Supplement of Biogeosciences, 11, 2991–3013, 2014
http://www.biogeosciences.net/bg-11-2991-2014/
doi:10.5194/bg-11-2991-2014-supplement

Supplement of

Can current moisture responses predict soil CO_2 efflux under altered precipitation regimes? A synthesis of manipulation experiments

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Supplementary Information content:

Table S1 indicates the (dominant) species for each experiment.

Table S2 presents contact details for each experiment.

Table S3 provides the coefficients for the four models tested for each experiment.

Table S4 shows the goodness of fit for the four models tested for each experiment.

Fig. S1 provides the residuals of model 4 for both control and treatment of all experiments listed in Table C1.

Fig. S2 displays the time course of Pi for both control and treatment of all experiments listed in Table C1 that are not shown in the manuscript.

Fig. S3 shows for each experiment predicted SCE versus observed SCE and this for both control and treatment.

Test for artefacts.

Figures S1, S2 and S3 are shown in separate pdf files.

Figure captions:

Figure S1: For each experiment listed in Table C1 the time course of the residuals obtained after fitting model 4 to the soil CO_2 efflux data of the control plots (black squares), as well as the residuals for the treatment (white squares) using the model parameterized for the control. Black and white circles display measurements of soil water content for control and treatment, respectively. Gray areas indicate the time that water inputs were manipulated.

Figure S2: The time course of Pi (predictability index; large black circles) for each experiment of Table C1 that is not displayed in the manuscript. Small black and white circles represent the soil water content, for control and treatment plots respectively. Gray areas indicate the time that water inputs were manipulated.

Figure S3: For each experiment, predicted soil CO_2 efflux (SCE; μmol CO_2 m^{-2} s^{-1}) is plotted versus measured SCE, for both control and treatment (black and white circles, respectively). Lines indicate the 1:1 line.

Table S1: The most abundant species for all experiments.

Experiment	species composition
Achenkirch	*Picea abies, Fagus sylvatica*
Almería	*Stipa tenacissima*
Aranjuez	*Stipa tenacissima*
BigBend_S	*Dasylirion leiophyllum, Bouteloua curtipendula, Opuntia phaeacantha*
BigBend_SW	*Dasylirion leiophyllum, Bouteloua curtipendula, Opuntia phaeacantha*
BigBend_W	*Dasylirion leiophyllum, Bouteloua curtipendula, Opuntia phaeacantha*
Boston_dry	Seedlings of *Acer rubrum, Betula lenta, Quercus rubra, Pinus strobus,* planted in grassland with a mix of grasses and forbs
Boston_wet	Seedlings of *Acer rubrum, Betula lenta, Quercus rubra, Pinus strobus,* planted in grassland with a mix of grasses and forbs
Brandbjerg	*Deschapsia flexuosa, Calluna vulgaris*
Caxiuana	*Eschweilera coreacea, Tetragastris panamensis, Manilkara bidentata*
Clocaenog	*Calluna vulgaris*
Coulissenhieb	*Picea abies*
Duolun_20	*Stipa Krylovii, Leymus chinensis, Artemisia frigida, Cleistogenes squarrosa*
Duolun_40	*Stipa Krylovii, Leymus chinensis, Artemisia frigida, Cleistogenes squarrosa*
Duolun_60	*Stipa Krylovii, Leymus chinensis, Artemisia frigida, Cleistogenes squarrosa*
Garraf	*Erica multiflora, Globularia alypum, Dorycnium pentaphyllum*
HarvardForest	*Acer rubrum, Quercus rubra*
Hohenheim_LA	*Triticum aestivum*
Hohenheim_LALF	*Triticum aestivum*
Hohenheim_LF	*Triticum aestivum*
Kiskunsag	*Populus alba, Festuca vaginata*
Mols	*Calluna vulgaris, Deschampsia fluxuosa*
Oldebroek	*Calluna vulgaris, Deschampsia flexuosa, Molinia caerulea*
PortoConte	*Cistus monspeliensis,Helychrisum italicum*
Prades	*Quercus ilex, Phillyrea latifolia, Arbutus unedo*
RaMPs_Alt	*Andropogon gerardii*
RaMPs_Dry	*Andropogon gerardii*
RaMPs_DryAlt	*Andropogon gerardii*
Sevilleta_Wet1	*Bouteloua eriopoda*
Sevilleta_Wet2	*Bouteloua eriopoda*
Solling	*Picea abies*
Stubai	*Anthoxanthum odoratum, Festuca rubra, Alchemilla vulgaris, Leontodon hispidus, Trifolium repens*
SulawesiCacao	*Gliricidia sepium, Theobroma cacao*
SulawesiForest	*Lauraceae, Fagaceae, Sapotaceae, Moraceae and Euphorbiaceae families*
ThuringerSchiefer1	*Dactylis glomerata, Festuca pratensis, Poa trivialis, Taraxacum officinale, Trifolium repens*
ThuringerSchiefer10	*Agrostis tenuis, Anthoxanthum odoratum, Festuca rubra, Meum athamanticum, Rhinanthus minor*
ThuringerSchiefer11	*Agrostis tenuis, Anthoxanthum odoratum, Cynosurus cristatus, Festuca rubra, Meum athamanticum, Plantago lanceolata, Rhinanthus minor, Taraxacum*

