Supporting Information for

Ecosystem photosynthesis in land-surface models: a first-principles approach

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Contents of this file

Figures S1 to S5

Introduction

This supplementary information contains additional figures for the other sites, which are referred to in the results section of the main manuscript

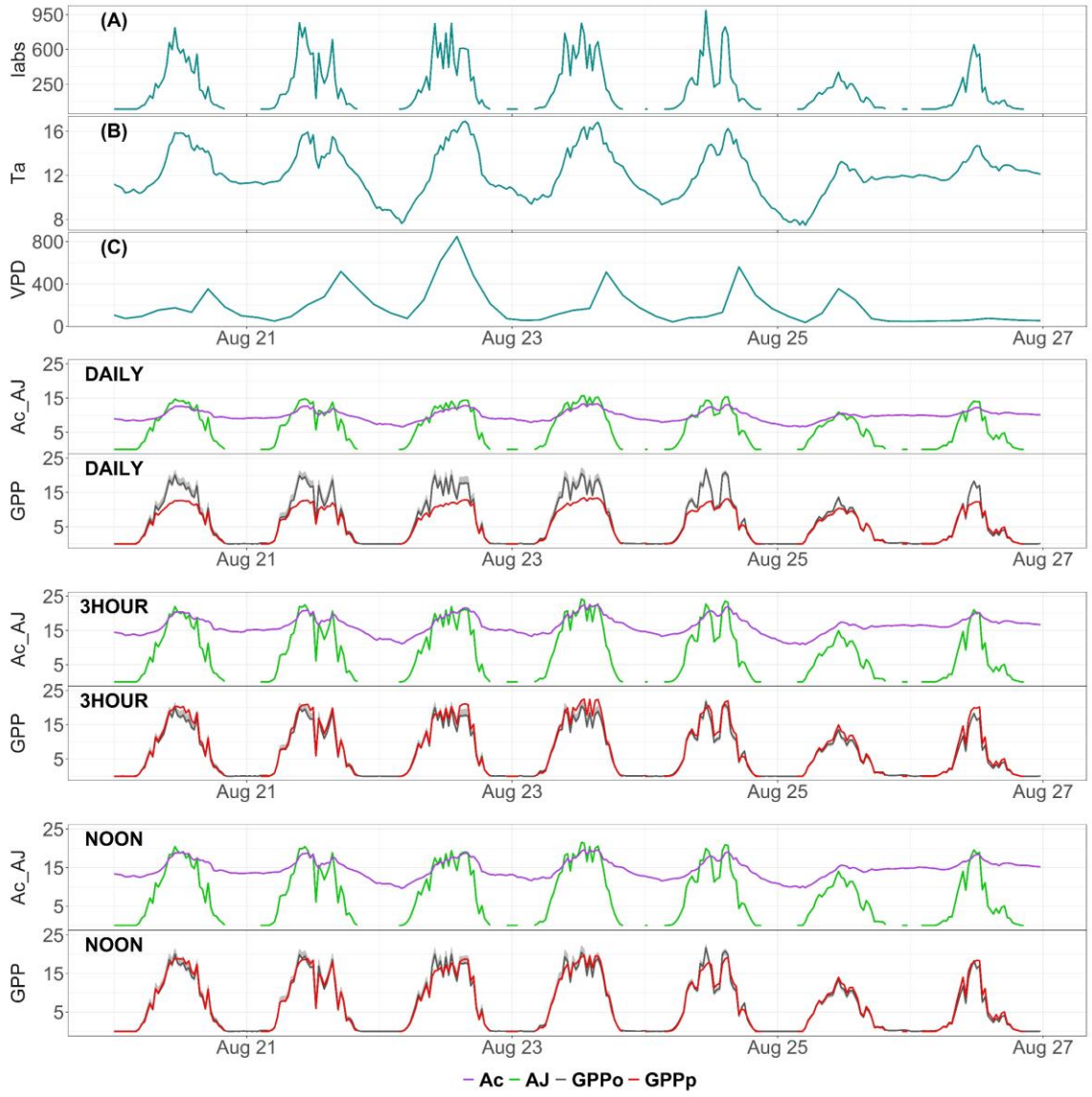

Figure S1. Sub-daily trends in model inputs (A, B, C) during one week in August 2014 at the **Hyytiälä (FI-Hyy)** site and the simulated Rubisco-limited assimilation rate (A_C; µmol CO_2 m^{-2} s^{-1}), electron-transport limited assimilation rate (A_J; µmol CO_2 m^{-2} s^{-1}) and gross primary production (GPP) using the running mean approach with inputs for average daytime conditions (DAILY), averaged over three hours from the middle of the day (3HOUR) and around midday (NOON). Simulated GPP (GPPp) is shown in red and the GPP derived from eddy covariance flux-tower measurements (GPPo) is shown in grey, both expressed in µmol CO_2 m^{-2} s^{-1}. Model inputs—Iabs, Ta, VPD—are in units of µmol Photon m^{-2} s^{-1}, °C and Pa respectively.

