

Supplemental Table 1. Impulse-response function (IRF) metrics quantified for all sites (dimensionless)

Site	skw-w	skw-d	kurt-w	kurt-d	MnMm-w	MnMm-d	SDMm-w	SDMm-d	PHA-w	PHA-d	MdMm-w	MdMm-d	SDMn-w	SDMn-d	WDA
BARsp	1.95	1.93	8.43	8.20	0.33	0.33	0.33	0.33	2.0E-05	9.5E-06	1.5E-03	8.0E-04	0.99	0.99	1.16
COMsp	1.92	1.92	8.10	8.10	0.33	0.33	0.33	0.33	2.7E-05	2.7E-05	6.3E-04	6.3E-04	0.99	0.99	1.00
HCV	3.68	3.68	21.54	21.54	0.28	0.28	0.39	0.39	1.3E-04	1.3E-04	3.8E-02	3.8E-02	1.40	1.40	1.00
LVL	2.11	2.11	10.66	10.66	0.44	0.44	0.29	0.29	1.6E-04	1.6E-04	2.6E-01	2.6E-01	0.66	0.66	1.00
FM1796	1.79	1.74	5.64	6.65	0.25	0.33	0.32	0.32	1.4E-04	8.0E-05	2.6E-03	7.7E-05	1.28	0.98	1.72
WCL	1.37	1.79	4.06	6.75	0.30	0.32	0.31	0.33	8.6E-06	4.3E-06	1.6E-02	2.8E-02	1.03	1.03	67.23
LA88C	1.37	1.25	5.61	5.72	0.38	0.42	0.32	0.31	1.0E-04	1.6E-04	3.9E-04	1.1E-03	0.86	0.74	1.24
FALr	0.39	1.27	3.31	5.37	0.51	0.41	0.29	0.31	1.6E-06	1.5E-06	5.0E-01	9.0E-05	0.56	0.75	1.34
RFsp	2.78	2.52	14.41	13.25	0.34	0.35	0.34	0.34	3.4E-07	7.4E-07	1.1E-01	5.6E-04	1.03	0.98	1.42
SPFcr	1.93	1.93	7.91	7.91	0.30	0.30	0.34	0.34	5.4E-04	5.4E-04	3.1E-04	3.1E-04	1.15	1.15	1.00
Tilf	2.08	1.94	9.08	8.30	0.35	0.33	0.32	0.33	2.0E-04	1.6E-04	1.4E-01	1.0E-03	0.93	0.99	6.49
Bxr	2.01	2.01	8.50	8.50	0.32	0.32	0.34	0.34	7.0E-05	7.0E-05	9.2E-05	9.2E-05	1.06	1.06	1.00
Bud	1.96	1.94	8.46	8.33	0.33	0.33	0.33	0.33	1.5E-04	2.6E-05	1.6E-03	1.1E-03	0.99	0.99	3.93
Dow	1.95	1.90	8.40	7.94	0.33	0.33	0.33	0.33	1.8E-04	3.5E-05	1.3E-03	4.6E-04	0.99	0.99	1.81
RG	1.93	1.93	8.25	8.25	0.33	0.33	0.33	0.33	2.1E-05	2.1E-05	8.9E-04	8.9E-04	0.99	0.99	1.00
LScr	1.91	1.93	7.94	8.19	0.32	0.33	0.33	0.33	6.5E-06	1.0E-05	4.3E-04	7.7E-04	1.03	1.01	1.23

Supplemental Table 2. Correlation matrix for metrics (Pearson's rho based on log transformed and standardized values)

	skw-w	skw-d	kurt-w	kurt-d	MnMm-w	MnMm-d	SDMm-w	SDMm-d	PHA-w	PHA-d	MdMm-w	MdMm-d	SDMn-w	SDMn-d	WDA
skw-w	1.00														
skw-d	0.81	1.00													
kurt-w	0.86	0.90	1.00												
kurt-d	0.76	0.96	0.93	1.00											
MnMm-w	-0.62	-0.46	-0.29	-0.29	1.00										
MnMm-d	-0.52	-0.60	-0.37	-0.42	0.82	1.00									
SDMm-w	0.75	0.72	0.75	0.69	-0.63	-0.74	1.00								
SDMm-d	0.60	0.75	0.63	0.67	-0.66	-0.88	0.92	1.00							
PHA-w	0.33	0.08	0.17	0.03	-0.30	-0.19	0.19	0.07	1.00						
PHA-d	0.37	0.11	0.25	0.10	-0.26	-0.13	0.24	0.08	0.94	1.00					
MdMm-w	-0.22	0.15	0.07	0.26	0.46	0.35	-0.38	-0.19	-0.34	-0.32	1.00				
MdMm-d	0.35	0.44	0.36	0.50	0.10	0.11	-0.01	-0.02	0.15	0.17	0.41	1.00			
SDMn-w	0.72	0.59	0.46	0.44	-0.97	-0.86	0.80	0.80	0.29	0.28	-0.47	-0.08	1.00		
SDMn-d	0.56	0.67	0.47	0.52	-0.78	-0.99	0.83	0.95	0.16	0.12	-0.31	-0.09	0.87	1.00	
WDA	-0.13	-0.13	-0.39	-0.23	-0.17	-0.16	-0.28	-0.06	-0.08	-0.23	0.24	0.28	0.04	0.09	1.00

