

Appendix 1

Correspondence table showing the composition of the spatial units (i.e. basins) based on subunits called sub-catchments derived from a DEM (30×30 m, LfU) (see Figure 2.5).

Spatial Unit	Composed of Sub-catchments
1	1 46
2	2
3	3 6 40
4	4 30
5	5 7 9
6	6 27 25 39 15
7	7
8	8 17 28
9	9 20 12
10	10 35 41
11	11
12	12 33 22 37
13	13
14	14
15	15 26 14 16
16	16
17	17
18	18
19	19 29
20	20
21	21
22	22 23
23	23 21
24	24 44 2 34 11 10 5
25	25
26	26 32
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34 31
35	35 38
36	36
37	37
38	38 18
39	39
40	40 42 8
41	41
42	42 19 24 1 4
43	43
44	44 36 45
45	45
46	46

Appendix 2

Basic information of the spatial units and their gauging stations located within the Study Area.

Spatial Unit	Gauging Station Name	River Name	Area [km²]	nobs [year]	Outliers [%]
1	Wannweil-Bahn	Echaz	161.31	32	16.3
2	Pfäffingen	Ammer	133.52	33	18.5
3	Plochingen	Neckar	4002.00	33	12.1
4	Riederich	Erms	161.25	33	18.2
5	Horb	Neckar	1119.74	33	15.5
6	Plochingen	Fils	701.61	33	11.5
7	Hopfau-2	Glatt	202.34	32	16.9
8	Wendlingen	Lauter	190.00	33	13.6
9	Oberndorf	Neckar	694.71	33	12.7
10	Bad Imnau	Eyach	331.08	33	10.3
11	Rangendingen Wehr	Starzel	122.50	33	9.7
12	Rottweil-Gaswerk	Neckar	454.78	33	13.6
13	Denkendorf-Sägewerk	Körsch	126.29	33	14.8
14	Geislingen	Eyb	123.20	33	16.1
15	Süßen	Fils	357.00	33	12.7
16	Süßen	Lauter	68.20	33	13.6
17	Kirchheim	Lindach	92.10	32	12.5
18	Frommern	Eyach	72.90	28	7.1
19	Oberensingen-2	Aich	178.00	32	10.0
20	Epfendorf	Schlich	106.00	32	10.6
21	Horgen	Fischbach	120.40	22	10.9
22	Bühlingen	Eschach	218.52	21	6.7
23	Horgen-Kläranlage	Eschach	208.00	33	20.0
24	Kirchentellinsfurt	Neckar	2321.83	33	32.4
25	Baiereck-Typ	Herrenbach	4.50	31	13.9
26	Geislingen-Brücke	Fils	137.60	32	12.8
27	Reichenbach	Lützelbach	14.57	22	15.0
28	Unterlenningen	Lauter	58.80	32	22.2
29	Neuenhaus-Brücke	Schaich	38.20	25	7.5
30	Bad Urach-Kurgebiet	Erms	108.30	32	19.4
31	Dußlingen-Pulvermühle	Wiesaz	38.10	30	9.3
32	Wiesensteig-Ort	Fils	30.30	33	17.3
33	Göllsdorf	Prim	124.90	31	4.8
34	Tübingen-Bläsiberg	Steinlach	139.00	31	10.0
35	Owingen-Ort	Eyach	206.20	32	8.4
36	Bebenhausen	Goldersbach	34.32	29	12.1
37	Deißlingen	Neckar	37.90	26	10.4
38	Balingen	Eyach	122.90	23	4.8
39	Eislingen	Krumm	25.80	19	3.2
40	Wendlingen Kläranlage	Neckar	3270.10	22	15.0
41	Gruol	Stunzach	75.80	19	14.2
42	Wendlingen Wehr	Neckar	3075.00	16	6.9
43	Schömberg-Zulauf	Schlichem	28.40	13	2.3
44	Tübingen-Lustnau	Goldersbach	68.18	9	4.4
45	Tübingen-Lustnau	Kirnbach	8.90	13	16.9
46	Wannweil	Firstbach	6.70	11	17.3

Appendix 3

Sample statistics of the explanatory variables employed in this Study.