	officinale, Trifolium pratense, Trisetum flavescens, Veronica chamaedrys
ThuringerSchiefer12	*Agrostis tenuis, Anthoxanthum odoratum, Deschampsia flexuosa, Festuca rubra, Meum athamanticum, Polygonum bistorta*
ThuringerSchiefer13	*Anthoxanthum odoratum, Chrysanthemum leucanthemum, Dactylis glomerata, Festuca rubra, Geranium sylvaticum, Holcus lanatus, Meum athamanticum, Taraxacum officinale, Trifolium repens, Trisetum flavescens*
ThuringerSchiefer14	*Anthoxanthum odoratum, Chrysanthemum leucanthemum, Geranium sylvaticum, Meum athamanticum, Plantago lanceolata, Trisetum flavescens*
ThuringerSchiefer15	*Agrostis tenuis, Alopecurus pratensis, Anthoxanthum odoratum, Cynosurus cristatus, Dactylis glomerata, Festuca rubra, Geranium sylvaticum, Holcus lanatus, Plantago lanceolata, Taraxacum officinale, Trifolium pratense, Trisetum flavescens*
ThuringerSchiefer16	*Alchemilla vulgaris, Arrhenatherum elatius, Arrhenatherum elatius, dactylis glomerata, Holcus mollis, Taraxacum officinale, Trisetum flavescens*
ThuringerSchiefer17	*Agrostis tenuis, Anthoxanthum odoratum, Arrhenatherum elatius, Dactylis glomerata, Festuca rubra, Holcus lanatus, Poa trivialis, Rumex acetosa, Taraxacum officinale, Trisetum flavescens*
ThuringerSchiefer18	*Agrostis tenuis, Alchemilla vulgaris, Anthoxanthum odoratum, Chrysanthemum leucanthemum, Festuca rubra, Geranium sylvaticum, Meum athamanticum, Plantago lanceolata, Trisetum flavescens*
ThuringerSchiefer19	*Agrostis tenuis, Alchemilla vulgaris, Anthoxanthum odoratum, Festuca rubra, Geranium sylvaticum, Meum athamanticum*
ThuringerSchiefer2	*Dactylis glomerata, Lolium multiflorum, Poa trivialis, Taraxacum officinale, Trifolium repens*
ThuringerSchiefer3	*Anthriscus sylvestris, Dactylis glomerata, Trifolium pratense*
ThuringerSchiefer4	*Anthoxanthum odoratum, Anthriscus sylvestris, Heracleum sphondylium, Hieracium pilosella, Holcus lanatus, Poa trivialis, Ranunculus acris, Taraxacum officinale, Trifolium pratense, Trisetum flavescens*
ThuringerSchiefer5	*Anthoxanthum odoratum, Dactylis glomerata, Holcus lanatus, Hypochoeris radicata, Poa pratensis, Ranunculus acris, Taraxacum officinale*
ThuringerSchiefer6	*Alchemilla vulgaris, Anthriscus sylvestris, Dactylis glomerata, Festuca pratensis, Holcus lanatus, Holcus mollis, Taraxacum officinale, Trifolium repens, Veronica chamaedrys*
ThuringerSchiefer7	*Anthriscus sylvestris, Dactylis glomerata, Festuca pratensis, Heracleum sphondylium, Lolium multiflorum, Poa trivialis, Trifolium pratense*
ThuringerSchiefer8	*Anthriscus sylvestris, Dactylis glomerata, Heracleum sphondylium, Phleum pratense, Poa pratense, Poa trivialis, Rumex obtusifolius, Taraxacum officinale, Trifolium repens*
ThuringerSchiefer9	*Alchemilla vulgaris , Festuca rubra, Hypericum maculatum, Luzula campestris, Meum athamanticum, Ranunculus acris, Veronica chamaedrys*
Tolfa_Dry	*Arbutus unedo, Erica Arborea, Fraxinus ornus*
Tolfa_Wet	*Arbutus unedo, Erica Arborea, Fraxinus ornus*
TurkeyPoint	*Pinus strobus*
WalkerBranch_Dry	*Quercus alba, Quercus prinus, Acer rubrum, Cornus florida*
WalkerBranch_Wet	*Quercus alba, Quercus prinus, Acer rubrum, Cornus florida*

Table S2: Contact details for each experiment. Stars are used when experiments with similar names (with different extensions) all have the same contact.

