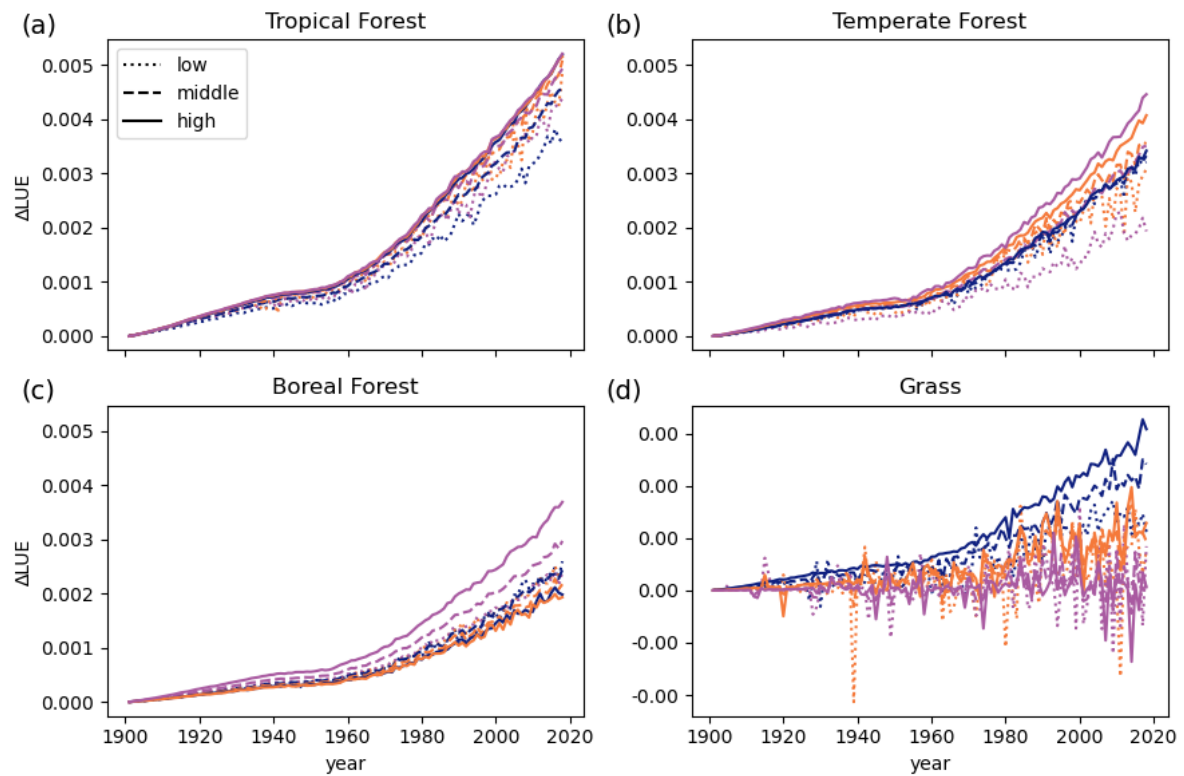


1 Supplemental materials

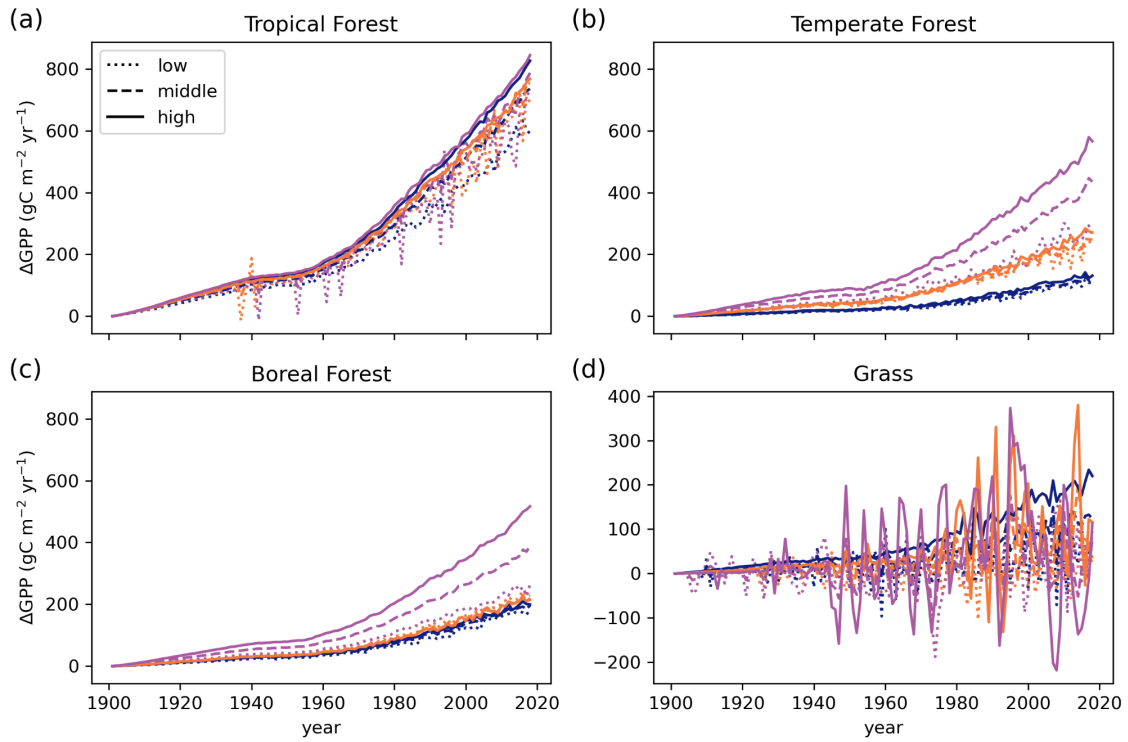
2 Table S1 Vegetation classes used in this study.

Vegetation classes	Plant functional types (PFTs) defined in the QUINCY model
Tropical Forest	Tropical broadleaf evergreen (TrBE)
	Tropical broadleaf rain deciduous (TrBR)
Temperate Forest	Temperate broadleaf evergreen (TeBE)
	Temperate broadleaf summer green (TeBS)
Boreal Forest	Boreal needleleaf evergreen (BNE)
	Boreal needleleaf summer green (BNS)
Grass	C3 grass (TeH)
	C4 grass (TrH)