Variable Name	Unit	nobs	Min	Max	Mean	Median	Std	C _v [%]
x_1	[km ²]	46	4.50	4002.00	433.08	124.05	895.75	206.8
x_2	[°]	46	3.02	11.07	6.97	7.27	2.07	29.7
x_3	[°]	46	2.20	10.01	6.00	6.00	1.53	25.5
x_4	[°]	46	4.92	9.14	6.68	6.73	1.09	16.3
x_5	[°]	46	3.24	8.86	6.13	6.10	1.36	22.2
x_6	[°]	46	1.09	3.73	2.36	2.29	0.68	28.7
x_7	[°]	46	3.37	15.93	7.63	7.09	2.60	34.0
x_8	[1/km]	46	1.75	2.53	2.16	2.18	0.16	7.4
x_9	[-]	46	1.02	7.06	2.56	2.23	1.10	42.7
x_{10}	[-]	46	5.49	18.20	12.34	12.12	2.42	19.6
x_{11}	[-]	46	5.13	30.75	18.66	17.79	4.33	23.2
x_{12}	[m]	46	386.14	818.34	595.13	609.72	114.40	19.2
x_{13}	[m]	46	144.00	768.00	434.22	447.00	161.57	37.2
x_{14}	[-]	46	39.82	65.48	56.78	57.08	5.74	10.1
x_{15}	[mm]	46	66.88	136.19	98.58	97.28	14.64	14.8
x_{16}	[-]	46	0.00	99.26	20.62	8.03	28.40	137.7
x_{17}	[-]	184	8.50	98.69	42.33	38.23	18.54	43.8
x_{18}	[-]	184	0.00	31.05	4.89	3.44	4.89	100.0
x_{19}	[-]	184	1.26	87.91	52.78	56.19	17.12	32.4
x_{20}	[mm]	1518	487.68	1680.32	910.44	892.52	182.94	20.1
x_{21}	[mm]	1518	170.68	1052.33	399.67	388.77	119.42	29.9
x_{22}	[mm]	1518	237.96	910.88	510.78	510.13	103.72	20.3
x_{23}	[mm]	1518	1.46	4.60	2.52	2.48	0.50	19.7
x_{24}	[mm]	1518	1.01	5.57	2.25	2.20	0.62	27.8
x_{25}	[mm]	1518	1.45	4.85	2.79	2.76	0.59	21.3
x_{27}	[mm]	1518	41.25	182.84	79.84	77.82	19.00	23.8
x_{28}	[mm]	1518	38.40	255.52	90.84	86.93	27.42	30.2
x_{29}	[mm]	1518	29.22	138.19	61.63	60.35	17.36	28.2

Appendix 3

(Continuation). Sample statistics of the explanatory variables employed in this Study.

Variable Name	Unit	nobs	Min	Max	Mean	Median	Std	C _v [%]
x_{30}	[°C]	1518	-8.10	4.20	-0.92	-0.70	2.65	289.3
x_{31}	[°C]	1518	13.10	22.20	16.82	16.60	1.56	9.3
x_{32}	[°C]	1518	0.60	12.20	6.20	6.20	2.21	35.7
x_{33}	[°C]	1518	19.70	29.60	23.30	22.90	1.73	7.4
x_{35}	[K]	1518	280.71	296.51	291.84	291.95	2.02	0.6
x_{36}	[K]	1518	279.06	286.41	282.26	282.14	1.51	0.5
x_{37}	[K]	1518	289.63	296.51	292.09	291.97	1.24	0.4
x_{38}	[day]	860	0	79	22.00	17.00	19.40	88.3
x_{39}	[day]	33	37	127	80.45	80.00	19.81	24.6
x_{40}	[day]	976	0	30	4.68	3.00	4.71	100.6
x_{41}	[day]	1239	0	60	11.30	10.00	8.14	71.8

Note: Variables x_{26} and x_{34} are not included in this table because they depend on the time point where the variable is to be evaluated.

