



El Niño diversity during the Holocene in relation to mean state changes

Isma Abdelkader Di Carlo¹, Pascale Braconnot¹, Matthieu Carré^{2,3}, Olivier Marti¹, Mary Elliot⁴

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⁴LPG, Université de Nantes, France

Ways to find me 🧑



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Isma Abdelkader Di Carlo



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Scan me 😊





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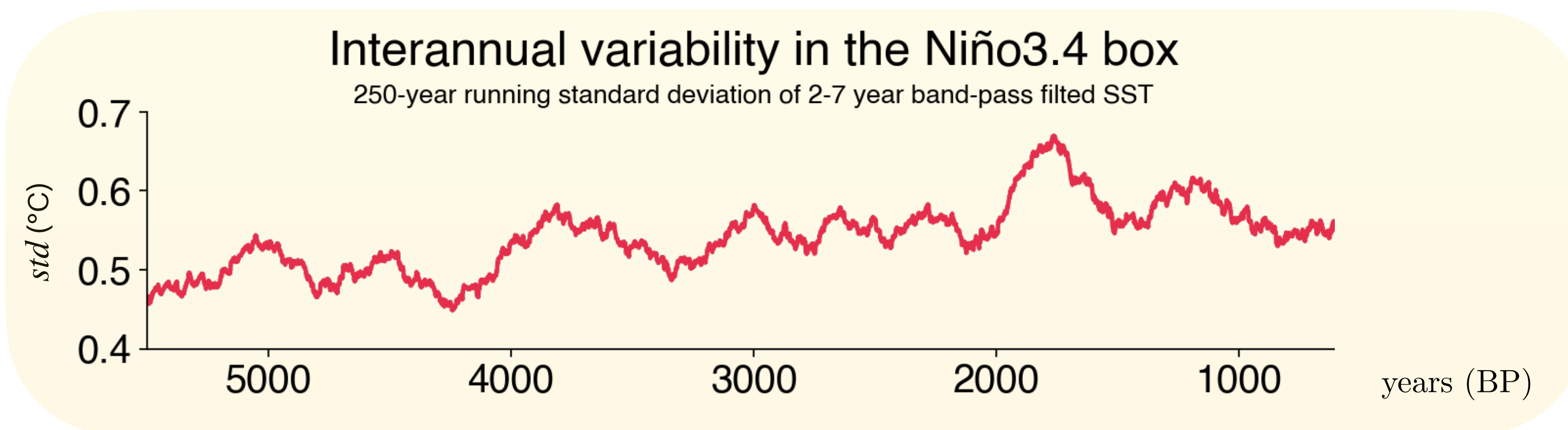
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Simulation with the IPSL model [Braconnot et al. (2019)]

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Key points

- We study El Niño diversity with two historical datasets and two 6000-year-long transient simulations from the IPSL model.

El Niño patterns

From [Takahashi et al., (2011)], we define:

