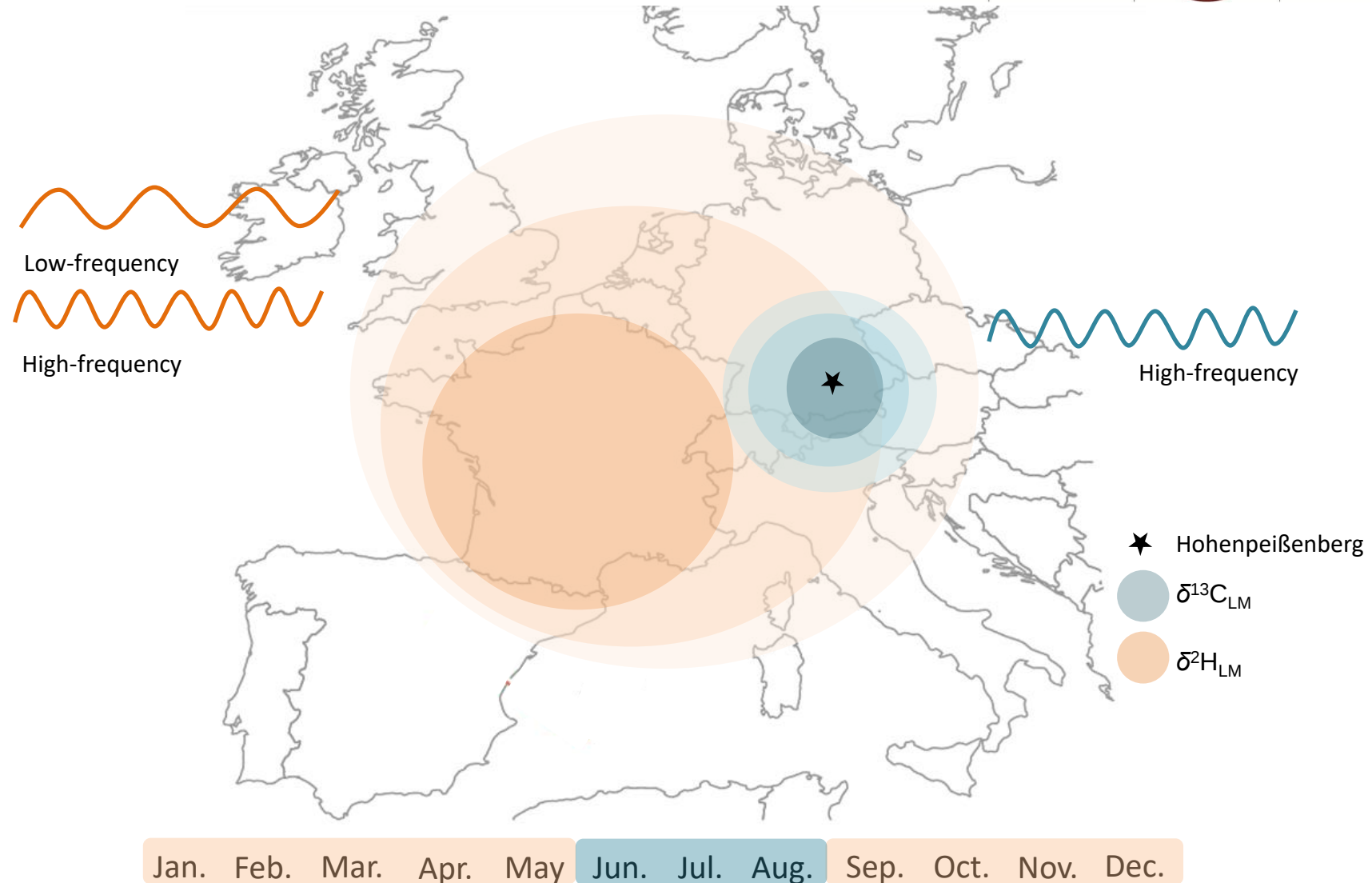
Transfer function and moving correlation



Relationship between $\delta^2\text{H}_{\text{LM}}$ chronology and climate parameter



Conclusion



Climate signals in stable carbon and hydrogen isotopes of lignin methoxy groups: assessing the potential for temperature reconstructions at different spatial and temporal scales

Anna Wieland¹, Markus Greule¹, Philipp Roemer², Jan Esper^{2,3}, and Frank Keppler^{1,4}

