

Preliminary results from Høvringen blue-grey roofs

Summary of four months data collection and roof response on a different
type of precipitation

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Field station configuration

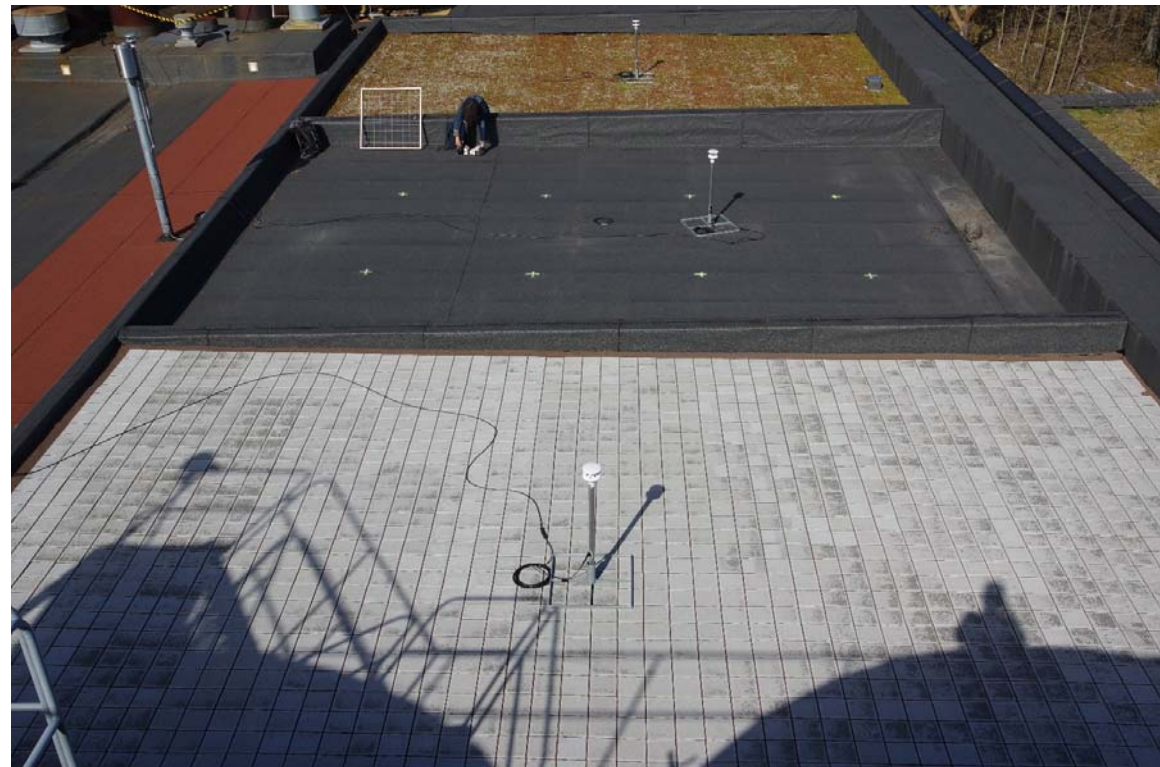
Blue-grey roof

- geotextile
- 200 mm Filtralite NC 1.5-2.5
- walkable concrete pavement (200x200x70 mm)

Green roof

- geotextile
- drainage board
- retention mat
- Sedum mats

- 8x11 m (inner dimensions)
- longitudinal slope 2 %



Instrumentation

Precipitation (Lambrecht meteo) 1-min interval, 0,1 mm resolution

Runoff (VisionTech) changes of weights in the collecting tanks

Data logger (Campbell Scientific)

- radiation [W/m²]
- air temperature [° C]
- soil temperature [° C]
- relative humidity [%]
- wind speed [m/s]
- wind direction [°]
- soil moisture content [%]



Event analysis

- minimum **6** hours antecedent dry weather period (ADWP)
- **0.5** mm - exclude irrelevant precipitation events
- **0.1** l – differentiation between runoff and no runoff

