Supplementary Material for the paper 'Integrating a global glacier model into local hydrological modeling: Impacts on melt contributions'

Justine Berg, Pascal Horton, Martina Kauzlaric, Alexandra von der Esch, and Bettina Schaefli

This Supplementary Material contains figures illustrating characteristics of the study sites (Figures S1–S2) and daily observed and simulated streamflow time series for each catchment and model configuration (Figures S3–S16). It further includes example scatter plots (Figure S17) and residual plots (Figure S18). Figures S19–S22 show the distributions of snow-related parameters and the precipitation correction factor. In addition, three tables (Tables S1–S3) present supplementary results referenced in the main text. The code used to produce the figures will be made available in the repository.
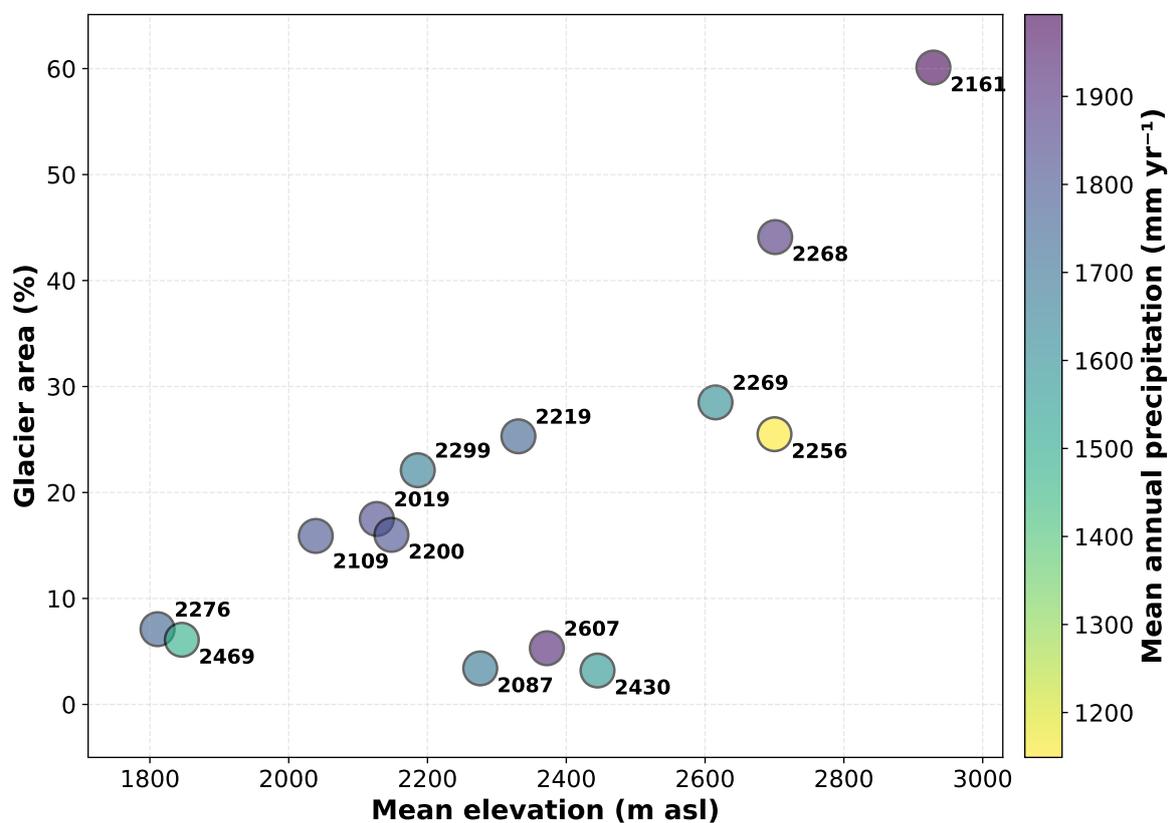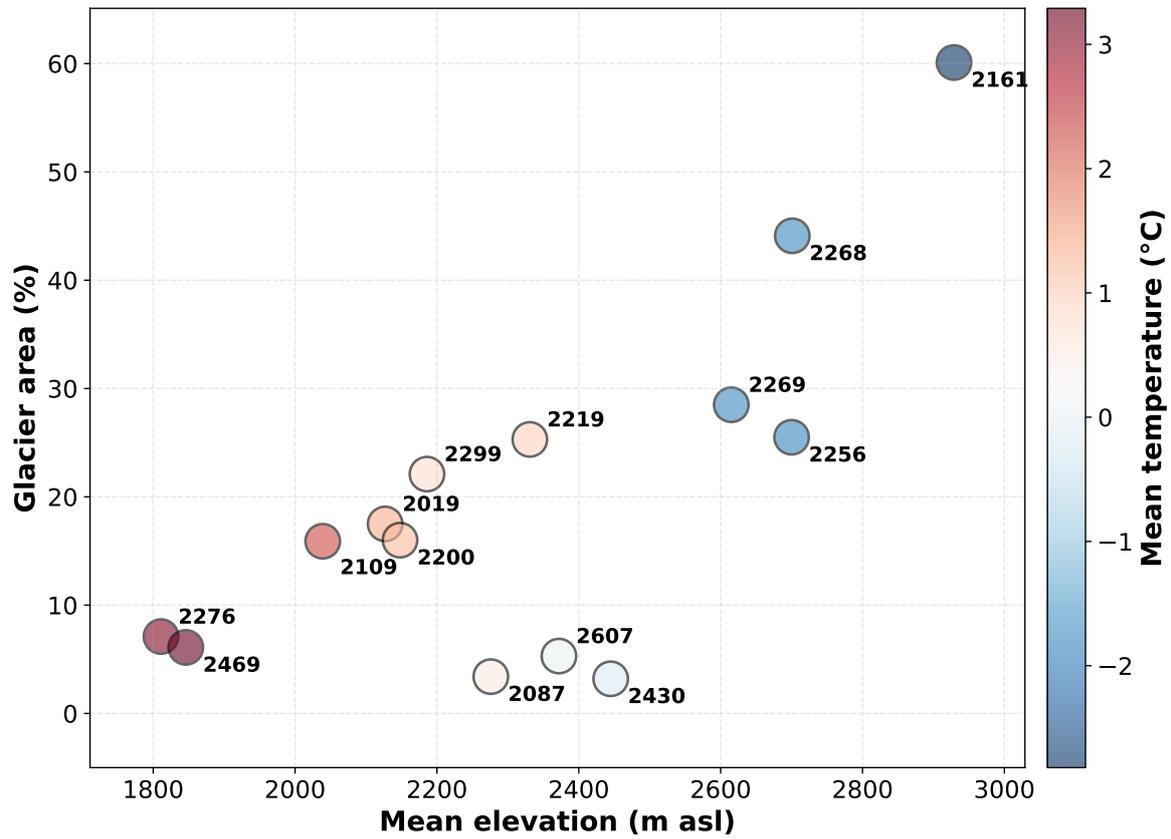

Figure S1. Mean elevation (m asl) against relative glacier area (%) an mean annual precipitation (mm) for each catchment.

Figure S2. Mean elevation (m asl) against relative glacier area (%) an mean temperature (°C) for each catchment.

Table S1. Number of HRUs and elevation bands per catchment for HBV and HBV-GloGEM configurations; All HBV and all HBV-GloGEM configurations have the same number of HRUs. HRUs are split according to elevation bands of 100 m and landuse class.

CAMELS-CH	n HRUs HBV	n HRUs HBV-GloGEM	n Elevation Bands
2019	174	321	37
2087	90	116	22
2109	172	195	35
2161	97	140	28
2200	158	190	36
2219	78	78	23
2256	76	80	23
2268	56	60	19
2269	90	126	24
2276	86	89	23
2299	77	76	22
2430	58	57	17
2469	159	209	31
2607	56	68	19

Table S2. Kling–Gupta Efficiency (KGE) values for all model configurations at selected CAMELS-CH gauges.

CAMELS-CH ID	HBV	HBV-SR	HBV-PCF	HBV-GloGEM	HBV-GloGEM-SR	HBV-GloGEM-PCF
2019	0.77	0.75	0.81	0.72	0.72	0.77
2087	0.83	0.83	0.83	0.82	0.79	0.79
2109	0.92	0.89	0.89	0.88	0.92	0.93
2161	0.96	0.88	0.88	0.95	0.95	0.92
2200	0.84	0.83	0.83	0.89	0.89	0.87
2219	0.87	0.88	0.88	0.79	0.79	0.82
2256	0.83	0.83	0.86	0.83	0.79	0.81
2268	0.92	0.92	0.92	0.91	0.92	0.92
2269	0.87	0.87	0.88	0.83	0.83	0.90
2276	0.82	0.84	0.84	0.82	0.83	0.80
2299	0.87	0.85	0.86	0.70	0.71	0.88
2430	0.60	0.60	0.86	0.63	0.62	0.87
2469	0.85	0.85	0.87	0.78	0.75	0.84
2607	0.83	0.82	0.88	0.83	0.83	0.88

