Supplementary material for

# Performance assessment of the global gross primary productivity datasets over India for climate and ecophysiological applications

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## S1. Description of the study sites

### S1.1. Croplands

***BIT:*** The site BIT is located in the Berambadi village, Gundlupet taluka in the Chamarajanagar district in Karnataka state. This area has a semi-arid climate zone, classified as tropical savannah (Aw) according to the Köppen-Geiger classification (Kottek et al., 2006). The mean annual rainfall and potential evapotranspiration being 800 and 1100 mm, respectively, with large inter-annual variability in the rainfall (Buvaneshwari et al., 2017). The three main soil types observed in the area are black, red, and rocky/weathered soils (Barbiéro et al., 2007; Tomer et al., 2015).

***BKC:*** The BKC site is located in Barkachha village in Nagar city block, in the Mirzapur district in Uttar Pradesh State. Here, the climate is semi-arid and sub-humid, with an annual rainfall of 968.5 mm (Tripathi et al., 2014). The site is situated on the Indo-Gangetic Plain, which has rich alluvial soil with good fertility and is well-irrigated. The site topography is undulating and rough. Red soil, generally tending to reddish brown, with a lighter texture and friable structure, is commonly observed in the farms. However, slightly alkaline, calcareous soil is also found in some patches.

***DIT:*** This site is located in the Dharwad district in the Karnataka State—the annual rainfall recorded near the site is 744-800 mm (Yadav et al., 2023). This district has three major agro-climatic zones, namely the northern dry, transition, and hilly zones. The climate is moderate and healthy. The soil types consist of deep black soils, shallow black soils, sandy loam and sandy soils.

***NIT:*** The site NIT is situated in Nawagam under the Kheda district in Gujrat state. The annual mean temperature varies from 25 °C to 40 °C. The annual precipitation is in the range of 500-750 mm. The South-west monsoon accounts for 95–98% of the study region's annual rainfall (Desai & Nigam,2021). The soil in this study region is classified as goradu (gravelly), black, sandy, and rocky.

***SIT:*** This site is located in the eastern Indo-Gangetic Plains of Bihar, India, representing an intensively managed agricultural ecosystem dominated by rice and wheat cropping systems. The region experiences a sub-humid climate with maximum temperatures ranging from 23–29 °C and minimum temperatures between 10–20 °C, along with an annual precipitation of about 900–1200 mm, primarily during the southwest monsoon (June–September) (Gharekhan et al.,2020)

### S1.2. Forests

***BFS:*** The site BFT is located in two forest ranges of Dehradun district: Barkot and Rishikesh Reserve Forest. The site represents the North Indian Tropical Moist Deciduous Forest. The region experiences a warm climate with a temperature range of 2°C-41°C and an average annual rainfall of ~2300. Vegetation is dominated by deciduous species such as Sal *(Shorea robusta*) (Watham et al., 2016)

***BFT***: The BFT site is situated in the mixed dry deciduous forests of Betul, Madhya Pradesh, under the Indian Space Research Organization–Geosphere Biosphere Program (ISRO-GBP)

and contributes to the AsiaFlux network. The site is dominated by Teak (*Tectona grandis*) with an average canopy height of 22 m. The region experiences a tropical moist climate. LAI is lowest during leaf-off (April–May) and peaks in greenness from September to October, with a mean annual precipitation of 1016 mm and a temperature of around 27°C (Rodda et al., 2021).

**HFS**: The HFS is located in the Himalayan foothill region and represents a young deciduous forest plantation ecosystem under a monsoon-influenced humid subtropical climate (Cwa). Situated at an elevation of 280 m above sea level, the site experiences a mean annual temperature of 23.16 °C and receives an average annual precipitation of 943.12 mm (2016–2018). The soil is characterized by greyish-brown silt clay loam with near-neutral pH, relatively low organic carbon content, and supports a 15-year-old plantation with an average canopy height of 16 m (Watham et al., 2016)

**KKM**: This site, KKM, is in the mid-altitude Himalayan region of Uttarakhand, Northwestern India, and is classified as a semi-evergreen coniferous-dominated forest (Mukherjee et al., 2018). According to the Köppen classification, the climate at KKM is classified as humid subtropical (CWa type) (Kottek et al., 2006). At the daily scale, 90% closure of the surface energy budget has been observed, with a mean canopy height of 12m. KKM is identified to act as a strong carbon sink (Deb Burman et al., 2021).

**KNP**: The site is a mixed Savannah forest with broadleaf deciduous trees and grasslands, located along the banks of the Brahmaputra River valley in Nagaon district, Assam. At KNP, soil respiration is high, and soil organic matter is also abundant (Rao et al., 2025; Samanta et al., 2025). The park's soil is rich in alluvial deposits due to annual flooding (Kushwaha et al., 2000). Climatologically, June to September is the wettest period at KNP, and it also receives a significant amount of rainfall during April and May due to Nor'weasters (Mahanta et al., 2013)

### S1.3. Grasslands

**JIT**: This site in Rajasthan is located within the arid western zone and represents an arid grassland ecosystem. Situated on the campus of the Central Arid Zone Research Institute (CAZRI), the site is dominated by natural vegetation, primarily sewan grass (*Lasiurus sindicus*), characteristic of desert landscapes. The region experiences maximum temperatures ranging from 25-40 °C, minimum temperatures from 8-25 °C, and low annual precipitation of about 100–300 mm (Bhat et al., 2020).

**UIT**: The site is a semi-natural grassland located at the Indian Institute of Technology, Kanpur (IITK). The climate is a humid subtropical (Csa) according to the Köppen-Geiger classification. The mean annual temperature and rainfall are 25.6 ° C and 820 mm $year^{-1}$, respectively. Soils here are young silty alluviums (Fluvisols) with sand, silt, and clay fractions of 5%, 80%, and 15%, respectively (Chakraborty et al., 2019).

### S1.4. Mangroves

**PVM**: This site represents a coastal mangrove ecosystem located on the southeast coast of India, along the Bay of Bengal, in the Cauvery delta between the Coleroon and Vellar estuaries. The climate is tropical savannah (Aw) according to the Köppen-Geiger classification, sub-humid, with a temperature range of 20 °C-38 °C and annual precipitation of 1310 mm. The

water level here varies from 0.3 to 3.0 m (Selvam et al., 2003). The topsoil layer is clayey, with a pH of 7.0-7.3.

**SFT**: The site is in the world's largest contiguous mangrove forest ecosystem in the Ganga Brahmaputra delta. Out of a total area of 9000 $km^2$, about 34% of the Sundarbans is in Indian territory and 66% in Bangladesh (Naskar et al.,2009). The climate is tropical humid, with an annual temperature range of 21°C to 30°C and high annual precipitation (1800mm) (Jha et al., 2014). The name Sundarbans is derived from the most dominant tree being *Heritiera fomes* (locally 'sundari′).

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**Table S1.** Summary of regression analysis results from various LULC classes across different databases. The table includes each regression model's coefficients, R-squared values, p-values, and standard errors with $GPP_{EC}$. This information provides insights into the strength, significance, and reliability of the relationships between the analysed variables in each database, highlighting any notable variations or trends.

| LULC Class | Site | Database name | Slope | Intercept | $R^2$ | Adj. $R^2$ | p-value |
|---|---|---|---|---|---|---|---|
| Cropland | BIT | FLUXCOM-RS | 0.57 | 0.523 | 0.606 | 0.6 | 0.00 |
| | | GED | 0.664 | 1.673 | 0.447 | 0.436 | 0.00 |
| | | GLASS | 0.448 | 2.003 | 0.39 | 0.38 | 0.00 |
| | | GOSIF | 0.319 | 0.531 | 0.534 | 0.527 | 0.00 |
| | | MODIS | 0.003 | 0.017 | 0.256 | 0.244 | 0.00 |
| | | MuSyQ | 0.177 | 3.149 | 0.079 | 0.065 | 0.02 |
| | | PML_V2 | 0.781 | 1.395 | 0.573 | 0.566 | 0.00 |
| | | SMAP | 0.487 | 3.236 | 0.259 | 0.257 | 0.00 |
| | | VODCA2GPP | 0.628 | 3.676 | 0.356 | 0.345 | 0.00 |
| | | XBASE | 0.503 | 0.698 | 0.531 | 0.53 | 0.00 |
| | BKC | FLUXCOM-RS | 0.282 | 2.253 | 0.184 | 0.166 | 0.00 |
| | | GED | 0.206 | 2.384 | 0.047 | 0.019 | 0.20 |
| | | GLASS | 0.217 | 1.648 | 0.16 | 0.142 | 0.01 |
| | | GOSIF | 0.294 | 0.715 | 0.344 | 0.33 | 0.00 |
| | | MODIS | 0.002 | 0.01 | 0.24 | 0.223 | 0.00 |
| | | MuSyQ | 0.305 | 2.051 | 0.158 | 0.139 | 0.01 |
| | | PML_V2 | 0.133 | 1.897 | 0.025 | 0.004 | 0.28 |
| | | SMAP | 1.142 | 1.829 | 0.487 | 0.484 | 0.00 |
| | | VODCA2GPP | -0.517 | 3.753 | 0.217 | 0.2 | 0.00 |
| | | XBASE | 0.476 | 2.295 | 0.146 | 0.143 | 0.00 |
| | DIT | FLUXCOM-RS | 0.173 | 0.951 | 0.669 | 0.665 | 0.00 |
| | | GED | 0.291 | 1.062 | 0.693 | 0.688 | 0.00 |
| | | GLASS | 0.254 | 1.114 | 0.633 | 0.629 | 0.00 |
| | | GOSIF | 0.198 | 1.096 | 0.608 | 0.604 | 0.00 |
| | | MODIS | 0.002 | 0.011 | 0.515 | 0.509 | 0.00 |
| | | MuSyQ | 0.146 | 1.242 | 0.513 | 0.508 | 0.00 |
| | | PML_V2 | 0.256 | 1.121 | 0.61 | 0.605 | 0.00 |
| | | SMAP | 0.3 | 1.879 | 0.514 | 0.513 | 0.00 |
| | | VODCA2GPP | 0.198 | 2.882 | 0.336 | 0.329 | 0.00 |
| | | XBASE | 0.314 | 1.122 | 0.736 | 0.735 | 0.00 |
| | NIT | FLUXCOM-RS | 0.224 | 1.288 | 0.333 | 0.326 | 0.00 |
| | | GED | 0.336 | 0.208 | 0.449 | 0.441 | 0.00 |
| | | GLASS | 0.098 | 1.422 | 0.098 | 0.088 | 0.00 |
| | | GOSIF | 0.152 | 1.271 | 0.195 | 0.186 | 0.00 |
| | | MODIS | 0.002 | 0.003 | 0.292 | 0.282 | 0.00 |
| | | MuSyQ | 0.268 | 1.374 | 0.361 | 0.354 | 0.00 |
| | | PML_V2 | 0.185 | 0.493 | 0.13 | 0.12 | 0.00 |