Experiment	Contact	Email
Achenkirch	Andreas Schindlbacher	andreas.schindlbacher@bfw.gv.at
Almeria	Fernando T Maestre	fernando.maestre@urjc.es
Aranjuez	Fernando T Maestre	fernando.maestre@urjc.es
BigBend_*	Natasja Van Gestel	Natasja.Gestel@ttu.edu
Boston_*	Jeffrey S Dukes	jsdukes@purdue.edu
Brandbjerg	Klaus S Larsen	klas@kt.dtu.dk
Caxiuana	Patrick Meir	pmeir@ed.ac.uk
Clocaenog	Alwyn Sowerby	asowe@ceh.ac.uk
Coulissenhieb	Jan Muhr	jmuhr@bgc-jena.mpg.de
Duolun_*	Shiqiang Wan	swan@henu.edu.cn
Garraf	Josep Peñuelas	josep.penuelas@uab.es
HarvardForest	Kathleen Savage	savage@whrc.org
Hohenheim_*	Christian Poll	Christian.Poll@uni-hohenheim.de
Kiskunsag	Eszter Lellei-Kovács	Lellei-kovacs.eszter@okologia.mta.hu
Mols	Inger Kappel Schmidt	iks@life.ku.dk
Oldebroek	Albert Tietema	a.tietema@uva.nl
PortoConte	Giannetto De Dato	gdd@unitus.it
Prades	Josep Peñuelas	josep.penuelas@uab.es
RaMPs_*	Philip Fay	philip.fay@ars.usda.gov
Sevilleta_*	Scott Collins	scollins@sevilleta.unm.edu
Solling	Werner Borken	werner.borken@uni-bayreuth.de
Stubai	Michael Bahn	michael.bahn@uibk.ac.at
Sulawesi*	Oliver van Straaten	ostraat@gwdg.de
ThuringerSchiefer*	Ansgar Kahmen	ansgar.kahmen@unibas.ch
Tolfa_*	Giorgio Alberti	alberti@uniud.it
TurkeyPoint	Altaf Arain	arainm@mcmaster.ca
WalkerBranch_*	Paul J Hanson	hansonpj@ornl.gov

Table S3: For each experiment with more than 10 data points, the coefficients for the four models (regressions were fitted to the data of the control plots only). The four models are:

