Supplement

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2.1 Field Campaign

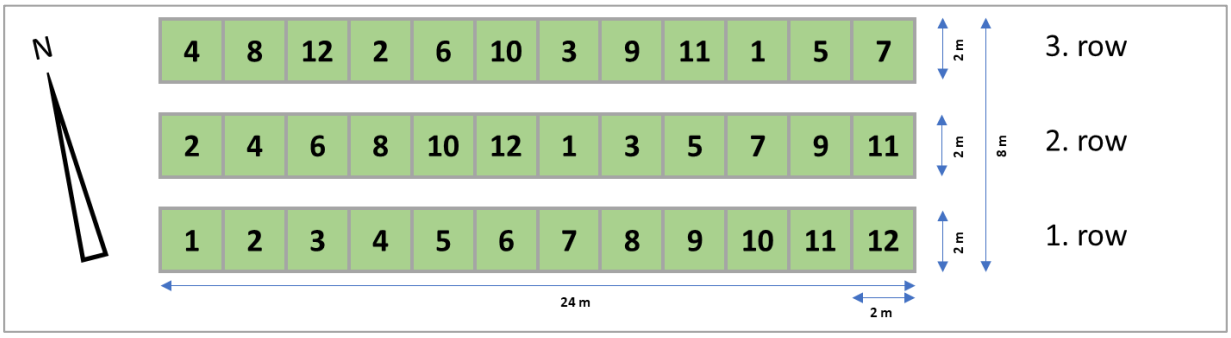

Figure S 1: Arrangement of the 12 green roof variants used in the field campaign. Location: 52°23'32.2"N 9°42'12.3"E; 52.392278, 9.703417

Table S 1: Grain size distribution of the materials used as substrates.

Grain fraction	Grain size [mm]	Lava 2/8		Pumice 2/8		Expanded clay 2/10		Multi-layer substrate		Vegetation mat	
Middle grained gravel	16.0 - 20.0	-		-		-		-		-	
Middle grained gravel	8.0 - 16.0	7.8	20.0	4.9	17.7	-		9.9	19.7	4.6	12.5
Middle grained gravel	6.3 - 8.0	12.2		12.8		2.2		9.8		7.9	
Fine grained gravel	4.0 - 6.3	25.1	59.8	37.1	71.1	54.4	88.4	27.5	59.5	12.9	25.1
Fine grained gravel	2.0 - 4.0	34.7		34.0		34.0		32.0		12.2	
Coarse sand	0.63 - 2.0	11.5		3.5		3.2		9.5		4.9	
Medium sand	0.2 - 0.63	3.1	17.5	4.1	8.7	1.4	6.7	4.4	16.9	27.2	49.0
Fine sand	0.063 - 0.2	2.9		1.1		2.1		3.0		16.9	
Silt and clay	< 0.063	2.7		2.5		2.7		3.9		13.4	
		100.0		100.0		100.0		100.0		100.0	

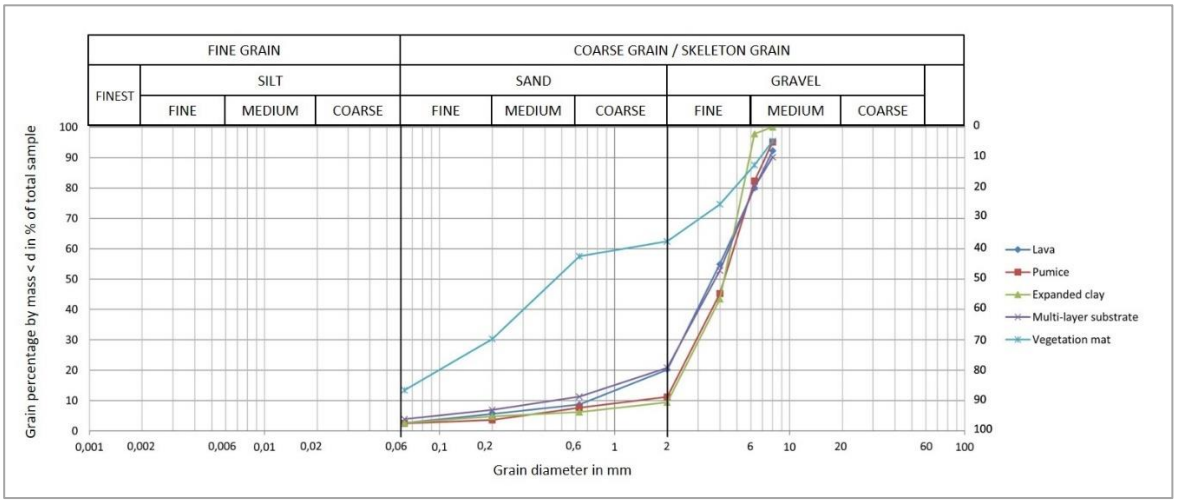

Figure S 2: Grain-size distribution curves of the materials used as substrates (according to Table S1).

Table S 2: Volume weight (dry, at delivery and max. water) and water content at delivery of the different materials used as substrates.

Substrate	Bulk density (Volume weight)			Water content at delivery at laboratory compression	
	Dry	at delivery	max. water		
	g m^{-3}	g m^{-3}	g m^{-3}	%mass	Vol.%
Lava 2/8	1.16	1.27	1.35	9.60	11.00
Pumice 2/8	0.70	0.94	0.99	34.80	24.40
Expanded clay 2/10	0.36	0.38	0.61	3.50	1.30
Multi-layer substrate	1.09	1.30	1.43	19.40	21.20
Vegetation mat	1.51	1.64	1.88	8.70	13.20

Table S 3: Maximum water capacity and infiltration rate of the materials used as substrates.

Substrate	Max. water capacity		Infiltration rate	
	%mass	Vol.%	cm s^{-1}	mm min^{-1}
Lava 2/8	16.60	19.30	> 1	> 600
Pumice 2/8	42.10	29.40	> 1	> 600
Expanded clay 2/10	67.80	24.80	> 1	> 600
Multi-layer substrate	31.20	34.00	0.36	217.20
Vegetation mat	24.10	36.40	0.00076	0.46

Table S 4: Total pore volume, air volume and volume reduction of the materials used as substrates.

Substrate	Total pore volume	Air volume		Volume reduction at laboratory compression
		max. water capacity	at pF 1,8	
	Vol.%	Vol.%	Vol.%	Vol.%
Lava 2/8	56.40	37.10	-	13.50
Pumice 2/8	74.30	44.90	-	13.20
Expanded clay 2/10	87.50	62.70	-	18.10
Multi-layer substrate	62.70	28.70	41.30	31.80
Vegetation mat	45.60	9.20	23.60	31.00

Table S 5: Organic material, pH-values, carbonate and salt contents of the materials used as substrates.

Substrate	Organic material %mass	pH-value in $CaCl_2$	Carbonate g l^{-1}	Salt g l^{-1}
Lava 2/8	-	6.80	1.89	0.24
Pumice 2/8	-	6.60	0.72	0.20
Expanded clay 2/10	-	5.90	1.48	1.21
Multi-layer substrate	2.60	6.60	3.16	0.51
Vegetation mat	1.70	6.50	5.45	0.54

Table S 6: Bulk materials: Comparison to requirements of the FLL-Guidline (2002)

Properties	**Requirements**		**Result**		
	Unit	Value	Lava 2/8 mm	Pumice 2/8 mm	Expanded clay 2/10 mm
Particle size distribution					
- proportion of silting components (d ≤ 0,063 mm)	%mass	≤ 7	2.7	2.5	2.7
- proportion of fine / medium gravel (d ≤ 4,0 mm)	%mass	≥ 25	45.1	54.8	56.6
Bulk density (Volume weight)[1)]					
- dry	g cm^{-3}	-	1.16	0.7	0.36
- at max. water capacity	g cm^{-3}	-	1.35	0.99	0.61
Water- / air-capacity					
- total pore volume[1)]	Vol.-%	-	56.4	74.3	87.5
- max. water capacity	Vol.-%	≥ 20	19.3	29.4	24.8
- air capacity at max. water capacity	Vol.-%	≥ 10	37.1	44.9	62.7
- water permeability (mod. Kf)	cm s^{-1}	≥ 0.1	> 1	> 1	> 1
	mm min^{-1}	≥ 60	> 600	> 600	> 600
pH-value, carbonate and salt					
- pH-value (in $CaCl_2$)		6.5 - 9.5	6.8	6.6	5.9
- carbonate (SCHEIBLER)	g l^{-1}	-	1.89	0.72	1.48
- salt content (water extract)	g l^{-1}	≤ 3.5	0.24	0.2	1.21
- salt content (gypsum extract)[2)]	g l^{-1}	≤ 2.5	-	-	-

(All values are derived from a condition of defined laboratory compaction).
1) no requirements
2) if applicable

Table S 7: Multi-layer substrate: Comparison to requirements of the FLL-Guidline (2002)