- **ER (Exact Regression):**

$$E = \frac{PC1 - PC2}{\sqrt{2}}$$

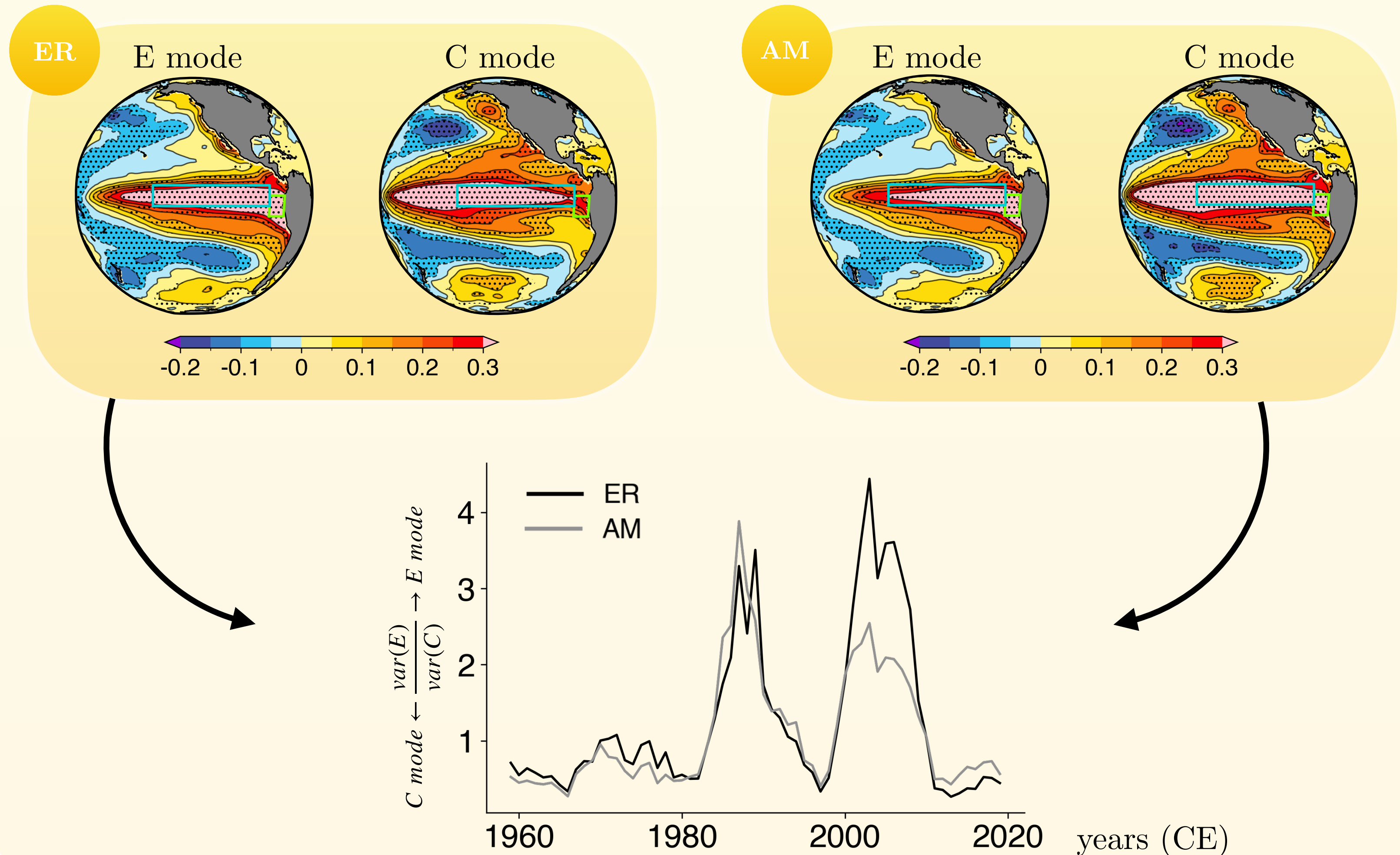
$$C = \frac{PC1 + PC2}{\sqrt{2}}$$

- **AM (Approximate Method):**

$$E = Niño_{1+2} - 0.5 \times Niño_4$$

$$C = 1.7 \times Niño_4 - 0.1 \times Niño_{1+2}$$

COBE-SST2



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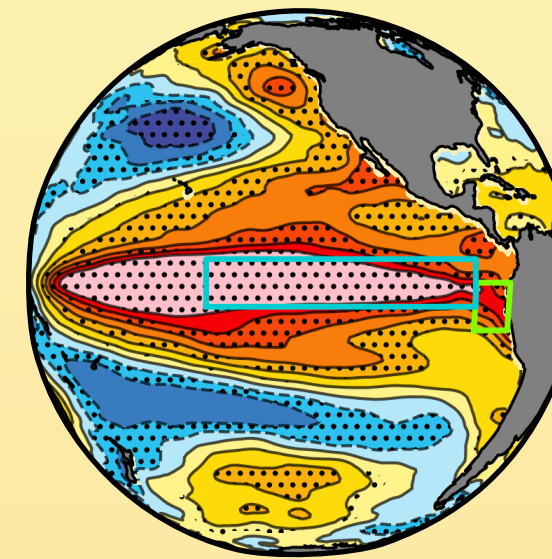
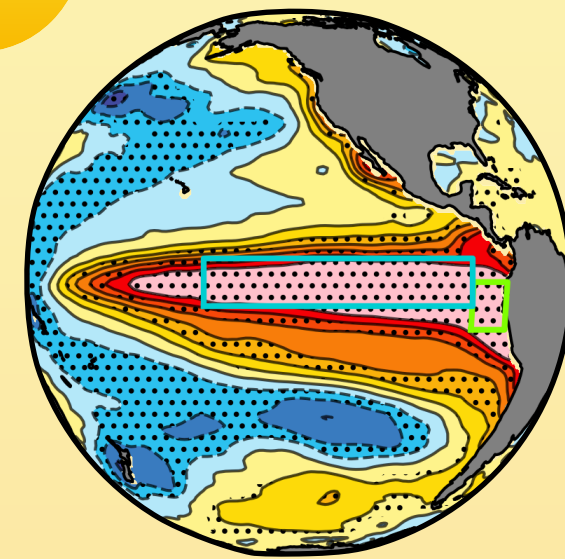
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Proxy for “EOF” methods

ER

E mode

C mode



-0.2 -0.1 0 0.1 0.2 0.3

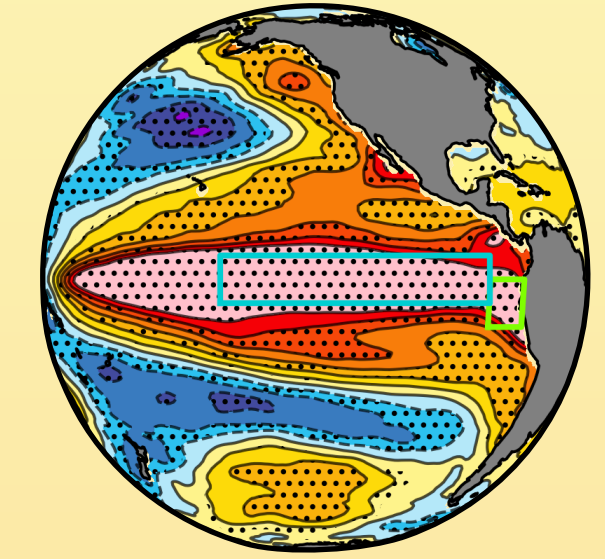
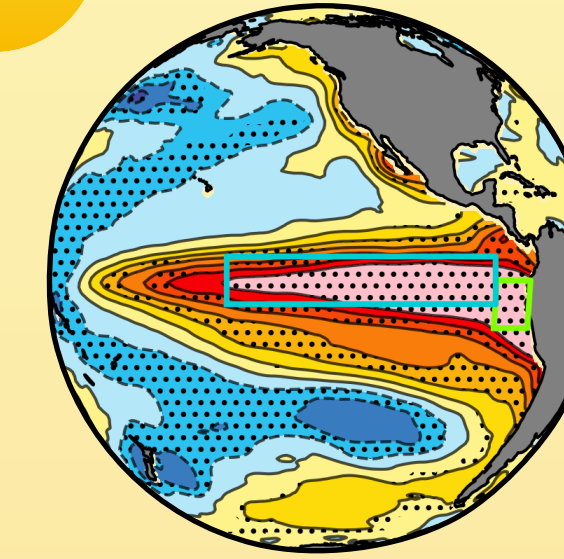
COBE-SST2