Supplemental Table 3. Results of principal component analysis showing (a) loading values and (b) score values

a. Loading values

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14	PC15
'skwW'	0.312	0.134	0.162	0.027	-0.461	0.199	0.361	-0.165	-0.236	-0.302	0.474	-0.270	-0.060	0.000	0.006
'skwD'	0.310	0.301	-0.042	0.013	0.035	0.078	-0.183	-0.380	0.032	0.332	-0.012	-0.109	0.708	-0.013	-0.018
'kurtW'	0.283	0.325	0.130	-0.196	-0.077	0.080	0.345	-0.119	0.022	-0.115	-0.436	0.634	-0.087	-0.003	-0.007
'kurtD'	0.276	0.394	-0.001	-0.072	0.053	0.018	-0.116	0.005	0.119	0.541	0.032	-0.246	-0.614	0.018	0.022
'MnMmW'	-0.284	0.272	0.071	-0.202	0.261	-0.439	0.327	-0.181	-0.105	-0.041	0.047	-0.170	0.056	0.108	0.583
'MnMmD'	-0.308	0.204	0.203	-0.127	-0.240	0.106	0.133	0.418	0.197	0.284	0.250	0.163	0.215	0.527	-0.106
'SDMmW'	0.337	-0.027	-0.023	-0.208	0.030	-0.289	0.294	0.476	0.146	-0.108	-0.330	-0.455	0.189	-0.037	-0.240
'SDMmD'	0.331	-0.027	-0.199	-0.071	0.310	-0.222	0.071	0.298	0.020	0.069	0.596	0.399	0.078	-0.280	0.042
'PHAw'	0.110	-0.177	0.571	0.227	0.293	0.035	0.120	-0.198	0.644	-0.094	0.114	-0.040	-0.026	-0.001	0.002
'PHAd'	0.116	-0.131	0.608	0.125	0.258	0.049	-0.028	0.206	-0.640	0.226	-0.090	0.017	0.048	0.001	-0.002
'MdMmW'	-0.104	0.462	-0.155	0.210	0.483	0.531	0.029	0.247	-0.024	-0.334	-0.006	-0.131	0.031	0.001	0.001
'MdMmD'	0.052	0.423	0.179	0.444	-0.236	-0.485	-0.419	0.169	0.020	-0.294	-0.015	0.088	-0.003	-0.002	-0.002
'SDMnW'	0.325	-0.218	-0.062	0.090	-0.192	0.247	-0.159	0.291	0.126	-0.004	-0.141	0.009	0.060	0.139	0.754
'SDMnD'	0.324	-0.150	-0.208	0.064	0.270	-0.148	-0.067	-0.187	-0.128	-0.174	0.045	0.040	-0.101	0.782	-0.141
'WDA'	-0.042	-0.057	-0.263	0.728	-0.061	-0.087	0.516	0.002	-0.026	0.324	-0.107	0.038	0.014	0.000	0.000

