Fig. S1

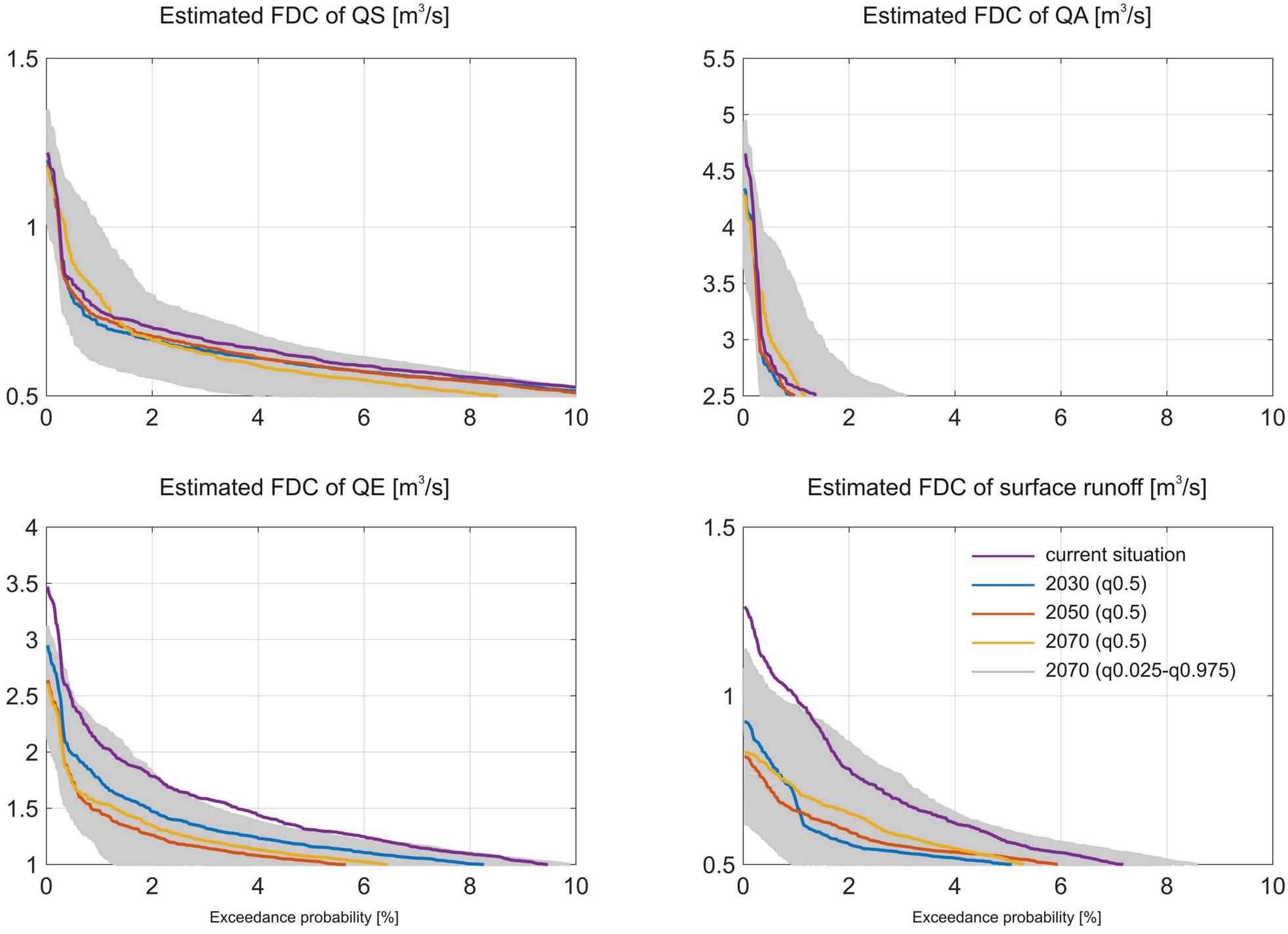
Estimated FDC of QS [m3/s]
Estimated FDC of QA [m3/s]
Estimated FDC of QE [m3/s]
Estimated FDC of surface runoff [m3/s]
current situation
2030 (q0.5)
2050 (q0.5)
2070 (q0.5)
2070 (q0.025-q0.975)
Exceedance probability [%]
Exceedance probability [%]

