Supplementary material

Additional tables and figures that were omitted in the manuscript for brevity.

Table S1: Performance measures for total absorbed shortwave radiation (W m^{-2}), simulations vs. observations, June to October 2016.

Station	Model	r^2	ME	RMSE
DE-Fen	WRF_SA	0.76	48.37	130.95
	WRF-H_FC	0.77	49.51	130.27
DE-RbW	WRF_SA	0.73	47.65	135.72
	WRF-H_FC	0.72	46.14	135.61
DE-Gwg	WRF_SA	0.66	68.16	162.10
	WRF-H_FC	0.65	68.64	163.69

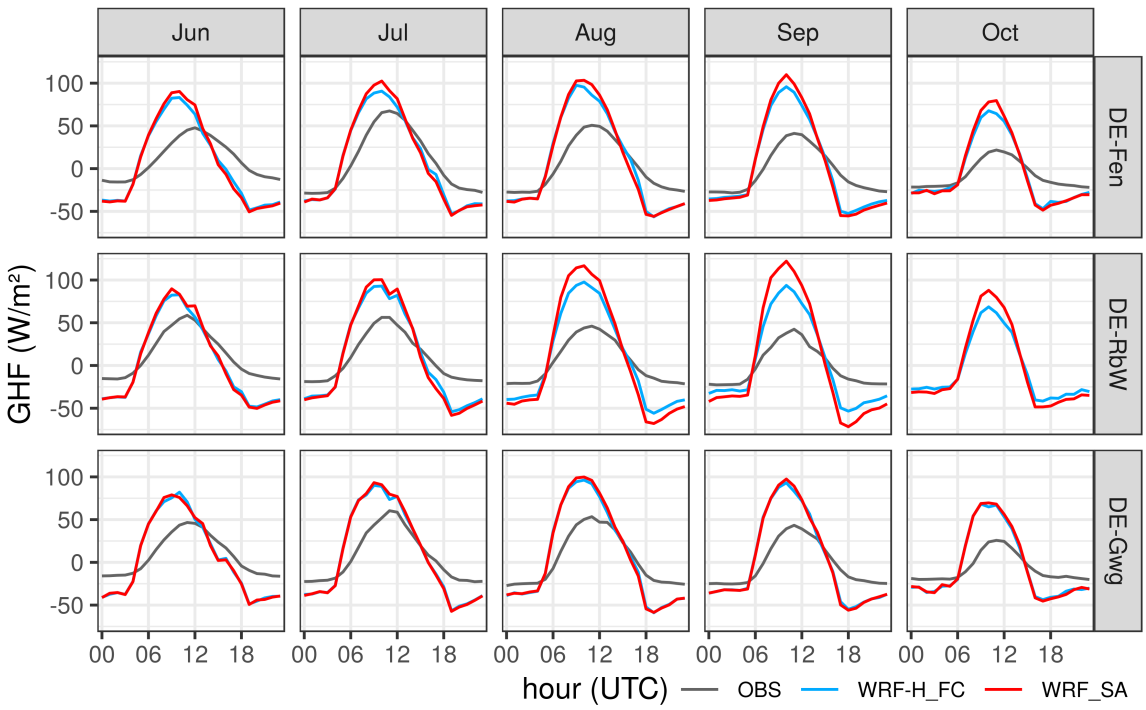

Figure S1: Mean diurnal cycles of simulated and observed ground heat flux for the months June to October 2016 at different TERENO-preAlpine sites.

Table S2: Performance measures for ground heat flux (W m^{-2}), simulations vs. observations, June to October 2016.

