# Supplementary: Amplification of ENSO-driven vegetation variability at decadal and longer timescales

Nora L. S. Fahrenbach[1] and Robert C. Jnglin Wills[1]

[1]Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

**Correspondence:** Nora L. S. Fahrenbach (nora.fahrenbach@env.ethz.ch)

## 1 Regression of LAI on Niño3.4 index for individual models

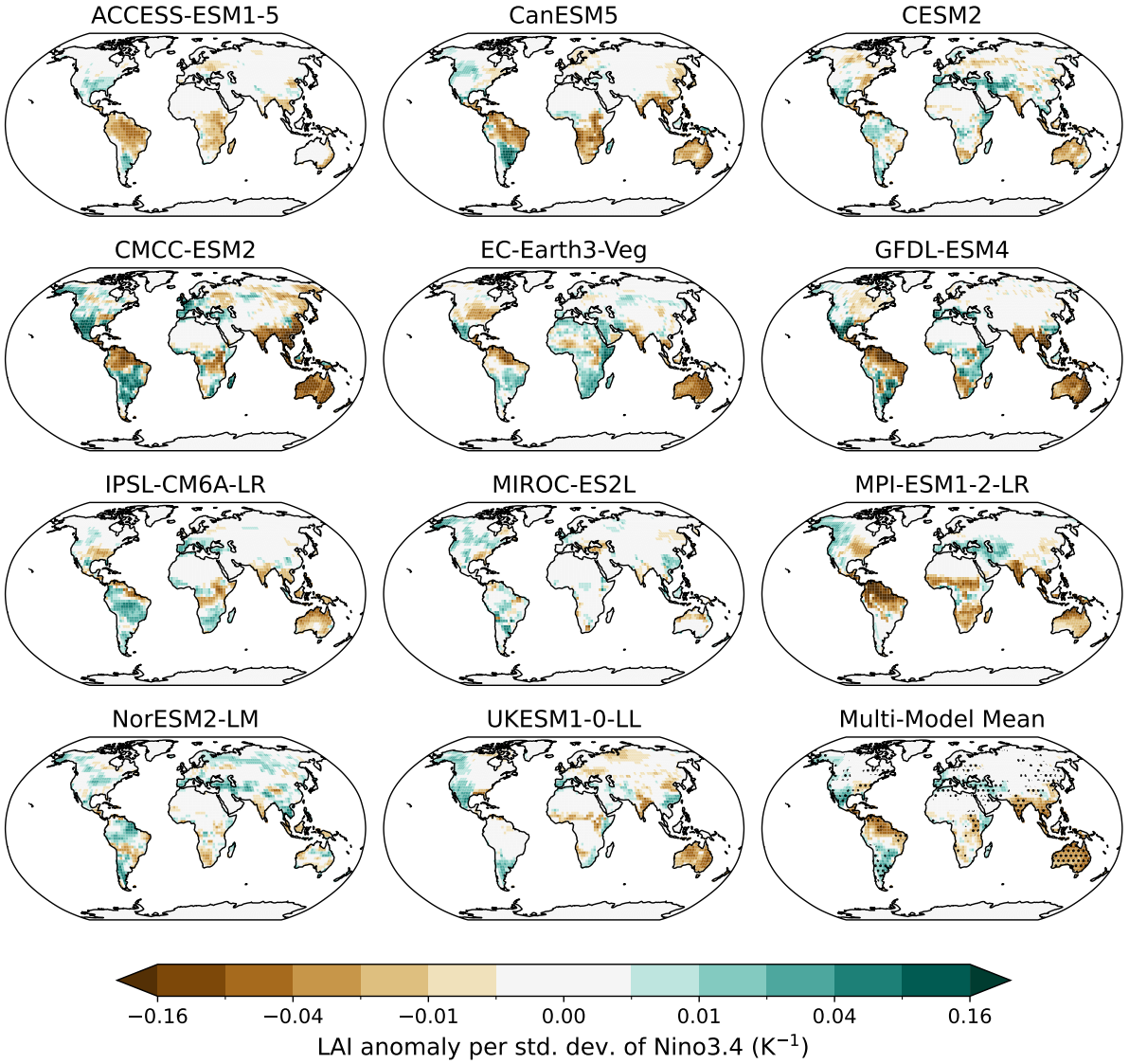


**Figure S1.** Spatial map of seasonal LAI anomalies regressed on the seasonal Niño3.4 index, normalized by the standard deviation of the Niño3.4 index, for each individual CMIP6 model used in this study and the MEM. The analysis uses 500 years of CMIP6 piControl simulations. Stippling in the MEM plot indicates agreement on the sign of change by at least 9 out of 11 models (95% confidence).