(1) $\log(SCE)=a+bST+cSWC$

(2) $\log(SCE)=a+bST+\log(c+dSWC)$

(3) $\log(SCE)=a+bST+\log(c+dSWC+eSWC^2)$

(4) $\log(SCE)=a+bST+cSWC+dSWC^2$

	Model 1			Model 2				Model 3					Model 4			
Experiment	**a**	**b**	**c**	**a**	**b**	**c**	**d**	**a**	**b**	**c**	**d**	**e**	**a**	**b**	**c**	**d**
Achenkirch	-0.18	0.08	-0.40	-0.48	0.08	0.5	-0.66	0.47	0.08	0.5	-2.3	2.5	-4.20	0.08	16.7	-18.1
Aranjuez	-0.42	0.01	0.93	-1.39	0.01	-32.9	-6.77	-1.05	0.01	-1.9	-77.0	299.8	-0.63	0.01	6.8	-26.7
Boston_dry	-0.79	0.06	1.25	-1.04	0.06	-5.9	-1.39	-0.06	0.06	-3.1	28.4	-70.4	1.85	0.06	-24.8	61.4
Boston_wet	-0.79	0.06	1.25	-1.04	0.06	-5.9	-1.39	-0.06	0.06	-3.1	28.4	-70.4	1.85	0.06	-24.8	61.4
Brandbjerg	-0.67	0.05	2.78	-0.90	0.05	-21.4	-1.05	-0.88	0.05	-1.4	-13.2	-34.1	-0.79	0.05	5.1	-10.1
Caxiuana	0.37	0.01	-0.08	-3.05	0.01	-186.6	1033.37	-2.30	0.01	-236.7	3335.6	-7460.3	-0.99	0.01	12.3	-27.4
Clocaenog	-0.50	0.07	0.00	-0.87	0.07	0.0	-0.56	-1.17	0.06	1.1	-3.5	4.1	-0.02	0.06	-2.4	2.8
Coulissenhieb	-0.24	0.05	0.36	-0.61	0.05	-1.2	-1.12	-0.60	0.05	-0.5	-0.3	-0.3	-0.23	0.05	0.3	0.1
Duolun_20	-0.65	0.02	4.70	-1.23	0.03	-116.7	2.28	0.04	0.03	1.3	-46.9	281.1	-3.26	0.03	74.8	-441.6
Duolun_40	-0.65	0.02	4.70	-1.23	0.03	-116.7	2.28	0.04	0.03	1.3	-46.9	281.1	-3.26	0.03	74.8	-441.6
Duolun_60	-0.65	0.02	4.70	-1.23	0.03	-116.7	2.28	0.04	0.03	1.3	-46.9	281.1	-3.26	0.03	74.8	-441.6
HarvardForest	-0.57	0.06	1.08	-1.16	0.06	-9.9	-2.43	-1.20	0.06	-1.7	-9.7	7.1	-0.61	0.06	1.6	-1.7
Hohenheim_LA	-0.88	0.06	-0.17	-1.44	0.06	-0.6	2.09	-1.87	0.06	-1.1	2.4	-2.8	-0.71	0.06	-1.5	1.7
Hohenheim_LALF	-0.88	0.06	-0.17	-1.44	0.06	-0.6	2.09	-1.87	0.06	-1.1	2.4	-2.8	-0.71	0.06	-1.5	1.7
Hohenheim_LF	-0.88	0.06	-0.17	-1.44	0.06	-0.6	2.09	-1.87	0.06	-1.1	2.4	-2.8	-0.71	0.06	-1.5	1.7
Kiskunsag	-0.70	0.01	2.57	-1.07	0.01	-17.7	-1.52	-1.05	0.01	-0.8	-52.7	252.5	-0.85	0.01	7.7	-36.0
Mols	-0.98	0.09	1.53	-1.32	0.08	-7.9	-1.51	-0.95	0.09	-1.9	24.5	-111.9	-0.44	0.09	-8.0	38.4
Oldebroek	-0.83	0.05	0.86	-1.03	0.05	0.1	0.01	-0.69	0.06	1.1	-16.2	42.1	-2.32	0.05	17.6	-45.8

