QPE

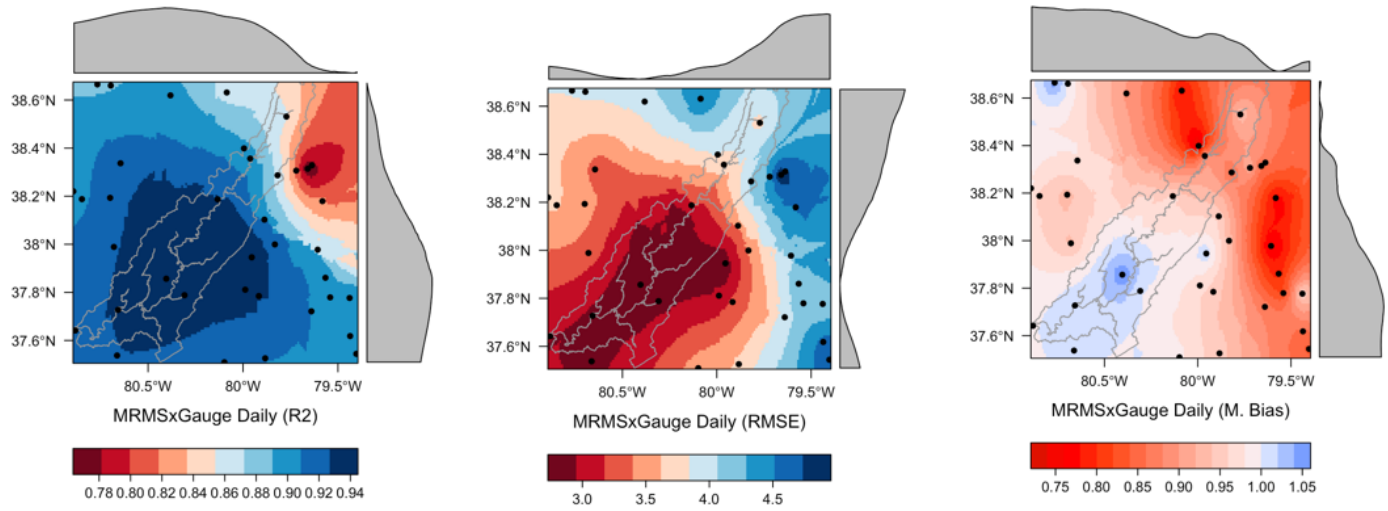

Figure 1S: (a) Pearson Correlation, (b) Root Mean Squared Error and (c) Multiplicative bias against MRMS and daily accumulated rain gauges time-series between 05/2015 and 03/2020.

