S1. Methodological Framework

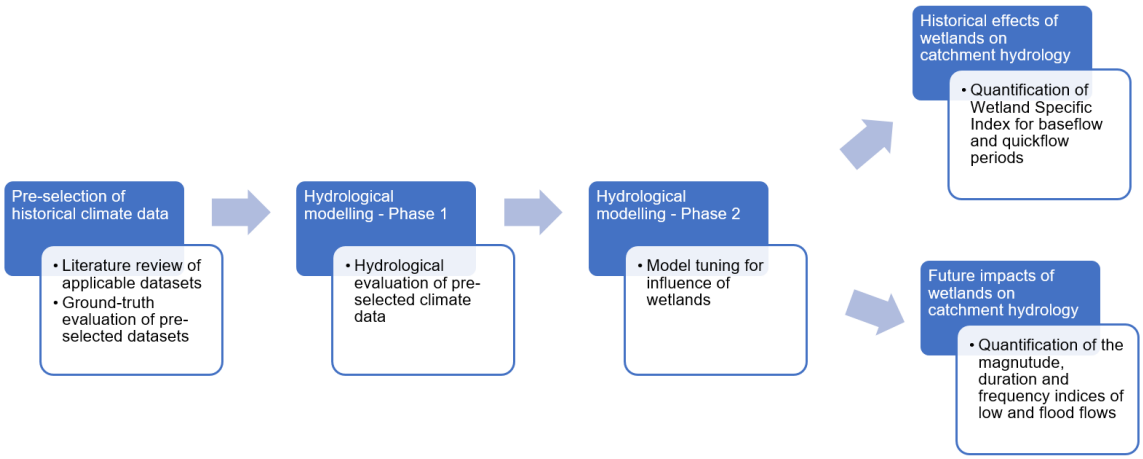

Figure S1. Schematisation of steps followed in the study.

S2. Equations for Calculation of FAR, POD, FB and HSS

$$FAR = [B \div (A + B)] \times 100 \quad \text{(S1)}$$

$$POD = [A \div (A + C)] \times 100 \quad \text{(S2)}$$

$$FB = (A + B) \div (A + C) \quad \text{(S3)}$$

$$HSS = 2(AD - BC) \div [(A + C) \times (C + D) + (A + B) \times (B + D)] \quad \text{(S4)}$$

where A, B, C and D represent hits ("event forecast to occur, and did occur"), false alarms ("event forecast to occur, but did not occur"), misses ("event forecast not to occur, but did occur") and correct negatives ("event forecast not to occur, and did not occur"), respectively.

S3. Other Figures and Tables

Table S1. FAR, POD, FB and HSS at Tororo and Buginyanya rain gauge stations over January 2001 and December 2016.

Statistical measure	Satellite Precipitation Product							
	CHIRPSv2.0	**ARC2**	**RFE2**	**PERSIANN-CDR**	**CMORPHv1.0ADJ**	**TAMSATv3.1**	**TRMM3B42v7**	**MSWEPv2.2**
Tororo (1,183 m above sea level)								
FAR (%)	44.76	37.76	41.82	52.93	43.49	47.68	53.71	48.35
POD (%)	73.3	70.11	79.89	92.2	77.69	86.81	49.4	78.9
FB	1.33	1.13	1.37	1.96	1.37	1.66	1.07	1.53
HSS	0.35	0.43	0.41	0.21	0.33	0.35	0.11	0.23
Buginyanya (1,889 m above sea level)								
FAR (%)	32.59	33.12	34.85	37.85	30.88	34.49	38.29	33.66
POD (%)	48.21	48.81	68.02	78.51	63.19	66.72	49.46	72.98
FB	0.72	0.73	1.04	1.26	0.91	1.02	0.8	1.1
HSS	0.29	0.28	0.37	0.37	0.28	0.36	0.21	0.3

