Supporting Information

Table S1 | Monthly mean values of net ecosystem exchange (NEE), gross primary production (GPP), and ecosystem respiration (Re) and soil respiration (Rs) during study period. Note: the numbers in parenthesis is the ±se.

Season	Month	NEE	GPP	Re	Rs
		[µmol m^{-2} s^{-1}]			
Wet season (Nov-Apr)	Nov	-0.25 (0.10)	-0.81 (0.10)	0.56 (0.03)	0.78 (0.01)
	Dec	-0.48 (0.05)	-1.08 (0.04)	0.59 (0.01)	0.57 (0.01)
	Jan	-0.94 (0.11)	-1.96 (0.11)	1.02 (0.02)	0.91 (0.01)
	Feb	-1.52 (0.19)	-3.58 (0.20)	2.06 (0.03)	1.52 (0.02)
	Mar	-2.23 (0.17)	-4.65 (0.17)	2.42 (0.02)	1.54 (0.01)
	Apr	-1.32 (0.13)	-3.98 (0.13)	2.66 (0.02)	1.40 (0.01)
	Average [µmol m^{-2} s^{-1}]	**-1.12 (0.30)**	**-2.68 (0.66)**	**1.55 (0.38)**	**1.12 (0.17)**
	Season sum [g C m^{-2}]	**-203 (9)**	**-482 (20)**	**279 (11)**	**202 (5)**
	Rs/Re [%]				**72 (13)**
Dry season (May-Oct)	May	-0.55 (0.08)	-2.23 (0.08)	1.67 (0.02)	1.20 (0.01)
	Jun	0.50 (0.04)	-0.90 (0.04)	1.40 (0.02)	0.61 (0.01)
	Jul	0.29 (0.04)	-0.77 (0.03)	1.06 (0.01)	0.36 (0.01)
	Aug	0.45 (0.05)	-0.63 (0.04)	1.08 (0.02)	0.24 (0.01)
	Sep	0.25 (0.04)	-0.60 (0.04)	0.85 (0.02)	0.30 (0.01)
	Oct	0.26 (0.03)	-0.50 (0.02)	0.76 (0.01)	0.30 (0.01)
	Average [µmol m^{-2} s^{-1}]	**0.20 (0.16)**	**-0.94 (0.26)**	**1.14 (0.14)**	**0.50 (0.15)**
	Season sum [g C m^{-2}]	**36 (5)**	**-173 (8)**	**209 (4)**	**93 (5)**
	Rs/Re [%]				**44 (7)**
Annual	**Average (SE) [µmol m^{-2} s^{-1}]**	**-0.46 (0.26)**	**-1.81 (0.43)**	**1.34 (0.20)**	**0.8 (0.1)**
	Annual sum (SE) [g C m^{-2} y^{-1}]	**-167 (8)**	**-655 (13)**	**488 (6)**	**295 (4)**
	Rs/Re [%]				**60 (10)**

Table S2 | Exponential and linear relationships between soil respiration rate (Rs; µmol m^{-2} s^{-1}) and abiotic factors during 2015-2016. Ts (°C): soil temperature; SWC (m^3 m^{-3}): soil water content; PAR (µmol m^{-2} s^{-1}): incoming photosynthetic activity radiation above canopy. The best-fit model parameters (β_0, β_1, β_2, and β_3) are reported for each model together with the squared coefficient of regression (R^2), and the root mean squared error (RSME).

a) Up-scaled daily time series (the models that used during Grünzweig et al., 2009)

Model	Study	β_0	β_1	β_2	β_3	β_4	R^2
$\beta_0 + \beta_1\theta + \beta_2 PAR$	2000-2006	-2.306	25.39	0.000545			0.83
<0.2 m^3 H_2O m^{-3} soilθ	2015-2016	-0.7313	11.14	0.000564			0.43
$\beta_0 + \beta_1 e^{\beta_2 Ts} + \beta_3 e^{\beta_4 PAR}$	2000-2006	1.394	0.1463	0.151	0.008408	0.003154	0.86
<0.2 m^3 H_2O m^{-3} soilθ	2015-2016						0.70