Properties	Requirements		Result	
	Unit	Value	Multi-layer substrate	Vegetation mat (substrate)
particle size distribution				
- proportion of silting components (d ≤ 0,063 mm)	%mass	≤ 15	3.9	13.4
- proportion of fine / medium gravel (d ≤ 2,0 mm)	%mass	-	79.2	37.6
Bulk density (Volume weight)[1)]				
- dry				
- light, at bulk density ≤ 0,8 g cm^{-3}	g cm^{-3}	-	-	-
- heavy, at bulk density > 0,8 g cm^{-3}	g cm^{-3}	-	1.09	1.51
- at max. water capacity	g cm^{-3}	-	1.43	1.88
Water- / air-capacity				
- total pore volume[1)]	Vol.-%	-	62.7	45.6
- max. water capacity	Vol.-%	≥ 35	34	36.4
- air capacity at max. water capacity	Vol.-%	≥ 10	28.7	9.2
- air capacity at pF 1,8 [2)]		≥ 25	41.3	23.6
- water permeability (mod. Kf*)	cm s^{-1}	≥ 0.001	0.36	0.00076
	mm min^{-1}	≥ 0.6	217.2	0.46
pH-value, carbonate and salt				
- pH-value (in $CaCl_2$)		6.5 - 8.0	6.6	6.5
- carbonate (SCHEIBLER)	g l^{-1}	-	3.16	5.45
- salt content (water extract)	g l^{-1}	≤ 3.5	0.51	0.54
- salt content (gypsum extract)[2)]	g l^{-1}	≤ 2.5	-	-
Organic substance				
- organic matter content				
- at bulk density ≤ 0,8 g cm^{-3}	%mass	≤ 8.0	-	-
- at bulk density > 0,8 g cm^{-3}	%mass	≤ 6.0	2.6	1.7
Nutrients				
- plant available nutrients				
- Nitrogen (N)	mg l^{-1}	≤ 80	n.d.	n.d.
- Phosphorus (P_2O_5)	mg l^{-1}	≤ 200	n.d.	n.d.
- Potassium (K_2O)	mg l^{-1}	≤ 700	n.d.	n.d.
- Magnesium (Mg)	mg l^{-1}	≤ 160	n.d.	n.d.

(All values are derived from a condition of defined laboratory compaction).
1) no requirements
2) if applicable
n.d. = not determined

Table S 8: Construction technique and material properties of the different green roof variants (1/2).

variant	construction technique and material description	thickness	weight		water storage capacity
			dry	max. water capacity	
		cm	kg m^{-2}	kg m^{-2}	l m^{-2}
1	vegetation mat	2.5	24.6	40.9	16.3
	protection fleece 300 g m^{-2}				
	geotextile recycling	0.2	0.3	2.6	2.3
		2.7	24.9	43.5	18.6
2	vegetation mat	2.5	24.6	40.9	16.3
	drainage and filtration mat				
	netting with filtration fleece	1.5	0.4	0.8	0.4
		4.0	25.0	41.7	16.7
3	vegetation mat	2.5	24.6	40.9	16.3
	water retention mat 800 g m^{-2}				
	geotextile recycling	0.6	0.9	8.2	7.3
		3.1	25.5	49.1	23.6
4	vegetation mat	2.5	24.6	40.9	16.3
	water retention mat 1200 g m^{-2}				
	geotextile recycling	0.8	1.3	10.6	9.3
		3.3	25.9	51.5	25.6
5	vegetation mat	2.5	24.6	40.9	16.3
	water retention mat 800 g m^{-2}	0.6	0.9	8.2	7.3
	drainage and filtration mat				
	netting with filtration fleece	1.5	0.4	0.8	0.4
		4.6	25.9	49.9	24.0
6	vegetation mat	2.5	24.6	40.9	16.3
	water retention mat 1200 g m^{-2}	0.8	1.3	10.6	9.3
	drainage and filtration mat				
	netting with filtration fleece	1.5	0.4	0.8	0.4
		4.8	26.3	52.3	26.0

Table S 9: Construction technique and material properties of the different green roof variants (2/2).

variant	construction technique and material description	thickness	weight		water storage capacity
			dry	max. water capacity	
		cm	kg m^{-2}	kg m^{-2}	l m^{-2}
7	vegetation mat	2.5	24.6	40.9	16.3
	single-layer substrate light pumice 2/8 mm	4.0	28.0	39.6	11.6
	protection fleece 300 g m^{-2}				
	geotextile recycling	0.2	0.3	2.6	2.3
		6.7	52.9	83.1	30.2
8	vegetation mat	2.5	24.6	40.9	16.3
	single-layer substrate light expanded clay 2/10 mm	4.0	14.4	24.4	10.0
	protection fleece 300 g m^{-2}				
	geotextile recycling	0.2	0.3	2.6	2.3
		6.7	39.3	67.9	28.6
9	vegetation mat	2.5	24.6	40.9	16.3
	single-layer substrate heavy lava 2/8 mm	4.0	46.4	54.0	7.6
	protection fleece 300 g m^{-2}				
	geotextile recycling	0.2	0.3	2.6	2.3
		6.7	71.3	97.5	26.2
10	vegetation mat	2.5	24.6	40.9	16.3
	gravel course granulation 16/32 mm	5.0	72.0	74.0	2.0
	protection fleece 300 g m^{-2}				
	geotextile recycling	0.2	0.3	2.6	2.3
		7.7	96.9	117.5	20.6
11	vegetation mat	2.5	24.6	40.9	16.3
	multi-layer substrate lava with dolomite and organic matter	3.0	32.7	42.9	10.2
	drainage and filtration mat				
	netting with filtration fleece	1.5	0.4	0.8	0.4
		7.0	57.7	84.6	26.9
12	vegetation mat	2.5	24.6	40.9	16.3
	multi-layer substrate lava with dolomite and organic matter	6.0	65.4	85.8	20.4
	drainage and filtration mat				
	netting with filtration fleece	1.5	0.4	0.8	0.4
		10.0	90.4	127.5	37.1

Variant 4: vegetation mat on protection fleece 1200 g m^{-2}; at plants sprout (2004-05-19) and…

… at flowering time (2004-07-07)

Variant 7: vegetation mat on 4 cm single-layer substrate light (pumice 2/8 mm) and protection fleece 300 g m^{-2}; at plants sprout (2004-05-19) and…

… at flowering time (2004-07-07)

Variant 12: vegetation mat on 6 cm multi-layer substrate (lava with dolomite and organic matter) and protection fleece 300 g m^{-2}; at plants sprout (2004-05-19) and…

… at flowering time (2004-07-07)

Figure S 3: Sedum development registered during the year 2004.

Table S 10: Results of the thirteen classification days of the total vegetation coverage and coverage share of the different vegetation groups, for the period 2002 to 2006 (vegetation surveys with ELLENBERG indicator values) (1/3)

vegetation group	coverage in %											
classification day	1	2	3	4	5	6	7	8	9	10	11	12
total coverage												
2002-07-30	86	83	98	93	92	91	99	86	98	91	100	97
2002-10-10	68	63	95	90	66	79	98	90	97	86	96	99
2003-05-09	30	59	66	64	61	62	95	80	75	86	73	91
2003-07-08	43	65	77	83	87	85	98	96	93	97	95	97
2003-09-10	52	73	86	87	95	91	99	99	98	99	99	99
2004-05-19	53	75	93	97	99	98	100	100	99	100	100	100
2004-07-08	65	82	97	99	99	98	100	100	100	100	100	99
2004-09-10	66	85	98	99	100	99	100	100	99	100	100	100
2005-05-11	80	94	99	99	100	99	100	100	100	100	100	100
2005-07-05	68	88	96	100	100	100	100	100	100	100	100	100
2005-09-12	70	90	98	100	99	100	100	100	100	100	100	100
2006-05-19	91	90	100	100	100	100	100	100	100	99	100	100
2006-07-11	89	88	99	100	100	99	100	100	100	100	100	100
succulent (sow)												
2002-07-30	< 1	3	4	3	4	4	1	1	1	3	1	1
2002-10-10	39	57	67	43	43	54	8	27	33	37	18	40
2003-05-09	28	59	60	60	60	57	46	60	54	76	66	56
2003-07-08	43	65	77	83	87	85	88	91	93	96	94	91
2003-09-10	52	73	86	86	95	90	81	89	98	98	98	89
2004-05-19	53	75	93	97	99	97	92	91	99	100	100	96
2004-07-08	64	82	97	99	99	98	100	100	100	100	100	98
2004-09-10	65	84	98	99	100	99	100	99	99	100	100	100
2005-05-11	76	92	99	97	99	98	94	93	98	98	99	99
2005-07-05	65	86	96	100	100	100	100	98	100	100	100	100
2005-09-12	52	87	93	98	98	99	99	98	97	99	98	99
2006-05-19	63	79	91	97	98	99	93	96	93	96	96	96
2006-07-11	66	81	90	97	97	97	98	95	96	96	97	97

