

**Interannual Variation and Trend of Carbon Budget in a Cool-Temperate Deciduous Forest in Central Japan at Takayama Detected from 28-year Observation**

Shohei Murayama<sup>1</sup>, Hiroaki Kondo<sup>1, 2</sup>, Shigeyuki Ishidoya<sup>1</sup>, Takahisa Maeda<sup>1</sup>, Nobuko Saigusa<sup>3</sup>, Susumu Yamamoto<sup>1</sup>, Kazuki Kamezaki<sup>1</sup>, and Hiroyuki Muraoka<sup>4, 5, 6, 3</sup>

1 National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan

2 Japan Weather Association, Tokyo, Japan

3 National Institute for Environmental Studies, Tsukuba, Japan

4 River Basin Research Center, Gifu University, Gifu, Japan

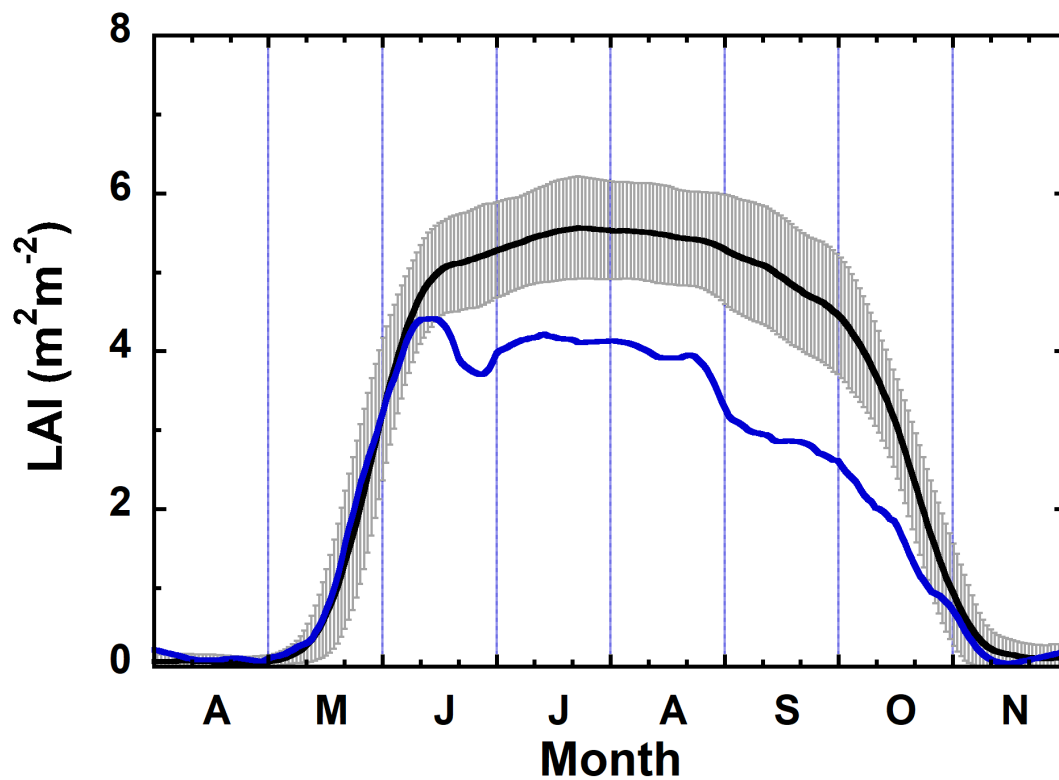
5 Center for Carbon Neutrality, Environment and Energy, Gifu University, Gifu, Japan

