

Supplementary Materials for

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

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

Note: M = number of objectives; N_{dv} = number of decision variables; N_{pop} = population size; N_{eval} = number of function evaluations; ε_{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.

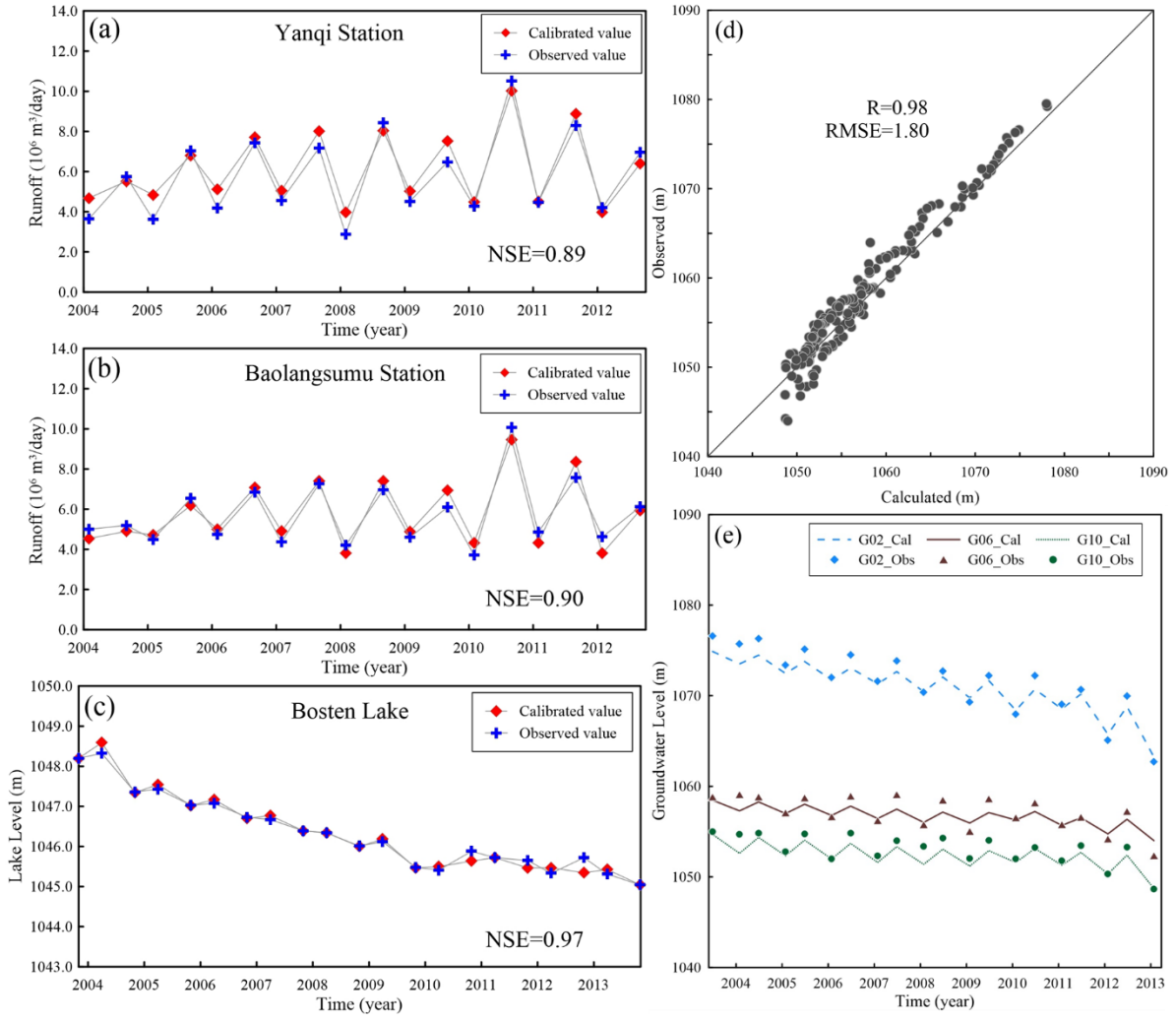


Fig. S1 The calibrated results of the transient model showing (a) observed vs. calibrated runoff at Yanqi station over time, (b) observed vs. calibrated runoff at Baolangsumu station over time; (c) observed vs. calibrated lake level over time; (d) comparison of observed and calibrated groundwater heads at all observation wells, and (e) observed vs. calibrated groundwater heads over time at three typical observation locations as labeled in Fig. 3.