



*Supplement of*

**FLAML version 2.3.3 model-based assessment of gross primary productivity at forest, grassland, and cropland ecosystem sites**

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## Article Supplementary information

**Table S1**

Optimal algorithms of the FLAML-LUE Model for GPP Simulation Across Different Temporal Scales and Predictor Combinations.

| FLAML   | Daily      | 8-day      | 16-day         | Monthly    |
|---------|------------|------------|----------------|------------|
| FLAML00 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML01 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML02 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML03 | extra_tree | extra_tree | xgb_limitdepth | extra_tree |
| FLAML04 | rf         | rf         | extra_tree     | extra_tree |
| FLAML05 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML10 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML11 | extra_tree | rf         | extra_tree     | extra_tree |
| FLAML12 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML13 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML14 | lgbm       | extra_tree | extra_tree     | extra_tree |
| FLAML15 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML20 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML21 | lgbm       | extra_tree | extra_tree     | extra_tree |
| FLAML22 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML23 | extra_tree | extra_tree | extra_tree     | extra_tree |
| FLAML24 | rf         | rf         | rf             | extra_tree |
| FLAML25 | extra_tree | extra_tree | extra_tree     | extra_tree |

**Table S2**

R<sup>2</sup> of different indicator combinations for forest ecosystem stations.

| FLAML   | HZF  | MEF  | CBF  | QYF  | ALF  | DHF  | BNF  | YJF  |
|---------|------|------|------|------|------|------|------|------|
| FLAML00 | 0.81 | 0.92 | 0.92 | 0.75 | 0.63 | 0.53 | 0.28 | 0.46 |
| FLAML01 | 0.85 | 0.92 | 0.91 | 0.74 | 0.63 | 0.51 | 0.38 | 0.41 |
| FLAML02 | 0.85 | 0.92 | 0.92 | 0.76 | 0.65 | 0.53 | 0.35 | 0.37 |
| FLAML03 | 0.85 | 0.92 | 0.92 | 0.74 | 0.66 | 0.55 | 0.37 | 0.40 |
| FLAML04 | 0.84 | 0.92 | 0.92 | 0.73 | 0.63 | 0.55 | 0.38 | 0.46 |
| FLAML05 | 0.86 | 0.92 | 0.92 | 0.74 | 0.67 | 0.56 | 0.36 | 0.40 |
| FLAML10 | 0.81 | 0.92 | 0.92 | 0.75 | 0.63 | 0.54 | 0.33 | 0.43 |
| FLAML11 | 0.84 | 0.90 | 0.91 | 0.75 | 0.63 | 0.53 | 0.38 | 0.39 |
| FLAML12 | 0.83 | 0.89 | 0.92 | 0.76 | 0.65 | 0.54 | 0.37 | 0.37 |
| FLAML13 | 0.84 | 0.89 | 0.91 | 0.74 | 0.66 | 0.56 | 0.38 | 0.34 |
| FLAML14 | 0.83 | 0.90 | 0.91 | 0.74 | 0.63 | 0.55 | 0.38 | 0.41 |
| FLAML15 | 0.84 | 0.89 | 0.92 | 0.75 | 0.67 | 0.56 | 0.36 | 0.38 |
| FLAML20 | 0.86 | 0.93 | 0.93 | 0.77 | 0.61 | 0.55 | 0.37 | 0.50 |
| FLAML21 | 0.89 | 0.92 | 0.93 | 0.77 | 0.62 | 0.56 | 0.41 | 0.48 |
| FLAML22 | 0.89 | 0.93 | 0.93 | 0.78 | 0.64 | 0.57 | 0.39 | 0.50 |
| FLAML23 | 0.89 | 0.93 | 0.93 | 0.77 | 0.66 | 0.57 | 0.41 | 0.46 |
| FLAML24 | 0.89 | 0.93 | 0.93 | 0.77 | 0.62 | 0.57 | 0.40 | 0.49 |
| FLAML25 | 0.89 | 0.92 | 0.93 | 0.77 | 0.67 | 0.57 | 0.40 | 0.47 |

Note: Bold numbers indicate the maximum R<sup>2</sup> value for each site, and underlined numbers indicate the minimum.