6 Regional Adaptation Research Center, Gifu University, Gifu, Japan

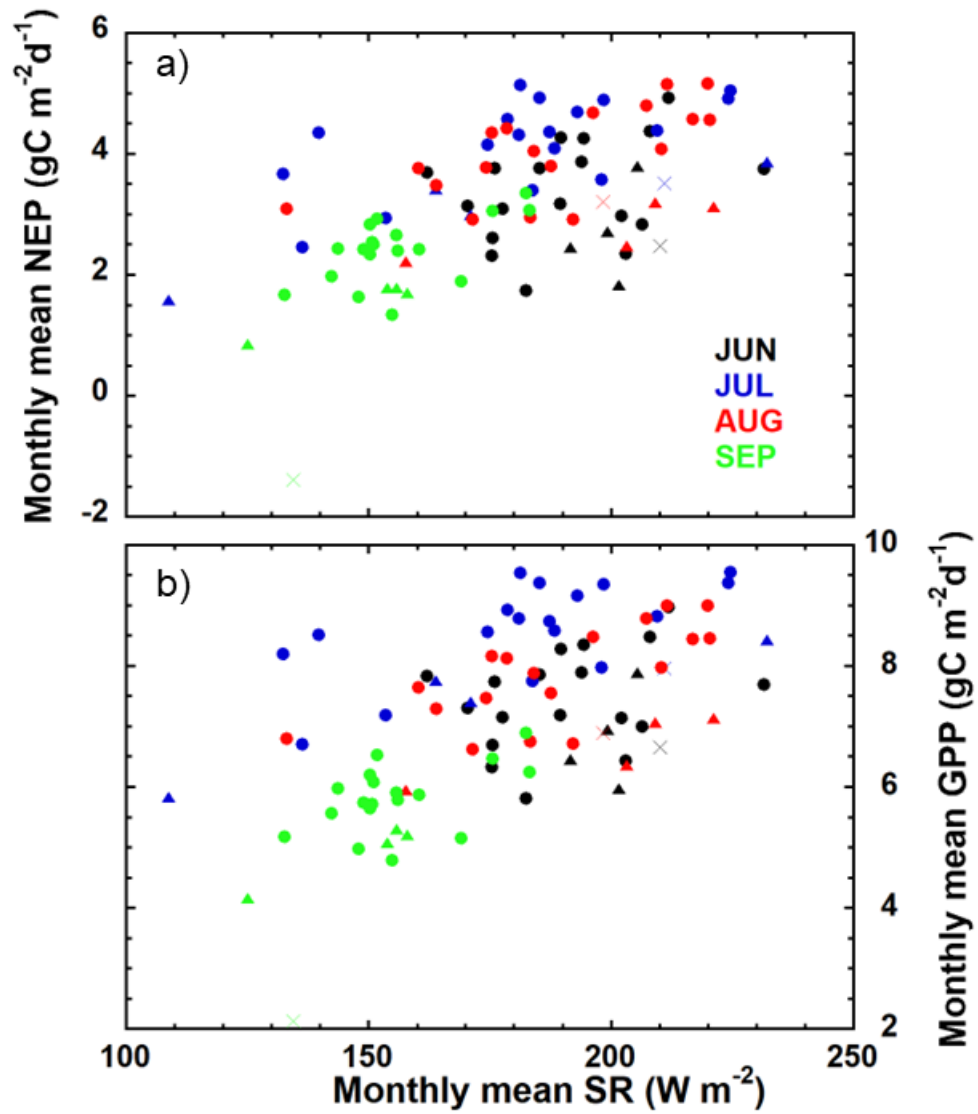
**Contents of this file**

Figures S1 to S7

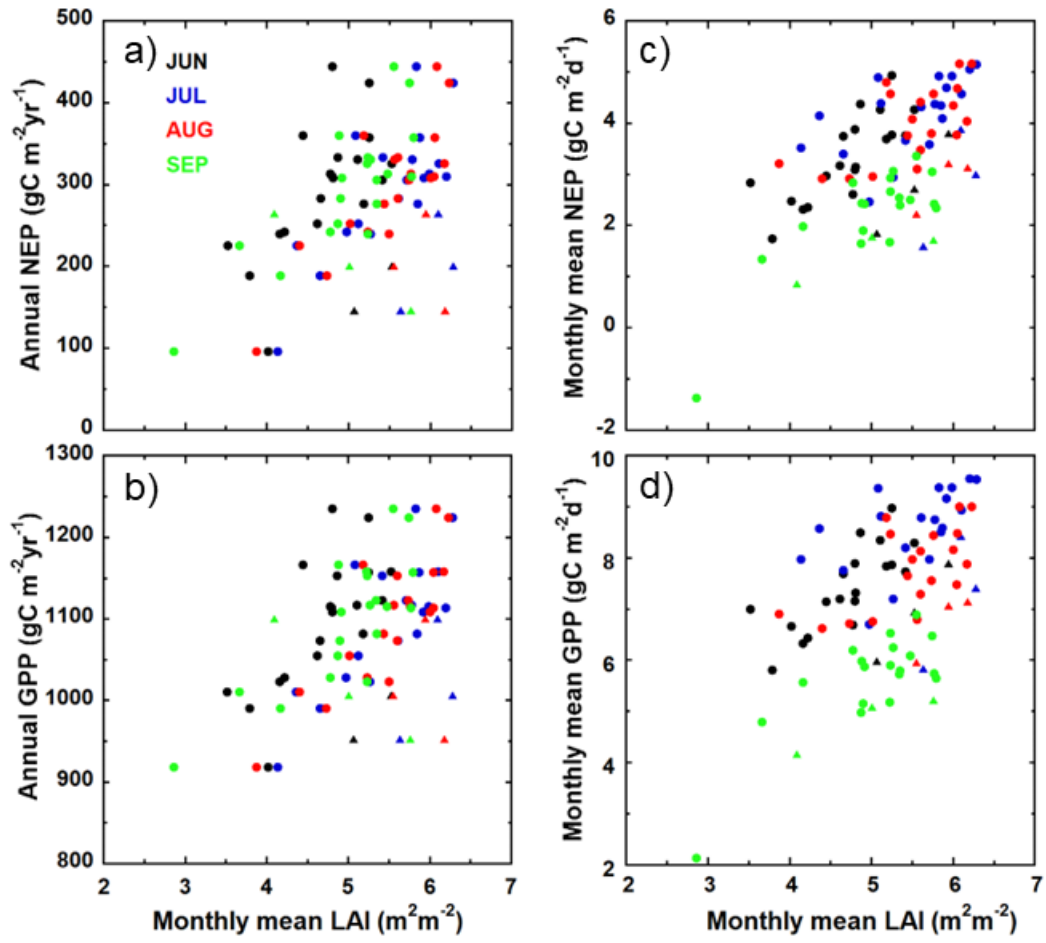
Tables S1 to S3



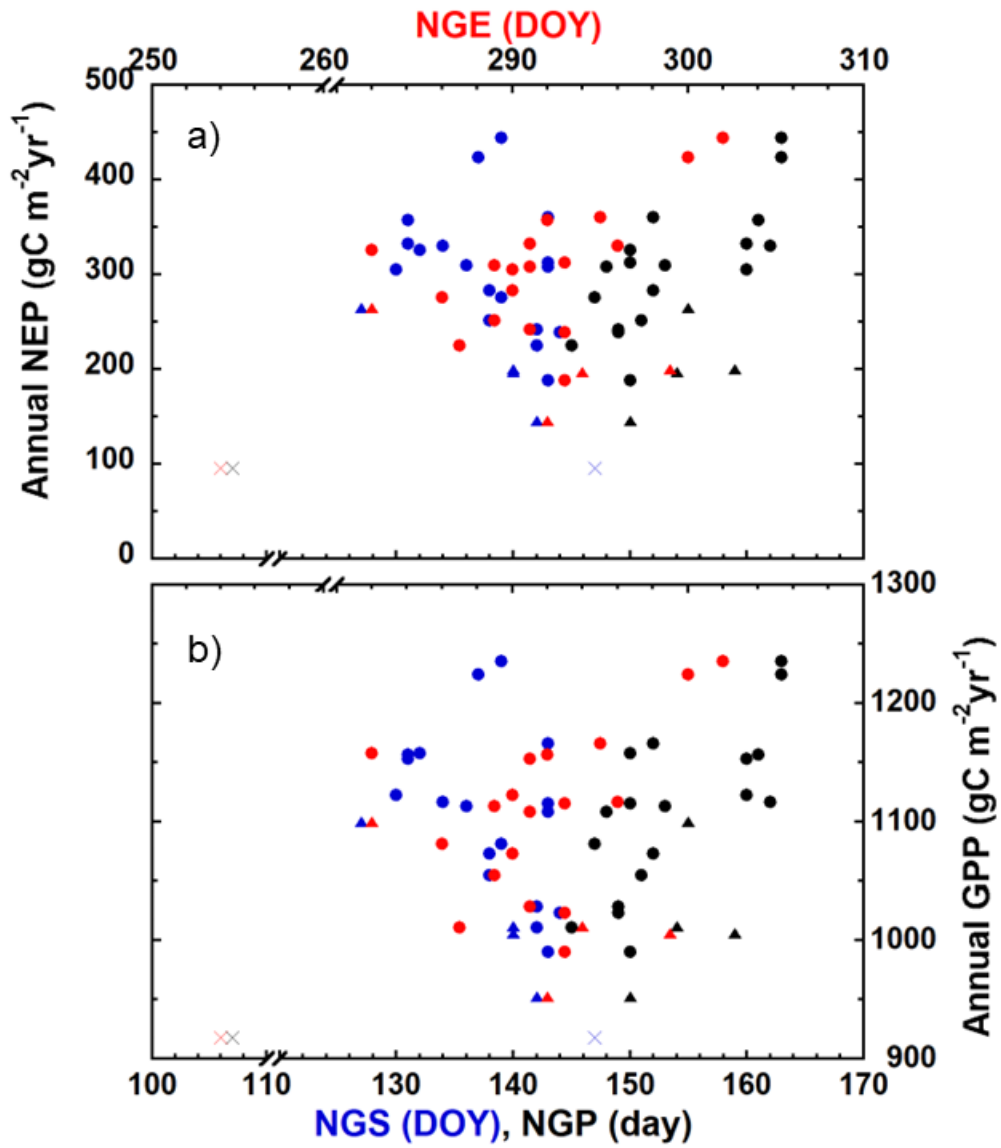
**Figure S1.** Temporal variation in LAI from April to November averaged over 1999-2021 except for 2019 (black) and in 2004 (blue). Vertical lines represent the range of the standard deviation ( $1\sigma$ ) from the average.