## 2 Regional coherence analysis

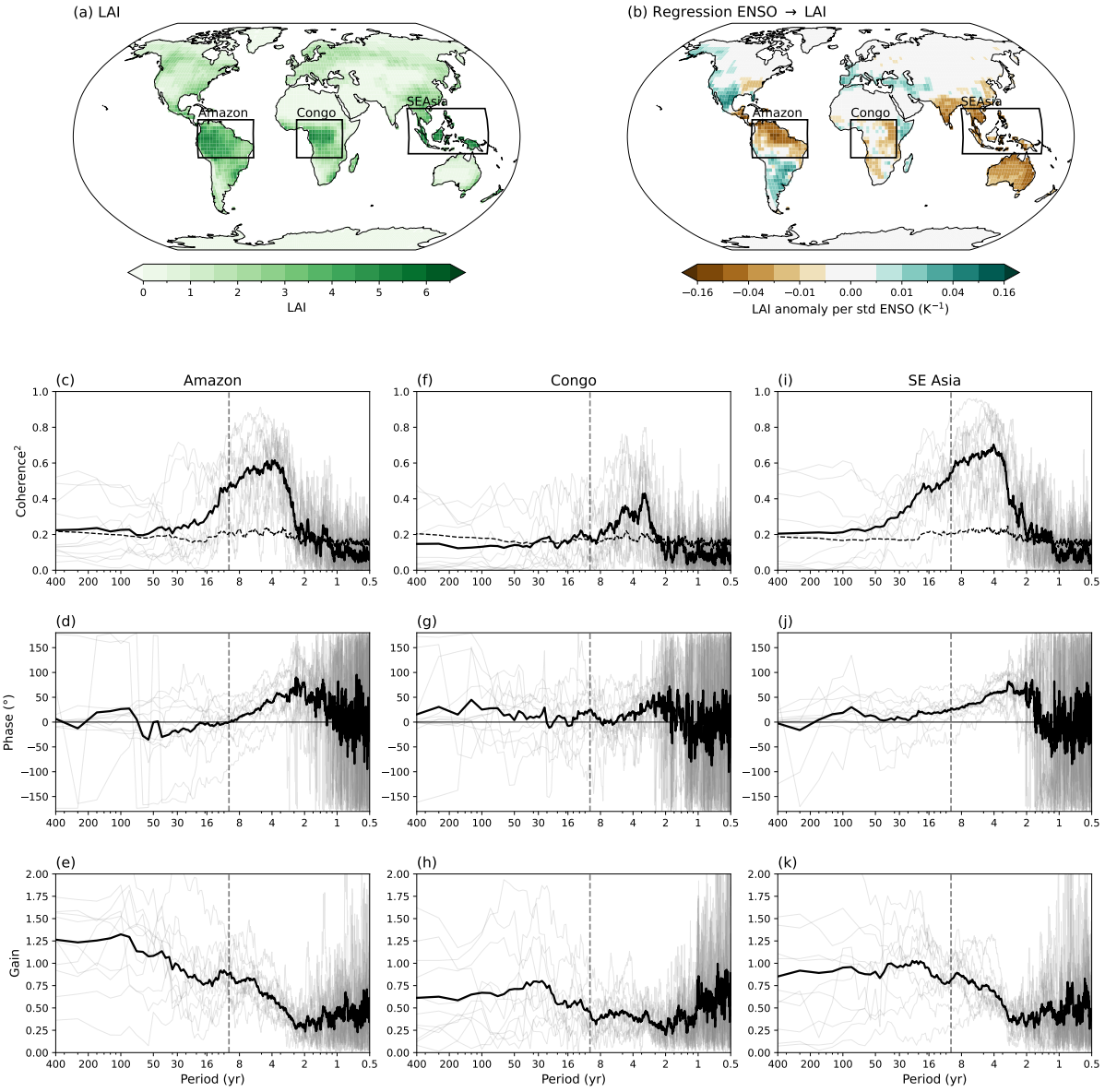


**Figure S2.** Maps of multi-model mean piControl (a) leaf area index and (b) seasonal LAI anomalies regressed on the seasonal Niño3.4 index. (c-k) Coherence squared, phase, and gain between the Niño3.4 index and LAI regressed on Niño3.4 in piControl over the (c-e) Amazon, (f-h) Congo and (i-k) Southeast Asian rainforest regions. Boxes in (a) and (b) show the regions used for the regional spectral analysis in (c-k). The black dashed line in panels (a, f, i) show the critical coherence squared at the 90% significance level. The dashed vertical lines in (c-k) mark a period of 10 years.