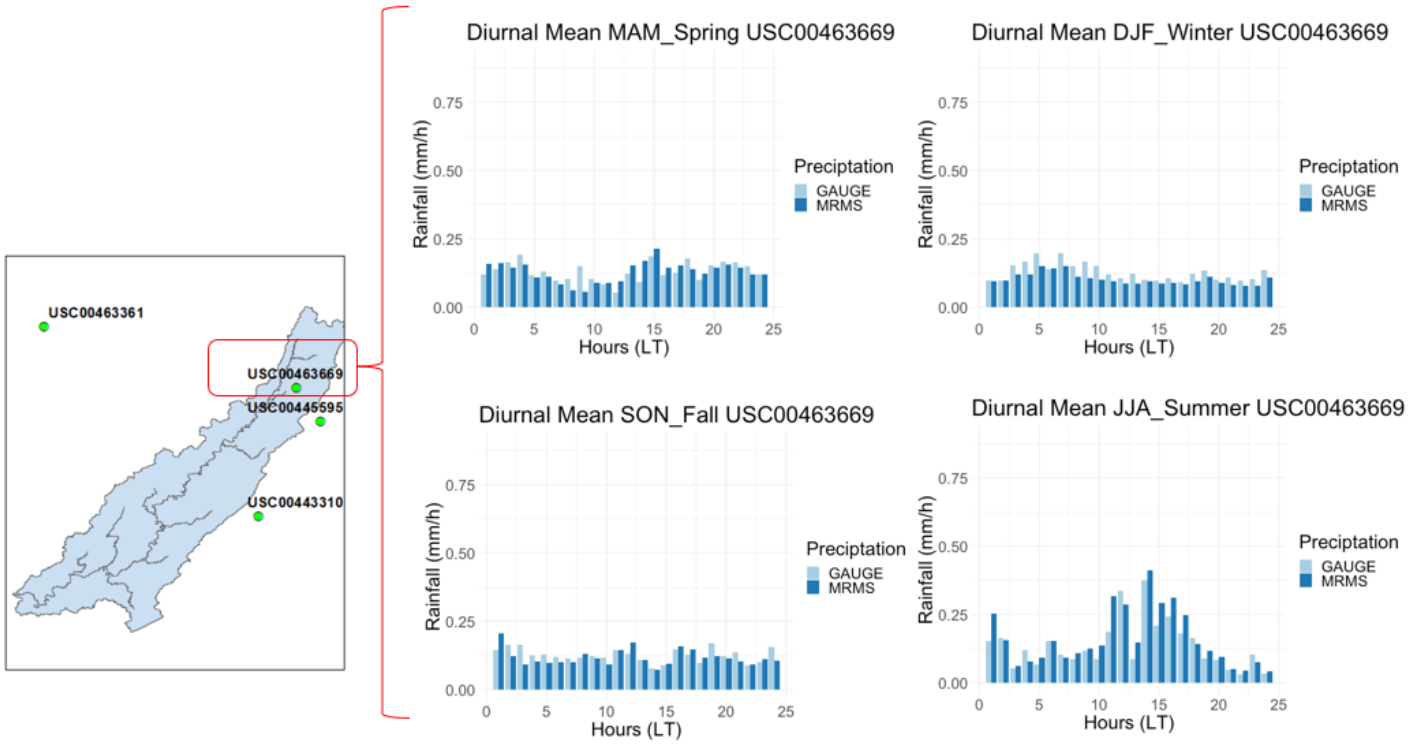

Figure 2S: Diurnal cycle of precipitation considering the available hourly rain gauge inside the basin and MRMS grid point between for different season groups between 05/2015 and 03/2020. (a) spring (b) winter (c)fall and (d) summer.