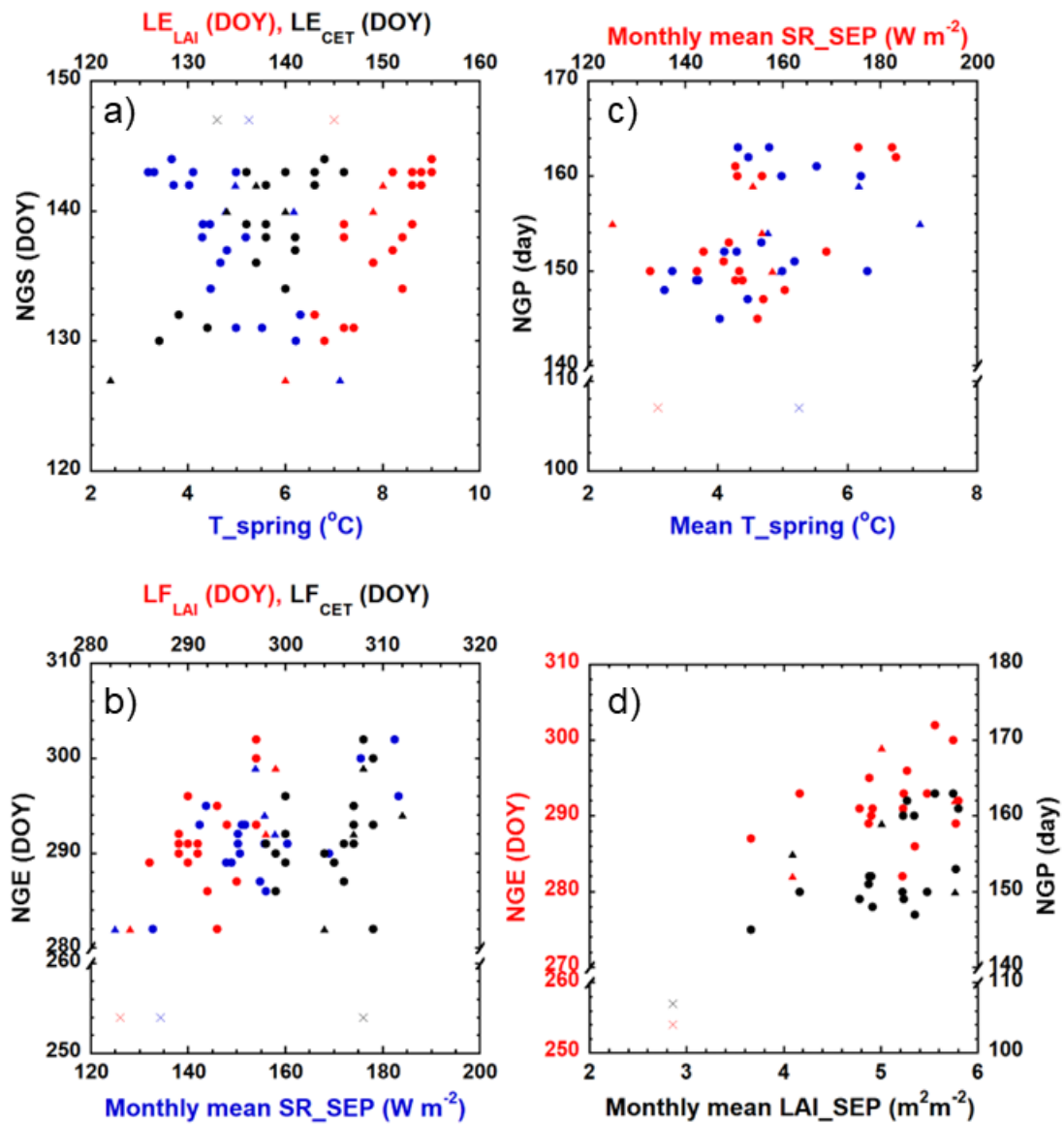
**Figure S2.** Correlation of IAVs in monthly mean SR in June, July, August and September with those of monthly mean NEP a) and GPP b) for the respective months. ●, × and ▲ represent the data for 1999-2017 except 2004, 2004 and 2018-2021, respectively.



