

Supplement of

Divergent historical GPP trends among state-of-the-art multi-model simulations and satellite-based products

Ruqi Yang et al.

5 *Correspondence to:* Jun Wang (wangjun@nju.edu.cn)

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Table S1. Information of the datasets used in this study.

Name	brief description	Reference	Access link
AVHRR	NDVI and NIRT reflectance		https://figshare.com/s/518a4bdcb14ae95dbcc7
NIRv	from AVHRR	(Wang et al., 2021)	
Revised EC-LUE GPP	A new estimation of GPP after adding CO ₂ fertilization effect to the generation of EC-LUE model	(Zheng et al., 2020)	https://figshare.com/articles/dataset/Improved_estimate_of_global_gross_primary_production
GLASS GPP	Global gridded GPP dataset	(Yuan et al., 2010)	http://www.glass.umd.edu/GPP/AVHRR/GLASS_GPP_005D_YEAR/
FLUXCOM GPP	Global GPP data upscaled based on the FLUXNET eddy-covariance tower measurements	(Jung et al., 2020)	https://www.bgc-jena.mpg.de/geodb/projects/Data.php
FLUXNET2015	Annual GPP observations (GPP_NT_VUT_REF) from 20 flux sites	(Pastorello et al., 2020)	http://fluxnet.fluxdata.org/data/fluxnet2015-dataset/
TRENDY v6 model simulations	GPP and LAI data from ten biome process-based models	(Sitch et al., 2015)	sftp trendy-v6@trendy.ex.ac.uk
GLASS LAI	Global gridded LAI dataset	(Xiao et al., 2016)	http://www.glass.umd.edu/05D/LAI/AVHRR/
CRU v4.0.1	Global gridded temperature and precipitation product based on weather stations	(Harris et al., 2014)	http://data.ceda.ac.uk/badc/cru/data/cru_ts/cru_ts_4.01/

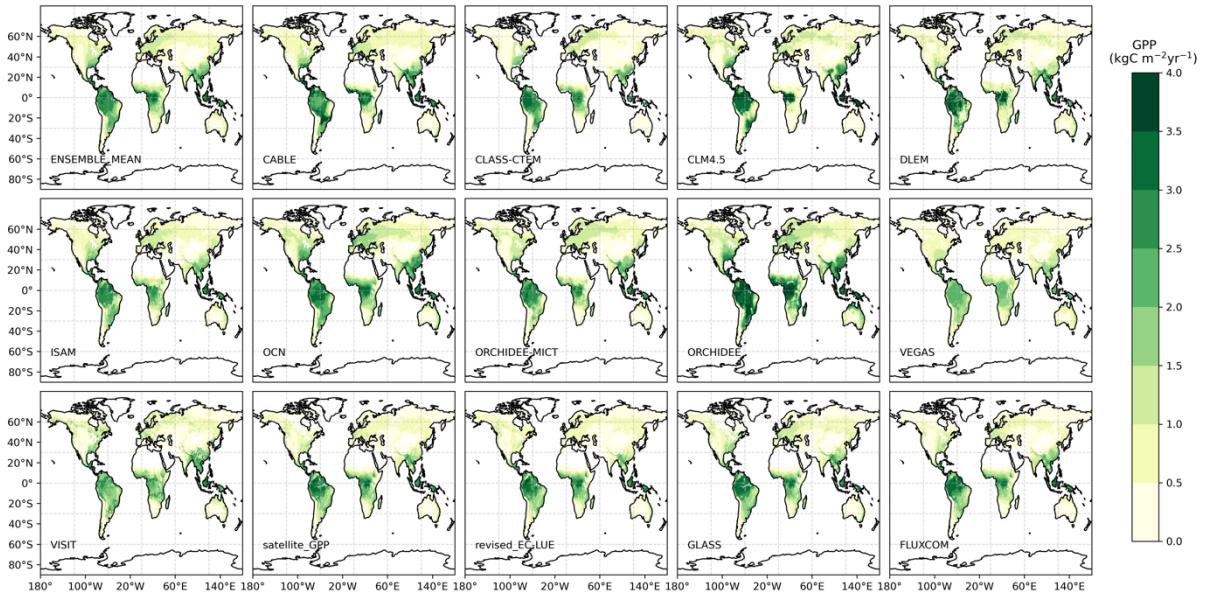


Figure S1: Geographical distributions of climatological annual terrestrial ecosystems gross primary productivity (GPP) from TRENDY DGVM simulations and GPP products (1982–2015). The unit of GPP is $\text{kg m}^{-2} \text{yr}^{-1}$.