Table S 11: Results of the thirteen classification days of the total vegetation coverage and coverage share of the different vegetation groups, for the period 2002 to 2006 (vegetation surveys with ELLENBERG indicator values) (2/3)

vegetation group	coverage in %											
classification day	1	2	3	4	5	6	7	8	9	10	11	12
herbs (sow)												
2002-07-30	78	78	87	83	85	84	93	68	90	84	86	90
2002-10-10	7	2	17	19	9	10	65	24	29	24	55	44
2003-05-09	2	<1	5	2	<1	4	48	16	17	8	7	34
2003-07-08	-	-	<1	<1	<1	<1	9	5	<1	1	1	6
2003-09-10	<1	-	<1	<1	<1	<1	17	9	<1	1	1	10
2004-05-19	-	-	<1	<1	<1	<1	7	9	<1	<1	<1	4
2004-07-08	<1	-	-	-	-	<1	<1	<1	-	-	<1	1
2004-09-10	<1	<1	-	-	-	-	<1	1	-	-	<1	<1
2005-05-11	-	-	<1	1	1	<1	6	6	<1	<1	<1	6
2005-07-05	-	-	-	-	-	-	-	2	-	-	-	<1
2005-09-12	-	-	-	<1	-	<1	<1	<1	-	-	<1	<1
2006-05-19	-	-	-	-	-	-	-	1	-	r	-	-
2006-07-11	-	-	-	-	-	-	r	1	-	-	-	1
grass (spontaneous)												
2002-07-30	8	2	7	7	3	3	5	17	7	4	13	6
2002-10-10	22	4	11	28	14	15	25	39	35	25	23	15
2003-05-09	<1	<1	1	2	1	1	1	4	4	2	<1	1
2003-07-08	<1	-	<1	<1	<1	<1	1	<1	<1	<1	<1	<1
2003-09-10	<1	-	<1	1	<1	<1	1	1	<1	<1	<1	<1
2004-05-19	-	-	-	-	-	1	1	<1	<1	-	-	<1
2004-07-08	<1	-	-	-	-	<1	<1	<1	-	-	-	-
2004-09-10	-	-	-	-	-	<1	<1	<1	-	-	-	<1
2005-05-11	<1	-	-	-	-	<1	<1	<1	-	<1	<1	<1
2005-07-05	-	-	-	-	-	-	<1	<1	-	-	-	-
2005-09-12	-	-	-	-	-	<1	<1	<1	-	-	-	<1
2006-05-19	-	-	-	-	-	r	2	1	-	r	1	2
2006-07-11	-	-	-	-	-	-	1	1	-	-	-	r

Table S 12: Results of the thirteen classification days of the total vegetation coverage and coverage share of the different vegetation groups, for the period 2002 to 2006 (vegetation surveys with ELLENBERG indicator values) (3/3)

vegetation group	coverage in %											
classification day	1	2	3	4	5	6	7	8	9	10	11	12
moose (spontaneous)												
2002-07-30	-	-	-	-	r	-	-	-	-	-	-	
2002-10-10	<1	-	-	-	-	<1	-	<1	-	-	-	-
2003-05-09	-	-	-	<1	-	<1	<1	-		-	-	-
2003-07-08	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2003-09-10	-	-	-	-	-	-	-	<1	-	-	-	-
2004-05-19	<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1	<1
2004-07-08	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2004-09-10	1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2005-05-11	5	2	2	2	<1	1	<1	1	2	2	1	1
2005-07-05	3	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2005-09-12	18	3	5	2	1	1	1	2	3	1	2	<1
2006-05-19	28	11	9	3	2	1	5	2	7	3	3	2
2006-07-11	23	7	9	3	3	2	1	3	4	4	3	2

Table S 13: Results of the classification days (in July) of the coverage share of the different sedum types, for the years 2002 to 2006 (vegetation surveys with ELLENBERG indicator values) – (1/2).

vegetation group, classification day and sedum type	coverage in %											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
classification at 2002-07-30												
Sedum acre	<1	2	2	3	3	2	<1	<1	1	1	2	1
Sedum album	-	r	r	r	<1	r	r	r	r	r	-	-
Sedum reflexum	r	<1	1	<1	1	1	<1	<1	1	1	r	r
Sedum spurium	r	r	r	<1	r	1	r	r	<1	<1	r	r
Sedum kamtschaticum [1)]	r	-	r	-	r	-	r	r	r	r	r	r
classification at 2003-07-08												
Sedum acre	37	54	57	55	57	57	52	76	71	79	74	70
Sedum album	4	6	4	16	12	13	5	3	2	3	2	3
Sedum reflexum	2	3	13	9	10	10	20	6	11	7	11	12
Sedum spurium	<1	1	1	<1	3	1	2	2	2	1	2	1
Sedum kamtschaticum [1)]	<1	<1	4	3	5	4	10	5	8	4	5	6
classification at 2004-07-08												
Sedum acre	42	43	38	35	42	36	9	41	35	40	52	35
Sedum album	23	32	34	30	36	34	17	22	21	26	15	13
Sedum reflexum	5	4	22	39	16	20	59	33	32	27	28	43
Sedum spurium	1	2	r	1	3	1	-	1	2	2	2	1
Sedum kamtschaticum [1)]	1	<1	3	3	3	3	11	2	5	3	3	5
classification at 2005-07-05												
Sedum acre	24	42	23	9	12	12	3	9	18	16	25	12
Sedum album	35	39	35	45	54	50	10	34	21	45	31	27
Sedum reflexum	5	3	29	30	19	20	40	25	30	16	13	25
Sedum spurium	1	<1	2	6	10	4	12	11	14	17	8	13
Sedum kamtschaticum [1)]	<1	1	3	10	5	10	27	12	14	5	17	18

Table S 14: Results of the classification days (in July) of the coverage share of the different sedum types, for the years 2002 to 2006 (vegetation surveys with ELLENBERG indicator values) – (2/2).

vegetation group, classification day and sedum type	coverage in %											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
classification at 2006-05-19												
Sedum acre	6	5	4	2	1	2	1	2	3	1	1	2
Sedum album	52	71	65	54	80	60	29	39	46	71	42	32
Sedum reflexum	2	1	11	12	4	9	11	9	10	3	6	6
Sedum spurium	r	1	2	7	5	4	4	16	15	11	6	9
Sedum kamtschaticum [1)]	3	1	8	19	7	21	45	26	16	5	39	41

[1)] Sedum kamtschaticum "Ellacombianum"

Table S 15: Species composition in the year 2006 (vegetation surveys with ELLENBERG indicator values) – (1/2).

	vegetation group in variants in 2006											
	1	2	3	4	5	6	7	8	9	10	11	12
Artenzahl												
- all together	8	8	9	9	9	8	11	12	11	10	10	10
- coverage ≥ 1 %	6	6	7	7	7	7	7	9	7	7	8	9
sedum type												
- all together	5	5	7	7	7	7	7	8	8	7	7	7
- coverage ≥ 1 %	3	4	6	6	6	6	6	7	6	5	7	6
- coverage ≥ 10%	1	1	2	3	1	3	3	3	3	3	2	3
vegetation group and classification day	**coverage in % in variants in 2006**											
	1	2	3	4	5	6	7	8	9	10	11	12
classification at 2006-05-19												
Sedum acre	6	5	4	2	1	2	1	2	3	1	1	2
Sedum album	52	71	65	54	80	60	29	39	46	71	42	32
Sedum reflexum	2	1	11	12	4	9	11	9	10	3	6	6
Sedum spurium	r	1	2	7	5	4	4	16	15	11	6	9
Sedum kamtschaticum [1)]	3	1	8	19	7	21	45	26	16	5	39	41
Sedum telephium	r	-	r	r	r	-	r	r	r	r	r	r
Sedum hybridum [2)]	r	r	r	2	r	1	2	2	2	2	1	3
Sedum floriferum	-	-	1	1	1	2	1	2	1	3	1	3

[1)] Sedum kamtschaticum "Ellacombianum"

[2)] Sedum hybridum "Immergrünchen"

Table S 16: Species composition in the year 2006 (vegetation surveys with ELLENBERG indicator values) – (2/2).

classification at 2006-07-11												
Sedum acre	5	3	2	2	4	1	r	1	1	r	2	1
Sedum album	54	74	63	46	74	50	24	34	33	63	46	30
Sedum reflexum	5	2	13	16	4	10	12	12	11	4	2	7
Sedum spurium	r	1	2	10	5	6	4	14	19	10	8	8
Sedum kamtschaticum [1)]	1	1	8	20	8	24	59	27	26	15	31	42
Sedum telephium	1	-	1	1	r	-	r	1	r	1	1	1
Sedum hybridum [2)]	r	r	r	2	r	3	2	3	3	2	3	5
Sedum floriferum	-	-	1	1	2	2	5	3	3	1	4	3

[1)] Sedum kamtschaticum "Ellacombianum"

[2)] Sedum hybridum "Immergrünchen"

Prof. Dr. Hans-Joachim Liesecke

From 1983 to 1993 professor at the Institute of Landscape Architecture (ILA). From 1966 to 2010, he published over 200 articles in the German-speaking world on green roofs (>130 articles), as well as on tree planting, vegetation substrates, sports field and turf construction. He is internationally recognized as a pioneer of green roofs and the development of the FLL Green Roof Guidelines, of which he was a member of the working group from 1980 to 2008.

(Information on the publications with English summaries at www.ila.uni-hannover.de; keyword "Liesecke")

Figure S 4: Prof. Dr. Hans-Joachim Liesecke

3.2 Model runs

Table S 17: Final model parameters for all green roof variants, obtained after calibration.