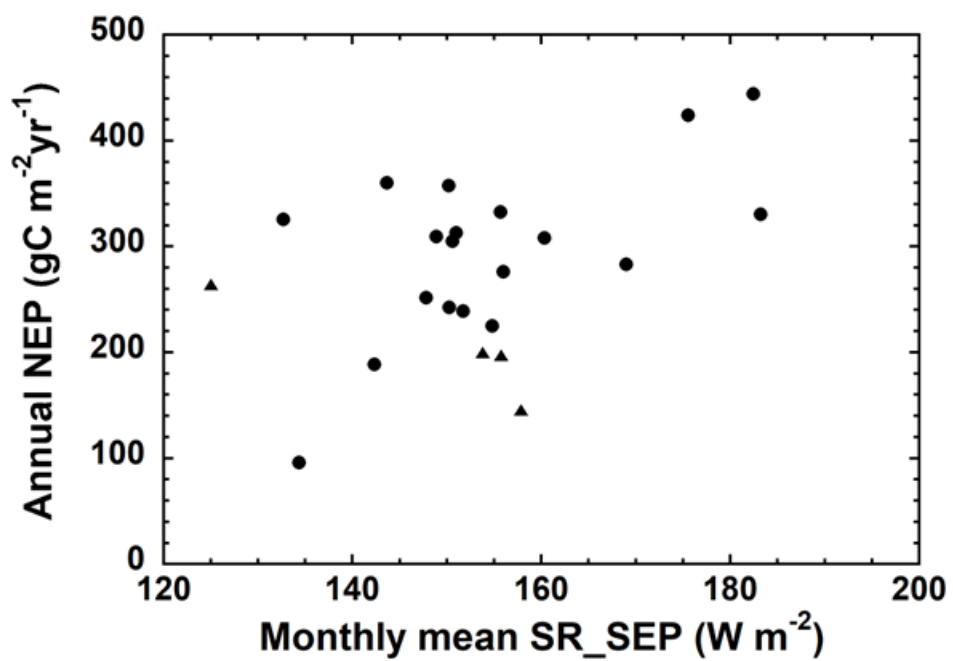
**Figure S3.** Correlation of IAV in monthly mean LAI in June, July, August and September with those of annual NEP a) and GPP b) and with those of monthly mean NEP c) and GPP d) for the respective months. ● and ▲ represent the data for 1999-2017 and 2018-2021 except 2019, respectively.