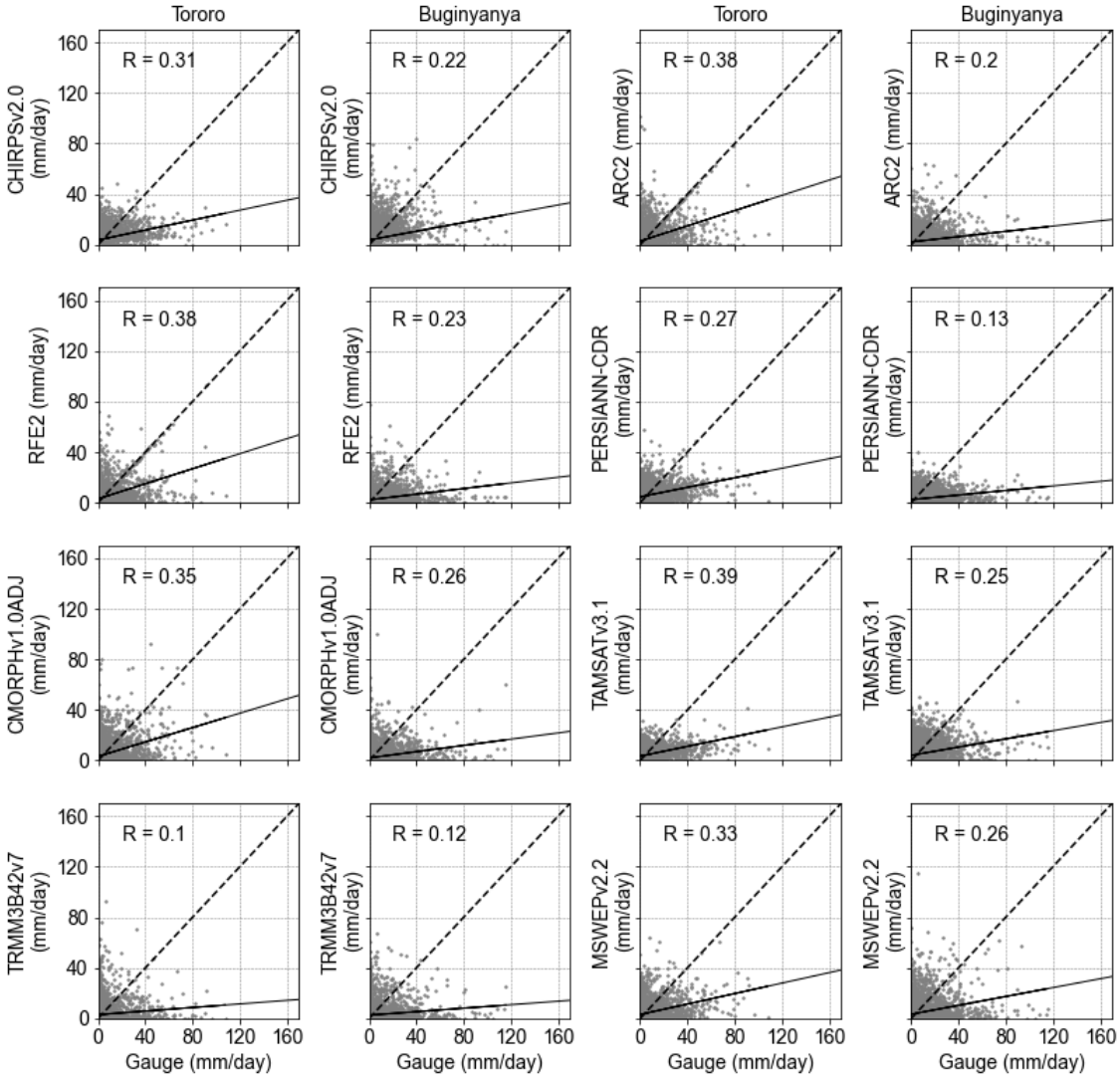

Figure S2. Scatter plots of daily rainfall total of SPPs and rain gauge data at Tororo and Buginyanya. The dashed line shows the perfect fit that could be attained if the gauge and SPP data were equal.