**Table S3.** Nash–Sutcliffe Efficiency (NSE) values for all model configurations at selected CAMELS-CH gauges.

CAMELS-CH ID	HBV	HBV-SR	HBV-PCF	HBV-GloGEM	HBV-GloGEM-SR	HBV-GloGEM-PCF
2019	0.58	0.53	0.62	0.53	0.54	0.54
2087	0.68	0.69	0.70	0.66	0.61	0.64
2109	0.85	0.80	0.81	0.81	0.84	0.87
2161	0.94	0.89	0.90	0.91	0.91	0.90
2200	0.85	0.82	0.81	0.85	0.86	0.84
2219	0.80	0.78	0.79	0.75	0.76	0.77
2256	0.83	0.79	0.82	0.83	0.81	0.81
2268	0.86	0.87	0.86	0.86	0.88	0.86
2269	0.82	0.82	0.83	0.84	0.85	0.81
2276	0.68	0.69	0.73	0.68	0.70	0.67
2299	0.74	0.70	0.77	0.72	0.72	0.79
2430	0.55	0.53	0.77	0.69	0.68	0.77
2469	0.73	0.72	0.78	0.72	0.62	0.76
2607	0.77	0.78	0.79	0.80	0.79	0.77
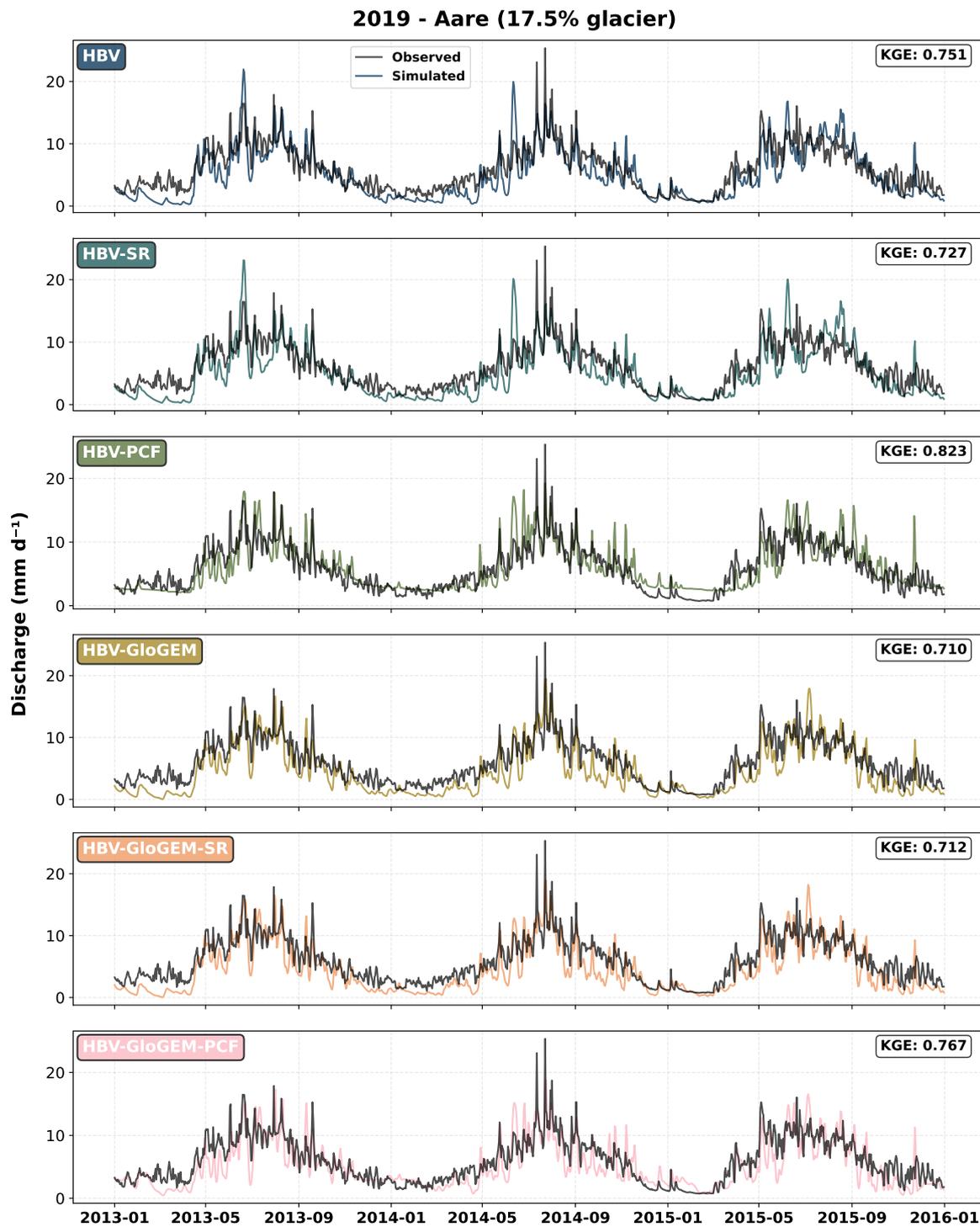
Figure S3. Daily observed and simulated streamflow time series for Aare catchment (ID 2019) for all configurations and years 2013-2016 in the validation period.
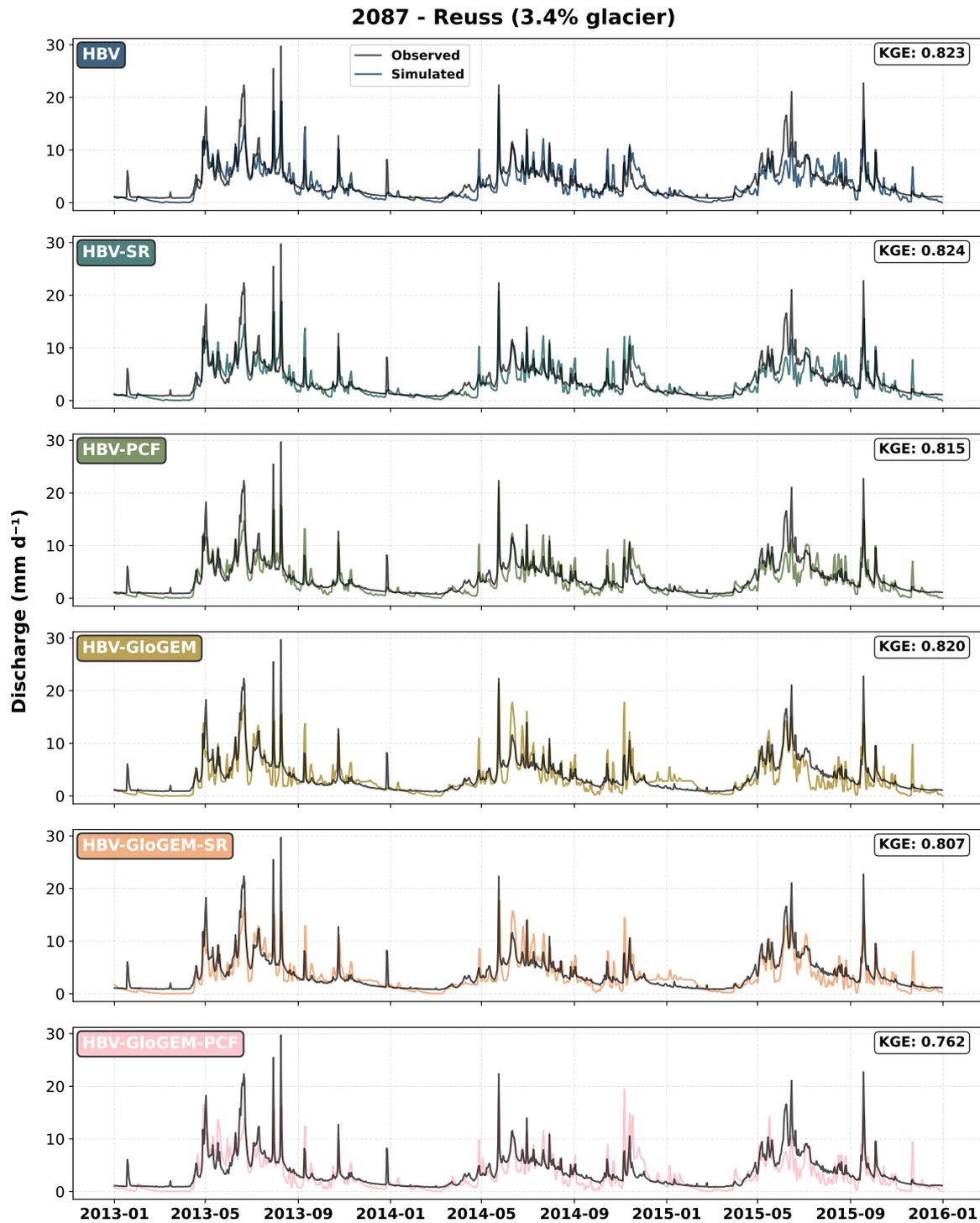
Figure S4. Daily observed and simulated streamflow time series for Reuss catchment (ID 2087) for all configurations and years 2013-2016 in the validation period.
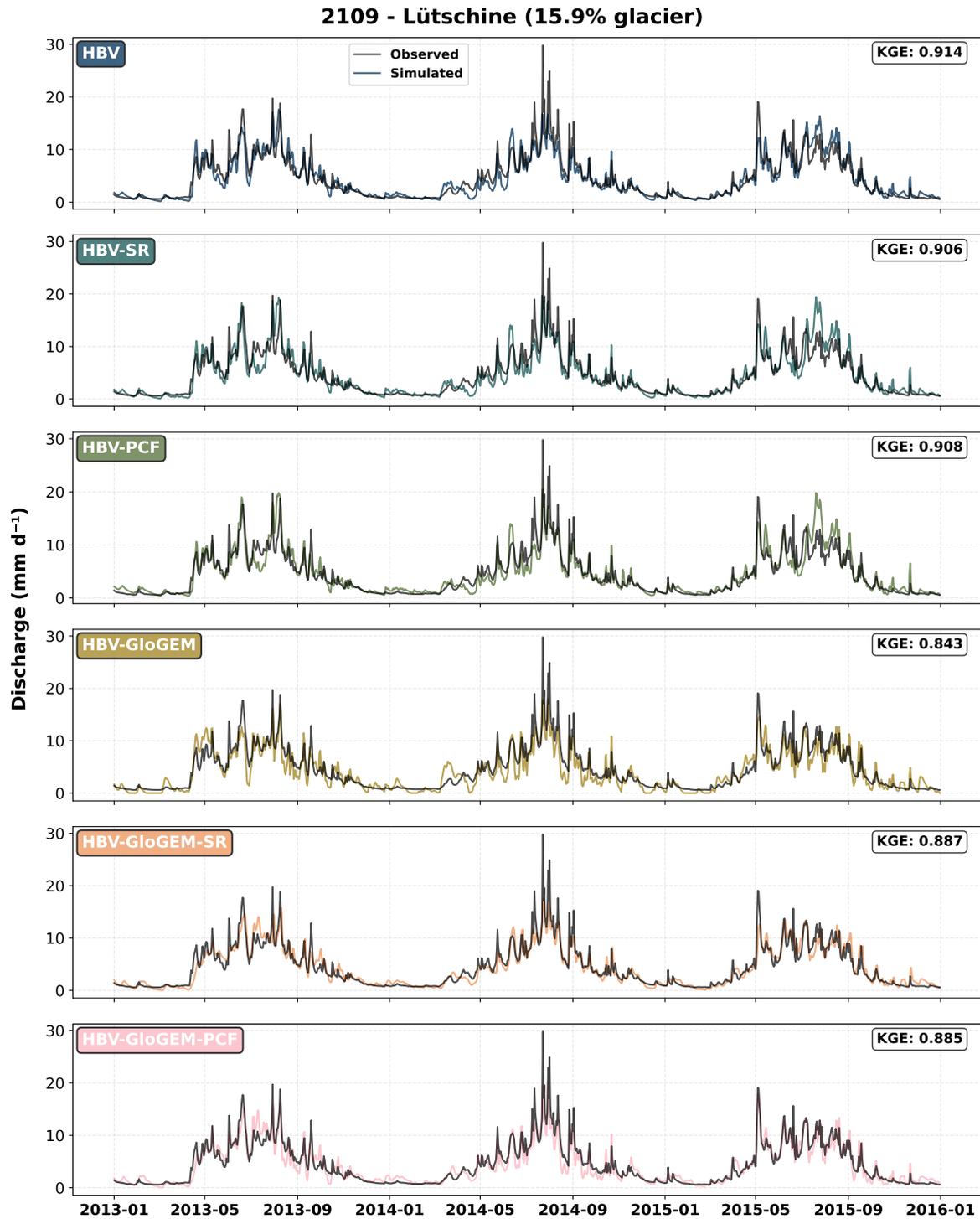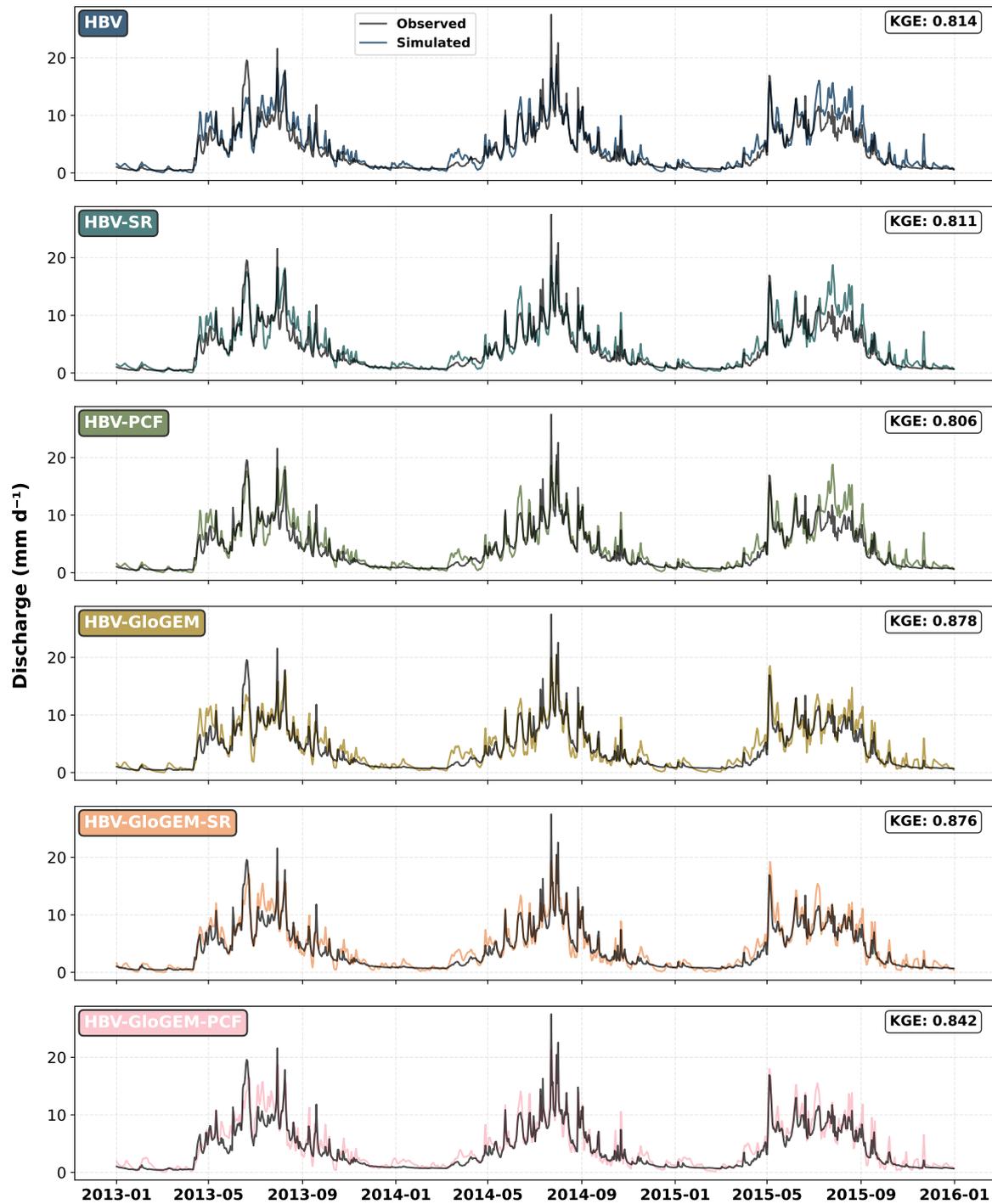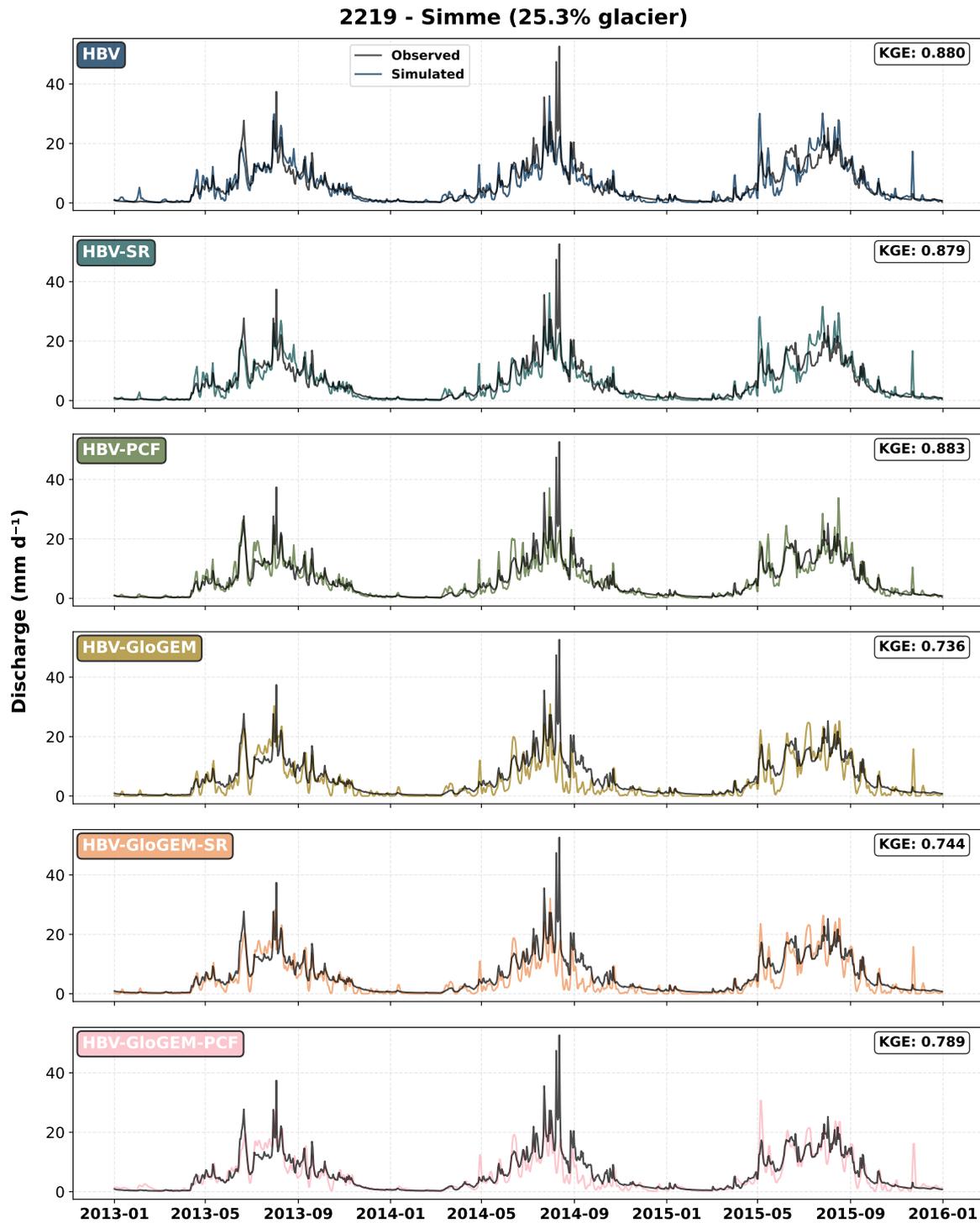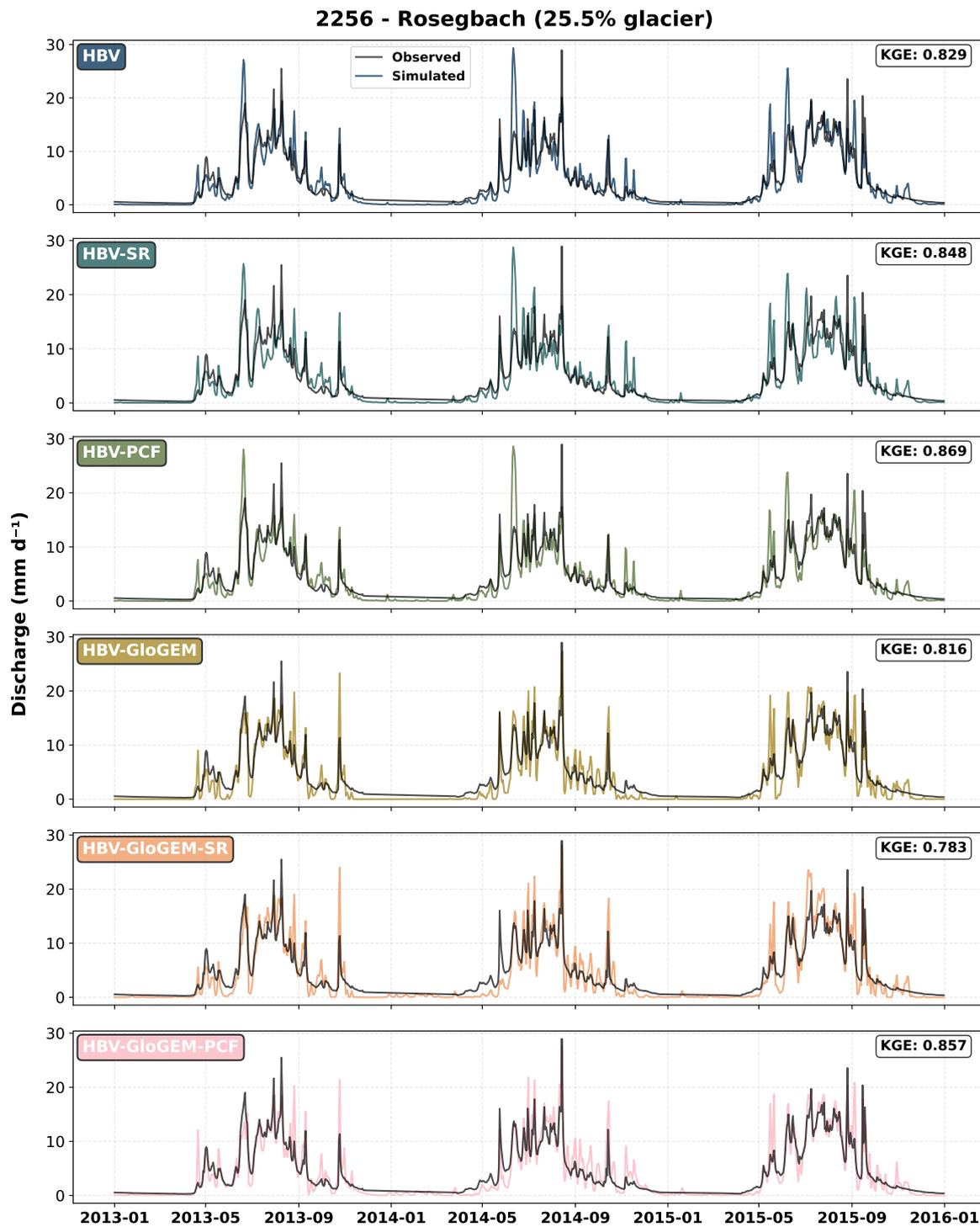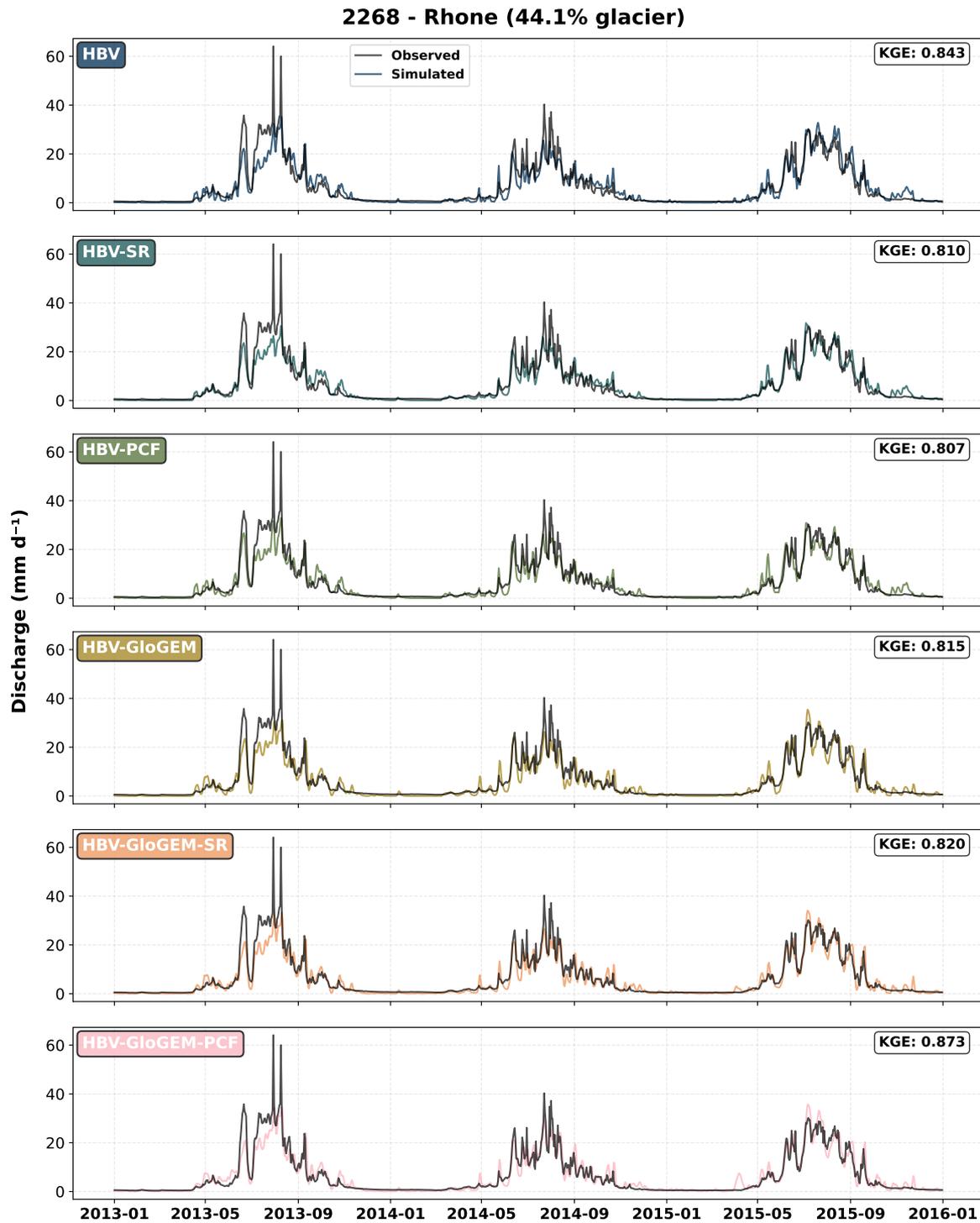