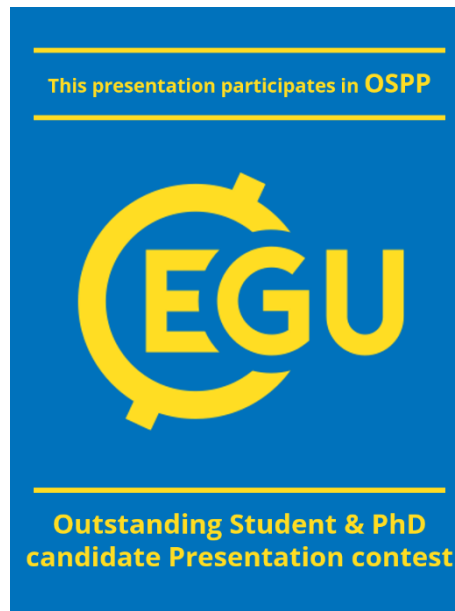
¹Institute of Earth Sciences, Ruprecht Karls University, Heidelberg, Germany (anna.wieland@geow.uni-heidelberg.de)

²Department of Geography, Johannes Gutenberg University, Mainz, Germany

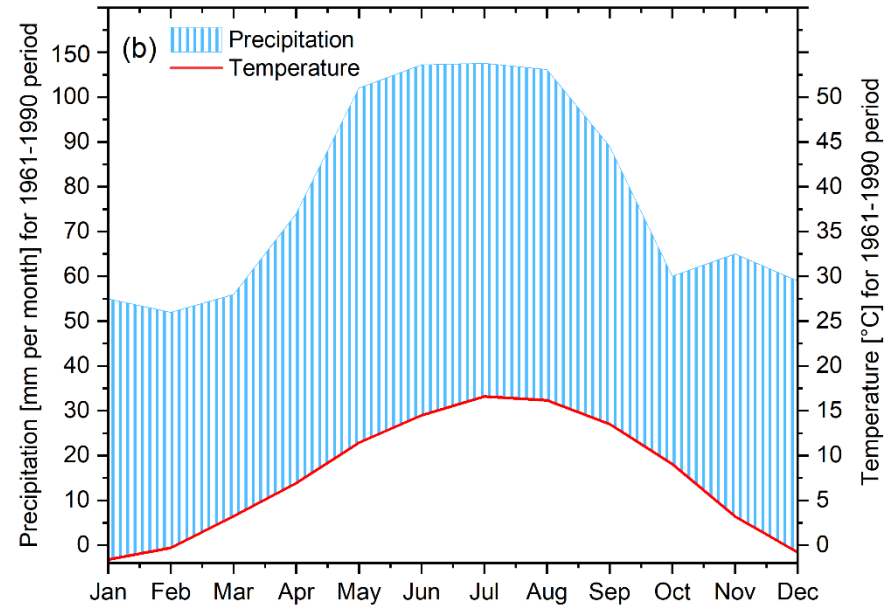
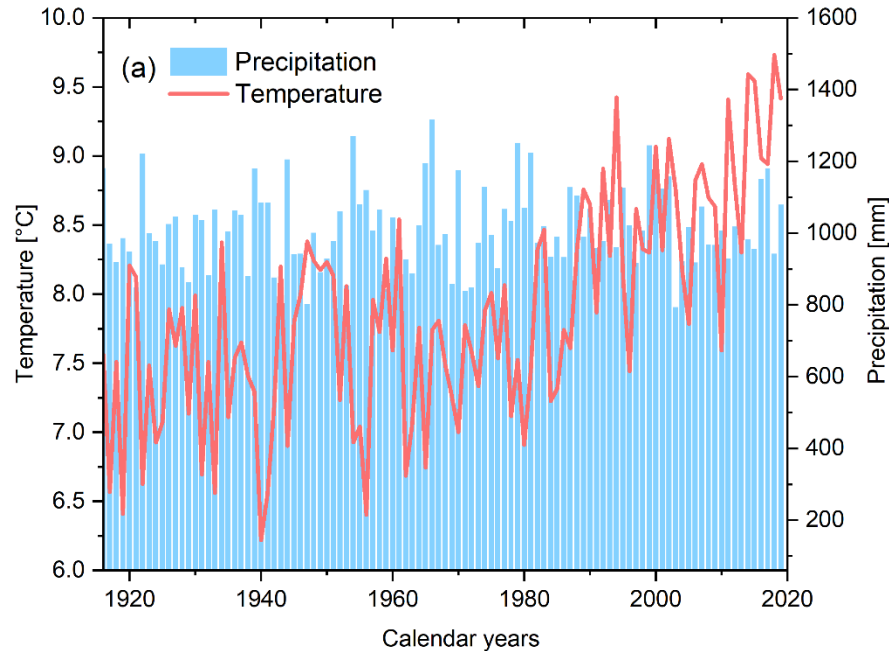
³Global Change Research Institute, Czech Academy of Sciences, Brno, Czech Republic