Appendix 4

Sample statistics of the explained variables modelled in this Study.


Variable Name	Unit	nobs	Min	Max	Mean	Median	Std	C_v [%]
Q_1	[mm]	1244	69.40	1 206.39	405.38	379.35	182.57	45.0
Q_2	[mm]	1254	31.89	793.67	248.90	234.74	117.35	47.1
Q_3	[mm]	1255	20.68	639.58	156.29	136.57	87.43	55.9
Q_4	[mm]	1312	0.67	59.48	8.80	7.58	5.44	61.8
Q_5	[mm]	1318	0.47	82.85	6.81	4.91	6.20	91.0
Q_6	[mm]	1307	1.60	119.94	30.68	27.83	16.13	52.6
Q_7	[mm]	1239	1.50	446.52	74.21	55.79	63.59	85.7
Q_8	[mm]	976	1.38	363.11	34.23	22.91	37.72	110.2
Q_9	[day]	1312	0	66	12.80	11.00	9.79	76.6
Q_{10}	[day]	1318	0	46	4.79	3.00	6.28	131.0
Q_{11}	[1/year]	1247	1	15	4.36	4.00	2.36	54.1
Q_{12}	[1/year]	977	1	16	3.02	2.00	2.31	76.6
Q_{13}	[day]	860	1	135	12.58	10.00	12.08	96.1
Q_{14}	[day]	860	1	145	31.76	25.00	27.2	85.6
Q_{15}	[mm/year]	834	0.14	304.91	19.97	15.82	18.95	94.9
Q_{16}	[mm]	834	0.00	33.63	1.57	0.70	2.37	151.3

Appendix 5

Existing valid runoff data for the gauging stations located within the Study Area from 1961 to 1993 (Gauging station No. ≡ Spatial unit No.).