< 5 mm → light event

5-15 mm → medium event

>15 mm → large event

- ✓ rain events (20)
- ✓ rain on snow events (7)
- ✓ snowmelt events (4)
- ✓ snow events (7)
- ✓ mix (8)

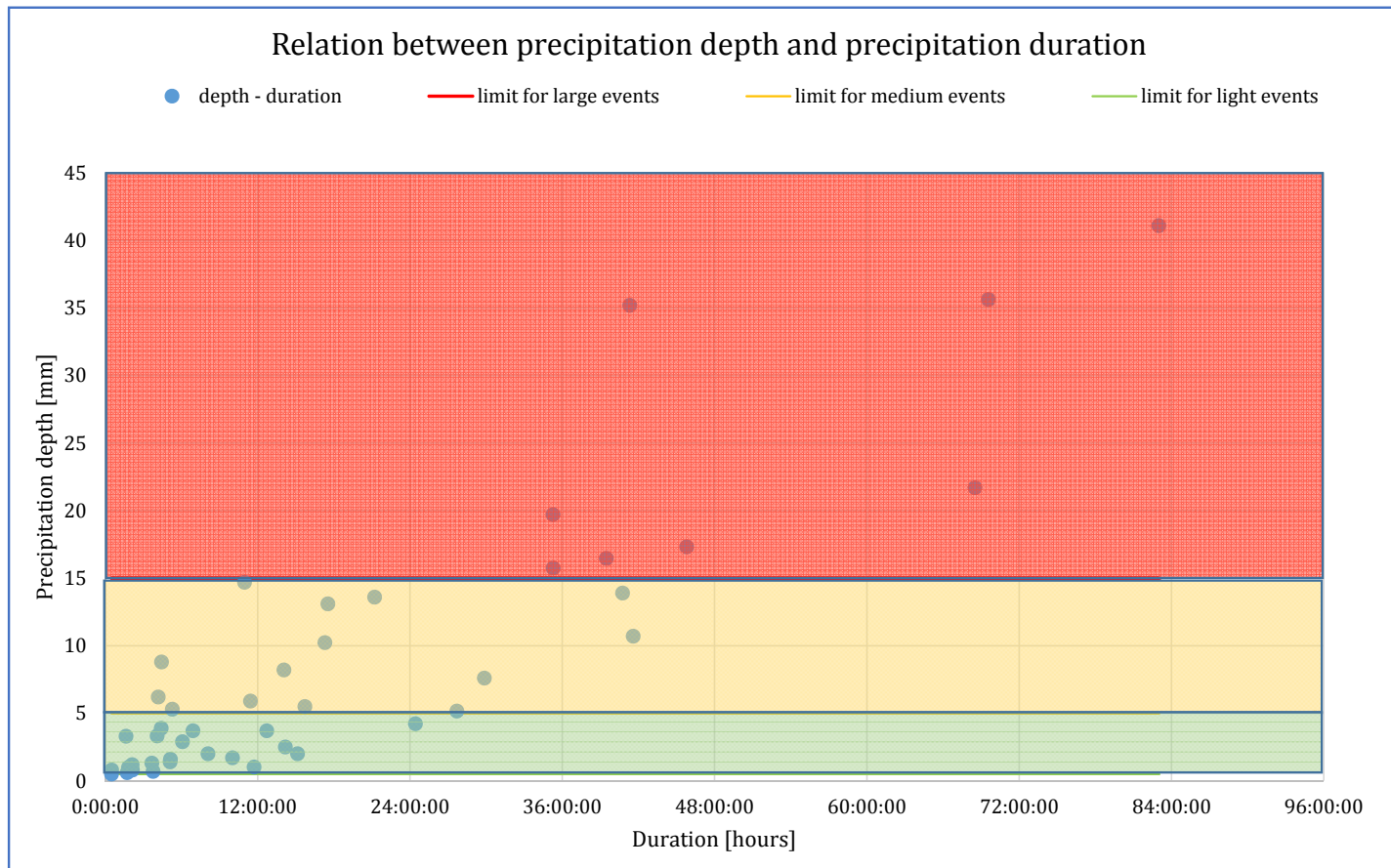
Month	Number of event	Large	Medium	Light
January	15	3	5	7
February	8	1	1	6
March	14	1	4	9
April	9	3	4	2
Total	46	8	14	24