b) Up-scaled half-hour time series

Model	β_0	β_1	β_2	β_3	R^2	SSE
$\beta_0 + \beta_1 Ts$	1.264	-0.02			0.07	0.556
$\beta_0 e^{\beta_1 Ts}$	1.309	-0.02			0.07	0.558
$\beta_0 + \beta_1\theta$	0.2934	5.57			0.35	0.4667
$\beta_0 + \beta_1\theta + \beta_2\theta^2$	-0.2175	17.47	-48.35		0.42	0.4388
$e^{\beta_0 + \beta_1\theta + \beta_2\theta^2}$	-1.68	23.49	-67.3		0.44	0.4378
$\beta_0 + \beta_1 PAR$	0.7121	0.0002			0.05	0.5603
$\beta_0 + \beta_1\theta + \beta_2 Ts$	-0.4213	7.626	0.02473		0.40	0.4499
$\beta_0 + \beta_1\theta + \beta_2 PAR$	0.1162	5.989	0.00028		0.44	0.4295
$\beta_0 \beta_1^{((Ts-10)/10)} \theta^{\beta_2}$	6.714	1.655	1.083		0.52	0.4151
$(\beta_0/(1 + e^{\beta_1 * (\beta_2 - Ts)})) * \theta^{\beta_3}$	11.91	0.267	12.04	0.9908	0.54	0.3914
$(\beta_0/(1 + e^{\beta_1 * (\beta_2 - PAR)})) * \theta^{\beta_3}$	90.12	0.0004	8625	0.6838	0.50	0.4169
$\beta_0 e^{\beta_1 Ts} e^{\beta_2\theta + \beta_3\theta^2}$	0.05126	0.04274	28.51	74.44	0.60	0.3932

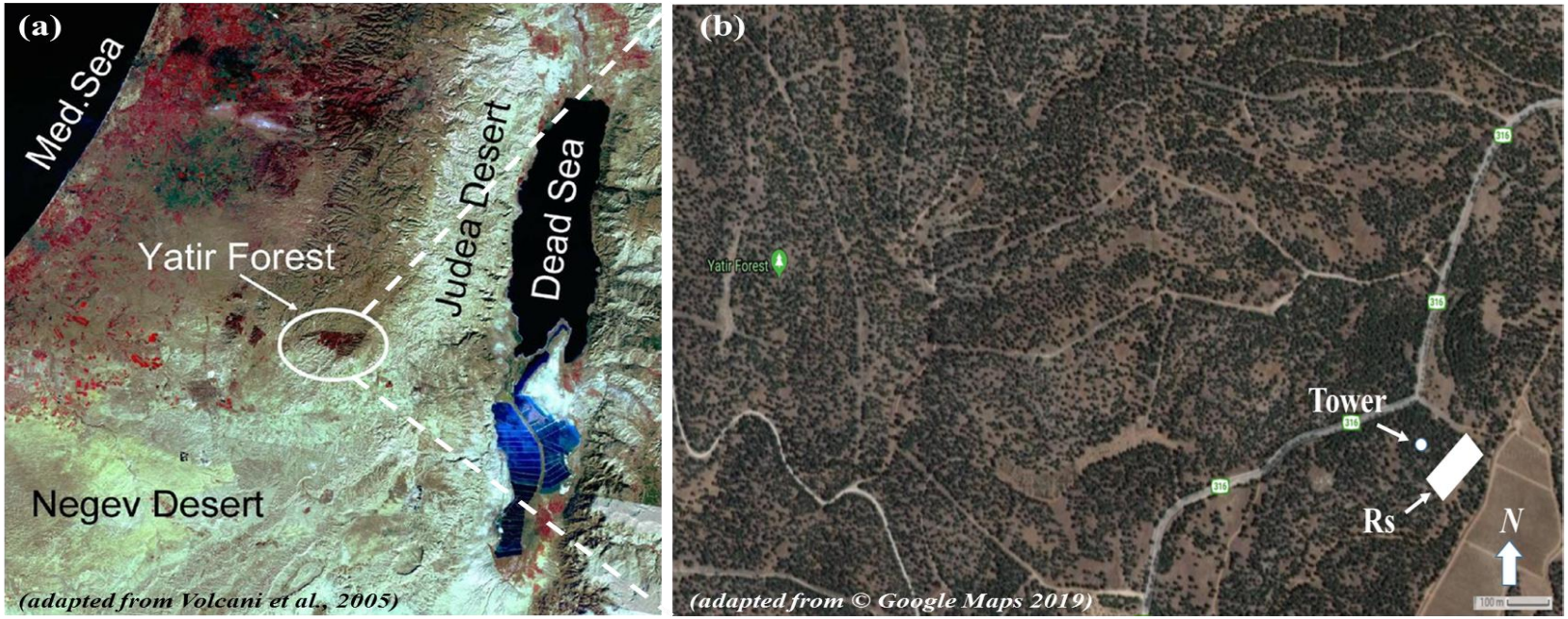

Figure S1 | (a) Landsat-TM image of Central Israel. (b) Map of the experimental set-up at the *Pinus halepensis* Yatir forest with white rectangle site of soil respiration (Rs) measurements and white dot is the location of the eddy covariance tower (NEE).