Proxy for “boxes” methods

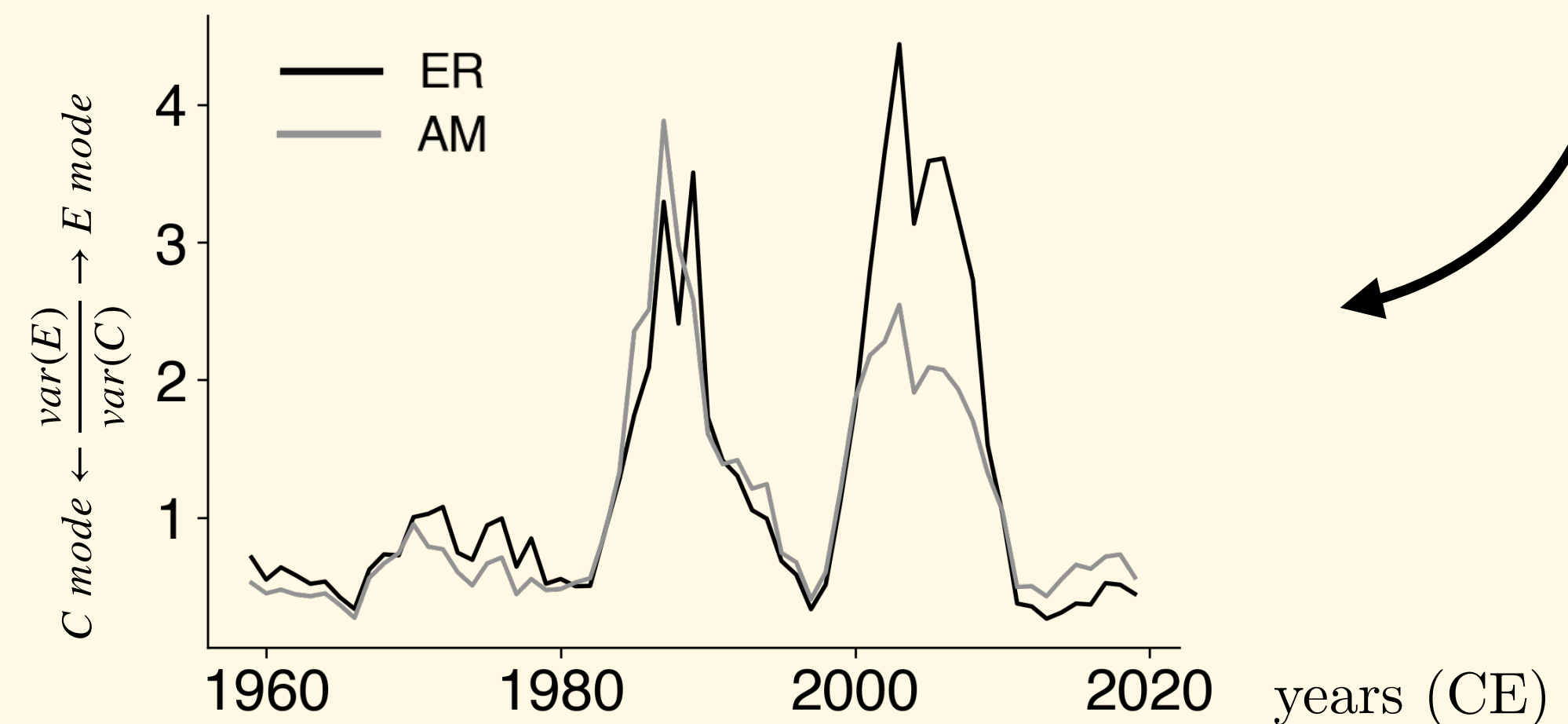
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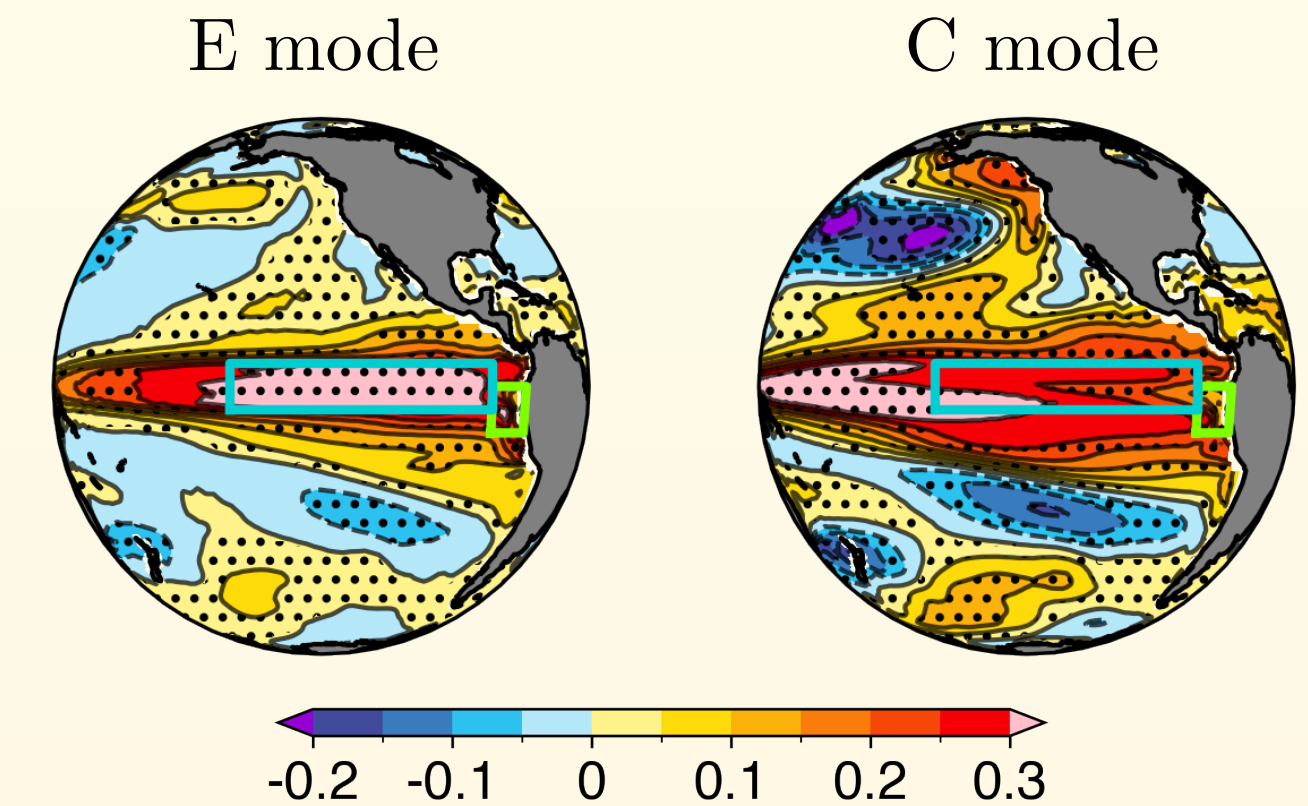
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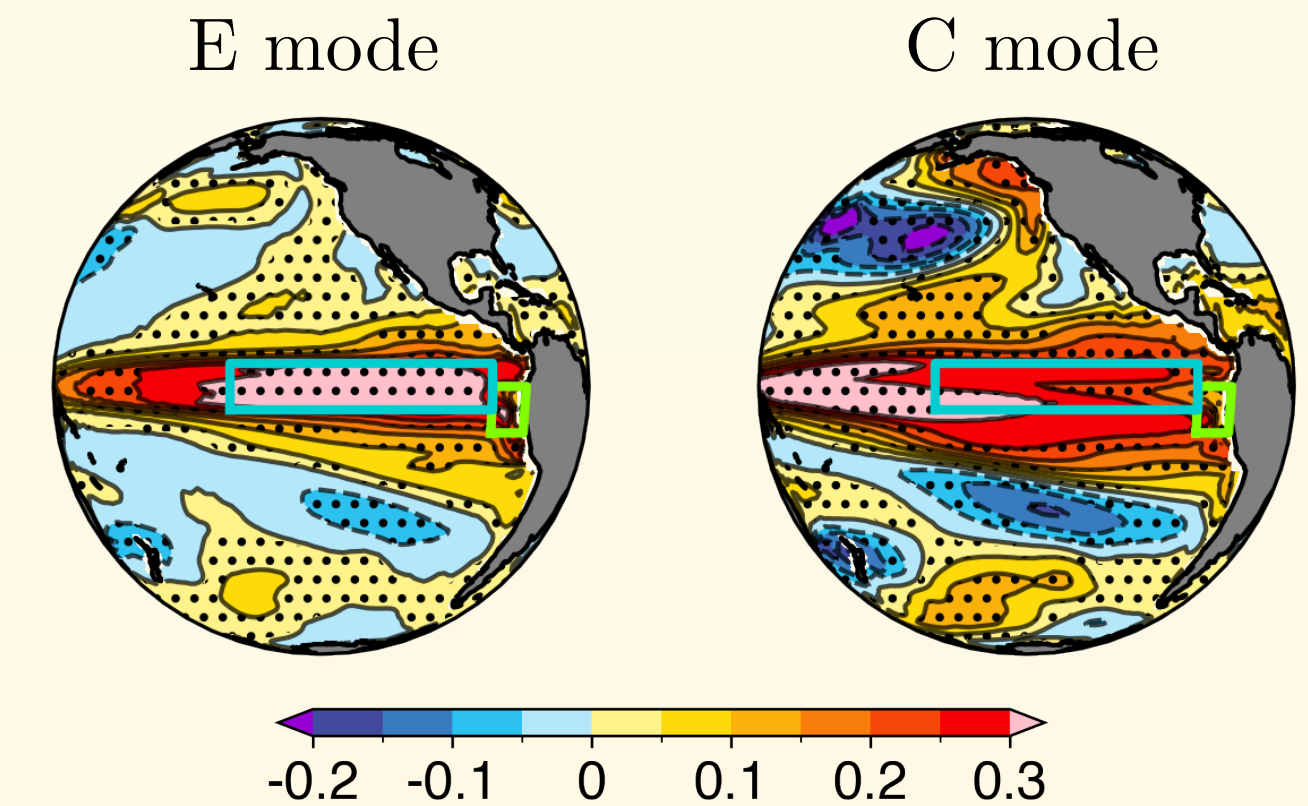