Parameter	Unit	Green roof variant											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**11**	**12**	**6 with HG**
Berm height	[mm]	17.01	11.02	25.00	27.74	17.62	28.46	4.07	0.52	0.19	6.93	0.01	0.03
Vegetation volume	[-]	0.19	0.10	0.06	0.29	0.15	0.20	0.20	0.24	0.19	0.13	0.17	0.10
Surface Roughness	[-]	0.19	0.17	0.04	0.07	0.10	0.19	0.14	0.07	0.19	0.18	0.18	0.08
Surface slope	[%]	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Thickness	[mm]	25.00	25.00	25.00	25.00	31.00	33.00	65.00	65.00	65.00	55.00	85.00	33.00
Porosity	[-]	0.40	0.42	0.41	0.53	0.47	0.42	0.75	0.79	0.68	0.41	0.58	0.42
Field capacity	[-]	0.31	0.29	0.21	0.39	0.28	0.30	0.30	0.27	0.26	0.30	0.34	0.24
Wilting point	[-]	0.15	0.12	0.04	0.12	0.11	0.08	0.02	0.03	0.10	0.15	0.08	0.12
Conductivity	[mm hr^{-1}]	119.34	134.84	179.76	195.40	107.15	131.62	106.83	38.64	98.57	98.26	144.17	65.99
Conductivity slope	[-]	60.99	20.45	67.17	48.59	42.59	41.83	42.46	9.38	60.54	61.69	48.09	24.19
Suction head	[mm]	48.72	47.35	15.33	53.87	46.32	30.36	47.72	63.13	40.37	56.23	45.19	24.54
Thickness	[-]	2.00	15.00	6.00	8.00	15.00	15.00	2.00	2.00	2.00	15.00	15.00	15.00
Void fraction	[-]	0.27	0.23	0.48	0.30	0.73	0.16	0.68	0.60	0.45	0.16	0.44	0.17
Roughness	[mm]	0.27	0.23	0.32	0.25	0.25	0.17	0.03	0.12	0.21	0.14	0.21	0.27
Albedo	[-]	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
Wind exp.	[-]	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
Crop height	[m]	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	
rs	[s m^{-1}]	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	78.00	

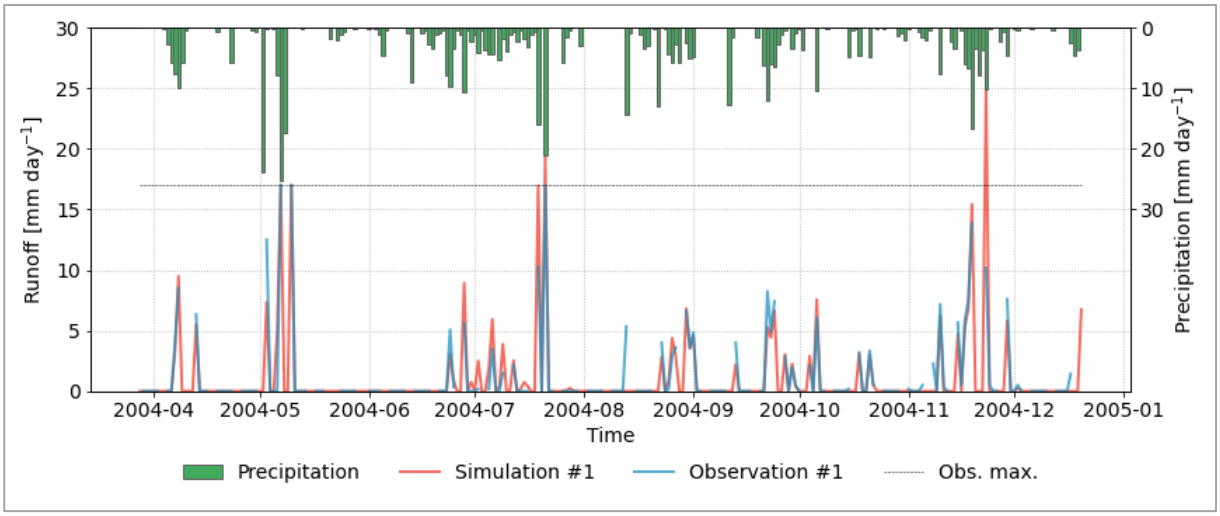

Figure S 5: Observed and simulated runoff obtained during calibration of the model for green roof variant #1.

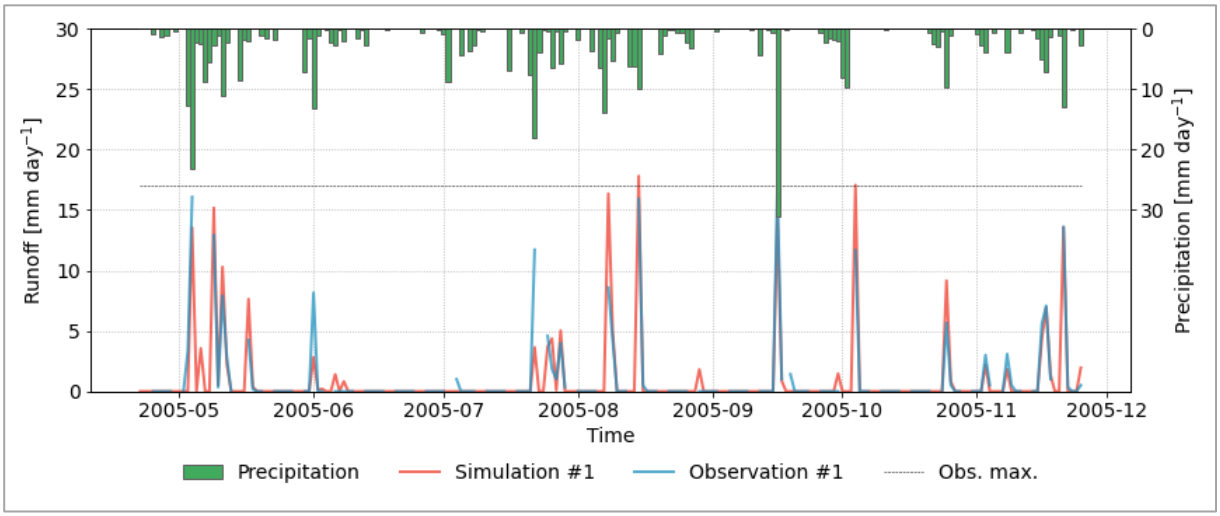

Figure S 6: Observed and simulated runoff obtained during validation of the model for green roof variant #1.

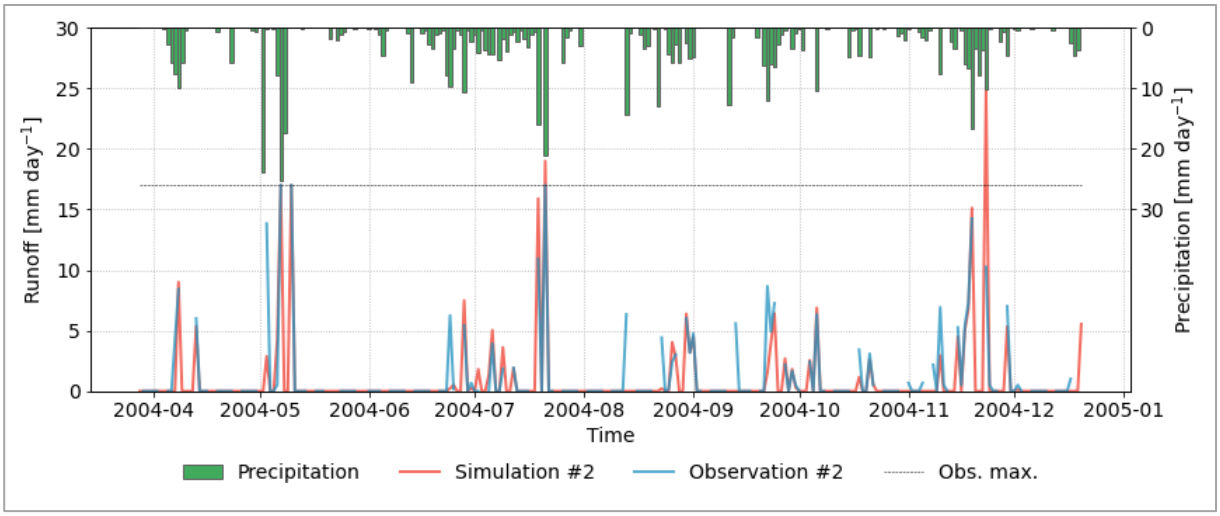

Figure S 7: Observed and simulated runoff obtained during calibration of the model for green roof variant #2.