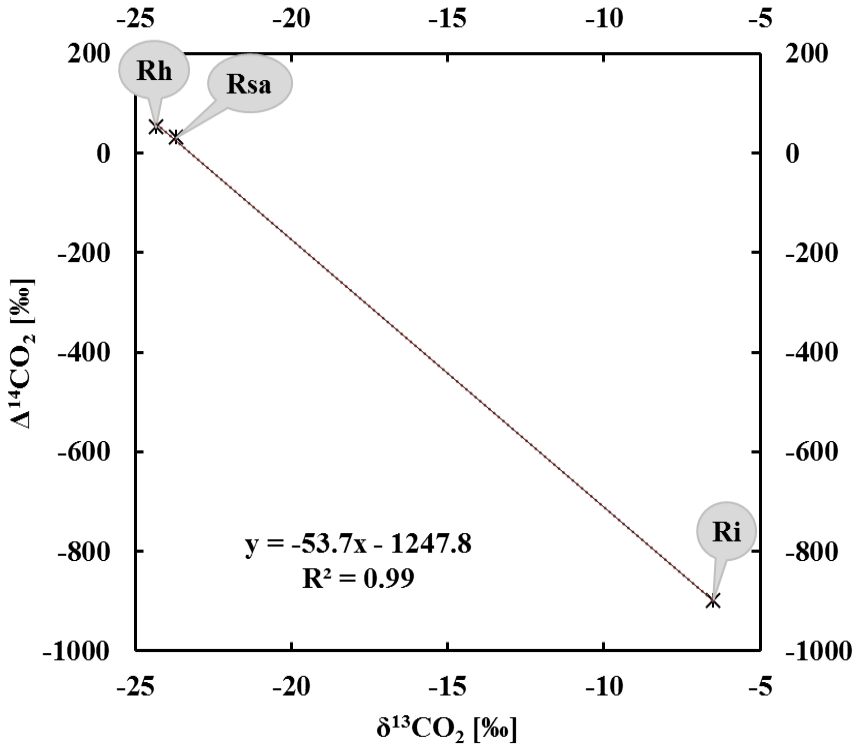

Figure S2 | The linear regression line used to estimate the $\Delta^{14}C$ of Rs. The line (dotted) was produced by the correlation between the average of the measured $\delta^{13}C$ values of Rsa, Rsh, and the $\delta^{13}C$ Ri (all from incubation measurements), and the $\Delta^{14}C$ values estimated based on measured $\Delta^{14}C$ at our site (Carmi et al. 2013) adjusted to the present study period and the mean accepted ages of autotrophic and heterotrophic soil organic material (Graven et al., 2012; Levin et al., 2010; Taylor et al., 2015).

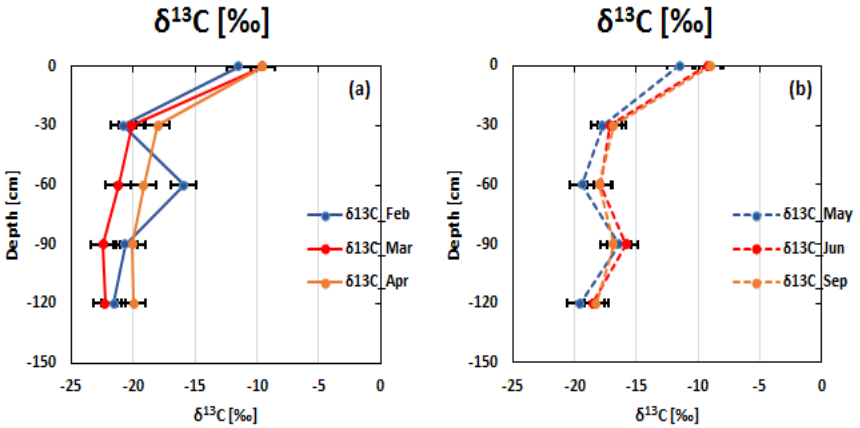

Figure S3 | Monthly averages of $\delta^{13}C$ (‰) from the soil CO_2 profile (at 0, 30, 60, 90, and 120 cm soil depth) during some campaigns in 2016 to determine the seasonal variations in the relative contribution of soil autotrophic (Rsa), heterotrophic (Rh), and abiotic (Ri) components to Rs.

