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Supplement of

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

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17 **Table S1** The control parameters and hypervolume metric obtained for ε -MOMA on

18 M -objective DTLZ1 and DTLZ3 problems

Problem	M	N_{dv}	N_{pop}	N_{eval}	ε_{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

19 Note: M = number of objectives; N_{dv} = number of decision variables; N_{pop} = population size;

20 N_{eval} = number of function evaluations; ε_{obj} = epsilon value for each objective; rp = the value of

21 reference point for each objective; HV_{rs} = hypervolume of Pareto reference set; HV_{as} =

22 hypervolume of Pareto approximate set; HV_n = the normalized hypervolume.

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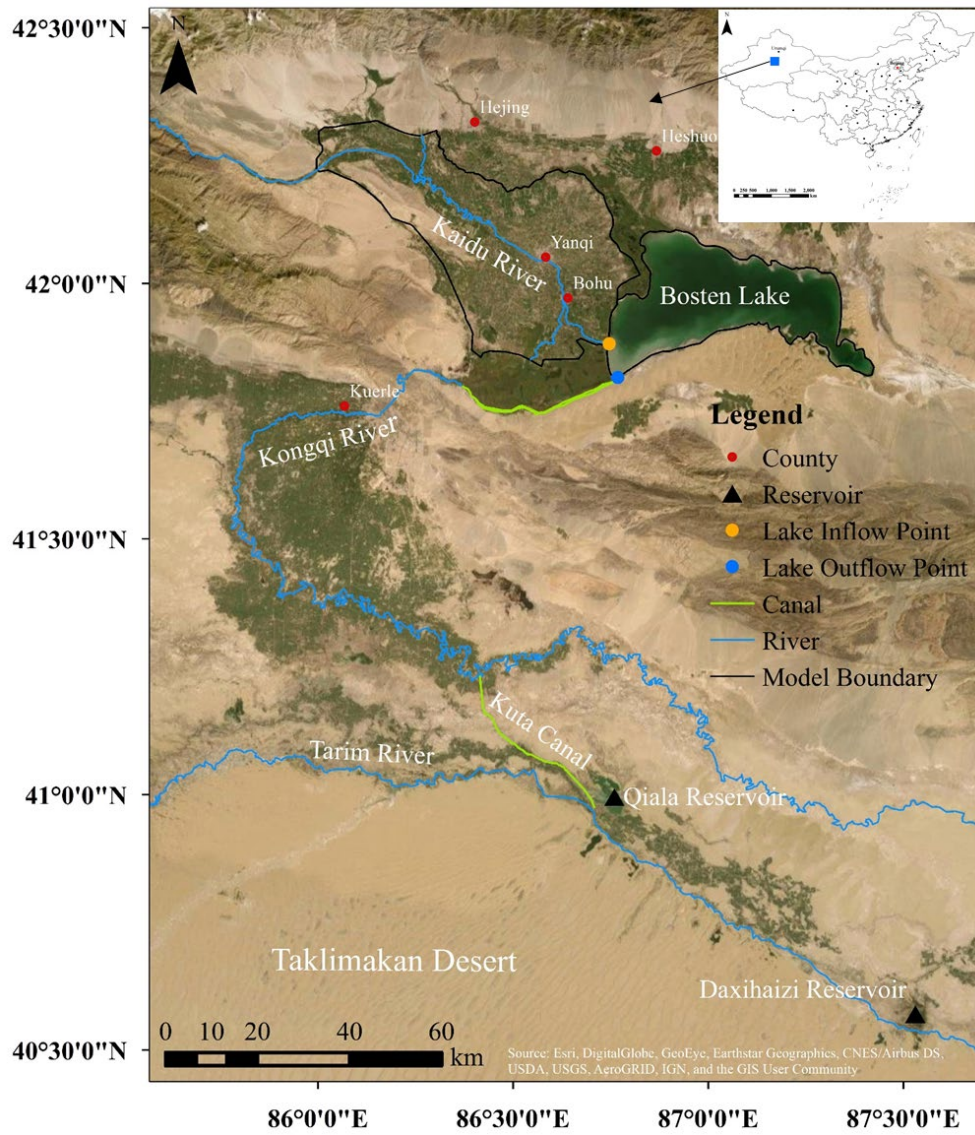
25 **Table S2** Multisource data for the model build-up