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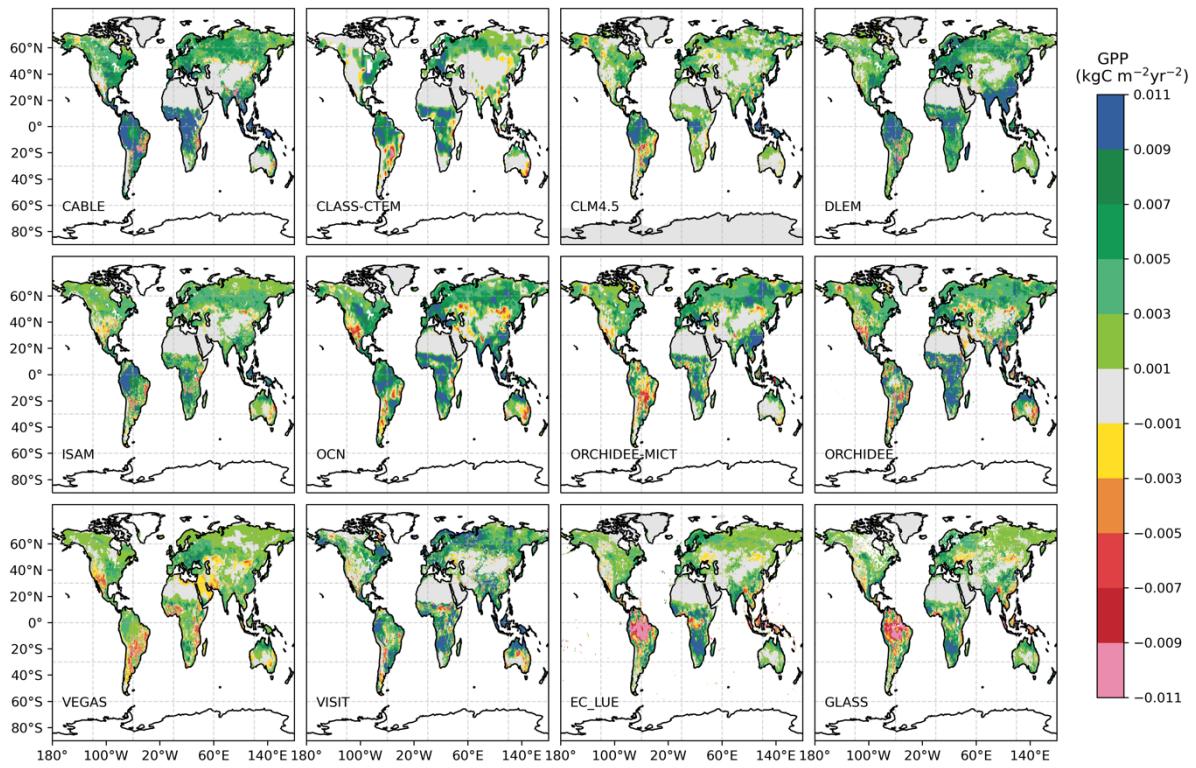


Figure S2. Geographical distributions of linear trends of annual GPP from TRENDY DGVMs and satellite-based products (1982–2015). The unit of GPP trend is $\text{kgC m}^{-2} \text{yr}^{-2}$.