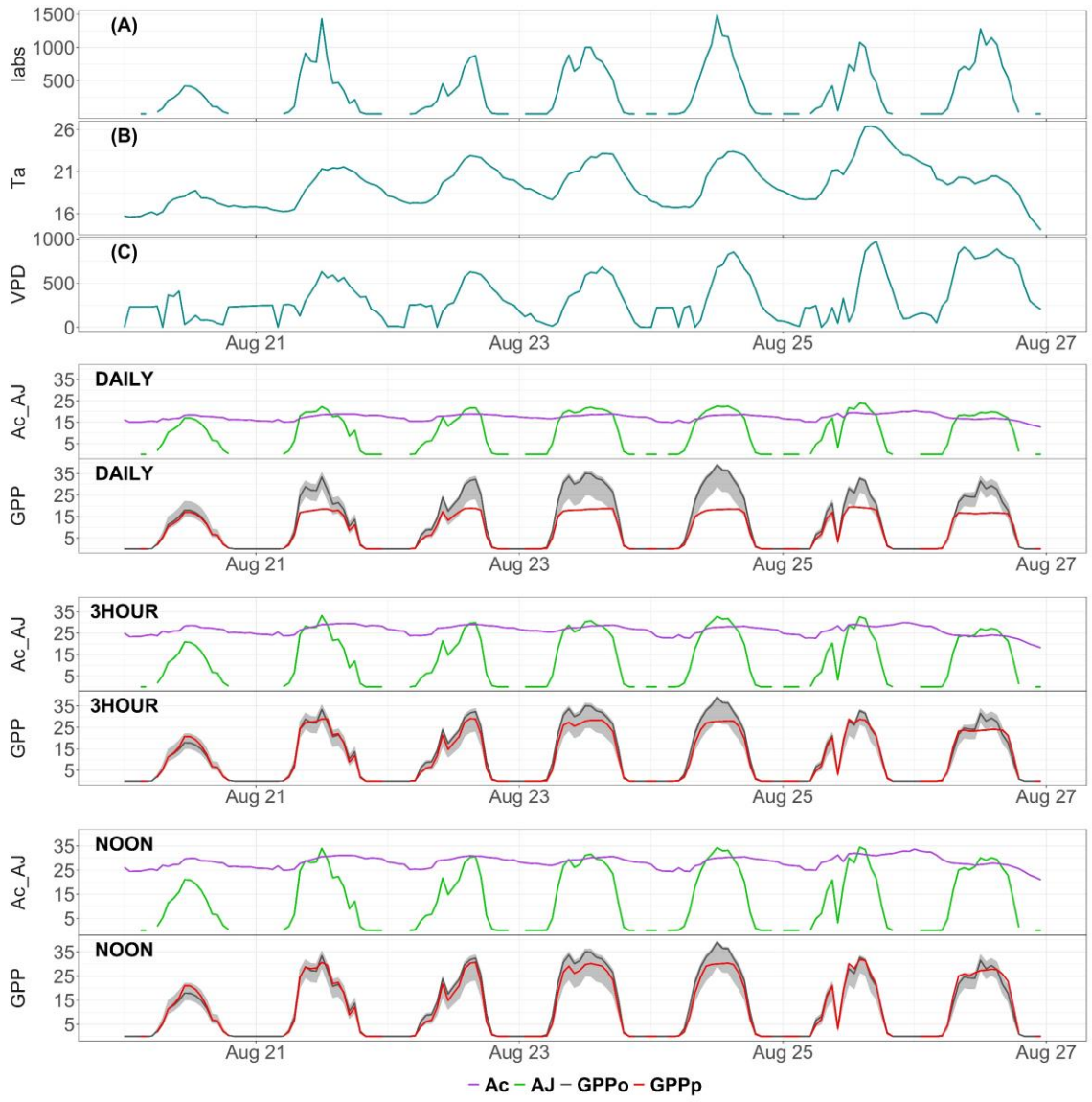

Figure S2. Sub-daily trends in model inputs (A, B, C) during one week in August 2014 at the **University of Michigan Biological Station (US-UMB)** site and the simulated Rubisco-limited assimilation rate (A_C; µmol CO_2 m^{-2} s^{-1}), electron-transport limited assimilation rate (A_J; µmol CO_2 m^{-2} s^{-1}) and gross primary production (GPP) using the running mean approach with inputs for average daytime conditions (DAILY), averaged over three hours from the middle of the day (3HOUR) and around midday (NOON). Simulated GPP (GPPp) is shown in red and the GPP derived from eddy covariance flux-tower measurements (GPPo) is shown in grey, both expressed in µmol CO_2 m^{-2} s^{-1}. Model inputs—Iabs, Ta, VPD—are in units of µmol Photon m^{-2} s^{-1}, °C and Pa respectively.