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|---|---|---|---|---|---|---|---|
| | | SMAP | 0.439 | 1.229 | 0.39 | 0.389 | 0.00 |
| | | VODCA2GPP | 0.222 | 0.072 | 0.345 | 0.338 | 0.00 |
| | | XBASE | 0.186 | 1.606 | 0.151 | 0.149 | 0.00 |
| | **SIT** | FLUXCOM-RS | 0.131 | 2.592 | 0.208 | 0.196 | 0.00 |
| | | GED | 0.087 | 3.426 | 0.115 | 0.098 | 0.01 |
| | | GLASS | 0.028 | 3.091 | 0.012 | -0.003 | 0.37 |
| | | GOSIF | 0.063 | 2.783 | 0.042 | 0.028 | 0.09 |
| | | MODIS | 0.001 | 0.013 | 0.124 | 0.109 | 0.01 |
| | | MuSyQ | 0.053 | 4.457 | 0.016 | 0.002 | 0.30 |
| | | PML_V2 | 0.174 | 2.011 | 0.127 | 0.115 | 0.00 |
| | | SMAP | 0.214 | 3.979 | 0.129 | 0.127 | 0.00 |
| | | VODCA2GPP | 0.048 | 3.053 | 0.005 | -0.011 | 0.58 |
| | | XBASE | 0.059 | 4.161 | 0.021 | 0.019 | 0.00 |
| **Forest** | **BFS** | FLUXCOM-RS | 0.333 | 2.558 | 0.552 | 0.545 | 0.00 |
| | | GED | 0.529 | -0.11 | 0.672 | 0.667 | 0.00 |
| | | GLASS | 0.395 | 1.921 | 0.345 | 0.334 | 0.00 |
| | | GOSIF | 0.229 | 0.246 | 0.333 | 0.322 | 0.00 |
| | | MODIS | 0.001 | 0.009 | 0.084 | 0.068 | 0.03 |
| | | MuSyQ | 0.336 | 2.214 | 0.443 | 0.434 | 0.00 |
| | | P-model | 0.022 | 4.134 | 0.004 | -0.001 | 0.39 |
| | | PML_V2 | 0.376 | 0.986 | 0.243 | 0.231 | 0.00 |
| | | SMAP | 0.602 | -0.542 | 0.595 | 0.594 | 0.00 |
| | | VODCA2GPP | 0.23 | 5.928 | 0.426 | 0.419 | 0.00 |
| | | XBASE | 0.358 | 0.657 | 0.552 | 0.551 | 0.00 |
| | **BFT** | FLUXCOM-RS | 0.187 | 1.371 | 0.766 | 0.764 | 0.00 |
| | | GED | 0.301 | 0.176 | 0.847 | 0.845 | 0.00 |
| | | GLASS | 0.222 | 0.785 | 0.739 | 0.737 | 0.00 |
| | | GOSIF | 0.138 | 0.318 | 0.768 | 0.765 | 0.00 |
| | | MODIS | 0.002 | 0 | 0.721 | 0.718 | 0.00 |
| | | MuSyQ | 0.185 | 0.904 | 0.637 | 0.633 | 0.00 |
| | | PML_V2 | 0.198 | 0.502 | 0.567 | 0.563 | 0.00 |
| | | SMAP | 0.277 | 0.724 | 0.771 | 0.771 | 0.00 |
| | | VODCA2GPP | 0.33 | 2.452 | 0.702 | 0.699 | 0.00 |
| | | XBASE | 0.179 | 0.339 | 0.699 | 0.699 | 0.00 |
| | **HFS** | FLUXCOM-RS | 0.563 | 0.689 | 0.794 | 0.791 | 0.00 |
| | | GED | 0.375 | 2.313 | 0.555 | 0.546 | 0.00 |
| | | GLASS | 0.421 | 2.294 | 0.578 | 0.571 | 0.00 |
| | | GOSIF | 0.602 | -0.297 | 0.702 | 0.697 | 0.00 |
| | | MODIS | 0.003 | -0.002 | 0.379 | 0.369 | 0.00 |
| | | MuSyQ | 0.408 | 2.688 | 0.73 | 0.726 | 0.00 |
| | | PML_V2 | 0.566 | -0.231 | 0.569 | 0.563 | 0.00 |
| | | SMAP | 0.621 | 0.003 | 0.606 | 0.605 | 0.00 |
| | | VODCA2GPP | 0.163 | 4.4 | 0.042 | 0.025 | 0.12 |
| | | XBASE | 0.356 | 1.16 | 0.55 | 0.549 | 0.00 |

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|---|---|---|---|---|---|---|---|
| | **KKM** | FLUXCOM-RS | 0.357 | 3.645 | 0.381 | 0.376 | 0.00 |
| | | GED | 0.58 | 2.024 | 0.388 | 0.382 | 0.00 |
| | | GLASS | 0.489 | 2.99 | 0.406 | 0.401 | 0.00 |
| | | GOSIF | 0.339 | 0.268 | 0.429 | 0.424 | 0.00 |
| | | MODIS | 0.002 | 0.008 | 0.126 | 0.118 | 0.00 |
| | | MuSyQ | 0.519 | 3.433 | 0.298 | 0.292 | 0.00 |
| | | P-model | 0.137 | 4.117 | 0.04 | 0.039 | 0.00 |
| | | PML_V2 | 0.328 | 3.698 | 0.114 | 0.107 | 0.00 |
| | | SMAP | 0.781 | 1.145 | 0.446 | 0.445 | 0.00 |
| | | VODCA2GPP | 0.412 | 5.322 | 0.301 | 0.295 | 0.00 |
| | | XBASE | 0.291 | 2.683 | 0.276 | 0.275 | 0.00 |
| | **KNP** | FLUXCOM-RS | 0.159 | 5.803 | 0.298 | 0.293 | 0.00 |
| | | GED | 0.196 | 3.693 | 0.287 | 0.28 | 0.00 |
| | | GLASS | 0.184 | 3.406 | 0.366 | 0.361 | 0.00 |
| | | GOSIF | 0.127 | 22.759 | 0.469 | 0.465 | 0.00 |
| | | MODIS | 0 | 0.03 | 0 | -0.008 | 0.98 |
| | | MuSyQ | 0.093 | 1.604 | 0.321 | 0.316 | 0.00 |
| | | PML_V2 | 0.079 | 4.342 | 0.131 | 0.124 | 0.00 |
| | | SMAP | 0.276 | 2.649 | 0.394 | 0.394 | 0.00 |
| | | VODCA2GPP | -0.242 | 4.989 | 0.244 | 0.238 | 0.00 |
| | | XBASE | 0.195 | 2.004 | 0.426 | 0.426 | 0.00 |
| **Grassland** | **JIT** | GED | 0.211 | 0.394 | 0.447 | 0.439 | 0.00 |
| | | GLASS | 0.066 | 0.163 | 0.189 | 0.18 | 0.00 |
| | | GOSIF | 0.099 | 0.102 | 0.336 | 0.328 | 0.00 |
| | | MODIS | 0 | 0.003 | 0.005 | -0.006 | 0.52 |
| | | MuSyQ | -0.002 | 0.175 | 0.001 | -0.01 | 0.79 |
| | | PML_V2 | 0.031 | 0.134 | 0.084 | 0.074 | 0.01 |
| | | SMAP | 0.026 | 0.455 | 0.016 | 0.015 | 0.00 |
| | | VODCA2GPP | 0.011 | 2.326 | 0 | -0.011 | 0.88 |
| | | XBASE | 0.207 | 0.078 | 0.27 | 0.269 | 0.00 |
| | **UIT** | FLUXCOM-RS | 0.111 | 1.955 | 0.232 | 0.224 | 0.00 |
| | | GED | 0.157 | 1.781 | 0.185 | 0.173 | 0.00 |
| | | GLASS | 0.089 | 0.889 | 0.306 | 0.298 | 0.00 |
| | | GOSIF | 0.115 | 0.443 | 0.477 | 0.471 | 0.00 |
| | | MODIS | 0.001 | 0.007 | 0.15 | 0.14 | 0.00 |
| | | MuSyQ | 0.097 | 0.935 | 0.333 | 0.325 | 0.00 |
| | | PML_V2 | 0.068 | 0.916 | 0.079 | 0.069 | 0.01 |
| | | SMAP | 0.432 | 0.68 | 0.543 | 0.543 | 0.00 |
| | | VODCA2GPP | -0.073 | 3.589 | 0.023 | 0.012 | 0.15 |
| | | XBASE | 0.175 | 1.466 | 0.324 | 0.323 | 0.00 |
| **Mangroves** | **PVM** | GED | 0.207 | 3.181 | 0.088 | 0.061 | 0.08 |
| | | GLASS | 0.47 | 0.78 | 0.104 | 0.084 | 0.03 |
| | | GOSIF | 0.03 | 22.085 | 0.113 | 0.093 | 0.02 |
| | | MODIS | 0.006 | -0.002 | 0.288 | 0.272 | 0.00 |