Figure S5. Daily observed and simulated streamflow time series for Lütschine catchment (ID 2109) for all configurations and years 2013-2016 in the validation period.
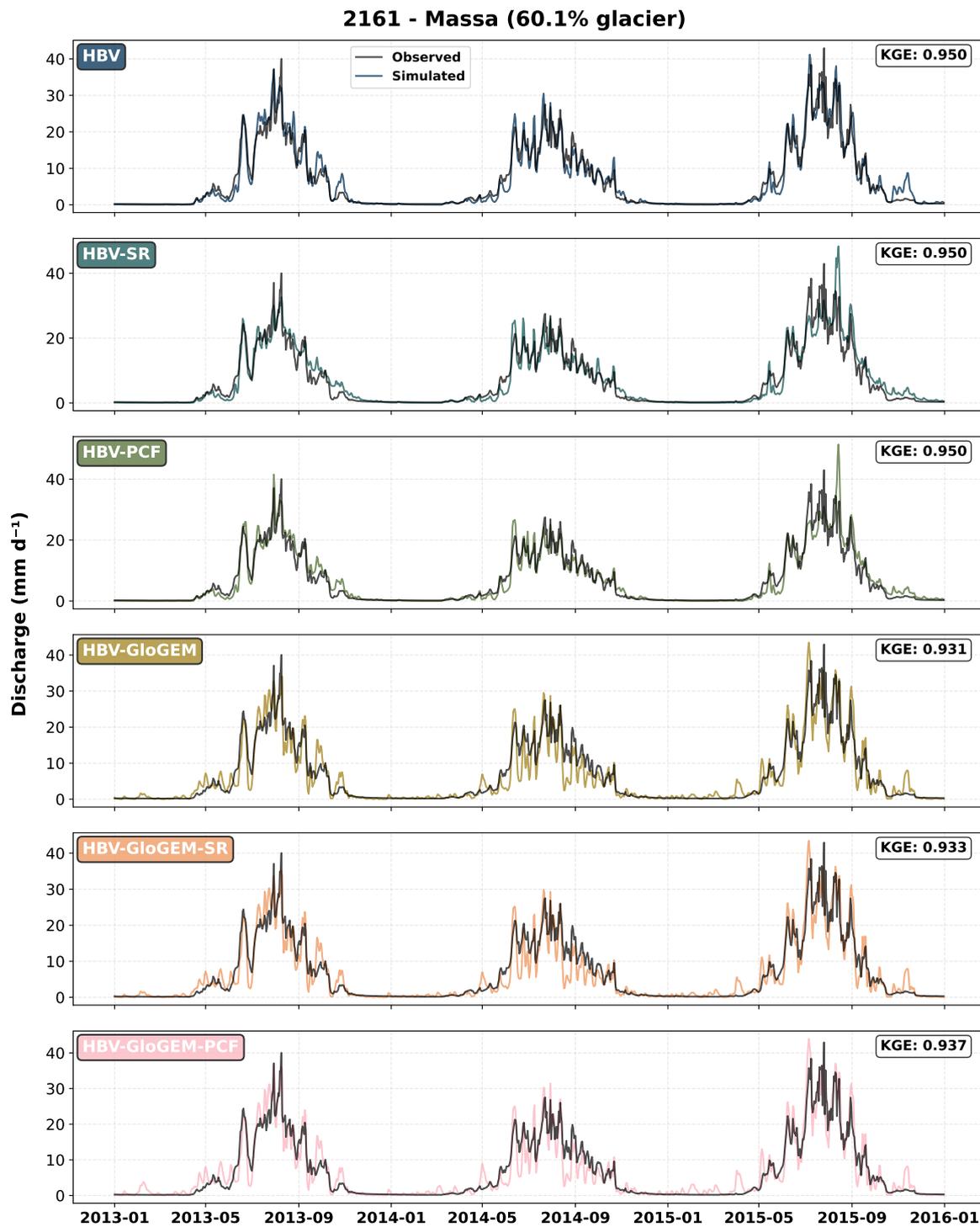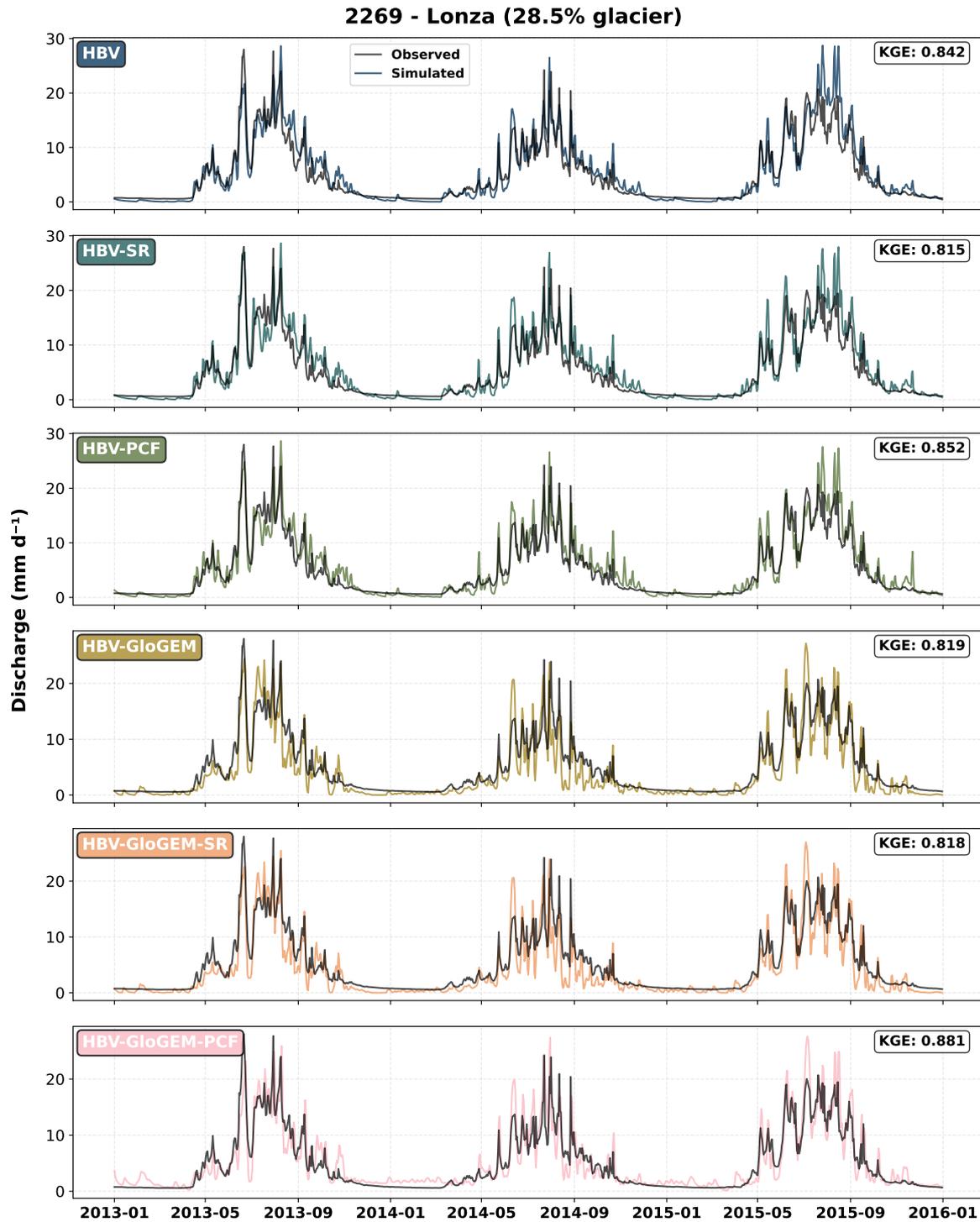
Figure S6. Daily observed and simulated streamflow time series for Massa catchment (ID 2161) for all configurations and years 2013-2016 in the validation period.
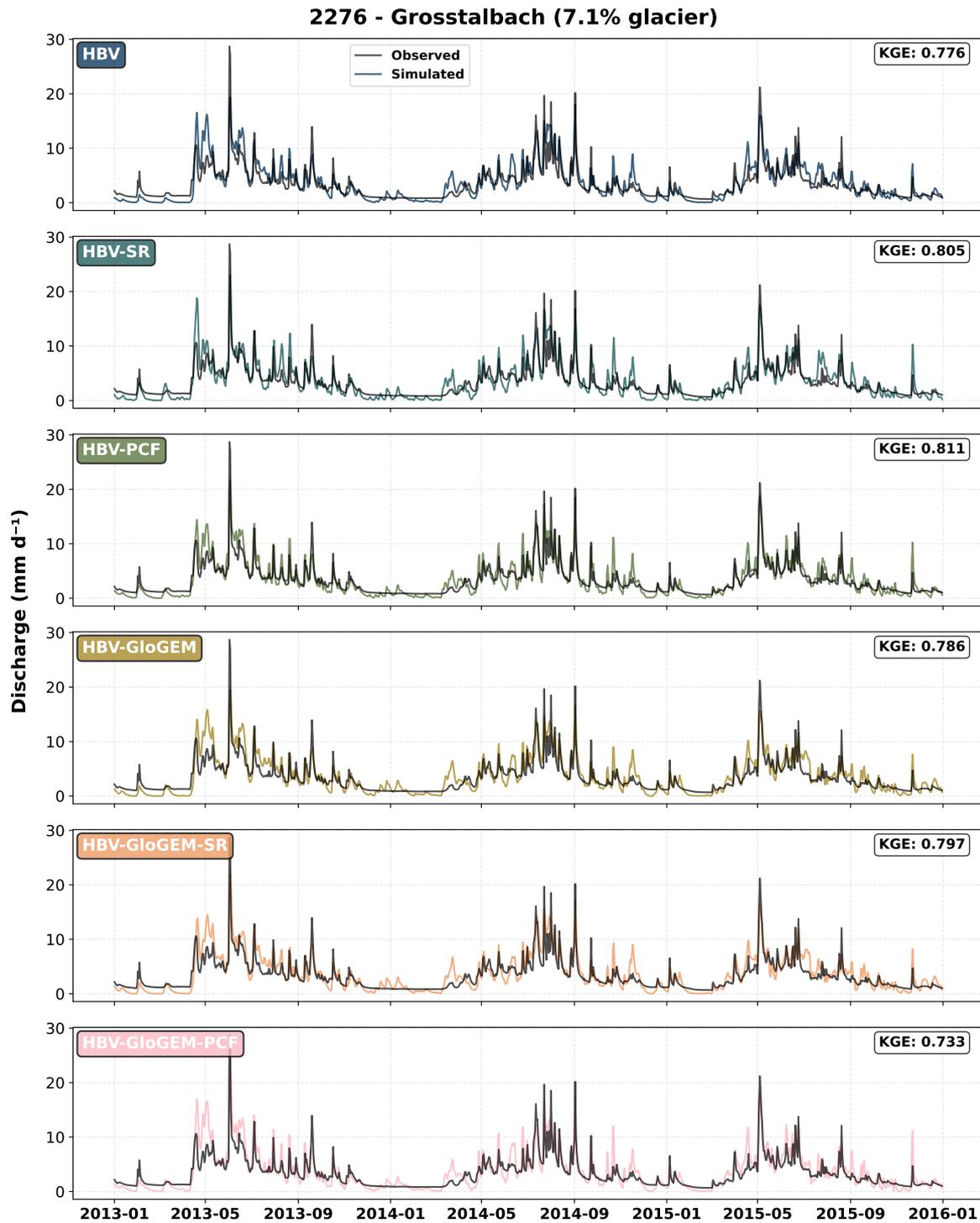
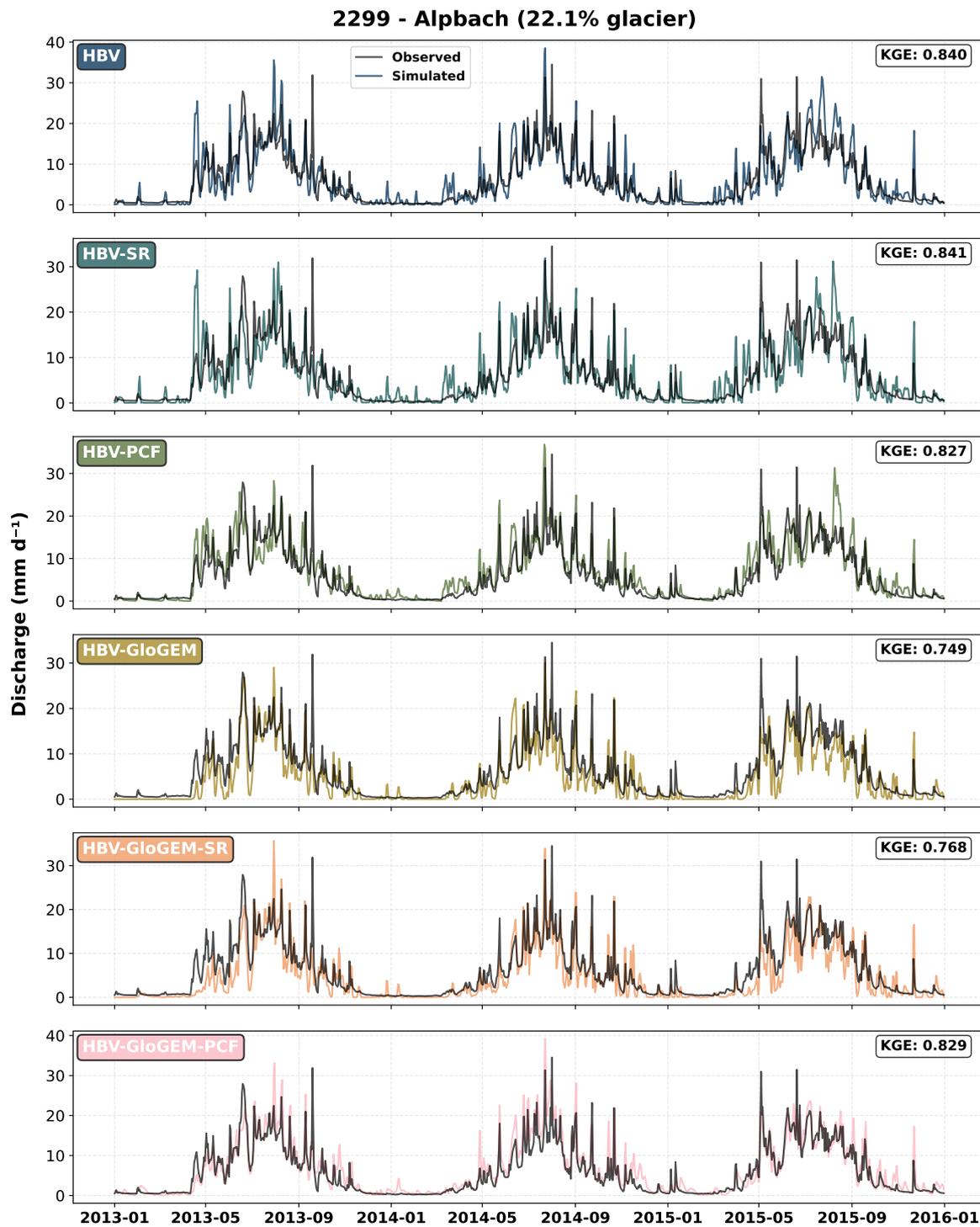**Figure S7.** Daily observed and simulated streamflow time series for Weisse Lütschine catchment (ID 2200) for all configurations and years 2013-2016 in the validation period.