PortoConte	-0.02	0.01	2.11	-0.82	0.02	-2.0	-0.15	-0.65	0.02	-2.8	-70.7	268.1	-0.17	0.02	6.8	-28.2
RaMPs_Alt	0.09	0.03	0.58	-1.74	0.03	-46.2	-16.54	-1.44	0.03	10.6	-304.4	475.7	-0.48	0.03	4.6	-7.2
RaMPs_Dry	0.24	0.03	0.09	-1.59	0.03	-5.5	-21.13	-1.36	0.03	1.9	-230.9	374.7	-0.23	0.03	3.6	-5.8
RaMPs_DryAlt	0.25	0.03	0.09	-1.69	0.03	-7.5	-29.75	-1.39	0.03	3.3	-282.5	459.8	-0.22	0.03	3.7	-6.1
Sevilleta_Wet1	-0.29	0.01	-1.73	-2.56	0.01	407.7	-131.15	-2.75	0.01	-116.2	-746.9	6105.7	-0.63	0.01	3.9	-29.2
Sevilleta_Wet2	-0.29	0.01	-1.73	-2.56	0.01	407.7	-131.15	-2.75	0.01	-116.2	-746.9	6105.7	-0.63	0.01	3.9	-29.2
Solling	-0.73	0.06	0.71	-1.00	0.06	-1.1	-0.22	-0.72	0.06	1.1	-8.3	11.6	-2.64	0.06	12.1	-17.1
Stubai	0.52	0.03	-0.50	-0.28	0.03	1.3	-1.60	-0.07	0.02	1.2	-9.0	11.2	-1.02	0.03	6.8	-8.5
SulawesiCacao_D	-0.24	0.05	-1.31	-4.35	0.05	-11690.1	8444.04	-3.09	0.06	-3904.1	19703.2	-23866.2	-14.71	0.06	67.2	-81.4
SulawesiForest_D	-0.46	0.00	1.87	-3.18	0.00	13646.9	-3298.65	-3.13	0.00	-7005.0	29376.3	-15534.6	-1.90	0.00	8.0	-6.5
ThuringerSchiefer1	-0.18	0.04	1.10	-0.78	0.04	-13.5	-2.85	-0.82	0.04	-3.0	-3.7	-19.9	-0.16	0.04	0.9	0.4
ThuringerSchiefer2	-0.57	0.05	2.65	-1.14	0.05	-56.3	-1.45	-1.28	0.05	-3.9	-29.9	-147.1	-0.61	0.05	3.3	-1.8
ThuringerSchiefer3	0.01	0.03	1.03	-0.81	0.03	-21.8	-4.68	-0.66	0.03	-2.2	-31.6	42.8	-0.04	0.03	2.3	-3.3
ThuringerSchiefer4	-0.34	0.05	1.11	-1.05	0.05	-18.2	-2.68	-0.81	0.05	-0.6	-54.6	112.5	-0.54	0.05	4.8	-9.6
ThuringerSchiefer5	-0.42	0.04	2.36	-1.18	0.05	-70.6	-0.79	-1.27	0.04	-0.2	-135.3	131.5	-0.79	0.05	6.1	-9.5
ThuringerSchiefer6	-0.23	0.04	1.59	-0.96	0.05	-37.4	-0.56	-0.94	0.04	2.0	-93.7	149.2	-0.81	0.05	6.8	-11.9
ThuringerSchiefer7	-0.08	0.04	1.23	-0.64	0.04	-12.0	-1.48	-0.60	0.04	-0.7	-20.4	24.9	-0.23	0.04	3.1	-4.3
ThuringerSchiefer8	-0.11	0.04	1.07	-0.62	0.04	-13.5	-1.61	-0.32	0.04	-0.1	-30.0	61.5	-0.40	0.04	5.5	-11.3
ThuringerSchiefer9	-0.75	0.07	1.00	-1.36	0.07	-14.7	-2.51	-1.39	0.07	-2.0	-33.3	38.2	-0.86	0.07	2.6	-3.3
ThuringerSchiefer10	-0.54	0.06	1.09	-1.10	0.06	-14.0	-1.84	-0.95	0.06	-0.8	-20.6	27.4	-0.71	0.06	2.9	-4.0
ThuringerSchiefer11	-0.42	0.05	1.21	-1.32	0.06	-39.8	-1.41	-0.82	0.05	1.2	-51.1	81.3	-0.77	0.05	5.3	-8.4
ThuringerSchiefer12	-0.17	0.05	0.79	-0.60	0.05	-5.3	-1.28	-0.66	0.05	1.2	-46.7	90.0	-0.62	0.05	5.3	-10.1
ThuringerSchiefer13	-0.23	0.05	0.65	-0.81	0.06	-5.9	-1.14	-0.75	0.06	1.7	-45.8	75.2	-0.83	0.06	5.9	-9.8
ThuringerSchiefer14	-0.78	0.08	1.32	-1.24	0.07	-9.5	-0.88	-1.27	0.07	-0.1	-27.7	40.1	-0.92	0.07	3.7	-5.4
ThuringerSchiefer15	-0.57	0.07	1.33	-1.00	0.07	-10.9	-1.27	-1.02	0.06	-1.3	-34.2	59.9	-0.69	0.06	4.3	-7.9
ThuringerSchiefer16	-0.47	0.05	1.35	-1.02	0.06	-19.9	-1.36	-0.84	0.05	-0.6	-36.9	62.8	-0.65	0.05	4.4	-7.7
ThuringerSchiefer17	-0.19	0.04	1.28	-1.34	0.05	-89.1	-2.03	-0.62	0.04	2.0	-93.6	242.7	-0.97	0.04	12.1	-30.2
ThuringerSchiefer18	-0.37	0.05	0.76	-0.94	0.06	-5.6	-1.19	-0.91	0.05	-0.3	-33.2	60.8	-0.68	0.05	4.0	-7.4
ThuringerSchiefer19	-0.49	0.06	0.84	-1.18	0.06	-12.7	-3.05	-1.09	0.06	-1.7	-20.3	25.7	-0.58	0.06	2.0	-2.5
Tolfa_Dry	0.29	0.01	0.19	-1.26	0.02	-19.2	-9.22	-0.36	0.01	-3.6	-21.1	68.0	-0.10	0.01	5.3	-14.3
Tolfa_Wet	0.00	0.02	0.94	-1.33	0.04	18.8	1.50	-0.28	0.01	-2.5	-21.1	54.6	-0.36	0.02	6.1	-15.0
TurkeyPoint	0.09	0.05	-0.91	0.39	0.05	-0.1	0.06	-0.22	0.05	2.4	-16.5	48.6	0.30	0.05	-3.9	10.6

WalkerBranch_Dry	-0.64	0.04	1.91	-2.54	0.05	-455.0	-20.53	-2.29	0.05	10.8	-542.1	865.1	-0.96	0.05	4.7	-7.7
WalkerBranch_Wet	-0.62	0.04	1.86	-2.51	0.04	-409.6	-20.32	-2.28	0.05	10.8	-540.3	868.1	-0.96	0.05	4.7	-7.8

Table S4: For each experiment with more than 10 data points the p value, R^2 and second-order Akaike criterion (AICc) for the four models (see Table S3 for more info).