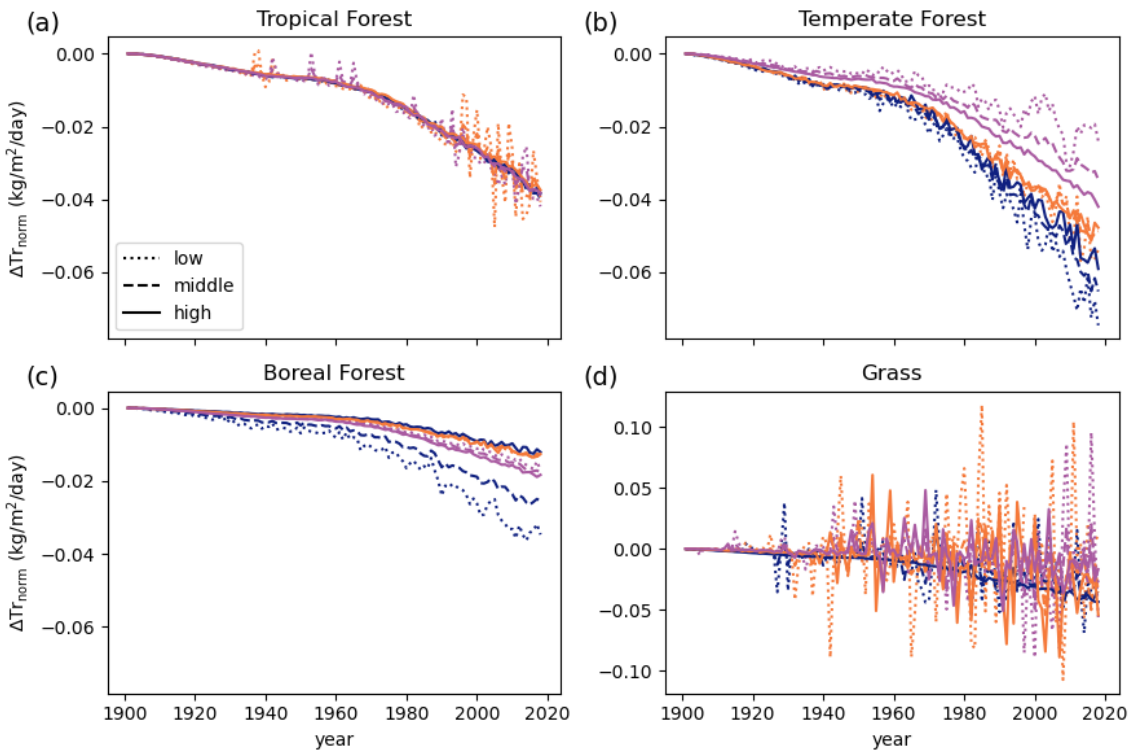
4

5 **Fig. S1 Differences in annual average light-use efficiency (LUE) between the**
6 **transient- CO_2 and the constant- CO_2 experiments across climate and vegetation**
7 **classes.** Analogous to Fig. 2 but with additional grouping of sites by precipitation
8 using quantiles (low in dotted line: ≤ 0.33 ; middle in dashed line: $0.33 - 0.66$; high in
9 solid line: ≥ 0.66).



10

11 **Fig. S2 Differences in annual average GPP between the transient- CO_2 and the**
 12 **constant- CO_2 experiments across climate and vegetation classes.** Analogous
 13 to Fig. S1.



14

Fig. S3 Differences in annual average Tr_{norm} between the transient- CO_2 and the constant- CO_2 experiments across climate and vegetation classes. Analogous to Fig. S1.

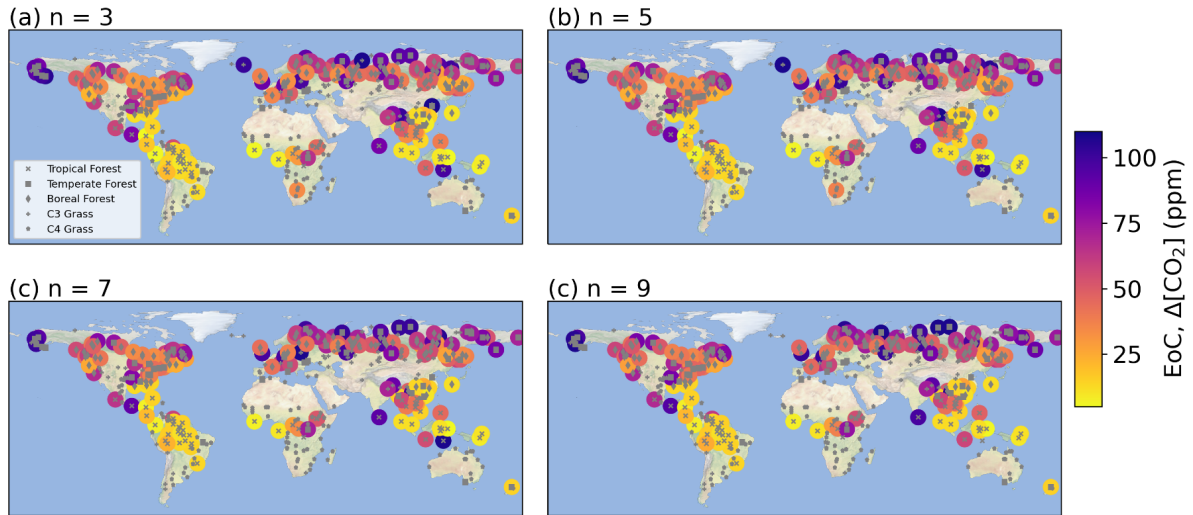


Fig. S4 Spatial distribution of EoC in GPP while changing the number ($n = 3, 5, 7, 9$) of consecutive years in the definition of EoC (section 2.2.2).

