Supplement

S1 Impact of parameter correlation on ET attribution to radiation

As outlined in *Sect. 2 Data & methods*, we performed an analysis of the respective contributions of the additive terms in the linear models. We exemplified this with a simple linear model

$$Y = a_1 \cdot X_1 + a_2 \cdot X_2 \,, \tag{S1}$$

where Y denotes the dependent variable, a_1 and a_2 denote parameters and X_1 and X_2 are two explanatory variables. We can calculate the contribution of a variable X_i as

$$f_{X_i} = \frac{\sum a_i \cdot X_i}{\sum a_1 \cdot X_1 + a_2 \cdot X_2} \,. \tag{S2}$$

In many realistic examples, the model parameters a_1 and a_2 are not perfectly identifiable. This could be due to the correlation of X_1 and X_2 or more fundamental model structural uncertainty. In these cases, f_{X_i} is confounded by the parameter correlation a_1 and a_2, leading to a high uncertainty of its estimation. To evaluate this effect, we estimated the contribution of the described within-site uncertainty of f_{X_i}. The variance-covariance matrix (V) of the parameter estimates could be calculated for each site with the results of the regression. Consequently, V can be used to derive the respective posterior parameter distributions, from which we sampled 200 parameter vectors per site, representing the uncertainty and correlation of the two parameters. Site-specific vectors $f_{X_i,S}$ can be calculated as

$$f_{X_i,s_j} = \left[f_{X_i,s_j,p_1}, f_{X_i,s_j,p_2}, \dots, f_{X_i,s_j,p_{200}}\right], \tag{S3}$$

where p_1 to p_{200} denote the 200 realizations of parameter vectors and s_j denotes a specific site.

Based on this, we tested whether the global variance of f_{X_i} is a product of differing means of the site-specific $f_{X_i,S}$ vectors or their variances. For this, we performed an ANOVA along the sites as categorical variable with the parameter realizations as random replicates.

S2 Overview over all FLUXNET sites used

Table S1 contains an overview of all FLUXNET sites used in our analysis. A full description of all FLUXNET sites can be found at http://fluxnet.fluxdata.org/sites/site-list-and-pages/

Table S1. Overview of all FLUXNET sites used in our analysis.

Site	Site-Years	Biome (IGBP)	Climate (K.-Geiger)
AT-Neu	2002-2004	GRA	Cfb
AU-How	2001-2006	WSA	Aw
AU-Tum	2001-2006	EBF	Cfb
AU-Wac	2005-2007	EBF	Cfb
BE-Bra	1997-2006[1]	MF	Cfb
BE-Lon	2004-2006	CRO	Cfb
BE-Vie	1996-2006	MF	Cfb
BW-Ghg	2003	SAV	BSh
BW-Ghm	2003	WSA	BSh
BW-Ma1	1999-2001	WSA	BSh
CA-Man	1994-2003	ENF	Dfc
CA-NS1	2002-2005	ENF	Dfc
CA-NS2	2001-2005	ENF	Dfc
CA-NS3	2001-2005	ENF	Dfc
CA-NS4	2002-2004	ENF	Dfc
CA-NS5	2001-2005	ENF	Dfc
CA-NS6	2001-2005	OSH	Dfc
CA-NS7	2002-2005	OSH	Dfc
CA-Qcu	2001-2006	ENF	Dfc
CA-Qfo	2003-2006	ENF	Dfc
CA-SF1	2003-2005	ENF	Dfc
CA-SF2	2003-2005	ENF	Dfc

[1] No observations in the years 1999 and 2003.