Figure S8. Daily observed and simulated streamflow time series for Simme catchment (ID 2219) for all configurations and years 2013-2016 in the validation period.
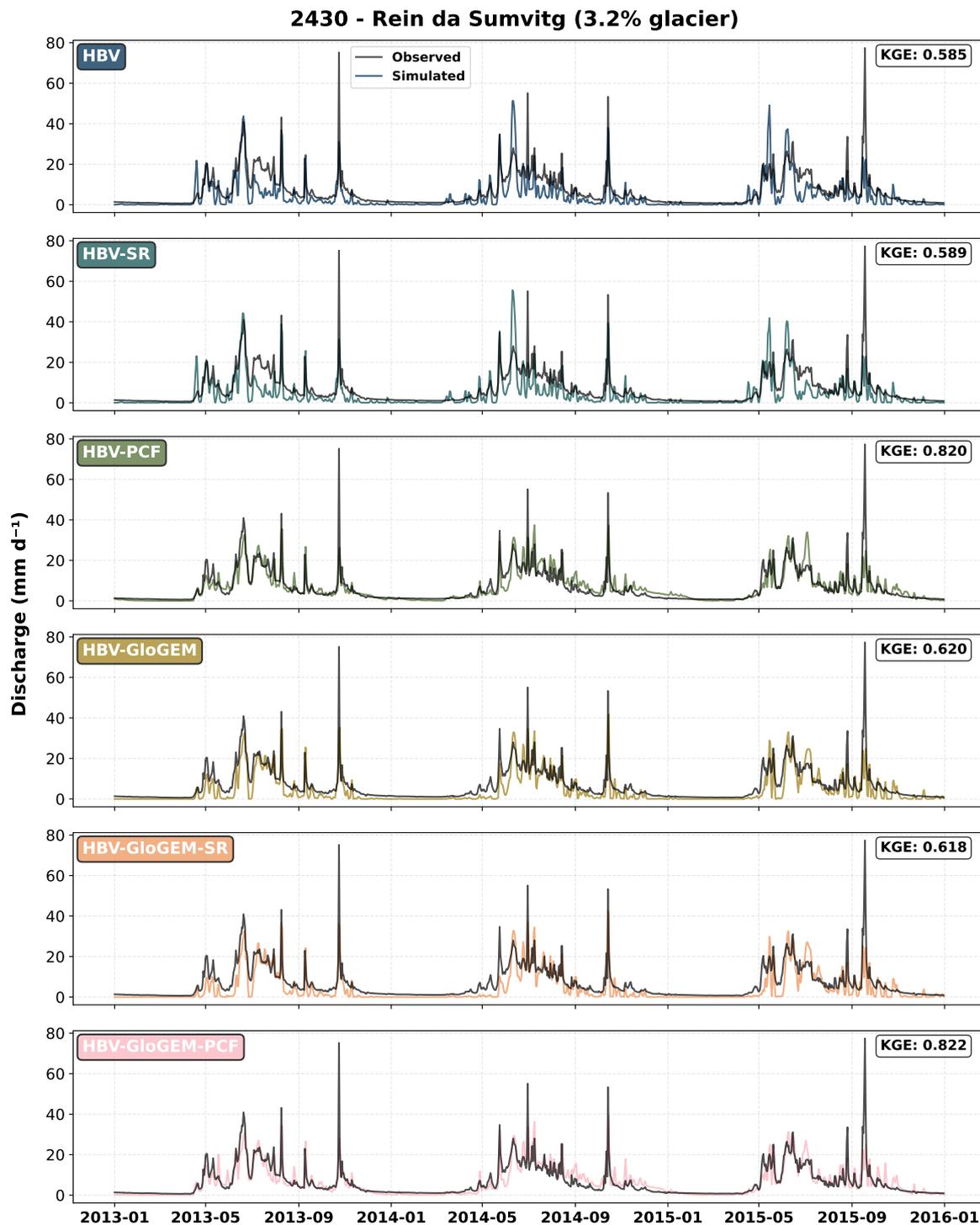
Figure S9. Daily observed and simulated streamflow time series for Rosegbach catchment (ID 2256) for all configurations and years 2013-2016 in the validation period.