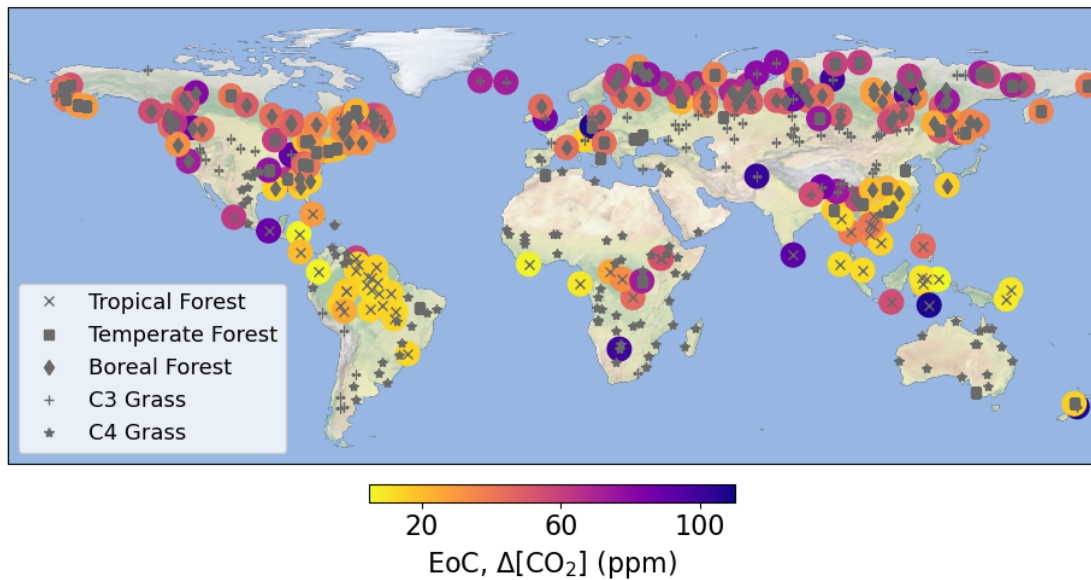


Fig. S5 Global distribution of EoC in light-use efficiency (LUE). Bright color indicates an earlier detection (lower EoC), and dark color indicates a later detection

(higher EoC). Non-colored points indicate sites where the elevated CO₂ does not translate into significant GPP changes within the historical time period.

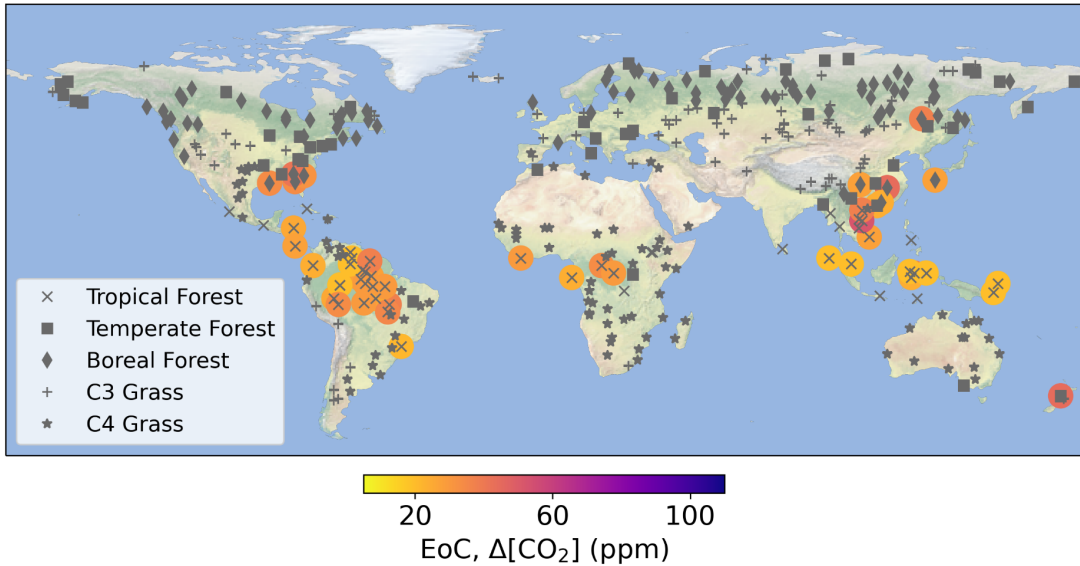


Fig. S6 Global distribution of EoC in GPP in recent years. Analogous to Fig. 4 but the EoC is derived from the transient-CO₂ and freeze-CO₂ experiments (see section 2.1.2.2).