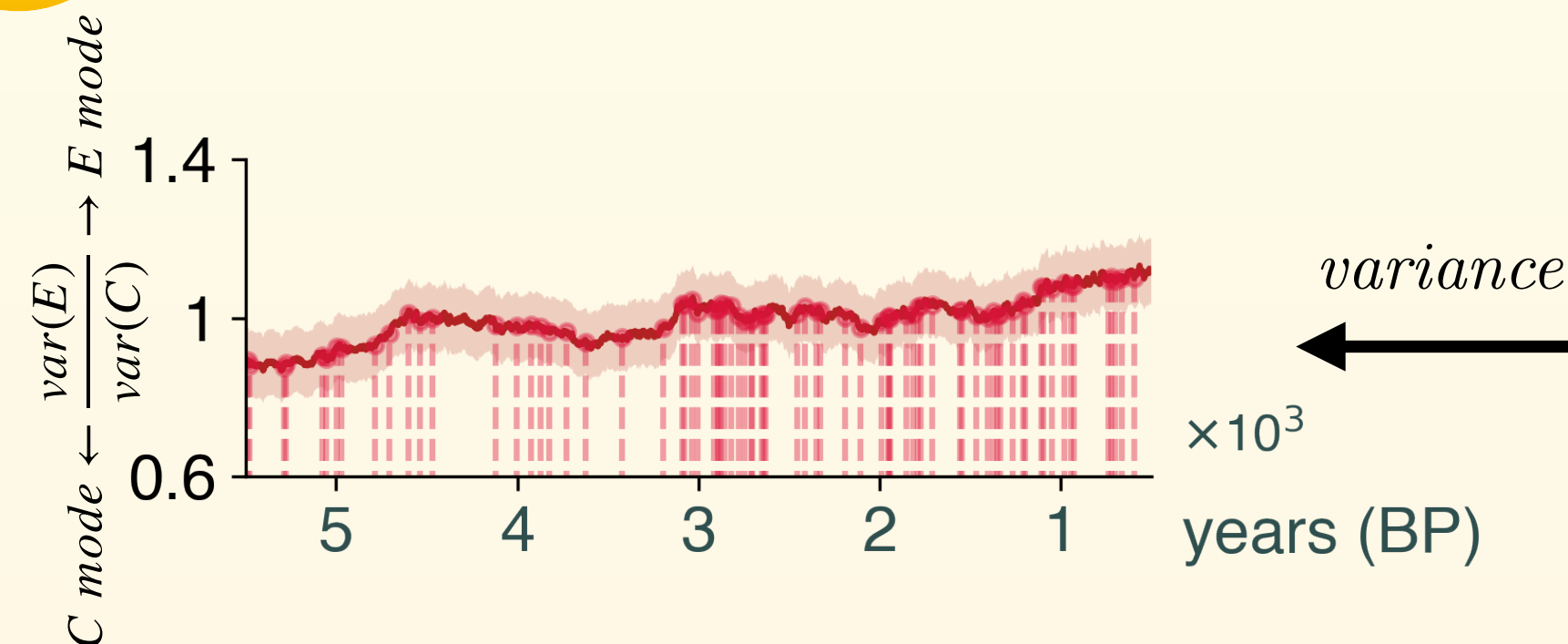
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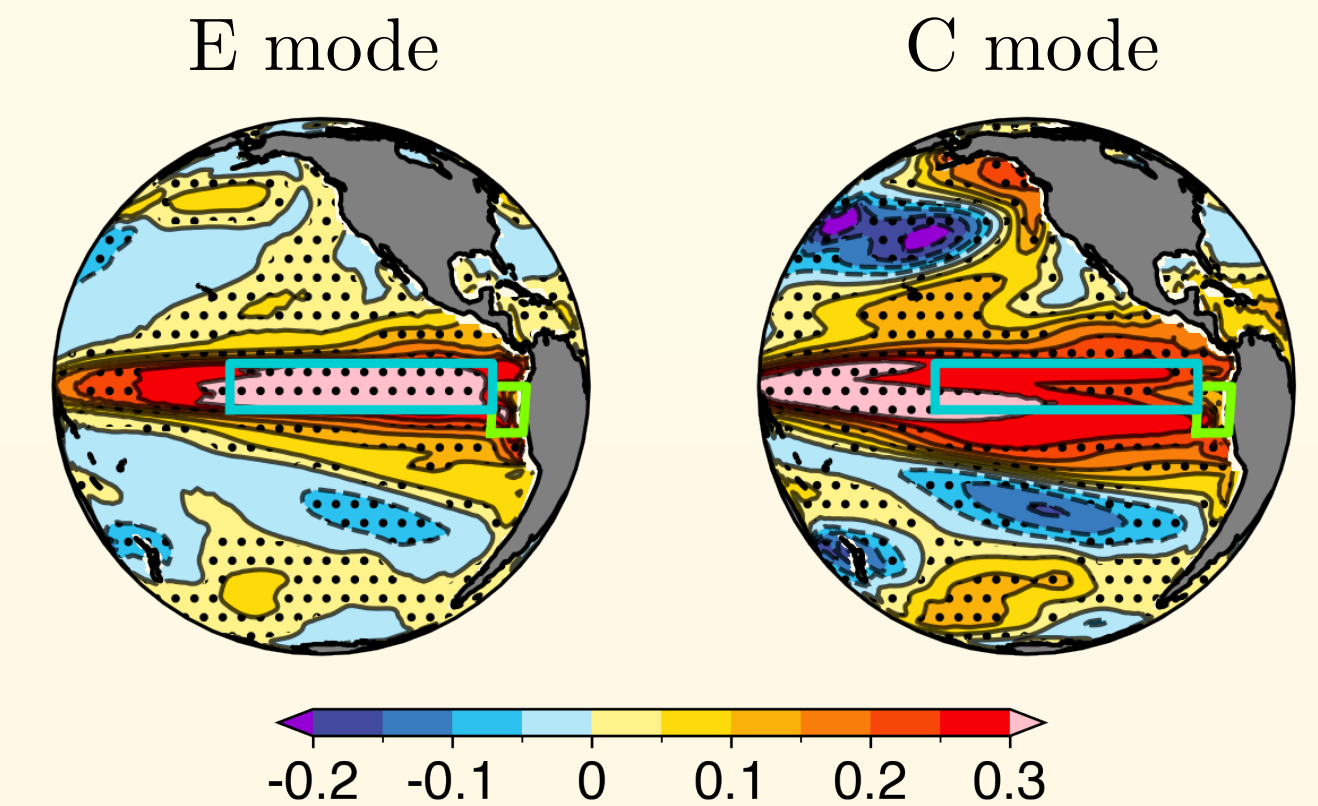
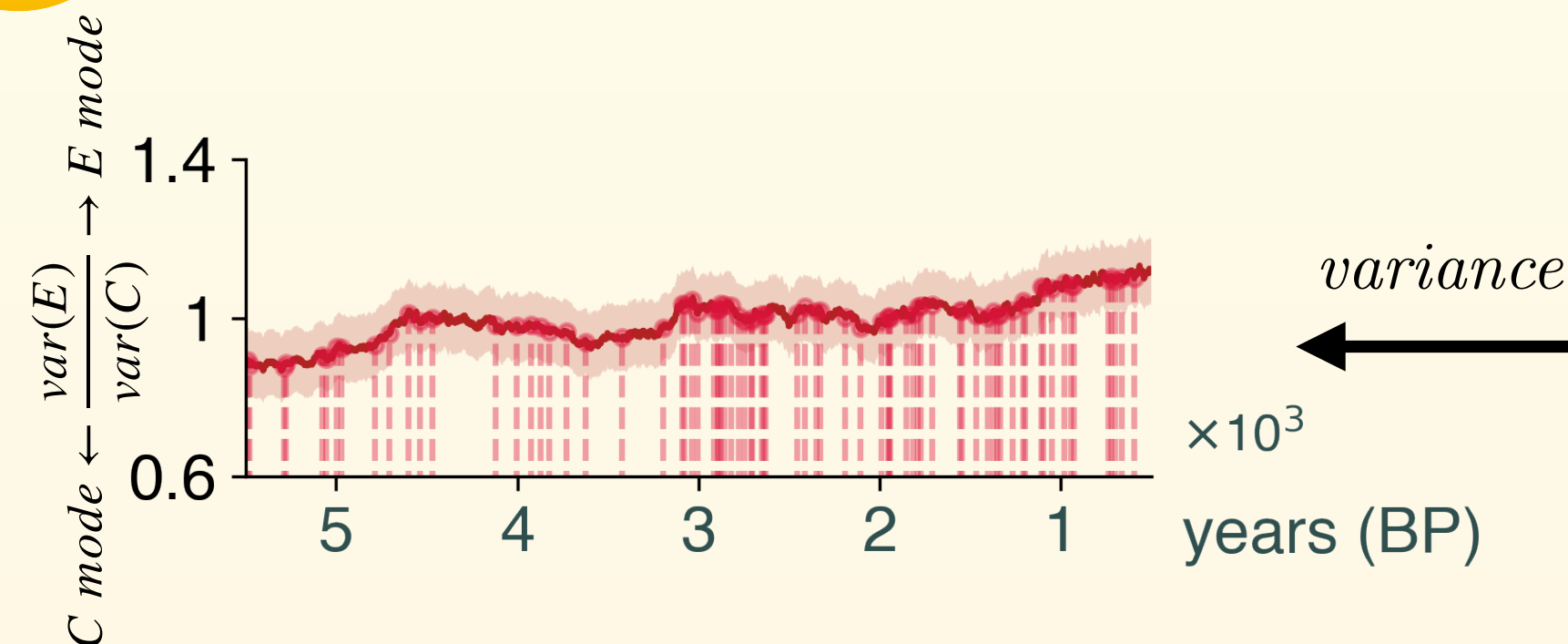
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