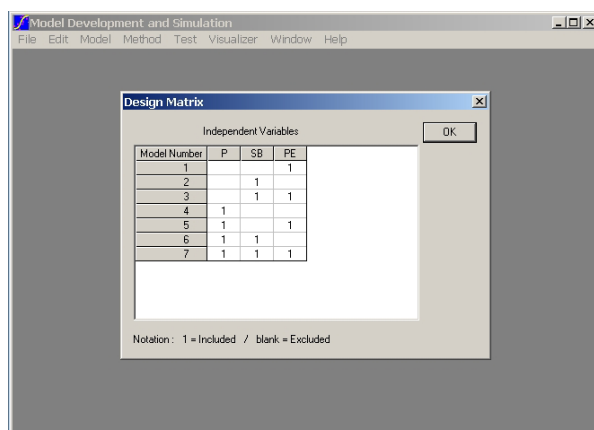
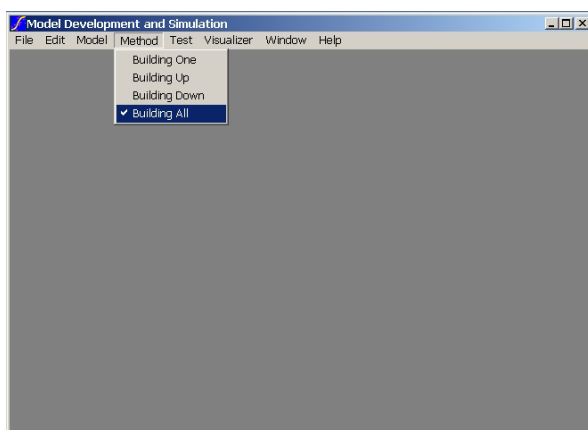
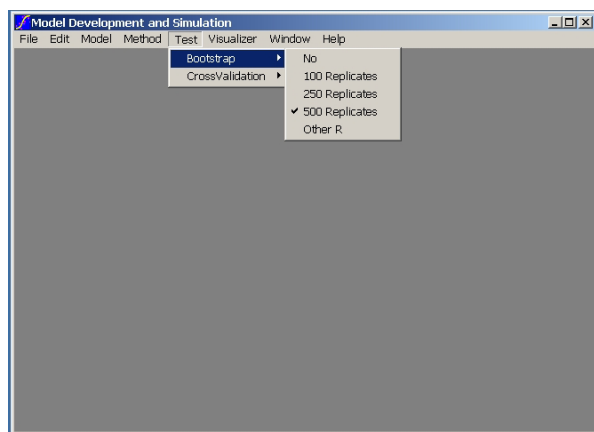
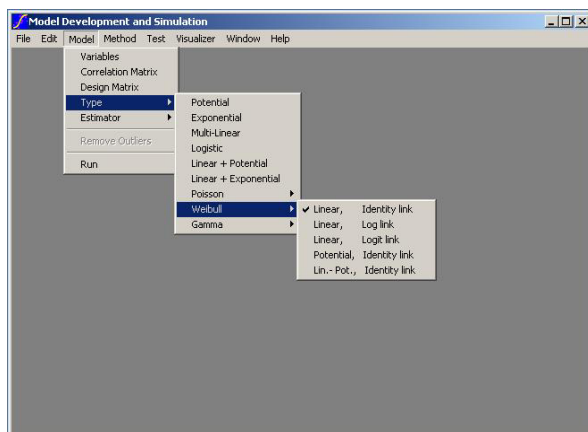
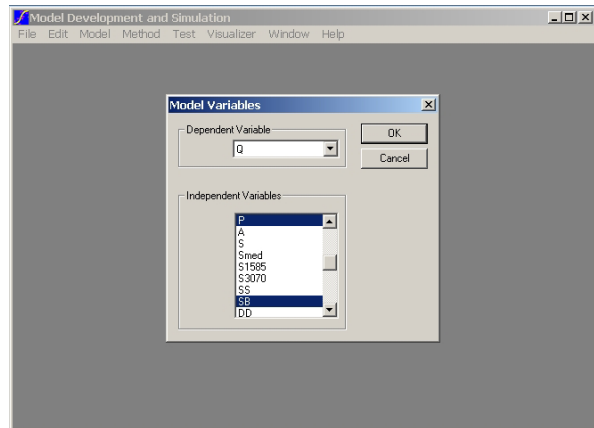
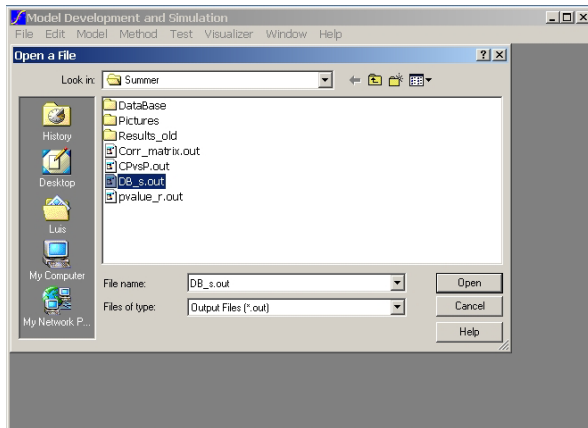
Station No.	Year (19xx)																																				
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93				
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Legend:

 Valid data exists for a given gauging station and a water year.