	Model 1			**Model 2**			**Model 3**			**Model 4**		
Experiment	**p value**	**R^2**	**AICc**	**p value**	**R^2**	**AICc**	**p value**	**R^2**	**AICc**	**p value**	**R^2**	**AICc**
Achenkirch	<0.01	0.90	-311	<0.01	0.90	-308	<0.01	0.90	-310	<0.01	0.90	-313
Aranjuez	0.14	0.08	-94	0.07	0.12	-92	<0.01	0.38	-100	<0.01	0.37	-102
Boston_dry	<0.01	0.86	-30	<0.01	0.85	-24	<0.01	0.95	-29	<0.01	0.93	-32
Boston_wet	<0.01	0.86	-30	<0.01	0.85	-24	<0.01	0.95	-29	<0.01	0.93	-32
Brandbjerg	<0.01	0.63	-664	<0.01	0.63	-662	<0.01	0.63	-660	<0.01	0.63	-662
Caxiuana	0.39	0.04	-119	0.39	0.04	-116	<0.01	0.48	-126	<0.01	0.49	-130
Clocaenog	<0.01	0.56	-280	<0.01	0.56	-277	<0.01	0.59	-281	<0.01	0.58	-283
Coulissenhieb	<0.01	0.86	-178	<0.01	0.86	-175	<0.01	0.86	-172	<0.01	0.86	-175
Duolun_20	0.02	0.22	-51	<0.01	0.30	-50	<0.01	0.50	-54	<0.01	0.53	-59
Duolun_40	0.02	0.22	-51	<0.01	0.30	-50	<0.01	0.50	-54	<0.01	0.53	-59
Duolun_60	0.02	0.22	-51	<0.01	0.30	-50	<0.01	0.50	-54	<0.01	0.53	-59
HarvardForest	<0.01	0.82	-194	<0.01	0.82	-191	<0.01	0.82	-189	<0.01	0.82	-191
Hohenheim_LA	<0.01	0.71	-109	<0.01	0.71	-106	<0.01	0.71	-104	<0.01	0.71	-107
Hohenheim_LALF	<0.01	0.71	-109	<0.01	0.71	-106	<0.01	0.71	-104	<0.01	0.71	-107
Hohenheim_LF	<0.01	0.71	-109	<0.01	0.71	-106	<0.01	0.71	-104	<0.01	0.71	-107
Kiskunsag	<0.01	0.35	-237	<0.01	0.37	-237	<0.01	0.40	-238	<0.01	0.38	-238
Mols	<0.01	0.79	-50	<0.01	0.79	-46	<0.01	0.80	-43	<0.01	0.80	-47
Oldebroek	<0.01	0.69	-252	<0.01	0.69	-250	<0.01	0.76	-268	<0.01	0.73	-262
PortoConte	<0.01	0.15	-174	<0.01	0.22	-175	<0.01	0.30	-178	<0.01	0.30	-181
RaMPs_Alt	<0.01	0.41	-825	<0.01	0.44	-830	<0.01	0.61	-900	<0.01	0.58	-890
RaMPs_Dry	<0.01	0.36	-306	<0.01	0.36	-304	<0.01	0.48	-317	<0.01	0.47	-318
RaMPs_DryAlt	<0.01	0.32	-301	<0.01	0.32	-299	<0.01	0.45	-312	<0.01	0.45	-314
Sevilleta_Wet1	<0.01	0.36	-737	<0.01	0.39	-743	<0.01	0.48	-768	<0.01	0.47	-768
Sevilleta_Wet2	<0.01	0.36	-737	<0.01	0.39	-743	<0.01	0.48	-768	<0.01	0.47	-768
Solling	<0.01	0.82	-1356	<0.01	0.82	-1358	<0.01	0.85	-1411	<0.01	0.85	-1412
Stubai	<0.01	0.57	-1788	<0.01	0.57	-1789	<0.01	0.61	-1821	<0.01	0.61	-1819