⁴Heidelberg Center for the Environment (HCE), Heidelberg University, Heidelberg, Germany

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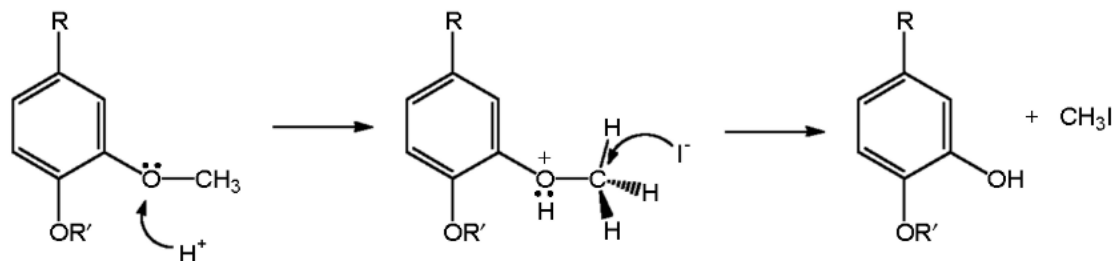
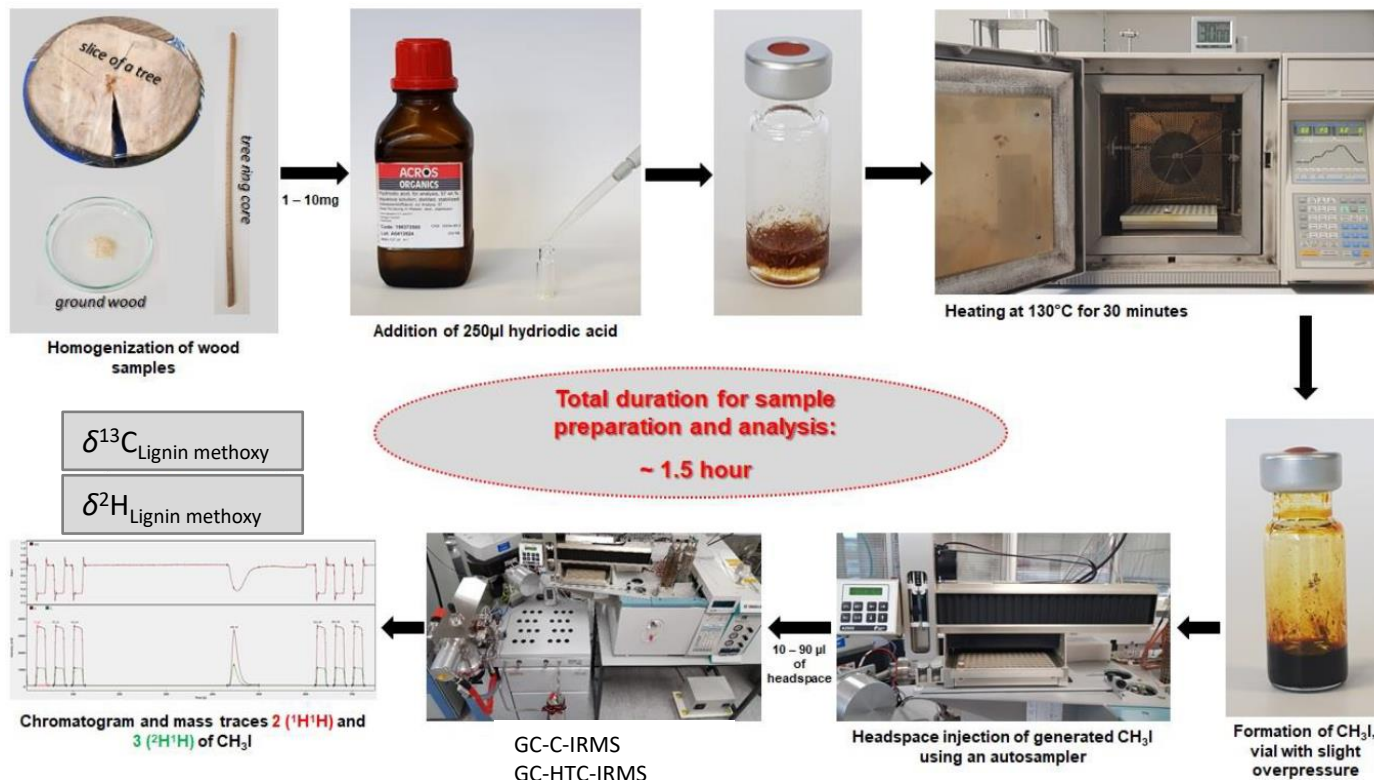