Event analysis – statistics

Month	Duration - min [h:m]	Duration - max [h:m]	Intensity - max [mm/h]	ADWP - min [h:m]	ADWP - max [h:m]
January	1 h 43 m	68 h 31 m	1.98	7 h 59 m	112 h 7 m
February	29 m	83 h	1.6	6 h 15 m	389 h 37 m
March	1 h 38	40 h 45 m	2.02	7 h 9 m	333 h 42 m
April	5 h 17 m	69 h 34 m	1.34	7 h m	206 h 6 m
Total	mean 18 h 46 m	median 11 h 34 m	mean 0.59 median 0.46	mean 44 h 38 m	median 13 h 11 m

- median is not affected by extreme values

Event analysis – statistics



Event analysis – precipitation duration

Month	Duration [day]	Duration [%]	Time for ET - dry period [day]	Time for ET [%]	Precipitation depth [mm]	Normal precipitation Voll [mm]
January	11	36	20	64	122	60
February	7	25	21	75	61	50
March	6	20	24	80	80	50
April	10	34	20	66	113	45
Total	34 (120)	29 %	86	71 %	376	205

Hydrological performance

based on:

- precipitation depth
- intensity
- after longest ADWP

Hydrological performance based on precipitation depth

Month	Type of event	Largest events [mm]	Duration	ADWP	Peak delay BR vs BGR & GR		Peak reduction BR vs BGR & GR	
January	Rain on snow	35.2	41 h 19 m	9 h 49 m	<i>1h 47 m</i>	-	75 %	-
February	Rain/snow (mix)	41.1	83 h	7 h 46 m	<i>39 h 46 m</i>	-	82 %	-
March	Rain on snow	19.7	35 h 16 m	10 h 9 m	<i>1 m</i>	-	72 %	-
April	Rain/snow (mix)	35.6	69 h 34 m	7 h 37 m	<i>2 h 30 m</i>	<i>14 m</i>	82 %	30 %