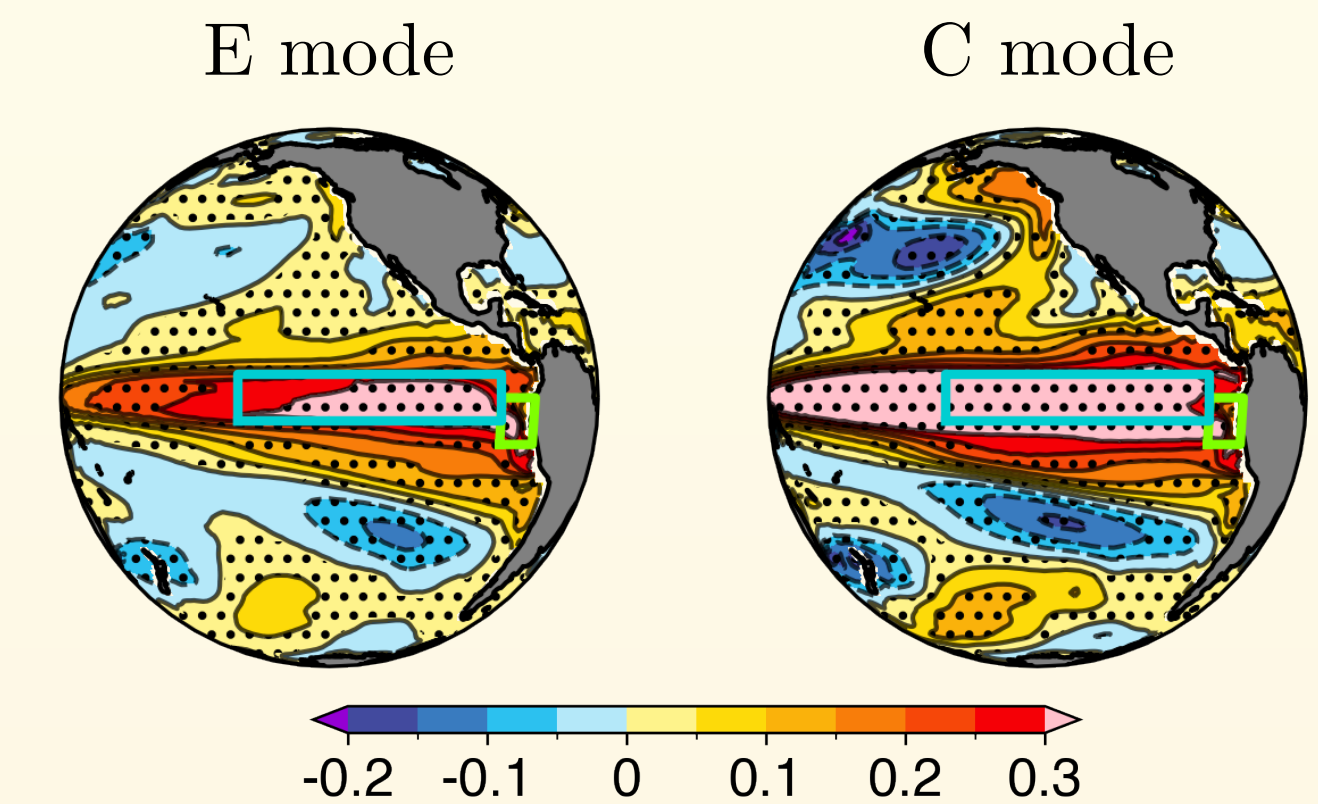
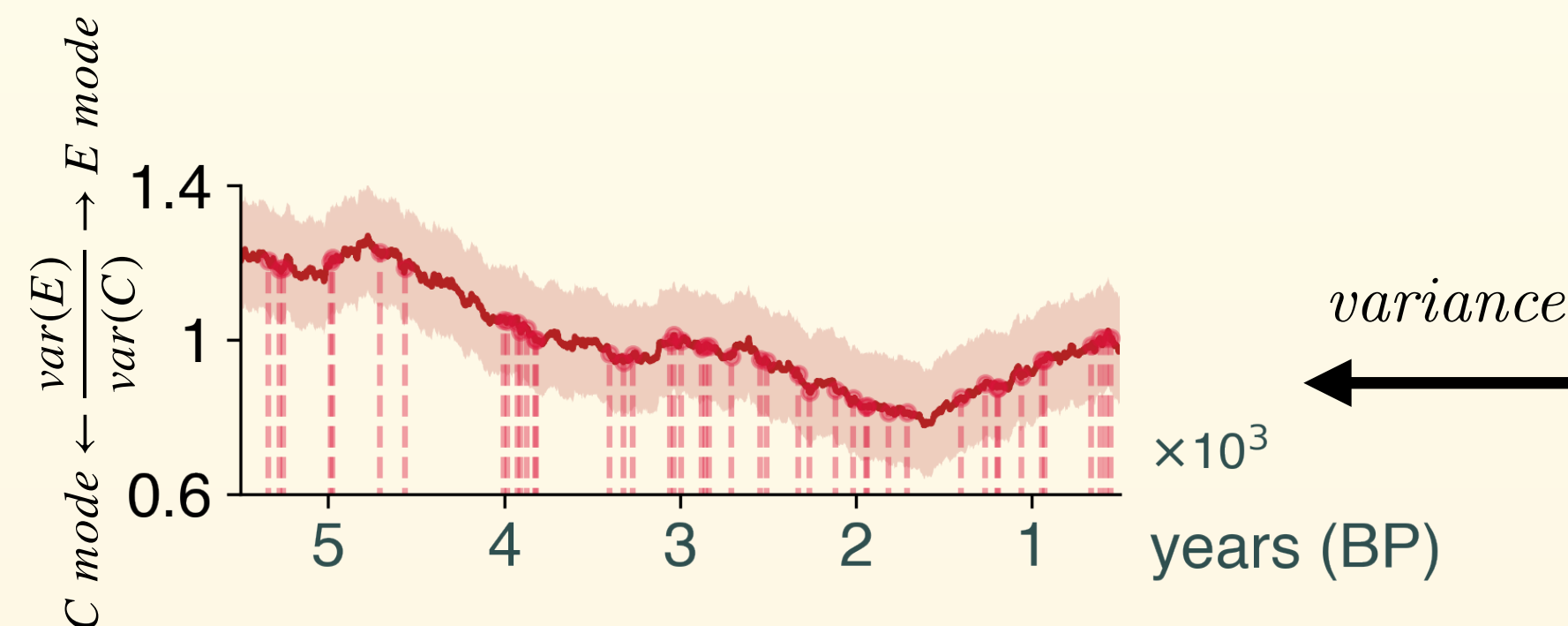
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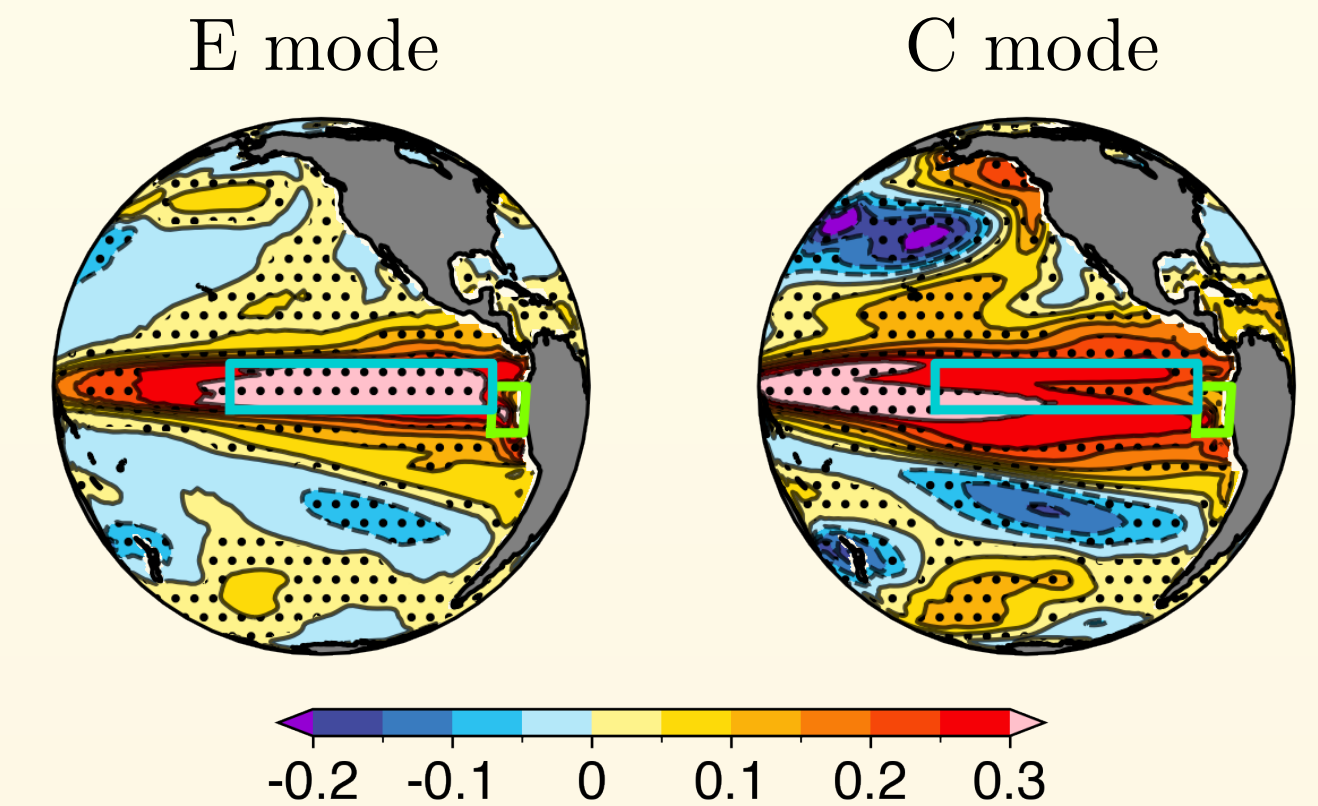
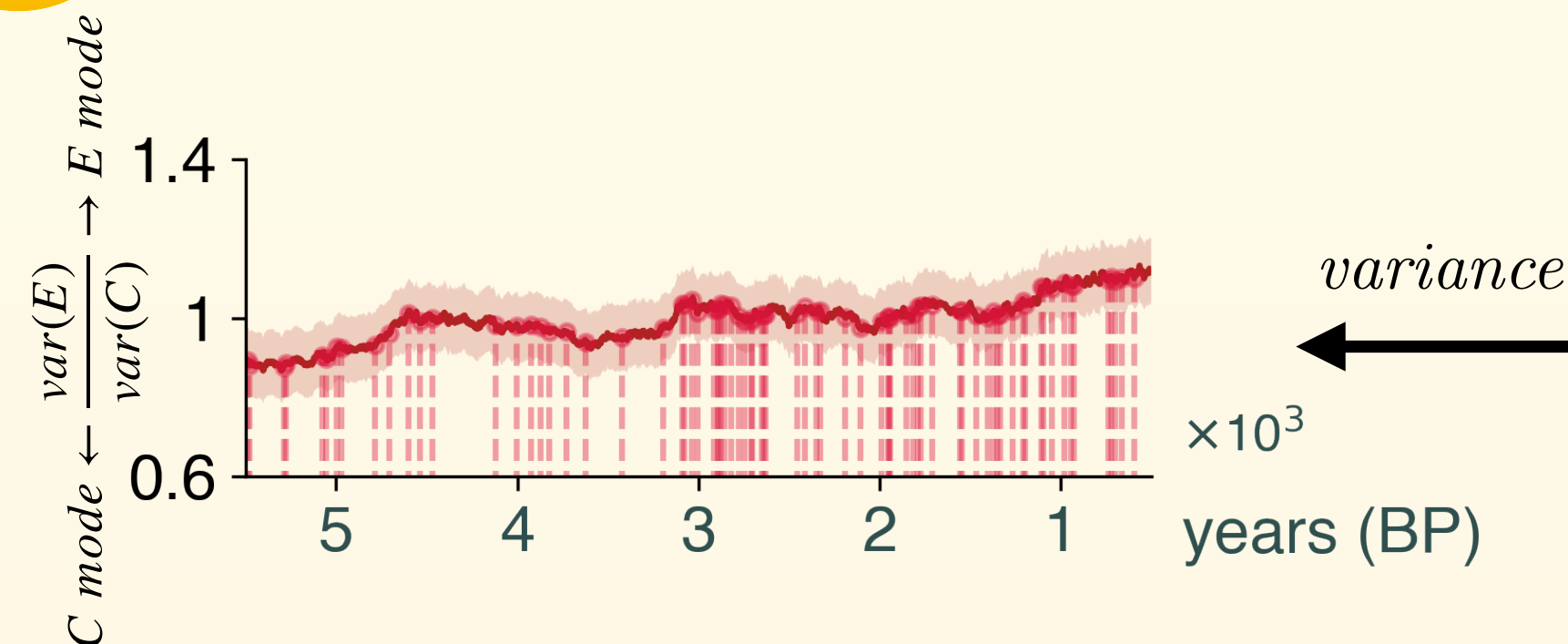
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- ▶ We study El Niño diversity with two historical datasets and two 6000-year-long transient simulations from the IPSL model.
- ▶ Two equivalent indicators in the present give opposite evolution on the Holocene.