**Table S3**

TSS of different indicator combinations for forest ecosystem stations.

| FLAML   | HZF    | MEF    | CBF    | QYF    | ALF    | DHF    | BNF    | YJF    |
|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| FLAML00 | 0.9549 | 0.9672 | 0.9667 | 0.9039 | 0.7329 | 0.8269 | 0.7824 | 0.8267 |
| FLAML01 | 0.9635 | 0.9655 | 0.9620 | 0.9013 | 0.7293 | 0.8199 | 0.7941 | 0.7158 |
| FLAML02 | 0.9655 | 0.9690 | 0.9698 | 0.9087 | 0.7624 | 0.8315 | 0.8012 | 0.7507 |
| FLAML03 | 0.9656 | 0.9666 | 0.9636 | 0.9013 | 0.7433 | 0.8275 | 0.7930 | 0.7266 |
| FLAML04 | 0.9614 | 0.9687 | 0.9624 | 0.8980 | 0.7129 | 0.8214 | 0.7901 | 0.7146 |
| FLAML05 | 0.9672 | 0.9650 | 0.9626 | 0.9038 | 0.7552 | 0.8361 | 0.7959 | 0.7224 |
| FLAML10 | 0.9531 | 0.9665 | 0.9609 | 0.9016 | 0.7395 | 0.8218 | 0.7840 | 0.7954 |
| FLAML11 | 0.9601 | 0.9633 | 0.9588 | 0.9008 | 0.7481 | 0.8222 | 0.8076 | 0.6660 |
| FLAML12 | 0.9601 | 0.9624 | 0.9683 | 0.9054 | 0.7483 | 0.8252 | 0.8052 | 0.7303 |
| FLAML13 | 0.9627 | 0.9612 | 0.9593 | 0.8997 | 0.7420 | 0.8255 | 0.8019 | 0.6683 |
| FLAML14 | 0.9581 | 0.9637 | 0.9589 | 0.8963 | 0.7233 | 0.8179 | 0.7964 | 0.6339 |
| FLAML15 | 0.9632 | 0.9619 | 0.9654 | 0.9038 | 0.7628 | 0.8297 | 0.8054 | 0.6456 |
| FLAML20 | 0.9666 | 0.9739 | 0.9681 | 0.9104 | 0.7233 | 0.8085 | 0.8009 | 0.7451 |
| FLAML21 | 0.9730 | 0.9737 | 0.9650 | 0.9105 | 0.7210 | 0.8016 | 0.8102 | 0.6994 |
| FLAML22 | 0.9729 | 0.9735 | 0.9685 | 0.9170 | 0.7383 | 0.8226 | 0.8127 | 0.7342 |
| FLAML23 | 0.9736 | 0.9739 | 0.9670 | 0.9127 | 0.7404 | 0.8214 | 0.8088 | 0.6792 |
| FLAML24 | 0.9728 | 0.9746 | 0.9648 | 0.9127 | 0.7228 | 0.8213 | 0.8040 | 0.6908 |
| FLAML25 | 0.9750 | 0.9716 | 0.9663 | 0.9159 | 0.7513 | 0.8221 | 0.8119 | 0.6899 |

**Table S4**R<sup>2</sup> of different indicator combinations for grassland ecosystem stations.

| FLAML   | XLG  | NMG  | DLG  | DMG  | HBG_S01 | HBG_G01 | DXG    |
|---------|------|------|------|------|---------|---------|--------|
| FLAML00 | 0.53 | 0.42 | 0.74 | 0.74 | 0.54    | 0.93    | 0.53   |
| FLAML01 | 0.54 | 0.39 | 0.75 | 0.66 | 0.53    | 0.93    | 0.32   |
| FLAML02 | 0.46 | 0.32 | 0.74 | 0.69 | 0.52    | 0.93    | 0.31   |
| FLAML03 | 0.54 | 0.40 | 0.73 | 0.70 | 0.54    | 0.93    | 0.28   |
| FLAML04 | 0.56 | 0.40 | 0.74 | 0.73 | 0.55    | 0.93    | 0.31   |
| FLAML05 | 0.55 | 0.40 | 0.73 | 0.69 | 0.54    | 0.93    | 0.27   |
| FLAML10 | 0.48 | 0.45 | 0.76 | 0.76 | 0.53    | 0.91    | 0.35   |
| FLAML11 | 0.41 | 0.38 | 0.75 | 0.57 | 0.50    | 0.92    | (0.39) |
| FLAML12 | 0.38 | 0.33 | 0.74 | 0.55 | 0.51    | 0.93    | (0.39) |
| FLAML13 | 0.45 | 0.43 | 0.73 | 0.60 | 0.54    | 0.92    | (0.90) |
| FLAML14 | 0.47 | 0.43 | 0.74 | 0.64 | 0.53    | 0.91    | (0.69) |
| FLAML15 | 0.45 | 0.43 | 0.73 | 0.59 | 0.53    | 0.92    | (0.90) |
| FLAML20 | 0.49 | 0.39 | 0.85 | 0.64 | 0.55    | 0.92    | 0.69   |
| FLAML21 | 0.44 | 0.37 | 0.85 | 0.43 | 0.54    | 0.92    | 0.65   |
| FLAML22 | 0.41 | 0.34 | 0.84 | 0.39 | 0.54    | 0.92    | 0.67   |
| FLAML23 | 0.52 | 0.41 | 0.84 | 0.40 | 0.55    | 0.92    | 0.64   |
| FLAML24 | 0.56 | 0.42 | 0.85 | 0.39 | 0.55    | 0.91    | 0.65   |
| FLAML25 | 0.50 | 0.40 | 0.83 | 0.41 | 0.54    | 0.93    | 0.65   |