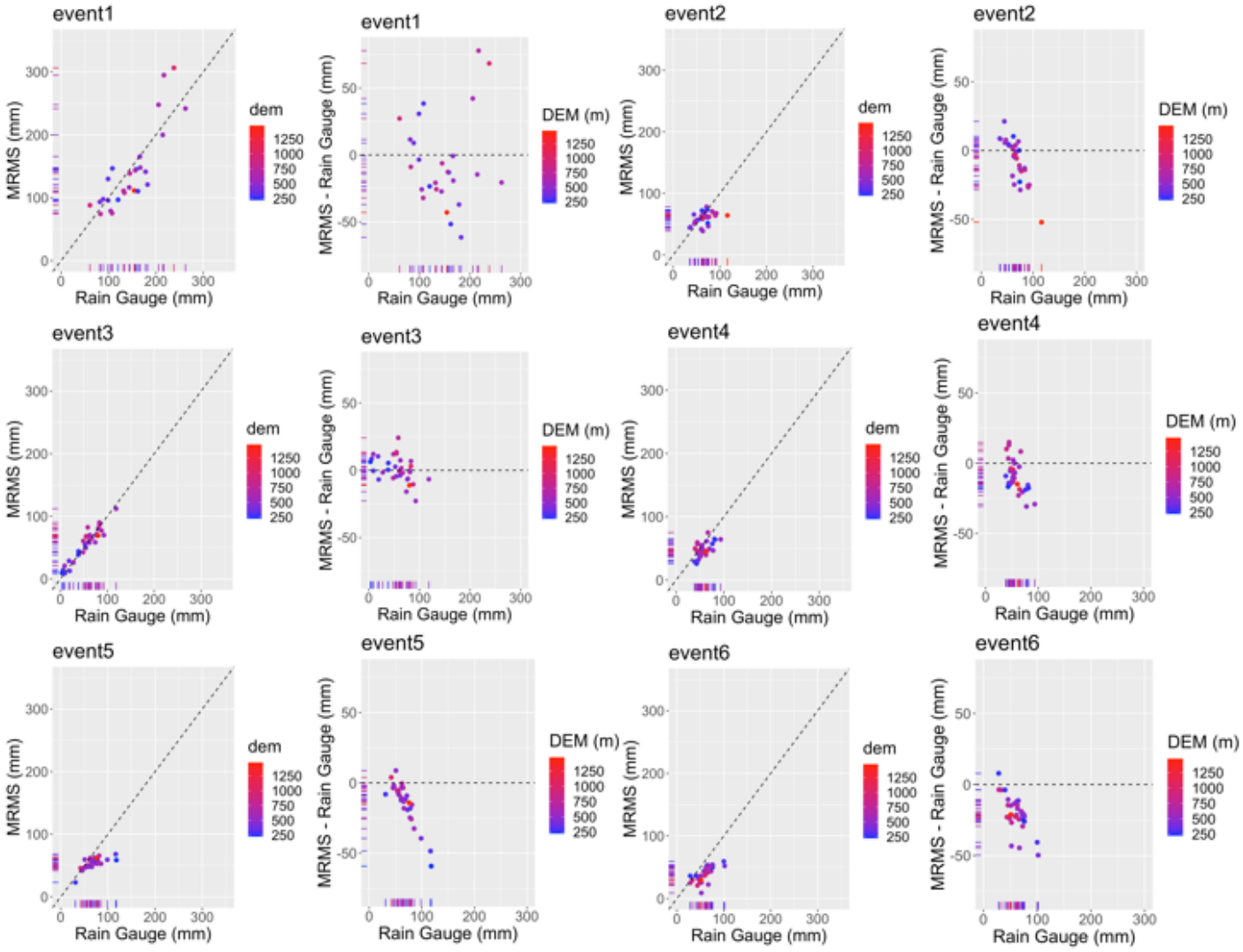

Figure 3S: Hourly comparison between mean rain gauge value and MRMS pixels averaged among the 4 rain gauges sites.