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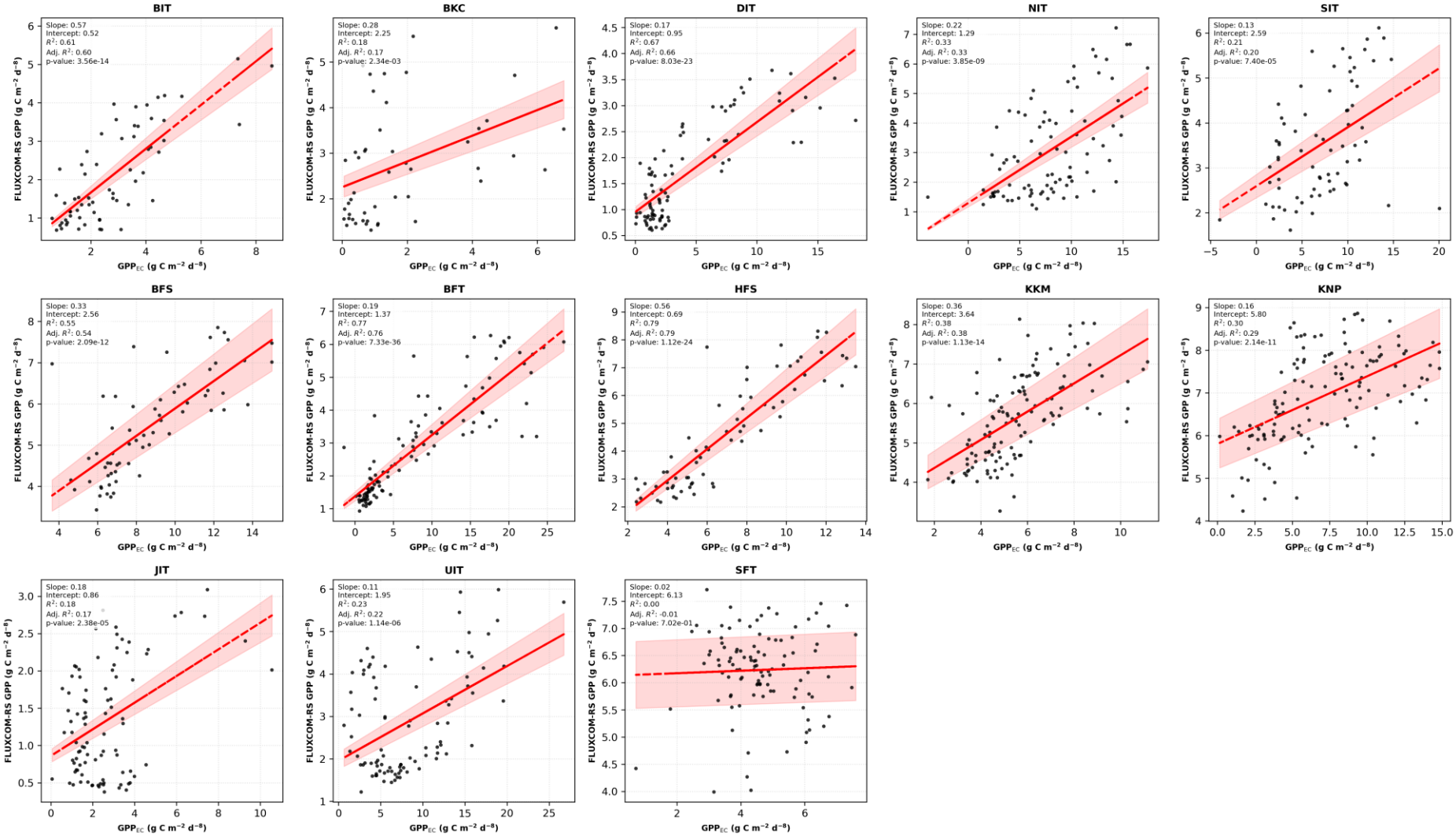
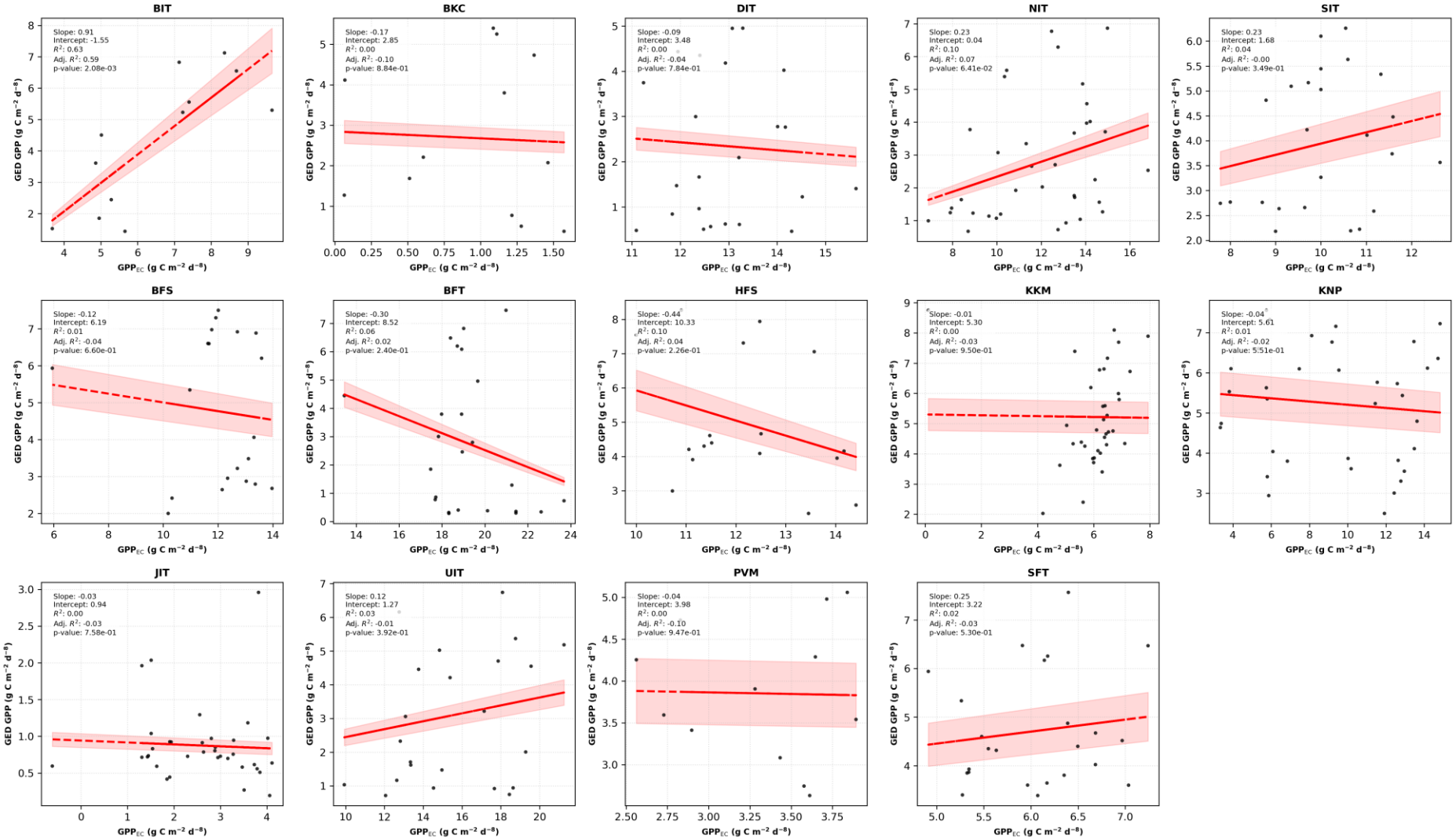
|---|---|---|---|---|---|---|---|
| | | MuSyQ | 0.122 | 0.829 | 0.045 | 0.023 | 0.16 |
| | | PML_V2 | 0.958 | -0.824 | 0.226 | 0.208 | 0.00 |
| | | SMAP | 1.392 | -0.091 | 0.358 | 0.356 | 0.00 |
| | | XBASE | 0.201 | 1.719 | 0.115 | 0.112 | 0.00 |
| | **SFT** | FLUXCOM-RS | 0.023 | 6.129 | 0.001 | -0.008 | 0.70 |
| | | GED | 0.239 | 3.483 | 0.053 | 0.041 | 0.04 |
| | | GLASS | 0.064 | 3.898 | 0.005 | -0.005 | 0.49 |
| | | GOSIF | 0.116 | 8.016 | 0.072 | 0.063 | 0.01 |
| | | MODIS | 0 | 0 | 0.01 | -0.001 | 0.34 |
| | | MuSyQ | 0.034 | 0.911 | 0.054 | 0.045 | 0.02 |
| | | P-model | 0.059 | 2.3 | 0.003 | 0.002 | 0.13 |
| | | PML_V2 | 0.01 | 2.144 | 0 | -0.009 | 0.84 |
| | | SMAP | 0.003 | 4.374 | 0 | -0.003 | 0.96 |
| | | XBASE | 0.312 | 1.835 | 0.087 | 0.086 | 0.00 |

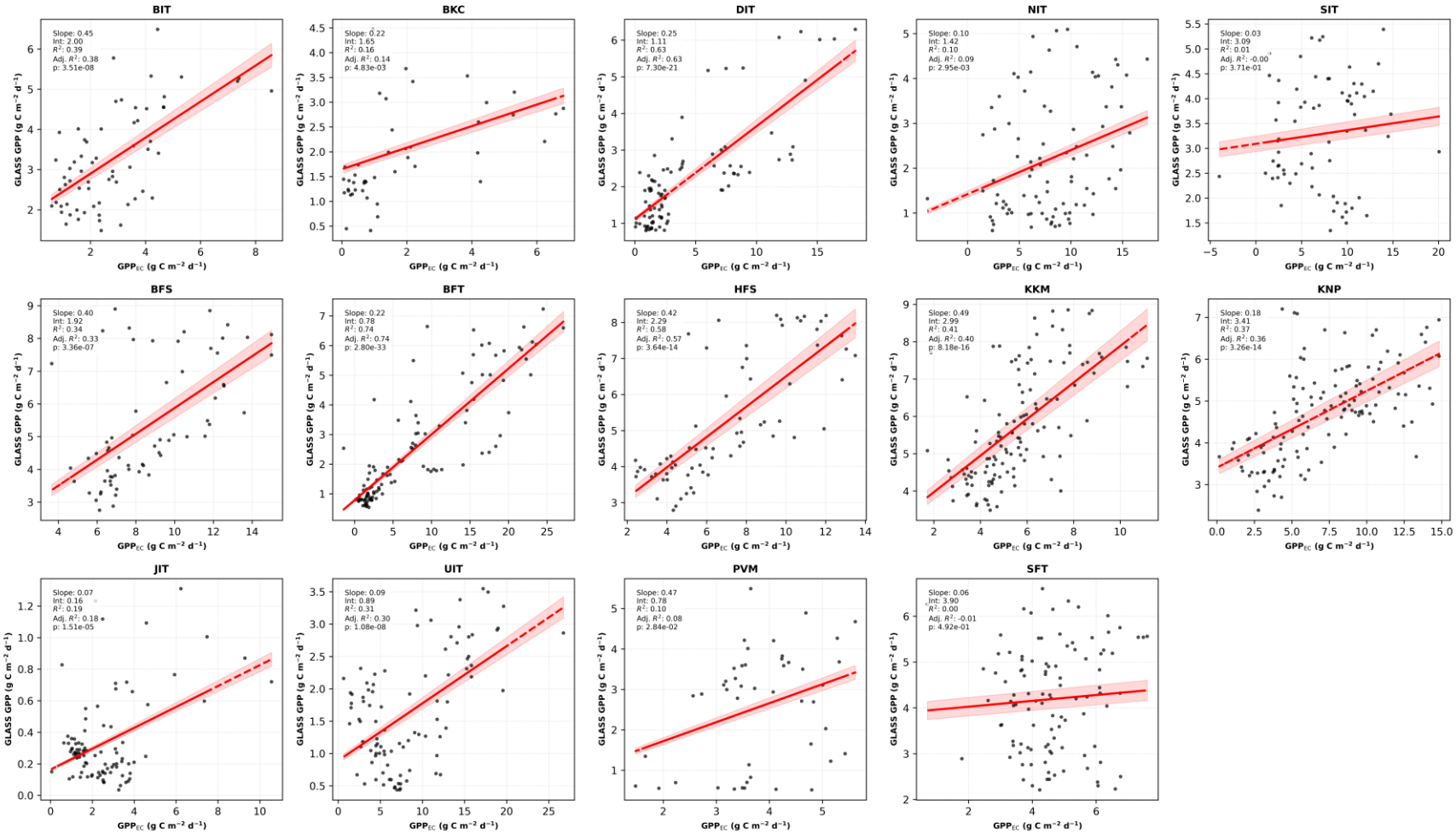
## a. FLUXCOM-RS


BIT
Slope: 0.57
Intercept: 0.52
$R^2$: 0.61
Adj. $R^2$: 0.60
p-value: 3.56e-14
BKC
Slope: 0.28
Intercept: 2.25
$R^2$: 0.18
Adj. $R^2$: 0.17
p-value: 2.34e-03
DIT
Slope: 0.17
Intercept: 0.95
$R^2$: 0.67
Adj. $R^2$: 0.66
p-value: 8.03e-23
NIT
Slope: 0.22
Intercept: 1.29
$R^2$: 0.33
Adj. $R^2$: 0.33
p-value: 3.85e-09
SIT
Slope: 0.13
Intercept: 2.59
$R^2$: 0.21
Adj. $R^2$: 0.20
p-value: 7.40e-05
BFS
Slope: 0.33
Intercept: 2.56
$R^2$: 0.55
Adj. $R^2$: 0.54
p-value: 2.09e-12
BFT
Slope: 0.19
Intercept: 1.37
$R^2$: 0.77
Adj. $R^2$: 0.76
p-value: 7.33e-36
HFS
Slope: 0.56
Intercept: 0.69
$R^2$: 0.79
Adj. $R^2$: 0.79
p-value: 1.12e-24
KKM
Slope: 0.36
Intercept: 3.64
$R^2$: 0.38
Adj. $R^2$: 0.38
p-value: 1.13e-14
KNP
Slope: 0.16
Intercept: 5.80
$R^2$: 0.30
Adj. $R^2$: 0.29
p-value: 2.14e-11
JIT
Slope: 0.18
Intercept: 0.86
$R^2$: 0.18
Adj. $R^2$: 0.17
p-value: 2.38e-05
UIT
Slope: 0.11
Intercept: 1.95
$R^2$: 0.23
Adj. $R^2$: 0.22
p-value: 1.14e-06
SFT
Slope: 0.02
Intercept: 6.13
$R^2$: 0.00
Adj. $R^2$: -0.01
p-value: 7.02e-01
FLUXCOM-RS GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