Hydrological performance based on intensity

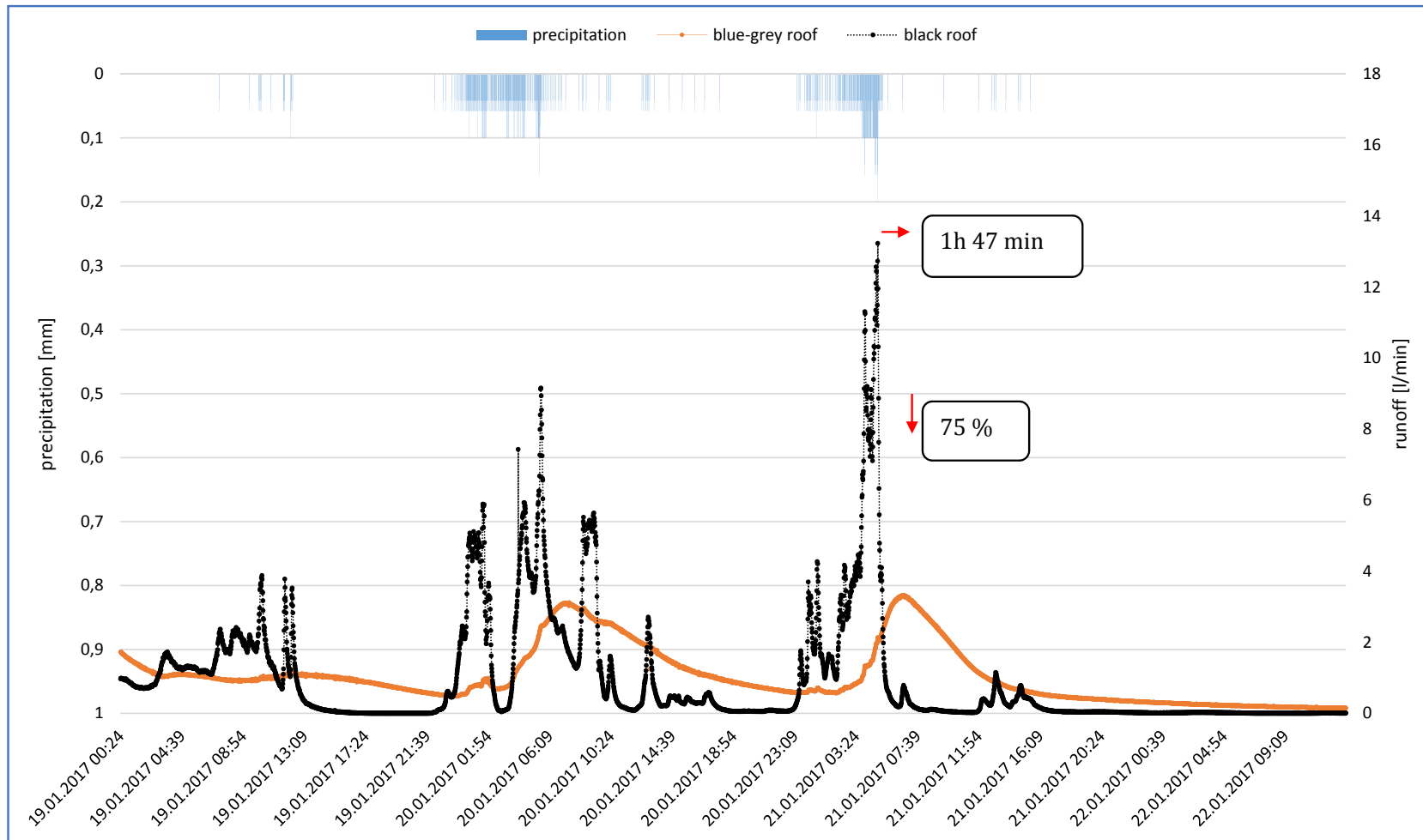
Month	Type of event	Duration	Intensity [mm/hour]	Depth [mm]	Designation	ADWP	Peak delay BR vs BGR & GR		Peak reduction BR vs BGR & GR	
January	Rain/snow (mix)	4 h 26 m	1.98	8.8	Medium	52 h 54 m	<i>4 h 7 m</i>	-	71 %	-
February	Snow	30 m	1.6	0.8	Light	7h 4 m	<i>No runoff</i>	-	No runoff	-
March	Rain	1 h 38 m	2.02	3.3	Light	23 h 41 m	<i>0 m</i>	-	95 %	-
April	Rain	10 h 58 m	1.34	14.7	Medium	206 h 6 m	<i>2 h 15 m</i>	<i>12 m</i>	78 %	65 %

Hydrological performance after longest ADWP

Month	Type of event	Duration	Intensity [mm/hour]	Depth [mm]	Designation	ADWP	Peak delay BR vs BGR & GR		Peak reduction BR vs BGR & GR	
January	Rain on snow	15 h 43 m	0.35	5.5	Medium	112 h 6 m	<i>31 min</i>	-	96 %	-
February	Rain	24 h 26 m	0.17	4.2	Light	389 h 37 m	<i>No runoff</i>	-	No runoff	-
March	Rain on snow	4 h 24 m	0.88	3.9	Light	333 h 42 m	<i>0 min</i>	-	89 %	-
April	Rain	10 h 58 m	1.34	14.7	Medium	206 h 6 m	<i>2 h 15 m</i>	<i>12 m</i>	78 %	65 %