## 3 Coherence analysis between ENSO and PDO

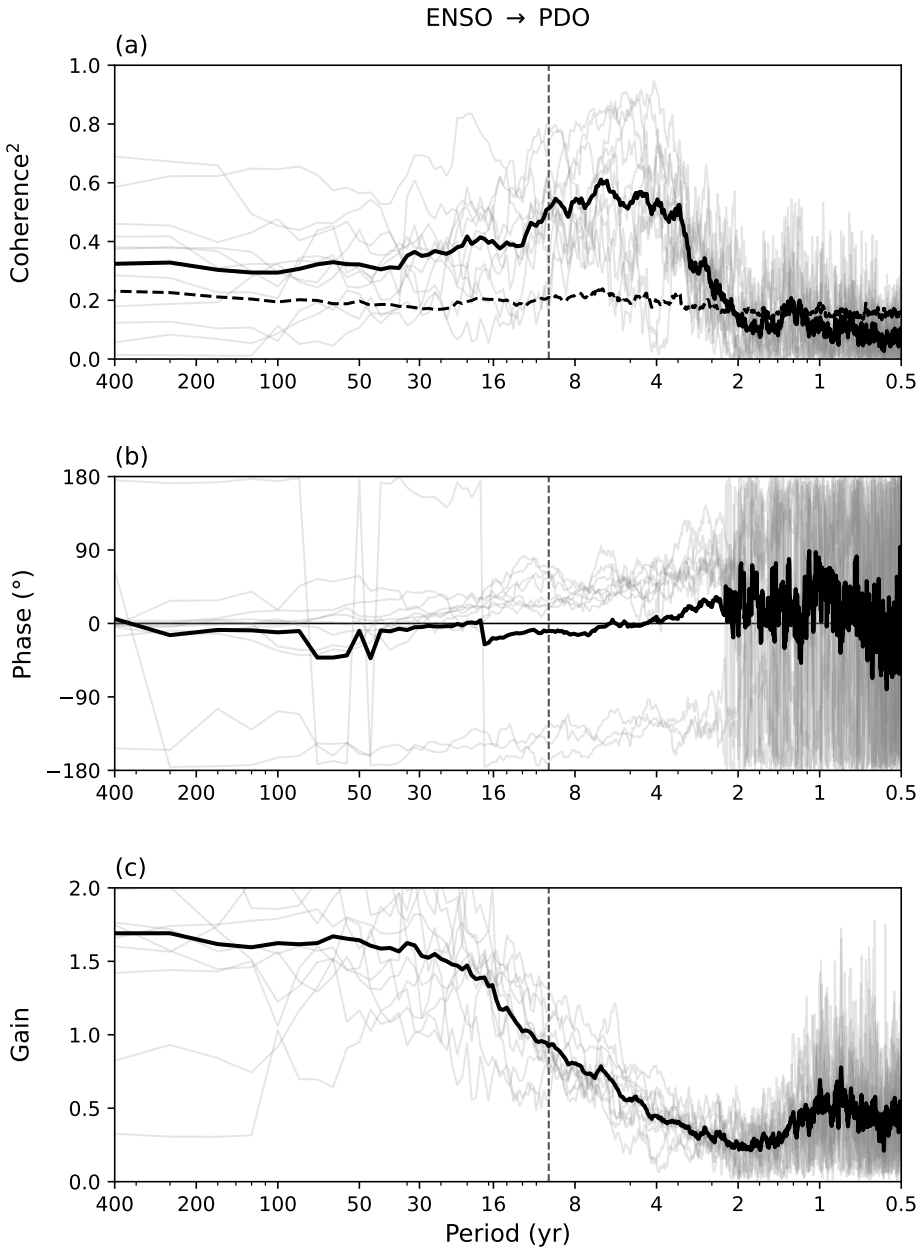


**Figure S3.** Coherence squared, phase, and gain between the Niño3.4 index and the PDO index, calculated from 500 years of CMIP6 piControl simulations. The thick line represents the MEM, and thin lines show individual model results. The black dashed line in panel (a) shows the critical coherence squared at the 90% significance level. The dashed vertical lines mark a period of 10 years.