SulawesiCacao	<0.01	0.22	-226	<0.01	0.23	-224	<0.01	0.35	-230	<0.01	0.37	-234
SulawesiForest	<0.01	0.38	-334	<0.01	0.38	-332	<0.01	0.38	-329	<0.01	0.39	-332
ThuringerSchiefer1	<0.01	0.72	-59	<0.01	0.71	-55	<0.01	0.72	-50	<0.01	0.72	-55
ThuringerSchiefer2	<0.01	0.80	-49	<0.01	0.79	-44	<0.01	0.80	-39	<0.01	0.81	-45
ThuringerSchiefer3	0.04	0.34	-41	0.03	0.35	-37	0.03	0.36	-31	0.03	0.35	-37
ThuringerSchiefer4	<0.01	0.50	-39	<0.01	0.53	-36	<0.01	0.60	-33	<0.01	0.59	-38
ThuringerSchiefer5	<0.01	0.62	-45	<0.01	0.80	-50	<0.01	0.82	-46	<0.01	0.75	-47
ThuringerSchiefer6	<0.01	0.51	-43	<0.01	0.65	-43	<0.01	0.74	-43	<0.01	0.67	-45
ThuringerSchiefer7	<0.01	0.69	-51	<0.01	0.71	-48	<0.01	0.73	-43	<0.01	0.72	-48
ThuringerSchiefer8	<0.01	0.59	-47	<0.01	0.64	-45	<0.01	0.78	-48	<0.01	0.75	-51
ThuringerSchiefer9	<0.01	0.81	-53	<0.01	0.83	-50	<0.01	0.83	-46	<0.01	0.83	-51
ThuringerSchiefer10	<0.01	0.73	-44	<0.01	0.75	-41	<0.01	0.78	-37	<0.01	0.76	-41
ThuringerSchiefer11	<0.01	0.54	-32	<0.01	0.63	-30	<0.01	0.74	-29	<0.01	0.67	-32
ThuringerSchiefer12	<0.01	0.46	-33	<0.01	0.47	-29	<0.01	0.55	-26	<0.01	0.52	-31
ThuringerSchiefer13	<0.01	0.60	-37	<0.01	0.62	-34	<0.01	0.82	-40	<0.01	0.73	-38
ThuringerSchiefer14	<0.01	0.83	-42	<0.01	0.86	-40	<0.01	0.88	-36	<0.01	0.87	-41
ThuringerSchiefer15	<0.01	0.90	-56	<0.01	0.93	-57	<0.01	0.96	-60	<0.01	0.96	-65
ThuringerSchiefer16	<0.01	0.64	-43	<0.01	0.72	-42	<0.01	0.79	-42	<0.01	0.73	-43
ThuringerSchiefer17	0.02	0.40	-36	<0.01	0.53	-35	<0.01	0.87	-49	<0.01	0.83	-50
ThuringerSchiefer18	<0.01	0.75	-48	<0.01	0.77	-45	<0.01	0.86	-47	<0.01	0.83	-50
ThuringerSchiefer19	<0.01	0.81	-54	<0.01	0.82	-51	<0.01	0.83	-47	<0.01	0.82	-51
Tolfa_Dry	<0.01	0.81	-1850	<0.01	0.05	-1851	<0.01	0.36	-2076	<0.01	0.39	-2026
Tolfa_Wet	<0.01	0.04	-2938	<0.01	0.20	-3017	<0.01	0.44	-3340	<0.01	0.85	-3272
TurkeyPoint	<0.01	0.84	-442	<0.01	0.84	-439	<0.01	0.85	-440	<0.01	0.85	-441
WalkerBranch_Dry	<0.01	0.58	-88	<0.01	0.60	-86	<0.01	0.63	-84	<0.01	0.59	-86
WalkerBranch_Wet	<0.01	0.61	-94	<0.01	0.64	-92	<0.01	0.66	-90	<0.01	0.63	-92

Test for artefacts

To test whether the outcome of the trend analysis could be related to erroneous soil water content (SWC) recordings (e.g., following soil drying and soil disruption), we simulated water availability using a simple bucket model, and then used this estimation to test the hypothesis (H1) that we can extrapolate current moisture responses of soil CO_2 efflux (SCE) to predict SCE in the treatment ($SCE_{treatment}$). Similar to the analyses described in the paper, we first selected the experiments with a reliable model for the control plots, i.e., the residuals should be normally distributed (Lilliefors test; $p>0.05$ indicates normal distribution). We then specified two criteria indicative for goodness of extrapolation from control conditions to treatment conditions to test H1:

(1) The difference between $SCE_{treatment}$ predicted by the control model (further termed 'predicted $SCE_{treatment}$') and observed $SCE_{treatment}$ followed a normal distribution (Lilliefors test). This test allows rejection of H1 for experiments where residuals show atypical patterns, but is only valid when residuals of the control model are normally distributed.

(2) The RMSE for predicted $SCE_{treatment}$ was less than double the RMSE for predicted $SCE_{control}$.

When both conditions were fulfilled, the prediction of $SCE_{treatment}$ was considered reasonable and H1 was not rejected. H1 was rejected when at least one criterion was not met. Note that this test is only performed on the full dataset, and not on a subset (as was done for the SWC approach), because the range of available water estimated from the bucket model was very similar for control and treatment for all experiments used here (data not shown).