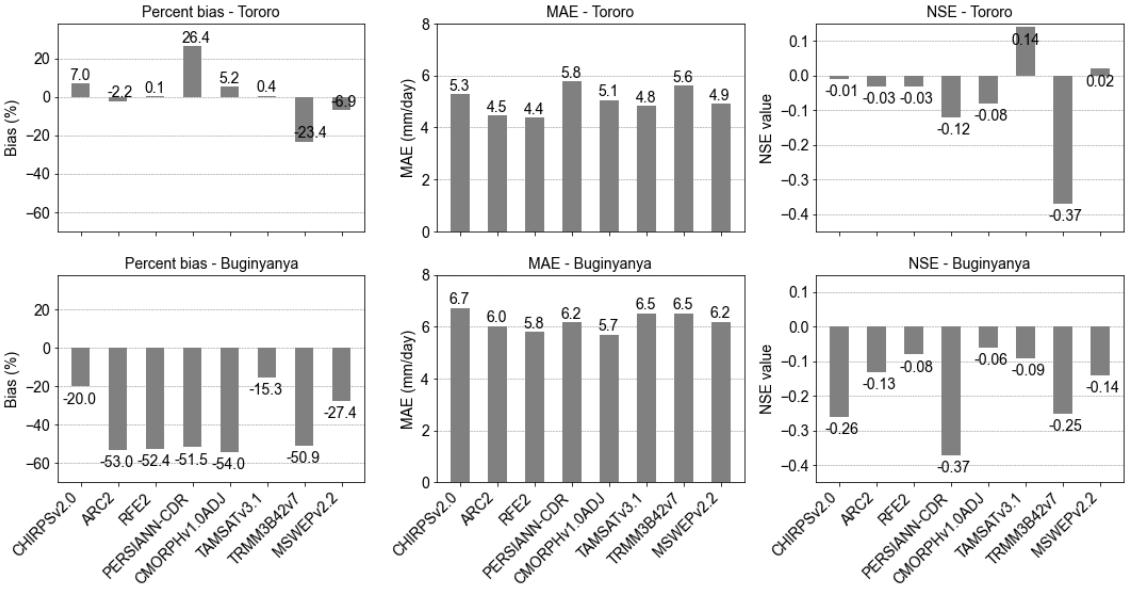

Figure S3. Bar graphs of percent bias, mean absolute error and Nash-Sutcliffe efficiency at daily timescale for the various SPPs at Tororo and Buginyanya.