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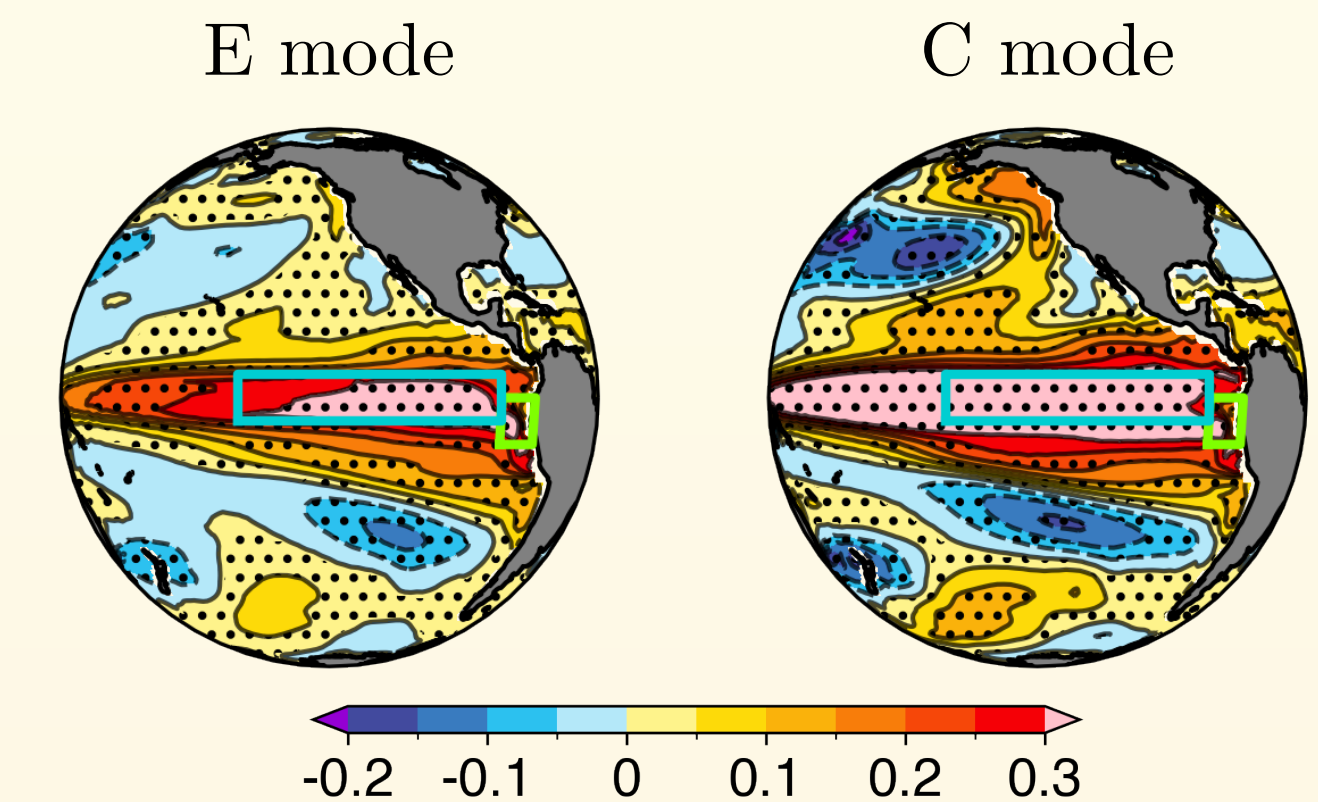
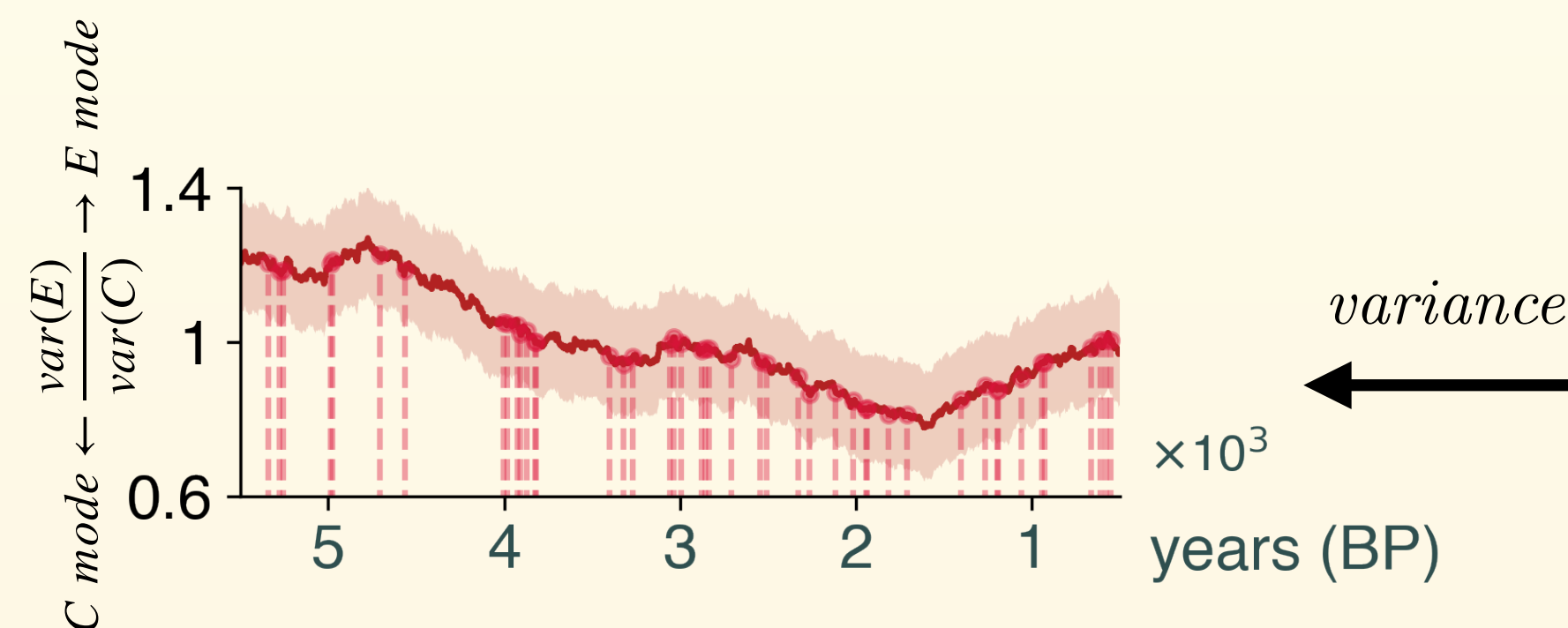
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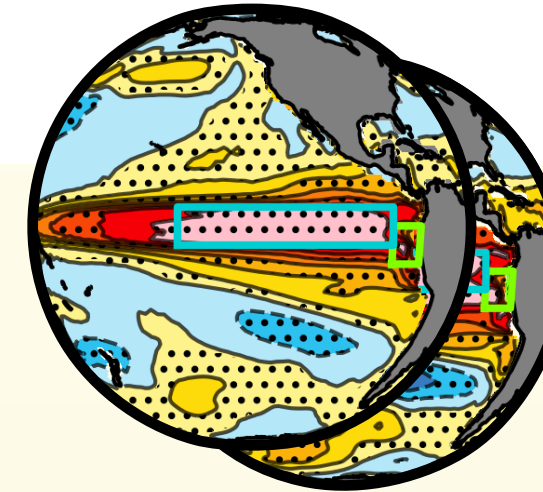
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Multi-linear regression