Note: Red text indicates a negative coefficient of determination (R<sup>2</sup>).

**Table S5**

TSS of different indicator combinations for grassland ecosystem stations.

| FLAML   | XLG    | NMG    | DLG    | DMG    | HBG_S01 | HBG_G01 | DXG    |
|---------|--------|--------|--------|--------|---------|---------|--------|
| FLAML00 | 0.8910 | 0.6170 | 0.9408 | 0.9035 | 0.8941  | 0.9727  | 0.8875 |
| FLAML01 | 0.8941 | 0.6880 | 0.9397 | 0.8160 | 0.8934  | 0.9726  | 0.8581 |
| FLAML02 | 0.8781 | 0.5931 | 0.9387 | 0.8786 | 0.8894  | 0.9744  | 0.8512 |
| FLAML03 | 0.8890 | 0.6311 | 0.9316 | 0.8450 | 0.8943  | 0.9727  | 0.8487 |
| FLAML04 | 0.8977 | 0.6185 | 0.9298 | 0.8465 | 0.8965  | 0.9692  | 0.8586 |
| FLAML05 | 0.8911 | 0.6356 | 0.9313 | 0.8426 | 0.8959  | 0.9733  | 0.8472 |
| FLAML10 | 0.8857 | 0.6816 | 0.9437 | 0.8955 | 0.8938  | 0.9658  | 0.8452 |
| FLAML11 | 0.8727 | 0.7514 | 0.9390 | 0.7432 | 0.8871  | 0.9713  | 0.7100 |
| FLAML12 | 0.8611 | 0.6316 | 0.9374 | 0.8323 | 0.8887  | 0.9724  | 0.7116 |
| FLAML13 | 0.8724 | 0.6953 | 0.9293 | 0.7610 | 0.8955  | 0.9665  | 0.6436 |
| FLAML14 | 0.8807 | 0.6933 | 0.9224 | 0.7512 | 0.8937  | 0.9631  | 0.6705 |
| FLAML15 | 0.8696 | 0.6986 | 0.9283 | 0.7721 | 0.8949  | 0.9712  | 0.6403 |
| FLAML20 | 0.8661 | 0.6716 | 0.9601 | 0.7898 | 0.8973  | 0.9708  | 0.9372 |
| FLAML21 | 0.8648 | 0.7459 | 0.9605 | 0.6525 | 0.8955  | 0.9751  | 0.9356 |
| FLAML22 | 0.8522 | 0.6448 | 0.9569 | 0.7473 | 0.8964  | 0.9759  | 0.9360 |
| FLAML23 | 0.8503 | 0.6704 | 0.9577 | 0.6096 | 0.8985  | 0.9735  | 0.9363 |
| FLAML24 | 0.8570 | 0.6661 | 0.9601 | 0.6066 | 0.8988  | 0.9707  | 0.9347 |
| FLAML25 | 0.8504 | 0.6770 | 0.9573 | 0.6426 | 0.8974  | 0.9749  | 0.9353 |