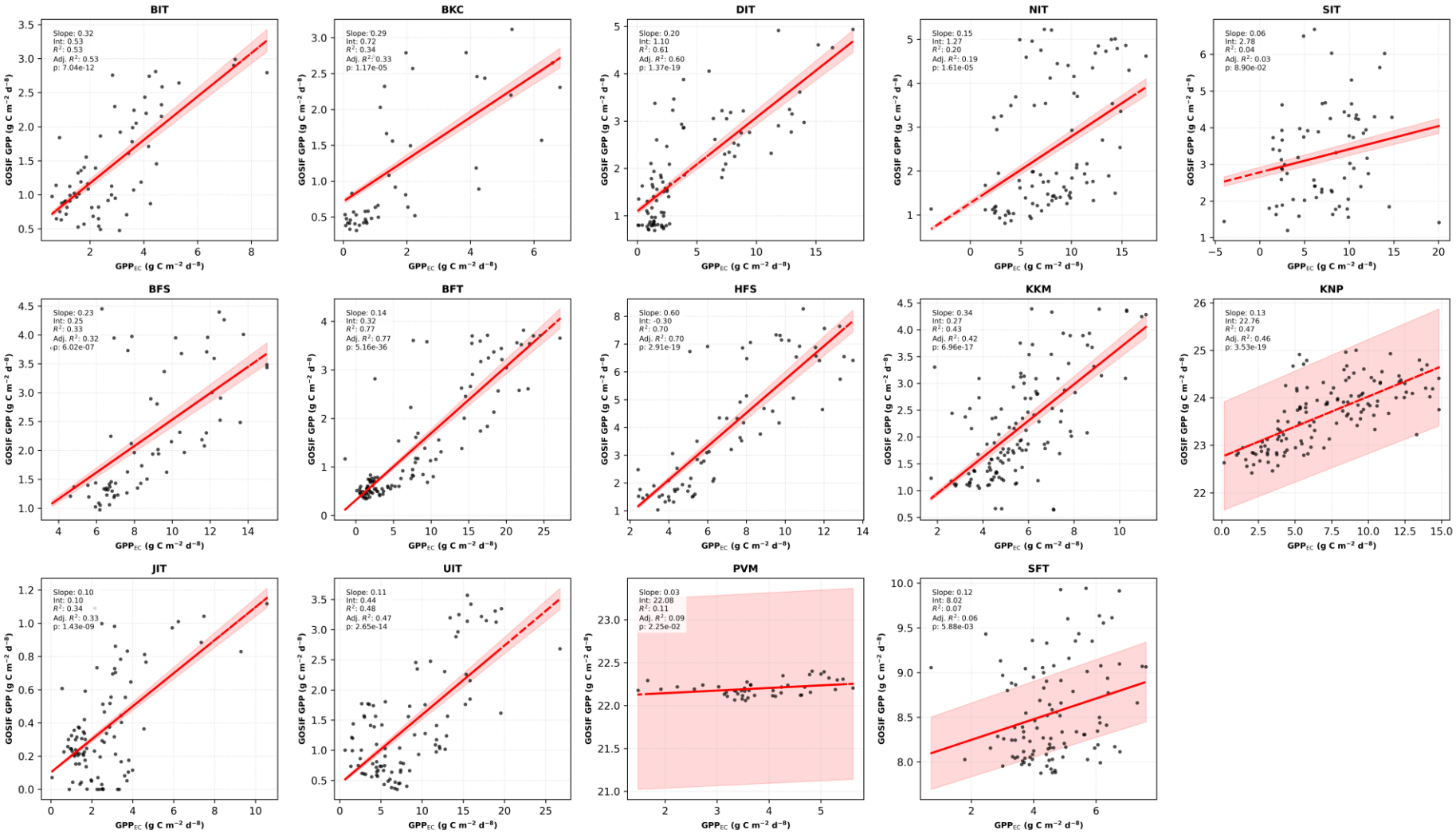
## b. GED


BIT
Slope: 0.91
Intercept: -1.55
$R^2$: 0.63
Adj. $R^2$: 0.59
p-value: 2.08e-03
BKC
Slope: -0.17
Intercept: 2.85
$R^2$: 0.00
Adj. $R^2$: -0.10
p-value: 8.84e-01
DIT
Slope: -0.09
Intercept: 3.48
$R^2$: 0.00
Adj. $R^2$: -0.04
p-value: 7.84e-01
NIT
Slope: 0.23
Intercept: 0.04
$R^2$: 0.10
Adj. $R^2$: 0.07
p-value: 6.41e-02
SIT
Slope: 0.23
Intercept: 1.68
$R^2$: 0.04
Adj. $R^2$: -0.00
p-value: 3.49e-01
BFS
Slope: -0.12
Intercept: 6.19
$R^2$: 0.01
Adj. $R^2$: -0.04
p-value: 6.60e-01
BFT
Slope: -0.30
Intercept: 8.52
$R^2$: 0.06
Adj. $R^2$: 0.02
p-value: 2.40e-01
HFS
Slope: -0.44
Intercept: 10.33
$R^2$: 0.10
Adj. $R^2$: 0.04
p-value: 2.26e-01
KKM
Slope: -0.01
Intercept: 5.30
$R^2$: 0.00
Adj. $R^2$: -0.03
p-value: 9.50e-01
KNP
Slope: -0.04
Intercept: 5.61
$R^2$: 0.01
Adj. $R^2$: -0.02
p-value: 5.51e-01
JIT
Slope: -0.03
Intercept: 0.94
$R^2$: 0.00
Adj. $R^2$: -0.03
p-value: 7.58e-01
UIT
Slope: 0.12
Intercept: 1.27
$R^2$: 0.03
Adj. $R^2$: -0.01
p-value: 3.92e-01
PVM
Slope: -0.04
Intercept: 3.98
$R^2$: 0.00
Adj. $R^2$: -0.10
p-value: 9.47e-01
SFT
Slope: 0.25
Intercept: 3.22
$R^2$: 0.02
Adj. $R^2$: -0.03
p-value: 5.30e-01
GED GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

