

1 *Supplementary Materials for*

2 **Basin-scale multi-objective simulation-optimization modeling for**  
3 **conjunctive use of surface water and groundwater in northwest China**

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**Table S1** The control parameters and hypervolume metric obtained for  $\varepsilon$ -MOMA on  $M$ -objective DTLZ1 and DTLZ3 problems

Problem	$M$	$N_{dv}$	$N_{pop}$	$N_{eval}$	$\varepsilon_{obj}$	$rp$	$HV_{rs}$	$HV_{as}$	$HV_n$
DTLZ1	3	$M+9$	200	100,000	0.01	0.55	0.14575	0.14480	0.9935
	4			150,000			0.08883	0.08828	0.9939
	5			200,000			0.05000	0.04982	0.9964
	6			400,000			0.02763	0.02759	0.9985
DTLZ3	3	$M+9$	200	100,000	0.01	1.05	0.63507	0.61857	0.9740
	4			150,000			0.89568	0.85577	0.9554
	5			200,000			1.08860	1.03550	0.9512
	6			400,000			1.23140	1.19210	0.9681

Note:  $M$  = number of objectives;  $N_{dv}$  = number of decision variables;  $N_{pop}$  = population size;  $N_{eval}$  = number of function evaluations;  $\varepsilon_{obj}$  = epsilon value for each objective;  $rp$  = the value of reference point for each objective;  $HV_{rs}$  = hypervolume of Pareto reference set;  $HV_{as}$  = hypervolume of Pareto approximate set;  $HV_n$  = the normalized hypervolume.

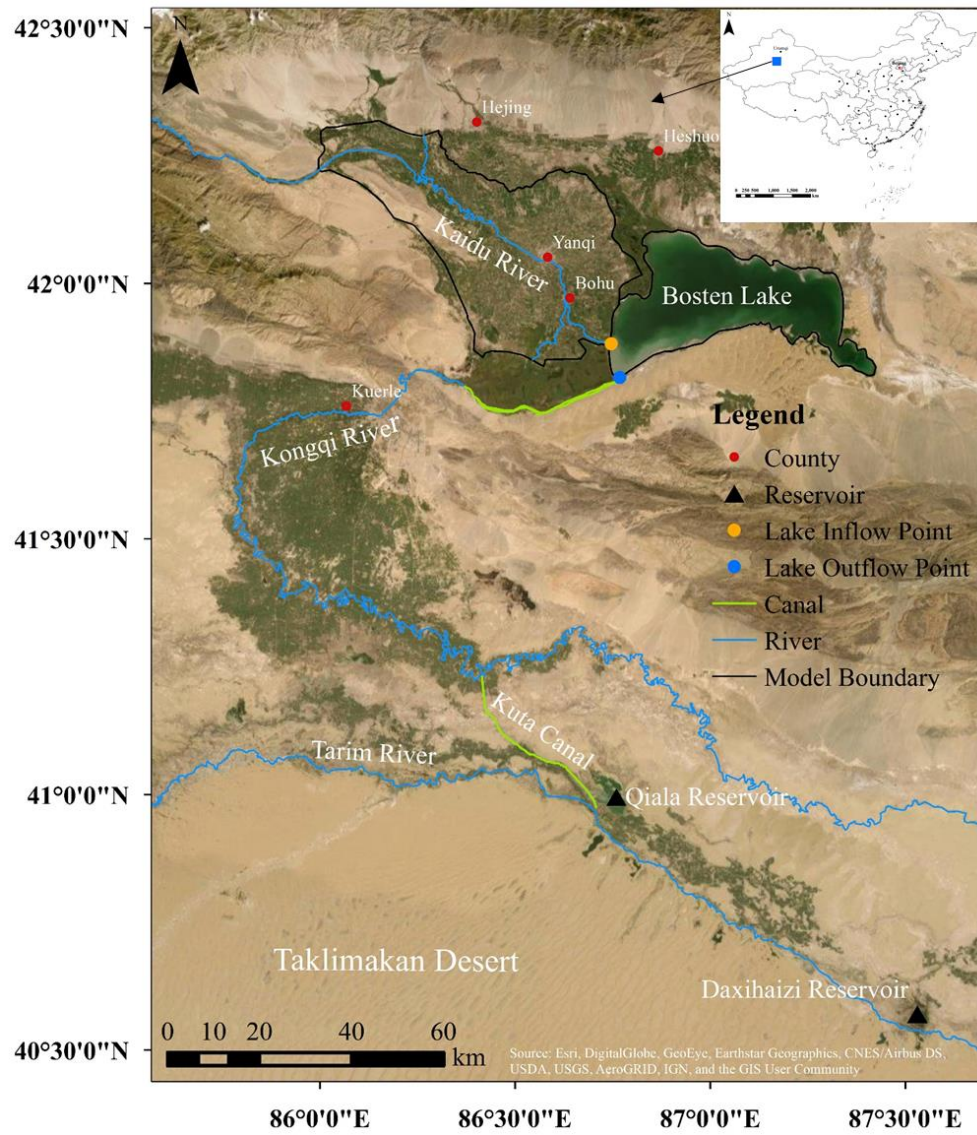
25 **Table S2** Multisource data for the model build-up