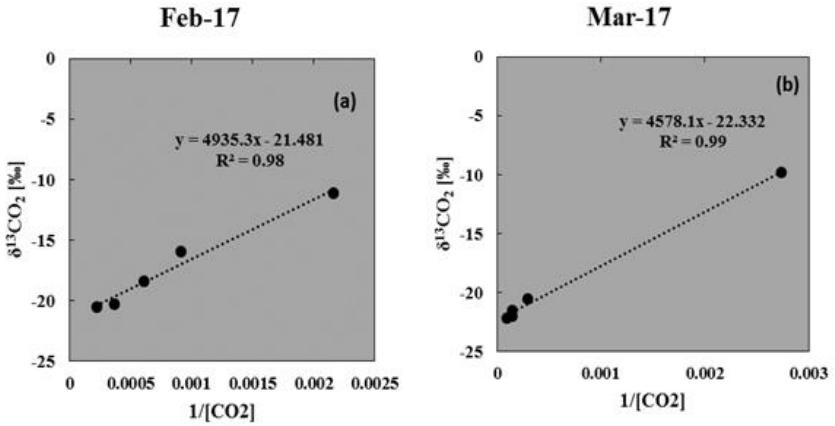

Figure S4 | Keeling plot for soil CO_2 profile (at 0, 30, 60, 90, and 120 cm soil depth) during some campaigns in 2016 to determine the seasonal variations in the relative contribution of soil autotrophic (Rsa), heterotrophic (Rh), and abiotic (Ri) components to Rs.

