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Influence of climate variability on water partitioning and effective energy and mass transfer (EEMT) in a semi-arid critical zone

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Supplementary Material

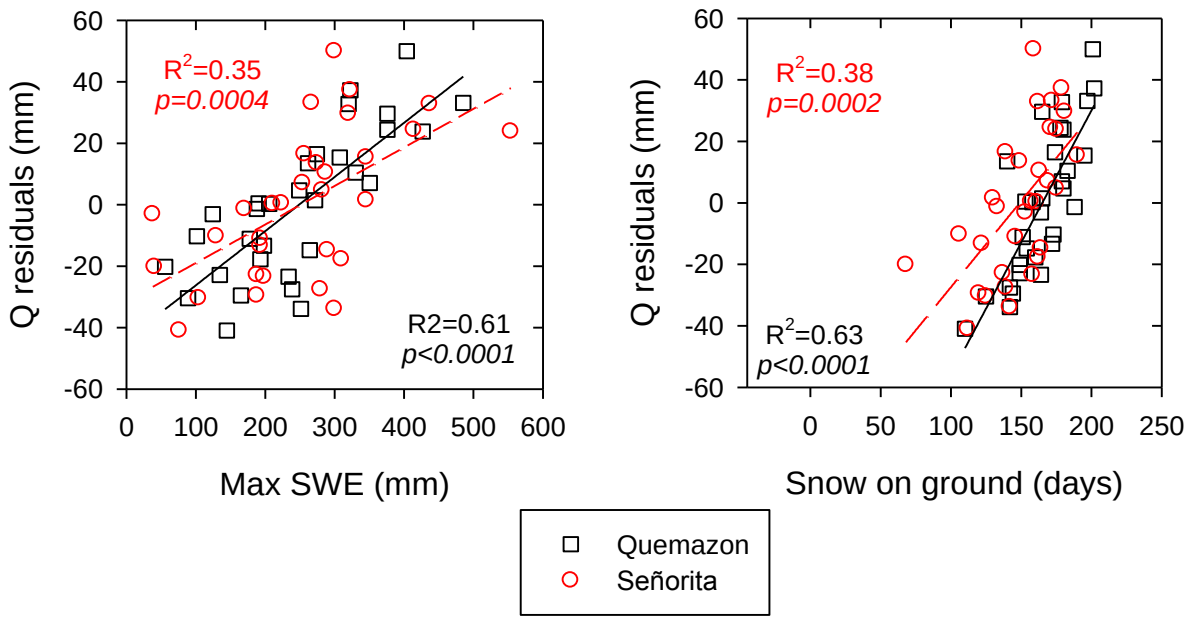

Figure S1. Plot of residuals between max SWE and snow on the ground from the linear model presented in Figure 2b. Maximum SWE and duration of the snow cover are the better predictors of discharge residuals variability. Q residuals increase during extreme dry and wet years.

Table S1. Empirical and modelled EEMT values estimated for the upper Jemez River basin. $Ebio_{emp}$ was estimated by multivariable linear regression from annual Precipitation at the Quemazon station and Jemez River basin between 1984-1999 (R^2=0.75; *p=0.0009*)

	$EEMT_{emp}$			$EEMT_{model}$		
Water year	$Eppt_{emp}$	$Ebio_{emp}$	$EEMT_{emp}$	$Eppt_{model}$	$Ebio_{model}$	$EEMT_{model}$
1984	1.28	11.27	12.55	0.05	5.09	5.14
1985	2.37	12.43	14.80	0.20	5.47	5.67
1986	1.42	12.48	13.90	0.19	9.34	9.53
1987	1.60	11.15	12.75	0.09	8.71	8.80
1988	1.16	11.21	12.37	0.14	8.52	8.66
1989	0.87	9.28	10.15	0.05	4.18	4.24
1990	0.80	11.77	12.56	0.14	5.45	5.58
1991	1.35	13.61	14.96	0.27	14.22	14.49
1992	1.77	11.47	13.24	0.14	9.11	9.26
1993	1.49	11.43	12.93	0.07	8.51	8.58
1994	0.75	11.96	12.71	0.15	8.79	8.94
1995	1.74	11.93	13.67	0.19	8.72	8.91
1996	0.33	10.13	10.46	0.02	4.94	4.96
1997	1.37	12.12	13.48	0.11	7.83	7.94
1998	1.04	10.94	11.98	0.04	4.98	5.02
1999	1.04	11.47	12.51	0.21	10.90	11.11
2000	0.60	8.42	9.02	0.06	5.35	5.42
2001	1.09	10.20	11.30	0.08	5.73	5.81
2002	0.35	8.36	8.71	0.05	5.78	5.83
2003	0.62	9.67	10.28	0.04	5.95	5.99
2004	0.77	10.03	10.81	0.18	5.89	6.07
2005	1.30	10.98	12.28	0.08	5.66	5.74
2006	0.48	11.08	11.56	0.03	5.23	5.26
2007	1.00	12.56	13.57	0.06	5.74	5.80
2008	0.88	10.45	11.33	0.01	5.24	5.24
2009	0.65	9.39	10.03	0.09	6.03	6.12
2010	0.73	10.39	11.13	0.08	5.20	5.29
2011	0.39	8.43	8.82	0.03	4.29	4.31
2012	0.50	8.65	9.15	0.03	4.12	4.16