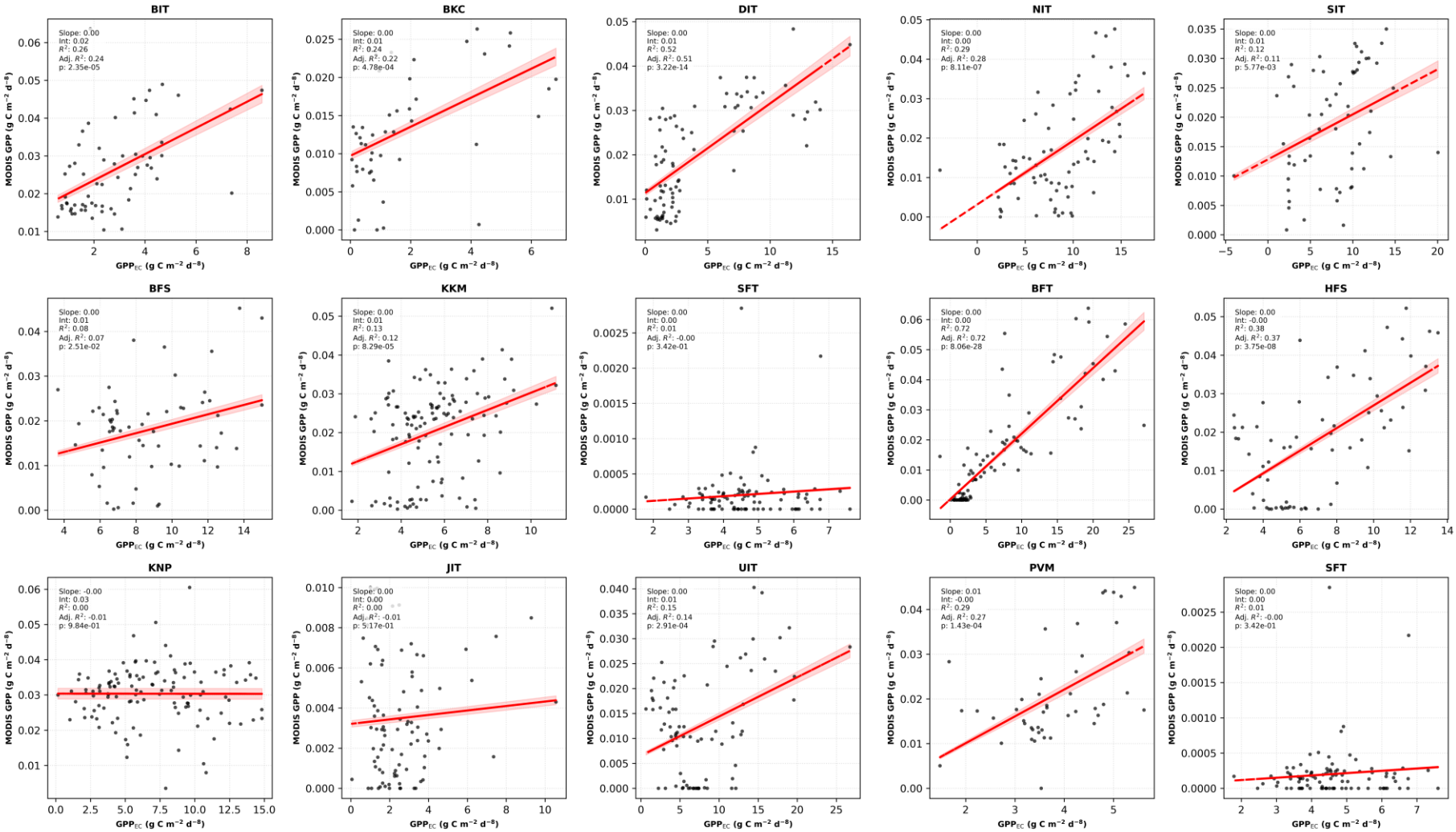
## c.GLASS

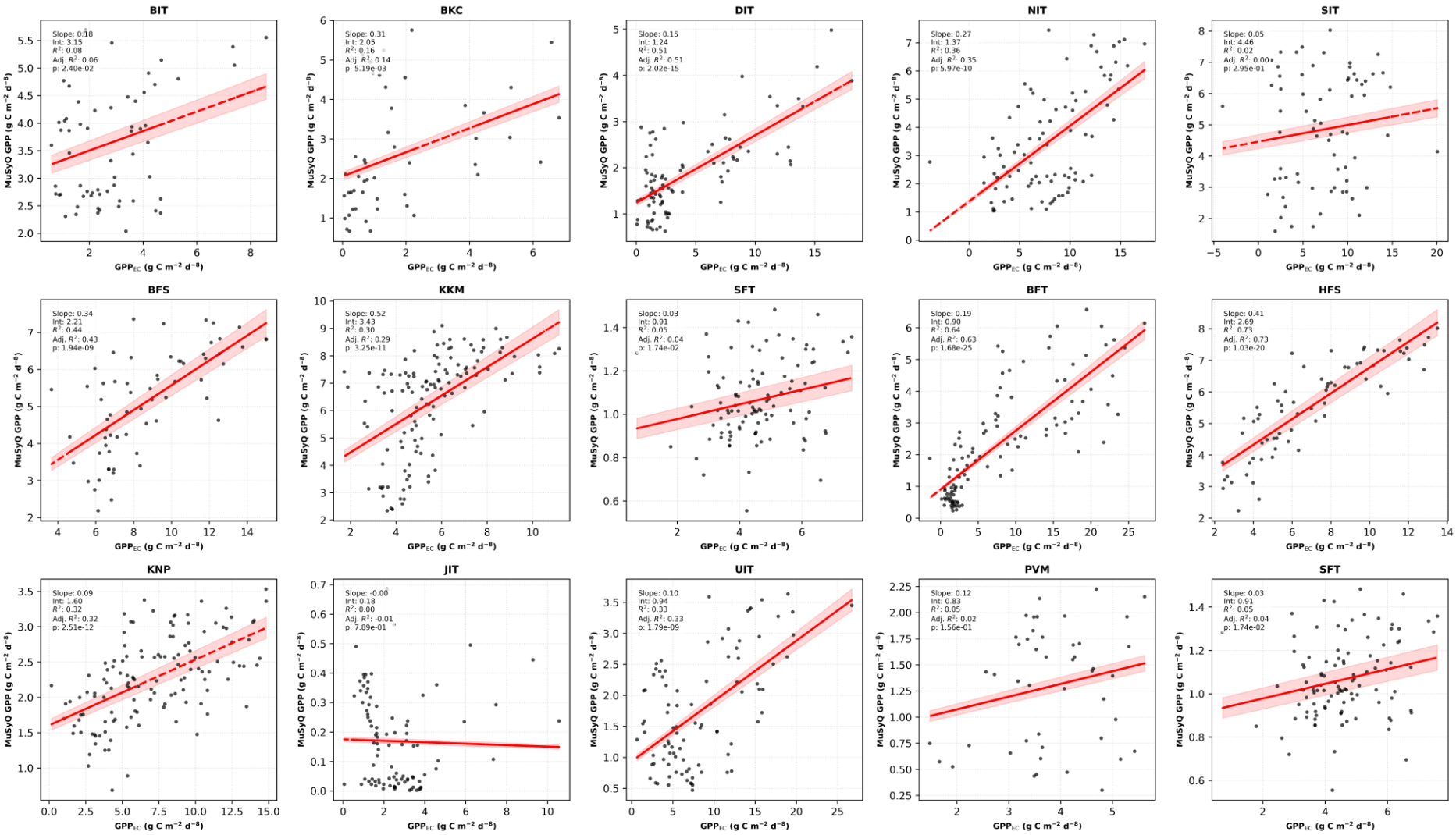

BIT
Slope: 0.45
Int: 2.00
$R^2$: 0.39
Adj. $R^2$: 0.38
p: 3.51e-08
BKC
Slope: 0.22
Int: 1.65
$R^2$: 0.16
Adj. $R^2$: 0.14
p: 4.83e-03
DIT
Slope: 0.25
Int: 1.11
$R^2$: 0.63
Adj. $R^2$: 0.63
p: 7.30e-21
NIT
Slope: 0.10
Int: 1.42
$R^2$: 0.10
Adj. $R^2$: 0.09
p: 2.95e-03
SIT
Slope: 0.03
Int: 3.09
$R^2$: 0.01
Adj. $R^2$: -0.00
p: 3.71e-01
BFS
Slope: 0.40
Int: 1.92
$R^2$: 0.34
Adj. $R^2$: 0.33
p: 3.36e-07
BFT
Slope: 0.22
Int: 0.78
$R^2$: 0.74
Adj. $R^2$: 0.74
p: 2.80e-33
HFS
Slope: 0.42
Int: 2.29
$R^2$: 0.58
Adj. $R^2$: 0.57
p: 3.64e-14
KKM
Slope: 0.49
Int: 2.99
$R^2$: 0.41
Adj. $R^2$: 0.40
p: 8.18e-16
KNP
Slope: 0.18
Int: 3.41
$R^2$: 0.37
Adj. $R^2$: 0.36
p: 3.26e-14
JIT
Slope: 0.07
Int: 0.16
$R^2$: 0.19
Adj. $R^2$: 0.18
p: 1.51e-05
UIT
Slope: 0.09
Int: 0.89
$R^2$: 0.31
Adj. $R^2$: 0.30
p: 1.08e-08
PVM
Slope: 0.47
Int: 0.78
$R^2$: 0.10
Adj. $R^2$: 0.08
p: 2.84e-02
SFT
Slope: 0.06
Int: 3.90
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 4.92e-01
GLASS GPP (g C m$^{-2}$ d$^{-1}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-1}$)

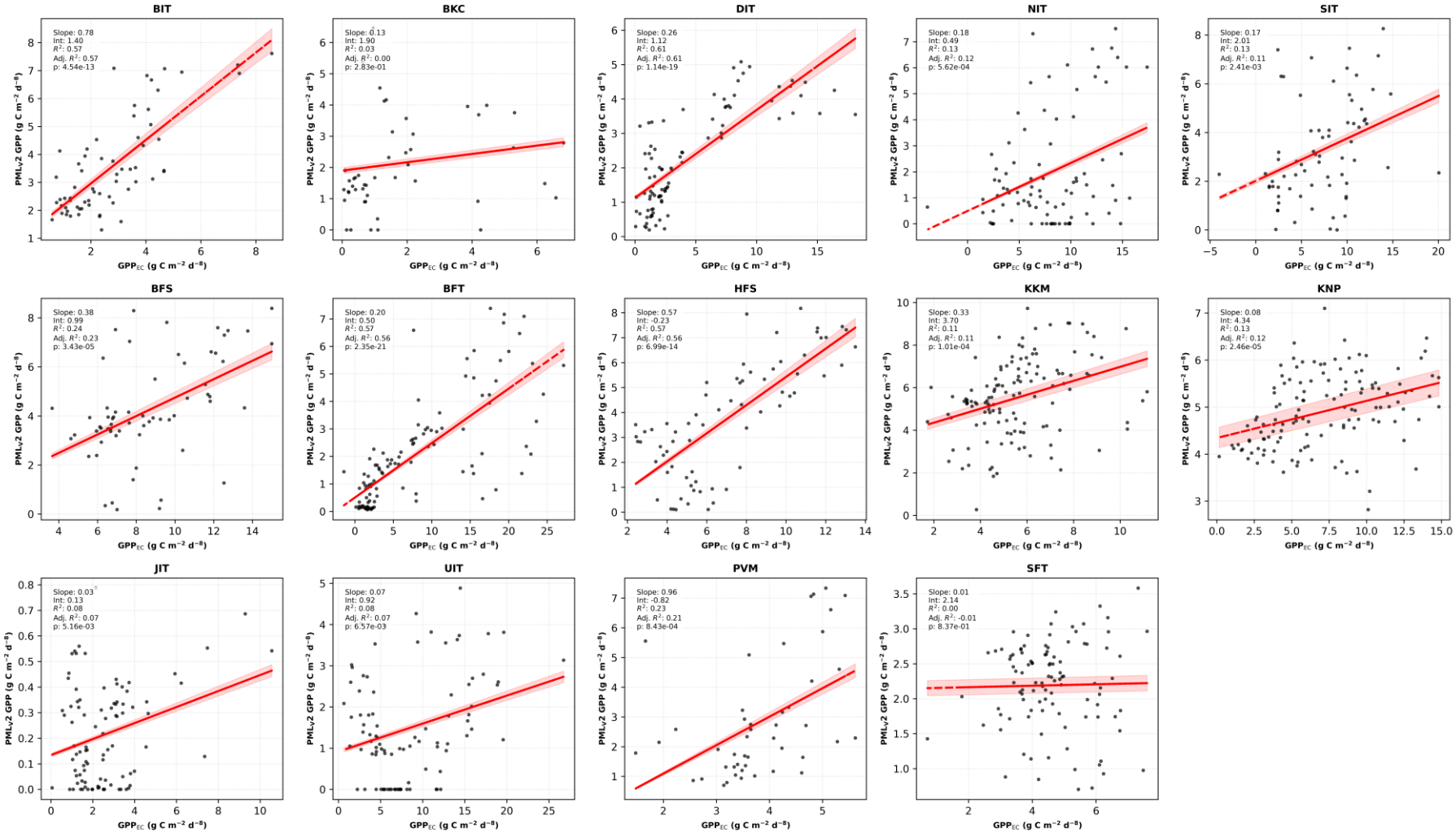
## d.GOSIF


BIT
Slope: 0.32
Int: 0.53
$R^2$: 0.53
Adj. $R^2$: 0.53
p: 7.04e-12
BKC
Slope: 0.29
Int: 0.72
$R^2$: 0.34
Adj. $R^2$: 0.33
p: 1.17e-05
DIT
Slope: 0.20
Int: 1.10
$R^2$: 0.61
Adj. $R^2$: 0.60
p: 1.37e-19
NIT
Slope: 0.15
Int: 1.27
$R^2$: 0.20
Adj. $R^2$: 0.19
p: 1.61e-05
SIT
Slope: 0.06
Int: 2.78
$R^2$: 0.04
Adj. $R^2$: 0.03
p: 8.90e-02
BFS
Slope: 0.23
Int: 0.25
$R^2$: 0.33
Adj. $R^2$: 0.32
p: 6.02e-07
BFT
Slope: 0.14
Int: 0.32
$R^2$: 0.77
Adj. $R^2$: 0.77
p: 5.16e-36
HFS
Slope: 0.60
Int: -0.30
$R^2$: 0.70
Adj. $R^2$: 0.70
p: 2.91e-19
KKM
Slope: 0.34
Int: 0.27
$R^2$: 0.43
Adj. $R^2$: 0.42
p: 6.96e-17
KNP
Slope: 0.13
Int: 22.76
$R^2$: 0.47
Adj. $R^2$: 0.46
p: 3.53e-19
JIT
Slope: 0.10
Int: 0.10
$R^2$: 0.34
Adj. $R^2$: 0.33
p: 1.43e-09
UIT
Slope: 0.11
Int: 0.44
$R^2$: 0.48
Adj. $R^2$: 0.47
p: 2.65e-14
PVM
Slope: 0.03
Int: 22.08
$R^2$: 0.11
Adj. $R^2$: 0.09
p: 2.25e-02
SFT
Slope: 0.12
Int: 8.02
$R^2$: 0.07
Adj. $R^2$: 0.06
p: 5.88e-03
GOSIF GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