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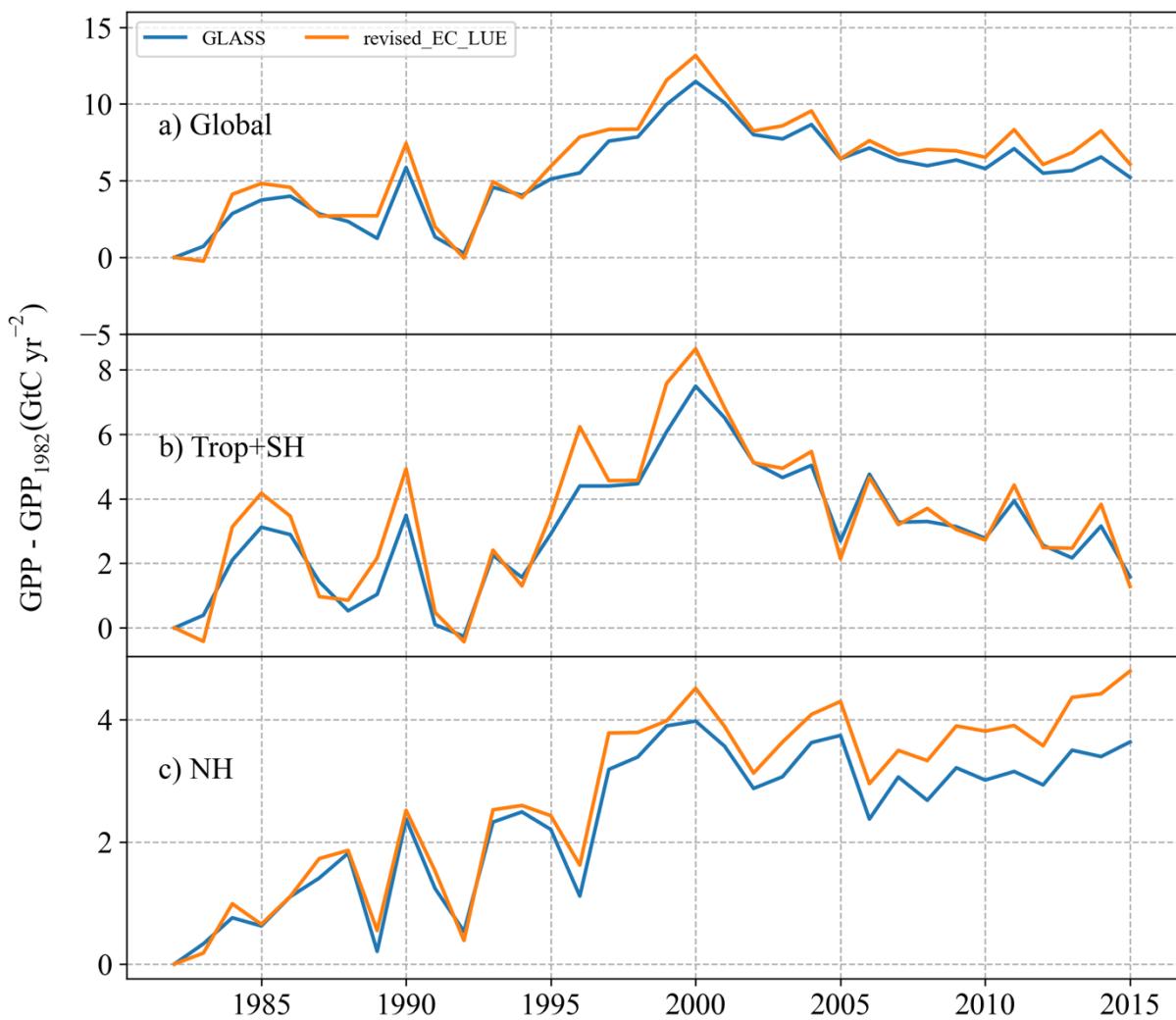