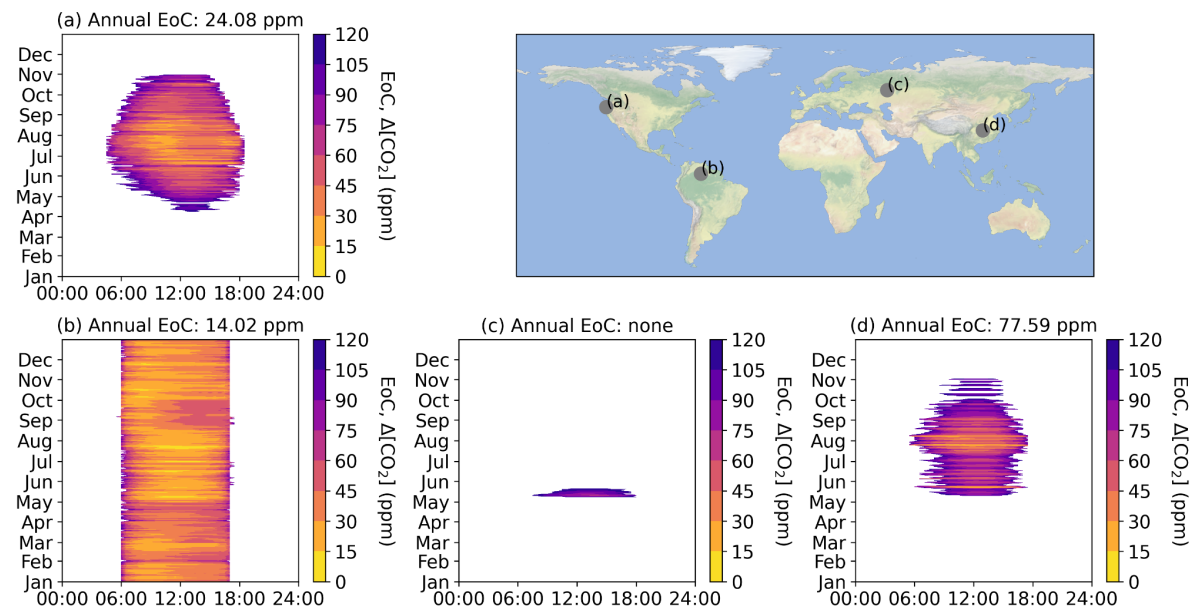


Fig. S7 Temporal variation in EoC in GPP across the seasonal and daily cycle.

Insets show so-called fingerprint plots illustrating EoC along the seasonal (y-axis) and diurnal cycle (x-axis) at representative sites for the vegetation classes (a) Boreal Forest, (b) Tropical Forest, (c) Grass and (d) Temperate Forest. The gray points on the map refer to the geographical locations of the four sites.