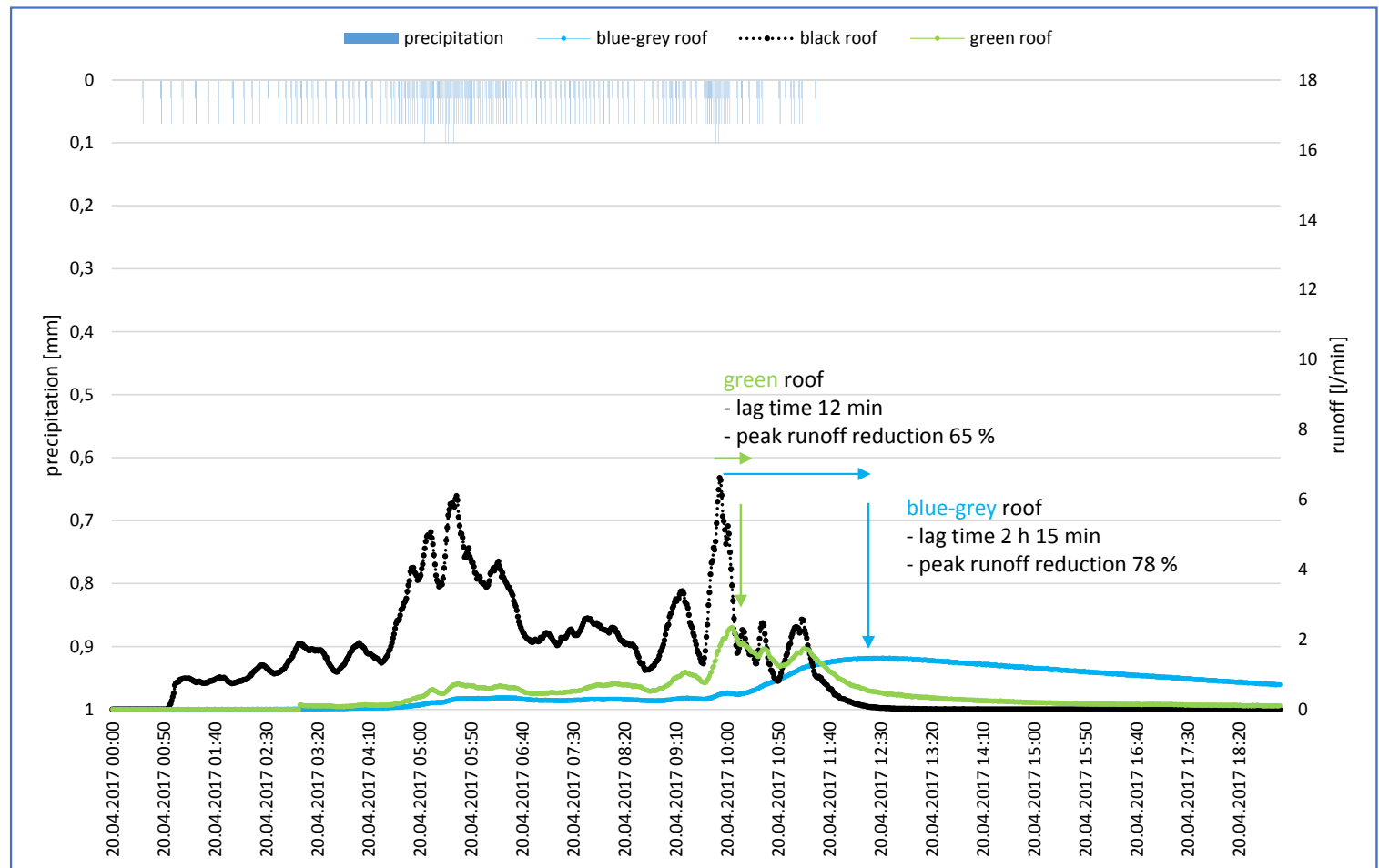
Month	Type of event	Largest events [mm]	Duration	ADWP	Peak detention BR vs BGR	Peak reduction BR vs BGR
January	Rain on snow	35.2	41 h 19 min	9 h 49 min	1h 47 min	75 %