## 4 Coherence analysis between ENSO and LAI without net precipitation influence

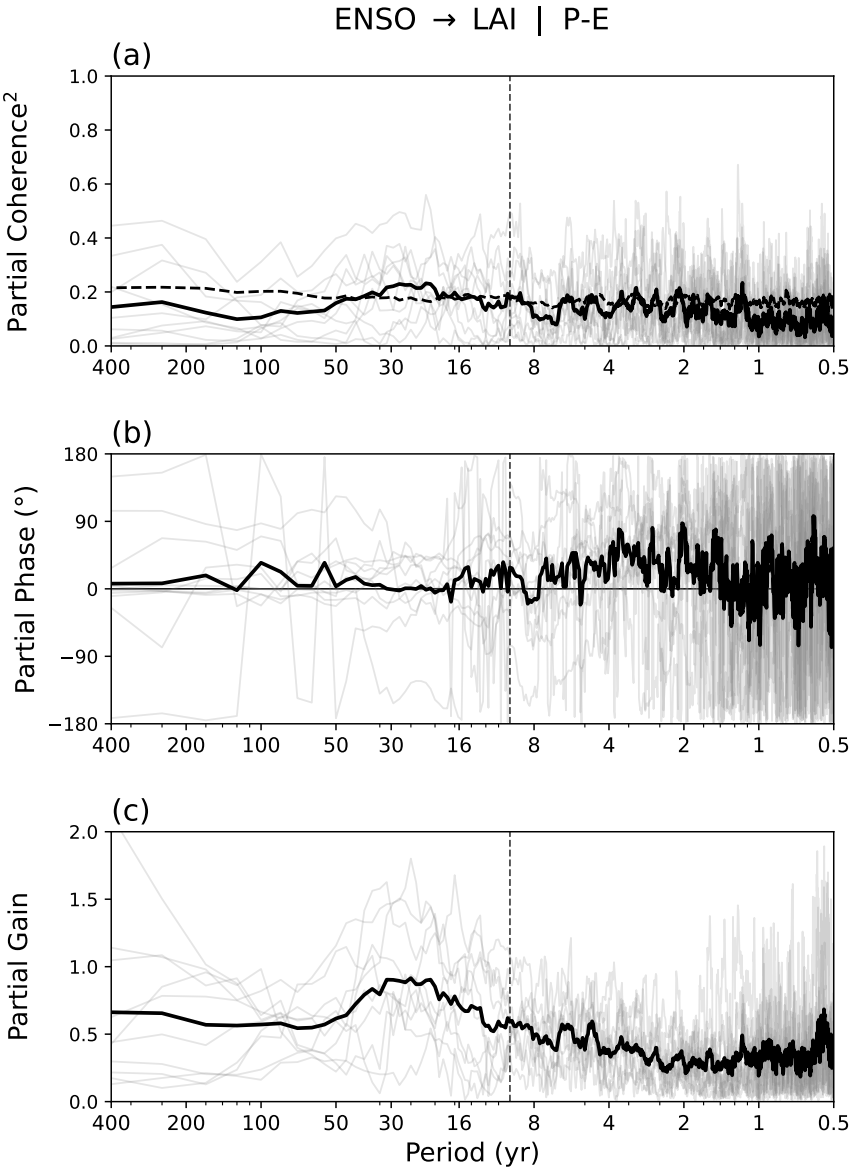


**Figure S4.** Partial coherence squared, phase, and gain between the Niño3.4 index and LAI regressed on Niño3.4, with the linear influence of net precipitation (precipitation P minus evapotranspiration E) excluded. The thick line represents the MEM, and thin lines show individual model results. The black dashed line in panel (a) shows the critical coherence squared at the 90% significance level. The dashed vertical lines mark a period of 10 years.

