Table S1. Isotopic values ($\delta^{18}O$, δD and d-excess) and tritium concentrations (^3H) of different water bodies in various watersheds of the Qaidam Basin during the wet and dry seasons

Watershed	Water type		$\delta^{18}O$ (‰)	δD (‰)	d-excess (‰)	$\delta^{18}O$ (‰)	δD (‰)	d-excess (‰)	^3H (TU)	Source
			Wet season			Dry season				
Aler	Surface water $N_W=3$ $N_D=0$	Mean	-7.27	-47.79	10.38				10.32	
		Max	-5.13	-40.03	19.74				16.43	
		Min	-9.41	-55.54	1.01				4.20	
		SD	2.14	7.76	9.37				6.12	
	Phreatic groundwater $N_W=4$ $N_D=0$	Mean	-8.50	-59.59	8.41				3.14	
		Max	-7.64	-53.86	18.62				9.21	
		Min	-9.06	-72.46	-11.34				B.D.	
		SD	0.54	7.49	11.72				4.30	This study
	Confined groundwater $N_W=4$ $N_D=0$	Mean	-9.05	-55.09	17.29				B.D.	
		Max	-8.74	-51.01	18.91					
		Min	-9.39	-57.50	16.06					
		SD	0.27	2.62	1.09					
Nalenggele	Surface water $N_W=13$ $N_D=18$	Mean	-8.44	-53.27	14.21	-9.04	-57.71	14.64	16.38	
		Max	-7.70	-50.60	20.42	-8.15	-51.07	23.05	17.84	
		Min	-9.71	-57.26	9.98	-13.51	-85.00	12.12	15.31	
		SD	0.60	1.64	3.34	1.14	7.10	2.66	0.92	
	Phreatic groundwater $N_W=28$ $N_D=38$	Mean	-7.91	-55.21	8.09	-8.89	-57.28	13.83	10.25	
		Max	-5.21	-48.18	17.95	-7.80	-50.72	17.00	19.07	
		Min	-9.60	-62.31	-8.05	-10.65	-70.41	5.73	B.D.	
		SD	1.24	3.58	7.50	0.47	3.42	1.99	4.50	

Watershed	Water type		δ¹⁸O (‰)	δD (‰)	d-excess (‰)	δ¹⁸O (‰)	δD (‰)	d-excess (‰)	³H (TU)	Source
			Wet season			**Dry season**				
Golmud	Confined groundwater $N_W=2$ $N_D=3$	Mean	-7.54	-53.52	6.80	-8.77	-55.49	14.67	10.59	
		Max	-6.51	-49.57	11.13	-8.63	-55.24	15.90	12.76	
		Min	-8.58	-57.47	2.47	-8.91	-55.86	13.79	8.42	
		SD	1.04	3.95	4.33	0.11	0.26	0.90	2.17	
	Surface water $N_W=15$ $N_D=29$	Mean	-8.87	-58.76	12.23	-9.77	-65.05	13.14	14.03	
		Max	-6.62	-47.50	20.48	-7.13	-49.54	22.10	16.66	
		Min	-11.25	-69.52	5.46	-11.94	-77.67	5.78	12.16	
		SD	1.07	4.83	4.10	0.98	5.14	3.43	1.18	
	Phreatic groundwater $N_W=20$ $N_D=15$	Mean	-10.07	-68.54	12.03	-10.30	-68.68	13.71	6.50	
		Max	-8.22	-61.52	17.70	-9.27	-62.22	18.08	10.82	
		Min	-11.99	-81.71	1.98	-11.11	-74.28	11.60	B.D.	
		SD	0.90	4.60	3.63	0.53	3.08	1.65	3.52	
	Confined groundwater $N_W=19$ $N_D=15$	Mean	-10.84	-73.99	12.71	-10.84	-72.21	13.61	1.93	
		Max	-9.87	-66.58	15.36	-9.57	-65.94	19.48	8.54	
		Min	-12.12	-85.00	1.49	-11.53	-77.79	0.00	B.D.	
		SD	0.61	4.18	3.40	0.53	3.50	4.14	3.05	
Numhon	Surface water $N_W=3$ $N_D=3$	Mean	-9.95	-69.04	10.58	-9.88	-69.68	9.34	7.64	
		Max	-7.35	-59.60	16.56	-9.08	-65.98	13.21	9.57	
		Min	-11.36	-74.32	-0.80	-11.01	-74.90	6.64	6.51	
		SD	1.84	6.69	8.05	0.83	3.80	2.81	1.37	
	Phreatic groundwater	Mean	-11.74	-78.26	15.69	-11.00	-74.89	13.07	3.88	
		Max	-10.66	-70.28	16.86	-7.89	-62.54	17.35	13.08	