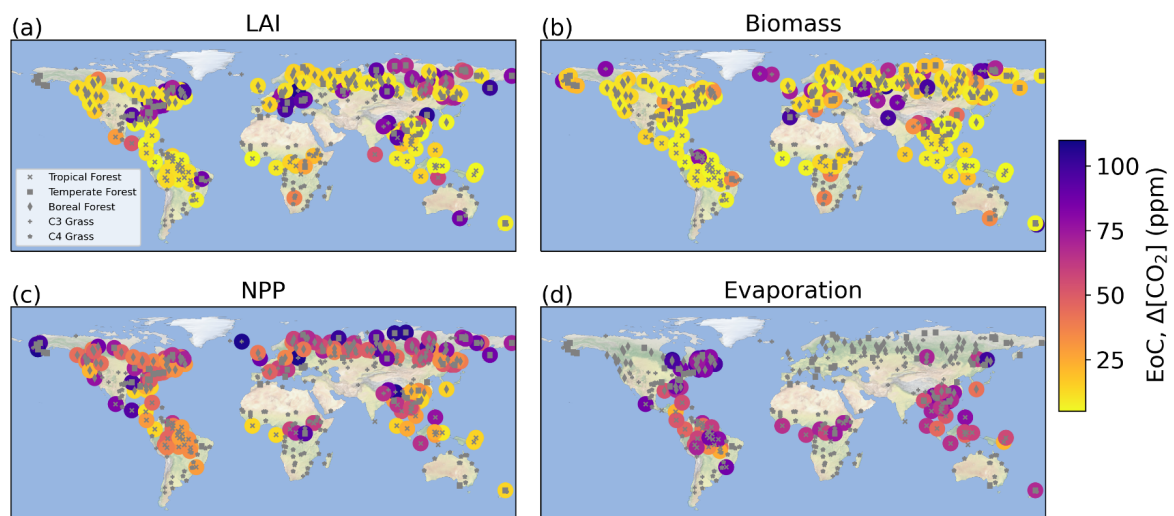


Fig. S8 Global distribution of EoC in LAI (a), biomass (b), NPP (c) and evaporation (d). Bright color indicates an earlier detection (lower EoC), and dark color indicates a later detection (higher EoC). Non-colored points indicate sites where the elevated CO₂ does not translate into significant GPP changes within the historical time period.

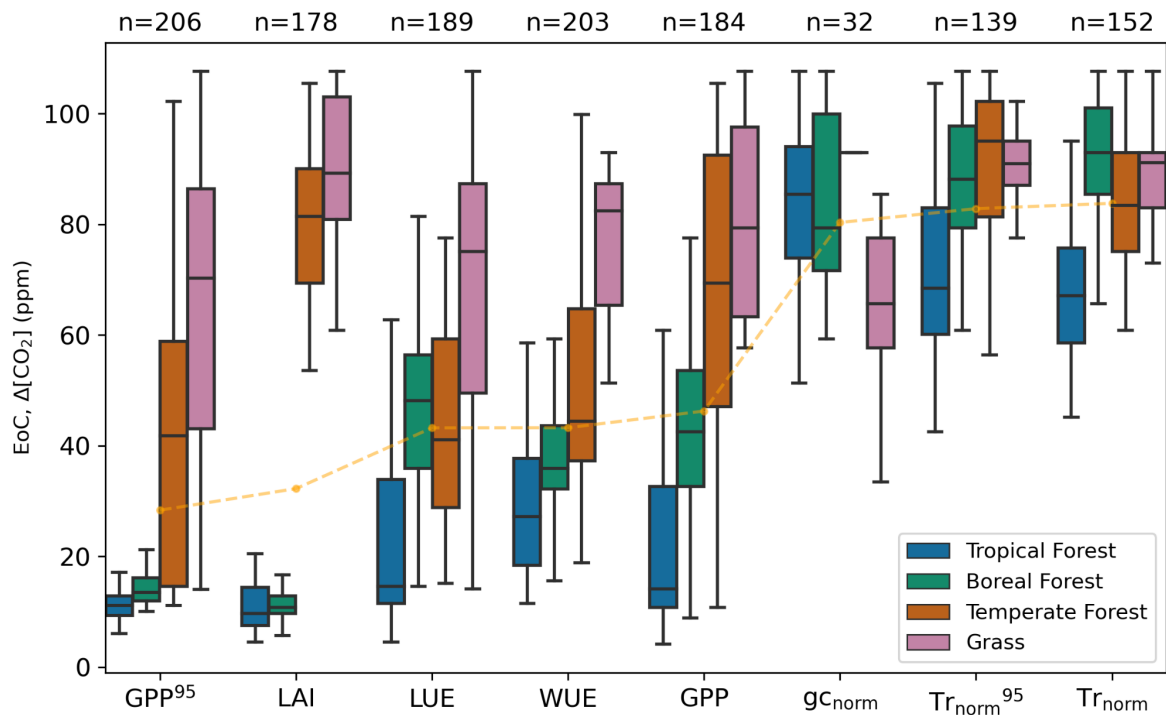


Fig. S9 Analogous to Fig. 5 but for different vegetation types. The dashed yellow line connects each point showing the mean EoC in each variable and metric. The definition of vegetation groups is the same as in Fig. 2.