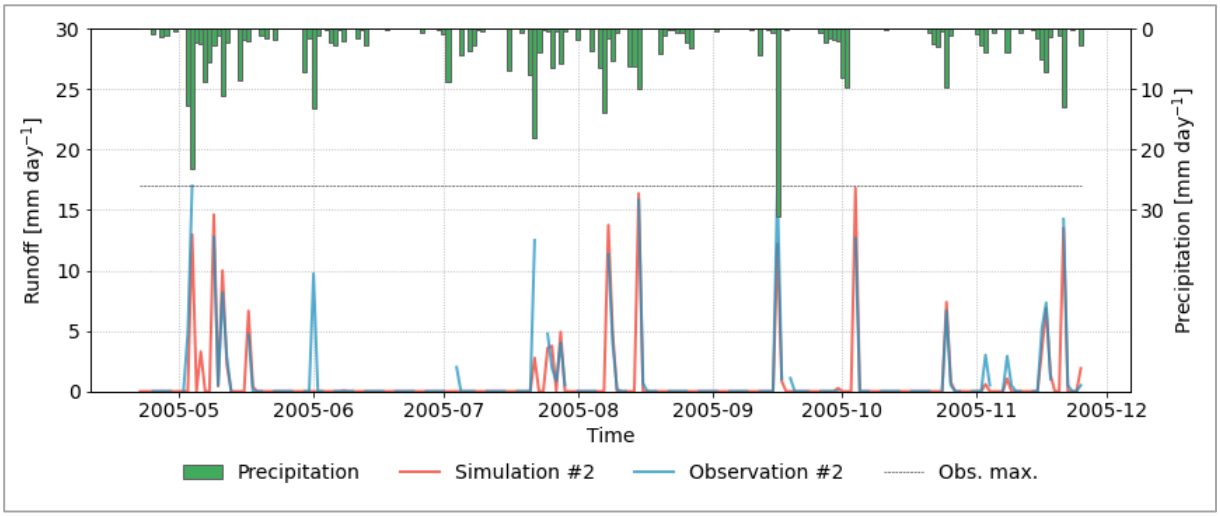

Figure S 8: Observed and simulated runoff obtained during validation of the model for green roof variant #2.

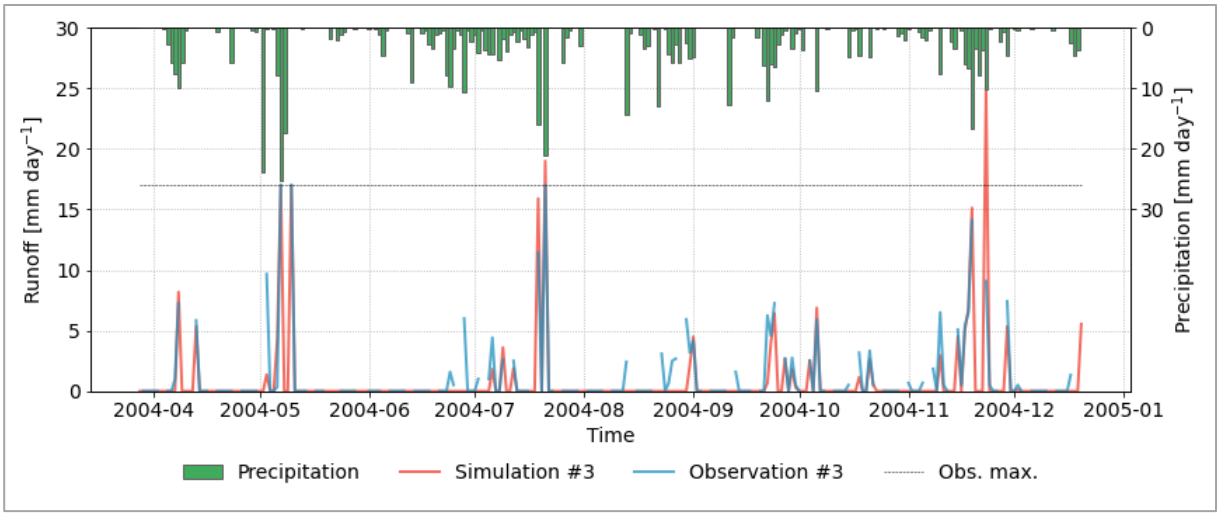

Figure S 9: Observed and simulated runoff obtained during calibration of the model for green roof variant #3.

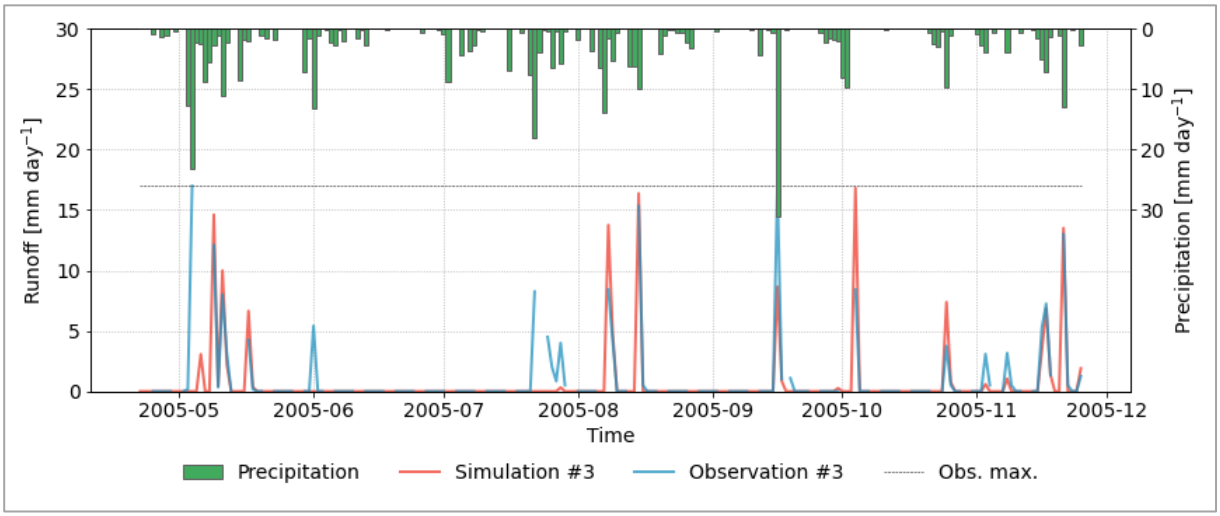

Figure S 10: Observed and simulated runoff obtained during validation of the model for green roof variant #3.

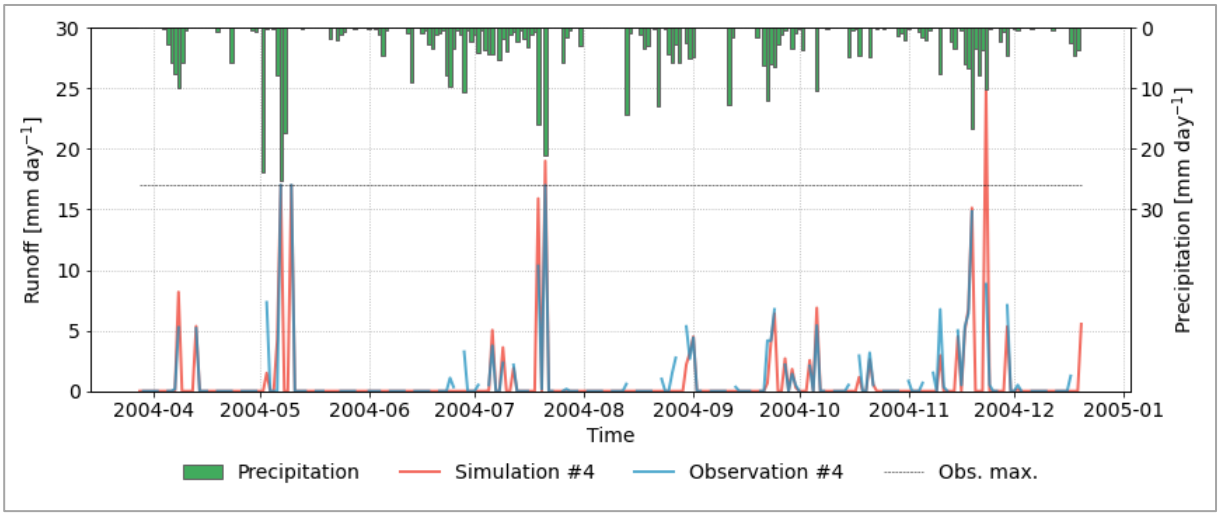

Figure S 11: Observed and simulated runoff obtained during calibration of the model for green roof variant #4.