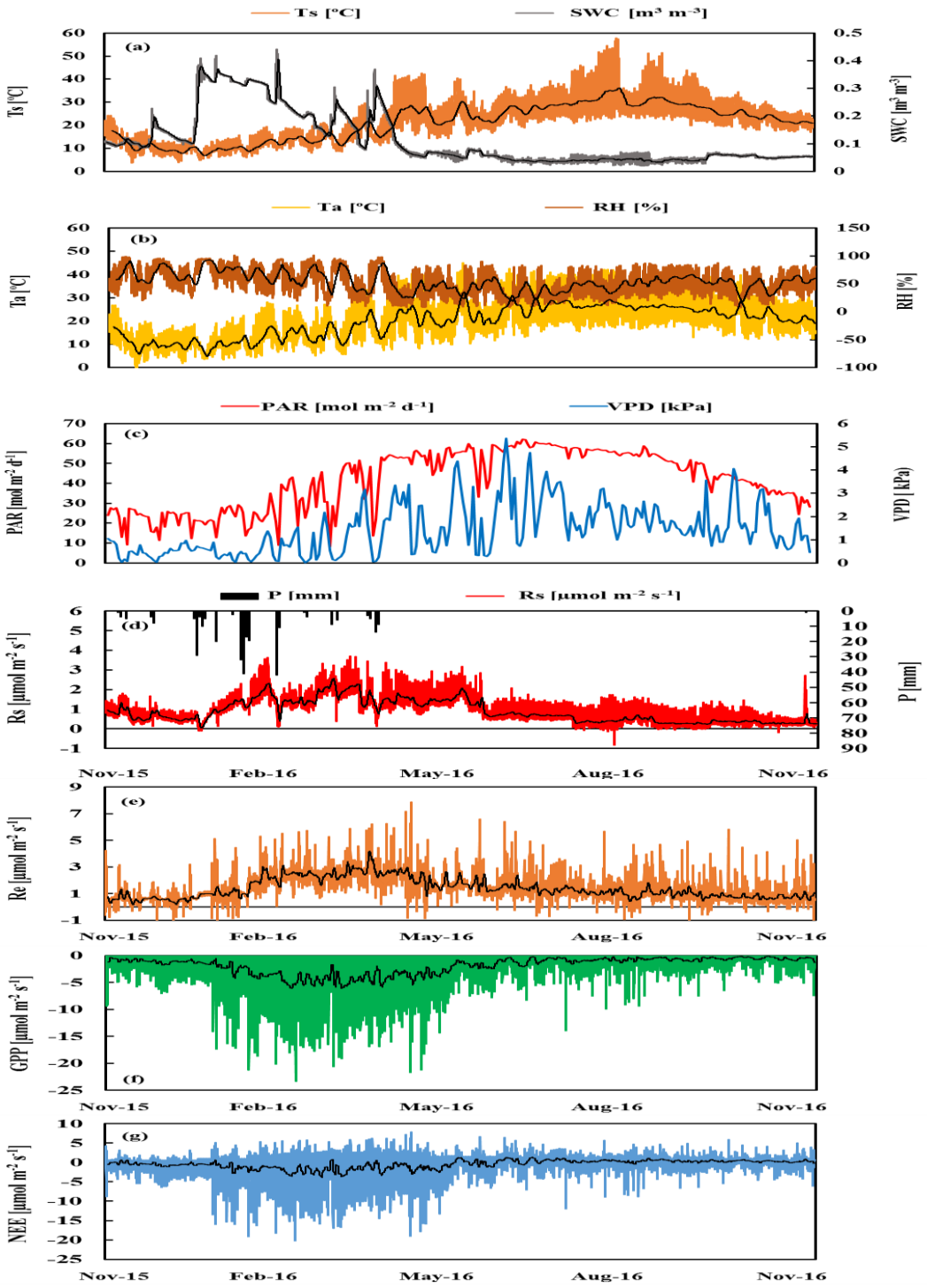

Figure S5 | a) half-hour values for soil temperature 5 cm (Ts) and soil water content 10 cm ($SWC_{0\text{-}10cm}$), b) half-hour values for the air temperature at 20 cm (Ta) and relative humidity at 20 cm (RH), c) daily average of incoming photosynthetic activity radiation above canopy (PAR) and vapour pressure deficit (VPD), half-hour values for the following CO_2 fluxes d) up-scaled Rs, e) ecosystem respiration (Re), f) gross primary production (GPP), and g) net ecosystem exchange (NEE). Black lines are a running average lines for 2 days.