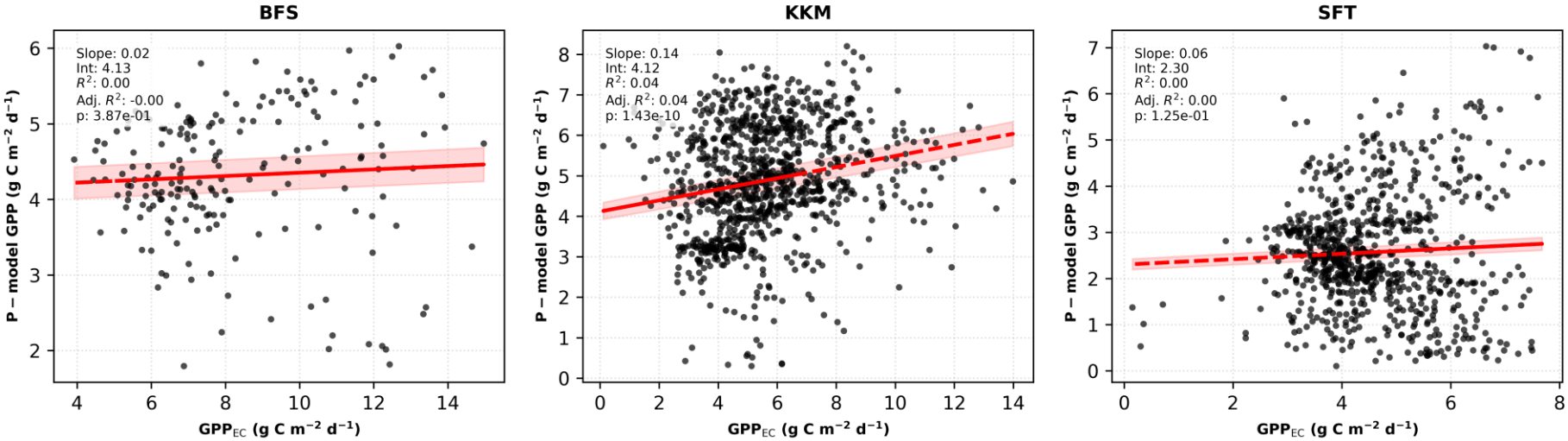
## e.MODIS

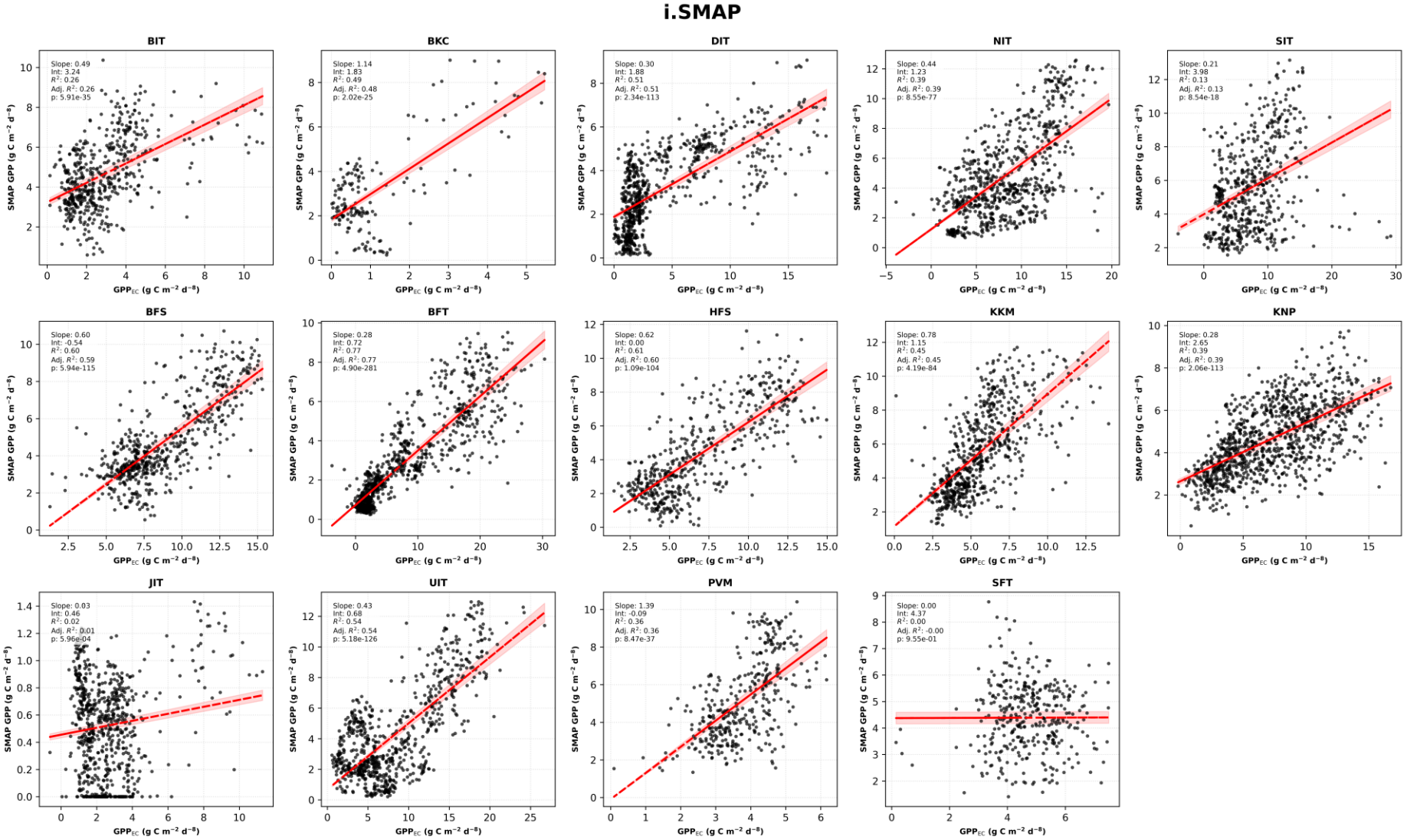

BIT
Slope: 0.00
Int: 0.02
$R^2$: 0.26
Adj. $R^2$: 0.24
p: 2.35e-05
BKC
Slope: 0.00
Int: 0.01
$R^2$: 0.24
Adj. $R^2$: 0.22
p: 4.78e-04
DIT
Slope: 0.00
Int: 0.01
$R^2$: 0.52
Adj. $R^2$: 0.51
p: 3.22e-14
NIT
Slope: 0.00
Int: 0.00
$R^2$: 0.29
Adj. $R^2$: 0.28
p: 8.11e-07
SIT
Slope: 0.00
Int: 0.01
$R^2$: 0.12
Adj. $R^2$: 0.11
p: 5.77e-03
BFS
Slope: 0.00
Int: 0.01
$R^2$: 0.08
Adj. $R^2$: 0.07
p: 2.51e-02
KKM
Slope: 0.00
Int: 0.01
$R^2$: 0.13
Adj. $R^2$: 0.12
p: 8.29e-05
SFT
Slope: 0.00
Int: 0.00
$R^2$: 0.01
Adj. $R^2$: -0.00
p: 3.42e-01
BFT
Slope: 0.00
Int: 0.00
$R^2$: 0.72
Adj. $R^2$: 0.72
p: 8.06e-28
HFS
Slope: 0.00
Int: -0.00
$R^2$: 0.38
Adj. $R^2$: 0.37
p: 3.75e-08
KNP
Slope: -0.00
Int: 0.03
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 9.84e-01
JIT
Slope: 0.00
Int: 0.00
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 5.17e-01
UIT
Slope: 0.00
Int: 0.01
$R^2$: 0.15
Adj. $R^2$: 0.14
p: 2.91e-04
PVM
Slope: 0.01
Int: -0.00
$R^2$: 0.29
Adj. $R^2$: 0.27
p: 1.43e-04
SFT
Slope: 0.00
Int: 0.00
$R^2$: 0.01
Adj. $R^2$: -0.00
p: 3.42e-01
MODIS GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)


f.MuSyQ
BIT
Slope: 0.18
Int: 3.15
$R^2$: 0.08
Adj. $R^2$: 0.06
p: 2.40e-02
BKC
Slope: 0.31
Int: 2.05
$R^2$: 0.16
Adj. $R^2$: 0.14
p: 5.19e-03
DIT
Slope: 0.15
Int: 1.24
$R^2$: 0.51
Adj. $R^2$: 0.51
p: 2.02e-15
NIT
Slope: 0.27
Int: 1.37
$R^2$: 0.36
Adj. $R^2$: 0.35
p: 5.97e-10
SIT
Slope: 0.05
Int: 4.46
$R^2$: 0.02
Adj. $R^2$: 0.00
p: 2.95e-01
BFS
Slope: 0.34
Int: 2.21
$R^2$: 0.44
Adj. $R^2$: 0.43
p: 1.94e-09
KKM
Slope: 0.52
Int: 3.43
$R^2$: 0.30
Adj. $R^2$: 0.29
p: 3.25e-11
SFT
Slope: 0.03
Int: 0.91
$R^2$: 0.05
Adj. $R^2$: 0.04
p: 1.74e-02
BFT
Slope: 0.19
Int: 0.90
$R^2$: 0.64
Adj. $R^2$: 0.63
p: 1.68e-25
HFS
Slope: 0.41
Int: 2.69
$R^2$: 0.73
Adj. $R^2$: 0.73
p: 1.03e-20
KNP
Slope: 0.09
Int: 1.60
$R^2$: 0.32
Adj. $R^2$: 0.32
p: 2.51e-12
JIT
Slope: -0.00
Int: 0.18
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 7.89e-01
UIT
Slope: 0.10
Int: 0.94
$R^2$: 0.33
Adj. $R^2$: 0.33
p: 1.79e-09
PVM
Slope: 0.12
Int: 0.83
$R^2$: 0.05
Adj. $R^2$: 0.02
p: 1.56e-01
SFT
Slope: 0.03
Int: 0.91
$R^2$: 0.05
Adj. $R^2$: 0.04
p: 1.74e-02
MuSyQ GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

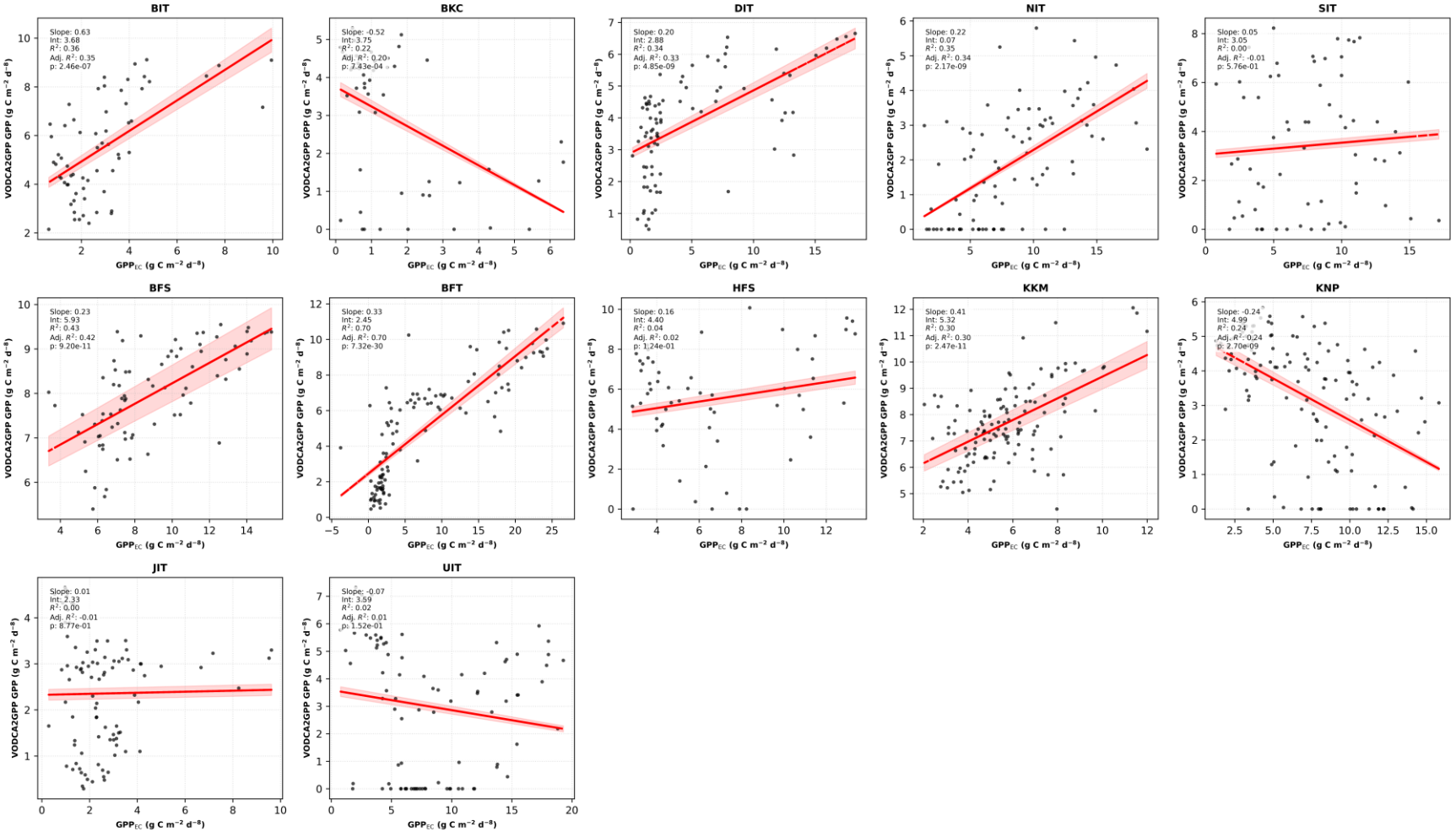

g.PML_V2
BIT
Slope: 0.78
Int: 1.40
$R^2$: 0.57
Adj. $R^2$: 0.57
p: 4.54e-13
BKC
Slope: 0.13
Int: 1.90
$R^2$: 0.03
Adj. $R^2$: 0.00
p: 2.83e-01
DIT
Slope: 0.26
Int: 1.12
$R^2$: 0.61
Adj. $R^2$: 0.61
p: 1.14e-19
NIT
Slope: 0.18
Int: 0.49
$R^2$: 0.13
Adj. $R^2$: 0.12
p: 5.62e-04
SIT
Slope: 0.17
Int: 2.01
$R^2$: 0.13
Adj. $R^2$: 0.11
p: 2.41e-03
BFS
Slope: 0.38
Int: 0.99
$R^2$: 0.24
Adj. $R^2$: 0.23
p: 3.43e-05
BFT
Slope: 0.20
Int: 0.50
$R^2$: 0.57
Adj. $R^2$: 0.56
p: 2.35e-21
HFS
Slope: 0.57
Int: -0.23
$R^2$: 0.57
Adj. $R^2$: 0.56
p: 6.99e-14
KKM
Slope: 0.33
Int: 3.70
$R^2$: 0.11
Adj. $R^2$: 0.11
p: 1.01e-04
KNP
Slope: 0.08
Int: 4.34
$R^2$: 0.13
Adj. $R^2$: 0.12
p: 2.46e-05
JIT
Slope: 0.03
Int: 0.13
$R^2$: 0.08
Adj. $R^2$: 0.07
p: 5.16e-03
UIT
Slope: 0.07
Int: 0.92
$R^2$: 0.08
Adj. $R^2$: 0.07
p: 6.57e-03
PVM
Slope: 0.96
Int: -0.82
$R^2$: 0.23
Adj. $R^2$: 0.21
p: 8.43e-04
SFT
Slope: 0.01
Int: 2.14
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 8.37e-01
$PML_V2$ GPP (g C $m^{-2}$ $d^{-8}$)
$GPP_{EC}$ (g C $m^{-2}$ $d^{-8}$)