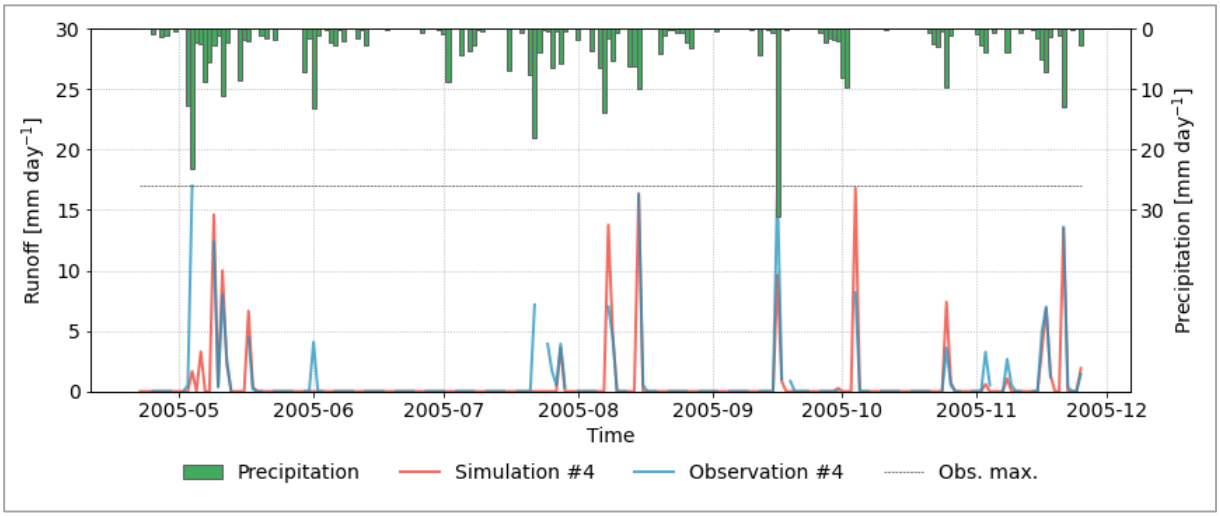

Figure S 12: Observed and simulated runoff obtained during validation of the model for green roof variant #4.

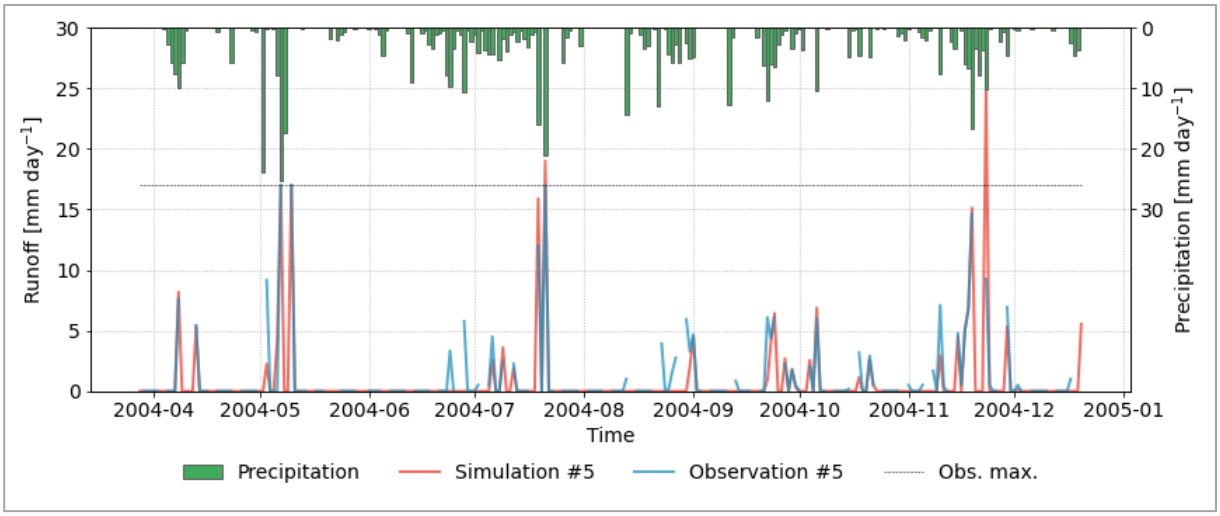

Figure S 13: Observed and simulated runoff obtained during calibration of the model for green roof variant #5.

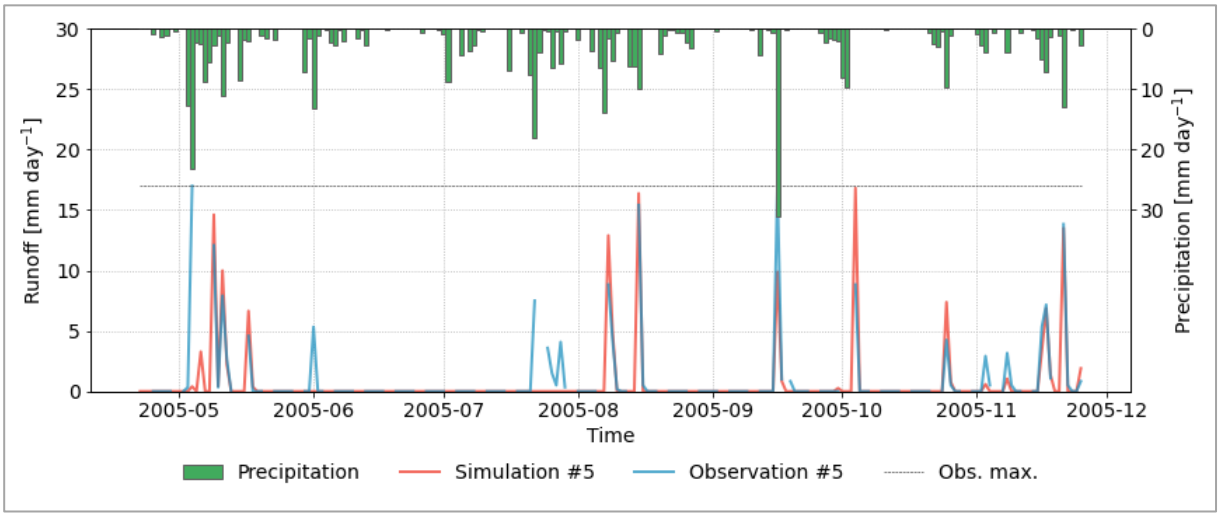

Figure S 14: Observed and simulated runoff obtained during validation of the model for green roof variant #5.

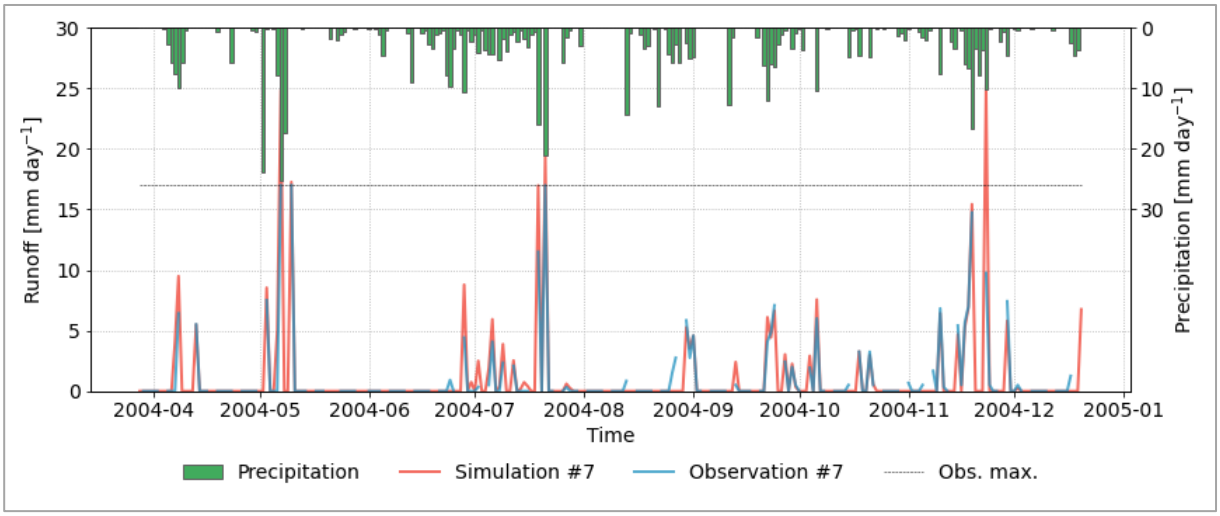

Figure S 15: Observed and simulated runoff obtained during calibration of the model for green roof variant #7.

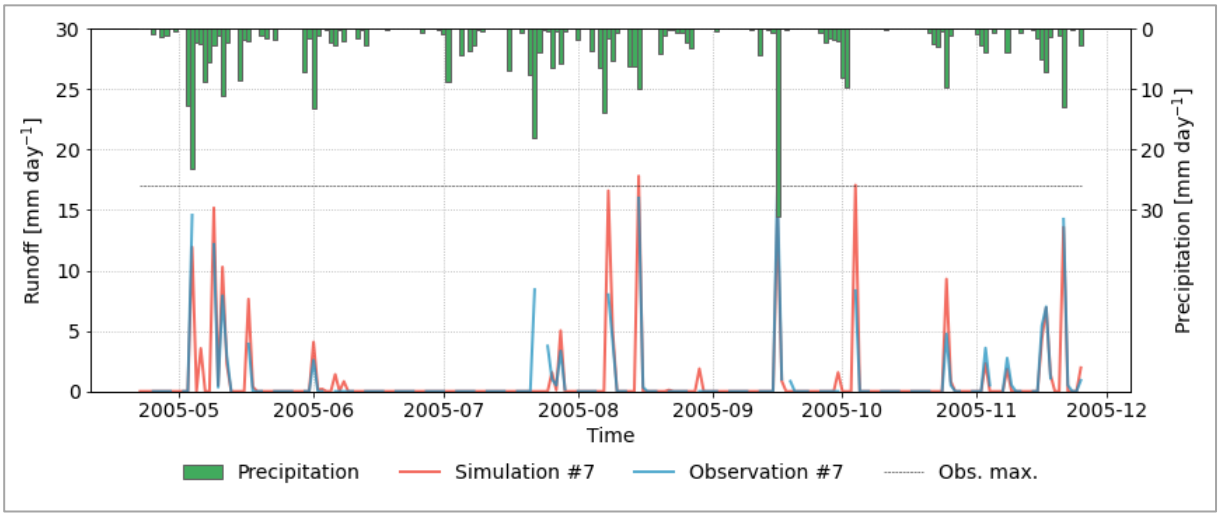

Figure S 16: Observed and simulated runoff obtained during validation of the model for green roof variant #7.