Category	Data	Data Time	Spatial Resolution
Initial parameterization and resolution	DEM	2008	90×90 m
	River network	2009	(Google Map)
	Aqueducts	2009	(Reports)
	Hydrogeology Map	1977	1:200000
	Lake topography	1977	1:200000
	Bottom of aquifer	1977	1:200000
Dynamic data and resolution	Boundary river inflow	2003-2012 (monthly)	1 station
	Boundary groundwater inflow	2009 (yearly)	(Reports)
	Boundary groundwater level	2003-2013 (non-irrigation and irrigation periods)	5 monitoring wells
	Meteorological observations	2003-2013 (monthly)	3 stations
	Surface water diversion	2003-2013 (non-irrigation and irrigation periods)	11 aqueducts
	Groundwater pumping	2003-2013 (yearly)	11 irrigation districts
	Lake artificial pumping	2003-2013 (monthly)	1 station
Calibrated data and resolution	Streamflow	2003-2012 (monthly)	2 stations
	Groundwater level	2003-2013 (non-irrigation and irrigation periods)	7 wells (2003-2013) 14 wells (2012-2013)
	Lake level	2003-2013 (monthly)	1 station

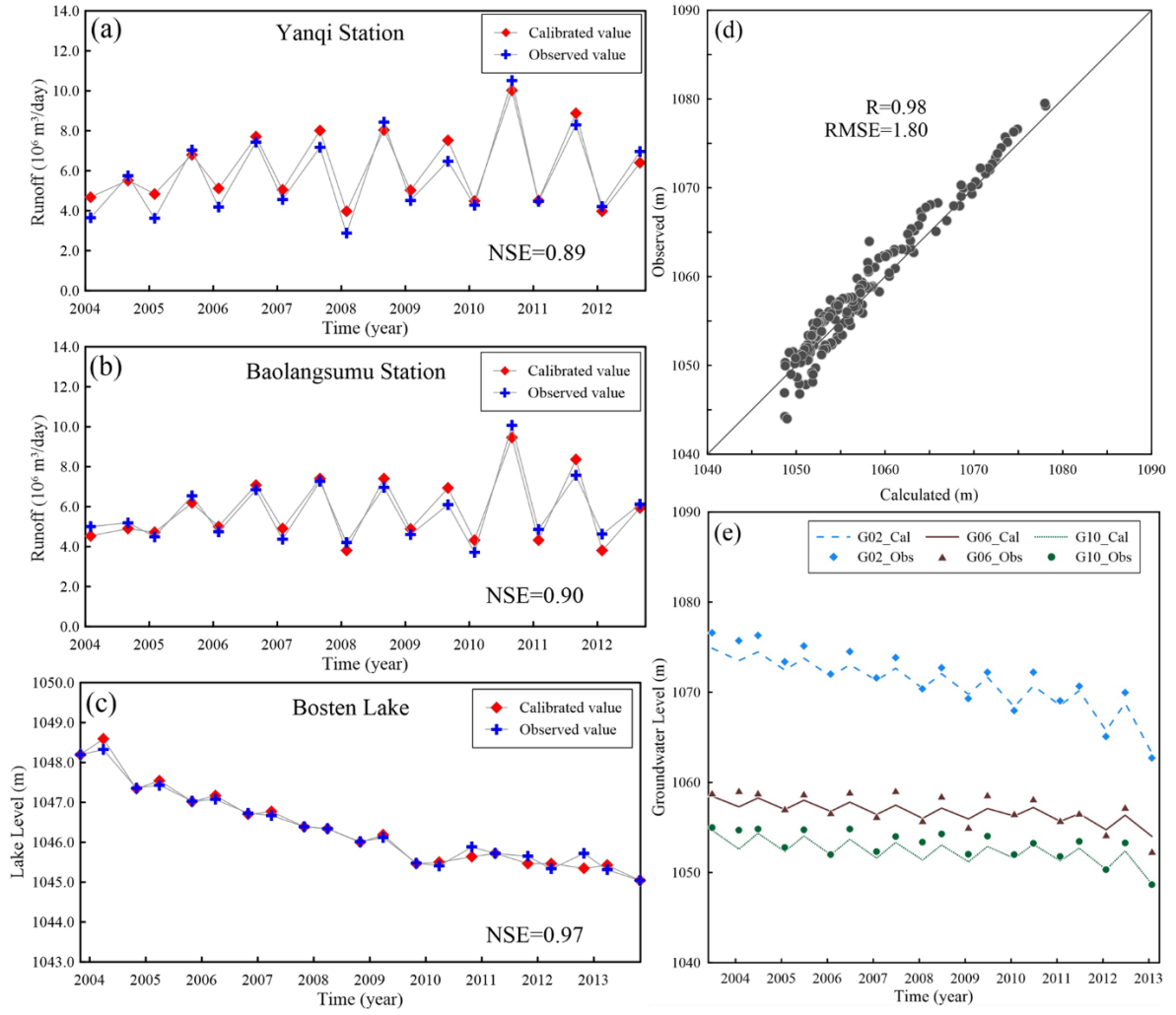
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**Fig. S1** The Ecological Water Conveyance Project



**Fig. S2** The calibrated results of the transient model showing (a) observed vs. calibrated runoff at Yanqi station over time, (b) observed vs. calibrated runoff at Baolangsumu station over time; (c) observed vs. calibrated lake level over time; (d) comparison of observed and calibrated groundwater heads at all observation wells, and (e) observed vs. calibrated groundwater heads over time at three typical observation locations as labeled in Fig. 3.