Watershed	Water type		δ¹⁸O (‰)	δD (‰)	d-excess (‰)	δ¹⁸O (‰)	δD (‰)	d-excess (‰)	³H (TU)	Source
			Wet season			**Dry season**				
	N_W=15	Min	-12.70	-87.38	14.22	-12.04	-79.96	0.58	B.D.	
	N_D=11	SD	0.47	3.86	0.71	1.24	5.83	4.86	4.83	
	Confined groundwater N_W=1 N_D=1	Mean	-12.01	-80.86	15.22	-11.24	-76.28	13.63	2.16	
		Max								
		Min								
		SD								
Qaidam	Surface water N_W=5 N_D=3	Mean	-8.79	-61.58	8.74	-9.63	-67.23	9.78	9.88	
		Max	-7.97	-58.45	14.11	-8.16	-60.27	16.15	10.66	
		Min	-9.47	-65.79	4.72	-11.66	-77.14	4.98	9.12	
		SD	0.56	3.00	3.65	1.49	7.19	4.69	0.63	
	Phreatic groundwater N_W=6 N_D=4	Mean	-9.53	-67.13	9.09	-10.47	-71.86	11.89	8.43	
		Max	-9.05	-65.24	10.82	-9.02	-65.09	15.46	8.76	
		Min	-9.94	-68.70	7.16	-11.64	-77.68	7.11	7.95	
		SD	0.26	1.28	1.26	1.04	5.29	3.11	0.35	
	Confined groundwater N_W=0 N_D=0	Mean								
		Max								
		Min								
		SD								
Qrhanwusu	Surface water N_W=1 N_D=3	Mean	-9.80	-61.57	16.83	-11.21	-74.42	15.24		
		Max				-10.78	-71.60	16.24		
		Min				-11.97	-79.49	14.61		
		SD				0.54	3.60	0.71		

Watershed	Water type		δ¹⁸O (‰)	δD (‰)	d-excess (‰)	δ¹⁸O (‰)	δD (‰)	d-excess (‰)	³H (TU)	Source
			Wet season			Dry season				
	Phreatic groundwater $N_W=4$ $N_D=0$	Mean								
		Max								
		Min								
		SD								
	Confined groundwater $N_W=4$ $N_D=0$	Mean								
		Max								
		Min								
		SD								
	Surface water $N_W=4$ $N_D=3$	Mean	-9.93	-63.91	15.53	-10.81	-70.85	15.64	13.52	
		Max	-9.27	-57.65	16.51	-10.31	-69.94	18.74	15.32	
		Min	-10.90	-72.06	14.95	-11.31	-71.76	12.53	10.39	
		SD	0.70	6.03	0.69	0.50	0.91	3.11	2.22	
Yuka	Phreatic groundwater $N_W=5$ $N_D=3$	Mean	-11.17	-74.61	14.75	-10.69	-71.87	13.66	13.42	
		Max	-10.95	-72.56	15.33	-10.66	-71.04	14.72	30.35	
		Min	-11.37	-77.08	13.88	-10.72	-72.69	12.61	0.60	
		SD	0.17	1.66	0.54	0.03	0.82	1.05	10.85	
	Confined groundwater $N_W=0$ $N_D=0$	Mean								
		Max								
		Min								
		SD								
Bayin		Mean	-8.41	-56.65	10.66	-9.20	-59.50	14.10	16.17	
		Max	-6.60	-50.80	15.72	-8.71	-56.88	15.90	17.80	

Watershed	Water type		δ^{18}O (‰)	δD (‰)	d-excess (‰)	δ^{18}O (‰)	δD (‰)	d-excess (‰)	^{3}H (TU)	Source
			Wet season			Dry season				
	Surface water N$_W$=18 N$_D$=10	Min	-9.44	-60.10	-4.30	-9.54	-61.25	11.99	14.00	
		SD	0.81	2.62	4.85	0.26	1.47	1.21	1.60	
	Phreatic groundwater N$_W$=25 N$_D$=9	Mean	-9.04	-59.55	12.74	-9.49	-61.40	14.49	9.89	
		Max	-6.50	-42.00	17.78	-8.41	-54.41	18.81	15.60	
		Min	-10.60	-71.10	8.84	-10.33	-69.11	8.46	1.30	
		SD	0.71	5.26	1.82	0.56	3.76	3.24	3.43	
	Confined groundwater N$_W$=4 N$_D$=4	Mean	-9.36	-61.83	13.06	-9.55	-60.29	16.09	7.95	
		Max	-8.82	-58.30	14.04	-9.24	-56.22	17.70	11.90	
		Min	-10.08	-66.60	12.26	-10.17	-66.60	14.69	3.70	
		SD	0.46	3.12	0.68	0.37	3.84	1.38	3.64	
Eastern Kunlun Mountations	Rain water N=51	Mean	-7.06	-39.12	17.32					
		Max	2.55	30.49	38.60					
		Min	-23.38	-158.64	-6.96					
		SD	4.73	35.95	8.44					
	Snowmelt N=5	Mean				-13.64	-87.73	21.43		
		Max				-11.30	-61.68	31.65		
		Min				-19.30	-152.02	2.38		
		SD				2.92	33.33	10.23		
Qilian Mountations	Rain water N=20	Mean	-7.80	-51.79	10.62					Zhu et al., 2015
		Max	0.27	13.75	20.89					
		Min	-17.24	-125.17	1.31					