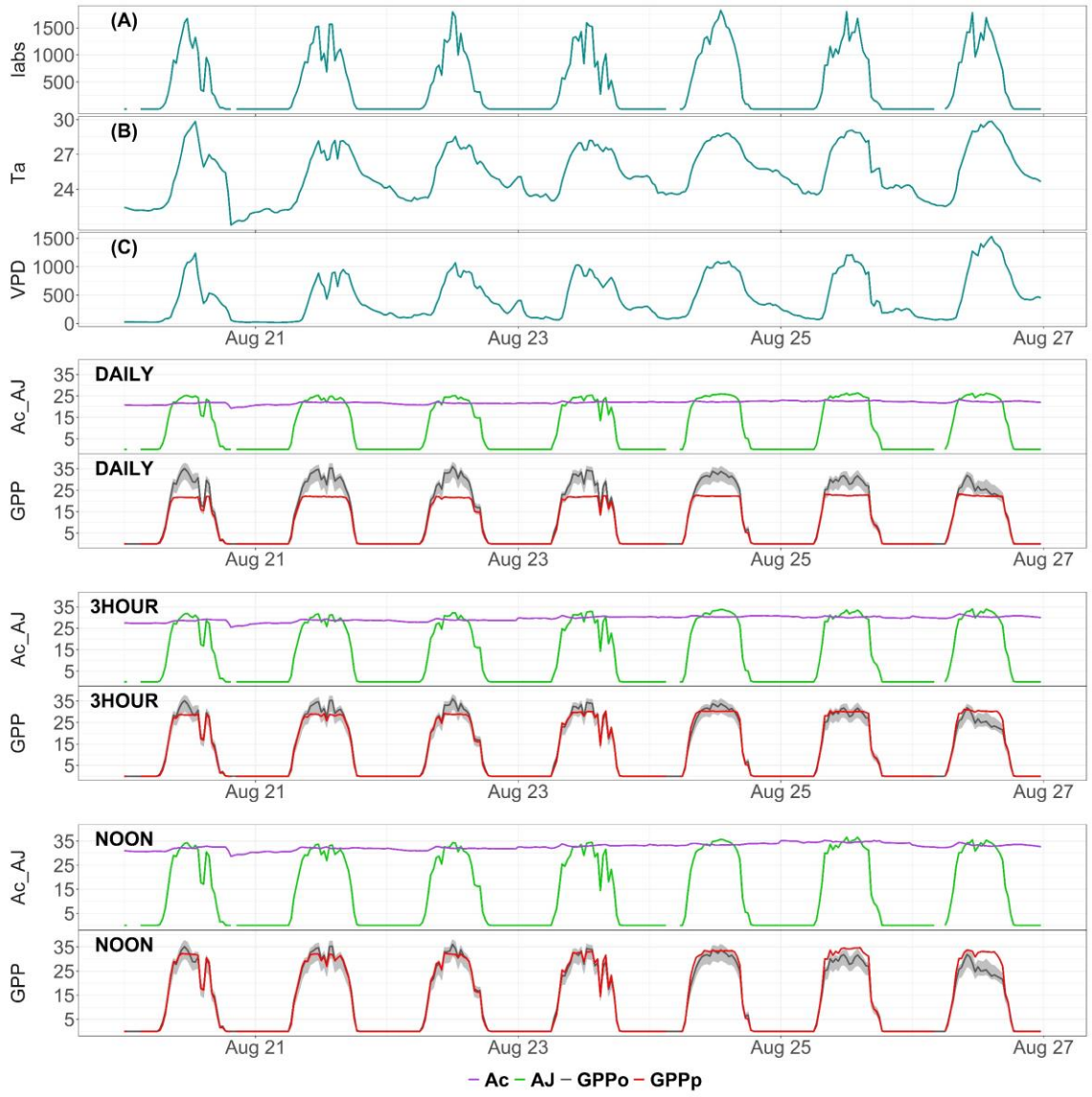

Figure S3. Sub-daily trends in model inputs (A, B, C) during one week in August 2014 at the **French Guiana (GF-Guy)** site and the simulated Rubisco-limited assimilation rate (A_C; µmol CO_2 m^{-2} s^{-1}), electron-transport limited assimilation rate (A_J; µmol CO_2 m^{-2} s^{-1}) and gross primary production (GPP) using the running mean approach with inputs for average daytime conditions (DAILY), averaged over three hours from the middle of the day (3HOUR) and around midday (NOON). Simulated GPP (GPPp) is shown in red and the GPP derived from eddy covariance flux-tower measurements (GPPo) is shown in grey, both expressed in µmol CO_2 m^{-2} s^{-1}. Model inputs—Iabs, Ta, VPD—are in units of µmol Photon m^{-2} s^{-1}, °C and Pa respectively.