Extended materials: Study site



Climate at Hohenpeißenberg. (a) Mean annual temperatures and monthly precipitation totals since 1916, and (b) mean monthly temperatures and precipitation amounts calculated from 1961-1990 (CRU TS 4.04 data at 47.75°N/11.25°E). The region is characterized by a strong temperature increase since the 1980s and non-significant precipitation changes.

Extended materials: Sample preparation

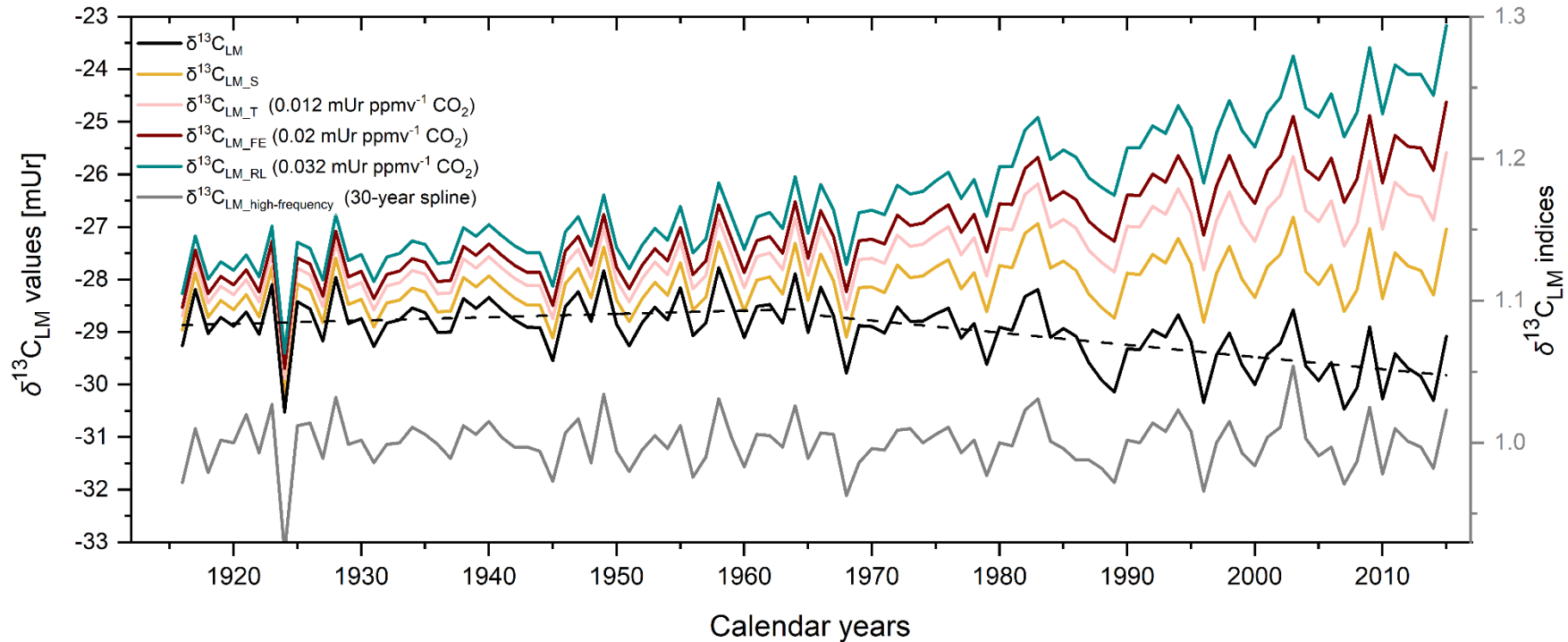


Greule et al., 2021

Goto et al., 2006

Reaction between lignin methoxy groups and hydriodic acid

Extended materials: $\delta^{13}\text{C}_{\text{LM}}$ values correction of the Suess effect and physiological response