# h.P-model


BFS
Slope: 0.02
Int: 4.13
$R^2$: 0.00
Adj. $R^2$: -0.00
p: 3.87e-01
P – model GPP (g C m$^{-2}$ d$^{-1}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-1}$)
KKM
Slope: 0.14
Int: 4.12
$R^2$: 0.04
Adj. $R^2$: 0.04
p: 1.43e-10
P – model GPP (g C m$^{-2}$ d$^{-1}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-1}$)
SFT
Slope: 0.06
Int: 2.30
$R^2$: 0.00
Adj. $R^2$: 0.00
p: 1.25e-01
P – model GPP (g C m$^{-2}$ d$^{-1}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-1}$)


i.SMAP
BIT
Slope: 0.49
Int: 3.24
$R^2$: 0.26
Adj. $R^2$: 0.26
p: 5.91e-35
BKC
Slope: 1.14
Int: 1.83
$R^2$: 0.49
Adj. $R^2$: 0.48
p: 2.02e-25
DIT
Slope: 0.30
Int: 1.88
$R^2$: 0.51
Adj. $R^2$: 0.51
p: 2.34e-113
NIT
Slope: 0.44
Int: 1.23
$R^2$: 0.39
Adj. $R^2$: 0.39
p: 8.55e-77
SIT
Slope: 0.21
Int: 3.98
$R^2$: 0.13
Adj. $R^2$: 0.13
p: 8.54e-18
BFS
Slope: 0.60
Int: -0.54
$R^2$: 0.60
Adj. $R^2$: 0.59
p: 5.94e-115
BFT
Slope: 0.28
Int: 0.72
$R^2$: 0.77
Adj. $R^2$: 0.77
p: 4.90e-281
HFS
Slope: 0.62
Int: 0.00
$R^2$: 0.61
Adj. $R^2$: 0.60
p: 1.09e-104
KKM
Slope: 0.78
Int: 1.15
$R^2$: 0.45
Adj. $R^2$: 0.45
p: 4.19e-84
KNP
Slope: 0.28
Int: 2.65
$R^2$: 0.39
Adj. $R^2$: 0.39
p: 2.06e-113
JIT
Slope: 0.03
Int: 0.46
$R^2$: 0.02
Adj. $R^2$: 0.01
p: 5.96e-04
UIT
Slope: 0.43
Int: 0.68
$R^2$: 0.54
Adj. $R^2$: 0.54
p: 5.18e-126
PVM
Slope: 1.39
Int: -0.09
$R^2$: 0.36
Adj. $R^2$: 0.36
p: 8.47e-37
SFT
Slope: 0.00
Int: 4.37
$R^2$: 0.00
Adj. $R^2$: -0.00
p: 9.55e-01
SMAP GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

## j.VODCA2GPP


BIT
Slope: 0.63
Int: 3.68
$R^2$: 0.36
Adj. $R^2$: 0.35
p: 2.46e-07
BKC
Slope: -0.52
Int: 3.75
$R^2$: 0.22
Adj. $R^2$: 0.20
p: 7.43e-04
DIT
Slope: 0.20
Int: 2.88
$R^2$: 0.34
Adj. $R^2$: 0.33
p: 4.85e-09
NIT
Slope: 0.22
Int: 0.07
$R^2$: 0.35
Adj. $R^2$: 0.34
p: 2.17e-09
SIT
Slope: 0.05
Int: 3.05
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 5.76e-01
BFS
Slope: 0.23
Int: 5.93
$R^2$: 0.43
Adj. $R^2$: 0.42
p: 9.20e-11
BFT
Slope: 0.33
Int: 2.45
$R^2$: 0.70
Adj. $R^2$: 0.70
p: 7.32e-30
HFS
Slope: 0.16
Int: 4.40
$R^2$: 0.04
Adj. $R^2$: 0.02
p: 1.24e-01
KKM
Slope: 0.41
Int: 5.32
$R^2$: 0.30
Adj. $R^2$: 0.30
p: 2.47e-11
KNP
Slope: -0.24
Int: 4.99
$R^2$: 0.24
Adj. $R^2$: 0.24
p: 2.70e-09
JIT
Slope: 0.01
Int: 2.33
$R^2$: 0.00
Adj. $R^2$: -0.01
p: 8.77e-01
UIT
Slope: -0.07
Int: 3.59
$R^2$: 0.02
Adj. $R^2$: 0.01
p: 1.52e-01
VODCA2GPP GPP (g C m$^{-2}$ d$^{-8}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-8}$)

## k.XBASE

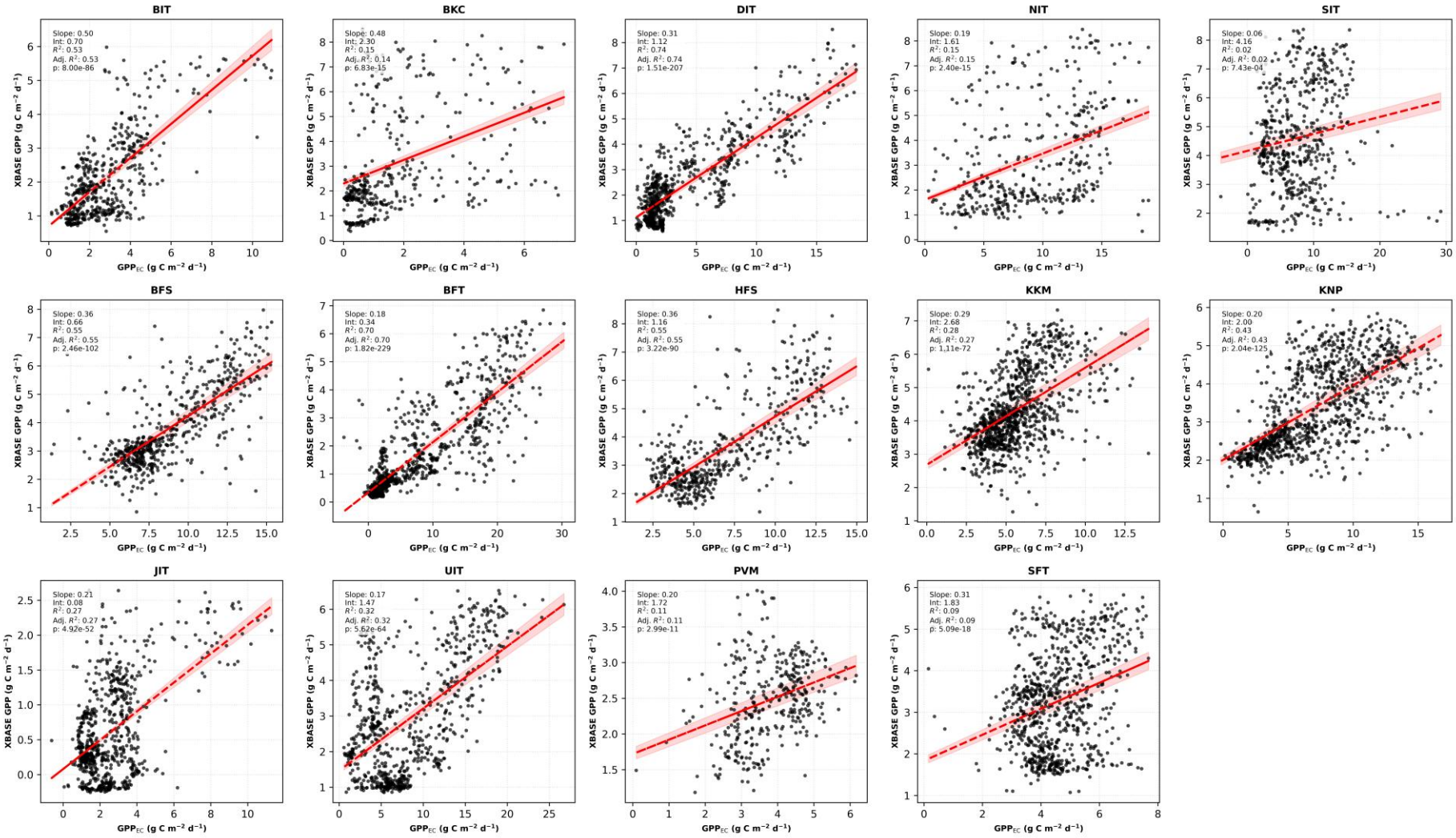
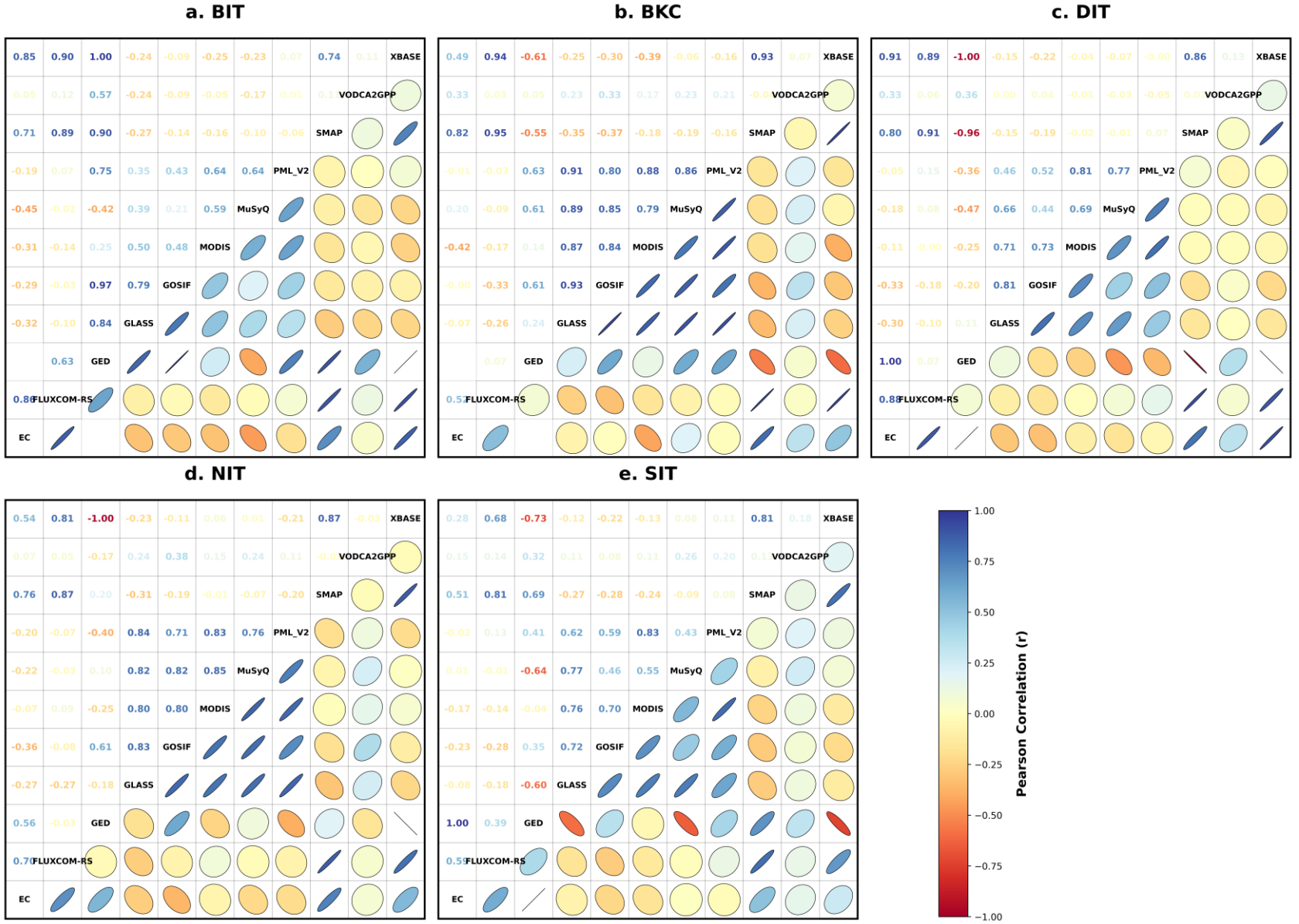
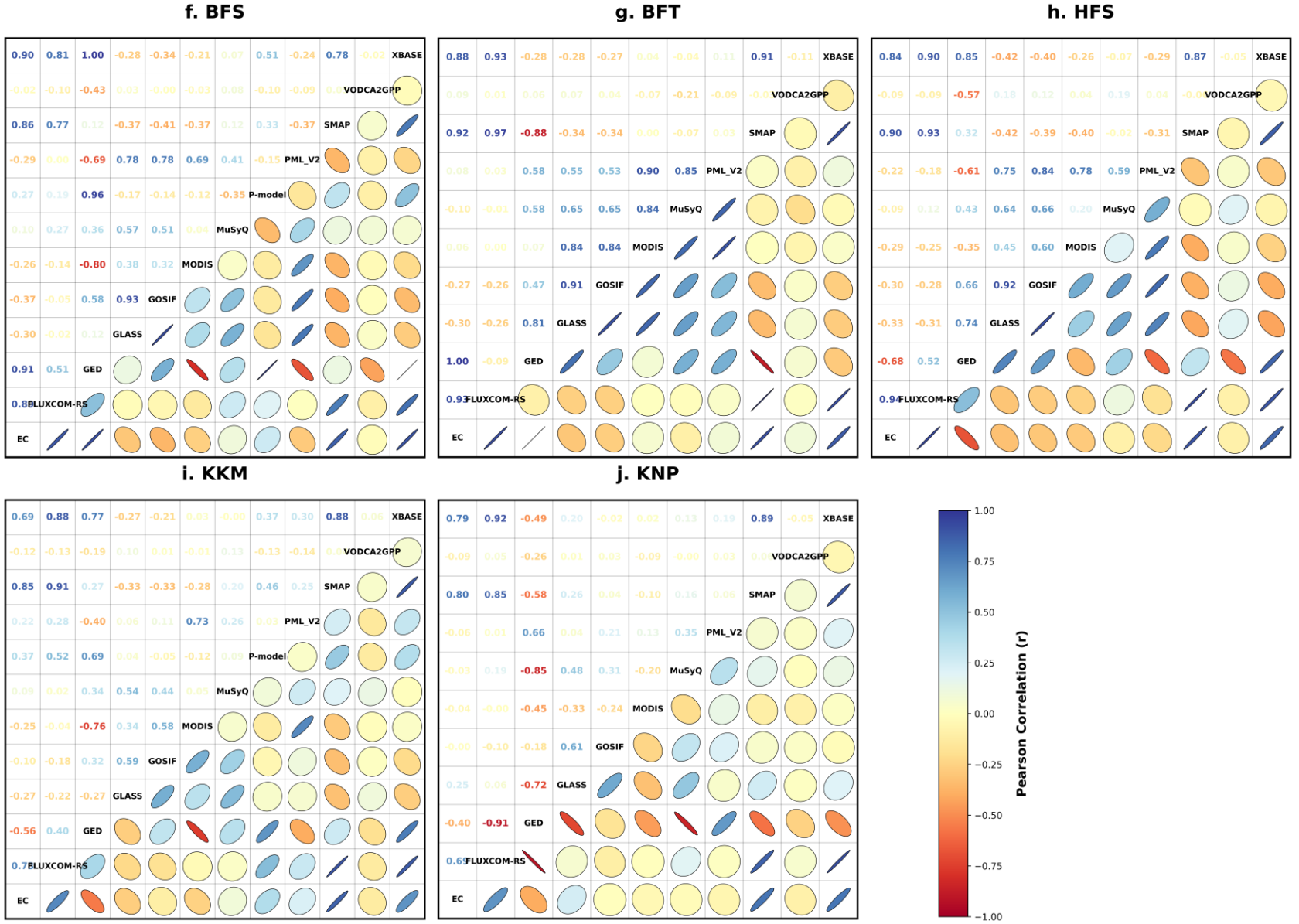