## 5 Regression of GPP on Niño3.4 index for individual models

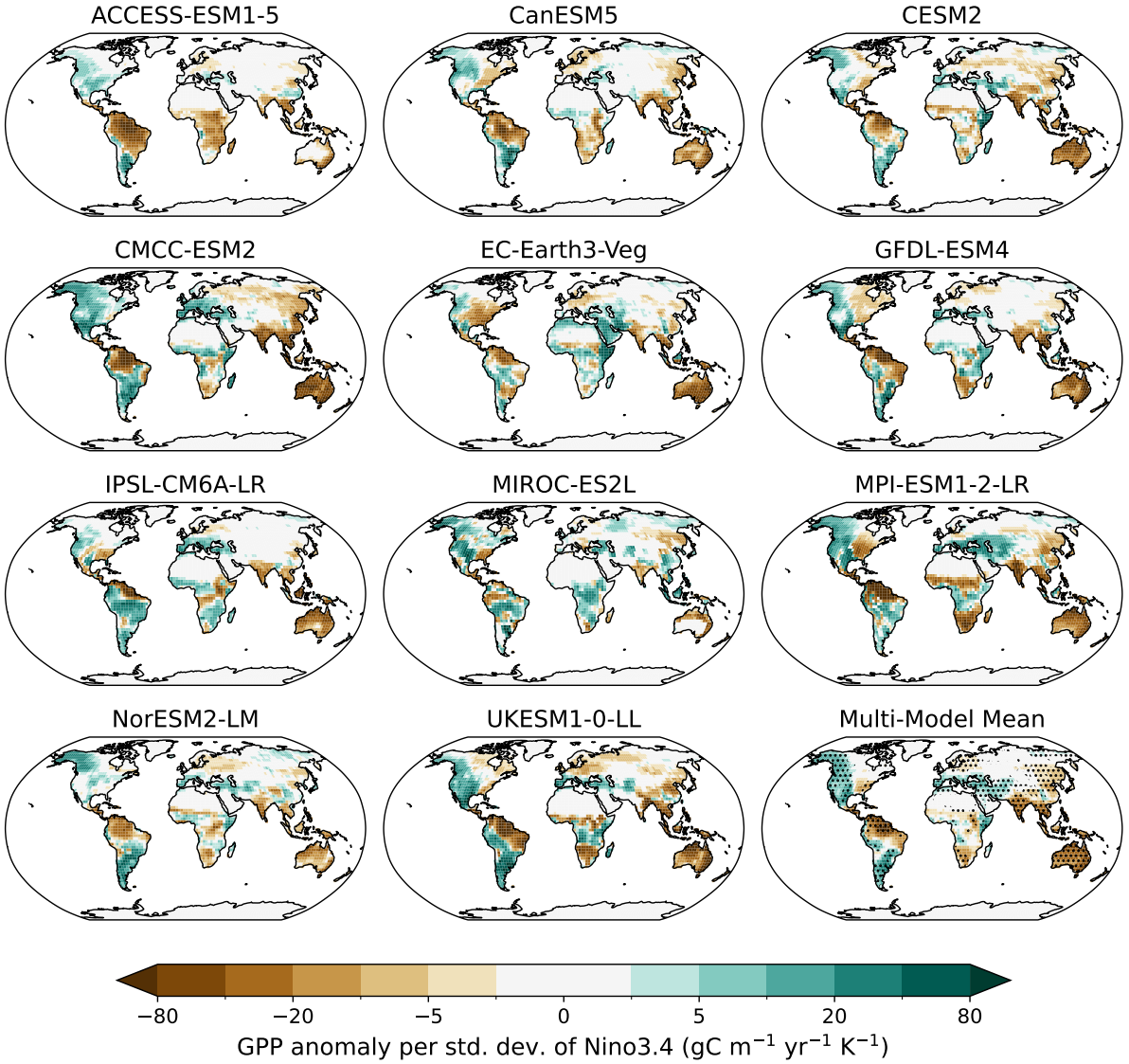


**Figure S5.** Spatial map of seasonal anomalies in GPP regressed on the Niño3.4 index, normalized by the standard deviation of the Niño3.4 index, for each individual CMIP6 model used in this study and the MEM. The analysis uses 500 years of CMIP6 piControl simulations. Stippling in the MEM plot indicates agreement on the sign of change by at least 9 out of 11 models (95% confidence).