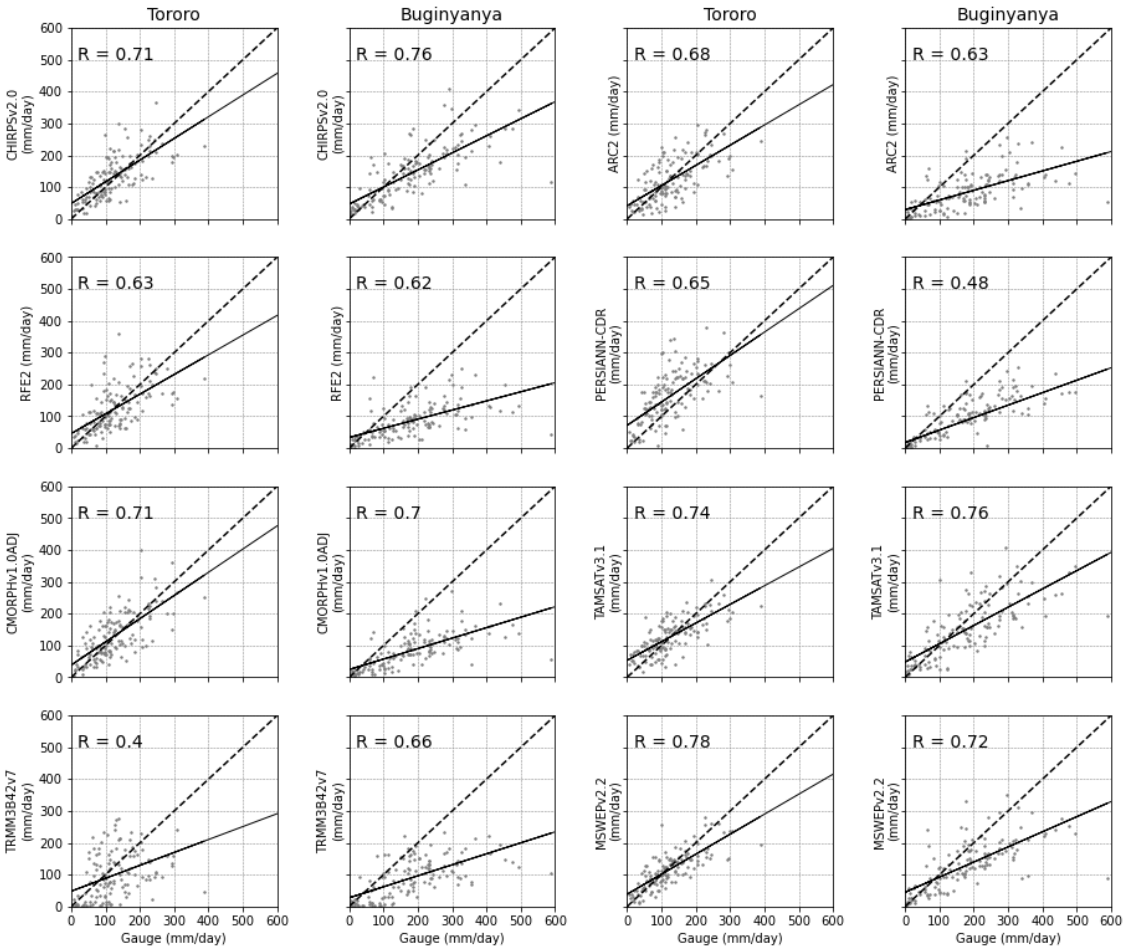

Figure S4. Scatter plots of monthly rainfall totals (satellite products against gauge) at Tororo and Buginyanya. The dashed line shows the perfect fit that could be attained if the gauge and SPP data were equal.

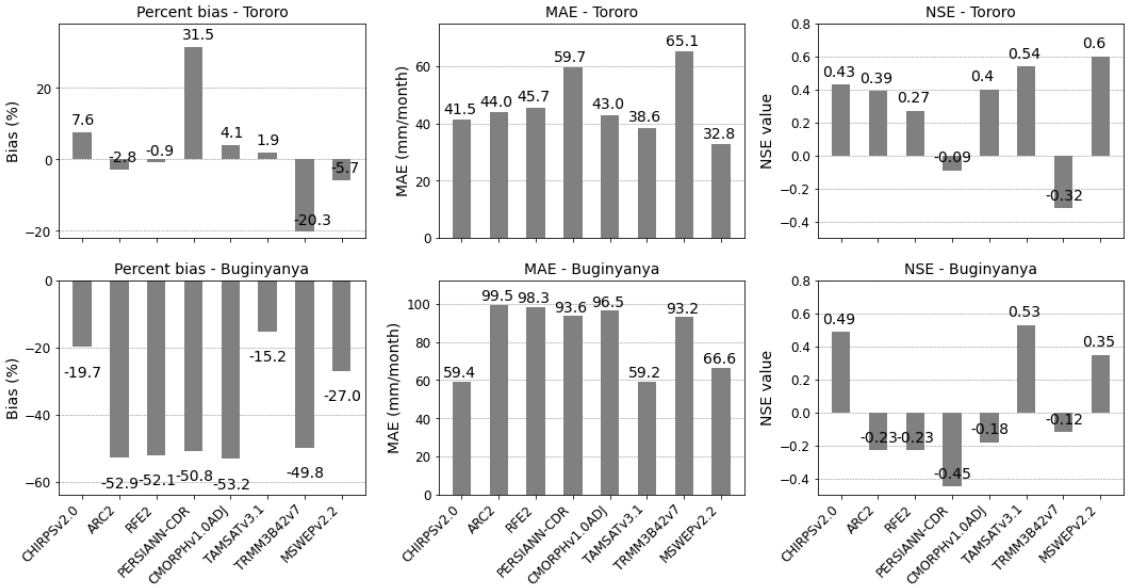

Figure S5. Bar graphs of percent bias, mean absolute error and Nash-Sutcliffe efficiency at monthly timescale for the various SPPs at Tororo and Buginyanya.