**Table S6** $R^2$  of different indicator combinations for cropland ecosystem stations.

| FLAML   | JZA  | GCA  | SYA  | LCA  | YCA  |
|---------|------|------|------|------|------|
| FLAML00 | 0.82 | 0.59 | 0.83 | 0.76 | 0.72 |
| FLAML01 | 0.82 | 0.61 | 0.87 | 0.69 | 0.67 |
| FLAML02 | 0.82 | 0.56 | 0.86 | 0.73 | 0.68 |
| FLAML03 | 0.81 | 0.57 | 0.84 | 0.76 | 0.70 |
| FLAML04 | 0.82 | 0.53 | 0.86 | 0.77 | 0.69 |
| FLAML05 | 0.81 | 0.58 | 0.84 | 0.76 | 0.70 |
| FLAML10 | 0.79 | 0.68 | 0.84 | 0.68 | 0.71 |
| FLAML11 | 0.78 | 0.64 | 0.84 | 0.54 | 0.60 |
| FLAML12 | 0.80 | 0.65 | 0.80 | 0.61 | 0.59 |
| FLAML13 | 0.78 | 0.65 | 0.79 | 0.67 | 0.62 |
| FLAML14 | 0.79 | 0.61 | 0.78 | 0.66 | 0.61 |
| FLAML15 | 0.78 | 0.65 | 0.79 | 0.65 | 0.62 |
| FLAML20 | 0.81 | 0.66 | 0.80 | 0.56 | 0.67 |
| FLAML21 | 0.81 | 0.67 | 0.84 | 0.50 | 0.57 |
| FLAML22 | 0.81 | 0.65 | 0.78 | 0.50 | 0.56 |
| FLAML23 | 0.81 | 0.64 | 0.73 | 0.54 | 0.59 |
| FLAML24 | 0.81 | 0.62 | 0.68 | 0.55 | 0.56 |
| FLAML25 | 0.81 | 0.64 | 0.72 | 0.52 | 0.60 |

**Table S7**

TSS of different indicator combinations for cropland ecosystem stations.

| FLAML   | JZA    | GCA    | SYA    | LCA    | YCA    |
|---------|--------|--------|--------|--------|--------|
| FLAML00 | 0.9090 | 0.9055 | 0.8934 | 0.8843 | 0.8534 |
| FLAML01 | 0.9023 | 0.9195 | 0.9146 | 0.8465 | 0.8248 |
| FLAML02 | 0.9027 | 0.8986 | 0.8993 | 0.8844 | 0.8454 |
| FLAML03 | 0.9077 | 0.8980 | 0.8900 | 0.8941 | 0.8491 |
| FLAML04 | 0.9109 | 0.8914 | 0.8966 | 0.9041 | 0.8431 |
| FLAML05 | 0.9045 | 0.8984 | 0.8806 | 0.8846 | 0.8426 |
| FLAML10 | 0.8935 | 0.9200 | 0.8831 | 0.8411 | 0.8389 |
| FLAML11 | 0.8827 | 0.9230 | 0.8863 | 0.8087 | 0.7880 |
| FLAML12 | 0.8897 | 0.9165 | 0.8534 | 0.8524 | 0.8004 |
| FLAML13 | 0.8942 | 0.9109 | 0.8358 | 0.8608 | 0.7993 |
| FLAML14 | 0.8985 | 0.9032 | 0.8351 | 0.8733 | 0.7936 |
| FLAML15 | 0.8966 | 0.9118 | 0.8438 | 0.8594 | 0.8112 |
| FLAML20 | 0.8756 | 0.9181 | 0.9214 | 0.7828 | 0.7958 |
| FLAML21 | 0.8741 | 0.9069 | 0.9213 | 0.7960 | 0.7583 |
| FLAML22 | 0.8805 | 0.8832 | 0.9151 | 0.8170 | 0.7527 |
| FLAML23 | 0.8725 | 0.8746 | 0.8965 | 0.8232 | 0.7668 |
| FLAML24 | 0.8804 | 0.8688 | 0.8717 | 0.8405 | 0.7425 |
| FLAML25 | 0.8732 | 0.8762 | 0.8997 | 0.8248 | 0.7717 |