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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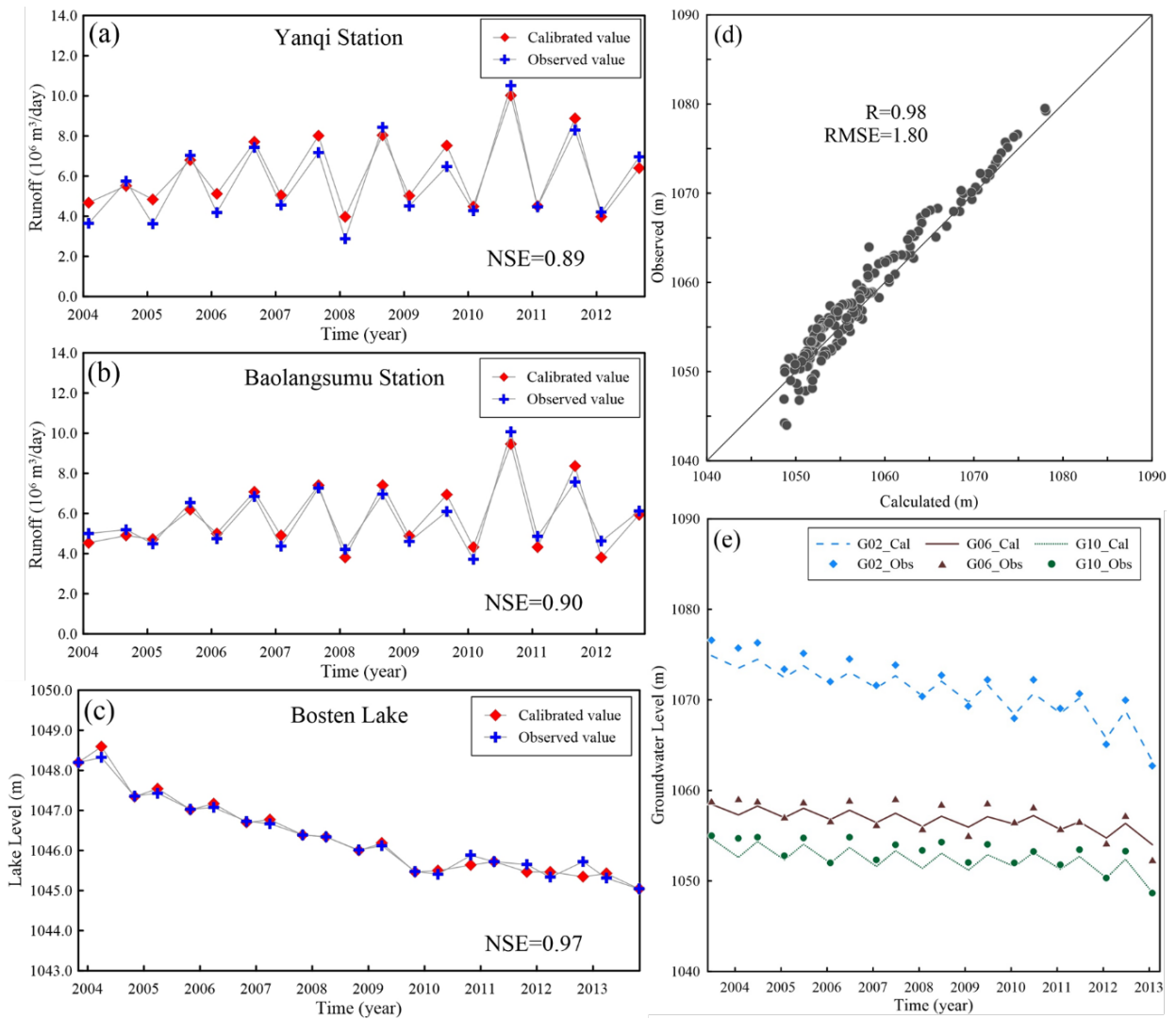
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Fig. S1 The Ecological Water Conveyance Project



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

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