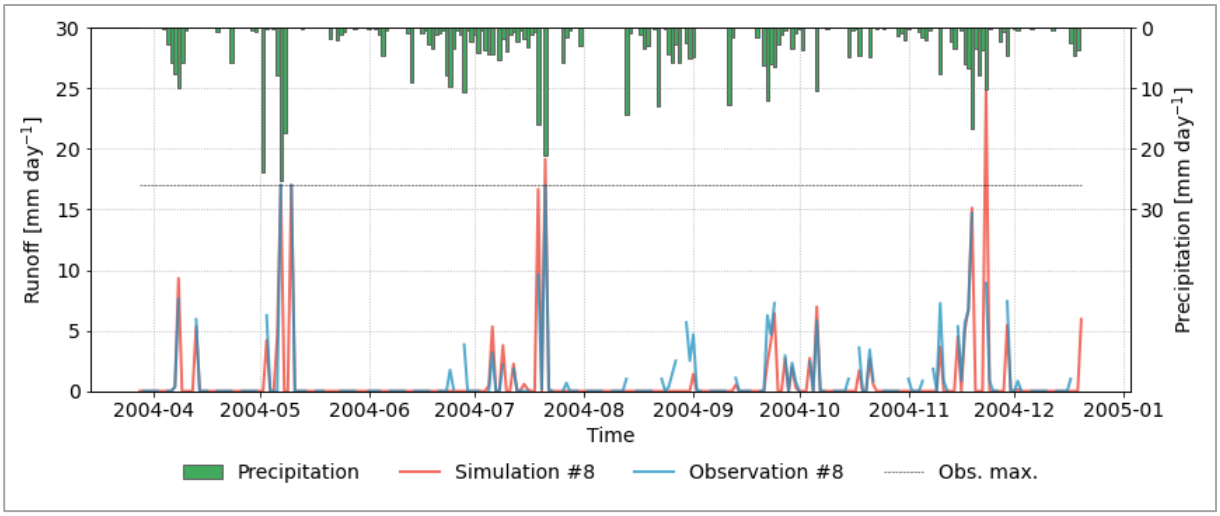

Figure S 17: Observed and simulated runoff obtained during calibration of the model for green roof variant #8.

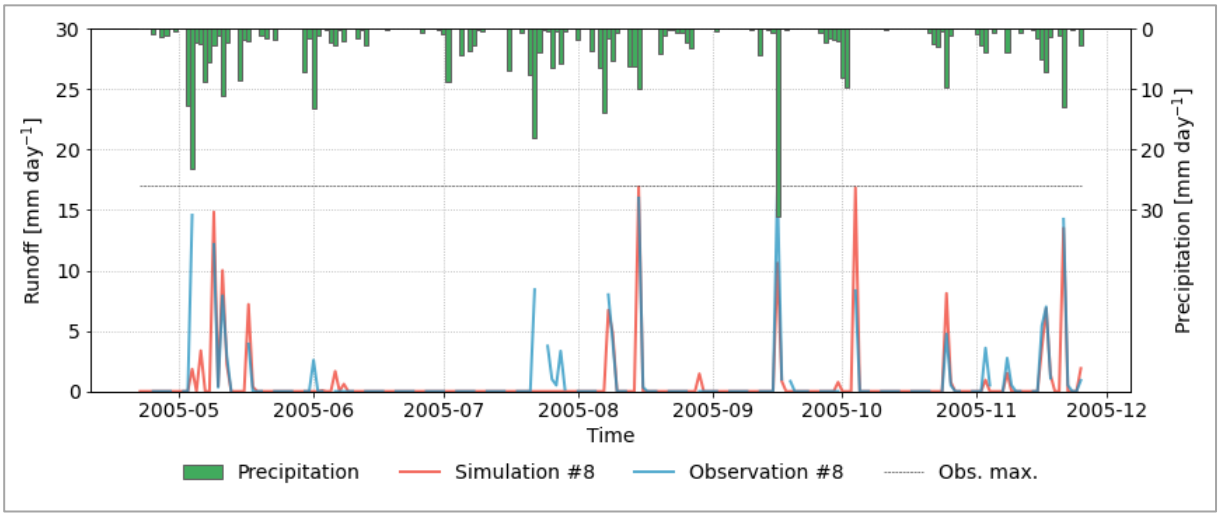

Figure S 18: Observed and simulated runoff obtained during validation of the model for green roof variant #8.

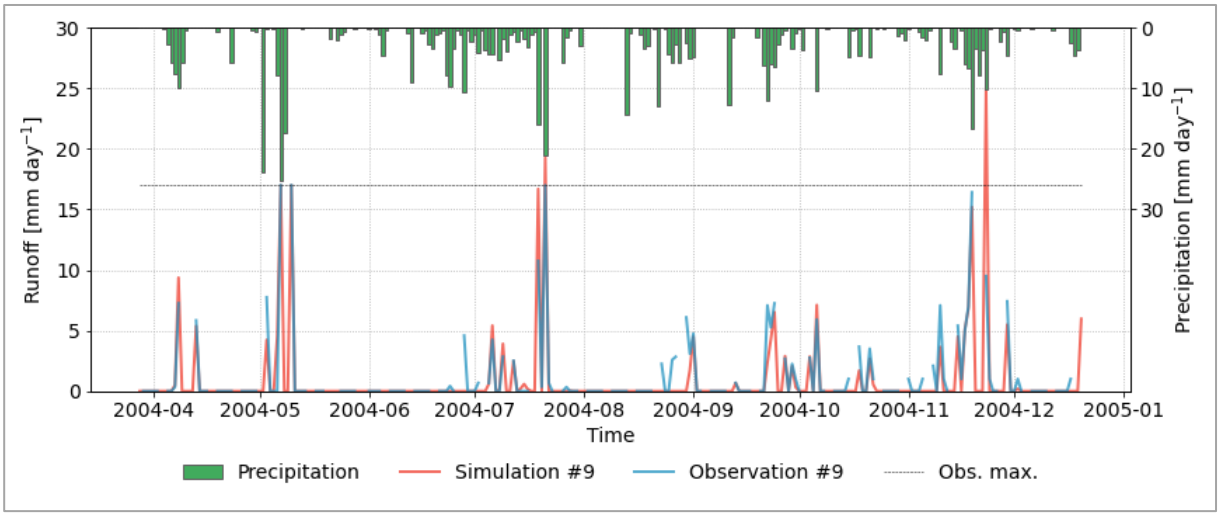

Figure S 19: Observed and simulated runoff obtained during calibration of the model for green roof variant #9.

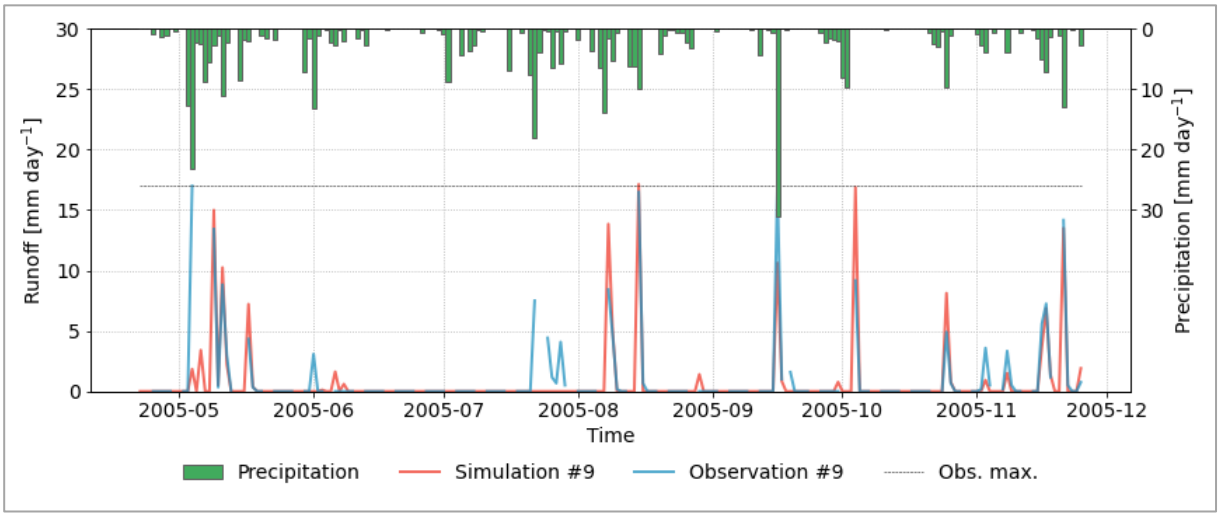

Figure S 20: Observed and simulated runoff obtained during validation of the model for green roof variant #9.