The analyses described above were considered reliable only when the R^2 of the control model was higher than 0.3 and when residuals of the control were normally distributed. For 14 of the 21 experiments with a reliable control model, both the bucket model approach and the SWC approach gave the same result for the test of H1 (Table S5). For five of these 21 experiments, results based on the SWC approach were not robust, and only for two experiments, the bucket model approach and the SWC approach yielded different results. For both experiments, relatively few data points were available. It is beyond the scope of the current study to fully unravel reasons for mismatches between both analyses (as both the model and the SWC measurements potentially give erroneous results, or differences may lay in the thresholds we set for reliability of the control model or for rejecting H1).

Table S5: Results of test for potential artefacts. The R² reflects the goodness of fit for the control model using model 4 but with SWC replaced by water availability calculated from the bucket model. The p value for normality indicates whether or not the residuals for the control model were normally distributed. We further show the results of the two tests that we performed to test the hypothesis H1: 'h1' is the p-value of the Lilliefors test for normality, 'h2' shows the ratio of $RMSE_{treatment}$ to $RMSE_{control}$. 'H' indicates whether or not H1 was rejected (see Methods for details). Results for hypothesis tests are shown only when the R² of the control model was above 0.3 (below which we consider the control model not useful for the current analysis), and when the residuals for the control were normally distributed (Lilliefors test)). For comparison, 'Robust H SWC' indicates whether results based on SWC measurements were robust or not (as given in Table C1). Only for 16 experiments was this comparison possible. For two of these the bucket model approach did not correspond to the approach using SWC measurement (indicated in italics).

Experiment	**R²**	**p normality**	**h1**	**h2**	**H**	**Robust H SWC**
Aranjuez	0.03	0.5	NA	NA	NA	0
Boston_dry	0.9	0.03	NA	NA	NA	NA
Boston_wet	0.9	0.03	NA	NA	NA	0
Brandbjerg	0.55	0.37	0.06	1.44	0	0
Caxiuana	0.09	0.5	NA	NA	NA	1
Clocaenog	0.68	0.5	0.19	0.97	0	0
Coulissenhieb	0.8	0.01	NA	NA	NA	1
Duolun_20	0.17	0.17	NA	NA	NA	1
Duolun_40	0.17	0.17	NA	NA	NA	0
Duolun_60	0.17	0.17	NA	NA	NA	NA
HarvardForest	0.78	0.5	0.28	1.64	0	0
Hohenheim_LA	0.72	0.5	0.35	1.14	0	0
Hohenheim_LALF	0.72	0.5	**0.03**	1.12	1	NA
Hohenheim_LF	0.72	0.5	0.5	1.05	0	0
Kiskunsag	0.22	0.11	NA	NA	NA	0
Mols	NA	NA	NA	NA	NA	0
Oldebroek	0.64	0.18	**0**	1.32	1	NA
PortoConte	0.01	0.2	NA	NA	NA	0
RaMPs_Dry	0.45	0.36	0.5	1.11	0	0
RaMPs_DryAlt	0.44	0.3	0.24	1.56	0	0
Sevilleta_Wet1	0.2	0	NA	NA	NA	1
Sevilleta_Wet2	0.2	0	NA	NA	NA	1
Solling	0.86	0.5	**0**	2.76	1	1
Stubai	0.38	0.32	**0**	4.94	1	1
SulawesiCacao	0.22	0.5	NA	NA	NA	1
SulawesiForest	0.29	0.5	NA	NA	NA	0
ThuringerSchiefer1	0.45	0.5	0.5	1.22	0	0

ThuringerSchiefer2	0.22	0.48	0.5	1.35	0	NA
ThuringerSchiefer3	0.37	0.33	0.5	1.12	0	NA
ThuringerSchiefer4	0.5	0.09	0.14	1.12	0	0
ThuringerSchiefer7	0.49	0.5	0.07	1.48	1	NA
ThuringerSchiefer8	0.51	0	NA	NA	NA	0
ThuringerSchiefer9	0.76	0.5	0.18	1.03	0	0
ThuringerSchiefer10	0.67	0.01	NA	NA	NA	0
ThuringerSchiefer11	0.46	0.04	NA	NA	NA	0
ThuringerSchiefer12	0.45	0.13	0.07	0.87	0	0
ThuringerSchiefer13	0.57	0	NA	NA	NA	0
ThuringerSchiefer14	0.73	0.01	NA	NA	NA	0
ThuringerSchiefer15	*0.77*	*0.07*	***0.01***	*1.43*	*1*	*0*
ThuringerSchiefer16	*0.51*	*0.12*	***0.02***	*1.05*	*1*	*0*
ThuringerSchiefer17	0.38	0	NA	NA	NA	NA
ThuringerSchiefer18	0.69	0.03	NA	NA	NA	0
TurkeyPoint	0.89	0.37	0	**3.96**	1	1
WalkerBranch_Dry	0.69	0.02	NA	NA	NA	0
WalkerBranch_Wet	0.7	0.01	NA	NA	NA	0