Station	Model	r^2	ME	RMSE
DE-Fen	WRF_SA	0.60	2.57	38.49
	WRF-H_FC	0.62	1.99	34.65
DE-RbW	WRF_SA	0.60	1.37	44.83
	WRF-H_FC	0.63	0.97	35.98
DE-Gwg	WRF_SA	0.57	2.32	37.91
	WRF-H_FC	0.56	2.05	37.23

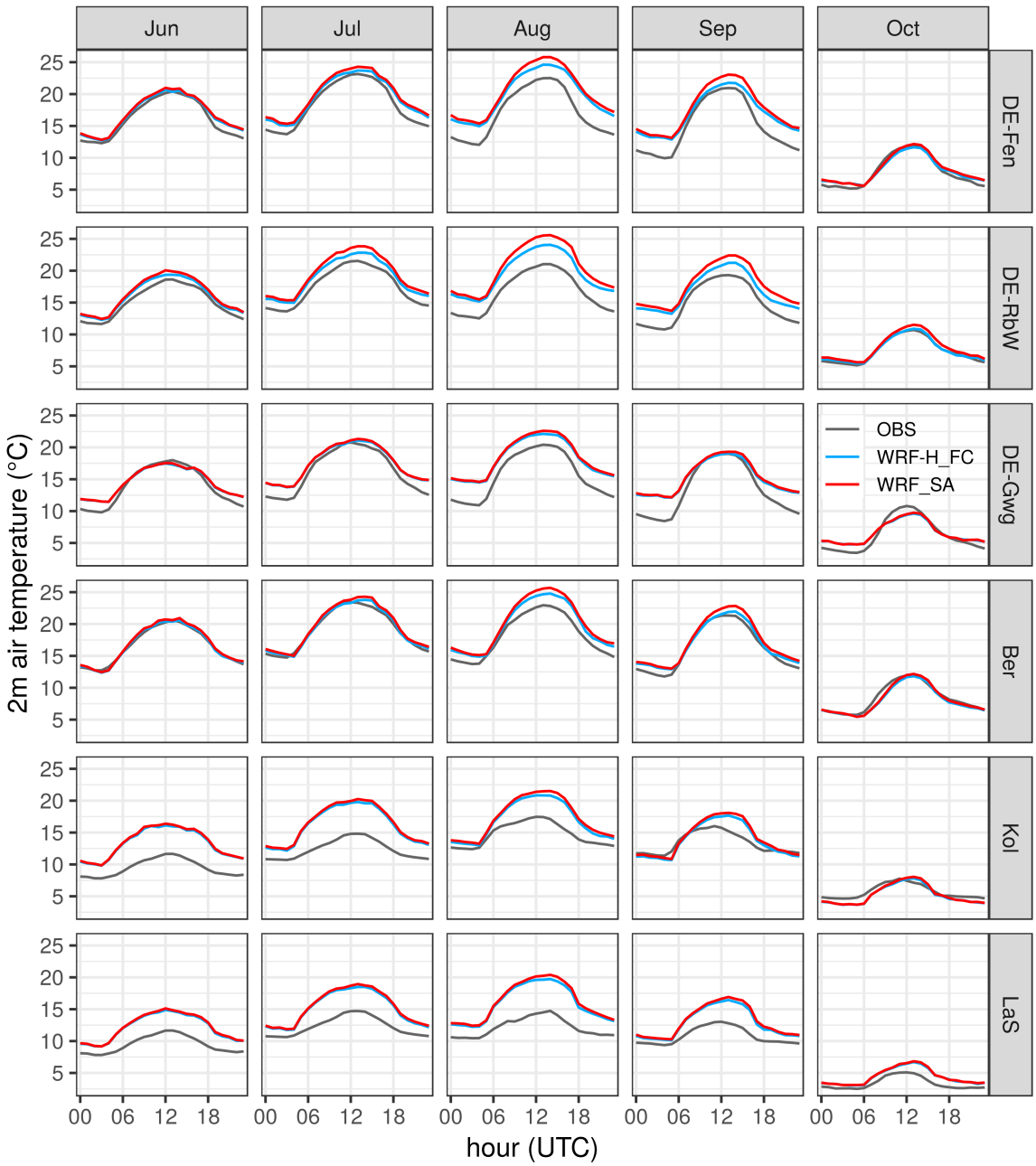

Figure S2: Supplemental: Mean diurnal cycles of simulated and observed 2 m air temperature for the months June to October 2016 at different TERENO-preAlpine sites.

Table S3: Performance measures for 2 m air temperature (K), simulations vs. observations, June to October 2016.