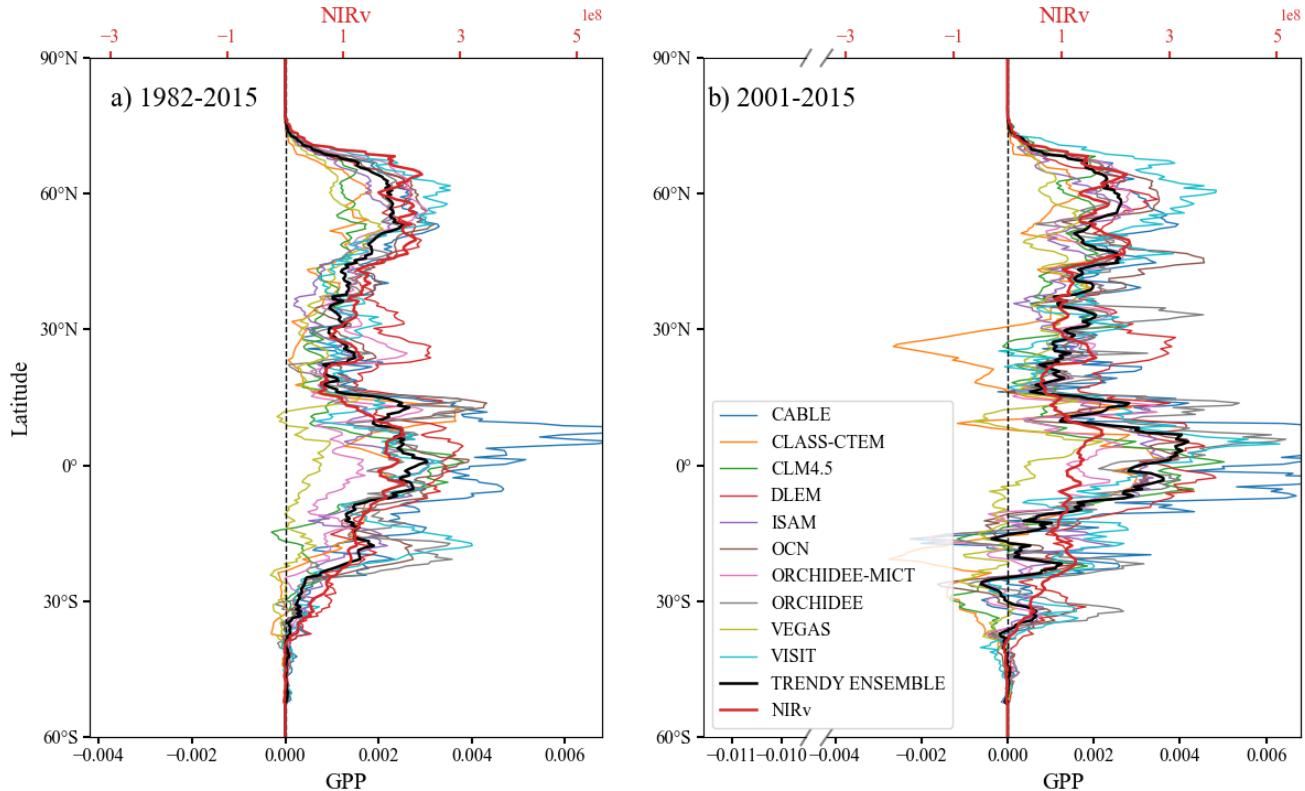
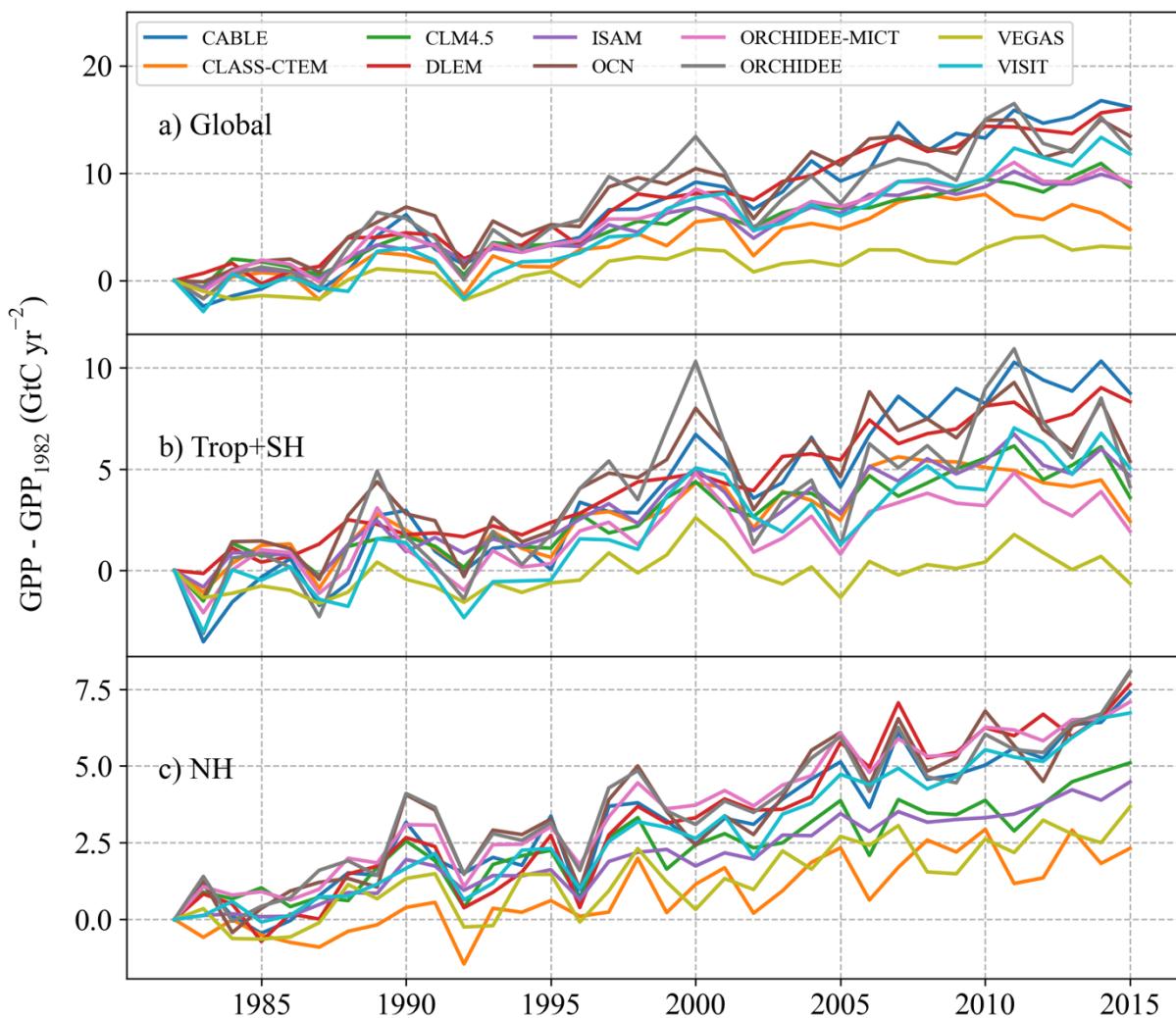