Representative hydrograph

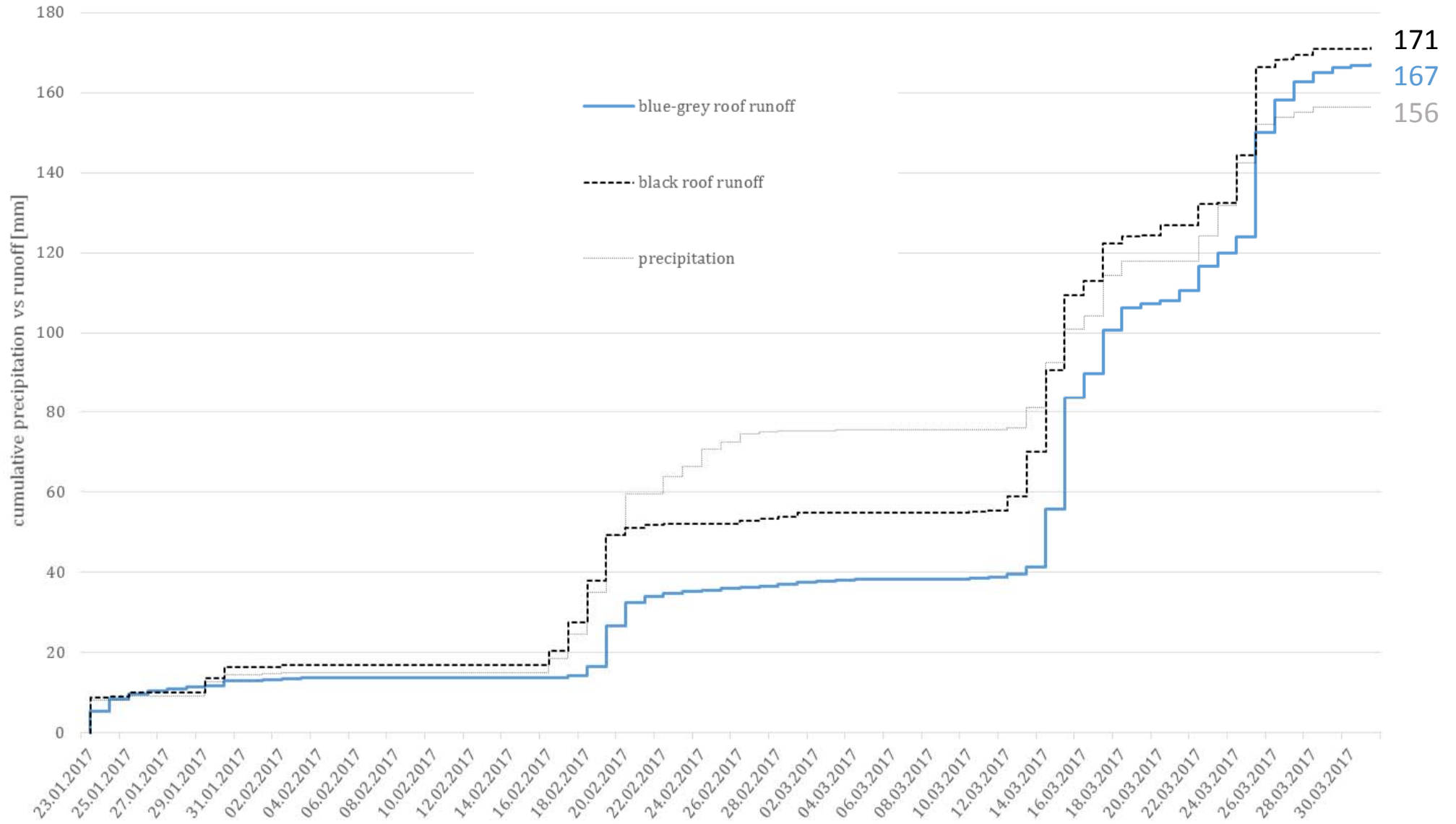


Month	Type of event	Precipitation depth [mm]	Duration	ADWP	Peak detention BR vs BGR & GR		Peak reduction BR vs BGR & GR	
April	Rain	14.7	10 h 58 m	206 h 6 m	2 h 15 m	12 m	78 %	65 %