b. Score values

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12	PC13	PC14	PC15
BARsp	0.239	-0.160	-0.462	-0.621	-0.398	-0.184	-0.069	-0.199	0.151	-0.280	0.020	0.003	-0.013	0.000	0.000
SPFcr	0.278	-0.491	0.010	-0.699	-0.319	-0.254	-0.154	-0.204	-0.119	-0.078	0.024	0.008	0.007	0.001	0.000
HCV	6.625	2.249	0.053	0.166	1.055	-0.356	-0.467	0.483	0.138	0.055	0.006	0.008	0.001	0.000	0.000
LVL	-2.892	3.844	3.014	0.677	-0.552	0.214	-0.373	-0.358	-0.044	0.049	-0.005	-0.005	-0.001	0.000	0.000
FM1796	0.239	-2.253	0.269	0.456	-0.245	1.733	-0.607	0.196	0.136	0.029	-0.002	0.007	0.000	0.000	0.000
WCL	-1.032	-0.421	-2.238	3.627	-0.537	-0.516	-0.225	0.048	-0.071	0.065	0.010	-0.009	0.000	0.000	0.000
LA88C	-2.784	-1.036	1.895	-0.433	-0.669	-0.504	0.343	1.089	0.018	0.044	0.007	0.000	0.000	0.000	0.000
FALr	-6.641	0.519	-1.779	-1.046	1.673	-0.101	-0.327	0.062	0.073	0.046	-0.002	0.001	0.000	0.000	0.000
RFsp	1.258	2.487	-2.629	-1.372	-0.820	0.727	0.494	0.226	-0.084	0.058	-0.003	-0.019	-0.002	0.000	0.000
SPFcr	1.943	-1.914	1.291	-0.137	0.849	-0.177	-0.180	-0.057	-0.250	-0.074	-0.024	-0.033	-0.006	0.000	0.000
Tilf	0.136	0.392	0.565	1.346	1.057	0.604	0.956	-0.027	-0.309	-0.125	0.003	0.017	0.001	0.000	0.000
Bxr	1.217	-1.469	0.318	-1.006	-0.038	-0.185	0.143	-0.463	-0.151	0.411	0.023	0.005	-0.003	0.000	0.000
Buda	0.400	-0.370	0.181	0.556	-0.038	-0.265	0.546	-0.260	0.427	0.089	-0.034	0.014	-0.006	0.001	0.000
Dow	0.350	-0.651	0.458	-0.094	0.098	-0.046	0.366	-0.310	0.375	-0.081	0.012	-0.023	0.012	0.000	0.000
RG	0.304	-0.284	-0.135	-0.670	-0.361	-0.277	-0.206	-0.147	-0.103	-0.153	0.021	0.013	0.000	0.000	-0.001
LSsp	0.360	-0.439	-0.813	-0.749	-0.755	-0.414	-0.241	-0.079	-0.189	-0.054	-0.055	0.014	0.006	0.000	0.000

Supplemental Table 4. Weather stations

Abbreviation	Weather Gage	
	COOPID	Station name
<i>Edwards Aquifer Sites</i>		
W1	410428	Austin - Camp Mabry
W2	410902	Boerne
W3	411215	Bulverde
W4	411398	Camp Wood
W5	412585	Dripping Springs 6 E
W6	413038	Fair Oaks Rch
W7	414088	Henly
W8	414254	Hondo
W9	414256	Hondo_Municipal_Airport
W10	414780	Kerrville
W11	417628	Riomedina
W12	417706	Rockspring 1s
W13	417712	Rockspring 18 SW
W14	417717	Rockspring 26ssw
W15	417873	Sabinal
W16	418845	Tarpley
N1	--	NEXRAD@Boerne
N2	--	NEXRAD@Rocksprings 26ssw
N3	--	NEXRAD@Tarpley
<i>Madison Aquifer Sites</i>		
W17	399347	Wind Cave National Park
W18	394834	Lead
W19	392087	Custer station
W20	393572	Hardy Rs
W21	392228	Deerfield 4 NW
W22	391246	Buskala Rch
W23	397227	Rochford 2 WNW
W24	397222	Rochford
W25	392231	Deerfield_3_SE
W26	392234	Deerfield_dam
W27	395858	Mtn Meadow Resort
W28	393069	Ft Meade
N4	--	NEXRAD for Beaver Creek Watershed

Supplemental Table 5. Weather stations used for simulation of each site. All precipitation data are from the National Climatic Data Center (2012)

Site label (fig. 1)	Weather stations used (Abbreviation from Supplemental Table 4) ^a
<u>Edwards aquifer sites</u>	
FM1796	W8, W9, (W16, W15, W11, W15)
Bxr	W8, W9, (W11, W15, W16), N3
HCV	W2, N1, (W3, W6, W10)
Bud	W5, (W1, W7)
Dow	W5, (W1, W7)
BARsp	W5, (W1, W7)
LVL	W5, (W1, W7)
COMsp	W14, N2, W13, (W4, W12)
<u>Madison aquifer sites</u>	
FALr	W19, N4 (W20, W21, W22, W23, W24, W25, W26, W27),
RFsp	W18 ^g
LScr	W18
SPFcr	W18
WCL	W19, N4
RG	USGS 6407500 ^b
Tilf	W28
LA88C	W18
<u>Cave drip</u>	
CTD	W17, N4
RmDr	W17, N4
<u>Fractured-rock watershed</u>	
BEVcr	W17, N4

^a Data from first station listed are used when available, and subsequent stations are used when necessary in the order listed. Arithmetic averages were computed for stations in parentheses, except for site RFsp for which an inverse-distance-weighted average was used.

^b Streamflow gage used to estimate sinking-stream recharge