QPF Evaluation

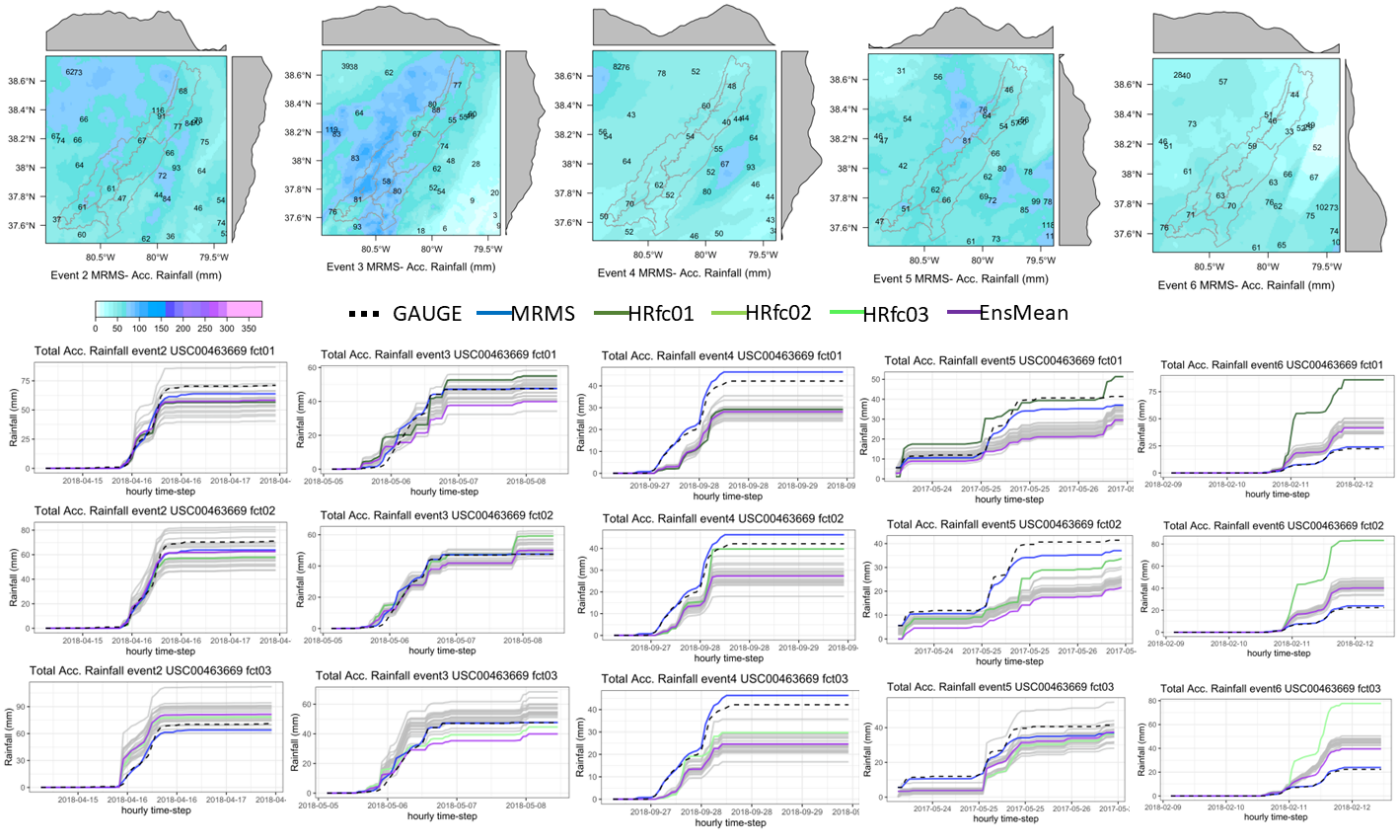

Figure 4S: Total accumulated rainfall for the remaining 5 extreme events analyzed in this study.