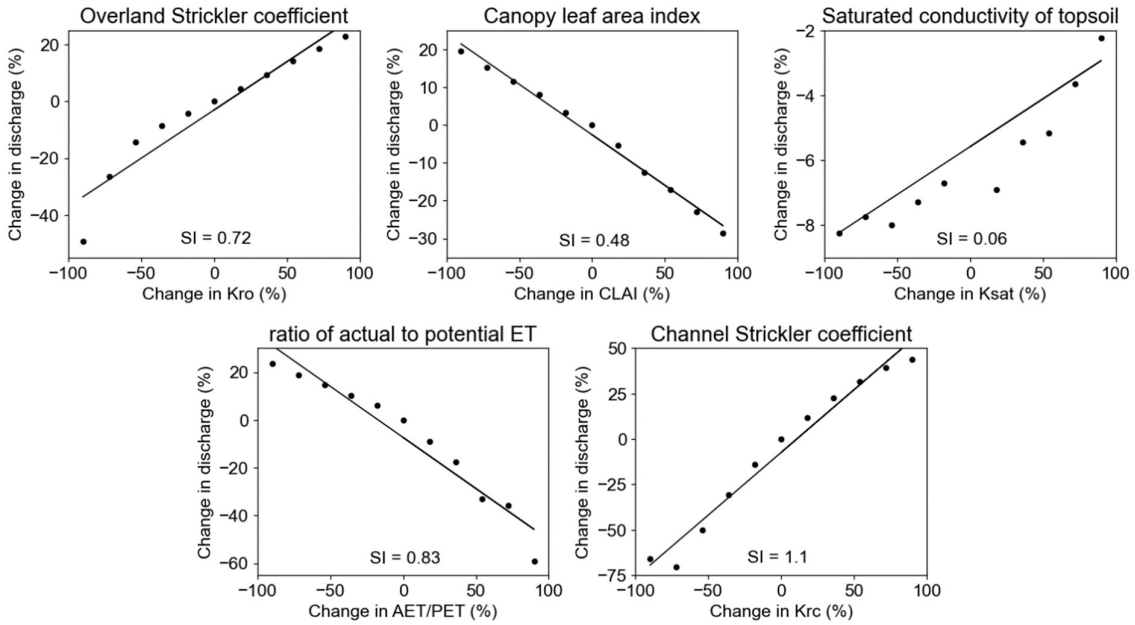

Figure S6. Scatter plots of model response to changes in key parameters. Inset is the sensitivity index (SI).

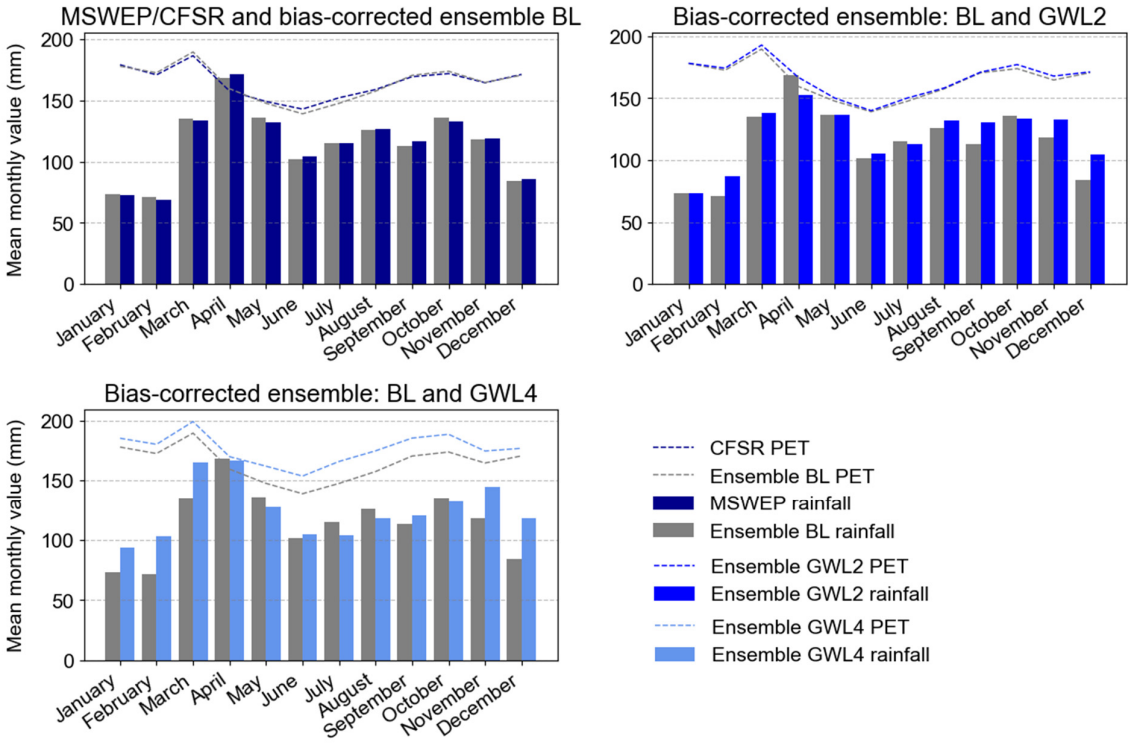

Figure S7. 30-year ensemble mean of 'observed' (MSWEP and CFSR) and bias-corrected CMIP6 models over the Mpologoma catchment. The plots show mean monthly rainfall and potential evapotranspiration (PET) at baseline (BL) and 2 and 4°C warming levels.