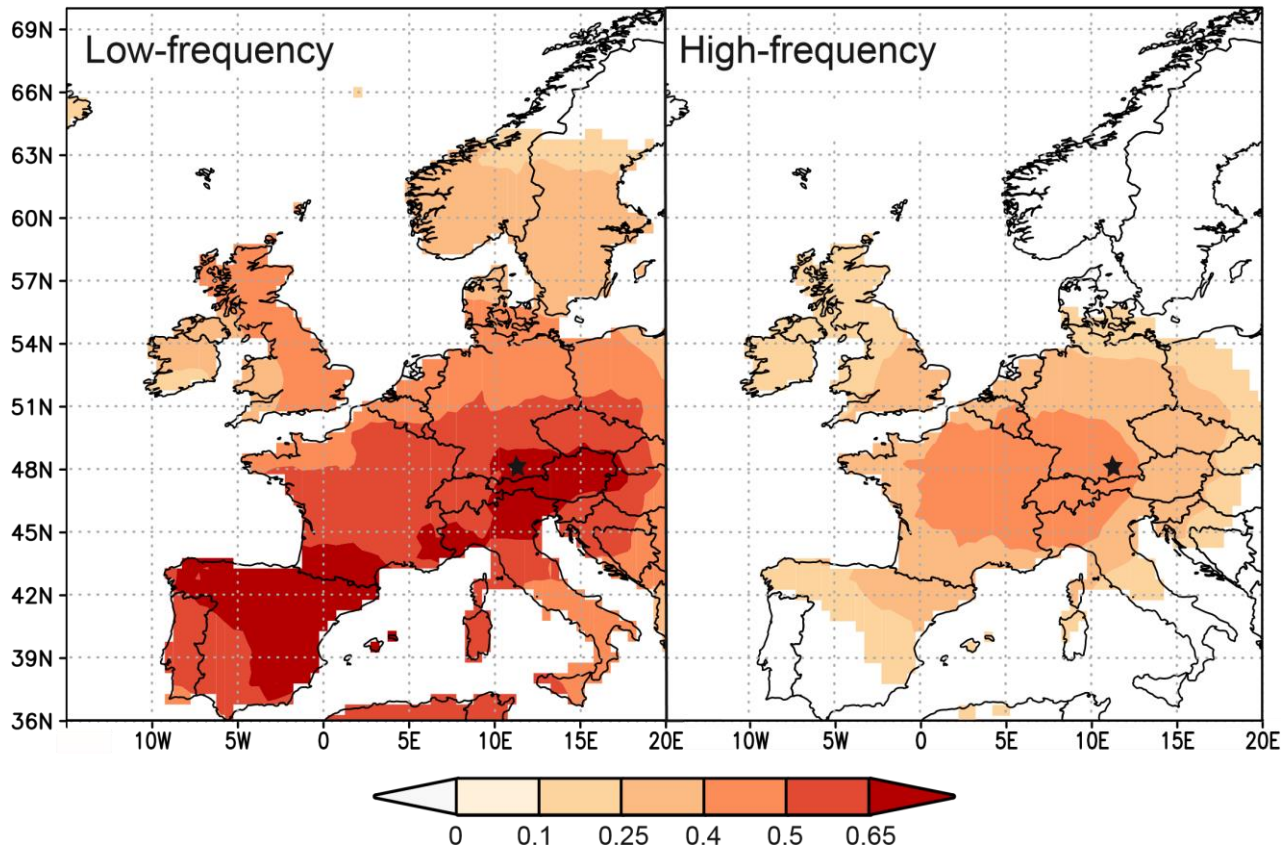
$$\delta^{13}\text{C}_{\text{LM}_S} = \delta^{13}\text{C}_{\text{LM}} - (\delta^{13}\text{C}_{\text{atmos}} + 6.4 \text{ mUr})$$

$$\delta^{13}\text{C}_{\text{cor.}} [\text{mUr}] = \delta^{13}\text{C}_{\text{LM}_S} [\text{mUr}] + \left((\text{CO}_2 \text{ atmos} [\text{ppmv}] - \text{CO}_2 \text{ pre.} [\text{ppmv}]) * \text{CF} [\text{mUr ppmv}^{-1}] \right)$$