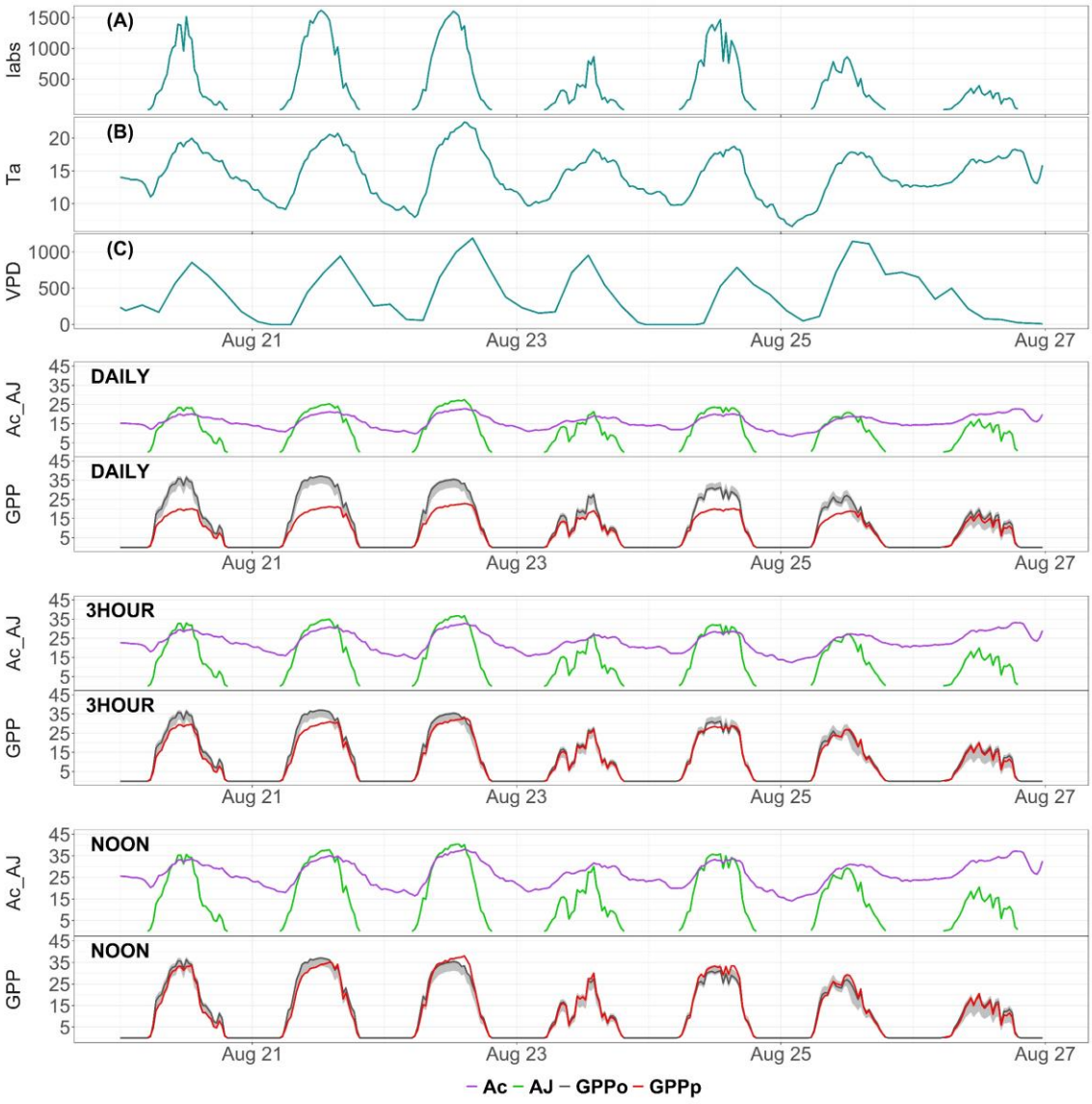

Figure S4. Sub-daily trends in model inputs (A, B, C) during one week in August 2014 at the **Chamau (CH-Cha)** site and the simulated Rubisco-limited assimilation rate (A_C; µmol CO_2 m^{-2} s^{-1}), electron-transport limited assimilation rate (A_J; µmol CO_2 m^{-2} s^{-1}) and gross primary production (GPP) using the running mean approach with inputs for average daytime conditions (DAILY), averaged over three hours from the middle of the day (3HOUR) and around midday (NOON). Simulated GPP (GPPp) is shown in red and the GPP derived from eddy covariance flux-tower measurements (GPPo) is shown in grey, both expressed in µmol CO_2 m^{-2} s^{-1}. Model inputs—Iabs, Ta, VPD—are in units of µmol Photon m^{-2} s^{-1}, °C and Pa respectively.