WRF-Hydro Calibration

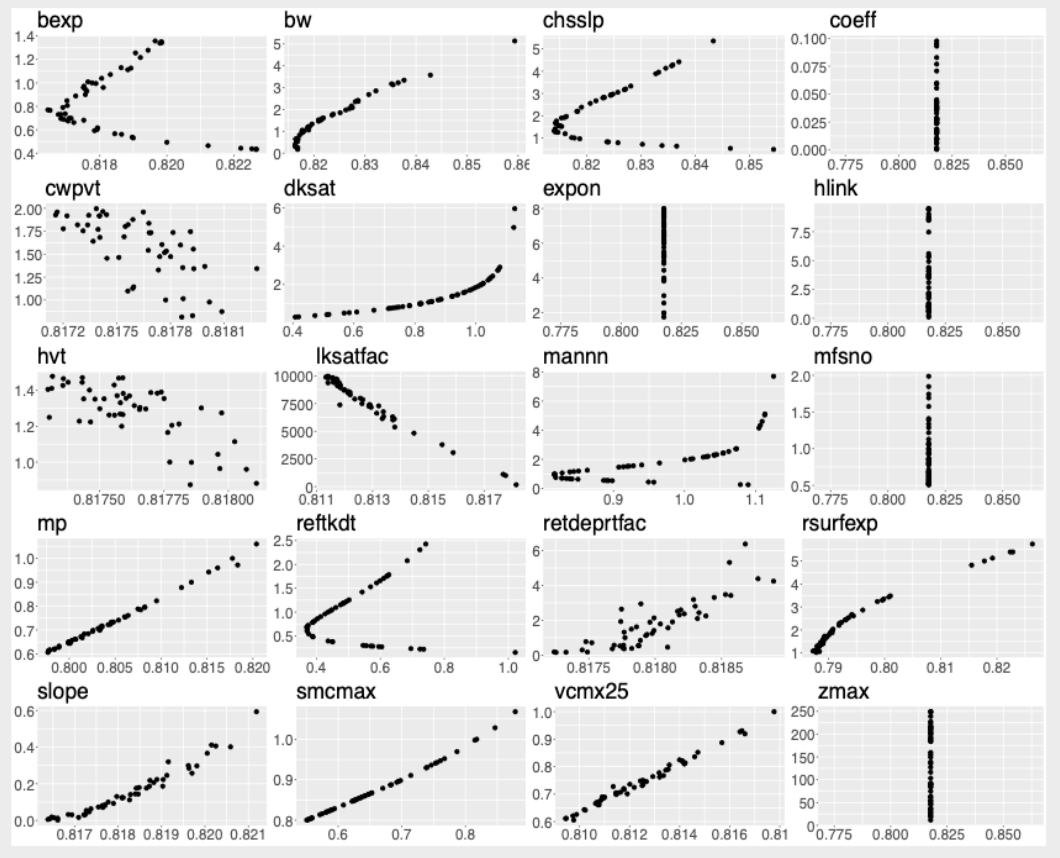

Figure 5S: Local sensitivity analysis (x axis; variation of one parameter at each time) of Noah-MP parameters during 50 DDS iterations considering the optimum NSE value (y axis).

Table 2: LSM parameters table with ranges and initial values for DDS iterations. NWM, Default and Calibrated are the spatial average values over the basin domain.

Parameter	Factor Type	Min	Max	Initial	NWM	Default	Calibrated
bexp	multiplicative	0.4	1.9	1	6.020	5.249	5.664
smcmax	multiplicative	0.5	1.5	1	0.484	0.463	0.188
dksat	multiplicative	0.1	1000	10	9.39E-06	3.30E-06	2.35E-06
lksat	multiplicative	0.2	1000	10	9.39E-06	3.30E-06	2.35E-06
refkdt	substitutive	0.1	4	0.4	0.399	3.000	0.318
slope	substitutive	0	1	0.1	0.082	0.100	0.017
retdeprtfac	substitutive	0.1	10000	7000	7490.832	1.000	3.654
lksatfac	multiplicative	1	10000	7	7609.401	1000.000	3821.044
zmax	substitutive	0	250	140	143.506	50.000	38.818
expon	substitutive	1	8	3.6	3.624	3.000	3.304
coeff	substitutive	0.0001	2	1	1.000	1.000	0.038
cwpvt	multiplicative	0.5	2	1.2	0.311	0.180	0.180
vcmx25	multiplicative	0.6	1.4	0.8	60.990	75.582	48.725
mp	multiplicative	0.6	1.4	1.2	9.396	8.939	8.939
hvt	multiplicative	0.25	10	6	15.400	2.624	2.624
mfsno	multiplicative	0.3	2	0.4	1.104	2.500	2.500
rsurfexp	substitutive	1	6	2.5	2.417	5.000	4.559