BIT
Slope: 0.50
Int: 0.70
$R^2$: 0.53
Adj. $R^2$: 0.53
p: 8.00e-86
BKC
Slope: 0.48
Int: 2.30
$R^2$: 0.15
Adj. $R^2$: 0.14
p: 6.83e-15
DIT
Slope: 0.31
Int: 1.12
$R^2$: 0.74
Adj. $R^2$: 0.74
p: 1.51e-207
NIT
Slope: 0.19
Int: 1.61
$R^2$: 0.15
Adj. $R^2$: 0.15
p: 2.40e-15
SIT
Slope: 0.06
Int: 4.16
$R^2$: 0.02
Adj. $R^2$: 0.02
p: 7.43e-04
BFS
Slope: 0.36
Int: 0.66
$R^2$: 0.55
Adj. $R^2$: 0.55
p: 2.46e-102
BFT
Slope: 0.18
Int: 0.34
$R^2$: 0.70
Adj. $R^2$: 0.70
p: 1.82e-229
HFS
Slope: 0.36
Int: 1.16
$R^2$: 0.55
Adj. $R^2$: 0.55
p: 3.22e-90
KKM
Slope: 0.29
Int: 2.68
$R^2$: 0.28
Adj. $R^2$: 0.27
p: 1,11e-72
KNP
Slope: 0.20
Int: 2.00
$R^2$: 0.43
Adj. $R^2$: 0.43
p: 2.04e-125
JIT
Slope: 0.21
Int: 0.08
$R^2$: 0.27
Adj. $R^2$: 0.27
p: 4.92e-52
UIT
Slope: 0.17
Int: 1.47
$R^2$: 0.32
Adj. $R^2$: 0.32
p: 5.62e-64
PVM
Slope: 0.20
Int: 1.72
$R^2$: 0.11
Adj. $R^2$: 0.11
p: 2.99e-11
SFT
Slope: 0.31
Int: 1.83
$R^2$: 0.09
Adj. $R^2$: 0.09
p: 5.09e-18
XBASE GPP (g C m$^{-2}$ d$^{-1}$)
GPP$_{EC}$ (g C m$^{-2}$ d$^{-1}$)

**Figure S1 (a – k).** Regression analysis of (Slope, Intercept, $R^2$, Adj. $R^2$, and p-Value) across different databases. Each plot represents the relationship between $GPP_{EC}$ and $GPP_{database}$ for each site, illustrating how the data fits the regression model. The trend lines indicate the strength and direction of the correlation. This analysis helps understand the variation in GPP across different data sources and its implications for validation purposes.


a. BIT
b. BKC
c. DIT
d. NIT
e. SIT
XBASE
VODCA2GPP
SMAP
PML_V2
MuSyQ
MODIS
GOSIF
GLASS
GED
FLUXCOM-RS
EC
Pearson Correlation (r)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00


f. BFS
g. BFT
h. HFS
i. KKM
j. KNP
XBASE
VODCA2GPP
SMAP
PML_V2
P-model
MuSyQ
MODIS
GOSIF
GLASS
GED
FLUXCOM-RS
EC
Pearson Correlation (r)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00

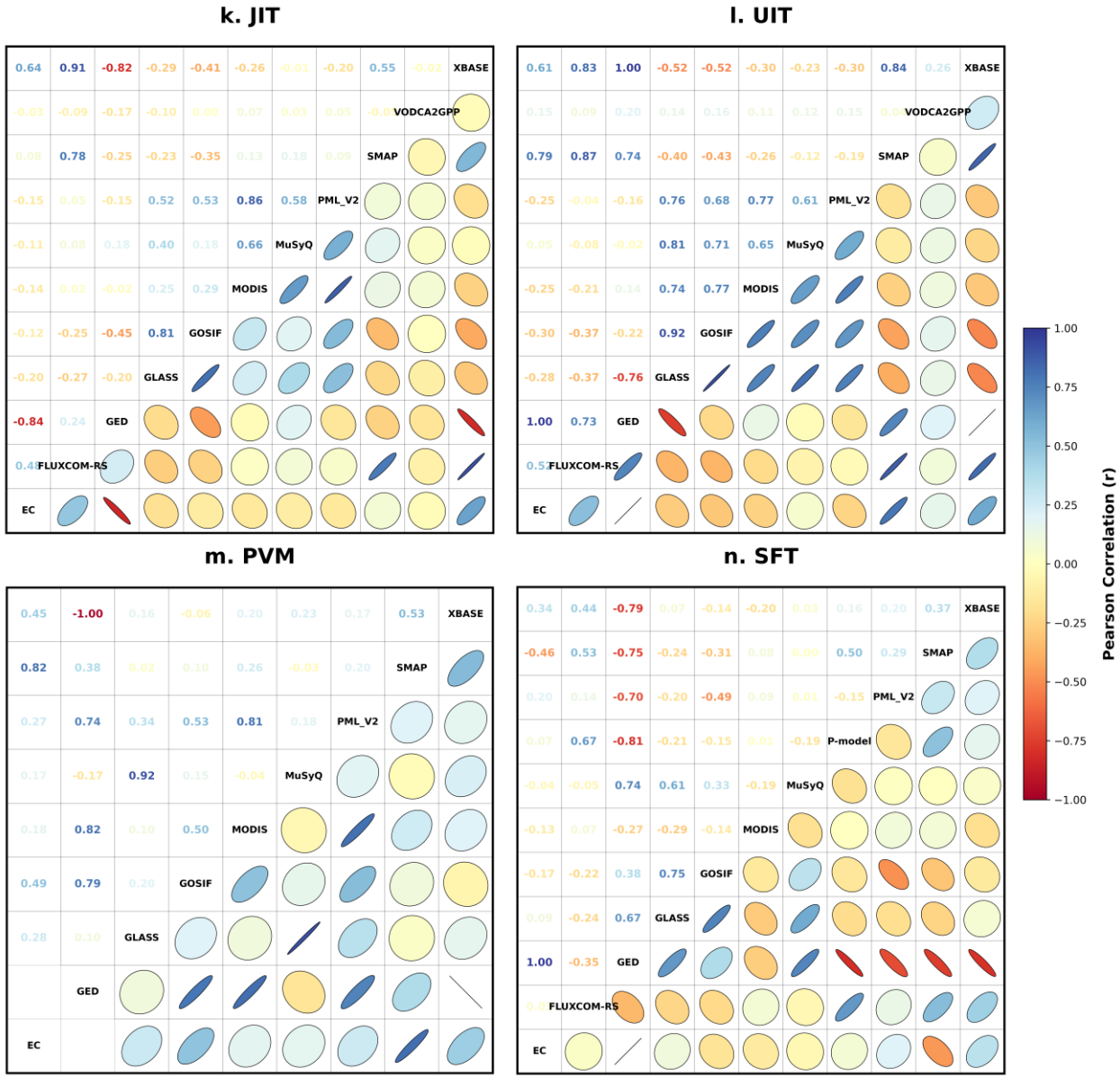

k. JIT
l. UIT
m. PVM
n. SFT
XBASE
VODCA2GPP
SMAP
PML_V2
MuSyQ
MODIS
GOSIF
GLASS
GED
FLUXCOM-RS
P-model
EC
Pearson Correlation (r)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00

**Figure S2 (a – n).** Correlation analysis of GPP estimates from various databases compared to $GPP_{EC}$. The plot shows the correlation coefficients, with a colour bar ranging from red (-1) to blue (1), indicating the strength and direction of the relationship between the $GPP_{EC}$ and GPP from other datasets.