## 6 Regression of NPP on Niño3.4 index for individual models

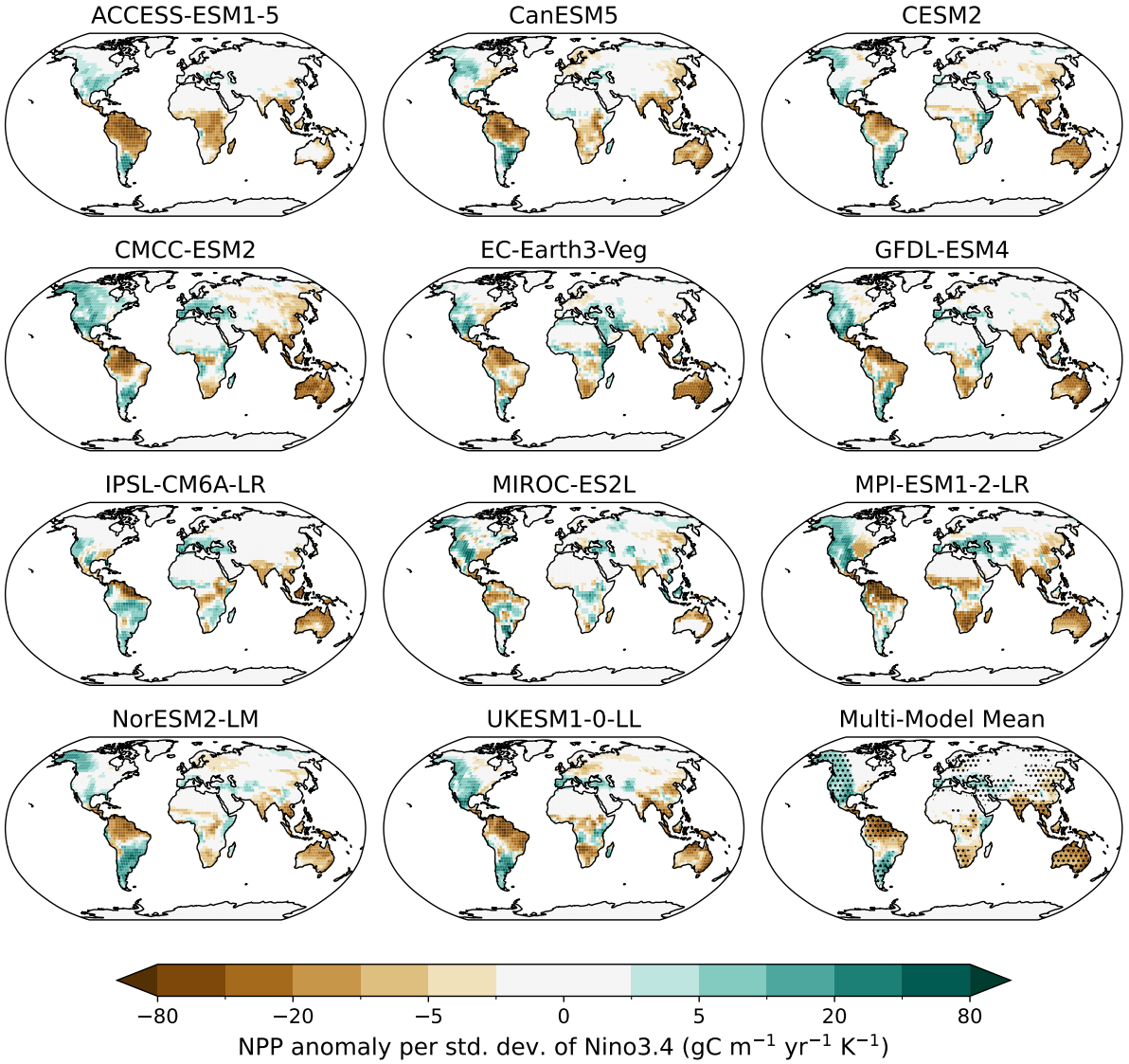


**Figure S6.** Spatial map of seasonal anomalies in NPP regressed on the Niño3.4 index, normalized by the standard deviation of the Niño3.4 index, for each individual CMIP6 model used in this study and the MEM. The analysis uses 500 years of CMIP6 piControl simulations. Stippling in the MEM plot indicates agreement on