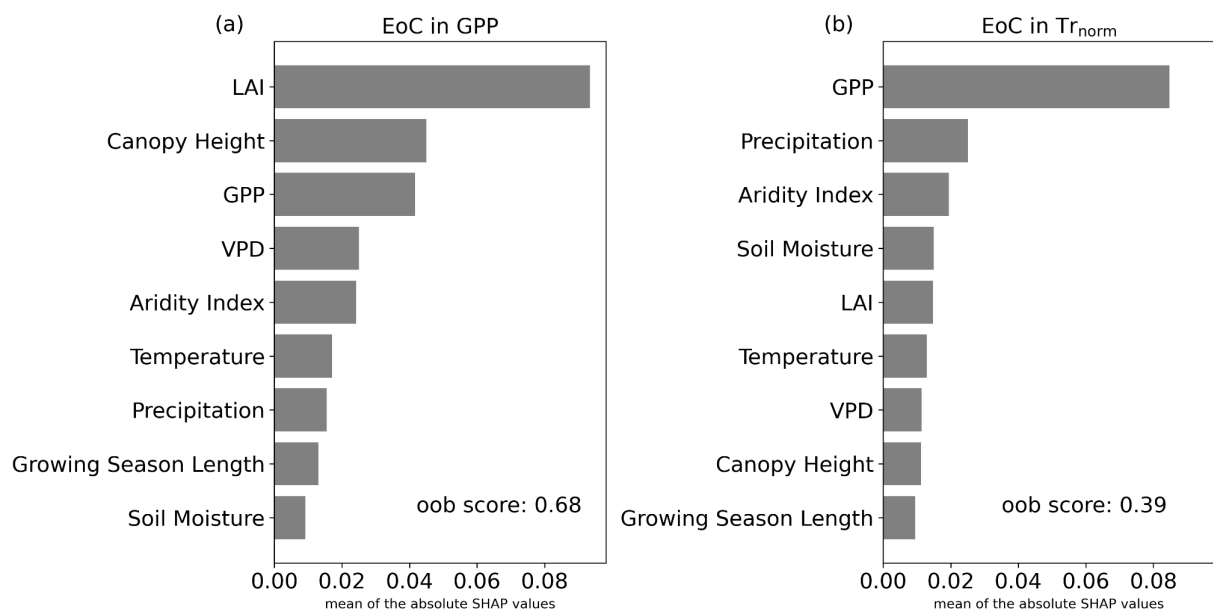


Fig. S10 Variable importance explaining the spatial patterns of EoC in GPP and Tr_{norm}. The figure shows the mean SHAP values from 1000 simulations based on a

random forest model to examine the variables that explain the spatial variability of EoC in (a) GPP and (b) Tr_{norm} . The variables used as predictors are the long-term mean values of each variable. The average Out of Bag (oob) score indicates the random forest model performance and can be interpreted as the explained fraction of the variance of the target variable.