Table S2. Relationship between climatic variables and discharge in the Jemez River Basin (1984-2012) based on records from the Quemazon and Señorita Divide#2 SNOTEL stations. The variables are listed in decreasing order according to the linear R^2 value from the Señorita Divide#2 station.

	Discharge					
	Quemazon station			Señorita Divide#2 station		
Variable	slope	R^2	*p*	slope	R^2	*p*
Winter P (mm)	0.18	0.24	*0.00550*	0.19	0.72	*0.00001*
1 April SWE	0.18	0.64	*0.00010*	0.16	0.56	*0.00001*
Max SWE (mm)	0.23	0.71	*0.00010*	0.19	0.55	*0.00001*
last day snow cover (day)	2.01	0.66	*0.00001*	1.83	0.54	*0.00001*
Annual P (mm)	0.10	0.19	*0.01480*	0.13	0.50	*0.00001*
Annual temp	-11.03	0.27	*0.00850*	-10.90	0.49	*0.00010*
50% max SWE day	1.92	0.48	*0.00010*	1.71	0.41	*0.00010*
Summer Temp	-2.04	0.01	*0.58740*	-4.94	0.32	*0.00320*
Winter Temp	-8.57	0.17	*0.04400*	-9.58	0.29	*0.00530*
snow in ground (days)	0.88	0.44	*0.00001*	0.37	0.25	*0.00390*
Max SWE day	1.15	0.31	*0.00120*	0.65	0.13	*0.04800*
1st day snow cover (day)	-0.51	0.09	*0.10290*	-0.30	0.12	*0.05570*
SWE:winter P ratio	69.29	0.40	*0.00020*	52.28	0.09	*0.09240*
SM50 (days)	-0.22	0.00	*0.73350*	0.24	0.01	*0.58760*

Table S3. Relationship between climatic variables and Horton index from the Jemez River basin (1984-2012) based on records from the Quemazon and Señorita Divide#2 SNOTEL stations. The variables are listed in decreasing order according to the linear R^2 value from the Señorita Divide#2 station.

	Horton index					
	Quemazon station			Señorita Divide#2 station		
Variable	slope	R^2	*p*	slope	R^2	*p*
Winter P (mm)	-0.0001	0.22	*0.00850*	-0.0001	0.59	*0.00001*
1 April SWE	-0.0001	0.60	*0.00001*	-0.0001	0.55	*0.00001*
Max SWE (mm)	-0.0002	0.67	*0.00001*	-0.0002	0.59	*0.00001*
last day snow cover (day)	-0.0017	0.62	*0.00001*	-0.0016	0.52	*0.00001*
Annual P (mm)	-0.0001	0.09	*0.09940*	-0.0001	0.29	*0.00160*
Annual temp	0.0103	0.32	*0.00430*	0.0086	0.40	*0.00070*
50% max SWE day	-0.0017	0.50	*0.00001*	-0.0015	0.41	*0.00010*
Summer Temp	0.0019	0.01	*0.57230*	0.0038	0.25	*0.01160*
Winter Temp	0.0079	0.19	*0.03300*	0.0079	0.26	*0.00910*
snow in ground (days)	-0.0007	0.34	*0.00060*	-0.0004	0.31	*0.00100*
Max SWE day	-0.0010	0.33	*0.00070*	-0.0006	0.15	*0.03140*
1st day snow cover (day)	0.0003	0.04	*0.26470*	0.0003	0.18	*0.01890*
SWE:winter P ratio	-0.0588	0.39	*0.00020*	-0.0620	0.18	*0.01700*
SM50 (days)	0.0002	0.01	*0.64710*	-0.0001	0.00	*0.74040*