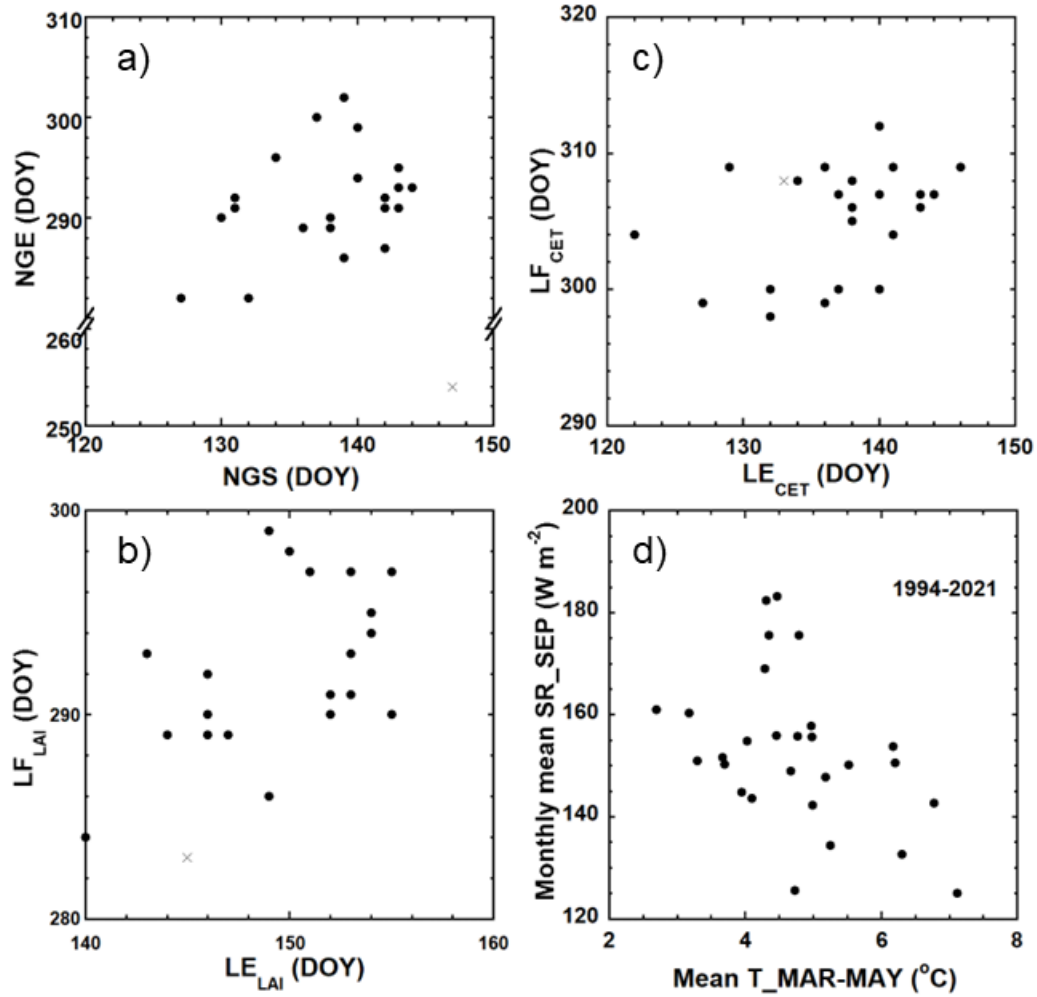
**Figure S4.** Correlations of IAVs in NGS (blue), NGE (red) and NGP (black) with those in annual NEP a) and GPP b). ●, × and ▲ represent the data for 1999-2017 except 2004, 2004 and 2018-2021 except 2019, respectively.



**Figure S5.** Correlations of IAV in NGS with those in mean air temperature in spring ( $T_{spring}$ ) (blue),  $LE_{LAI}$  (red) and  $LE_{CET}$  (black) a), that in NGE with those in monthly mean SR in September ( $SR_{SEP}$ ) (blue),  $LF_{LAI}$  (red) and  $LF_{CET}$  (black) b), that in NGP with those in  $T_{spring}$  (blue) and  $SR_{SEP}$  (red) c), and those in NGE (red) and NGP (black) with that in monthly mean LAI in September ( $LAI_{SEP}$ ). ●, × and ▲ represent the data for 1999-2017 except 2004, 2004 and 2018-2021 except 2019, respectively.



**Figure S6.** Correlation of the IAV in the monthly mean SR in September with that in the annual NEP. ● and ▲ represent the data for 1999-2017 and 2018-2021, respectively.



**Figure S7.** Correlations of IAVs in occurrence between NGS and NGE a), between LE<sub>LAI</sub> and LF<sub>LAI</sub> b) and between LE<sub>CET</sub> and LF<sub>CET</sub> c) for 1999-2021. The data for 2019 are not included in b) and c). × and ● represent the data for 2004 and the other years, respectively. Correlations of IAVs between mean air temperature in spring (T<sub>spring</sub>) and monthly mean SR in September (SR<sub>SEP</sub>) for 1994-2021 d).