Watershed	Water type		δ¹⁸O (‰)	δD (‰)	d-excess (‰)	δ¹⁸O (‰)	δD (‰)	d-excess (‰)	³H (TU)	Source
			Wet season			**Dry season**				
		SD	5.13	40.59	4.90					
	Snowmelt N=7	Mean				-11.50	-78.40	13.56		Yang et al., 2021
		Max				-2.19	32.40	49.92		
		Min				-20.05	-141.73	-15.89		
		SD				5.59	53.86	18.87		

$N_{W/D}$ represents the number of samplings in wet/dry season; **N** represents the number of samplings of rain water or snowmelt; **B.D.** represents below the detection limit.

References

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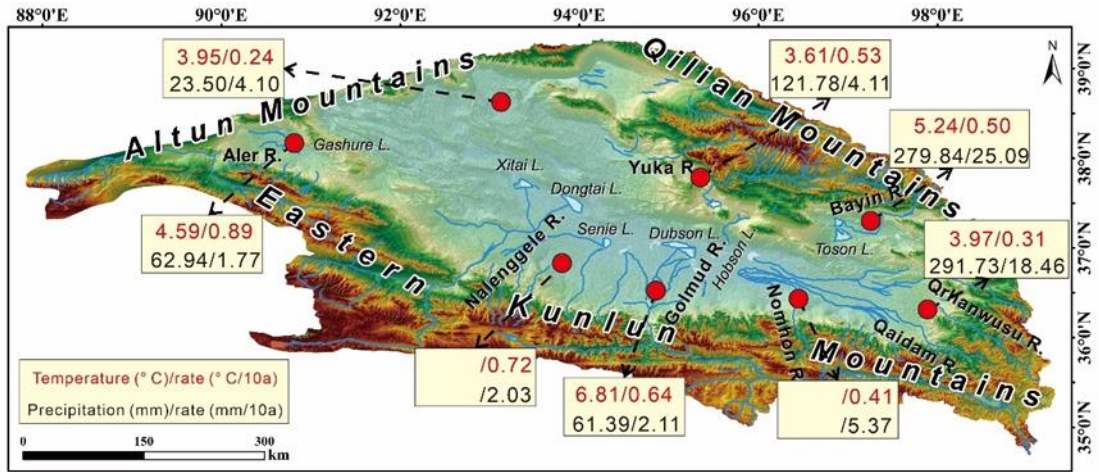
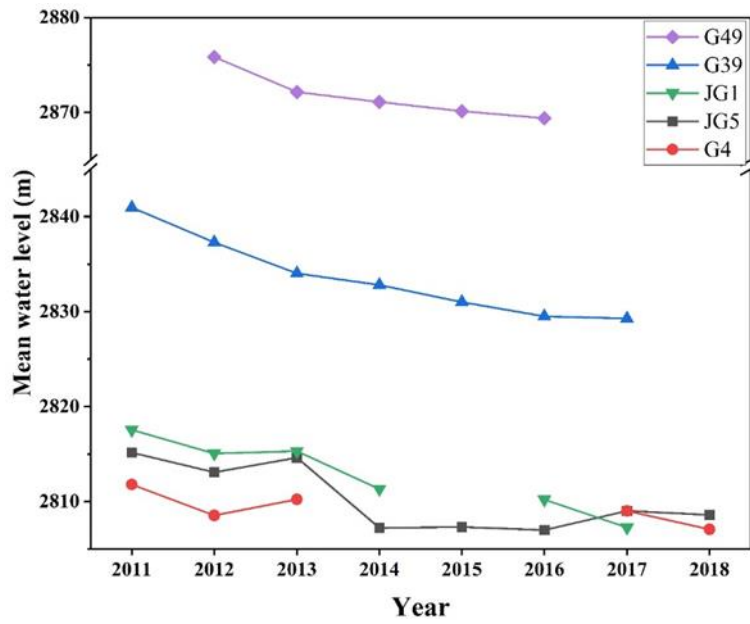


Figure S1. Average annual temperature and precipitation of each meteorological station in the Qaidam Basin since 2005 and rise in temperature and precipitation since 1961 (The rate data are from Yang et al., 2014)

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15 **Figure S2.** Changes in groundwater level in the Golmud River from 2011 to 2018