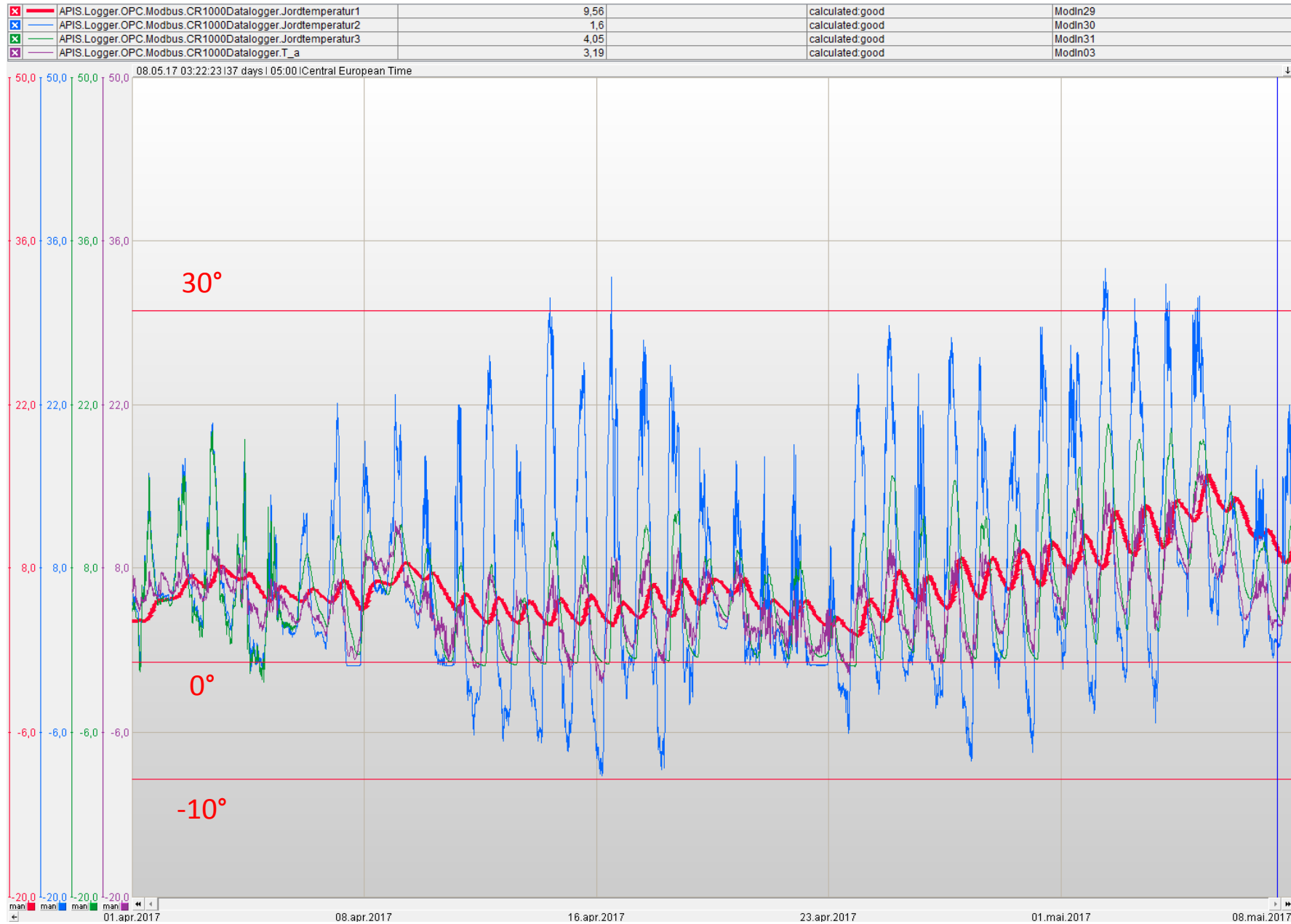
Representative hydrograph



Cumulative hydrograph



Temperature behavior



Conclusion

Peak reduction

- BR vs **BGR** varies 41 % - 100 %
- BR vs **GR** varies 30 % - 96 %

Peak delay

- BR vs **BGR** varies 0 min – 39 h 46 min
- BR vs **GR** varies 0 min – 6 h 27 min

BGR and **GR** improve thermal condition of the space below them