Fig. S2

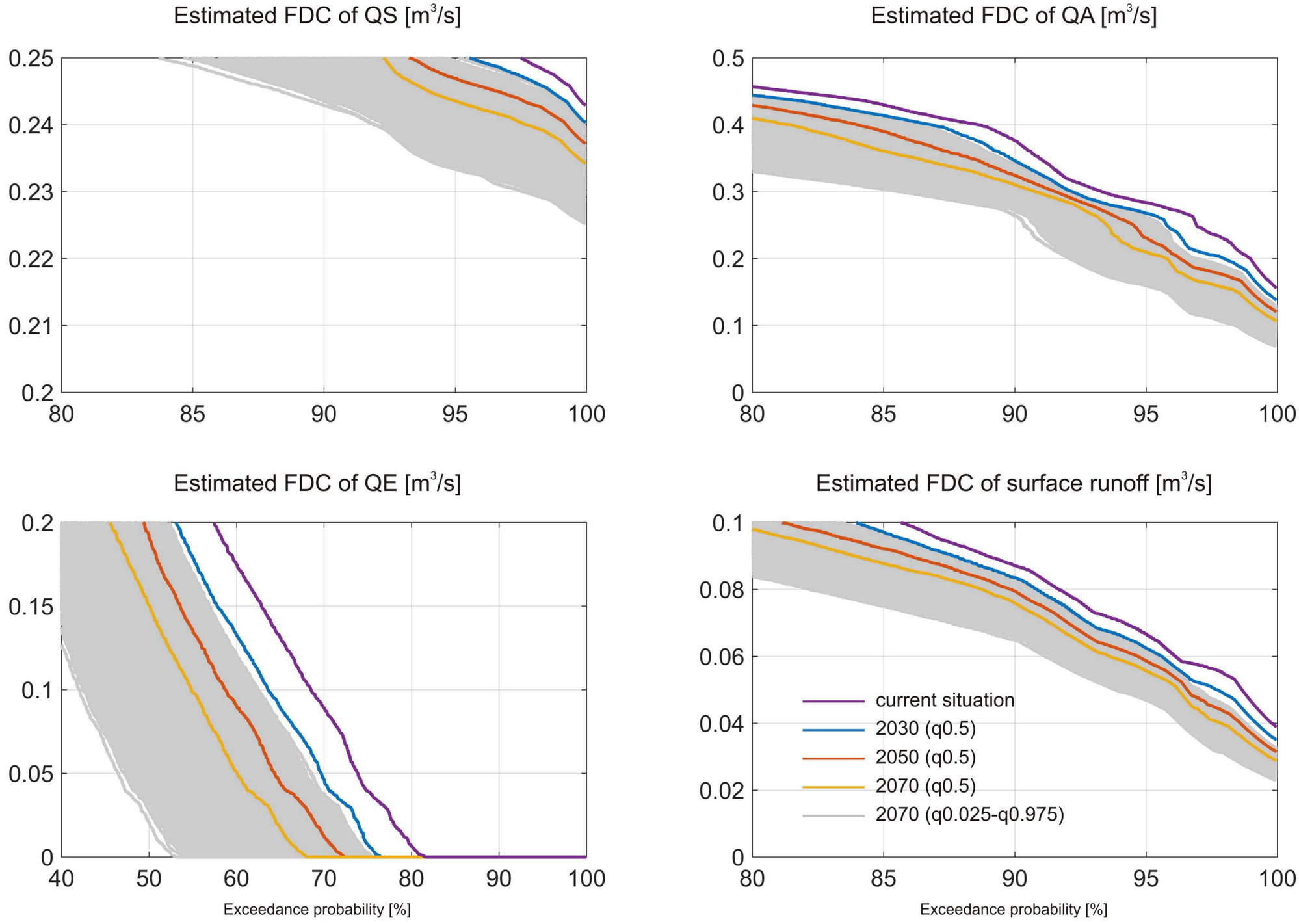
Estimated FDC of QS [m3/s]
Estimated FDC of QA [m3/s]
Estimated FDC of QE [m3/s]
Estimated FDC of surface runoff [m3/s]
current situation
2030 (q0.5)
2050 (q0.5)
2070 (q0.5)
2070 (q0.025-q0.975)
Exceedance probability [%]
Exceedance probability [%]

Table S1 Summary of calibrated model parameters.