Station	Model	r^2	ME	RMSE
DE-Fen	WRF_SA	0.81	1.76	3.34
	WRF-H_FC	0.81	1.32	3.04
DE-RbW	WRF_SA	0.84	2.06	3.35
	WRF-H_FC	0.84	1.41	2.84
DE-Gwg	WRF_SA	0.79	1.40	3.16
	WRF-H_FC	0.79	1.27	3.08
Ber	WRF_SA	0.85	0.72	2.57
	WRF-H_FC	0.86	0.38	2.43
Kol	WRF_SA	0.77	2.19	3.73
	WRF-H_FC	0.77	1.94	3.55
LaS	WRF_SA	0.81	2.66	3.80
	WRF-H_FC	0.81	2.45	3.60

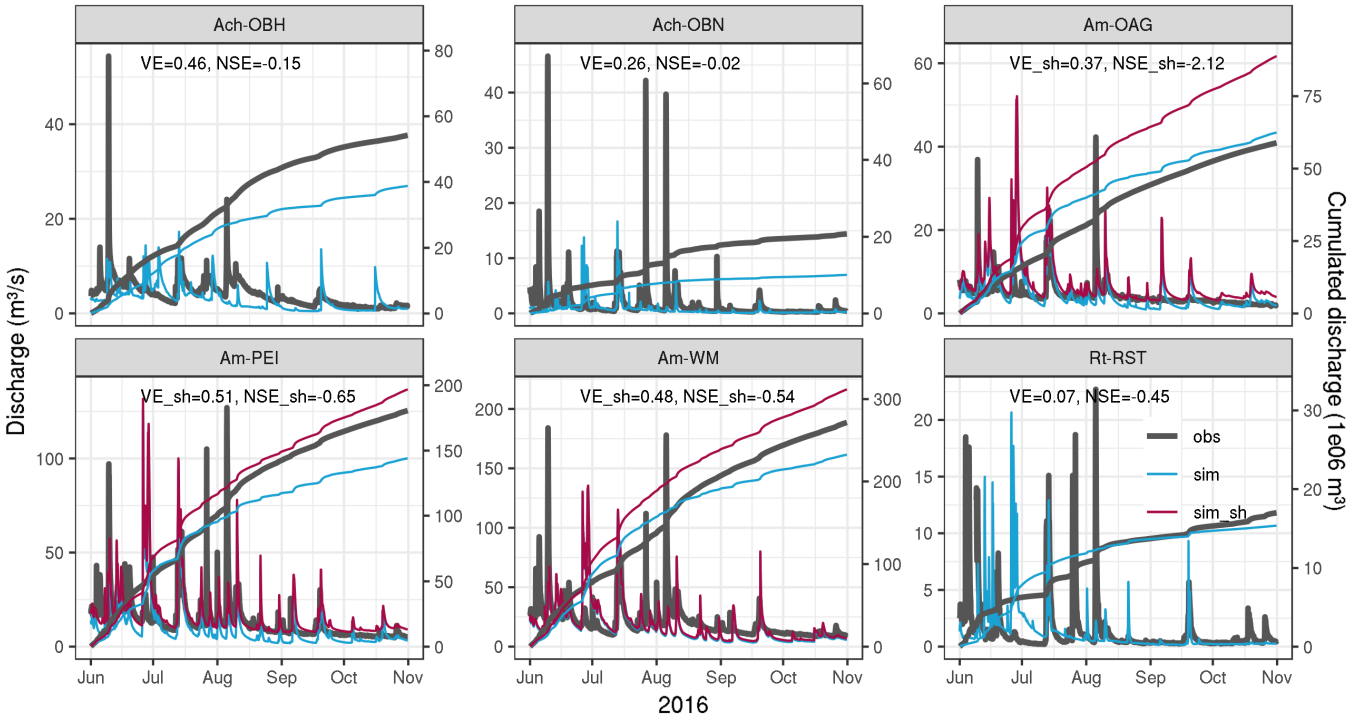

Figure S3: Subcatchment hydrographs for validation period. Standard WRF-H_FC model output is printed in blue. Shifted (sh) hydrographs are shown in red. Shift amounts are listed in Tab. 3 of the manuscript.