Figure S10. Daily observed and simulated streamflow time series for Rhone catchment (ID 2268) for all configurations and years 2013-2016 in the validation period.

Figure S11. Daily observed and simulated streamflow time series for Lonza catchment (ID 2269) for all configurations and years 2013-2016 in the validation period.
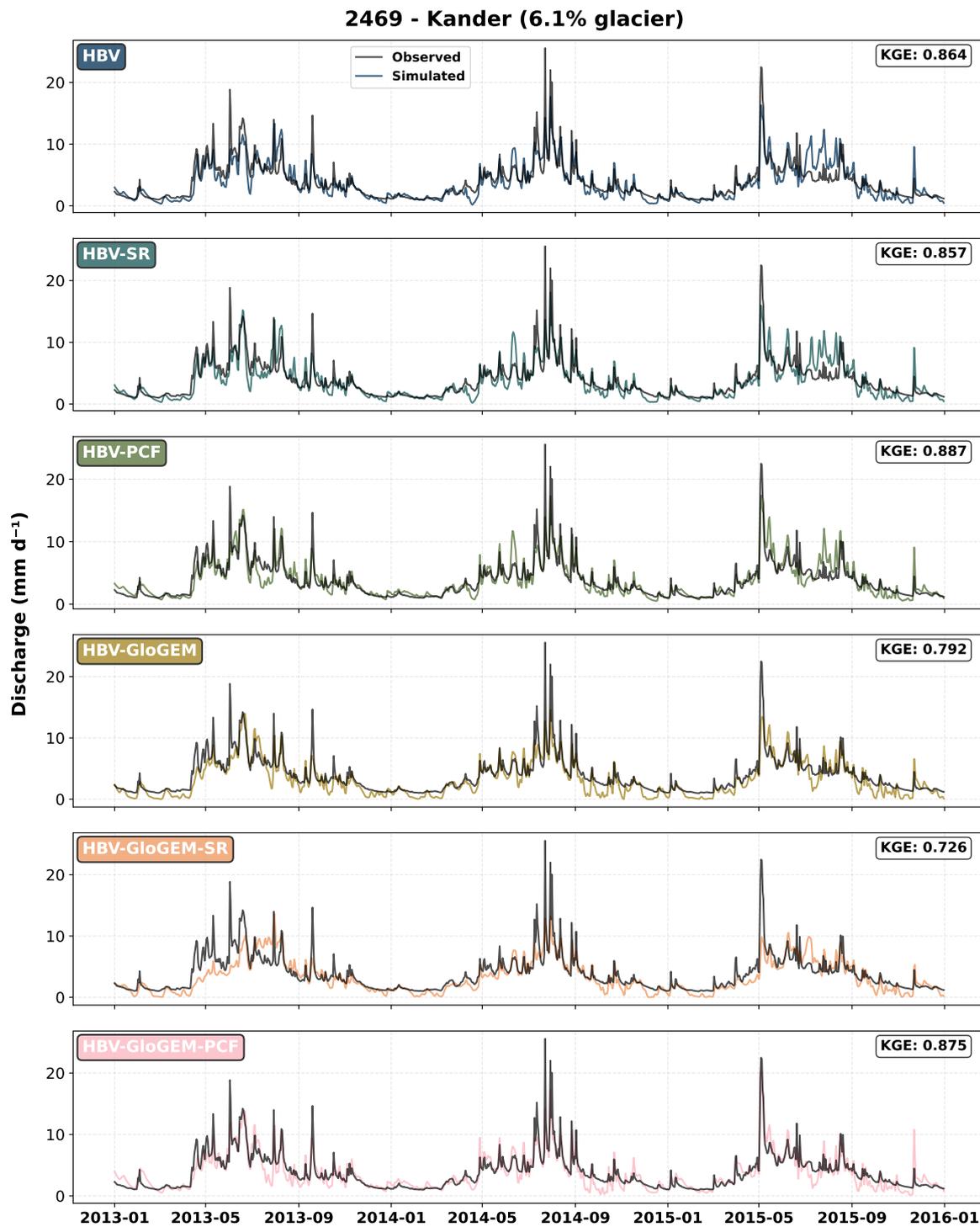
Figure S12. Daily observed and simulated streamflow time series for Grosstalbach catchment (ID 2276) for all configurations and years 2013-2016 in the validation period.
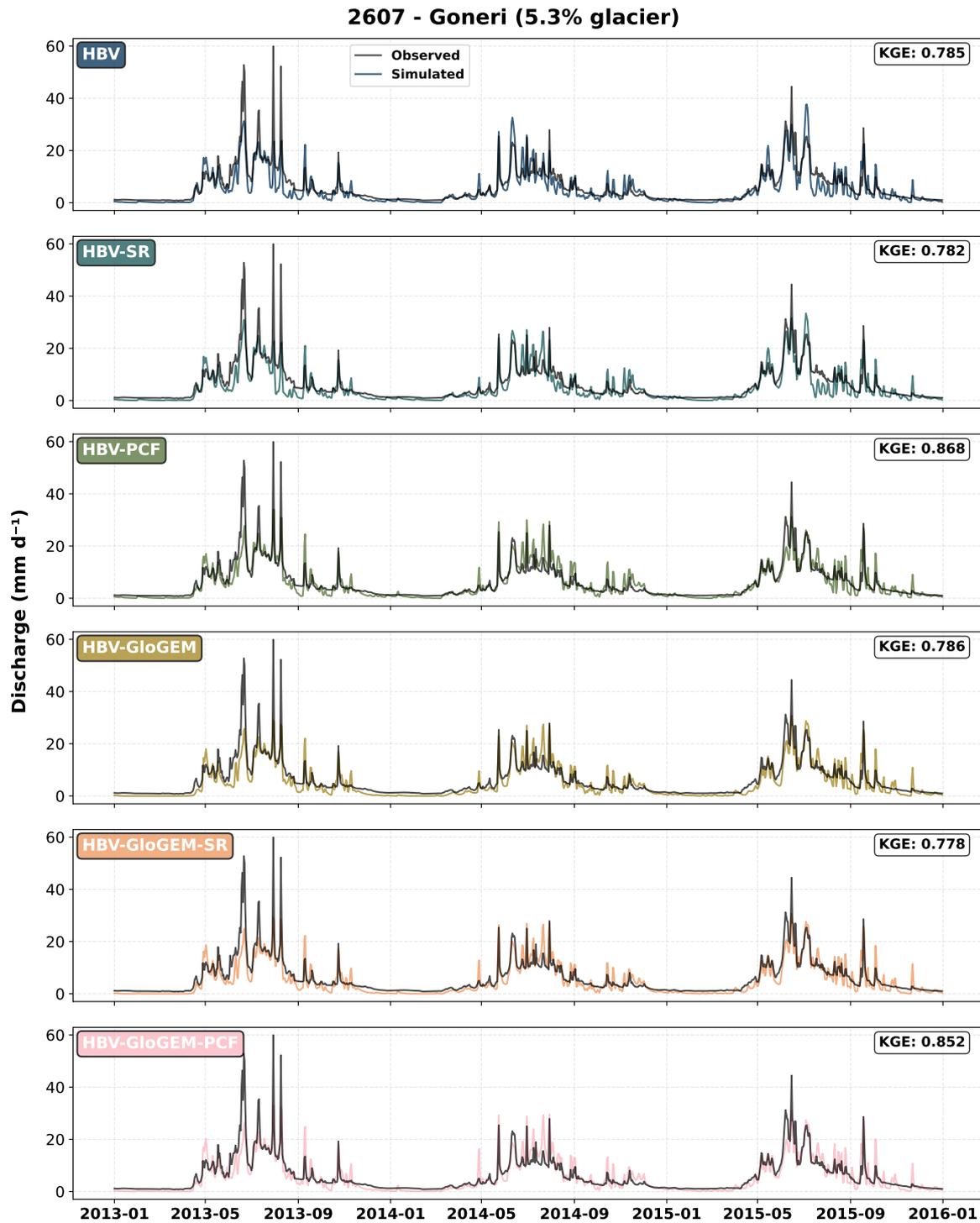
2299 - Alpbach (22.1% glacier)

Figure S13. Daily observed and simulated streamflow time series for Alpbach catchment (ID 2299) for all configurations and years 2013-2016 in the validation period.

Figure S14. Daily observed and simulated streamflow time series for Rein da Sumvitg catchment (ID 2430) for all configurations and years 2013-2016 in the validation period.

Figure S15. Daily observed and simulated streamflow time series for Kander catchment (ID 2469) for all configurations and years 2013-2016 in the validation period.