$$\text{var}(\text{Niño}_{1+2}) = \alpha \times \text{var}(E) + \beta \times \text{var}(C) + \text{residual}$$

$$\text{var}(\text{Niño}_4) = \alpha \times \text{var}(E) + \beta \times \text{var}(C) + \text{residual}$$

with α and β the regression coefficients.

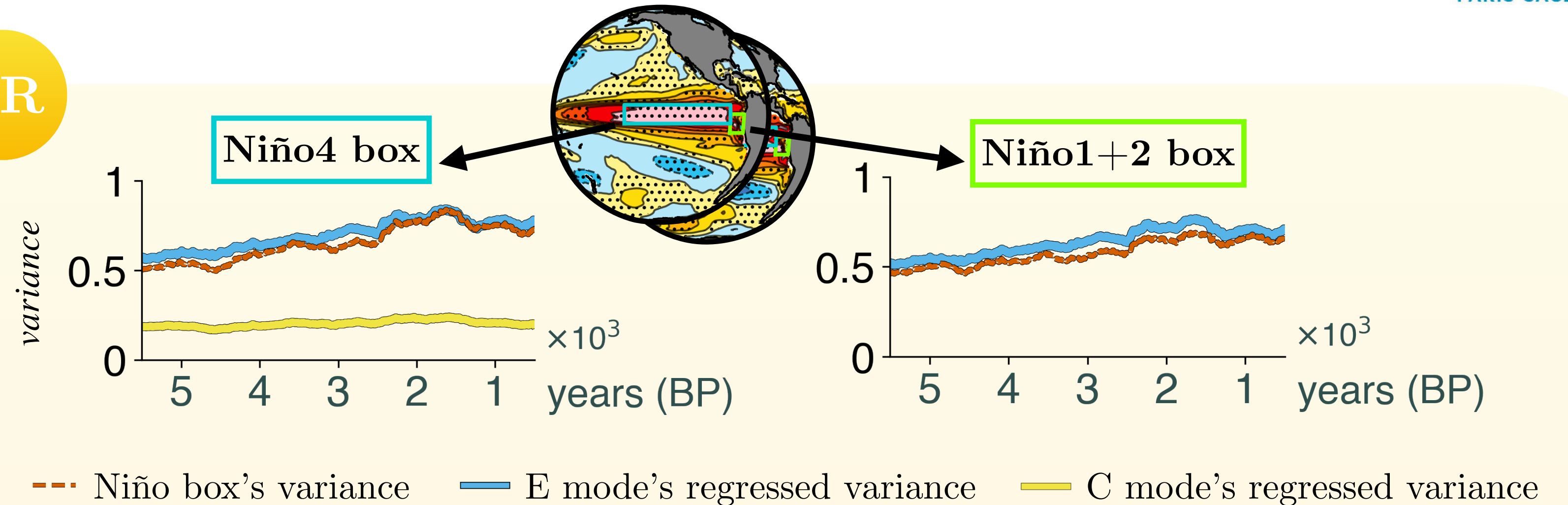
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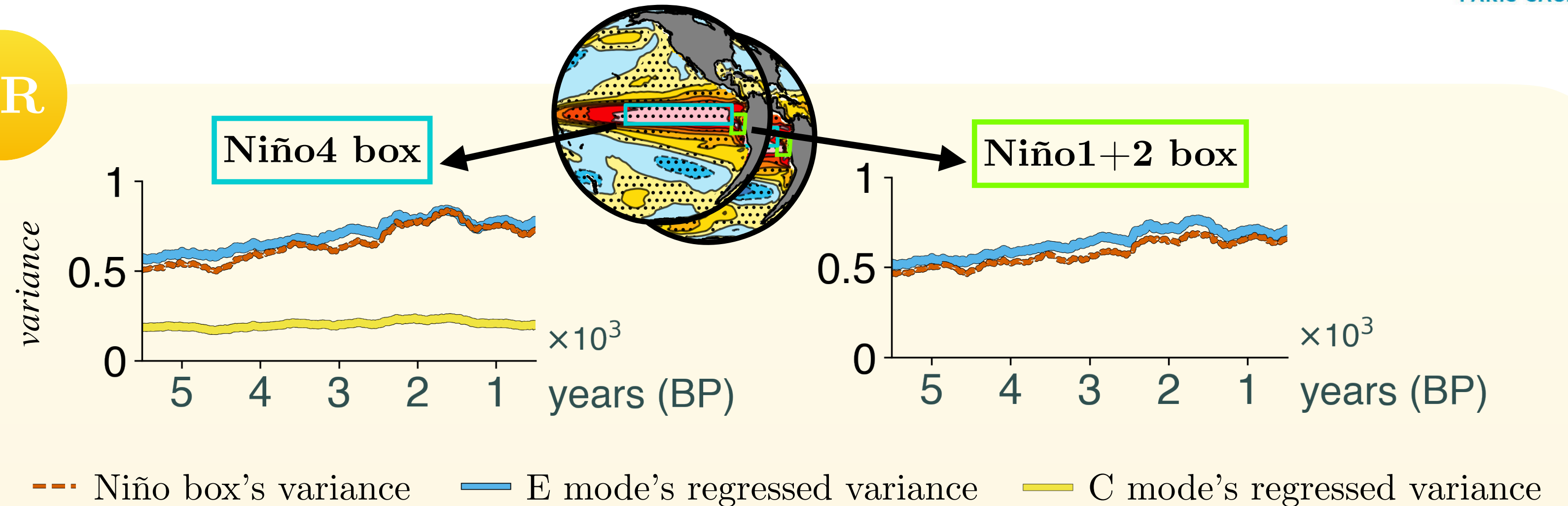
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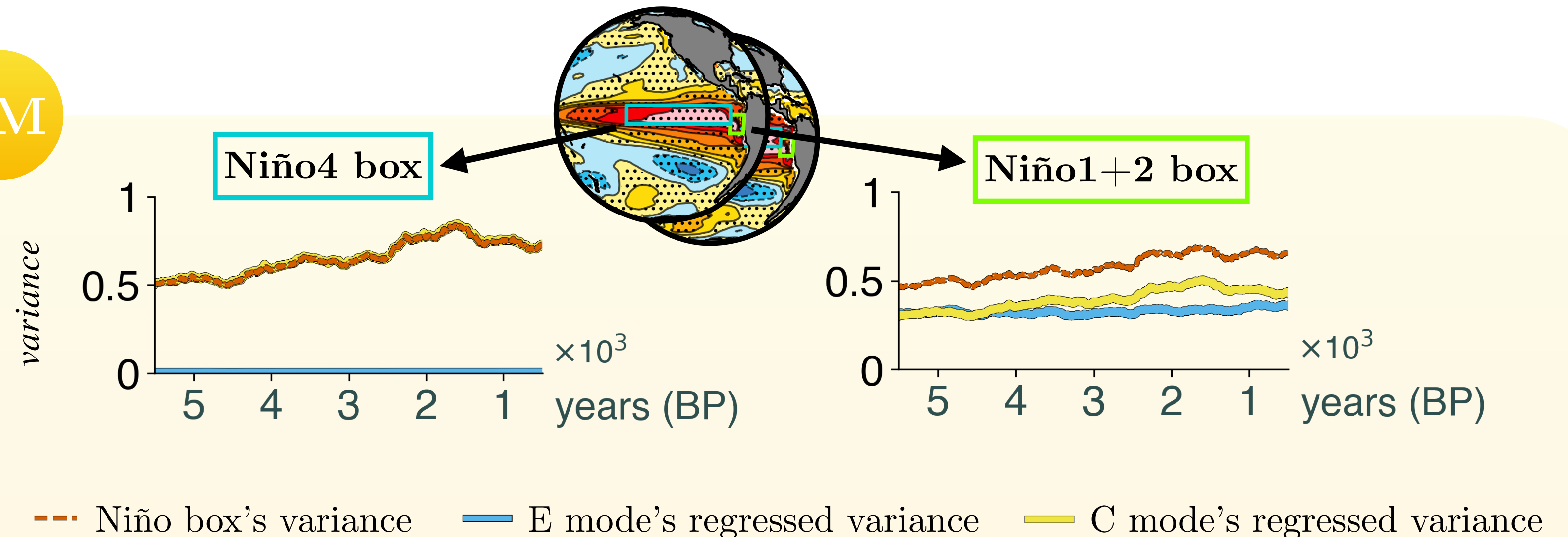
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Take-away message

Indicator definitions need to take into account El Niño mean-state changes over time!

El Niño composite patterns over 1000-year windows