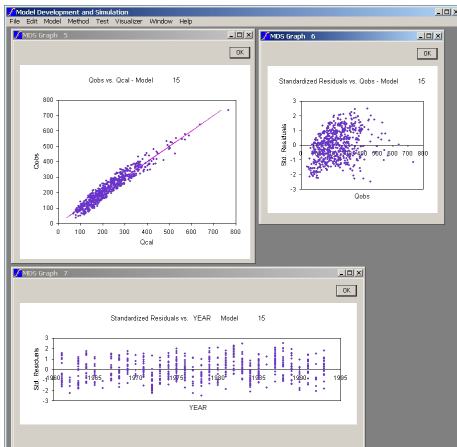
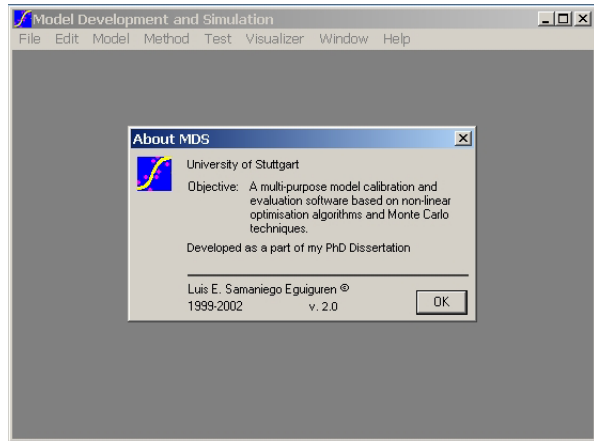
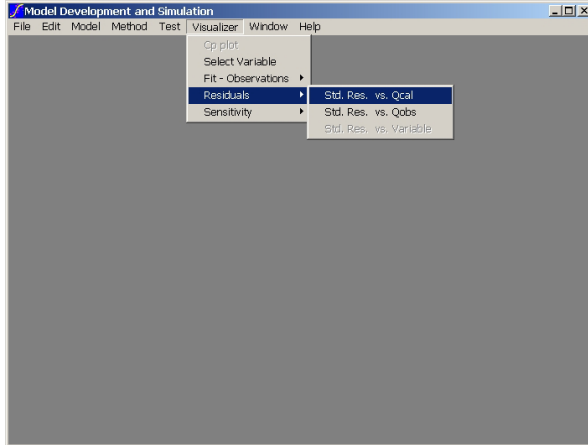
Appendix 6

Sequence of screen captures showing the user interface of the MDS program. From top-left to bottom-right: 1) reading a database; 2) selecting variables; 3) selecting the model type; 4) selecting the number of replicates for the permutation test; 5) selecting the method for searching the best model; 6) displaying the design matrix of all possible combinations of variables.



Appendix 6

(Continuation). From top-left to bottom-right: 7) selecting the visualizer; 8) authorship; 9) working space showing many examples of possible plots included in the program that help the user to judge the goodness of the fit during the process of calibration of a model.



Appendix 7

European Circulation Patterns according to Hess and Brezowsky (1969).

Major Type	Sub-type	No.	Description	Abbreviation	
Zonal circulation	W	1	West, anticyclonic	Wa	
		2	West, cyclonic	Wz	
		3	Southern, West	WS	
		4	Angleformed West	WW	
Mixed circulation	SW	5	Southwest, anticyclonic	SWa	
		6	Southwest, cyclonic	SWz	
	NW	7	Northwest, anticyclonic	NWa	
		8	Northwest, cyclonic	NWz	
	HM	9	Central European high	HM	
		10	Central European ridge	BM	
	TM	11	Central European low	TM	
Meridional circulation	N	12	North, anticyclonic	Na	
		13	North, cyclonic	Nz	
		14	North, Iceland high, anticyclonic	HNa	
		15	North, Iceland high, cyclonic	HNz	
		16	British Isles high	HB	
		17	Central European trough	TRM	
	NE	18	Northeast, anticyclonic	NEa	
		19	Northeast, cyclonic	NEz	
	E	20	Fennoscandian high, anticyclonic	HFa	
		21	Fennoscandian high, cyclonic	HFz	
		22	Norwegian Sea-Fennoscandian high, anticyclonic	HNFa	
		23	Norwegian Sea-Fennoscandian high, cyclonic	HNFz	
		24	Southeast, anticyclonic	SEa	
		25	Southeast, cyclonic	SEz	
	S	26	South, anticyclonic	Sa	
		27	South, cyclonic	Sz	
		28	British Isles low	TB	
		29	Western Europe trough	TRW	
	Unclassified	U	30	Classification not possible	U