Figure S3: Changes of annual total GPP relative to 1982 for GLASS GPP and revised EC-LUE GPP.



45 **Figure S4: Latitudinal profiles of trends of zonal total NIRv and annual GPP (0.5° latitudinal intervals). DGVM ensemble mean (blue), individual TRENDY model simulations (grey), and NIRv (red) during 1982–2015 (a) and 2001–2015 (b), respectively. The shaded areas represent the standard deviation of the individual TRENDY model simulated GPP trend. The trends of NIRv and GPP are unitless and GtC yr^{-2} , respectively.**



50 Figure S5: Changes of annual total GPP relative to 1982 for individual DGVM simulations.

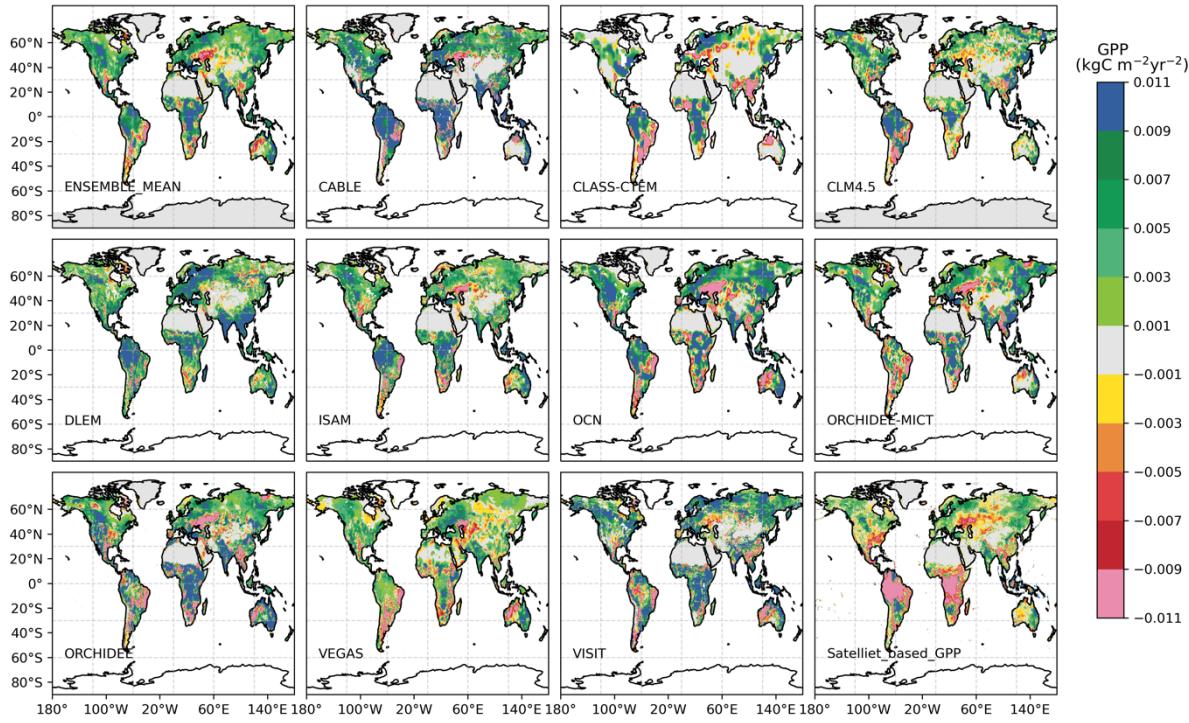
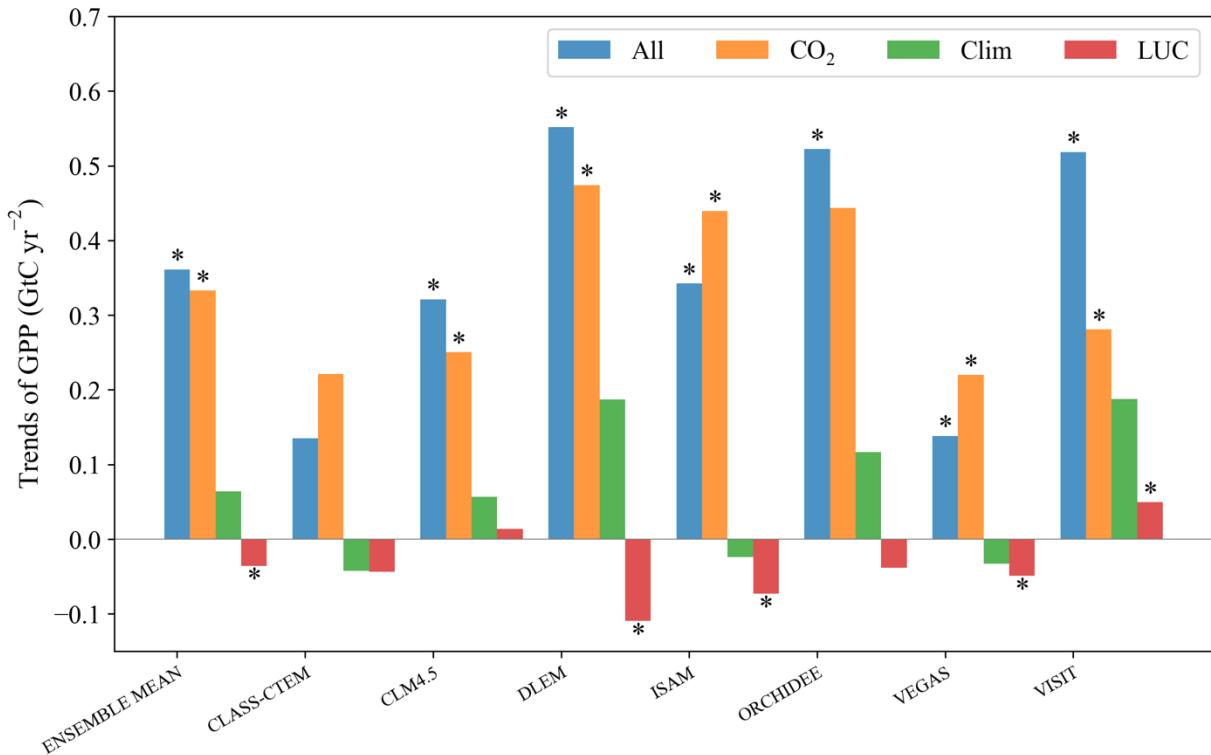