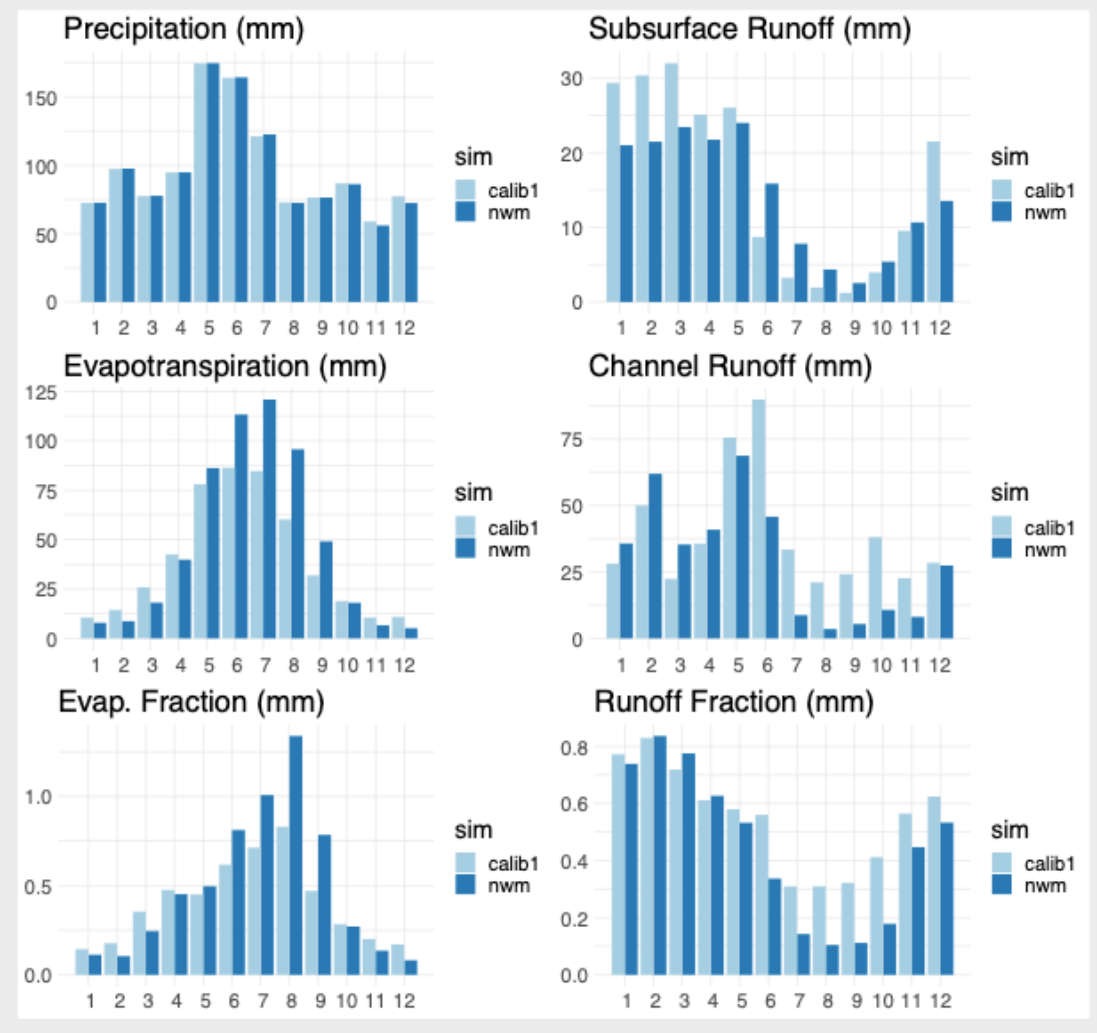

Figure 6S: Comparison of water budget components between the calibrated WRF-Hydro gridded and parameters obtained from the NWM version 2.0. The x axis represent the average for each month between 05/2015 and 12/2019. Channel runoff represents the mean lateral flow entering the channel over the basin area.

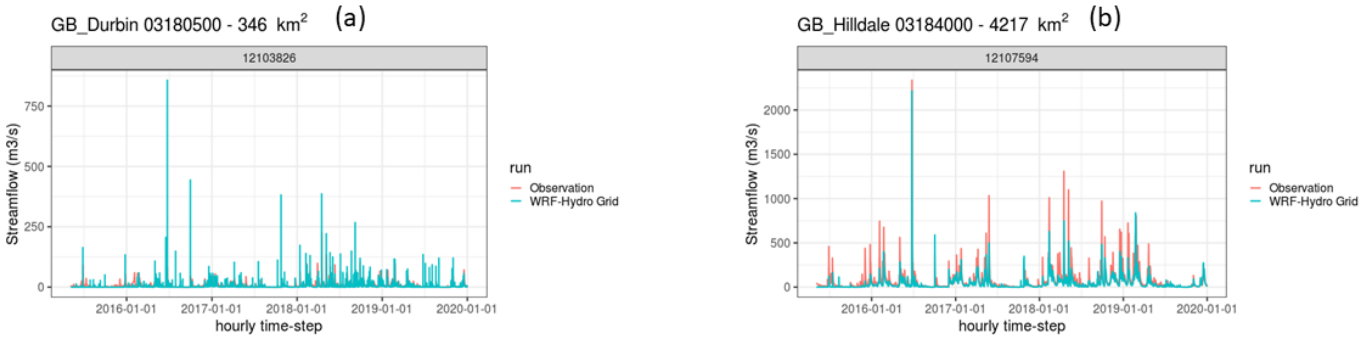

Figure 6Sb: Hydrographs using the NWM version 2.0 calibrated parameters for (a) Durbin (NSE=-0.25, r2=0.35, bias=-4.89) and (b) Hilldale (NSE=0.71, r2=0.89, bias = -36.9). The statistics were calculated using the package *rwrfhydro*.