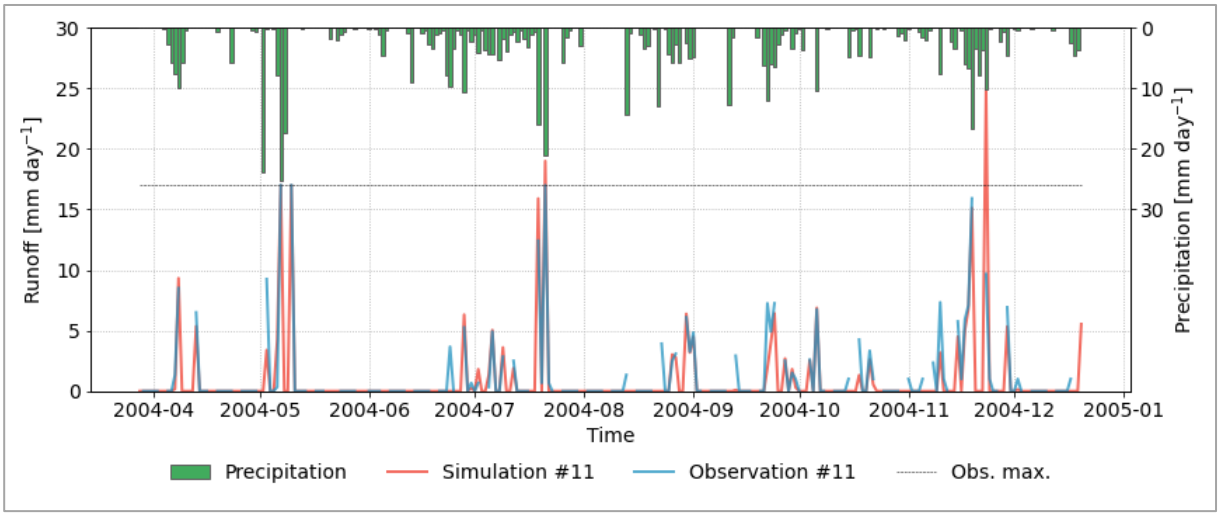

Figure S 21: Observed and simulated runoff obtained during calibration of the model for green roof variant #11.

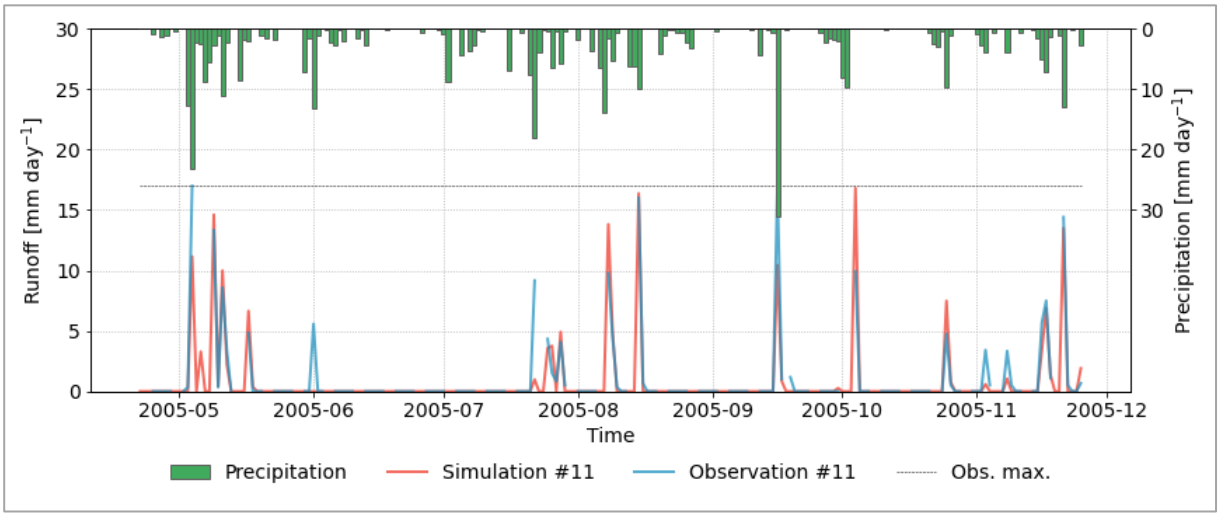

Figure S 22: Observed and simulated runoff obtained during validation of the model for green roof variant #11.

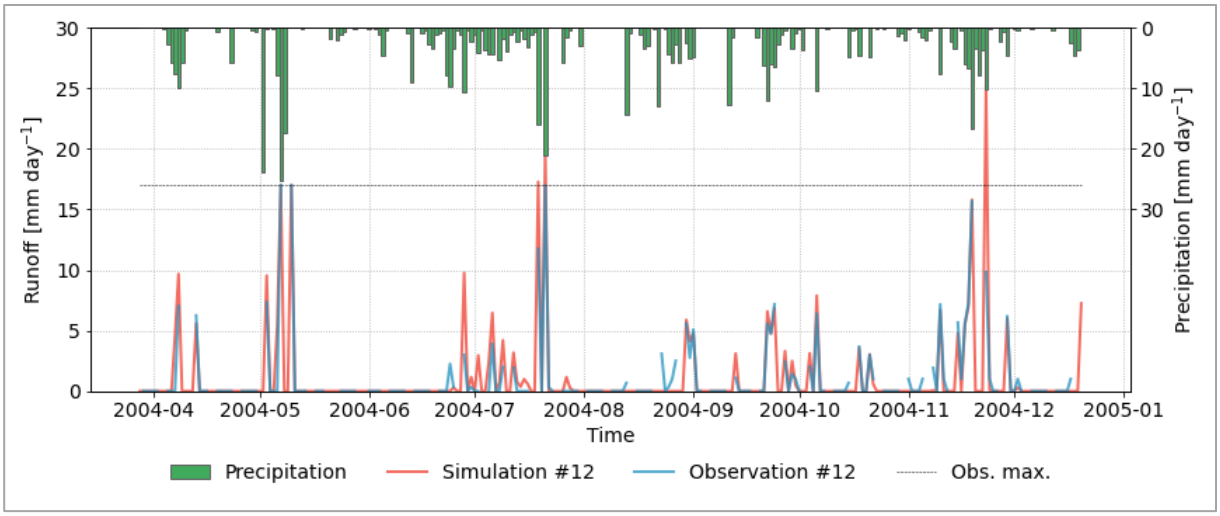

Figure S 23: Observed and simulated runoff obtained during calibration of the model for green roof variant #12.

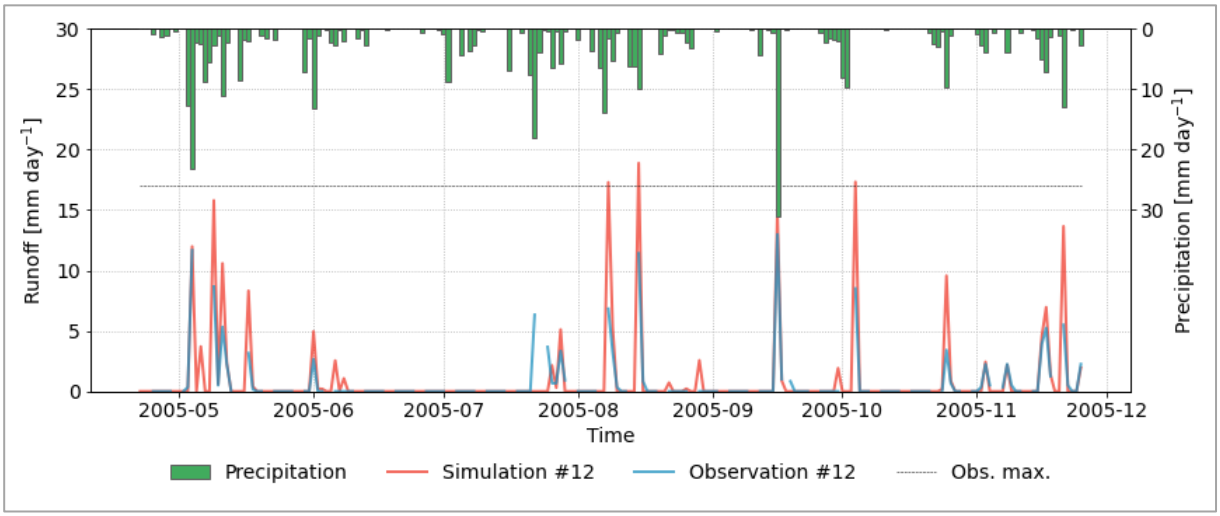

Figure S 24: Observed and simulated runoff obtained during validation of the model for green roof variant #12.