model domain	model parameter	model location	description	units	parameter range lower	parameter range upper	final calibrated parameter set
snow storage	x_1	sub. 1-29	threshold temperature	°C	0.00	6.00	1.95
	x_2	sub. 1-29	degree day factor	mm h^{-1} °C^{-1}	0.00	0.10	0.00
	x_3	sub. 1-29	refreezing factor	-	0.00	0.50	0.37
	x_4	sub. 1-29	water holding capacity	-	0.00	0.50	0.00
	x_5	sub. 1-29	radiation coefficient	-	0.0002	0.0006	0.0002
unsaturated zone	x_6	sub. 1-5	infiltration threshold	mm	0.00	0.50	0.26
	x_7	sub. 6-10			0.00	0.50	0.38
	x_8	sub. 11-15			0.00	0.50	0.29
	x_9	sub. 16-20			0.00	0.50	0.40
	x_{10}	sub. 21-29			0.00	0.50	0.50
	x_{11}	sub. 1-5	proportion of recharge distributed into fast flow reservoir	%	0.60	1.00	0.60
	x_{12}	sub. 6-10			0.60	1.00	1.00
	x_{13}	sub. 11-15			0.60	1.00	0.64
	x_{14}	sub. 16-20			0.60	1.00	0.67
	x_{15}	sub. 1-5	effective flow width for fast flow / surface runoff reservoir	m	100	1500	959
	x_{16}	sub. 6-10			100	1500	1500
	x_{17}	sub. 11-15			100	1500	1008
	x_{18}	sub. 16-20			100	1500	421
	x_{19}	sub. 21-29			100	1500	100
	x_{20}	sub. 1-20	initial base flow	m^3/s	0.26	0.40	0.40
drainage network	x_{21}	N1	junction elevation	m asl	1430	1450	1446
	x_{22}	N2			1300	1320	1300
	x_{23}	N3			1280	1300	1280
	x_{24}	N4			1270	1290	1270
	x_{25}	N5			1240	1260	1240
	x_{26}	N6			1210	1230	1210
	x_{27}	N7			1120	1130	1127
	x_{28}	N8			1105	1115	1105
	x_{29}	N9			1095	1105	1098
	x_{30}	N10			1020	1035	1028
	x_{31}	C1-C5	conduit diameter	m	2.00	4.00	2.88
	x_{32}	C6-C10			2.00	4.00	2.00
	x_{33}	C11-C15			2.00	4.00	2.81
	x_{34}	C16-C20			2.00	4.00	4.00
	x_{35}	C21			2.00	4.00	2.71
	x_{36}	C22			2.00	4.00	3.95
	x_{37}	C23			2.00	4.00	4.00
	x_{38}	C24			2.00	4.00	4.00
	x_{39}	C25			2.00	4.00	3.46
	x_{40}	C26			2.00	4.00	2.53
	x_{41}	C27			0.60	1.00	0.86
	x_{42}	C28			2.00	4.00	3.77
	x_{43}	C29			0.60	1.00	0.76
	x_{44}	C30			2.00	4.00	2.92
	x_{45}	C31			2.00	4.00	2.00
	x_{46}	C32			2.00	4.00	2.51
	x_{47}	C33			2.00	4.00	2.97
	x_{48}	C34			0.20	2.00	0.51
	x_{49}	C35			0.20	2.00	0.85
	x_{50}	C36			0.20	2.00	0.20
	x_{51}	C37			0.20	2.00	2.00
	x_{52}	C38			0.20	2.00	0.21
	x_{53}	C1-C5	conduit diameter	m	10	2000	1189
	x_{54}	C6-C10			10	2000	2000
	x_{55}	C11-C15			10	2000	1134
	x_{56}	C16-C20			10	2000	263
	x_{57}	C21			10	2000	1397
	x_{58}	C22			10	2000	1011
	x_{59}	C23			10	2000	10
	x_{60}	C24			10	2000	1661
	x_{61}	C25			10	2000	1304
	x_{62}	C26			10	2000	756
	x_{63}	C27			10	2000	1450
	x_{64}	C28			10	2000	752
	x_{65}	C29			10	2000	1782
	x_{66}	C30			10	2000	1797
	x_{67}	C31			10	2000	1577
	x_{68}	C32			10	2000	2000
	x_{69}	C33			10	2000	967
	x_{70}	C34			10	2000	274
	x_{71}	C35			10	2000	10
	x_{72}	C36			10	2000	1273
	x_{73}	C37			10	2000	1753
	x_{74}	C38			10	2000	1451
	x_{75}	Sc1-Sc5	open channel roughness coeffient	mm	0.01	0.20	0.03
	x_{76}	Sc6-Sc11			0.01	0.20	0.08