Figure S6: Geographical distributions of linear trends of GPP from satellite-based products and DGVM simulations (2001–2015).
The unit of GPP trend is $\text{kgC m}^{-2} \text{yr}^{-2}$.

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Figure S7: Attributions of global total GPP trends for TRENDYv6 simulations during 2001–2015: CO₂ fertilization effect (S1), climate (S2-S1), and land use change (S3-S2). “All” gives the values of the reference simulation that includes the effect of all three drivers (S3). Asterisks indicate that the trend is significant with $p < 0.05$ following the non-parametric Mann-Kendall trend test.

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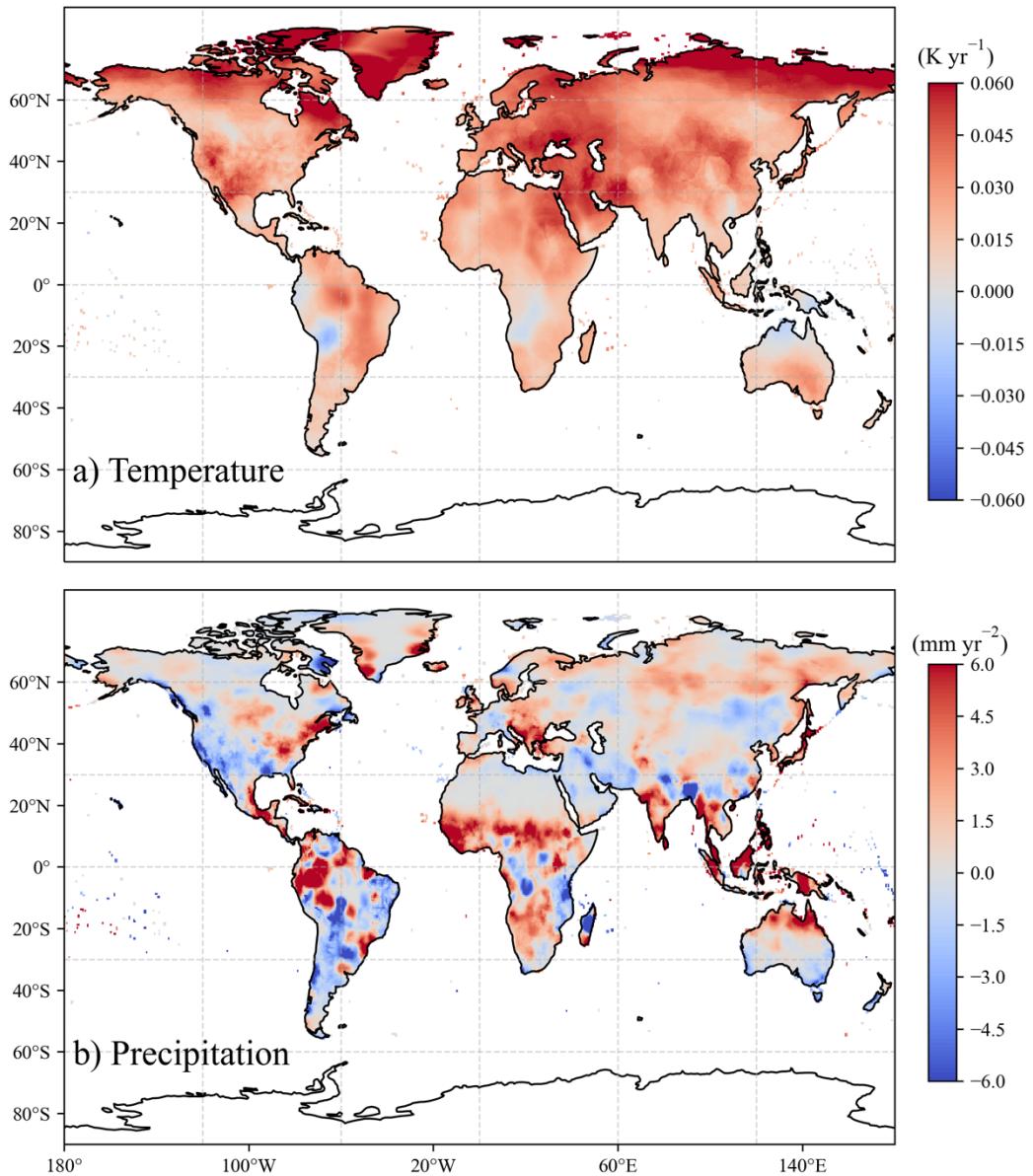
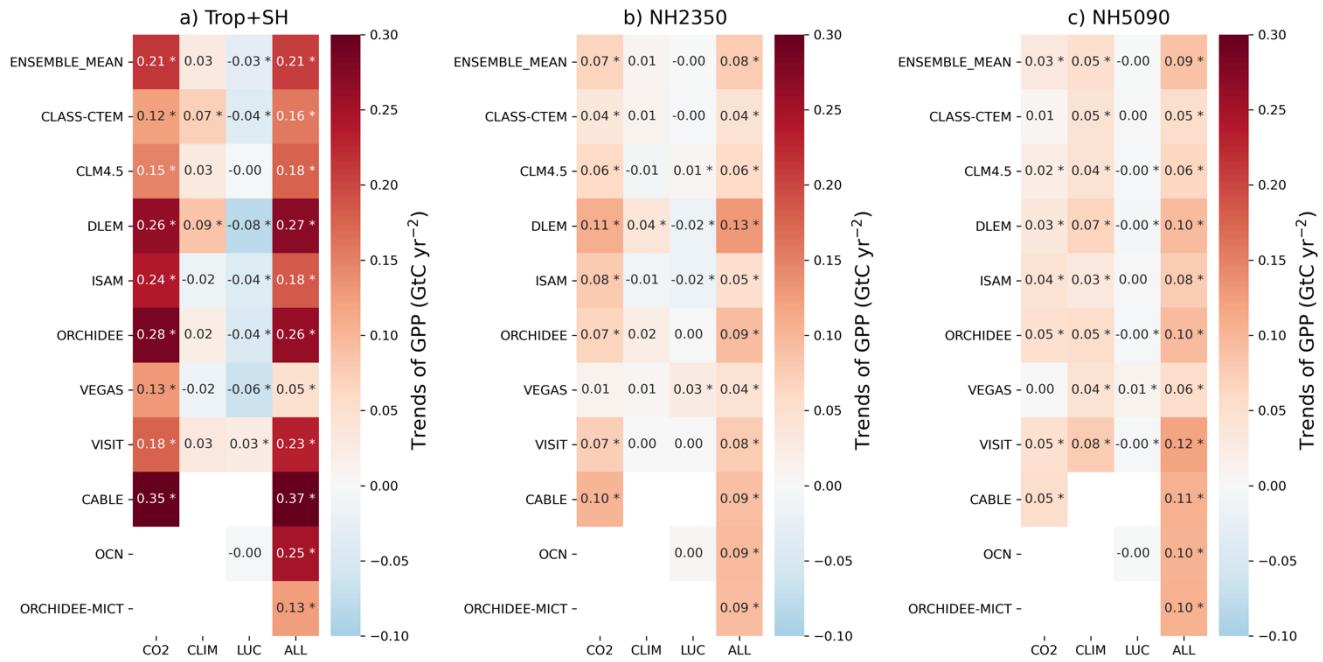


Figure S8: Geographical distributions of linear trends of (a) temperature and (b) precipitation from CRU datasets during 1982 to 2015. The trends of temperature and precipitation are K yr^{-1} and mm yr^{-2} , respectively.