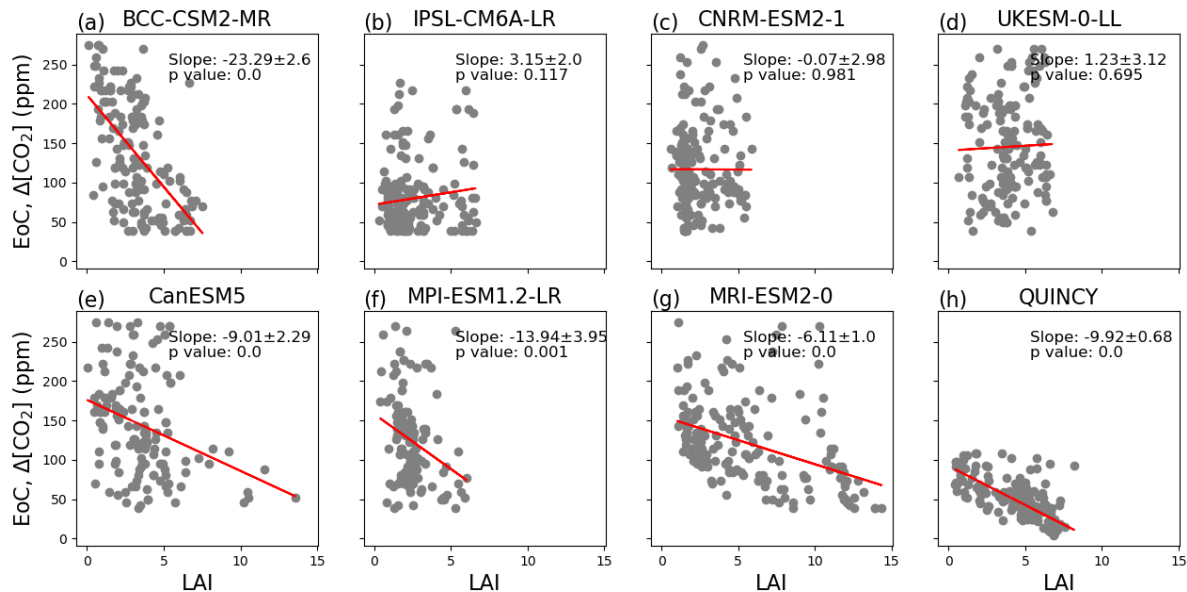
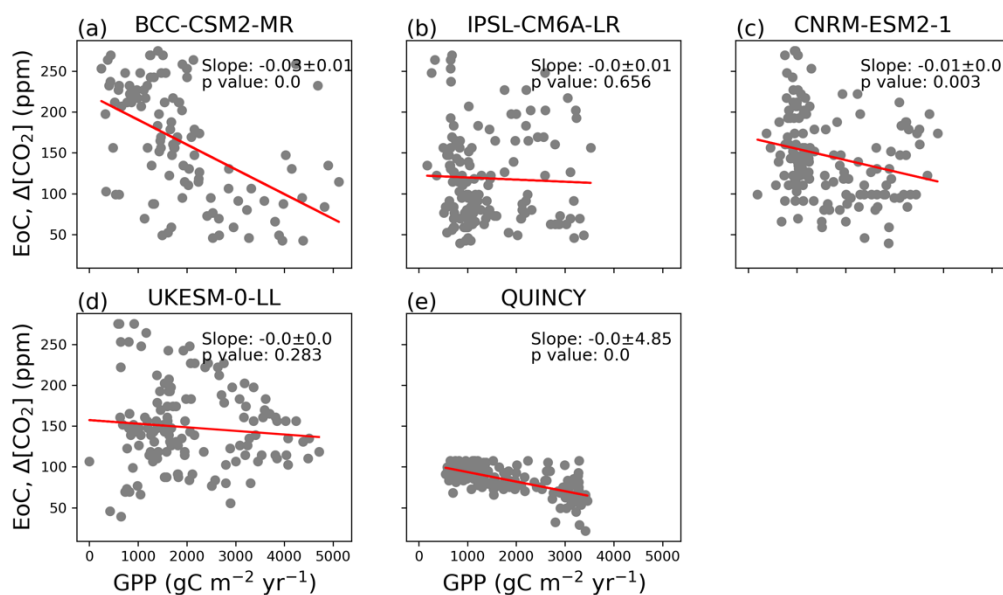


Fig. S11 EoC in GPP across the participating CMIP6 models and QUINCY. EoC in GPP is plotted against the long-term mean LAI, and each dot represents the grid-cell value in closest proximity to the particular QUINCY site. The red line refers to the least-squares regression best-fit.



60

61 **Fig. S12 EoC in Tr_{norm} across the participating CMIP6 models and QUINCY.** EoC
 62 in Tr_{norm} is plotted against the long-term mean GPP, and each dot represents the grid-
 63 cell value in closest proximity to the particular QUINCY site. The red line refers to the
 64 least-squares regression best-fit.