Figure S16. Daily observed and simulated streamflow time series for Goneri catchment (ID 2607) for all configurations and years 2013-2016 in the validation period.
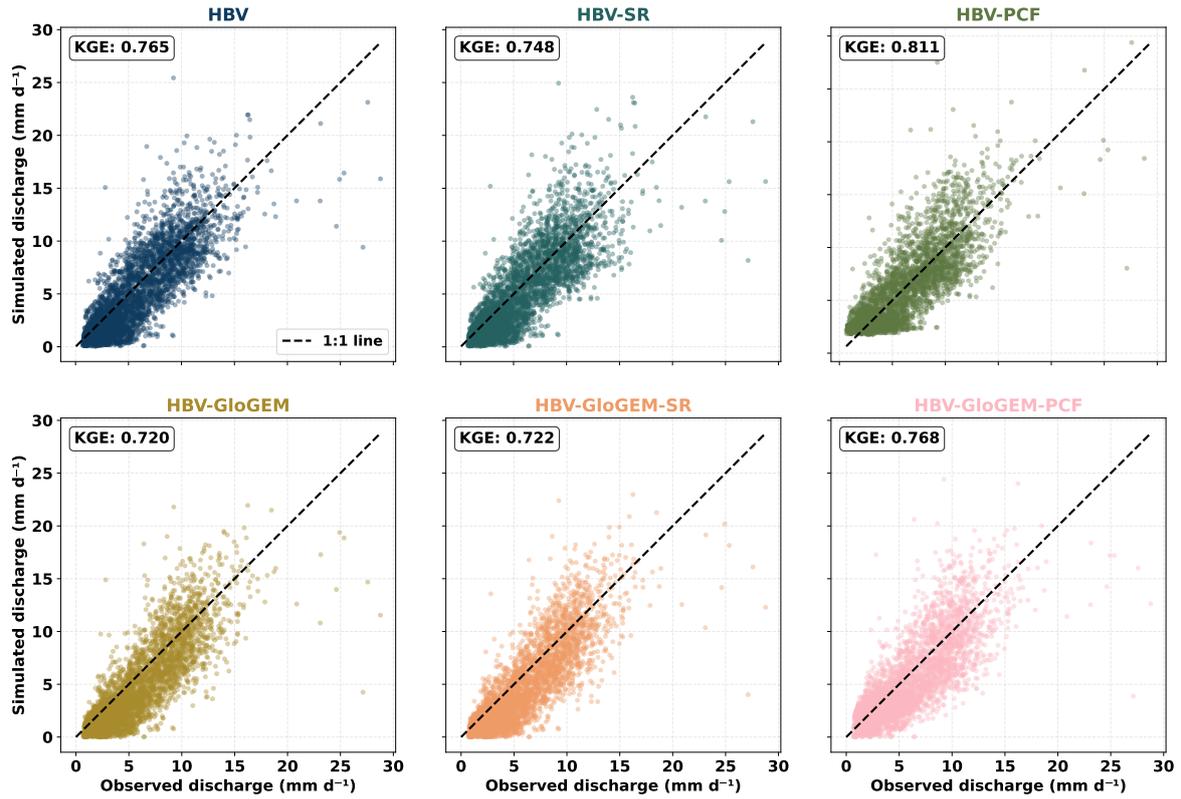
2019 - Aare (17.5% glacier)

Figure S17. Scatter plot of observed and simulated streamflow for Aare catchment (ID 2019) for all configurations in the validation period.
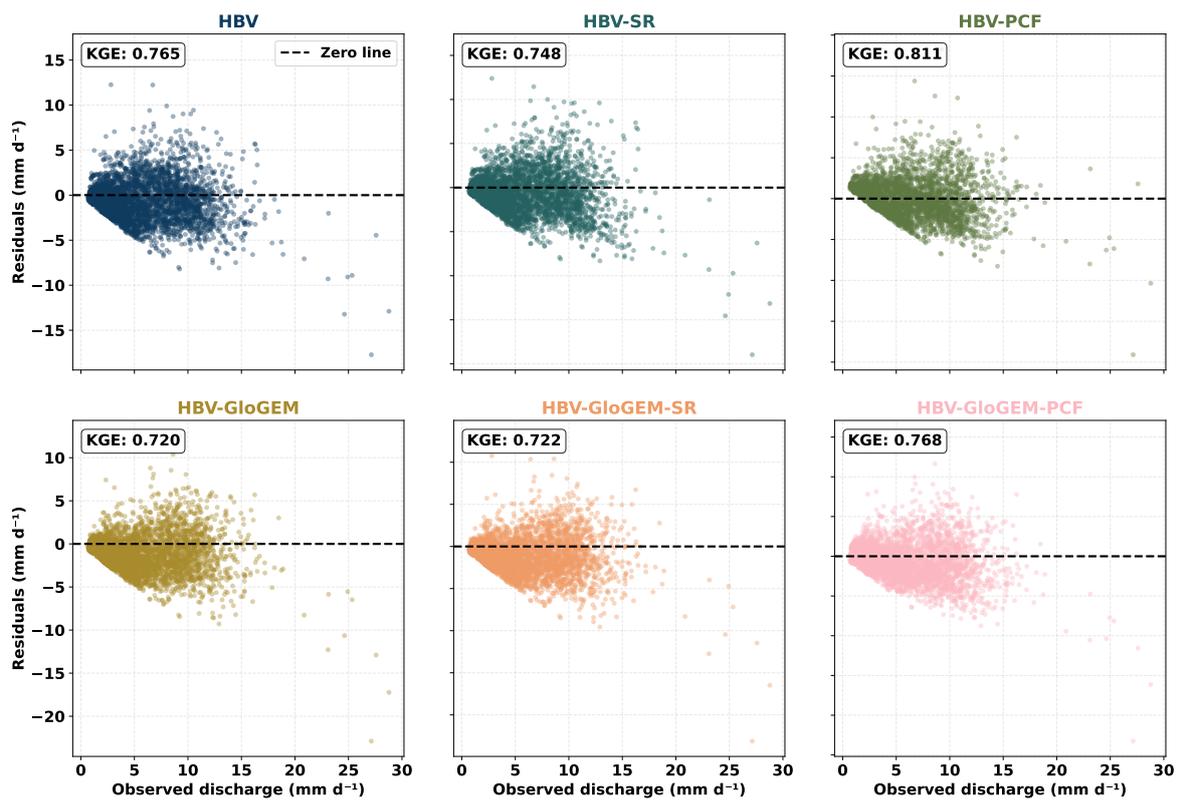
2019 - Aare (17.5% glacier)