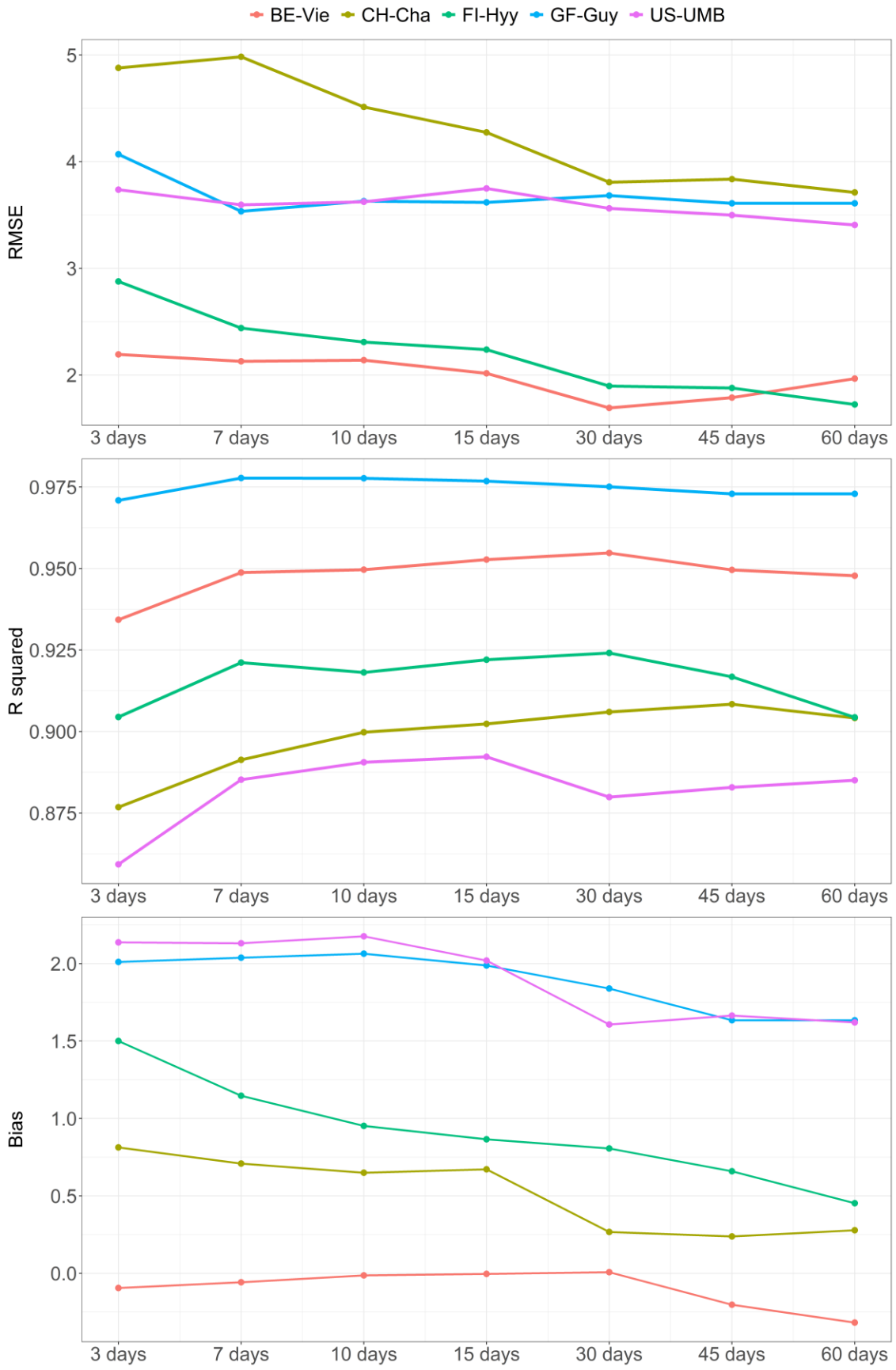
BE-Vie
CH-Cha
FI-Hyy
GF-Guy
US-UMB
RMSE
5
4
3
2
3 days
7 days
10 days
15 days
30 days
45 days
60 days
R squared
0.975
0.950
0.925
0.900
0.875
Bias
2.0
1.5
1.0
0.5
0.0

Figure S5. Median RMSE, R^2 and bias error distributions according to different lengths of acclimation time (n. of days) using the exponential moving average approach, computed per each of the five FLUXNET2015 sites, over 2014.