**Table S8**Variation of model R<sup>2</sup> and nuRMSE across different temporal scales.

| FLAML   | R <sup>2</sup> |       |        |         | nuRMSE |        |        |         |
|---------|----------------|-------|--------|---------|--------|--------|--------|---------|
|         | daily          | 8days | 16days | monthly | daily  | 8days  | 16days | monthly |
| HZF     | 0.85           | 0.90  | 0.92   | 0.96    | 0.3685 | 0.2882 | 0.2574 | 0.1712  |
| MEF     | 0.91           | 0.94  | 0.93   | 0.97    | 0.2918 | 0.2445 | 0.2546 | 0.1773  |
| CBF     | <b>0.92</b>    | 0.94  | 0.92   | 0.94    | 0.2716 | 0.2279 | 0.2505 | 0.2141  |
| QYF     | 0.75           | 0.86  | 0.86   | 0.88    | 0.4677 | 0.3356 | 0.3062 | 0.2723  |
| ALF     | 0.64           | 0.74  | 0.75   | 0.78    | 0.5950 | 0.5003 | 0.4963 | 0.4553  |
| DHF     | 0.55           | 0.62  | 0.71   | 0.68    | 0.6671 | 0.6070 | 0.5282 | 0.5544  |
| BNF     | 0.37           | 0.49  | 0.52   | 0.64    | 0.7540 | 0.6627 | 0.6304 | 0.5122  |
| YJF     | 0.43           | 0.40  | 0.28   | 0.19    | 0.7348 | 0.6487 | 0.5870 | 0.5123  |
| XLG     | 0.49           | 0.66  | 0.68   | 0.72    | 0.6980 | 0.5655 | 0.5293 | 0.5067  |
| NMG     | 0.40           | 0.39  | 0.36   | 0.38    | 0.7685 | 0.7733 | 0.7868 | 0.7716  |
| DLG     | 0.78           | 0.87  | 0.90   | 0.90    | 0.4543 | 0.3300 | 0.2942 | 0.2881  |
| DMG     | 0.59           | 0.63  | 0.67   | 0.70    | 0.6204 | 0.5756 | 0.5389 | 0.5081  |
| HBG_G01 | 0.92           | 0.96  | 0.96   | 0.97    | 0.2750 | 0.1986 | 0.1896 | 0.1613  |
| HBG_S01 | 0.53           | 0.51  | 0.51   | 0.57    | 0.6556 | 0.6633 | 0.6523 | 0.6125  |
| DXG     | <u>0.17</u>    | 0.41  | 0.37   | 0.55    | 0.7631 | 0.6115 | 0.5951 | 0.4611  |
| JZA     | 0.80           | 0.83  | 0.84   | 0.86    | 0.4373 | 0.4016 | 0.3877 | 0.3650  |
| GCA     | 0.62           | 0.69  | 0.73   | 0.75    | 0.5950 | 0.5436 | 0.4909 | 0.4608  |
| SYA     | 0.81           | 0.85  | 0.80   | 0.88    | 0.4294 | 0.3728 | 0.4342 | 0.3271  |
| LCA     | 0.64           | 0.72  | 0.71   | 0.76    | 0.5898 | 0.4956 | 0.4926 | 0.4160  |
| YCA     | 0.64           | 0.68  | 0.73   | 0.80    | 0.5991 | 0.5583 | 0.5110 | 0.4281  |
| Average | 0.64           | 0.70  | 0.71   | 0.74    | 0.5518 | 0.4802 | 0.4607 | 0.4088  |

**Table S9**Annual GPP for forest stations (g C m<sup>-2</sup> y<sup>-1</sup>).

| Year    | HZF    | MEF     | CBF     | QYF     | ALF     | DHF     | BNF     | YJF    |
|---------|--------|---------|---------|---------|---------|---------|---------|--------|
| 2003    |        |         | 1450.36 | 1690.57 |         | 1434.68 | 2435.57 |        |
| 2004    |        |         | 1376.82 | 1882.95 |         | 1418.54 | 2598.21 |        |
| 2005    |        |         | 1192.84 | 1646.81 |         | 1254    | 2550.77 |        |
| 2006    |        |         | 1642.28 | 1844.4  |         | 1460.02 | 2535.49 |        |
| 2007    |        |         | 1567.89 | 1847.33 |         | 1552.94 | 2610.95 |        |
| 2008    |        |         | 1518.81 | 1752.78 |         | 1381.15 | 2408.41 |        |
| 2009    |        |         | 1622.47 | 1852.84 | 2116.36 | 1354.39 | 2146.42 |        |
| 2010    |        |         | 1331.39 | 1926.25 | 2210.67 | 1422.73 | 2244    |        |
| 2011    |        |         |         |         | 2238.62 |         | 2826.87 |        |
| 2012    |        |         |         |         | 2087.8  |         | 2664.65 |        |
| 2013    |        |         |         |         | 1893.98 |         | 2860.98 | 607.87 |
| 2014    | 764.73 |         |         |         |         |         | 2405.34 | 720.11 |
| 2015    | 831.3  |         |         |         |         |         | 2548.65 | 693.96 |
| 2016    | 858.41 | 1413.72 |         |         |         |         |         |        |
| 2017    | 824.89 | 1466.58 |         |         |         |         |         |        |
| 2018    | 845.04 | 1421.83 |         |         |         |         |         |        |
| 2019    |        |         |         |         |         |         |         |        |
| 2020    |        |         |         |         |         |         |         |        |
| 2021    |        |         |         |         |         |         |         |        |
| 2022    |        |         |         |         |         |         |         |        |
| Average | 824.87 | 1434.04 | 1462.86 | 1805.49 | 2109.48 | 1409.81 | 2525.87 | 673.98 |