the sign of change by at least 9 out of 11 models (95% confidence).

## 7 Coherence of GPP and autotrophic respiration

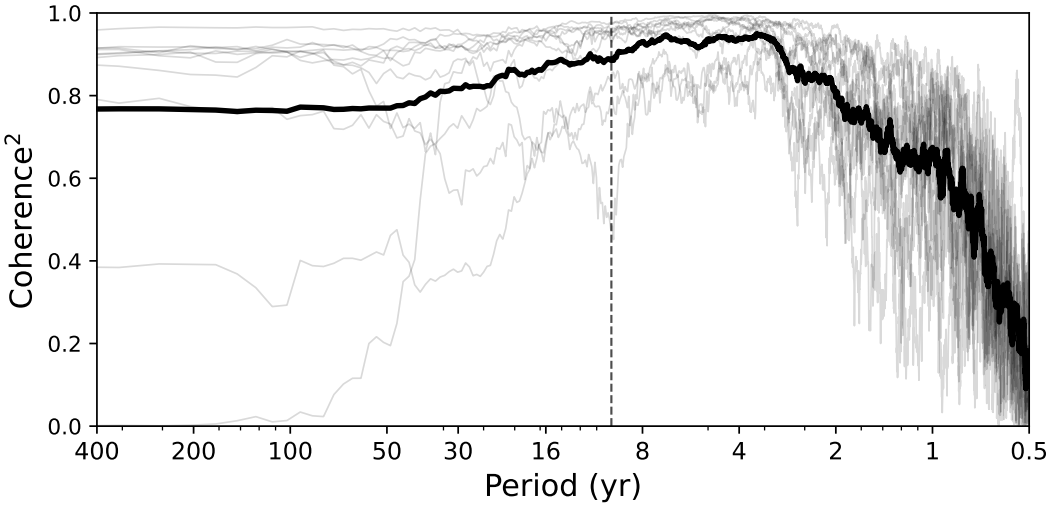


**Figure S7.** Coherence squared of GPP regressed on Niño3.4 and autotrophic respiration ($R_a$) regressed on Niño3.4 for the multi-model mean MEM (black thick line) and individual models (thin black lines). The dashed vertical line marks a period of 10 years.