Figure S18. Residual plot of observed and simulated streamflow for Aare catchment (ID 2019) for all configurations in the validation period.
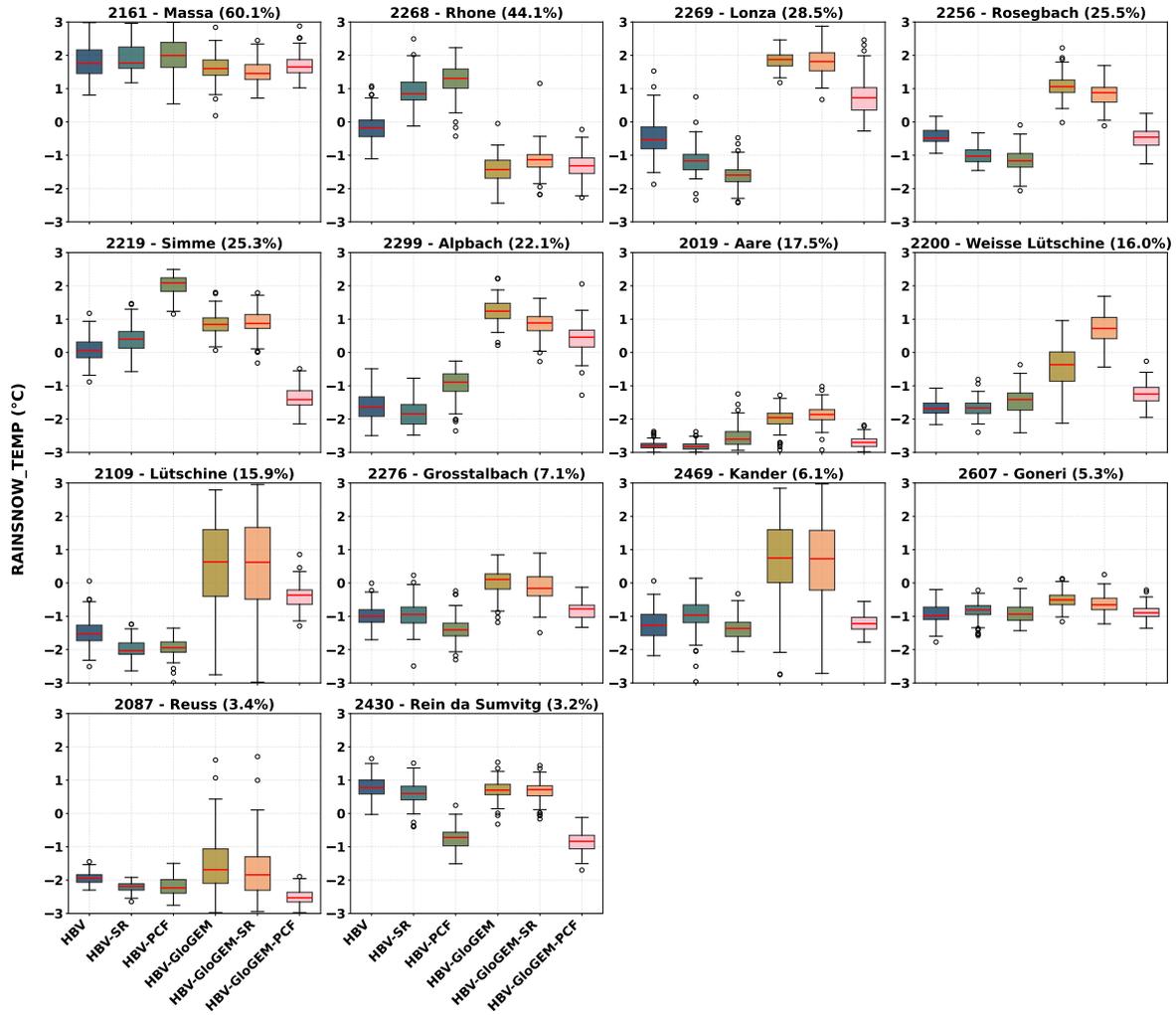
Figure S19. $f_{RAINSNOW\_TEMP}$ parameter distribution for 100 best parameter sets for all catchments and all model configurations
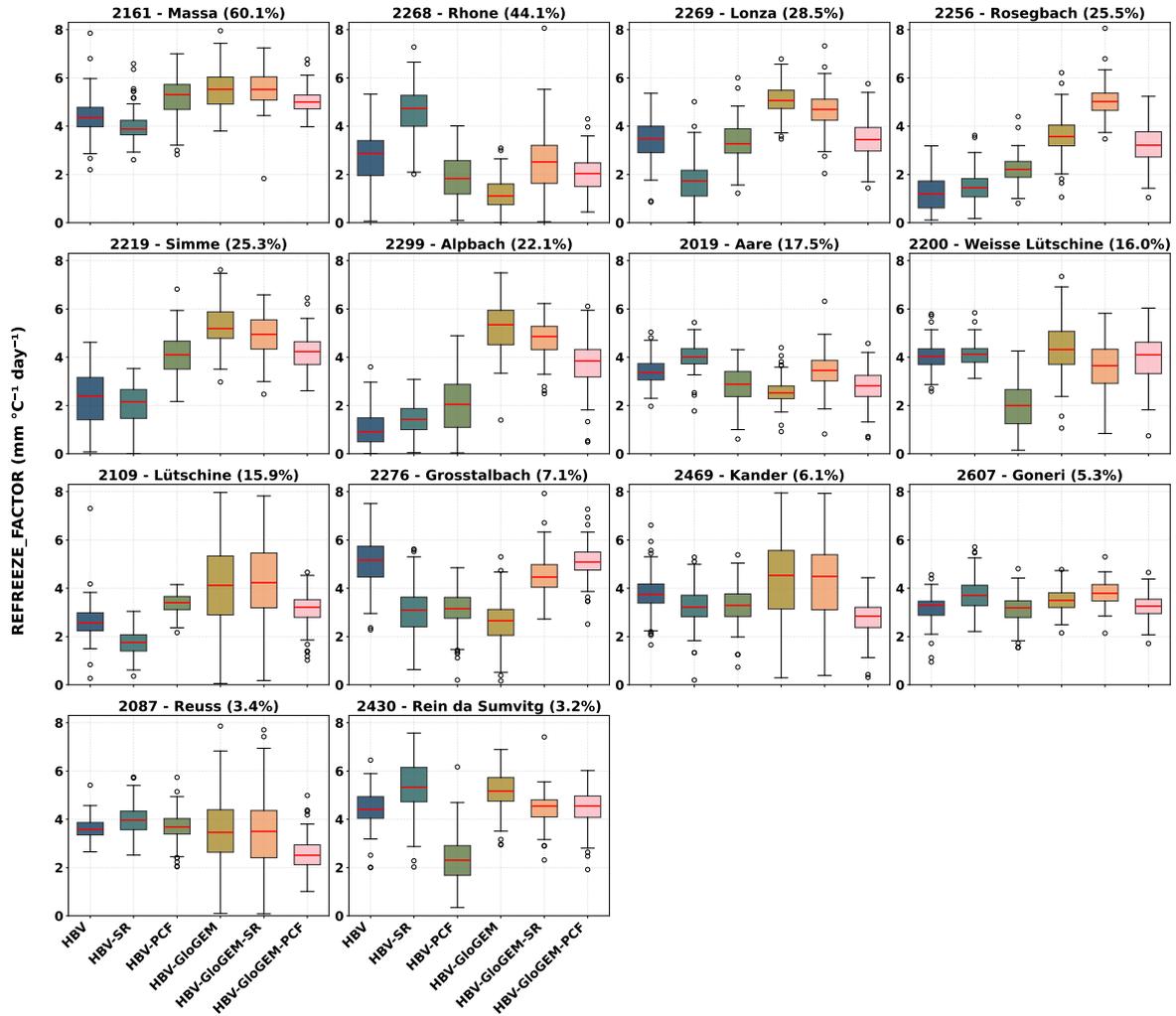
Figure S20. $f_{\text{REFREEZE\_FACT}}$ parameter distribution for 100 best parameter sets for all catchments and all model configurations
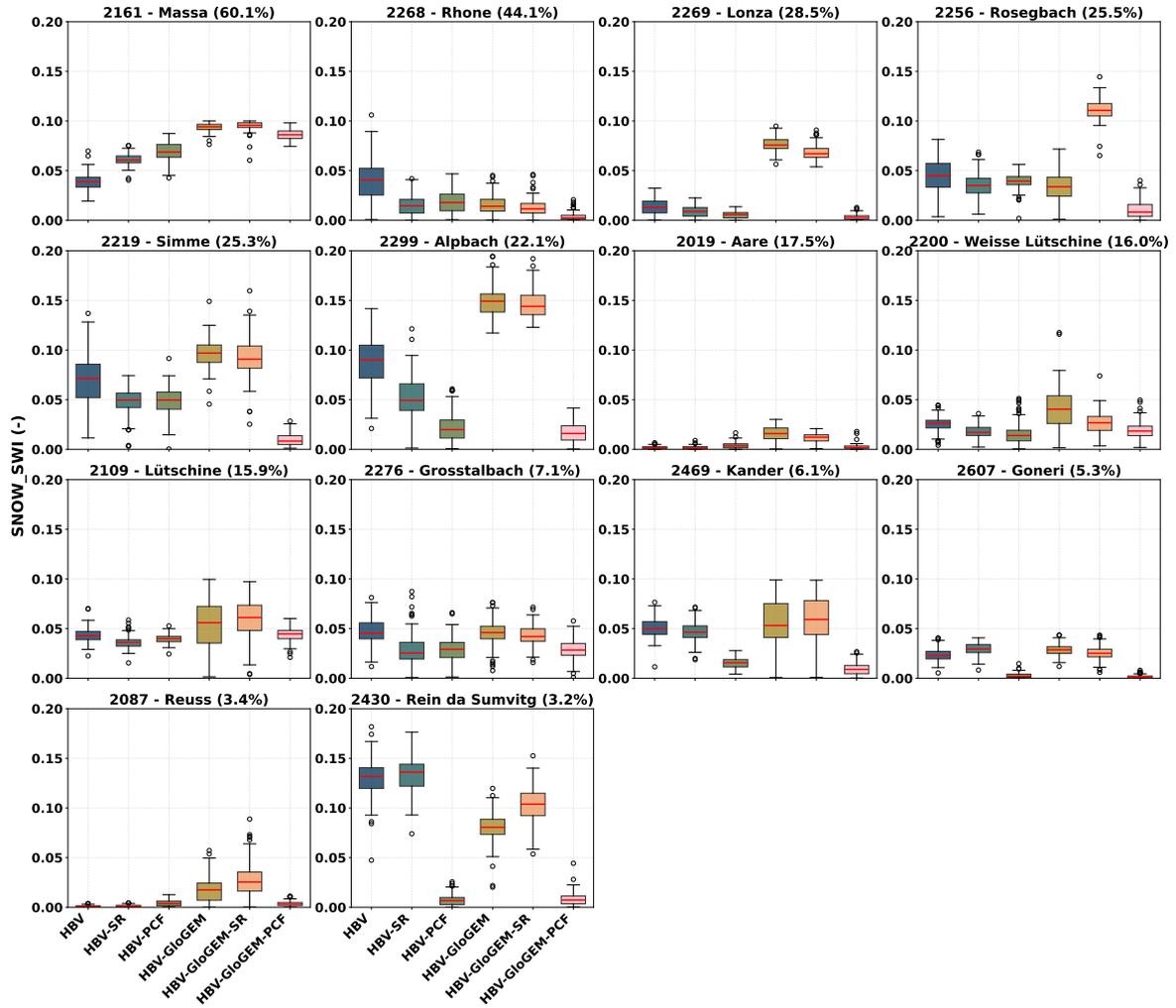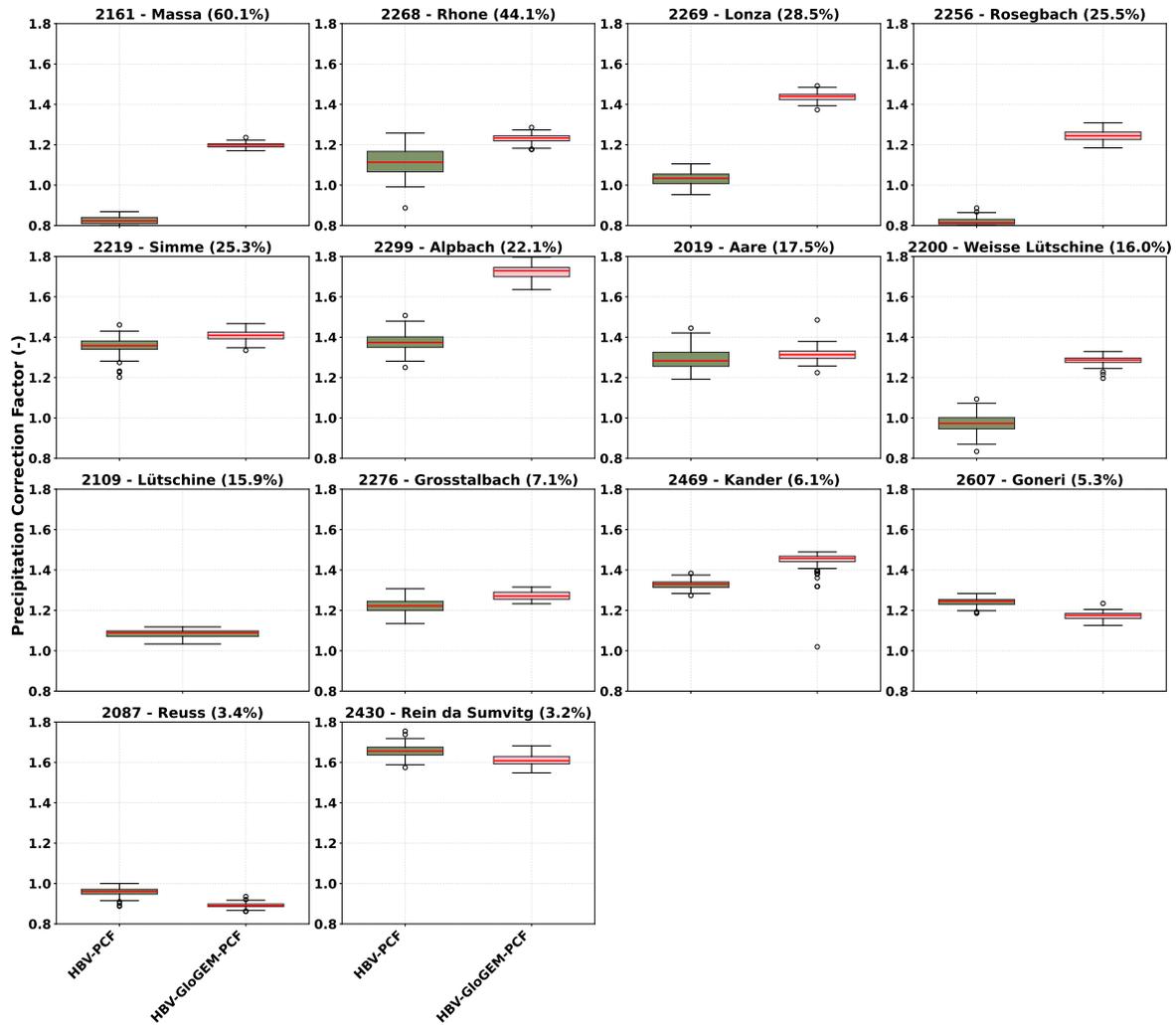
Figure S21. f_{SNOW_SWI} parameter distribution for 100 best parameter sets for all catchments and all model configurations

Figure S22. $f_{\text{PRECIP\_CORR}}$ parameter distribution for 100 best parameter sets for all catchments, and HBV-PCF and HBV-GloGEM-PCF configurations