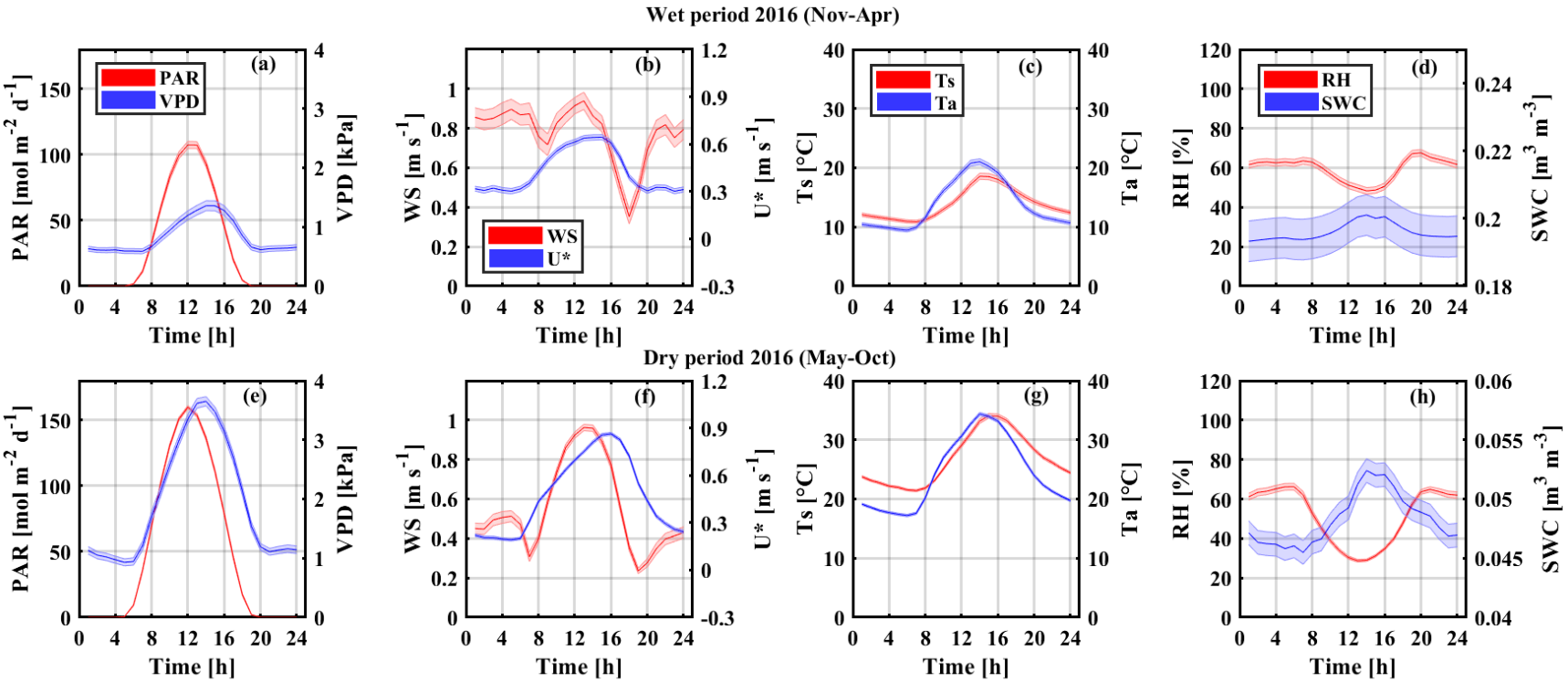

Figure S6 | Typical diurnal cycle of the meteorological parameters during the wet period (Nov.-Apr.; upper panels) and for the dry period (May-Oct.; lower panels); each set includes six months of half-hour measurements. a and e) incoming photosynthetic activity radiation above canopy (PAR) and vapour pressure deficit (VPD), b and f) wind speed (WS) and covariation of friction velocity (U*), c and g) soil temperature at 5 cm (Ts) and air temperature at 20 cm (Ta), and d and h) relative humidity (RH) and soil water content at the top 10 cm (SWC0-10cm). Shaded areas indicate ±se.

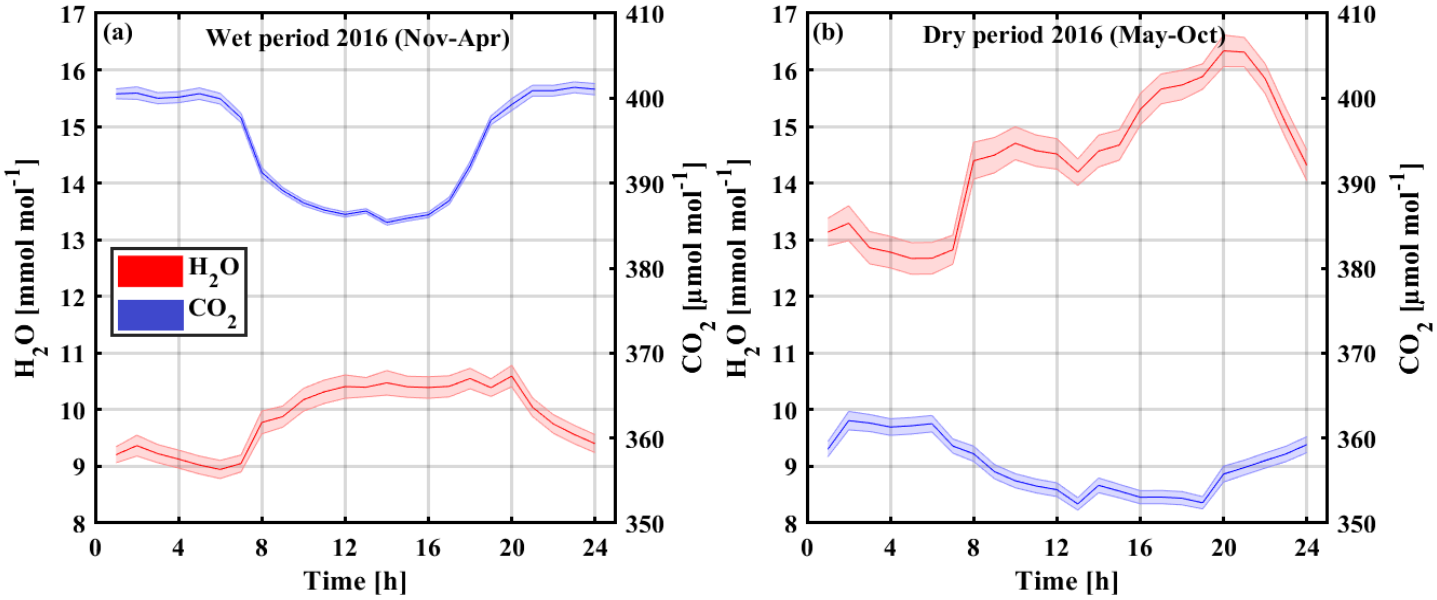

Figure S7 | Representative diurnal cycles of the ambient H_2O and CO_2 concentrations at ground level during a) the wet (Nov-Apr) and b) the dry (May-Oct) periods, each set includes six months of half-hour measurements. These concentrations were measured with the system that determined Rs; shaded areas indicate ±se.