## 8 Coherence analysis between ENSO and LAI for historical CMIP6 and observations

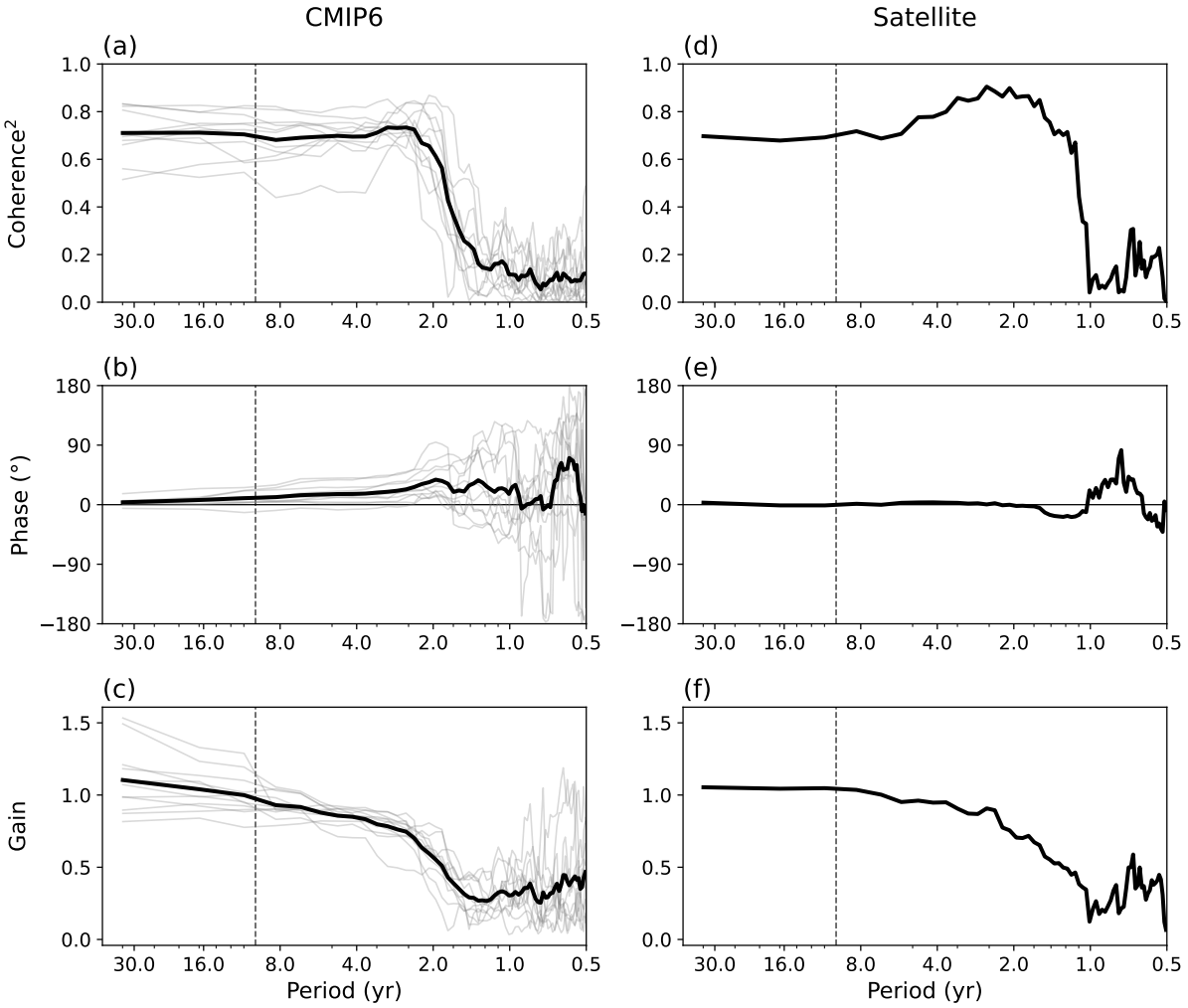


**Figure S8.** Coherence squared, phase, and gain of the Niño3.4 index and LAI regressed on Niño3.4 for the historical period 1980–2014. (a-c) show results using CMIP6 historical simulation data, where thin grey lines represent individual models and the thick black line shows the MEM. (d-f) show results using HadISST SST for the Niño3.4 index and GLASS LAI. The dashed vertical lines mark a period of 10 years.