CA-SF3	2003-2005	ENF	Dfc
CH-Oe1	2002-2006	GRA	Cfb
CZ-BK1	2000-2006	ENF	Dfb
DE-Geb	2004-2006	CRO	Cfb
DE-Gri	2005-2006	GRA	Cfb
DE-Hai	2000-2006	DBF	Cfb
DE-Kli	2004-2006	CRO	Cfb
DE-Meh	2003-2006	GRA	Cfb
DE-Tha	1996-2006	ENF	Cfb
DE-Wet	2002-2006	ENF	Cfb
DK-Lva	2005-2006	GRA	Cfb
DK-Ris	2004-2005	CRO	Cfb
DK-Sor	1996-2006	DBF	Cfb
ES-ES1	1999-2006	ENF	Csa
ES-ES2	2004-2006	CRO	Csa
ES-LMa	2004-2006	SAV	Csa
ES-VDA	2004-2006	GRA	Cfb
FI-Hyy	1996-2006	ENF	Dfc
FI-Sod	2000-2006	ENF	Dfc
FR-Fon	2005-2006	DBF	Cfb
FR-Gri	2005-2006	CRO	Cfb
FR-Hes	1997-2006	DBF	Cfb
FR-LBr	1996-2006	ENF	Cfb
FR-Lq1	2004-2006	GRA	Cfb
FR-Lq2	2004-2006	GRA	Cfb
FR-Pue	2000-2006	EBF	Csa
HU-Bug	2002-2006	GRA	Cfb
HU-Mat	2004-2006	GRA	Cfb
IE-Dri	2003-2005	GRA	Cfb
IL-Yat	2001-2006	ENF	BSh
IT-Amp	2002-2006	GRA	Cfa
IT-BCi	2004-2006	CRO	Csa

IT-Col	1996-2006	DBF	Cfa
IT-Cpz	1997-2006	EBF	Csa
IT-Lav	2000-2006	ENF	Cfb
IT-Lec	2005-2006	EBF	Cfa
IT-LMa	2003-2006	GRA	Cfb
IT-Mal	2003-2006	GRA	Cfb
IT-MBo	2003-2006	GRA	Cfb
IT-Non	2001-2006	DBF	Cfa
IT-Pia	2002-2005	OSH	Csa
IT-PT1	2002-2004	DBF	Cfa
IT-Ren	1999-2006	ENF	Dfb
IT-Ro1	2000-2006	DBF	Csa
IT-Ro2	2002-2006	DBF	Csa
IT-SRo	1999-2006	ENF	Csa
NL-Ca1	2003-2006	GRA	Cfb
NL-Hor	2004-2006	GRA	Cfb
NL-Loo	1996-2006	ENF	Cfb
NL-Lut	2006	CRO	Cfb
PT-Esp	2002-2006	EBF	Csa
PT-Mi1	2003-2005	EBF	Csa
PT-Mi2	2004-2006	GRA	Csa
RU-Fyo	1998-2004	ENF	Dfb
RU-Ha1	2002-2004	GRA	Dfc
RU-Zot	2002-2004	ENF	Dfc
SE-Fla	1996-2002	ENF	Dfc
SE-Nor	1996-2005	ENF	Dfb
SK-Tat	2005	ENF	Dfb
UK-ESa	2003-2005	CRO	Cfb
UK-Gri	1997-2006	ENF	Cfc
UK-Ham	2004-2005	DBF	Cfb
UK-PL3	2005-2006	DBF	Cfb
US-ARM	2003-2006	CRO	Cfa

US-Aud	2002-2006	GRA	BSk
US-Bar	2004-2005	DBF	Dfb
US-Bkg	2004-2006	GRA	Dfa
US-Blo	1997-2006	ENF	Csa
US-Bo1	1996-2007	CRO	Dfa
US-FPe	2000-2006	GRA	BSk
US-Goo	2002-2006	GRA	Cfa
US-Ha1	1991-2006	DBF	Dfb
US-Ho1	1996-2004	ENF	Dfb
US-Me4	1996-2000	ENF	Csb
US-MMS	1999-2005	DBF	Cfa
US-MOz	2004-2006	DBF	Cfa
US-Ne1	2001-2005	CRO	Dfa
US-Ne2	2001-2005	CRO	Dfa
US-Ne3	2001-2005	CRO	Dfa
US-PFa	1996-2003	MF	Dfb
US-SP1	2000-2005	ENF	Cfa
US-SP2	1998-2004	ENF	Cfa
US-SP3	1999-2004	ENF	Cfa
US-Syv	2002-2006	MF	Dfb
US-Ton	2001-2006	WSA	Csa
US-UMB	1999-2003	DBF	Dfb
US-Var	2001-2006	GRA	Csa
US-WCr	1999-2006	DBF	Dfb
US-Wi4	2002-2005	ENF	Dfb
ZA-Kru	2001-2003	SAV	Cwa