**Table S10**Annual GPP for grassland stations (g C m<sup>-2</sup> y<sup>-1</sup>).

| Year | XLG    | NMG    | DLG    | DMG    | HBG_S01 | HBG_G01 | DXG    |
|------|--------|--------|--------|--------|---------|---------|--------|
| 2003 |        |        |        |        | 500.05  |         |        |
| 2004 |        | 356.04 |        |        | 552.49  |         | 222.67 |
| 2005 |        | 93.27  |        |        | 583.03  |         | 172.16 |
| 2006 | 272.75 | 391.35 | 650.27 |        | 261.43  |         | 124.36 |
| 2007 | 449.23 | 370.61 | 386.62 |        | 272.74  |         | 188.13 |
| 2008 | 550.3  | 474.06 | 680.71 |        | 273.98  |         | 280    |
| 2009 | 320.8  | 164.22 | 430.89 |        | 282.54  |         | 158.09 |
| 2010 | 339.05 | 550.67 | 565.28 |        | 292.36  |         | 183.96 |
| 2011 | 591.24 |        | 736.8  |        | 463.84  |         |        |
| 2012 | 716.58 |        | 713.66 |        | 467.26  |         |        |
| 2013 | 803.2  |        | 803.98 |        | 484.04  |         |        |
| 2014 | 531.38 |        | 619.78 |        |         |         |        |
| 2015 | 501.52 |        | 665.99 | 110.4  |         | 942.62  |        |
| 2016 |        |        |        | 237.39 | 611.08  | 940.12  |        |
| 2017 |        |        |        | 146.02 | 545.08  | 933.35  |        |
| 2018 |        |        |        | 397.67 | 595.22  | 974.37  |        |
| 2019 |        |        |        |        |         | 1028.5  |        |
| 2020 |        |        |        |        | 510.9   | 961.43  |        |
| 2021 |        |        |        |        |         |         |        |
| 2022 |        |        |        |        |         |         |        |

|         |        |        |       |        |       |       |        |
|---------|--------|--------|-------|--------|-------|-------|--------|
| Average | 507.61 | 342.89 | 625.4 | 222.87 | 446.4 | 963.4 | 189.91 |
|---------|--------|--------|-------|--------|-------|-------|--------|

**Table S11**

Annual GPP for cropland stations (g C m<sup>-2</sup> y<sup>-1</sup>).

| Year    | GCA     | JZA     | LCA     | SYA     | YCA     |
|---------|---------|---------|---------|---------|---------|
| 2003    |         |         |         |         | 1660.44 |
| 2004    |         |         |         |         | 1608.06 |
| 2005    |         | 932.05  |         |         | 1851.3  |
| 2006    |         | 1253.66 |         |         | 2282.53 |
| 2007    |         | 1198.56 |         |         | 2597.22 |
| 2008    |         | 1011.93 |         |         | 2126.39 |
| 2009    |         | 1071.52 |         |         | 2445.98 |
| 2010    |         | 1101.77 |         |         | 2080.32 |
| 2011    |         | 943.38  |         |         |         |
| 2012    |         | 995.96  |         | 1281.01 |         |
| 2013    |         | 1361.07 |         | 1443.98 |         |
| 2014    |         | 1096.66 | 1896.29 | 1297.51 |         |
| 2015    |         |         | 1665.4  |         |         |
| 2016    |         |         | 1911.14 |         |         |
| 2017    |         |         | 2288.87 |         |         |
| 2018    |         |         |         |         |         |
| 2019    |         |         |         |         |         |
| 2020    | 2072.08 |         |         |         |         |
| 2021    | 1819.59 |         |         |         |         |
| 2022    | 1850.53 |         |         |         |         |
| Average | 1914.07 | 932.05  | 1568.43 | 1340.83 | 2081.53 |