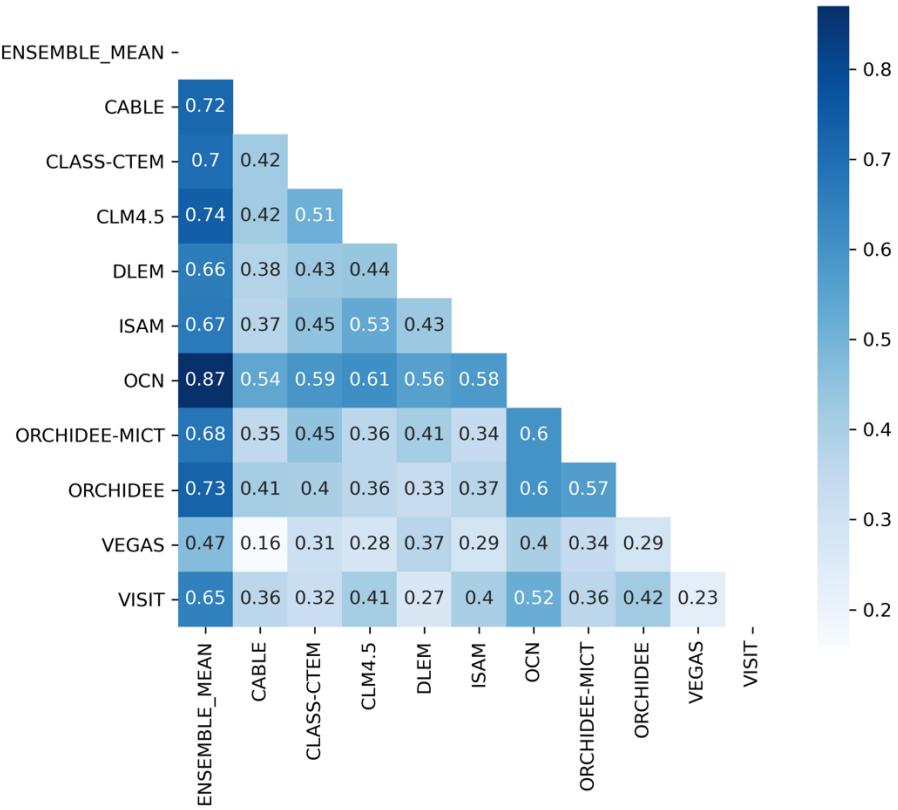


100 **Figure S9: Regional GPP trends in individual model for the period of 1982–2015. CO₂ fertilization effect (S1), climate (S2-S1), LUC (S3-S2). “All” gives the values of the reference simulation that includes the effect of all three drivers (S3). NH2350 and NH5090 mean 50°N–90°N and 23°N–90°N, respectively. Asterisks indicate that the trend is significant with p < 0.05 following the non-parametric Mann-Kendall trend test.**

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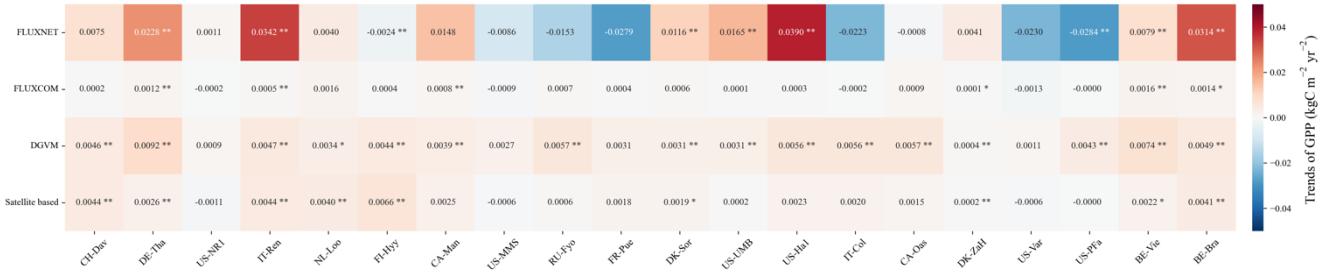
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Figure S10: Spatial correlation coefficients among DGVM simulated GPP trends in pairs during 1982–2015.

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130 **Figure S11: Trends of GPP at sites.** The global GPP datasets were interpolated into the locations of these sites according to the bilinear interpolation method. The unit of GPP trend is $\text{kgC m}^{-2} \text{yr}^{-2}$.

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