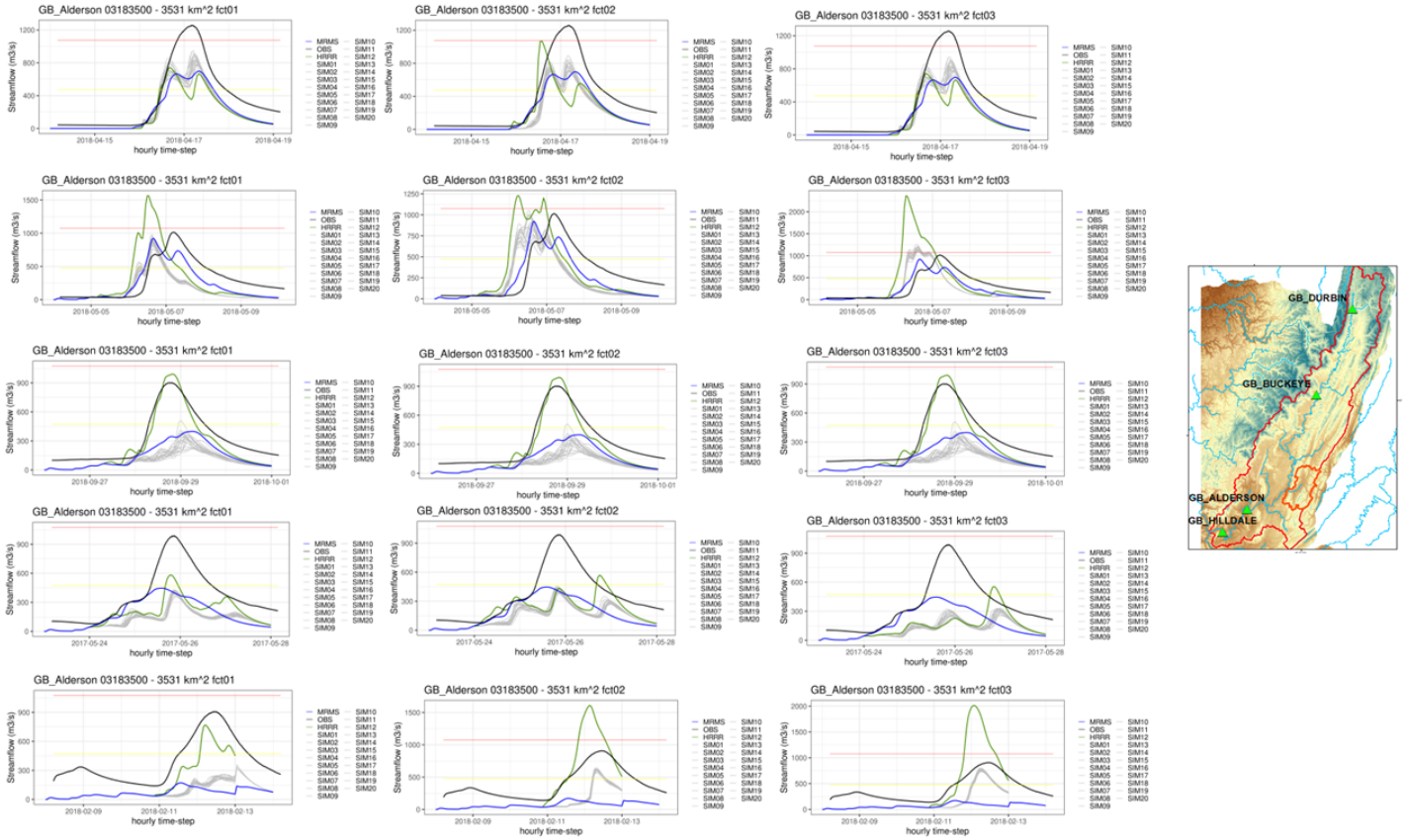

Figure 7S: Streamflow simulations for the remaining 5 events analyzed. Each row represents a flood event, and each column is the corresponding forecast lead-time up to 3 hours.