Wieland et al. Clim. Past Discuss. [preprint],

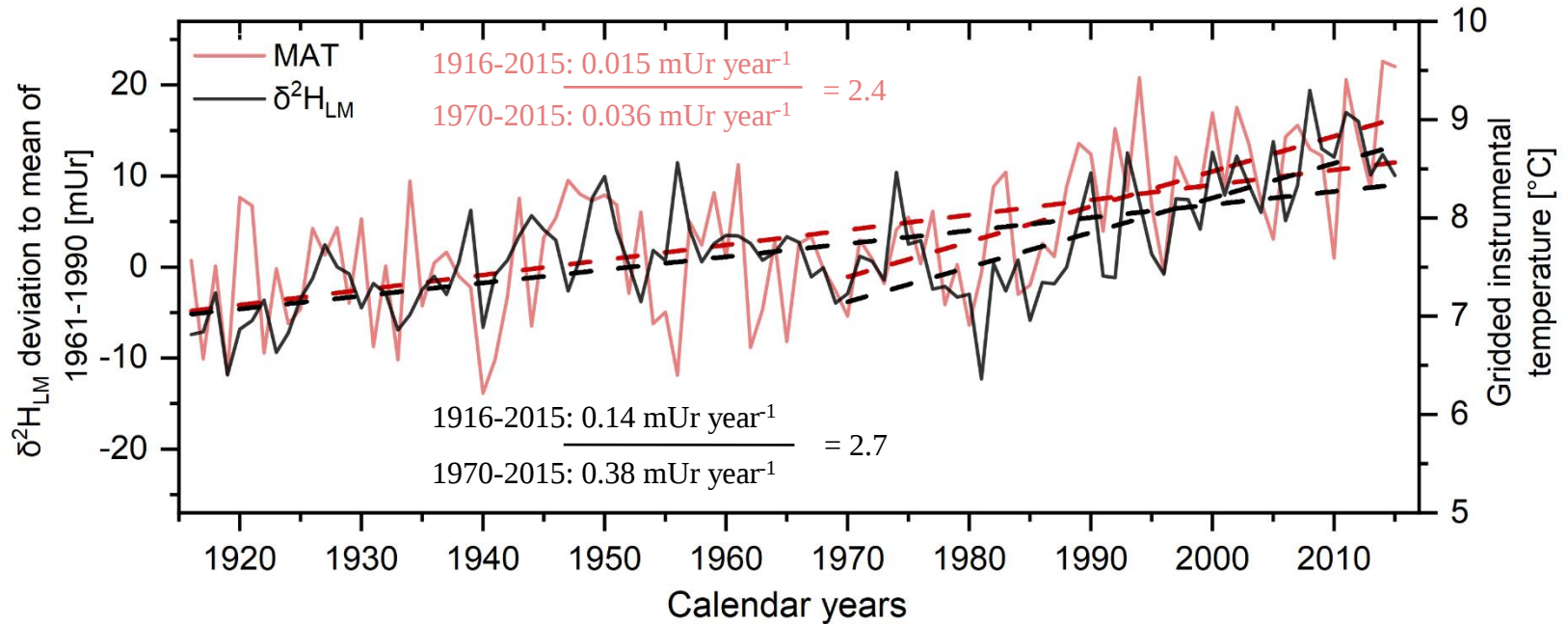
<https://doi.org/10.5194/cp-2021-135>

Extended materials: Relationship between $\delta^{13}\text{C}_{\text{LM}}$ chronologies and large-scale temperature



Spatial correlations between summer temperatures (CRU TS4.04) and $\delta^{13}\text{C}_{\text{LM_RL}}$ anomalies (left site) and $\delta^{13}\text{C}_{\text{LM_high-frequency}}$ indices (right site) from 1916-2015. Black star marks the Hohenpeißenberg in Germany.

Extended materials: $\delta^2\text{H}_{\text{LM}}$ chronology and mean annual temperature



Gridded mean $\delta^2\text{H}_{\text{LM}}$ chronology and instrumental MAT (relative to the mean value of 1961-1990) (solid lines) from 1916 to 2015. Linear regression lines (dashed lines) are calculated for the period 1970 to 2015 and the whole period. The ratio between the two slopes of the $\delta^2\text{H}_{\text{LM}}$ chronology is similar to the rates of temperature changes.

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